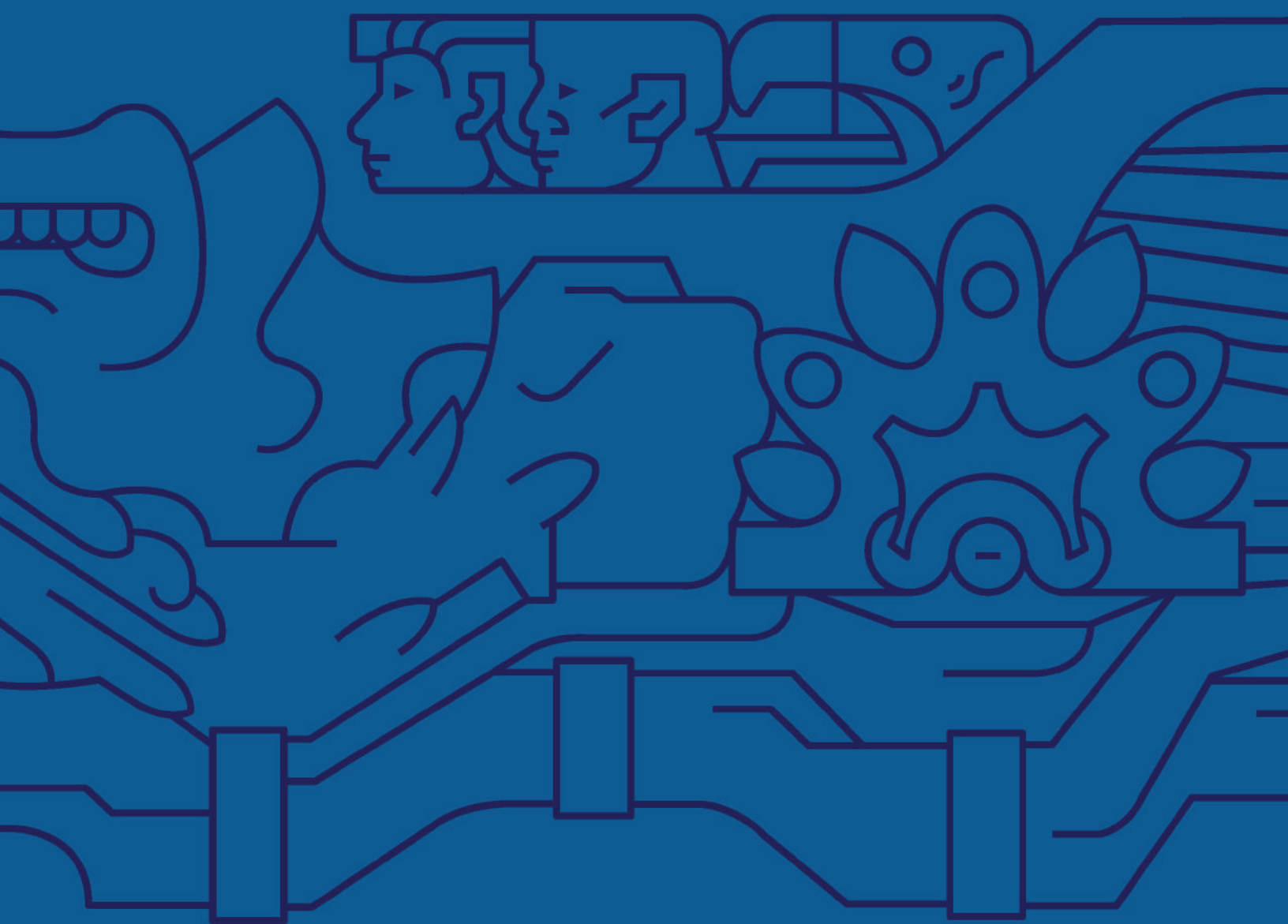


# Undergraduate **Programs Catalogue**



**Undergraduate Programs Catalogue**  
Tecnológico de Monterrey  
2016

Publication by the Vice Rector for Academic .

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# Undergraduate

Programs Catalogue

## 2016



**TECNOLOGICO  
DE MONTERREY®**



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## Message from the President of Tecnológico de Monterrey

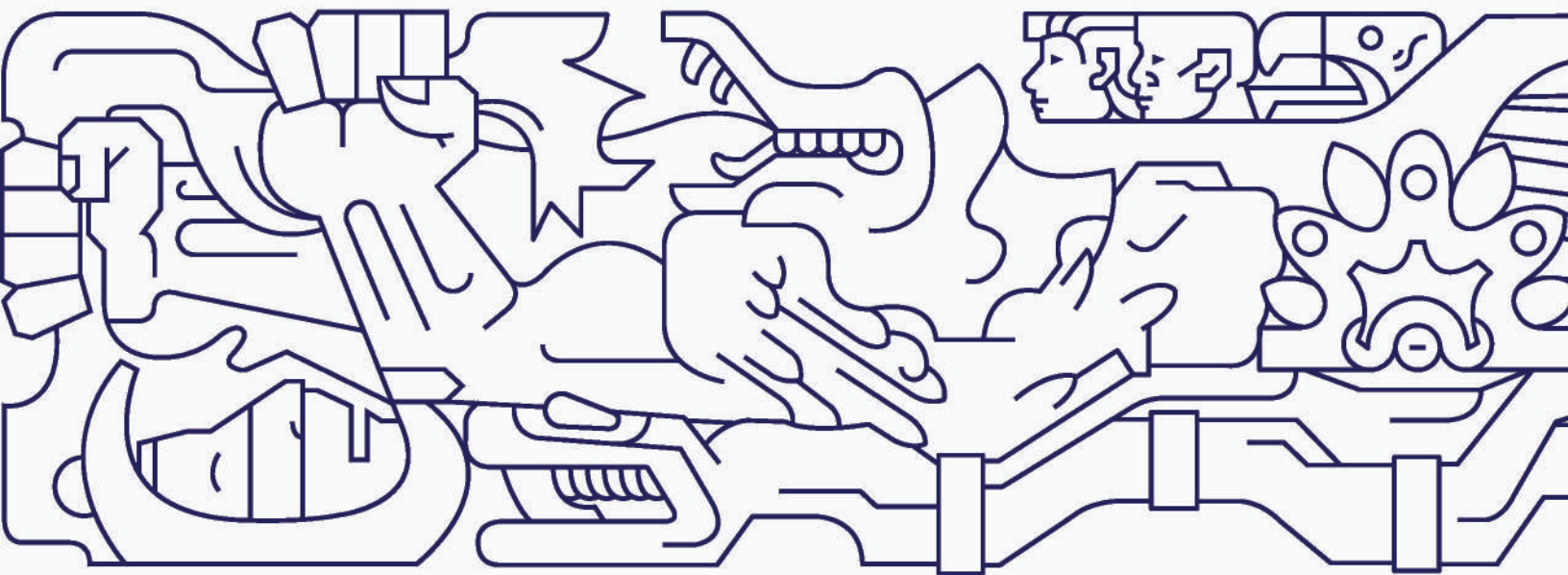


It gives me great pleasure to present the **Undergraduate Programs Catalogue of Tecnológico de Monterrey**. This document describes the extensive range of academic programs offered by the Institute in the areas of Agriculture and Food, Architecture, Social Sciences and Humanities, Communication and Journalism, Law, Design and Applied Art, Engineering and Science, Business and Administration, Health, and Information Technologies. It also provides information on the Concentrations and Modalities our students can study in addition to their degree program. Our academic programs also include the International Majors as an option for students who wish to broaden their international vision.

A brief description is included of our Educational Model, the structure of the curricula, the resources and media available to all our students, student life, the academic policies and regulations including the admissions process, and educational support and scholarships.

David Noel Ramírez Padilla  
Rector of Tecnológico de Monterrey  
March 2016





# I. El Tecnológico de Monterrey



# I. Tecnológico de Monterrey

## History and Evolution

Tecnológico de Monterrey was founded in 1943 thanks to the vision of Don Eugenio Garza Sada and a group of entrepreneurs who formed a non-profit association called Enseñanza e Investigación Superior, A. C.

Tecnológico de Monterrey is a private, non-profit, independent institution with no political and religious affiliations.

The work of Tecnológico de Monterrey and all its campuses is supported by civil associations made up of a numerous group of outstanding leaders from all over the country who are committed to quality in higher education.

Every year, the board members of these associations meet to define the goals that will guide the

major decisions which will help Tecnológico de Monterrey to meet its objective of driving the development of communities and the nation.

Tecnológico de Monterrey enjoys the support of the national community, which participates in the raffles organized by the institution to expand its scholarship program and investment in infrastructure.

Tecnológico de Monterrey enjoys the status of Free University School, which enables it to function as an educational institution.

These are some of the main events that distinguish our Institution 70 years after the foundation of Tecnológico de Monterrey:



## Beginning

- 1944** | The number of students enrolled at Tecnológico de Monterrey increases from 350 to 452, while the total number of faculty members, all full-time, grows from 14 to 33. This year sees the initiation of extracurricular activities: the first student association is formed, the first basketball and soccer teams are created, and "Onda", the institution's first magazine, is published.
- 1945** | The students adopt "El Borrego" (The Ram) as their mascot.
- 1947** | The Monterrey Campus is inaugurated and has one thousand students this year. The first undergraduate degrees are awarded to eight students from the BS in Chemical Engineering program. The first raffle, known as, Sorteo Tec, is held.
- 1950** | Tecnológico de Monterrey is accredited by the Southern Association of Colleges and Schools (SACS), a US accrediting agency.
- 1954** | The Library building is opened with the mural on its façade that has become a symbol of Tecnológico de Monterrey. This mural represents the triumph of culture and work with motifs taken from pre-Cortés mythology. Later on, the Library building will become the Offices of the Presidency of Tecnológico de Monterrey.

## Growth

- 1960** | Tecnológico de Monterrey has 4,458 students from 19 countries in America and all the states of Mexico.
- 1963** | At the beginning of this year, the first master's degree is awarded in Chemical Sciences. Twenty years after its foundation, Tecnológico de Monterrey begins to delve into two educational facets that will be of paramount importance: the use of electronic computers and educational television.
- 1967** | The first campus outside the city of Monterrey is founded: the Guaymas Campus.
- 1968** | This year sees the launch of the first doctoral program: the PhD in Chemistry, specializing in Organic Chemistry.
- 1973** | Two new campuses open in other Mexican cities: the Mexico City Campus and the Ciudad Obregón Campus.
- 1974** | The Saltillo Campus is founded.
- 1975** | Operations start in the Eugenio Garza Sada Campus, in Monterrey; and the Laguna, Querétaro and San Luis Potosí Campuses.
- 1976** | The Chihuahua, Estado de México and Irapuato Campuses are inaugurated.



- 1978** | Tecnológico de Monterrey now has more than 25 thousand students in 14 units throughout Mexico. The Ignacio A. Santos School of Medicine is opened next to the Hospital San José building. The León Campus becomes operational.
- 1980** | Personal computers are introduced as a higher education tool in Mexico. The Colima, Chiapas, Guadalajara, Hidalgo and Morelos (nowadays called Cuernavaca) Campuses are opened.
- 1981** | The Central de Veracruz and Tampico Campuses are inaugurated.
- 1982** | The Toluca Campus begins operating.
- 1983** | The Ciudad Juárez, Mazatlán, Sinaloa and Sonora Norte Campuses begin operating.
- 1985** | The Zacatecas Campus is inaugurated.

## Consolidation

- 1986** | The mission “to prepare professionals with levels of excellence in their area of specialization” is defined, together with the general statutes. Tecnológico de Monterrey is formally incorporated as a multi-campus educational system with a new organizational structure.
- 1986** | Tecnológico de Monterrey is connected to the international inter-university communication network known as BITNET. The satellite telecommunications network is launched.
- 1989** | The Center for Advanced Technology for Production (CETEC) is opened on the Monterrey Campus. Satellite transmissions are used to teach the Master’s in Education with diverse specializations.
- 1990** | The Center for Strategic Studies (CEE) is created. Courses from the master’s degrees in Business Administration and Computer Studies are transmitted by satellite for Tecnológico de Monterrey faculty members, as well as three core courses, related to sociocultural values and professional practice.

## Transformation

- 1996** | Tecnológico de Monterrey defines its mission toward 2005: To prepare individuals who are committed to the development of their communities; who are internationally competitive in their area of knowledge; and who conduct relevant research and extension studies for the development of Mexico.
- 1997** | Universidad Virtual is created. Tecnológico de Monterrey offers its academic and continuing education programs in Mexico and Latin America. The teaching-learning redesign process begins.

- 1998** The Aguascalientes Campus is inaugurated. The rule was laid down that undergraduate students' social service must benefit the community.
- 2001** Tecnológico de Monterrey, in conjunction with diverse national and international organizations and foundations, creates the Community Learning Centers. Two new campuses begin their activities: the Cumbres Campus, in Monterrey; and the Santa Fe Campus, in Mexico City.
- 2002** The Morelia Campus is inaugurated.
- 2003** The Puebla Campus is inaugurated. The Graduate School for Public Administration and Public Policy (EGAP) is opened with sites on the Mexico City, Estado de México and Monterrey Campuses. Tecnológico de Monterrey receives the Andrew Heiskell Award 2003-2004, bestowed by the United Nations Institute of International Education, in the Outstanding Faculty Program Category.
- 2004** The Council for the Accreditation of Higher Education (COPAES) of the Mexican Ministry of Education recognizes Tecnológico de Monterrey as the institution of higher education with the highest number of academic programs accredited or recognized by national and international organizations. By this year, Tecnológico de Monterrey has a network consisting of 27 Business Incubators. Prepanet activities are launched to offer online high school with a few face-to-face activities to people who need to earn their high school diploma, but who for diverse reasons were unable to do so. Two new high schools are opened: one in Matamoros, Tamaulipas, and the other in Metepec, Estado de México. The Alumni and Friends Philanthropic Network begins operating in Monterrey.







- 2005** A new Tecnológico de Monterrey Vision is defined to be fulfilled in 2015, together with the Mission and strategies that will contribute to the realization of this new vision. Tecnológico de Monterrey is awarded the accolade given by the Ministry of the Economy to institutions who provide outstanding support to the consolidation of the National System of Business Incubation. The Family Business Institute is created and developed through an agreement between the Spanish Enterprise Institute and Tecnológico de Monterrey. The Valle Alto High School begins operating in Monterrey.
- 2007** The Business Accelerator Network began operations. It was created by the Institute for Sustainable Social Development to support society in the areas of education and business creation and development; academic programs in health, nutrition and housing; and professional consulting services.
- 2008** At the initiative of Tecnológico de Monterrey alumni, the ENLACE E+E Network was created to drive Tecnológico de Monterrey's business incubators and accelerators. The FEMSA Biotechnology Center was opened at the Monterrey Campus, focusing on three areas: Bioprocess Engineering, Food Biotechnology and Pharmaceutical Biotechnology.
- 2009** With FEMSA's support, the Strategic Technology Observatory opened its doors to promote business innovation and a spirit of research. Community Learning Centers were created to take quality education to underprivileged and geographically remote communities.
- 2010** After serving as President of the Tecnológico de Monterrey System for just over 25 years, in June 2010, Dr. Rafael Rangel Sostmann tendered his resignation as President to the Board of Directors.
- The EGADE programs at the Mexico City, Monterrey and Santa Fe campuses merged to form a single national school known as EGADE Business School.

**2011** As of October 3, Salvador Alva Gómez took over as the new Chancellor of the Tecnológico de Monterrey System. On January 1, David Noel Ramírez Padilla was appointed President of Tecnológico de Monterrey.

**2012** The Zambrano Hellion Medical Center was opened in January. This new hospital center seeks to transform private medical practice in Mexico.

The Board of Directors of the Tecnológico de Monterrey System announced the appointment of José Antonio Fernández Carbajal as the new Chairman of the Board, replacing Mr. Lorenzo H. Zambrano Treviño as of February 14. Mr. Fernández Carbajal became the fourth Chairman of the Board, succeeding Eugenio Garza Sada (1943-1973), Eugenio Garza Lagüera (1973-1997) and Lorenzo H. Zambrano Treviño (1997-2012).

The Monterrey Regional Presidency established the Distinguished Professor Emeritus Prize to be awarded on May 15 every year (Teachers' Day in Mexico). The first professor to receive this honor was the architect José Luis Pineda.

The Latin American Citizenship Institute was created with the aim of replicating the best civic practices of Mexico and Latin America and orientating the entrepreneurial and humanistic capacity of Tecnológico de Monterrey.

Tecnológico de Monterrey initiates a transformation to generate cultural change and a process-based approach.

The values that govern the institution's operations are defined:

- Innovation  
We generate and realize ideas, break paradigms, take risks and learn from our mistakes.
- Global outlook  
We live in a global culture and foment diversity.
- Teamwork  
We foster collaborative work and seek collective success above that of the individual.
- Ethics and citizenship  
We respect the dignity of people and act with solidarity.
- Integrity  
We behave in an ethical manner, and are honest, austere and congruent.

As Tecnológico de Monterrey collaborators, we are committed to complying with the guidelines contained in the Code of Ethics and making them part of our lives and daily activities.

## 2013

The Institution announced the new Educational Model Tec21, which will enable the development in future generations of competencies for the leaders of the 21st century. The Model is based on innovative, challenging experiences, spaces for active learning, and faculty who inspire and innovate.

The following changes were announced in the institution: the term "System" would no longer be used; Salvador Alva is now President of Tecnológico de Monterrey; there are now three instead of five regional presidencies: Northern Zone, Central-Southern Zone and Western Zone; three Vice Presidencies were created: High School, Undergraduate, and Research, Graduate and Continuing Education.

The Protein Development Research Center was created.

The Eugenio Garza Sada Institute for Entrepreneurship was founded.

## 2014

The Federal Government of Mexico honored Tecnológico de Monterrey with the National Entrepreneurship Award.

## Education that Transforms Lives

### Multi-campus University System

Nowadays, Tecnológico de Monterrey is a multi-campus university system with academic sites in the diverse regions of Mexico.

The prestige enjoyed by Tecnológico de Monterrey since its foundation, stemming from the culture of entrepreneurship, work, efficiency and responsibility that it fosters its students, motivated its graduates, who come from diverse regions of Mexico, to promote the presence of Tecnológico de Monterrey in their hometowns.

This gave the Institution significant insight into the different needs of each region in order to prepare professionals, without uprooting them from their hometowns, with the capacity to address them. Moreover, as a nationwide, multicampus university, Tecnológico de Monterrey accepts its responsibility to provide a valid response to the country's foremost challenges.

Some of Tecnológico de Monterrey's alumni are now directors in successful companies in Mexico and Latin America, while the presence of its graduates in key government and public administration positions is constantly growing.



### Values

At Tecnológico de Monterrey, we are governed by the values of the Tecnológico de Monterrey System:



#### Innovation

We generate and realize ideas, break paradigms, take risks and learn from our mistakes.



#### Global vision

We live a global culture and foment diversity.



#### Teamwork

We foster collaborative work and seek collective success above that of the individual.



#### Sense of humanity

We respect the dignity of people and act with solidarity.



#### Integrity

We behave in an ethical manner, and are honest, austere and congruent.

## Vision

Tecnológico de Monterrey:  
We educate leaders with an entrepreneurial spirit, committed to ethics and citizenship, and who are internationally competitive.

## Differentiators

The relevant characteristics that distinguish Tecnológico de Monterrey are:

- A state-of-the-art educational model, focused on developing a spirit of entrepreneurship
- Education with a sense of humanity
- The institution's prestige built on the basis of the actions of our graduates
- Relationships with alumni, companies and institutions

With these three major components (Values, Vision and Differentiators), at Tecnológico de Monterrey we recognize the need to undertake actions that will lead us toward change, to a transition targeting a better lifestyle emerging from the academic preparation of young people who care deeply about their country.

## Code of Ethics

This Code of Ethics is based on the purpose of the Tecnológico de Monterrey: Education that transforms lives, and on the visions of its institutions. It is grounded in our institutional values and, in particular, a sense of humanity and integrity.

It is not, nor does it seek to be, exhaustive in relation to the ethical dilemmas that arise in the setting of our activities; therefore, it will be enriched when the requirements of daily practice so require.

As members of the organization, we are committed to channeling our actions toward the common



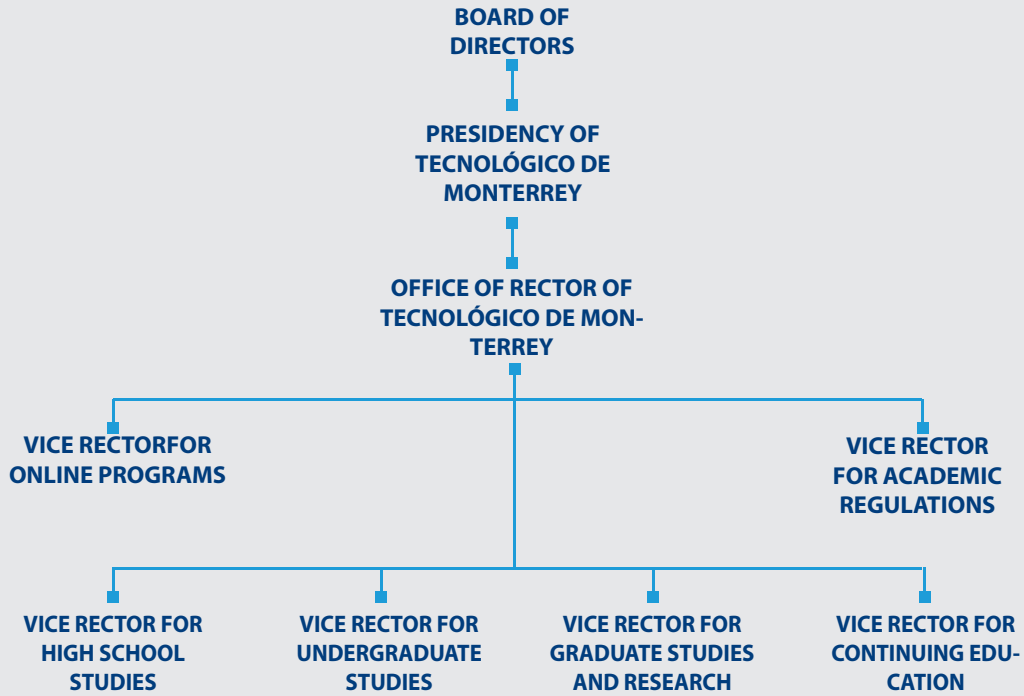
good and the transformation of our society. Thus, all the board members, directors, faculty, doctors and employees of the Tecnológico de Monterrey:

1. Acknowledge the dignity of people and treat them with respect and justice.
2. Treat everybody equally and shun discrimination in every form.
3. Act with integrity, honesty, responsibility, objectiveness, congruence and impartiality.
4. Recognize and respect intellectual property and others' merit.
5. Avoid any type of conflict of interest and, if any conflicts should arise, report them to the corresponding authorities.
6. Assume data transparency as a commitment and respect the confidentiality of issues as determined by the Institution.
7. Use resources in a responsible, austere and efficient manner.
8. Protect the environment.
9. Seek the benefit of the Institution above personal benefit.
10. Comply with the laws, regulations and policies that govern our activities at institutional, national and international levels.

As Tecnológico de Monterrey collaborators, we undertake to fulfill the guidelines contained in the Code of Ethics and make them part of our lives and daily actions.



# Organization of Tecnológico de Monterrey



## Accreditations

The national and international academic program and institutional accreditations reflect the quality of the academic services offered and are one of the means employed by Tecnológico de Monterrey to assure and enhance its academic quality, thus consolidating its leadership position in Mexico's higher education.

### Institutional Accreditations

#### a) International

Tecnológico de Monterrey is accredited by the Southern Association of Colleges and Schools (SACS COC, <http://www.sacscoc.org>) to award undergraduate, master's and doctorate degrees.

For further information on Tecnológico de Monterrey's accreditation, please contact:

##### **Southern Association of Colleges and Schools**

Commission of Colleges  
1866 Southern Lane  
Decatur, GA. 30033-4097  
Telephone: (+1) 404-679-4500

#### b) National

Tecnológico de Monterrey is accredited by the Federation of Mexican Private Higher Education Institutions (FIMPES, <http://www.fimpes.org.mx>).

For further information on Tecnológico de Monterrey's accreditation, please contact:

##### **Federación de Instituciones Mexicanas Particulares de Educación Superior**

Río Guadalquivir No. 50 - 4° piso, Col. Cuauhtémoc  
Delegación. Cuauhtémoc. C.P. 06500  
México, D.F.  
Telephone: (+52) (55) 5514-5514

### Program Accreditations

#### a) National

At March 2016, el 85.3% (191 de 224) of the undergraduate academic programs offered in full on each of the Tecnológico de Monterrey campuses, and which have at least three generations of graduates, have been accredited in Mexico by one of the agencies recognized by the Council for the Accreditation of Higher Education (COPAES), the organization that authorizes the operation of accrediting agencies for undergraduate programs. The programs for which a COPAES accrediting agency does not exist have been evaluated at Level 1 (the highest) by the Inter-institutional Committees for the Evaluation of Higher Education (CIEES)

The following COPAES-recognized agencies have accredited Tecnológico de Monterrey programs:

- Association for the Accreditation and Certification of Social Sciences (ACCECISO)
- Mexican Committee for the Accreditation of Education in Agronomy (COMEAA)
- Accreditation Council for Engineering Education (CACEI)
- Accreditation Council for Accounting and Business Administration Education (CACECA)
- Accreditation Council for Education and Research in Psychology (CNEIP)
- National Accrediting Agency for Architecture Programs and Habitable Space Disciplines (ANPADEH)
- Mexican Council for the Accreditation of Education in Medicine (COMAEM)

- Mexican Council for the Accreditation of Design Programs (COMAPROD)
  - National Accreditation Council for Informatics and Computing (CONAIC)
  - National Accreditation Council for Economic Sciences (CONACE)
  - National Accreditation Council for Higher Education in Law (CONFEDE)
  - Accreditation Council for Law Education (CONAED)
  - Accreditation Council for Communication (CONAC)
  - National Council for Quality in Nutritional Science Education Programs (CONCAPREN).
- The following tables show the undergraduate programs by campus that have been accredited by national agencies COPAES, at March, 2016.

### Undergraduate Programs Accredited by COPAES, by Campus

Campus	Programs	Description	Agency
Aguascalientes	IIS	B.A. International Business	CACECA
	IMT	B.S. Mechatronics Engineering	CACEI
	LIN	B.S. Industrial Engineering with minor in Systems Engineering	CACEI
Chiapas	LAE	Bachelor of Business Administration	CACECA
Chihuahua	IMT	B.S. Mechatronics Engineering	CACEI
	ITIC	B.S. Information and Communication Technologies	CACEI
	LAE	Bachelor of Business Administration	CACEI
	LAF	B.A. Financial Management	CACECA
	LCDE	B.A. Business Creation and Development	CACECA
	LIN	B.A. International Business	CACECA
Ciudad de México	ARQ	B.A. Architecture	ANPADEH
	IBT	B.S. Biotechnology Engineering	CACEI
	IIS	B.S. Industrial Engineering with minor in Systems Engineering	CACEI
	IMD	B.S. Biomedical Engineering	CACEI
	IME	B.S. Mechanical Engineering Option E	CACEI
	IMT	B.S. Mechatronics Engineering	CACEI
	ITC	B.S. Computer Science and Technology	CACEI
	ITS	B.S. Telecommunications and Electronic Systems	CACEI
	LAE	Bachelor of Business Administration	CACECA
	LAD	B.A. Animation and Digital Art	COMAPROD
	LAF	B.A. Financial Management	CACECA
	LCPF	B.A. Finance and Accounting	CACECA
	LDI	B.A. Industrial Design	COMAPROD
	LEC	B.A. Economics	CONACE
	LED	B.A. Law	CONAED
	LEF	B.A. Economics and Finances	CONACE
	LEM	B.A. Marketing	CACECA
LIN	B.A. International Business	CACECA	
LRI	B.A. International Relations	ACCECISO	
Ciudad Juárez	IMT	B.S. Mechatronics Engineering	CACEI



Campus	Program	Description	Agency
Cuernavaca	IIS	B.S. Industrial Engineering with minor in Systems Engineering	CACEI
	IMT	B.S. Mechatronics Engineering	CACEI
	ITC	B.S. Computer Science and Technology	CONAIC
	LAE	Bachelor of Business Administration	CACECA
	LIN	B.A. International Business	CACECA
Estado de México	ARQ	B.A. of Architecture	ANPADEH
	IIS	B.S. Industrial Engineering with minor in Systems Engineering	CACEI
	IME	B.S. Mechatronics Engineering	CACEI
	IMT	B.S. Mechanical Engineering Option E	CACEI
	ISC	B.S. Computer Systems Engineering	CONAIC
	LDI	B.A. Industrial Design	COMAPROD
	LED	B.A. Law	CONAED
Guadalajara	ARQ	B.A. of Architecture	ANPADEH
	IBT	B.S. Biotechnology Engineering	CACEI
	IIS	B.S. Industrial Engineering with minor in Systems Engineering	CACEI
	IMD	B.S. Biomedical Engineering	CACEI
	IMT	B.S. Mechatronics Engineering	CACEI
	ITE	B.S. Electronic and Computer Engineering	CACEI
	LAE	Bachelor of Business Administration	CACECA
	LAF	B.A. Financial Management	CACECA
	LCDE	B.A. Business Creation and Development	CACECA
	LCPF	B.A. Finance and Accounting	CACECA
	LDI	B.A. Industrial Design	COMAPROD
	LEM	B.A. Marketing	CACECA
	LIN	B.A. International Business	CACECA
	LRI	B.A. International Relations	ACCECISO
Hidalgo	IIS	B.S. Industrial Engineering with minor in Systems Engineering	CACEI
	ITIC	B.S. Information and Communication Technologies	CONAIC
	LAE	Bachelor of Business Administration	CACECA
	LCPF	B.A. Finance and Accounting	CACECA
Laguna	IMT	B.S. Industrial Engineering with minor in Systems Engineering	CACEI
	LAF	B.S. Information and Communication Technologies	CACECA
	LCDE	B.A. Financial Management	CACECA
	LDI	B.A. Business Creation and Development)	COMAPROD
	LIN	B.A. International Business	CACECA
León	IIS	B.S. Industrial Engineering with minor in Systems Engineering	CACEI
	IMT	B.S. Mechatronics Engineering	CACEI
	LAF	B.A. Financial Management	CACECA
	LIN	B.A. International Business	CACECA
Monterrey	ARQ	B.A. of Architecture	ANPADEH
	IBT	B.S. Biotechnology Engineering	CACEI
	IC	B.S. Civil Engineering	CACEI
	IFI	B.S. Engineering Physics	CACEI
	IIA	B.S. Food Industry Engineering	CACEI
	IIS	B.S. Industrial Engineering with minor in Systems Engineering	CACEI
	IMA	B.S. Mechanical Engineering Option A	CACEI
	IMD	B.S. Biomedical Engineering	CACEI
	IME	B.S. Mechanical Engineering Option E	CACEI
	IMT	B.S. Mechatronics Engineering	CACEI
	INT	B.S. Business Informatics	CONAIC

Campus	Program	Description	Agency
Monterrey	IQA	B.S. Chemical Engineering Option A	CACEI
	ISD	B.S. Digital Systems and Robotics Engineering	CACEI
	ITC	B.S. Computer Science and Technology	CONAIC
	LAE	Bachelor of Business Administration	CACECA
	LAF	B.A. Financial Management	CACECA
	LCMD	B.A. Communication and Digital Media	CONAC
	LCPF	B.A. Finance and Accounting	CACECA
	LEC	B.A. Economics	CONACE
	LED	B.A. Law	CONFEDE
	LEM	B.A. Marketing	CACECA
	LIN	B.A. International Business	CACECA
	LMI	B.A. Journalism and Media Studies	CONAC
	LNB	B.A. Nutrition and Wellness	CONCAPREN
	LPL	B.A. Political Science	ACCECISO
	LPO	B.A. Organizational Psychology	CNEIP
	LRI	B.A. International Relations	ACCECISO
MC	Physician & Surgeon	COMAEM	
Puebla	ARQ	B.A. of Architecture	ANPADEH
	IIS	B.S. Industrial Engineering with minor in Systems Engineering	CACEI
	IMA	B.S. Mechanical Engineering Option A	CACEI
	IMT	B.S. Mechatronics Engineering	CACEI
	ITC	B.S. Computer Science and Technology	CACEI
	ITE	B.S. Electronic and Computer Engineering	CACEI
	LAD	B.A. Animation and Digital Art	COMAPROD
	LAE	Bachelor of Business Administration	CACECA
	LAF	B.A. Financial Management	CACECA
	LCDE	B.A. Business Creation and Development	CACECA
	LDI	B.A. Industrial Design	COMAPROD
	LED	B.A. Law	CIEES
	LIN	B.A. International Business	CACECA
LRI	B.A. International Relations	ACCECISO	
Querétaro	ARQ	B.A. of Architecture	ANPADEH
	IA	B.S. Agronomy Engineering	COMEAA
	IBT	B.S. Biotechnology Engineering	CACEI
	IC	B.S. Civil Engineering	CACEI
	IIA	B.S. Food Industry Engineering	CACEI
	IIS	B.S. Industrial Engineering with minor in Systems Engineering	CACEI
	IMA	B.S. Mechanical Engineering Option A	CACEI
	IMT	B.S. Mechatronics Engineering	CACEI
	ISC	B.S. Computer Systems Engineering	CACEI
	LAD	B.A. Animation and Digital Art	COMAPROD
	LAE	Bachelor of Business Administration	CACECA
	LAF	B.A. Financial Management	CACECA
	LCDE	B.A. Business Creation and Development	CACECA
	LCMD	B.A. Communication and Digital Media	CONAC
	LCPF	B.A. Finance and Accounting	CACECA
	LDI	B.A. Industrial Design	COMAPROD
	LIN	B.A. International Business	CACECA
LMC	B.A. Marketing and Communication	CACECA	
LRI	B.A. International Relations	ACCECISO	

Campus	Program	Description	Agencia
Saltillo	IIS	Bachelor of Business Administration B.A. International Business	CACEI
	IMT	B.S. Industrial Engineering with minor in Systems Engineering	CACEI
	LIN	B.S. Mechatronics Engineering	CACECA
San Luis Potosí	IIS	B.S. Industrial Engineering with minor in Systems Engineering	CACEI
	IMT	B.S. Mechatronics Engineering	CACEI
	LAE	Bachelor of Business Administration	CACECA
	LCDE	B.A. Business Creation and Development	CACECA
	LIN	B.A. International Business	CACECA
Santa Fe	IIS	B.S. Industrial Engineering with minor in Systems Engineering	CACEI
	ITC	B.S. Computer Science and Technology	CACEI
	IMT	Bachelor of Business Administration	CACEI
	LAE	B.A. Financial Management	CACECA
	LAF	B.A. Business Creation and Development	CACECA
	LCDE	B.A. Business Creation and Development	CACECA
	LIN	B.A. International Business	CACECA
	LRI	B.A. International Relations	ACCECISO
Sinaloa	IIS	B.S. Industrial Engineering with minor in Systems Engineering	CACEI
	LAF	B.A. Financial Management	CACECA
	LIN	B.A. International Business	CACECA
Sonora	ARQ	B.A. of Architecture	ANPADEH
	IIS	B.S. Industrial Engineering with minor in Systems Engineering	CACEI
	IMT	B.S. Mechatronics Engineering	CACEI
	LCDE	B.A. Business Creation and Development	CACECA
	LIN	B.A. International Business	CACECA
Tampico	IMT	B.S. Mechatronics Engineering	CACEI
	ITIC	B.S. Information and Communication Technologies	CACEI
	LIN	B.A. International Business	CACECA
Toluca	IIS	B.A. of Architecture	CACEI
	IMA	B.S. Industrial Engineering with minor in Systems Engineering	CACEI
	IMT	B.S. Mechanical Engineering Option A	CACEI
	ISC	B.S. Mechatronics Engineering	CACEI
	LAE	B.S. Computer Systems Engineering	CACECA
	LCPF	Bachelor of Business Administration	CACECA
	LED	B.A. Finance and Accounting	CONAED
	LEM	B.A. Law	CACECA
	LIN	B.A. Marketing	CACECA
Veracruz	IIS	B.A. International Business B.S. Industrial Engineering with minor in Systems Engineering	CACEI
	LAE	Bachelor of Business Administration	CACECA

## b) International

In addition, some of Tecnológico de Monterrey's programs have been accredited by the following international organizations:

- Accreditation Board for Engineering and Technology (ABET).  
111 Market Place, Suite 1050,  
Baltimore MD 21202-4012.  
United States of America  
Telephone: (+01)410-3477700  
[www.abet.org](http://www.abet.org)

- Association to Advance Collegiate Schools of Business (AACSB).  
777 South Harbour Island Boulevard, Suite 750  
Tampa, FL. 33602-5730  
Telephone: (+1) 813 769 6500  
[www.aacsb.edu/accreditation](http://www.aacsb.edu/accreditation)
- Institute of Food Technologists (IFT) Committee on Higher Education.  
525 W. Van Buren, Suite 1000  
Chicago, IL. 60607  
Telephone: (+1) 312 782 8424  
[www.ift.org](http://www.ift.org)
- Latin American Accrediting Council on Education in Journalism (CLAEP)  
1801 S.W. 3rd Avenue Miami, FL. 33129  
Telephones: (+1) 305 634 2465. (+1) 305 635 2272  
[www.claep.org](http://www.claep.org)
- The Accrediting Council on Education in Journalism and Mass Communications (ACEJMC)  
1435 Jayhawk Blvd.  
Lawrence, KS 66045  
Telephone: (+1) 785 864 3973
- National Association of Schools of Art and Design (NASAD)  
11250 Roger Bacon Drive, Suite 21  
Reston, VA 20190-5248  
Telephone: 703-437-0700  
<http://nasad.arts-accredit.org/>

This list shows Tecnológico de Monterrey's undergraduate programs accredited by international organizations, at March, 2016, in the academic areas indicated:

### Undergraduate Programs Accredited by International Agencies, by Campus

Campus	Program	Description	Agencia
Chihuahua	MT	B.S. Mechatronics Engineering	ABET
	IIS	B.S. Industrial Engineering with minor in Systems Engineering	ABET
Estado de México	IIS	B.S. Industrial Engineering with minor in Systems Engineering	ABET
	IME	B.S. Mechanical Engineering Option E	ABET
	IMT	B.S. Mechatronics Engineering	ABET
Monterrey	IBT	B.S. Biotechnology Engineering	AABET
	IC	B.S. Civil Engineering	ABET
	IFI	B.S. Engineering Physics	ABET
	IIA	B.S. Food Industry Engineering	ABET / IFT
	IIS	B.S. Industrial Engineering with minor in Systems Engineering	ABET
	IMA	B.S. Mechanical Engineering Option A	ABET
	IME	B.S. Mechanical Engineering Option E	ABET
	IMT	B.S. Mechatronics Engineering	ABET
	IQA	B.S. Chemical Engineering Option A	ABET
	IQP	B.S. Chemical Engineering Option S	ABET
	ISD	B.S. Digital Systems and Robotics Engineering	ABET
	ITC	B.S. Computer Science and Technology	ABET
	LAE	Bachelor of Business Administration	AACSB
	LAF	B.A. Financial Management	AACSB
	LCD	B.A. Communication and Digital Media	ACEJMC
	LCPF	B.A. Finance and Accounting	AACSB
	LEC	B.A. Economics	AACSB
LEM	B.A. Marketing	AACSB	
LIN	B.A. International Business	AACSB	
LMI	B.A. Journalism and Media Studies	CLAEP & ACEJMC	
Querétaro	IIS	B.S. Industrial Engineering with minor in Systems Engineering	ABET
	IMA	B.S. Mechanical Engineering Option A	ABET
	IMT	B.S. Mechatronics Engineering	ABET
	ISC	B.S. Computer Systems Engineering	ABET
	LDI	B.A. Industrial Design	NASAD
San Luis Potosí	IIS	B.S. Industrial Engineering with minor in Systems Engineering	ABET

## Campus Directory

Tecnológico de Monterrey has 26 campuses nationwide, which are listed below together with their contact information.

### Aguascalientes Campus

**Campus Director:**

**Agustín Mateo Arredondo Corrales**

*agustin.mateo@itesm.mx*

Av. Eugenio Garza Sada # 1500

Aguascalientes, Aguascalientes, C.P. 20328

Telephone: +52 (449) 910-0900

<http://www.ags.itesm.mx>

### Central de Veracruz Campus

**Campus Director:**

**Mauricio García Ballinas**

*mauricio.garcia@itesm.mx*

Av. Eugenio Garza Sada # 1

Col. Las Quintas

Córdoba, Veracruz, C.P. 94500

Telephone: +52 (271) 717-0500

<http://www.ver.itesm.mx>

### Chiapas Campus

**Campus Director:**

**Manuel de Jesús Villalobos García**

*mvillalobos@itesm.mx*

Carretera Tapanatepec Km. 149 + 746

Col. Juan Crispín

Tuxtla Gutiérrez, Chiapas, C.P. 29020

Telephone: +52 (961) 617-6000

<http://www.chs.itesm.mx>

### Chihuahua Campus

**Campus Director:**

**Dr. Rodolfo Julio Castillo Zetina**

*rodolfo.castello@itesm.mx*

Av. Heróico Colegio Militar # 4700

Col. Nombre de Dios

Chihuahua, Chihuahua., C.P. 31300

Telephone: +52 (614) 439 5000

<http://www.chi.itesm.mx>

### México City Campus

**Campus Director:**

**Dr. Pedro Luis Grasa Soler**

*grasa@itesm.mx*

Calle del Puente # 222, esq. Periférico Sur

Col. Ejidos de Huipulco

Delegación Tlalpan

México, D.F., C.P. 14380

Telephone: +52 (55) 5483-2020

<http://www.ccm.itesm.mx>

### Ciudad Juárez Campus

**Campus Director:**

**Arq. Carlos Bejos Acevo**

*cbejos@itesm.mx*

Bldv. Tomás Fernández Campos # 8945

Parque Industrial Antonio J. Bermúdez

Ciudad Juárez, Chihuahua, C.P. 32470

Telephone: +52 (656) 629-9100

<http://www.cdj.itesm.mx>

### Ciudad Obregón Campus

**Campus Director:**

**Claudia Margarita Félix Sandoval M.A.**

*c.felix@itesm.mx*

California # 2100 Nte.

Col. Obregón Norte

Ciudad Obregón, Sonora, C.P. 85010

Telephone: +52 (644) 410-5700

<http://www.cob.itesm.mx>

### Cuernavaca Campus

**Campus Director:**

**Dr. José Carlos Miranda Valenzuela**

*jmiranda@itesm.mx*

Autopista del Sol Km 104

Col. Real del Puente

Xochitepec, Morelos, C.P. 62790

Telephone: +52 (777) 362 0800

<http://www.cva.itesm.mx>

**Estado de México Campus****Campus Director:****Dr. Pedro Luis Grasa Soler***grasa@itesm.mx*

Carretera Lago de Guadalupe Km. 3.5

Atizapán de Zaragoza

Estado de México, C.P. 52926

Telephone: +52 (55) 5864-5555

<http://www.cem.itesm.mx>**Guadalajara Campus****Campus Director:****Dr. Mario Adrián Flores Castro***adrian.flores@itesm.mx*

Ave. Gral. Ramón Corona # 2514

Col. Nuevo México

Zapopan, Jalisco, C.P. 45201

Telephone: +52 (33) 3669-3000

<http://www.gda.itesm.mx>**Hidalgo Campus****Campus Director:****Claudia Gallegos Cesaretti***cgallego@itesm.mx*

Blvd. Felipe Ángeles # 2003

Col. Venta Prieta

Pachuca, Hidalgo, C.P. 42080

Telephone: +52 (771) 717-02-14

<http://www.hgo.itesm.mx>**Irapuato Campus****Campus Director:****Javier Benavides Ornelas***javier.benavides@itesm.mx*

Paseo Mirador del Valle # 445

Col. Villas de Irapuato

Irapuato, Guanajuato, C.P. 36670

Telephone: +52 (462) 606-8000

<http://www.ira.itesm.mx>**Laguna Campus****Campus Director:****Martín López Méndez***lopezmendez@itesm.mx*

Paseo del Tecnológico # 751

Col. Ampliación la Rosita

Torreón, Coahuila, C.P. 27250

Telephone: +52 (871) 729-6363

<http://www.lag.itesm.mx>**León Campus****Campus Director:****Dr. Isaac Lucatero Castañeda***isaac.lucatero@itesm.mx*

Av. Eugenio Garza Sada S/N

Col. Cerro Gordo

León, Guanajuato, C.P. 37190

Telephone: +52 (477) 710-9000

<http://www.leo.itesm.mx>**Monterrey Campus****Campus Director:****Víctor Eduardo Gutiérrez Aladro***victor.gutierrez@itesm.mx*

Av. Eugenio Garza Sada #2501 Sur

Col. Tecnológico

Monterrey, Nuevo León, C.P. 64849

Telephone: +52 (81) 8358-2000

<http://www.mty.itesm.mx>**Morelia Campus****Campus Director:****Dr. Edgar Montalvo Escamilla***edgar.montalvo@itesm.mx*

Camino a Jesús del Monte S/N

Col. Jesús del Monte

Morelia, Michoacán, C.P. 58350

Telephone: +52 (443) 322-6800

<http://www.cmr.itesm.mx>**Puebla Campus****Campus Director:****Rashid Abella Yunes***rabella@itesm.mx*

Vía Atlixcayotl # 2301

Col. San Andrés

Cholula, Puebla, C.P. 72800

Telephone: +52 (222) 303-2000

<http://www.pue.itesm.mx/>**Querétaro Campus****Campus Director:****Romeo Salvador Coutiño Audiffred***scoutino@itesm.mx*

Av. Epigmenio González # 500



Fraccionamiento San Pablo  
 Querétaro, Querétaro, C.P. 76130  
 Telephone: +52 (442) 238-3100  
<http://www.gro.itesm.mx>

### **Saltillo Campus**

**Campus Director:**  
**Angelberto Guardado Astorga**  
*aguardad@itesm.mx*  
 Prol. Juan de la Barrera # 1241 Ote.  
 Col. Cumbres  
 Saltillo, Coahuila, C.P. 25270  
 Telephone: +52 (844) 411-8000  
<http://www.sal.itesm.mx>

### **San Luis Potosí Campus**

**Campus Director:**  
**Dr. Héctor Morelos Borja**  
*hmorelos@itesm.mx*  
 Av. Eugenio Garza Sada # 300  
 Fracc. Lomas del Tecnológico  
 San Luis Potosí, San Luis Potosí, C.P. 78211  
 Telephone: +52 (444) 834-1000  
<http://www.slp.itesm.mx>

### **Santa Fe Campus**

**Campus Director:**  
**Dr. Pedro Luis Grasa Soler**  
*grasa@itesm.mx*  
 Ave. Carlos Lazo # 100  
 Col. Lomas de Santa Fe,  
 Delegación Álvaro Obregón  
 México, D.F., C.P.01389  
 Telephone: +52 (55) 9177-8000  
<http://www.csf.itesm.mx>



### **Sinaloa Campus**

**Campus Director:**  
**Isidro Cavazos de León**  
*icavazos@itesm.mx*  
 Blvd. Pedro Infante # 3773 Pte.  
 Culiacán, Sinaloa, C.P. 80100  
 Telephone: +52 (667) 759-1600  
<http://www.sin.itesm.mx>

### **Sonora Norte Campus**

**Campus Director:**  
**Dr. Francisco Javier Quezada Andrade**  
*jquezada@itesm.mx*  
 Blvd. Enrique Mazón López # 965  
 Hermosillo, Sonora, C.P. 83000  
 Telephone: +52 (662) 259-1000  
<http://www.her.itesm.mx>

### **Tampico Campus**

**Campus Director:**  
**Marco Edgar Vargas Herrada**  
*marco.vargas@itesm.mx*  
 Blvd. Petrocel Km. 1.3 Puerto Industrial  
 Altamira, Tamaulipas, C.P. 89600  
 Telephone: +52 (833) 229-1600  
<http://www.tam.itesm.mx>

### **Toluca Campus**

**Campus Director:**  
**Juan Carlos Arreola Rivas**  
*juan.carlos.arreola@itesm.mx*  
 Eduardo Monroy Cárdenas # 2000  
 San Antonio Buenavista  
 Toluca, Estado de México, C.P. 50110  
 Telephone: +52 (722) 279-9990  
<http://www.tol.itesm.mx>

### **Zacatecas Campus**

**Campus Director:**  
**Miguel Ángel Burgoin Carrera**  
*miguel.burgoin@itesm.mx*  
 Ave. Pedro Coronel # 16  
 Col. Dependencias Federales  
 Guadalupe, Zacatecas, C.P. 98600  
 Telephone: +52 (492) 925-6820  
<http://www.zac.itesm.mx>

## Educational Model Tec 21

The educational model of Tecnológico de Monterrey comprises a set of structured components through which the institution fulfills its students' educational goals. It integrates the aims of the institutional mission and the values it promotes, the pedagogical practices that make it operational, and the supporting mechanisms and resources.

### Characteristics of the Educational Model

- Academic content that encompasses an education in science, technology, humanism, ethics and citizenship.
- Use of teaching techniques that provide a practical approach to our students' education and offer them the opportunity to analyze and propose answers to complex real-world and work-environment problems. These techniques include: Collaborative Learning, Problem-based Learning, Project-oriented Learning, Case Method, Service Learning and Research-based Learning.
- Development of our students' capacity for self-directed research and learning, as a result of their active participation in the educational process. This will enable them to keep up-to-date throughout their professional lives.
- Use of the most advanced information technologies as learning support tools.
- A comprehensive educational approach complemented by co-curricular activities in student leadership, cultural diffusion and physical education.

Through the Educational Model Initiative Tec 21, our educational model adapts to the times, fulfilling its purpose of driving the skills of current generations, in order to educate leaders with an



entrepreneurial spirit, ethics and citizenship and who are internationally competitive. This will enable our students to face up to the challenges of a world that has yet to be invented.

### Characteristics that Enrich Our Educational Model



**Faculty** who are innovative and up-to-date in their discipline, have experience in their professional practice (liaison) and incorporate technology in the teaching-learning process.

**Challenging, interactive learning experiences** in the new educational spaces.



**Flexibility** in how, when and where the teaching-learning process takes place.



The following is a description of the characteristics of the diverse programs through which Tecnológico de Monterrey educates its students; the academic processes that form the framework of their personal and professional development; the resources that support and facilitate these processes; and the quality assurance schemes for the Institution's overall academic operations.

## Student Learning Development Process

The main characteristic of Tecnológico de Monterrey's educational process is the active role played by students in their own education. By becoming actively involved in this process, students develop the capacity for self-directed learning, which is indispensable for innovating and staying up to date throughout their professional lives. Moreover, while studying at the Institution, students develop a series of personal competencies that enable them to attain a comprehensive education. The following is a list of the main elements that distinguish Tecnológico de Monterrey educational process:

### ◆ Active Learning

The environment at Tecnológico de Monterrey is designed to offer students multiple opportunities to participate actively in their professional and personal preparation process. Through the institution-wide use of diverse teaching techniques, such as problem-based learning, project-oriented learning, collaborative learning, service-learning, case method and research-based learning, among others, students play a purposeful, structured role in the construction of their knowledge and the development of the competencies described in the graduate profile and the Mission. In this context, students can discover, process and apply knowledge in a relevant, significant way both inside and outside the classroom.

### ◆ Self-regulated Learning

A key objective of Tecnológico de Monterrey's learning model is for students to develop the skills needed to achieve lifelong learning. Therefore, in their courses, they repeatedly face challenging, highly academically demanding educational situations, which motivate them to gradually develop the capacity to regulate their learning, setting goals and reflecting on their achievements.

Throughout this process, the students are constantly guided and supported by their teachers and by the huge range of physical, technological and human resources offered by the Institution.

### ◆ Comprehensive Education

Comprehensive education is based on the idea of developing in students the diverse human dimensions. With this aim, the educational model contemplates the development of competencies for reflecting on, analyzing and evaluating the social, economic, political and ecological reality, from both personal and professional perspectives; respect for others and for the environment; acting with solidarity and responsibility to enhance the quality of life of the country and the world. Tecnológico de Monterrey's comprehensive education is based on its academic programs, cross-curriculum strategies and a variety of co-curricular activities.

### ◆ Teaching Techniques

Just as the greatest care is employed when designing the programs' curricula and selecting the content, Tecnológico de Monterrey's academic activity is characterized by the use of teaching techniques that add a practical and professional approach to the students' academic training, while developing their personal competencies. Although techniques to support teaching have always been used at Tecnológico de Monterrey, the Institution formalized a faculty training program in this area to strengthen the implementation of its educational model

and strongly promote its application in each of the courses offered.

There are many teaching techniques and just as many ways of classifying them. In the same way, at an institutional level, the faculty select the techniques that they consider to be the most appropriate for their teaching objectives. The most commonly used techniques are:

- Collaborative Learning
- Problem-based Learning
- Project-oriented Learning
- Case Method
- Service-Learning
- Research-based Learning

#### ◆ **The Professor as a Learning Facilitator and Guide**

The faculty profile underscores their outstanding preparation within their professional fields, as well as the intensive teacher training fomented by the Institution that enables the professors to design and guide carefully structured teaching processes in which students will achieve the maximum benefit of their participation.

## Internationalization

Students' academic preparation is broadened with internationalization experiences that enrich their academic life by offering a more global insight.

The internationalization component helps students to enrich their academic life with more global experiences, through academic, cultural and linguistic exchange, and also to take a major step towards achieving personal maturity.

Students are offered the internationalization experience through:

- Participation in academic experiences in prestigious overseas universities and academic institutions for periods of two semesters, one semester, one summer or a specific academic trip.
- Socializing with and meeting students from other countries who are studying at one of Tecnológico de Monterrey's campuses.
- Attendance at conferences offered by qualified scholars from foreign universities who have been invited as visiting professors to Tecnológico de Monterrey or who participate in satellite sessions or online courses.



- Participation in projects conducted in association with groups of students from foreign universities through the facilities offered online.

## Undergraduate Programs

Tecnológico de Monterrey offers a wide variety of undergraduate programs and specializations.

The academic programs include the areas of Administration and Finance, Engineering and Architecture, Education, Information Technologies and Electronics, Health Sciences, Humanities and Social Sciences.

In view of the demands of an increasingly complex, globalized society and a changing, competitive environment, Tecnológico de Monterrey considers that the education offered by universities should go beyond vocational competencies. This implies providing students with a comprehensive education that will enable them, on graduating, to address the diverse professional, personal and citizenship challenges that will arise throughout their lives. The importance attached by Tecnológico de Monterrey to comprehensive education is clearly portrayed in its institutional Vision and Mission.

The undergraduate curricula include the following components:

### a. General Education

Apart from the occupational competencies specific to their profession, each of the programs includes objectives that focus on the development of the following general competencies in students:

#### — Communication competencies:

- Displays communication skills by using language appropriately as a learning, reflection and communication instrument in both academic and professional settings.

- Is proficient in English, including reading and writing and oral comprehension skills, at a level that enables the student to perform in international academic settings.

#### — Ethical competencies:

- Reflects on, analyzes and evaluates ethical dilemmas related to themselves, their professional practice and their environment.
- Respects people and the environment.

#### — Humanistic competencies:

- Appreciates and analyzes diverse artistic and cultural expressions that contribute to the student's understanding of the world and of his or her social and personal reality.

#### — Citizenship competencies:

- Knows and is aware of the social, economic and political reality.
- Acts with solidarity and civic responsibility to improve the quality of life in the community, particularly deprived communities.

#### — Mathematics competencies:

- Displays adequate mathematical reasoning skills, and uses them to solve problems.

#### — Entrepreneurship competencies:

- Carries out the necessary actions to realize innovative ideas with the resources available, seeking to generate the greatest possible value, assessing their feasibility and the risks involved.

In order to develop these competencies, since 2011 Tecnológico de Monterrey's curricula have included ten courses distributed as follows:



### Communication and Foreign Languages

1. Analysis and Verbal Expression
2. Verbal Expression in the Workplace
3. Foreign Language (English or another language if the student is proficient in the English language)

**3 courses obligatory for all the degrees**

#### Area of Ethics

1. Bioethics/Clinical Bioethics
2. Ethics, Self and Society
3. Applied Ethics

**2 courses obligatory for all the degrees**

#### Area of Humanities and Fine Arts

1. Musical Appreciation I
2. Contemporary Art and Society
3. Art and Interculturality
4. Contemporary Art and Culture
5. Film, Literature and Culture
6. Creative Writing
7. History of Architecture and the City
8. Mexican Identity and Culture
9. Contemporary Literature and Society
10. Contemporary World Literature
11. Media, Culture and Society
12. Music and Society

**One course obligatory for all the degrees**

#### Area of Citizenship

1. Citizenship: Political and Social Practice
2. Citizenship and Democracy
3. Social Responsibility and Citizenship
4. Civil Society and Citizen Participation
5. Society, Development and Citizenship in Mexico

**One course obligatory for all the degrees**

### Ethics, Humanities/ Fine Arts and Citizenship

### Mathematics and Natural Sciences

1. Introduction to Financial Mathematics
2. Mathematics for Design
3. Mathematics
4. Mathematics I
5. Mathematics for Engineering I
6. Statistics for Research in Social Sciences
7. Biostatistics

**One course obligatory for all the degrees**

### Entrepreneurship

1. Development of Social Impact Companies
2. Education for the Development of Entrepreneurial Leadership
3. Microenterprise Planning for Social Development

**One course obligatory for all the degrees**

*Note: Students can choose other courses (not included in this table) depending on the options available according to their degree and campus, as long as they are authorized by the Academy for the corresponding area of knowledge and the Vice Rector for Academic.*

### b. Basic Core Courses

These courses are shared by several undergraduate programs and are offered in the areas of administration, health sciences, social sciences, humanities and engineering.

### c. Discipline Courses

Son los cursos que forman a los estudiantes en el área principal de conocimiento de cada programa de licenciatura.

### d. Relationships with Regional Companies or Organizations

These relationships are achieved through the Development Support Courses (CAD) based on the practical learning methodology in which students complete a project for a company or institution, under the guidance of a professor with experience in leading projects or consulting processes, who acts as the teaching-learning facilitator. The outcome is significant learning in students and a direct benefit for the company or organization. In these courses, the educational process focuses on developing the skills and qualities needed to enrich students' professional work with actions that reflect responsibility for themselves and for the rest of society.

One of the key characteristics of the CAD courses is that the time devoted to the project represents at least 70% of the course's total academic load.

### e. Elective Courses

The elective courses give students the opportunity to broaden their professional vision through diverse classes or a modality. The modalities are academic options consisting of a set of courses and learning experiences that enrich students' preparation by providing them with knowledge and skills in a discipline that complements their degree program or that aims to enhance the skills, attitudes and values described in the graduate profile. Elective courses also allow students to engage in



research, internationalization or university-business relationship programs.

### f. Comprehensive Education

Tecnológico de Monterrey fomenta the comprehensive education of its students by giving them the opportunity to participate in a variety of student activities that promote the development of the values, attitudes and skills stated in the institutional Vision and Mission.

### g. Community Social Service

Tecnológico de Monterrey has instituted a Community Social Service program which forms part of the Social Service mandated by law in Mexico as a graduation requirement. The aim of this program is to help students to become aware of the country's social reality by participating in programs that generate social, economic and educational development in needy communities and institutions.

### h. Modalities

At Tecnológico de Monterrey, students can achieve their full potential in keeping with their interests, while studying for their degree, through the option of electing a modality that will train them in a complementary discipline and provide the opportunity to obtain a certificate in addition to their bachelor's degree diploma.

**Characteristics of the Modalities**

- They are optional for students.
- They begin from the fourth semester and do not imply additional requirements (although there are some exceptions).
- They offer students a special approach by providing the opportunity to attend workshops, summer school and study abroad, study their topics and some courses in a discipline of their interest.

The modalities students can choose from are:

- Bicultural
- Consultancy
- Entrepreneurship
- Entrepreneurial Families
- Research and Innovation
- Professional experience
- Leadership for social development

For further details about the modalities, please visit <http://www.itesm.mx>, Profesional- Programas de estudio- Modalidades.

**i. Concentrations**

The professional concentrations furnish knowledge and skills in a discipline that complements the students' major, or in areas related to the degree program in order to enhance their learning. Unlike the modalities, concentrations do not require prior workshop attendance or internships.

**Characteristics of the Concentrations**

The total academic load is 48 units, distributed as follows:

- Four or five courses, each with an academic load of 8 units.
- One or two capstone projects, each with an academic load of 8 units and to be completed in an organization assigned in accordance with the area of concentration.
- The courses that comprise the concentrations provide credit for the variable courses (identified in the curricula as "Topics").
- Concentrations can be studied as of the fifth semester.

Students can choose one of the following concentrations:

**Administration and Finance**

- Service Management
- Bank Management
- Retail Management
- Retail
- Business Creation
- Marketing and Sales
- Private Law
- Public Law
- Innovation
- Family Businesses and Wealth Generation
- Financial Analysis and Investment Management
- Financial Markets
- Business Finance
- Finance
- Pharmaceutical Management
- Hospitality Management
- International Business
- Knowledge Management
- Logistics
- Interactive Marketing
- Marketing Strategies
- Marketing
- International Entrepreneurship
- International Accounting
- Small Business Management
- Promotion and Advertising
- Human Resource Management
- Global Supply Chain Management
- Tourism

**Health Sciences**

- Biomedical Microtechnology

**Humanities and Social Sciences**

- Latin American Art
- Global Affairs
- Political Science
- Communication and Public Relations
- International Cooperation for Development
- Literary Creation
- Editorial Project Creation
- Political Studies
- Contemporary Literature and Discourse
- Music

- Journalism
- Film Production
- Audiovisual Media Production

### ***Engineering and Architecture***

- Agricultural Engineering
- Construction Management
- Environment and Sustainable Development
- Agribusiness
- Aeronautical Engineering
- Biobusiness
- Quality and Production
- Aeronautical Design and Manufacturing
- Design and Manufacturing
- Automotive Styling
- Automotive Mechanical Design
- Environmental Management and Administration
- Automotive Engineering
- Agroindustrial Engineering
- Health Systems Engineering
- Process Enhancement in the Automotive Industry
- Automotive Mechatronics
- Engineering Works
- Robotics
- Supervision and Advanced Control
- Agri-food Production Systems
- Plastics and Resin Technologies
- Animation and Visual Effects
- Interior Architecture
- Jewelry Design, Manufacturing and Commercialization
- Biopharmaceutical Processes

### ***Information Technologies and Electronics***

- Business Intelligence
- Applied Robotics
- Intelligent Systems

## **Resources and Media**

### **◆ Information and Communication Technologies**

In an era of major advancements in the development and use of information and communication

technologies, Tecnológico de Monterrey promotes their use with the twofold aim of bringing students into contact with these tools, as a competitive advantage in their professional education and, at the same time, making the most of all the support resources available to enrich the teaching-learning process.

### **◆ Tecnológico de Monterrey Library Network**

In order to support the learning, research and social development activities in which students and faculty participate, Tecnológico de Monterrey has a solid collection of printed and digital information resources made available through the 32 libraries distributed in each of its campuses and a Digital Library.

As a result of the collection development program, the Tecnológico de Monterrey Library Network collection continued to be enriched during 2015 through the acquisition of 352,225 volumes (55,839 physical and 296,386 digital), reaching a total printed and digital bibliographic collection of 3.5 million volumes– 2,367,646 physical and 1,139,793 digital – available for the academic community. The collection includes books, eBooks, encyclopedias, discs, videos, magazines and journals that cover all the areas of knowledge in which Tecnológico de Monterrey offers academic programs. Moreover, in 2015, the libraries dealt with a total of 415,454 physical book loan requests, while, through the Digital Library ([biblioteca.itesm.mx](http://biblioteca.itesm.mx)), an average of 2 million searches were completed every month in the electronic information resources.

### **◆ Vice Rector for Online Programs**

Tecnológico de Monterrey offers graduate, continuing education and social development programs in Mexico and some Latin American countries, using innovative educational models, learning networks and advanced information technologies, to contribute to the integration and development of Spanish-speaking communities.

The courses on line respond to diverse market

needs. Faculty members who are experts in their fields, assisted by a team of instructional design and technology specialists, are in charge of developing these courses. Moreover, the faculty are supported by a team of tutors to manage the students' learning process.

The variety of services on line spans undergraduate courses to online literacy programs for the members of the most underprivileged communities in the country, as well as a wide range of master's degrees and continuing education programs. It also offers teacher training programs for both Tecnológico de Monterrey professors and those from other educational systems in Mexico and at least ten other Latin American countries.

### ◆ Student Life

Tecnológico de Monterrey, in its endeavor to promote the development and comprehensive education of its students, offers diverse programs, courses, workshops and student groups that provide spaces for the development of competencies, such as leadership, self-confidence, ethics and citizenship. These competencies help students to fulfill their personal and professional goals.

The formal student life actions include sports, cultural and student leadership activities, together with prevention and psycho-pedagogic counseling, which are offered through the healthy envi-

ronment promotion program.

For further information about student life at Tecnológico de Monterrey, visit: <http://dae.itesm.mx/>.

### ◆ Vocational Guidance

A vocational guidance program run by expert specialists is available to students at the Tecnológico de Monterrey campuses upon request. The objective of this service is to provide high school and undergraduate students with the tools for making decisions regarding their life and career plans, such as choosing which major they are going to study, deciding whether to change majors or if they have doubts about continuing at the Institution. Students can take tests in this space to identify the skills, interests and personality characteristics that coincide with the professional profiles of the different degree programs and which are important components in this decision-making process.

### ◆ Dormitories

In order to provide a comprehensive service, the Guadalajara, Monterrey, Puebla and Querétaro campuses offer dormitories that promote integration and participation in co-curricular activities, such as excursions, tournaments and trips, as well as the possibility of socializing with people from other parts of the world.



## Academic Policies and Academic Regulations



### Admissions

Tecnológico de Monterrey's admissions process focuses on selecting young people who have the potential to become internationally competitive leaders with a spirit of entrepreneurship and a sense of humanity, as well as the clear capacity and enthusiasm to enrich the academic and student life of the Tecnológico community. As a selective institution, every year there are more student applications than available places.

The Admission Committee is responsible for reviewing the profiles and academic records, since its members assign the admissions decisions through a comprehensive process of selection criteria, as follows:

- Application for admission
- Result of the Academic Aptitude Test
- Prior academic history
- Curriculum (academic, leadership, sports, cultural, personal accomplishments, etc.)

- Essay (which reflects the applicants' personal interests and displays their enthusiasm for belonging to our community)
- Letters of recommendation
- Result of the TOEFL or an alternative English language proficiency test
- Interview

For further details on the undergraduate admissions process, visit the Tecnológico de Monterrey website at <http://www.itesm.edu>.

### Credit Transfer

The credit transfer and equivalence agreements for students enrolled in Tecnológico de Monterrey with partial studies in an academic period, completed at another educational institution, are issued by the Mexican Department of Education based on a proposal made for each particular case by Tecnológico de Monterrey.

Tecnológico de Monterrey recognizes the results of the official examinations by area of knowledge of the International Baccalaureate (IB) and of the Advanced Placement Program (AP), for undergraduate course credit transfer.

Credit transfer applications must be completed during the admissions process for the selected undergraduate degree through the Credit and Credit Transfer Office of the corresponding campus.

The deadline for requesting credit transfer corresponds to the date specified to request a change of courses during the students' first semester at our institution.

## Evaluation and Continuance

Tecnológico de Monterrey considers that from 48 to 60 units per semester is an adequate academic load. It structures its curricula and enrollment rules around these figures.

The evaluation of the students' performance in each of their courses is carried out through partial evaluations and a final evaluation. The final evaluation is compulsory.

Grades are expressed in whole numbers, on a scale of one to one hundred. The minimum pass grade is seventy.

Regarding continuance at Tecnológico de Monterrey, the students with Academic Support standing will face permanent dismissal for unsatisfactory academic performance if:

1. They do not enroll in the Academic Support Program.
2. They fail one or two courses while enrolled in the Academic Support Program.
3. After completing the Academic Support Program, they fail:
  - a. Two or more courses in each of the last three consecutive academic periods.

- b. Three or more courses in each of the last two consecutive academic periods.

Regarding these two subsections, all the courses completed by the student, including remedial courses, will be taken into account even if the student changes his/her major. However, the results of intensive courses will not be taken into account.

4. They fail a total of four or more of the following eighteen courses in which they enroll as of their entry into the Academic Support Program.

## Graduation

In order to receive an undergraduate degree at Tecnológico de Monterrey, students must satisfy the following requirements:

1. Completion in full of high school studies before passing the first course of the undergraduate curriculum.
2. Taken and passed all the courses included in the curriculum of the major from which they are graduating, in accordance with the provisions of Tecnológico de Monterrey's academic regulations.
3. Completed their social service, in accordance with the legal principles in effect and the corresponding institutional regulations.
4. Taken the General Exit Exam of the National Education Evaluation Center in the majors for which this exam exists. In the case of the majors for which this exam does not exist, students will take a comprehensive examination designed for this purpose.
5. Obtained at least the minimum grade stipulated by Tecnológico de Monterrey on the exam selected by Tecnológico de Monterrey to evaluate students' proficiency in the English language.

## General Student Rules and Regulations

Since its foundation, Tecnológico de Monterrey defined the regulations that would guide its students regarding academic expectations and their conduct inside and outside the classroom.

The Institution, committed to its academic quality, informs the students and the community of the regulations that govern it within the framework of the principles and values stated in the Mission.

The General Student Rules and Regulations can be consulted at <http://www.itesm.mx/wps/wcm/connect/ITESM/Tecnologico+de+Monterrey/Carreras+Profesionales/Admision/Políticas+y+reglamentos/?cache=none>

## Educational Support and Scholarships

In general, the three types of financial aid programs offered by Tecnológico de Monterrey, applicable to Mexican students, are:

### — Traditional or Socioeconomic Program

This program targets students with an outstanding academic standing and insufficient funds to pay the tuition fees in their entirety.

In the scholarship-loan program, when the scholarship holders graduate, they will be responsible for paying back to the Institute the educational loan enjoyed during their studies, in order to provide another student with financial support.

In the scholarship program, students do not have to pay the Institute back after graduation.

### — Talent Program

Some of the Tecnológico de Monterrey campuses award a limited number of high school and undergraduate scholarships for students whose academic performance is outstanding or who are

highly talented in sports, cultural or leadership activities.

### — Academic Loan Program

As part of the financial aid that Tecnológico de Monterrey awards to its students to favor the continuance of their education, the Institution has established an academic loan program, which is an option for high school, undergraduate and graduate students.

The Tec Academic Credit, which is available to all students regardless of their grade point average, grants diverse amounts of financial aid according to the economic situation of the student and also offers flexible payment terms.

## Fee refunds

Students who withdraw from the courses in which they are enrolled will be refunded a percentage of the total corresponding fees in accordance with the cost of the program and the established policies, which are published on the official Tecnológico de Monterrey website (<http://www.itesm.edu>).



## Research

For Tecnológico de Monterrey, research is a strategic activity that promotes the generation of innovative solutions for the economic, social and environmental development of Mexico. Tecnológico de Monterrey, committed to scientific and applied research oriented toward adding value to society, focuses its human, material and financial resources on priority areas, in order to drive companies' competitiveness, regional progress, the growth of technology-based businesses and its own educational model.

One of the objectives of research is to identify strategic industrial sectors in the regions of the country in which the institution's campuses are located.

Tecnológico de Monterrey has decided to center its scientific activity on eight strategic research areas in order to foster innovation, knowledge generation and knowledge transfer, endeavoring to solve problems in Mexico and across the world. These eight strategic areas are:

### Strategic focus areas:

- I. Biotechnology
- II. Mechatronics
- III. Information Technologies, Electronics and Communications
- IV. Sustainable Technologies Sustentables
- V. Public Policy
- VI. Business
- VII. Medicine

### Transversal Area:

- VIII. Education, Humanities and Social Science

The strategic focus of research in these areas seeks to:

- Accelerate the preparation of leading research professors in state-of-the-art topics.
- Access to cutting-edge knowledge through strategic ties with the top universities.
- Educate human capital in strategic areas through world-class academic programs.

- Help Mexican companies to become leaders in research, technology development and innovation.
- Develop technological solutions that will transform strategic sectors.

In order to fulfill these scientific objectives, the institution has created 41 strategic groups that support the academic and research activities of the Graduate Schools and of the research-oriented academic programs.

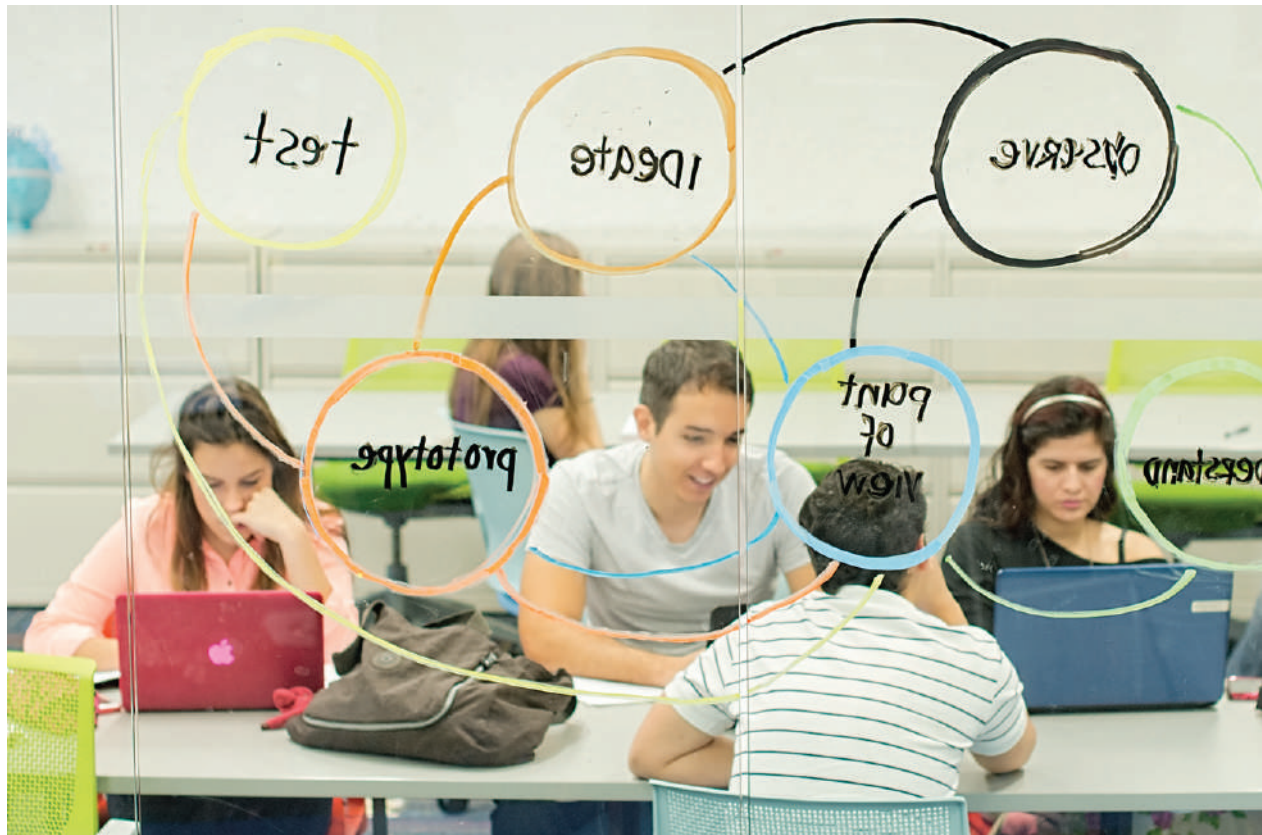
These groups engage in generating knowledge at the forefront of their discipline, taking into consideration global technological and social megatrends. Each group is made up of a worldwide leader in the discipline, a national-level leader and research professors from the different graduate schools. Doctoral students, postdoctoral researchers, master's students and undergraduate students also participate.

The 41 focus groups enjoy the participation of 68 international and national leaders, 371 professors, 411 doctoral students, 143 master's students, and 53 postdoctoral researchers.

In addition to these focus groups, there are four strategic initiatives: Nanotechnology, Energy, Education and Entrepreneurship. The leading educational institutions in the world participate in these initiatives, in which research is conducted across the diverse schools and strategic focus groups.

Research that transforms lives is one of the seven Strategic Initiatives of Tecnológico de Monterrey's 2020 Strategic Plan, driving the generation of innovative solutions for the sustainable economic and social development of Mexico. Eight of the projects are currently transforming Mexico, developed by the Institution's researchers in the areas of education, engineering, sustainable development, medicine, nanotechnology and security, seeking to convert scientific knowledge into socially beneficial innovative solutions,





enhancing and changing people's daily lives. Multidisciplinary teams, comprised of researchers from different levels, work in alliance with national and foreign institutions on topics ranging from the creation of exoskeletons to improve the quality of life of people who, for diverse reasons, have lost the capacity for movement, to corneal grafts to restore lost vision or the rescue of marginalized communities through the adoption of productive projects. Find out more at:

[http://sitios.itesm.mx/congresodeinvestigacion/proyectos\\_que\\_estan\\_transformando\\_mexico.html](http://sitios.itesm.mx/congresodeinvestigacion/proyectos_que_estan_transformando_mexico.html)

Research efforts concentrate on activities such as: generating innovative entrepreneurship models and systems; managing and incubating technology-based companies; and enhancing graduate programs with the support groups of researchers and research centers.

Of the more than 1,100 faculty members who teach the master's and doctoral students at Tecnológico de Monterrey, 322 are research professors who be-

long to the National System of Researchers (SNI). The aim of this system is to recognize the work of people who are dedicated to producing scientific and technological knowledge in Mexico by appointing them as "National Researchers", which symbolizes the quality and prestige of their scientific contributions.

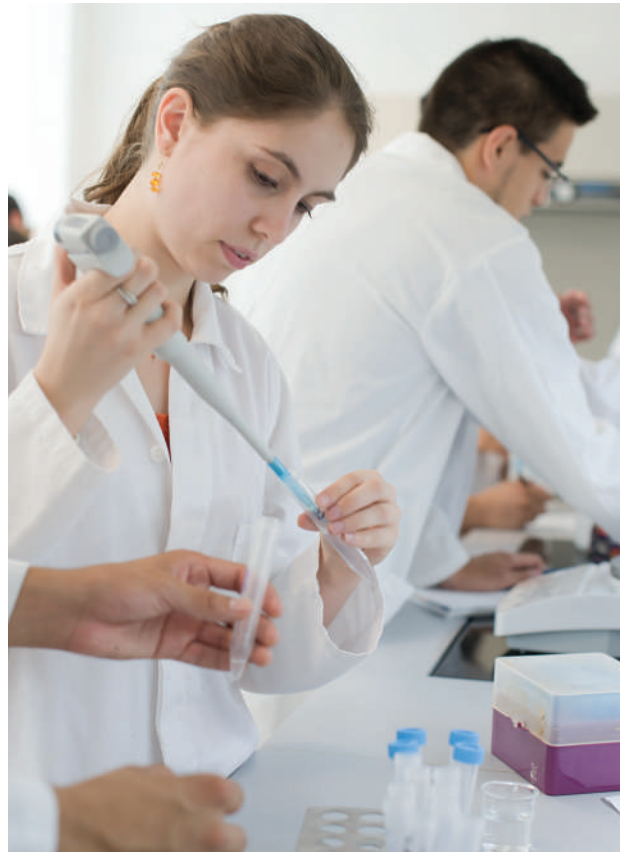
The institution offers 10 doctoral programs, 36 master's programs, 5 specializations and 16 medical residencies, 63% of which have been awarded accreditation by the National Program for Quality Graduate Studies (PNPC) of the National Council of Science and Technology (CONACyT). In addition, the 16 medical specializations have been endorsed and approved by the Inter-institutional Commission for the Education of Human Resources in Healthcare, of the Mexican Department of Health (CIFRHS).

The researchers, together with the students who participate in research projects, strengthen the Patent Program which, between 2006 and 2014, accumulated 331 patent applications in Mexico

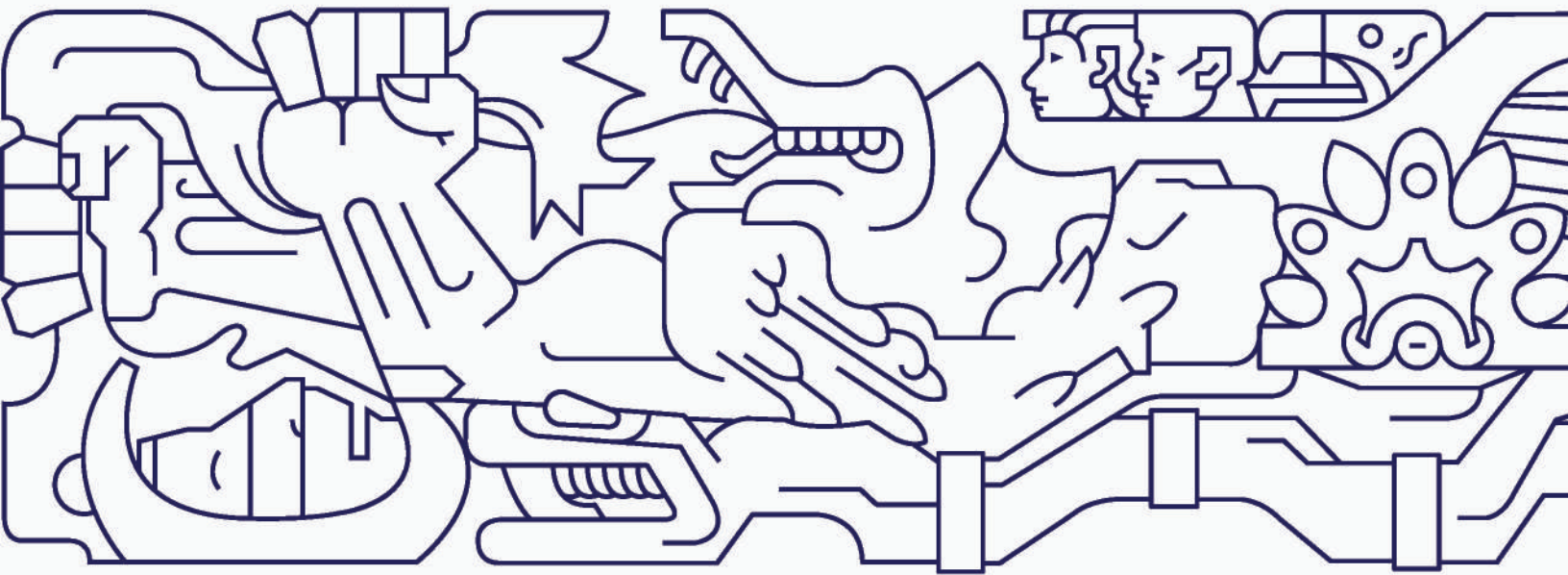
and 434 in Mexico, the United States, the European Union, Asia and the PCT. A total of 76 patents were awarded in Mexico, 11 in the United States, 3 in the European Union and 4 in Asia. From 2006 through 2013, Tecnológico de Monterrey was the Mexican educational institution with the most patent applications per year. The Incubation Cell program has support about 30 entrepreneurship projects, 15 of which have been constituted as Technology-based Companies (Spinoffs). Tecnológico de Monterrey has 23 licensed patents and 1 franchise.

In short, research at Tecnológico de Monterrey fosters our students' learning process, supports the intellectual activities of our faculty, and generates the knowledge and innovative solutions that society demands.

The impact of these activities on our graduates is reflected in the 2015 Graduate Employability Rankings, a new initiative of the British firm Quacquarelli Symonds (QS), in which Tecnológico de Monterrey was ranked first for Latin American and 21st on a global level.







## II. Curricula



## Academic Programs Offered at Each Campus Part 1

CAMPUS	ARQ	IA	IBN	IBT	IC	IDA	IDS	IFI	IIA	IID	IIS	IMA	IMD	IME	IMI	IMT	INCQ
Plan	2011	2011	2011	2011	2011	2011	2011	2011	2011	2012	2011	2011	2011	2011	2011	2011	2013
Aguascalientes	2	1		2	2			2	2		x	4	2	4		x	
Central de Veracruz	2	2	2	2	2	3	2	2	2		x	3		3		3	
Chiapas	2	2	3	2	2	2	2	3	2		4	3		3		3	
Chihuahua	x	3		x	x		4				x	x				x	
Ciudad de México	x	2		x	2		x	3	3		x		x	x	x	x	
Ciudad Juárez			1	1	1	3	2	2	1		2	4		4		x	1
Ciudad Obregón	2	2		2	2			2	2		4	2		2		3	
Cuernavaca		2	4	2	3	3	x	3	2		x	4		4	4	x	
Estado de México	x	2		x	x	x	3	2	2		x	3		x	x	x	
Guadalajara	x	2		x	x		4	3	2		x	x	x	4	4	x	
Hidalgo	4	2	4	4	2	4	2	2	2		x	3		4		3	
Irapuato		2		2	2			2	2		4	2		2		4	
Laguna	x	2	x	4	2	4	2	3	3		x	4		4		x	2
León	x	2		2	2			2	2		x	2		2		x	
Monterrey	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x
Morelia	x	2		2	2	2	2	2	2		x	4	2	4		x	
Puebla	x	2	3	x	x	x	x	3	2		x	x	2	4	x	x	
Querétaro	x	x		x	x	5	4	2	x		x	x		7		x	
Saltillo	2	1	1	2	2	4	2	3	2		x	4		4		x	1
San Luis Potosí	3	1		2	2			2	2		x	4		4		x	
Santa Fe		2		2	2		x	2	2		x	3		3	x	x	
Sinaloa	2	2	x	2	2			2	2		x	2		2		3	
Sonora Norte	x	3		2	2			2	2		x	2		2		x	
Tampico		1	1	1	2	4	2	3	1		x	4		4		x	1
Toluca	x	2		x	2	x		2	2		x	x		2		x	
Zacatecas	4	1		1	2	3		2	1	1	x	3		3		3	
<b>Total de Campus</b>	<b>12</b>	<b>1</b>	<b>2</b>	<b>8</b>	<b>6</b>	<b>4</b>	<b>5</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>22</b>	<b>6</b>	<b>3</b>	<b>3</b>	<b>5</b>	<b>19</b>	<b>1</b>

The "x" means that the career's offered complete in that Campus.  
A number means that the career's offered in the Campus up to the semester that the number indicates.  
Its content reflects the information available in official media as of March 2014.

## Academic Programs Offered at Each Campus Parte 2

CAMPUS	INT	IQA	IQP	ISC	ISD	ITC	ITE	ITIC	ITS	LAD	LAE	LAF	LCDE	LCMD	LCPF	LDF	LDI	LDN
	Plan	2011	2011	2011	2011	2011	2011	2011	2011	2011	2016	2011	2011	2011	2011	2011	2011	2011
Aguascalientes		2	2			3	3					4	4	1	4		2	x
Central de Veracruz	4	2	3		3	4	3	3	2	2	x	3	2	1	4	2	1	4
Chiapas	4	2	2	3	3		3	3	2	2	x	4	4	2	4	2	2	4
Chihuahua						3						x	x					x
Ciudad de México	4	3	3		3	x	3		x	x	x	x	x	x	x		x	x
Ciudad Juárez	1	2	2		2	1	2	1	1				2	2	4			
Ciudad Obregón	2	2	2		2	3	3	3	2	2	4	4	4		4		2	2
Cuernavaca		2	2			x	3	3		2	x	x	4		4	2	2	4
Estado de México		x	3	x	x		3	3		x	x	x	x	x	x		x	
Guadalajara	4	2	2	x		3	x			x	x	x	x	x	x		x	
Hidalgo	4	2	2			3	3	x			x	4	4	1	x	4	2	
Irapuato		2	2			2	2	2			4	4	4		4			
Laguna	2	4	4		2				2			x	x		4		x	x
León		2	2			3	3	3		2	x	x	x		4		x	
Monterrey	x	x	x		x	x				x	x	x	x	x	x	x	x	
Morelia		2	2			3	3	3			x	4	4					
Puebla		3	3		x	x		3		x	x	x	x	x	4		x	
Querétaro		2	2	x	x		3	3		x	x	x	x	x	x		x	
Saltillo	2	2	2		1		1	1	1			3	4		4			x
San Luis Potosí	x	3	3			3	3				x	x	4		4			
Santa Fe		2	2		3	x	3	3	3		x	x	x	x	4		2	
Sinaloa	4	2	2			3	3	3			x	x	4		4		2	
Sonora Norte		2	2			1	2	2			x	4	x	2	4		x	
Tampico	3	3	3	4	3	4	2	x	2			3	4		4			x
Toluca		2	2	x	3					3	x	4	x	x	x		x	
Zacatecas		2	2			3	3	3				4	4	1	4		1	x
<b>Total de Campus</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>4</b>	<b>4</b>	<b>5</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>6</b>	<b>17</b>	<b>13</b>	<b>12</b>	<b>8</b>	<b>7</b>	<b>1</b>	<b>10</b>	<b>7</b>

The "x" means that the career's offered complete in that Campus.

A number means that the career's offered in the Campus up to the semester that the number indicates.

Its content reflects the information available in official media as of March 2014.

## Academic Programs Offered at Each Campus

### Parte 3

CAMPUS	LDP	LEC	LED	LEF	LEM	LIN	LLE	LLN	LMC	LMI	LNB	LP	LPM	LPL	LPO	LPS	LRI	MC	MO	TOTAL
	Plan	2011	2011	2011	2011	2011	2011	2011	2011	2011	2011	2012	2012	2011	2011	2012	2011	2011	2011	
Aguascalientes		3	2		4	x	1		x						1		1			5
Central de Veracruz	2	1	2	1	4	4		4	4								1			2
Chiapas	2	2	2	2	4	4							3				3			1
Chihuahua			x		5	x			2									4	2	11
Ciudad de México			x	x	x	x			x		x	x					x	x		27
Ciudad Juárez				1	4	3		3	2				2							1
Ciudad Obregón		2		2	4	4			2				2				2			0
Cuernavaca		2	2			x			x								3			8
Estado de México			x	x	x	x			x					x			x			25
Guadalajara		3	x		x	x		x			x				2		x	x		23
Hidalgo	4	2	4		4	4														4
Irapuato		2			4	4		4	4											0
Laguna				1	5	x		4	x				2							10
León		4				x			x											9
Monterrey		x	x		x	x	x			x	x		x	x	x	x	x	x	x	42
Morelia		3	x		4	x			x											7
Puebla	x		x	x		x			x								x			23
Querétaro		3			4	x			x								x			20
Saltillo		2		1	4	x		3	2				2							4
San Luis Potosí		3			4	x	1	4	x						1					7
Santa Fe		3	x	x	4	x			x								x			14
Sinaloa		4			4	x			x											6
Sonora Norte		2	2		4	x			x								2			8
Tampico					5	x			2				2							5
Toluca		3	x		x	x											3			15
Zacatecas		3			4	4	1	4	4				2		1					2
<b>Total de Campus</b>	<b>1</b>	<b>1</b>	<b>9</b>	<b>4</b>	<b>5</b>	<b>19</b>	<b>1</b>	<b>1</b>	<b>13</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>7</b>	<b>3</b>	<b>1</b>	<b>279</b>

The "x" means that the career's offered complete in that Campus.  
 A number means that the career's offered in the Campus up to the semester that the number indicates.  
 Its content reflects the information available in official media as of March 2014.

## Profiles and Curricula of the Undergraduate Programs

This section contains the undergraduate curricula offered by Tecnológico de Monterrey.

Information on these programs and the description of the courses they include are also available at [www.itesm.mx](http://www.itesm.mx)

Tecnológico de Monterrey reserves the right to change the programs described in this document.

The course descriptions are presented by academic discipline. The letters in the course codes indicate the discipline associated to the course and can be used to locate the description of the courses in the corresponding section of this document.

Course code	Course	C - L - U
MA1016	Mathematics I	3 - 0 - 8

The letters of the code indicate the discipline to which the course belongs. In the example, the letters MA indicate that the course corresponds to the discipline Mathematics. All the courses of a curriculum are described in the section Course Content by Academic Discipline.

The letter "C" indicates the number of class hours per week.

The letter "L" indicates experimental and/or experiential activities supervised by a teacher per week.

The letter "U" indicates the number of total academic units per week of the course.

In this case, the course Mathematics I consists of 3 class hours per week, 0 hours of experimental and/or experiential activities and a total of 8 academic units. The academic units represent the total number of hours per week on average that students should devote to the course. The total academic units include the class hours, experimental and/or experiential activity hours supervised by a teacher, and the independent work hours.

Any course requirements are listed in the course description.

One academic unit presents approximately 16 hours of work during the academic semester.





Undergraduate Degree Profiles  
and Curricula of

# Business Administration and Finance

## B.A. Business Administration (LAE)

Graduates from this program are highly skilled in the area of strategic business innovation, which contributes to the creation of new business models, making it possible to manage and direct public and private organizations and/or family businesses efficiently and effectively, with a systemic, ethical and humanistic approach.

### Competencies for Graduates:

- Identify, design and capitalize on business opportunities through regional analysis, the use of technology and commitment to sustainable development.
- Contribute to the professionalization and enhancement of family businesses, promoting the best corporate governance practices.
- Ensure business sustainability through the effective management of human, financial, technological and organizational resources, within a framework of ethics and citizenship.
- Perform auditing and consulting activities to diagnose and implement solutions to organizational problems.
- Negotiate successfully with diverse stakeholders in multicultural contexts.



## LAE Bachelor of Business Administration Edition 2016

Remedial Semester			C	L	U	Fifth Semester			C	L	U
H1001	Remedial English I		5	0	8	AD3018	Planning Processes and Models		3	0	8
H1002	Remedial English II		5	0	8	CD2006	Forecasting for Decision Making		3	0	8
H1003	Remedial English III		5	0	8	CH2007	Human Capital Management by Competencies		3	0	8
H1004	Remedial English IV		5	0	8	FZ1006	Personal and Business Financ		3	0	8
H1005	Remedial English V		5	0	8	FZ2016	Project Valuation and Financing		3	0	8
H1015	Spanish Composition		5	0	8	HS2000	Humanities and Fine Arts		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8						
			<b>39</b>	<b>0</b>	<b>72</b>						
First Semester			C	L	U	Sixth Semester			C	L	U
AD1011	Introduction to Business Field		3	0	4	CD2007	Quantitative and Optimization Models		3	0	8
CF1008	Financial Information for Decision Making		3	0	8	CF2019	Control and Business Development		3	0	8
D1021	Business Law		3	0	8	EM1005	Entrepreneurship		3	0	8
H1016	Foreign Language		5	0	8	HS2005	Citizenship		3	0	8
MA1016	Mathematics I		3	0	8	HS2006	Applied Ethics		3	0	8
OP1008	Exploration Elective A - I		3	0	8	NI2018	Analysis and Management of the Value Chain		3	0	8
OP1009	Exploration Elective A - II		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
			<b>23</b>	<b>0</b>	<b>52</b>						
Second Semester			C	L	U	Seventh Semester			C	L	U
EC1008	Enterprise Economics		3	0	8	OP3051	Professional Elective I		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	OP3052	Professional Elective II		3	0	8
MA1018	Mathematics II		3	0	8	OP3053	Professional Elective III		3	0	8
OP1010	Exploration Elective B - I		3	0	8	OP3054	Professional Elective IV		3	0	8
OP1011	Exploration Elective B - II		3	0	8	OP3055	Professional Elective V		3	0	8
OP1012	Exploration Elective B - III		3	0	8	OP3056	Professional Elective VI		3	0	8
			<b>20</b>	<b>0</b>	<b>8</b>				<b>18</b>	<b>0</b>	<b>48</b>
Third Semester			C	L	U	Eighth Semester			C	L	U
EC1009	Macroeconomic Environment		3	0	8	OP3061	Complementary Professional Elective I		3	0	8
H1018	Ethics, Self and Society		3	0	8	OP3062	Complementary Professional Elective II		3	0	8
OP1013	Exploration Elective C - I		3	0	8	OP3063	Complementary Professional Elective III		3	0	8
OP1014	Exploration Elective C - II		3	0	8	OP3064	Complementary Professional Elective IV		3	0	8
OP1015	Exploration Elective C - III		3	0	8	OP3065	Complementary Professional Elective V		3	0	8
VA1000	Complementary Exploration Elective		3	0	8	OP3066	Complementary Professional Elective VI		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>				<b>18</b>	<b>0</b>	<b>48</b>
Fourth Semester			C	L	U	Ninth Semester			C	L	U
CF1011	Managerial Accounting		3	0	8	AD3025	Introduction to Professional Development		2	0	2
H2001	Verbal Expression in the Workplace		3	0	8	VA3101	Elective I		3	0	8
MT2025	Consumer Behavior and Market Intelligence		3	0	8	VA3102	Elective II		3	0	8
OP1016	Exploration Elective C - IV		3	0	8	VA3103	Elective III		3	0	8
OP1017	Exploration Elective C - V		3	0	8	VA3104	Elective IV		3	0	8
OP1018	Exploration Elective C - VI		3	0	8	VA3105	Elective V		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>	VA3106	Elective VI		3	0	8
									<b>20</b>	<b>0</b>	<b>50</b>

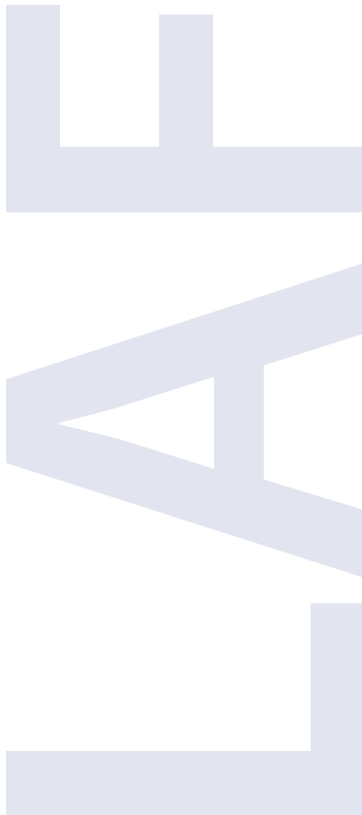
- C Number of class hours per week  
L Number of laboratory hours or activities per week  
U Study hours that must be dedicated to the course (class hours included)

## BA Financial Management (LAF)

Graduates from this program are professionals with a solid quantitative and business background who generate value for the organization by managing and optimizing the financial resources, acting at all times with ethics and social responsibility and complying fully with the prevailing regulatory framework.

### Competencies for Graduates:

- Make investment and financing decisions in both national and international settings.
- Optimize the available resources and manage risk as a result of decision making.
- Use information technologies efficiently in order to operate in national and international financial markets, and support businesses' comprehensive strategy.
- Harmonize the financial interests of the organizational stakeholders, promoting good corporate governance practices.
- Operate instruments on the stock market in order to maximize the return on investment.



## LAF B.A. Financial Management Edition 2011

<b>Remedial Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Fifth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
H1001	Remedial English I		5	0	8	EC2003	Financial Econometrics I		3	0	8
H1002	Remedial English II		5	0	8	FZ1006	Personal and Business Finance		3	0	8
H1003	Remedial English III		5	0	8	FZ2014	Management of Banks and Financial Groups		3	0	8
H1004	Remedial English IV		5	0	8	FZ2015	Financial Structure and Corporate Governance		3	0	8
H1005	Remedial English V		5	0	8	HS2000	Humanities and Fine Arts		3	0	8
H1015	Spanish Composition		5	0	8	VA2010	Topics I		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8						
			<b>39</b>	<b>0</b>	<b>72</b>						
<b>First Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
AD1005	Management and Business Model Innovation		3	0	8	EC2004	Financial Econometrics II		3	0	8
CF1008	Financial Information for Decision Making		3	0	8	EM1005	Entrepreneurship		3	0	8
D1021	Business Law		3	0	8	FZ2016	Project Valuation and Financing		3	0	8
FZ1007	Introduction to the Finance Management Academic Program		3	0	4	FZ3027	Derivatives Valuation		3	0	8
H1016	Foreign Language		5	0	8	NI2018	Analysis and Management of the Value Chain		3	0	8
MA1015	Mathematics I		3	0	8	VA2011	Topics II		3	0	8
TI1012	Business Information Technology		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
			<b>23</b>	<b>0</b>	<b>52</b>						
<b>Second Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
CF1009	Cost and Price Management		3	0	8	CF2018	Strategic Information Systems		3	0	8
D1022	Business Law and Intellectual Property		3	0	8	FZ2017	Debt Instruments and Securitization		3	0	8
EC1008	Enterprise Economics		3	0	8	FZ3009	International Financial Management		3	0	8
FZ1005	Financial Mathematics		3	0	8	FZ3025	Credit Management		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	FZ3026	Valuation, Mergers and Acquisitions		3	0	8
MA1017	Mathematics II		3	0	8	VA2012	Topics III		3	0	8
			<b>20</b>	<b>0</b>	<b>48</b>				<b>18</b>	<b>0</b>	<b>48</b>
<b>Third Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Eighth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
AD1006	Organizational Learning and Knowledge Management		3	0	8	AD2013	Project and Process Strategic Management		3	0	8
CF1011	Managerial Accounting		3	0	8	FZ3028	Investment Management		3	0	8
H1018	Ethics, Self and Society		3	0	8	FZ3030	Financial Modeling		3	0	8
MA1020	Statistics I		3	0	8	HS2005	Citizenship		3	0	8
MT1003	Marketing and Creativity		3	0	8	VA2013	Topics IV		3	0	8
NI1001	Enterprise, Culture and Business in The World		3	0	8	VA2014	Topics V		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>				<b>18</b>	<b>0</b>	<b>48</b>
<b>Fourth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Ninth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
AD2011	Innovation, Markets and Technological Development		3	0	8	AD3024	Planning, Innovation and Strategic Sustainability		3	0	8
CD2007	Quantitative and Optimization Models		3	0	8	CF1013	Taxes and Business Strategies		3	0	8
CF2015	Financial Information Analysis		3	0	8	FZ3031	Risk Management and Regulation		3	0	8
FZ2006	Money and Capital Markets		3	0	8	FZ3032	Seminar of Finance		3	0	8
FZ2013	Regulation and Structure of Financial Institutions		3	0	8	FZ3033	Introduction to Professional Development		2	0	2
H2001	Verbal Expression in the Workplace		3	0	8	HS2006	Applied Ethics		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>	VA2015	Topics VI		3	0	8
									<b>20</b>	<b>0</b>	<b>50</b>

- C Number of class hours per week  
L Number of laboratory hours or activities per week  
U Study hours that must be dedicated to the course (class hours included)



## B.A. Business Creation and Development (LCDE)

Graduates from this program are professionals with ethical integrity, social responsibility and a solid background in mathematics, specializing in the incubation and generation of new businesses that contribute to economic and business development.

### Competencies for Graduates:

- Incubate new businesses, focusing on industry-based and service companies.
- Detect, evaluate and implement investment projects.
- Provide continuity to and promote the development of existing family businesses.
- Form business networks to compete in a globalized world.



## LCDE B.A. Business Creation and Development Edition 2011

<b>Remedial Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Fifth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
H1001	Remedial English I		5	0	8	CD2007	Quantitative and Optimization Models		3	0	8
H1002	Remedial English II		5	0	8	DE2002	Innovation and Designing a Product or Service		3	0	8
H1003	Remedial English III		5	0	8	EC1009	Macroeconomic Environment		3	0	8
H1004	Remedial English IV		5	0	8	FZ1006	Personal and Business Finance		3	0	8
H1005	Remedial English V		5	0	8	HS2000	Humanities and Fine Arts		3	0	8
H1015	Spanish Composition		5	0	8	IN3035	Analysis and Enhancement of Manufacturing Systems		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8				<b>C</b>	<b>L</b>	<b>U</b>
			<b>39</b>	<b>0</b>	<b>72</b>	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
<b>First Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	AD3017	Family Business and Corporate Governance		3	0	8
AD1005	Management and Business Model Innovation		3	0	8	DE3013	Pre Incubation and Business Feasibility		1	4	8
CF1008	Financial Information for Decision Making		3	0	8	EM1005	Entrepreneurship		3	0	8
DE1005	Introduction to the Business Creation and Development Academic Program		3	0	4	FZ2016	Project Valuation and Financing		3	0	8
DL1009	Creativity and Innovation		3	0	8	NI1002	Negotiation Techniques and International Trade		3	0	8
H1016	Foreign Language		5	0	8	NI2018	Analysis and Management of the Value Chain		3	0	8
H1040	Analysis and Verbal Expression		5	0	8				<b>16</b>	<b>4</b>	<b>48</b>
MA1016	Mathematics I		3	0	8	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>25</b>	<b>0</b>	<b>52</b>	AD2013	Project and Process Strategic Management		3	0	8
<b>Second Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	CF2018	Strategic Information Systems		3	0	8
AD1006	Organizational Learning and Knowledge Management		3	0	8	DE3014	Incubation and Business Models		1	4	8
CF1009	Cost and Price Management		3	0	8	HS2005	Citizenship		3	0	8
DE1004	Business Technology and the OET		3	0	8	NI2017	Competitive Intelligence and Geo economics		3	0	8
EC1008	Enterprise Economics		3	0	8	VA2010	Topics I		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8				<b>16</b>	<b>4</b>	<b>48</b>
MA1018	Mathematics II		3	0	8	<b>Eighth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>18</b>	<b>0</b>	<b>48</b>	AD3024	Planning, Innovation and Strategic Sustainability		3	0	8
<b>Third Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	DE3015	Business Incubation and Starting Up Strategic Operations		1	4	8
CD1003	Statistical Methods for Decision Making		3	0	8	DE3016	Incubation and Financing of New Ventures		1	4	8
CF1011	Managerial Accounting		3	0	8	FZ3029	International Finance and Risk Management		3	0	8
D1021	Business Law		3	0	8	IN3039	Problem Solving Methodologies		3	0	8
FZ1005	Financial Mathematics		3	0	8	VA2011	Topics II		3	0	8
MT1003	Marketing and Creativity		3	0	8				<b>14</b>	<b>8</b>	<b>48</b>
NI1001	Enterprise, Culture and Business in The World		3	0	8	<b>Ninth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>18</b>	<b>0</b>	<b>48</b>	DE3017	Strategies for Market Positioning		3	0	8
<b>Fourth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	DE3018	Incubation and Strategic Control of Cash Flow		1	4	8
AD2011	Innovation, Markets and Technological Development		3	0	8	DE3019	Family Business Acceleration Models		3	0	8
CD2006	Forecasting for Decision Making		3	0	8	DE3020	Introduction to Professional Development		2	0	2
CF2015	Financial Information Analysis		3	0	8	HS2006	Applied Ethics		3	0	8
H1018	Ethics, Self and Society		3	0	8	VA2012	Topics III		3	0	8
MT2006	Consumer Behavior		3	0	8	VA2013	Topics IV		3	0	8
RH1000	Organizational Behavior and Human Talent Development		3	0	8				<b>18</b>	<b>4</b>	<b>50</b>
			<b>18</b>	<b>0</b>	<b>48</b>						

- C Number of class hours per week  
L Number of laboratory hours or activities per week  
U Study hours that must be dedicated to the course (class hours included)

## B.A. Finance & Accounting (LCPF)

Graduates from this program are experts in financial information with a solid grounding in finance. They have the capacity to control management, evaluate value creation and identify opportunities for growth in organizations

They are trained to evaluate, based on ethical criteria, the quality and reliability of the financial-fiscal information generated by organizations in accordance with the relevant international standards for issuing recommendations, thus contributing to their financial stability.

### Competencies for Graduates:

- Plan, implement and control processing systems for accounting, financial, fiscal and control data, incorporating national and international standards and contributing to the generation of value in organizations.
- Integrate and reconcile the interests of the functional areas of a company in order to achieve its objectives, through the strategic use of the accounting, financial and fiscal information.
- Evaluate and form opinions on the quality and reliability of the financial and fiscal information generated by organizations.
- Integrate, analyze and interpret financial and administrative information to detect areas of opportunity in the organization.
- Formulate and implement financial and fiscal strategies that allow the company to maintain and efficiently use its economic resources.



## LCPF B.A. Finance & Accounting Edition 2011

<b>Remedial Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Fifth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
H1001	Remedial English I		5	0	8	CD2007	Quantitative and Optimization Models		3	0	8
H1002	Remedial English II		5	0	8	CF1012	Tax Accounting Fundamentals		3	0	8
H1003	Remedial English III		5	0	8	CF2006	Intermediate Accounting: Operating Cycle and Investment	3	0	8	
H1004	Remedial English IV		5	0	8	CF2016	Activity Based Costing for Products and Services		3	0	8
H1005	Remedial English V		5	0	8	FZ2006	Money and Capital Markets		3	0	8
H1015	Spanish Composition		5	0	8	HS2000	Humanities and Fine Arts		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8				<b>C</b>	<b>L</b>	<b>U</b>
			<b>39</b>	<b>0</b>	<b>72</b>	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
<b>First Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	AD2013	Project and Process Strategic Management		3	0	8
AD1005	Management and Business Model Innovation		3	0	8	CF2007	Intermediate Accounting: Financing Cycle and Updating Information		3	0	8
CF1008	Financial Information for Decision Making		3	0	8	CF2018	Strategic Information Systems		3	0	8
CF1014	Introduction to the Public Accounting and Finance Academic Program		3	0	4	CF3018	Corporate Taxation		3	0	8
D1021	Business Law		3	0	8	EM1005	Entrepreneurship		3	0	8
H1016	Foreign Language		5	0	8	FZ2016	Project Valuation and Financing		3	0	8
MA1016	Mathematics I		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
TI1012	Business Information Technology		3	0	8	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>23</b>	<b>0</b>	<b>52</b>	CF2017	Financial Statement Auditing		3	0	8
<b>Second Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	CF3019	Corporate Accounting		3	0	8
CF1009	Cost and Price Management		3	0	8	CF3020	Personal Taxation		3	0	8
D1022	Business Law and Intellectual Property		3	0	8	FZ2015	Financial Structure and Corporate Governance		3	0	8
EC1008	Enterprise Economics		3	0	8	FZ3027	Derivatives Valuation		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	HS2005	Citizenship		3	0	8
MA1018	Mathematics II		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
NI1001	Enterprise, Culture and Business in The World		3	0	8	<b>Eighth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>20</b>	<b>0</b>	<b>48</b>	CF2019	Control and Business Development		3	0	8
<b>Third Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	CF3021	International Financial Reports		3	0	8
CD1003	Statistical Methods for Decision Making		3	0	8	CF3022	Assurance and Risk Evaluation		3	0	8
CF1011	Managerial Accounting		3	0	8	FZ3009	International Financial Management		3	0	8
EC1009	Macroeconomic Environment		3	0	8	VA2010	Topics I		3	0	8
FZ1005	Financial Mathematics		3	0	8	VA2011	Topics II		3	0	8
MT1003	Marketing and Creativity		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
RH1000	Organizational Behavior and Human Talent Development		3	0	8	<b>Ninth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>18</b>	<b>0</b>	<b>48</b>	AD3024	Planning, Innovation and Strategic Sustainability		3	0	8
<b>Fourth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	CF3006	International Taxation		3	0	8
CD2006	Forecasting for Decision Making		3	0	8	CF3008	Strategic Accounting		3	0	8
CF2015	Financial Information Analysis		3	0	8	CF3025	Introduction to Professional Development		2	0	2
FZ1006	Personal and Business Finance		3	0	8	HS2006	Applied Ethics		3	0	8
H1018	Ethics, Self and Society		3	0	8	VA2012	Topics III		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	VA2013	Topics IV		3	0	8
NI1002	Negotiation Techniques and International Trade		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
			<b>18</b>	<b>0</b>	<b>48</b>						

C Number of class hours per week

L Number of laboratory hours or activities per week

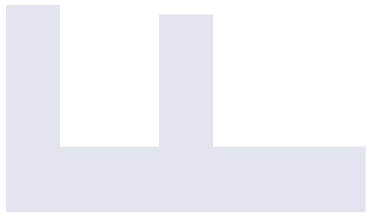
U Study hours that must be dedicated to the course (class hours included)

## B.A. Law with Minor in Finance (LDF)

Graduates from this program are professionals with a solid grounding in the field of law and an in-depth knowledge of finance, specializing in proposing legal alternatives to solve problems related to corporate and public finance, and participating in the design and application of taxes, as well as their legal determination and defense.

### Competencies for Graduates:

- Apply instruments that are provided by the law and their knowledge of public and corporate finance in environments related to this field.
- Propose comprehensive legal and financial solutions with a broad vision of the needs of the social, public and private sectors in the relevant subject matters.
- Participate in the formulation of laws that are consistent with the country's economic and financial reality.
- Offer solutions to the issues involved in the combination of law and corporate finance in a highly competitive global setting.
- Advise companies on good corporate governance practices by reconciling the company's financial interests and legal matters.





## LDF B.A. Law with Minor in Finance

### Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
H1001	Remedial English I		5	0	8	D2010	Obligation Law II		3	0	8
H1002	Remedial English II		5	0	8	D2016	Public International Law		3	0	8
H1003	Remedial English III		5	0	8	D2022	Administrative Law and Public Policy II		3	0	8
H1004	Remedial English IV		5	0	8	D2023	Labor Law I		3	0	8
H1005	Remedial English V		5	0	8	EM1005	Entrepreneurship		3	0	8
H1015	Spanish Composition		5	0	8	FZ2013	Regulation and Structure of Financial Institutions		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8	Sixth Semester			C	L	U
			<b>39</b>	<b>0</b>	<b>72</b>	D3019	Civil and Mercantile Contracts		3	0	8
First Semester			C	L	U	D3020	Labor Law II		3	0	8
CF1008	Financial Information for Decision Making		3	0	8	FZ1006	Personal and Business Finance		3	0	8
D1005	Law Theory		3	0	8	FZ2006	Money and Capital Markets		3	0	8
D1023	Roman Law		3	0	8	HS2000	Humanities and Fine Arts		3	0	8
D1026	Introduction to Law Field		3	0	4	VA2010	Topics I		3	0	8
H1016	Foreign Language		5	0	8				<b>18</b>	<b>0</b>	<b>48</b>
H1040	Analysis and Verbal Expression		5	0	8	Seventh Semester			C	L	U
MA1015	Mathematics I		3	0	8	D1015	Business Corporations		3	0	8
			<b>25</b>	<b>0</b>	<b>52</b>	D2004	Oral Judgments		3	0	8
Second Semester			C	L	U	D2015	Tax Law		3	0	8
CF2015	Financial Information Analysis		3	0	8	D2024	Intellectual Property Law		3	0	8
D1010	Introduction to Civil and Family Law		3	0	8	D3010	Private International Law		3	0	8
D1012	Constitutional Law		3	0	8	VA2011	Topics II		3	0	8
EC1008	Enterprise Economics		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MA1017	Mathematics II		3	0	8	Eighth Semester			C	L	U
RI1004	International Politics		3	0	8	D2017	Credit Titles		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>	D3023	Procedural, Administrative and Tax Law		3	0	8
Third Semester			C	L	U	D3024	Amparo Trial I		3	0	8
D1003	Assets, Real Rights and Successions		3	0	8	FZ2015	Financial Structure and Corporate Governance		3	0	8
D1007	General Procedural Theory		3	0	8	FZ2016	Project Valuation and Financing		3	0	8
D1019	Criminal Law		3	0	8	HS2005	Citizenship		3	0	8
D2009	Fundamental Rights		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
EC1009	Macroeconomic Environment		3	0	8	Ninth Semester			C	L	U
FZ1005	Financial Mathematics		3	0	8	D3026	Mercantile Trial Law		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>	D3027	Amparo Trial II		3	0	8
Fourth Semester			C	L	U	D3028	Alternatives for Dispute Resolution		3	0	8
D2013	Obligation Law I		3	0	8	D3029	Introduction to Professional Development		2	0	2
D2021	Administrative Law and Public Policy I		3	0	8	HS2006	Applied Ethics		3	0	8
D3017	Civil Trial Law		3	0	8	VA2012	Topics III		3	0	8
D3018	Criminal Law Clinic		3	0	8	VA2013	Topics IV		3	0	8
H1018	Ethics, Self and Society		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
H2001	Verbal Expression in the Workplace		3	0	8						
			<b>18</b>	<b>0</b>	<b>48</b>						

- C Number of class hours per week  
 L Number of laboratory hours or activities per week  
 U Study hours that must be dedicated to the course (class hours included)

## B.A. Business Innovation and Management (LDN)

Graduates from this program are professionals who focus on business strategy and innovation and are highly knowledgeable in the areas of administration, finance, marketing and operations. They are upright, socially responsible and committed to their environment, with the ability to identify, create and realize opportunities.



### Competencies for Graduates:

- Extensively knowledgeable in diverse areas of the company and therefore able to create efficient strategies in each area.
- Design and develop sustainable strategies oriented toward the company's constant growth and diversification to achieve a greater national and international market penetration, thus guaranteeing the company's presence on the medium and long terms.
- Develop market intelligence mechanisms to meet the needs of the consumer and support the firm's corporate objectives, using leading-edge technology.
- Demonstrate leadership skills by directing working groups and channeling their actions toward the fulfillment of the organization's objectives.
- Apply negotiation strategies and techniques that result in efficient operations and commercial success.
- Identify business opportunities related to diverse activities/industries into which the company might foray.
- Communicate effectively orally and in writing, in Spanish and in English.
- Identify, analyze and assess ethical dilemmas related to their personal lives, profession and environment.
- Act with solidarity and responsibility to improve the quality of life of the communities with which they interact.

## LDN B.A. Business Innovation and Management Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
H1001	Remedial English I		5	0	8	AD2018	Innovation Project on Business Processes		3	0	8
H1002	Remedial English II		5	0	8	CD2006	Forecasting for Decision Making		3	0	8
H1003	Remedial English III		5	0	8	FZ1006	Personal and Business Finance		3	0	8
H1004	Remedial English IV		5	0	8	HS2000	Humanities and Fine Arts		3	0	8
H1005	Remedial English V		5	0	8	MT2006	Consumer Behavior		3	0	8
H1015	Spanish Composition		5	0	8	NI1002	Negotiation Techniques and International Trade		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8	Sixth Semester			C	L	U
			<b>39</b>	<b>0</b>	<b>72</b>	AD2015	International Commercial Law and Policies		3	0	8
First Semester			C	L	U	AD2016	Innovation Project on Human Capital Development		3	0	8
AD1005	Management and Business Model Innovation		3	0	8	AD2019	Business Incubator Lab and Workshop		0	3	4
AD1008	Introduction to Business Direction and Innovation Academic Program		3	0	4	CD2007	Quantitative and Optimization Models		3	0	8
CF1008	Financial Information for Decision Making		3	0	8	EM1005	Entrepreneurship		3	0	8
D1021	Business Law		3	0	8	FZ2016	Project Valuation and Financing		3	0	8
H1016	Foreign Language		5	0	8	MT2007	Qualitative Marketing Research		3	0	8
MA1016	Mathematics I		3	0	8				<b>18</b>	<b>3</b>	<b>52</b>
TI1012	Business Information Technology		3	0	8	Seventh Semester			C	L	U
			<b>23</b>	<b>0</b>	<b>52</b>	AD2017	Innovation Project on Enterprise Strategy		3	0	8
Second Semester			C	L	U	FZ3029	International Finance and Risk Management		3	0	8
AD1006	Organizational Learning and Knowledge Management		3	0	8	MT2013	Quantitative Marketing Research		3	0	8
CF1009	Cost and Price Management		3	0	8	NI2018	Analysis and Management of the Value Chain		3	0	8
D1022	Business Law and Intellectual Property		3	0	8	VA2010	Topics I		3	0	8
EC1008	Enterprise Economics		3	0	8	VA2011	Topics II		3	0	8
H1040	Analysis and Verbal Expression		5	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MA1018	Mathematics II		3	0	8	Eighth Semester			C	L	U
			<b>20</b>	<b>0</b>	<b>48</b>	AD2020	Family Business Lab and Workshop		0	3	4
Third Semester			C	L	U	AD3027	Innovation Project on Regional Businesses		3	0	8
CF1011	Managerial Accounting		3	0	8	HS2005	Citizenship		3	0	8
EC1009	Macroeconomic Environment		3	0	8	MT2021	Promotion, Media and Public Relations		3	0	8
FZ1005	Financial Mathematics		3	0	8	VA2012	Topics III		3	0	8
H1018	Ethics, Self and Society		3	0	8	VA2013	Topics IV		3	0	8
MT1003	Marketing and Creativity		3	0	8	VA2014	Topics V		3	0	8
RH1000	Organizational Behavior and Human Talent Development		3	0	8				<b>18</b>	<b>3</b>	<b>52</b>
			<b>18</b>	<b>0</b>	<b>48</b>	Ninth Semester			C	L	U
Fourth Semester			C	L	U	AD3025	Introduction to Professional Development		2	0	2
AD1009	Business Creativity Lab and Workshop		0	3	4	AD3026	Innovation Project on Technology Based Businesses		3	0	8
CD1003	Statistical Methods for Decision Making		3	0	8	HS2006	Applied Ethics		3	0	8
CF2015	Financial Information Analysis		3	0	8	MT3019	Digital Commerce and Sales		3	0	8
D1002	Labor Law		3	0	8	VA2015	Topics VI		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	VA2016	Topics VII		3	0	8
NI1001	Enterprise, Culture and Business in The World		3	0	8	VA2017	Topics VIII		3	0	8
NI2017	Competitive Intelligence and Geo economics		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
			<b>18</b>	<b>3</b>	<b>52</b>						

C Number of class hours per week

L Number of laboratory hours or activities per week

U Study hours that must be dedicated to the course (class hours included)

## B.A. Law with Minor in Political Science (LDP)

Graduates from this program are legal experts with an in-depth knowledge of political science, specialized in formulating and implementing legal strategies that focus on the legislation of politics and conducting legal-political research to solve social problems through the application of public policies.

### Competencies for Graduates:

- Direct legal-political research projects focused on solving problems through the application of public policies.
- Guide the legal-political decisions of public, private and social organizations.
- Conduct impact analyses of political players in the field of law in order to accomplish equitable negotiations.
- Apply the prevailing laws, regulations, international treaties and provisions in the areas of legal intermediation in both private and public settings.
- Participate directly or indirectly in the formulation of political social impact instruments.
- Design legal strategies that include components of political science analysis.

## LDP B.A. Law with Minor in Political Science Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
H1001	Remedial English I		5	0	8	D2004	Oral Judgments		3	0	8
H1002	Remedial English II		5	0	8	D2010	Obligation Law II		3	0	8
H1003	Remedial English III		5	0	8	D2016	Public International Law		3	0	8
H1004	Remedial English IV		5	0	8	D2022	Administrative Law and Public Policy II		3	0	8
H1005	Remedial English V		5	0	8	HS2000	Humanities and Fine Arts		3	0	8
H1015	Spanish Composition		5	0	8	P2003	Contemporary Political Theory		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8	Sixth Semester			C	L	U
			<b>39</b>	<b>0</b>	<b>72</b>	D3010	Private International Law		3	0	8
First Semester			C	L	U	D3019	Civil and Mercantile Contracts		3	0	8
D1005	Law Theory		3	0	8	D3021	Public Financial Law		3	0	8
D1013	Political Theory of the State		3	0	8	EM1005	Entrepreneurship		3	0	8
D1023	Roman Law		3	0	8	P2005	Principles of Public Policy		3	0	8
D1026	Introduction to Law Field		3	0	4	P2010	Politics, Media and Public Opinion		3	0	8
H1016	Foreign Language		5	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MA1008	Statistics for Research in the Social Sciences		3	0	8	Seventh Semester			C	L	U
P1002	Fundamentals of Political Science		3	0	8	D1002	Labor Law		3	0	8
			<b>23</b>	<b>0</b>	<b>52</b>	D1015	Business Corporations		3	0	8
Second Semester			C	L	U	D2015	Tax Law		3	0	8
D1010	Introduction to Civil and Family Law		3	0	8	HS2005	Citizenship		3	0	8
D1012	Constitutional Law		3	0	8	P3005	Political Analysis		3	0	8
D2006	Legal Research		3	0	8	VA2010	Topics I		3	0	8
H1040	Analysis and Verbal Expression		5	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MA1016	Mathematics I		3	0	8	Eighth Semester			C	L	U
P2009	Classical Political Thinking		3	0	8	D2017	Credit Titles		3	0	8
			<b>20</b>	<b>0</b>	<b>48</b>	D3022	Procedural Labor Law		3	0	8
Third Semester			C	L	U	D3025	Environmental Law and Sustainable Development		3	0	8
D1003	Assets, Real Rights and Successions		3	0	8	HS2006	Applied Ethics		3	0	8
D1007	General Procedural Theory		3	0	8	P2011	Mexican Political System		3	0	8
D1019	Criminal Law		3	0	8	VA2011	Topics II		3	0	8
D2009	Fundamental Rights		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
EC1008	Enterprise Economics		3	0	8	Ninth Semester			C	L	U
H2001	Verbal Expression in the Workplace		3	0	8	D3014	Amparo Trial		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>	D3028	Alternatives for Dispute Resolution		3	0	8
Fourth Semester			C	L	U	D3029	Introduction to Professional Development		2	0	2
D2013	Obligation Law I		3	0	8	P3010	Political Parties		3	0	8
D2021	Administrative Law and Public Policy I		3	0	8	P3012	Design of Public Policies		3	0	8
D3017	Civil Trial Law		3	0	8	VA2012	Topics III		3	0	8
D3018	Criminal Law Clinic		3	0	8	VA2013	Topics IV		3	0	8
EC1009	Macroeconomic Environment		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
H1018	Ethics, Self and Society		3	0	8						
			<b>18</b>	<b>0</b>	<b>48</b>						

- C Number of class hours per week  
L Number of laboratory hours or activities per week  
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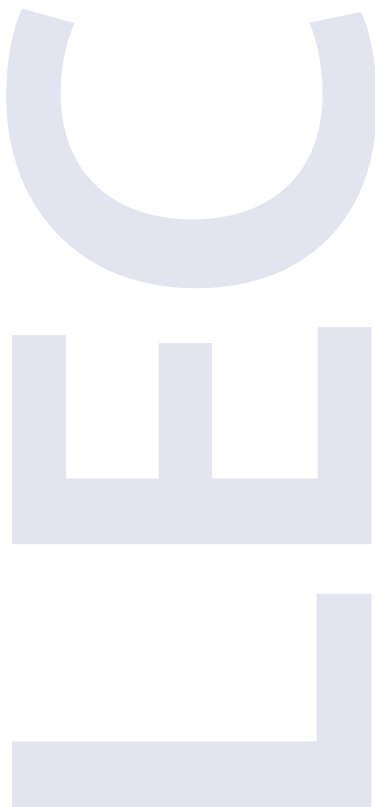


## B.A. Economics (LEC)

Graduates from this program are professionals with a solid background in economic theory who use quantitative tools to analyze economic models that seek to optimize the physical, financial and human resources of society, and are capable of addressing issues in the following areas: design and evaluation of international trade policy, economic development, regulation of competition, price fixing and optimal taxes, among others.

### Competencies for Graduates:

- Participate with a strategic vision in decision making in national and international public and private organizations, using statistical and financial economic analysis.
- Recognize the factors that trigger economic crises and seek solutions in the best interests of society.
- Carry out economic policy proposals in the public sector at federal, state and municipal levels, developing forward-looking projects to propose policies for the development of the country or region.
- Use their analytical and quantitative capacities in the financial system, the Bank of Mexico and company treasuries to assess investment projects, calculate the price of diverse financial instruments and allocate resources efficiently.
- Participate in national and international theoretical and applied economic research projects and consultancy projects.



## LEC B.A. Economics

### Edition 2011

<b>Remediales</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Quinto Semestre</b>			<b>C</b>	<b>L</b>	<b>U</b>
HH1001	Remedial English I		5	0	8	EC2013	Econometrics I		3	0	8
H1002	Remedial English II		5	0	8	EC2016	Monetary Theory and Politics		3	0	8
H1003	Remedial English III		5	0	8	EC3023	Mathematical Economics		3	0	8
H1004	Remedial English IV		5	0	8	EC3024	Dynamic Macroeconomics		3	0	8
H1005	Remedial English V		5	0	8	EC3025	Theory and Pricing Strategies		3	0	8
H1015	Spanish Composition		5	0	8	EM1005	Entrepreneurship		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8				<b>C</b>	<b>L</b>	<b>U</b>
			<b>39</b>	<b>0</b>	<b>72</b>	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
<b>First Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	EC3002	Econometrics II		3	0	8
EC1007	Economic History		3	0	8	EC3009	Theory and Politics of International Commerce		3	0	8
EC1011	Introduction to Economics Field		3	0	4	EC3026	Industrial Organization and Regulation		3	0	8
H1016	Foreign Language		5	0	8	EC3027	Economic Growth		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	EC3032	Public Sector Economics and Social Well Being		3	0	8
HS2000	Humanities and Fine Arts		3	0	8	VA2010	Topics I		3	0	8
MA1015	Mathematics I		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
P1002	Fundamentals of Political Science		3	0	8	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>25</b>	<b>0</b>	<b>52</b>	EC3008	Time Series Analysis		3	0	8
<b>Second Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	EC3028	Economic Development		3	0	8
EC1008	Enterprise Economics		3	0	8	EC3029	Managerial Economics and Incentives		3	0	8
EC1009	Macroeconomic Environment		3	0	8	EC3030	Financial Economics		3	0	8
H1018	Ethics, Self and Society		3	0	8	EC3031	Macroeconomics and Business Cycles		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	HS2005	Citizenship		3	0	8
MA1017	Mathematics II		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
RI2029	History of Contemporary Mexico		3	0	8	<b>Eighth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>18</b>	<b>0</b>	<b>48</b>	EC3010	Multivariate Economic Analysis		3	0	8
<b>Third Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	EC3012	Social Evaluation of Projects		3	0	8
CF1010	Accounting and Cost Management		3	0	8	EC3014	Regional Economics		3	0	8
EC2007	History of Economic Thought		3	0	8	HS2006	Applied Ethics		3	0	8
EC2009	Intermediate Microeconomics		3	0	8	VA2011	Topics II		3	0	8
EC2023	Intermediate Macroeconomics		3	0	8	VA2012	Topics III		3	0	8
MA1020	Statistics I		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MA2000	Mathematics for Economics I		3	0	8	<b>Ninth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>18</b>	<b>0</b>	<b>48</b>	EC3016	Mexican Economics Seminar		3	0	8
<b>Fourth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	EC3033	Natural Resources Economics and Sustainability		3	0	8
CO2003	Quantitative Social Research Methods		3	0	8	EC3034	Seminar on Economic, Financial and Political Analysis		3	0	8
EC2024	Game Theory and Strategic Decisions		3	0	8	EC3035	Introduction to Professional Development		2	0	2
EC3021	International Finance and Open Economy		3	0	8	VA2013	Topics IV		3	0	8
EC3022	Consumer Theory		3	0	8	VA2014	Topics V		3	0	8
MA2011	Statistics II		3	0	8	VA2015	Topics VI		3	0	8
MA3001	Mathematics for Economics II		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
			<b>18</b>	<b>0</b>	<b>48</b>						

C Number of class hours per week

L Number of laboratory hours or activities per week

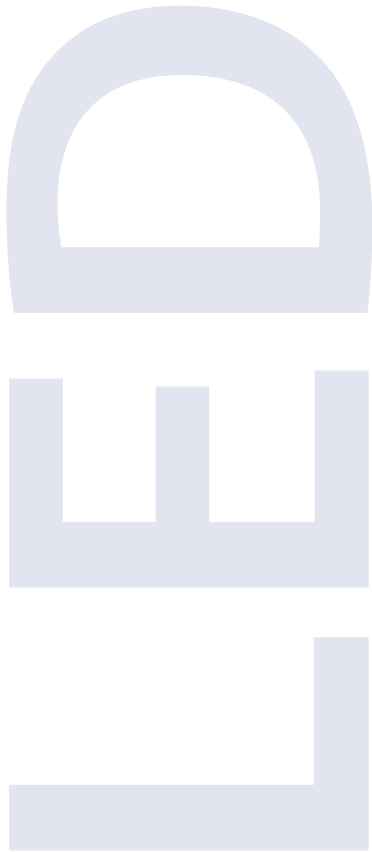
U Study hours that must be dedicated to the course (class hours included)

## B.A. Law (LED)

Graduates from this program are professionals with a command of the oral and written language required for legal argumentation and interpretation, in Spanish and English, specializing in the design and application of legal innovations for the administration of justice, as well as in the implementation of dispute prevention and resolution strategies, applying alternative dispute resolution processes.

### Competencies for Graduates:

- Apply legal instruments in law-related settings.
- Know the prevailing laws, regulations, international treaties and provisions in the areas of legal intermediation and apply them in real cases.
- Conduct impact analyses of the global players in the field of international law in order to advise on legal decision-making.
- Propose comprehensive legal solutions with a broad vision of the needs of the social, public and private sectors.
- Advise transnational companies, government and non-government organizations in legal matters in order to regulate their exchanges and protect their products and interests.
- Successfully implement oral trials.



## LED B.A. Law Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
H1001	Remedial English I		5	0	8	D2004	Oral Judgments		3	0	8
H1002	Remedial English II		5	0	8	D2010	Obligation Law II		3	0	8
H1003	Remedial English III		5	0	8	D2016	Public International Law		3	0	8
H1004	Remedial English IV		5	0	8	D2022	Administrative Law and Public Policy II		3	0	8
H1005	Remedial English V		5	0	8	D2023	Labor Law I		3	0	8
H1015	Spanish Composition		5	0	8	HS2000	Humanities and Fine Arts		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8	Sixth Semester			C	L	U
			<b>39</b>	<b>0</b>	<b>72</b>	D2011	Mercantile Contracts		3	0	8
First Semester			C	L	U	D3000	Civil Contracts		3	0	8
D1005	Law Theory		3	0	8	D3010	Private International Law		3	0	8
D1013	Political Theory of the State		3	0	8	D3020	Labor Law II		3	0	8
D1023	Roman Law		3	0	8	D3021	Public Financial Law		3	0	8
D1026	Introduction to Law Field		3	0	4	EM1005	Entrepreneurship		3	0	8
H1016	Foreign Language		5	0	8				<b>18</b>	<b>0</b>	<b>48</b>
P1000	Sociology		3	0	8	Seventh Semester			C	L	U
RI1004	International Politics		3	0	8	D1015	Business Corporations		3	0	8
			<b>23</b>	<b>0</b>	<b>52</b>	D2015	Tax Law		3	0	8
Second Semester			C	L	U	D2024	Intellectual Property Law		3	0	8
CO2004	Qualitative Research Methods		3	0	8	D3025	Environmental Law and Sustainable Development		3	0	8
D1010	Introduction to Civil and Family Law		3	0	8	VA2010	Topics I		3	0	8
D1011	Criminal Law I		3	0	8	VA2011	Topics II		3	0	8
D1012	Constitutional Law		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
D2006	Legal Research		3	0	8	Eighth Semester			C	L	U
H1040	Analysis and Verbal Expression		5	0	8	D2017	Credit Titles		3	0	8
			<b>20</b>	<b>0</b>	<b>48</b>	D3023	Procedural, Administrative and Tax Law		3	0	8
Third Semester			C	L	U	D3024	Amparo Trial I		3	0	8
D1003	Assets, Real Rights and Successions		3	0	8	HS2005	Citizenship		3	0	8
D1007	General Procedural Theory		3	0	8	VA2012	Topics III		3	0	8
D2009	Fundamental Rights		3	0	8	VA2013	Topics IV		3	0	8
D2012	Criminal Law II		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
H2001	Verbal Expression in the Workplace		3	0	8	Ninth Semester			C	L	U
MA1016	Mathematics I		3	0	8	D3026	Mercantile Trial Law		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>	D3027	Amparo Trial II		3	0	8
Fourth Semester			C	L	U	D3028	Alternatives for Dispute Resolution		3	0	8
D2013	Obligation Law I		3	0	8	D3029	Introduction to Professional Development		2	0	2
D2021	Administrative Law and Public Policy I		3	0	8	HS2006	Applied Ethics		3	0	8
D3017	Civil Trial Law		3	0	8	VA2014	Topics V		3	0	8
D3018	Criminal Law Clinic		3	0	8	VA2015	Topics VI		3	0	8
EC1008	Enterprise Economics		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
H1018	Ethics, Self and Society		3	0	8						
			<b>18</b>	<b>0</b>	<b>48</b>						

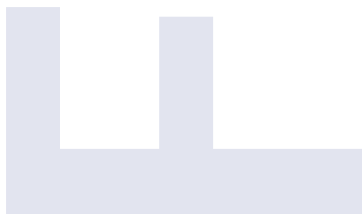
- C Number of class hours per week  
L Number of laboratory hours or activities per week  
U Study hours that must be dedicated to the course (class hours included)

## B.A. Economics and Finance (LEF)

Graduates from this program are highly skilled in finance and critical thinking, specialized in the analysis and design of economic models for the optimal allocation of physical, monetary and human resources in the corporate, government, social and financial sectors. They have the capacity to propose solutions in areas such as the design and assessment of international commerce, among others.

### Competencies for Graduates:

- Understand the economic and financial system within a globalized context.
- Identify, analyze and offer solutions to economic-financial, social and sustainable development issues in a country or region.
- Participate in economic and financial decision making in public and private organizations with a strategic vision and using quantitative and qualitative tools from economic and financial theory.
- Negotiate between diverse economic agencies in conflict situations in business, finance and public policy environments to find the best, most ethical solutions.
- Handle information technologies, databases and programming tools for economic-financial analyses and decision making.
- Transfer knowledge resulting from applied research and studies related to economics and finance in the best interests of social, business and economic environments.





## LEF B.A. Economics and Finances Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
H1001	Remedial English I		5	0	8	CO2003	Quantitative Social Research Methods		3	0	8
H1002	Remedial English II		5	0	8	EC2013	Econometrics I		3	0	8
H1003	Remedial English III		5	0	8	EC3023	Mathematical Economics		3	0	8
H1004	Remedial English IV		5	0	8	EC3025	Theory and Pricing Strategies		3	0	8
H1005	Remedial English V		5	0	8	FZ2006	Money and Capital Markets		3	0	8
H1015	Spanish Composition		5	0	8	FZ2014	Management of Banks and Financial Groups		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8				<b>C</b>	<b>L</b>	<b>U</b>
			<b>39</b>	<b>0</b>	<b>72</b>	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
First Semester			C	L	U	EC2016	Monetary Theory and Politics		3	0	8
EC1007	Economic History		3	0	8	EC3002	Econometrics II		3	0	8
EC1011	Introduction to Economics Field		3	0	4	EC3024	Dynamic Macroeconomics		3	0	8
H1016	Foreign Language		5	0	8	EC3026	Industrial Organization and Regulation		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	EC3030	Financial Economics		3	0	8
HS2000	Humanities and Fine Arts		3	0	8	EM1005	Entrepreneurship		3	0	8
MA1015	Mathematics I		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
P1002	Fundamentals of Political Science		3	0	8	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>25</b>	<b>0</b>	<b>52</b>	EC3008	Time Series Analysis		3	0	8
Second Semester			C	L	U	EC3009	Theory and Politics of International Commerce		3	0	8
CF1010	Accounting and Cost Management		3	0	8	EC3027	Economic Growth		3	0	8
EC1008	Enterprise Economics		3	0	8	EC3029	Managerial Economics and Incentives		3	0	8
EC1009	Macroeconomic Environment		3	0	8	EC3031	Macroeconomics and Business Cycles		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	FZ3027	Derivatives Valuation		3	0	8
MA1017	Mathematics II		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
RI2029	History of Contemporary Mexico		3	0	8	<b>Eighth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>18</b>	<b>0</b>	<b>48</b>	EC3012	Social Evaluation of Projects		3	0	8
Third Semester			C	L	U	EC3032	Public Sector Economics and Social Well Being		3	0	8
CF2015	Financial Information Analysis		3	0	8	FZ3030	Financial Modeling		3	0	8
EC2009	Intermediate Microeconomics		3	0	8	HS2005	Citizenship		3	0	8
EC2023	Intermediate Macroeconomics		3	0	8	VA2010	Topics I		3	0	8
H1018	Ethics, Self and Society		3	0	8	VA2011	Topics II		3	0	8
MA1020	Statistics I		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MA2000	Mathematics for Economics I		3	0	8	<b>Ninth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>18</b>	<b>0</b>	<b>48</b>	EC3034	Seminar on Economic, Financial and Political Analysis		3	0	8
Fourth Semester			C	L	U	EC3035	Introduction to Professional Development		2	0	2
EC2024	Game Theory and Strategic Decisions		3	0	8	FZ2017	Debt Instruments and Securitization		3	0	8
EC3021	International Finance and Open Economy		3	0	8	FZ3031	Risk Management and Regulation		3	0	8
EC3022	Consumer Theory		3	0	8	HS2006	Applied Ethics		3	0	8
FZ1006	Personal and Business Finance		3	0	8	VA2012	Topics III		3	0	8
MA2011	Statistics II		3	0	8	VA2013	Topics IV		3	0	8
MA3001	Mathematics for Economics II		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
			<b>18</b>	<b>0</b>	<b>48</b>						

- C Number of class hours per week  
L Number of laboratory hours or activities per week  
U Study hours that must be dedicated to the course (class hours included)

## B.A. Marketing (LEM)

Graduates from this program are business professionals who are capable of identifying and analyzing consumers' needs worldwide to develop innovative, sustainable commercial strategies that contribute to brand value, in an honest, ethical manner while respecting the rights of other companies.

### Competencies for Graduates:

- Evaluate and implement financially solid marketing strategies.
- Generate market intelligence to satisfy the consumer's needs and support the company's corporate objectives, using leading-edge technology.
- Develop products or services that help to meet the needs of consumers, taking into consideration resource and environmental sustainability.
- Implement strategies that foster lasting company-customer-supplier relationships.



## LEM B.A. Marketing Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
H1001	Remedial English I		5	0	8	AD2011	Innovation, Markets and Technological Development		3	0	8
H1002	Remedial English II		5	0	8	CD2007	Quantitative and Optimization Models		3	0	8
H1003	Remedial English III		5	0	8	FZ1006	Personal and Business Finance		3	0	8
H1004	Remedial English IV		5	0	8	HS2000	Humanities and Fine Arts		3	0	8
H1005	Remedial English V		5	0	8	MT2006	Consumer Behavior		3	0	8
H1015	Spanish Composition		5	0	8	NI2017	Competitive Intelligence and Geo economics		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8	Sixth Semester			C	L	U
			<b>39</b>	<b>0</b>	<b>72</b>	EM1005	Entrepreneurship		3	0	8
First Semester			C	L	U	FZ2016	Project Valuation and Financing		3	0	8
AD1005	Management and Business Model Innovation		3	0	8	MT2007	Qualitative Marketing Research		3	0	8
CF1008	Financial Information for Decision Making		3	0	8	MT2020	Strategic Services Marketing		3	0	8
D1021	Business Law		3	0	8	MT2021	Promotion, Media and Public Relations		3	0	8
H1016	Foreign Language		5	0	8	NI2018	Analysis and Management of the Value Chain		3	0	8
MA1016	Mathematics I		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MT1004	Introduction to the Marketing Academic Program		3	0	4	Seventh Semester			C	L	U
TI1012	Business Information Technology		3	0	8	CF2018	Strategic Information Systems		3	0	8
			<b>23</b>	<b>0</b>	<b>52</b>	HS2005	Citizenship		3	0	8
Second Semester			C	L	U	MT2013	Quantitative Marketing Research		3	0	8
AD1006	Organizational Learning and Knowledge Management		3	0	8	MT3019	Digital Commerce and Sales		3	0	8
CF1009	Cost and Price Management		3	0	8	VA2010	Topics I		3	0	8
D1022	Business Law and Intellectual Property		3	0	8	VA2011	Topics II		3	0	8
EC1008	Enterprise Economics		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
H1040	Analysis and Verbal Expression		5	0	8	Eighth Semester			C	L	U
MA1018	Mathematics II		3	0	8	MT2009	B2B Marketing		3	0	8
			<b>20</b>	<b>0</b>	<b>48</b>	MT3020	Distribution Strategies		3	0	8
Third Semester			C	L	U	MT3021	Pricing Strategy		3	0	8
CD1003	Statistical Methods for Decision Making		3	0	8	MT3022	Market Intelligence		3	0	8
CF1011	Managerial Accounting		3	0	8	VA2012	Topics III		3	0	8
FZ1005	Financial Mathematics		3	0	8	VA2013	Topics IV		3	0	8
MT1003	Marketing and Creativity		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
NI1001	Enterprise, Culture and Business in The World		3	0	8	Ninth Semester			C	L	U
RH1000	Organizational Behavior and Human Talent Development		3	0	8	AD3024	Planning, Innovation and Strategic Sustainability		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>	HS2006	Applied Ethics		3	0	8
Fourth Semester			C	L	U	MT3023	Global Brands and Product Development		3	0	8
CD2006	Forecasting for Decision Making		3	0	8	MT3024	Strategic Marketing Capstone Seminar		3	0	8
CF2015	Financial Information Analysis		3	0	8	MT3025	Introduction to Professional Development		2	0	2
EC1009	Macroeconomic Environment		3	0	8	VA2014	Topics V		3	0	8
H1018	Ethics, Self and Society		3	0	8	VA2015	Topics VI		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
NI1002	Negotiation Techniques and International Trade		3	0	8						
			<b>18</b>	<b>0</b>	<b>48</b>						

C Number of class hours per week

L Number of laboratory hours or activities per week

U Study hours that must be dedicated to the course (class hours included)

## B.A. International Business (LIN)

Graduates from this program are specialists in effective communication, interaction and negotiation between different cultures and are trained to identify and take advantage of global business opportunities, developing innovative solutions consistent with the global reality in a multicultural context.

### Competencies for Graduates:

- Detect, analyze and take advantage of business and investment opportunities between companies and countries worldwide that favor the development of the country.
- Consolidate international businesses in diverse political, economic, social and cultural settings, respecting diversity and freedom of thought, exercising influence and resolving intercultural disputes during the negotiations.
- Develop international marketing strategies, integrating production and service chains, in the framework of customs operations and make the best possible use of international trade agreements.
- Use specialized, cutting-edge information technologies for operations, marketing and decision making.



## LIN B.A. International Business Edition 2011

<b>Remedial Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Fifth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
H1001	Remedial English I		5	0	8	CD2007	Quantitative and Optimization Models		3	0	8
H1002	Remedial English II		5	0	8	FZ1006	Personal and Business Finance		3	0	8
H1003	Remedial English III		5	0	8	HS2000	Humanities and Fine Arts		3	0	8
H1004	Remedial English IV		5	0	8	NI1002	Negotiation Techniques and International Trade		3	0	8
H1005	Remedial English V		5	0	8	NI2016	Legal Aspects of International Commerce		3	0	8
H1015	Spanish Composition		5	0	8	NI2017	Competitive Intelligence and Geo economics		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>39</b>	<b>0</b>	<b>72</b>	AD2011	Innovation, Markets and Technological Development		3	0	8
<b>First Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	EC2026	Economics for International Business		3	0	8
AD1005	Management and Business Model Innovation		3	0	8	EM1005	Entrepreneurship		3	0	8
CF1008	Financial Information for Decision Making		3	0	8	FZ2016	Project Valuation and Financing		3	0	8
D1021	Business Law		3	0	8	NI2018	Analysis and Management of the Value Chain		3	0	8
H1016	Foreign Language		5	0	8	NI3035	Intercultural Negotiation and Communication		3	0	8
MA1016	Mathematics I		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
NI1003	Introduction to the International Business Academic Program		3	0	4	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
TI1012	Business Information Technology		3	0	8	CF2018	Strategic Information Systems		3	0	8
			<b>23</b>	<b>0</b>	<b>52</b>	HS2005	Citizenship		3	0	8
<b>Second Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	NI2019	International Logistics		3	0	8
CF1009	Cost and Price Management		3	0	8	NI2020	Customs Operations		3	0	8
D1022	Business Law and Intellectual Property		3	0	8	NI3036	International Trade Agreements		3	0	8
EC1008	Enterprise Economics		3	0	8	VA2010	Topics I		3	0	8
H1040	Analysis and Verbal Expression		5	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MA1018	Mathematics II		3	0	8	<b>Eighth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
NI1001	Enterprise, Culture and Business in The World		3	0	8	AD2013	Project and Process Strategic Management		3	0	8
			<b>20</b>	<b>0</b>	<b>48</b>	FZ3029	International Finance and Risk Management		3	0	8
<b>Third Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	NI3037	International Services Development		3	0	8
CD1003	Statistical Methods for Decision Making		3	0	8	NI3038	International Business Intelligence		3	0	8
CF1011	Managerial Accounting		3	0	8	VA2011	Topics II		3	0	8
FZ1005	Financial Mathematics		3	0	8	VA2012	Topics III		3	0	8
MT1003	Marketing and Creativity		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
RH1000	Organizational Behavior and Human Talent Development		3	0	8	<b>Ninth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
RI1004	International Politics		3	0	8	AD3024	Planning, Innovation and Strategic Sustainability		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>	HS2006	Applied Ethics		3	0	8
<b>Fourth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	NI3039	International Business Management		3	0	8
CD2006	Forecasting for Decision Making		3	0	8	NI3040	Introduction to Professional Development		2	0	2
EC1009	Macroeconomic Environment		3	0	8	VA2013	Topics IV		3	0	8
H1018	Ethics, Self and Society		3	0	8	VA2014	Topics V		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	VA2015	Topics VI		3	0	8
NI2015	Regional Business Development		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
RI2031	Geopolitics and Global Changes		3	0	8						
			<b>18</b>	<b>0</b>	<b>48</b>						

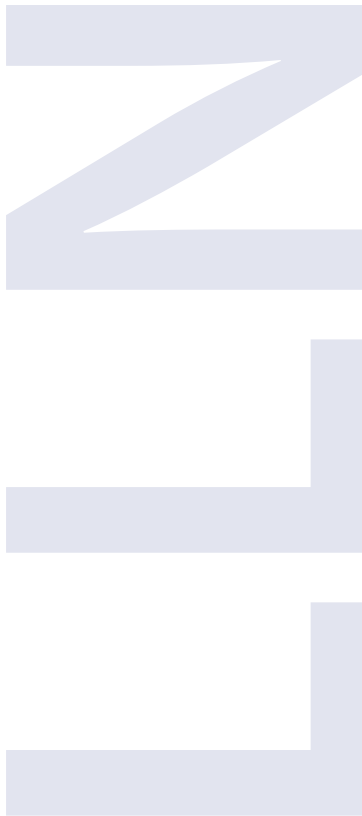
- C Number of class hours per week  
L Number of laboratory hours or activities per week  
U Study hours that must be dedicated to the course (class hours included)

## B.A. International Logistics (LLN)

Graduates from this program are specialists in the design, implementation and management of provision technologies that optimize the supply, operation and distribution of the production for companies with national and international operations. They have the capacity to detect business opportunities within the supply chain.

### Competencies for Graduates:

- Knowledgeable and aware of the economic, social and political reality, taking it into account when designing, executing and managing supply and distribution systems.
- Identify and solve logistics problems (purchases, materials management, inventory optimization, merchandise transportation, distribution channels and customer service) using quantitative tools and information technologies.
- Generate relevant information for the organization based on the statistical analysis of the supply chain's functional data.
- Influence and motivate people in order to set goals and work efficiently in conjunction with the other members of the supply chain.
- Find a positive resolution for any ethical dilemmas that might arise in supply chain management.





## LLN B.A. International Logistics Edition 2011

<b>Remedial Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Fifth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
H1001	Remedial English I		5	0	8	AD2011	Innovation, Markets and Technological Development		3	0	8
H1002	Remedial English II		5	0	8	CD2007	Quantitative and Optimization Models		3	0	8
H1003	Remedial English III		5	0	8	FZ1006	Personal and Business Finance		3	0	8
H1004	Remedial English IV		5	0	8	HS2000	Humanities and Fine Arts		3	0	8
H1005	Remedial English V		5	0	8	LN1005	Purchasing and Inventory Management		3	0	8
H1015	Spanish Composition		5	0	8	RH1000	Organizational Behavior and Human Talent Development		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8				<b>C</b>	<b>L</b>	<b>U</b>
			<b>39</b>	<b>0</b>	<b>72</b>	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
<b>First Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	CF2018	Strategic Information Systems		3	0	8
AD1005	Management and Business Model Innovation		3	0	8	EM1005	Entrepreneurship		3	0	8
CF1008	Financial Information for Decision Making		3	0	8	FZ2016	Project Valuation and Financing		3	0	8
D1021	Business Law		3	0	8	LN2000	Transportation Systems		3	0	8
H1016	Foreign Language		5	0	8	LN3008	Production Logistics		3	0	8
LN1007	Introduction to International Logistics Academic Program		3	0	4	NI2018	Analysis and Management of the Value Chain		3	0	8
MA1016	Mathematics I		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
TI1012	Business Information Technology		3	0	8				<b>C</b>	<b>L</b>	<b>U</b>
			<b>23</b>	<b>0</b>	<b>52</b>	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
<b>Second Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	AD2013	Project and Process Strategic Management		3	0	8
AD1006	Organizational Learning and Knowledge Management		3	0	8	HS2005	Citizenship		3	0	8
CF1009	Cost and Price Management		3	0	8	LN1002	Package, Packing and Material Handling		3	0	8
D1022	Business Law and Intellectual Property		3	0	8	LN1006	Distribution Systems		3	0	8
EC1008	Enterprise Economics		3	0	8	LN2001	International Commerce Operations		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	NI2017	Competitive Intelligence and Geo economics		3	0	8
MA1018	Mathematics II		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
			<b>20</b>	<b>0</b>	<b>48</b>	<b>Eighth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
<b>Third Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	VA2010	Topics I		3	0	8
CD1003	Statistical Methods for Decision Making		3	0	8	VA2011	Topics II		3	0	8
CF1011	Managerial Accounting		3	0	8	VA2012	Topics III		3	0	8
FZ1005	Financial Mathematics		3	0	8	VA2013	Topics IV		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	VA2014	Topics V		3	0	8
MT1003	Marketing and Creativity		3	0	8	VA2015	Topics VI		3	0	8
NI1001	Enterprise, Culture and Business in The World		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
			<b>18</b>	<b>0</b>	<b>48</b>	<b>Ninth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
<b>Fourth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	AD3024	Planning, Innovation and Strategic Sustainability		3	0	8
CD2006	Forecasting for Decision Making		3	0	8	FZ3029	International Finance and Risk Management		3	0	8
CF2015	Financial Information Analysis		3	0	8	HS2006	Applied Ethics		3	0	8
EC1009	Macroeconomic Environment		3	0	8	LN1013	Customer Service Systems		3	0	8
H1018	Ethics, Self and Society		3	0	8	LN3009	Strategic Supply Chain Management		3	0	8
LN1000	Logistics from a Global Perspective		3	0	8	LN3010	Logistics Systems Modeling		3	0	8
NI1002	Negotiation Techniques and International Trade		3	0	8	LN3011	Introduction to Professional Development		2	0	2
			<b>18</b>	<b>0</b>	<b>48</b>				<b>20</b>	<b>0</b>	<b>50</b>

- C Number of class hours per week  
L Number of laboratory hours or activities per week  
U Study hours that must be dedicated to the course (class hours included)

## B.A. Marketing and Communication (LMC)

Graduates from this program are professionals who design and implement innovative communication strategies applied to marketing, responding to the global, dynamic environment of organizations. They interpret market and media data to identify business opportunities.

### Competencies for Graduates:

- Design, produce and execute comprehensive communication strategies related to markets, advertising, public relations, sales promotion and digital media, considering the company's resources and market knowledge.
- Detect the communication needs of an organization, comprehending the characteristics of its customers in accordance with the ethics and morals inherent to the practice of this profession.
- Use cutting-edge technology with a strategic approach in order to integrate marketing communication activities with clients and companies in national and international contexts.
- Develop strategies that foster lasting company-customer-supplier relations.
- Generate persuasive texts in marketing communication campaigns.



## LMC B.A. Marketing and Communication

### Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
H1001	Remedial English I		5	0	8	AV1001	Graphic Design		3	0	8
H1002	Remedial English II		5	0	8	AV2002	Digital and Graphic Design Laboratory		0	3	4
H1003	Remedial English III		5	0	8	AV2005	Advertising and Commercial Photography		3	0	8
H1004	Remedial English IV		5	0	8	CD2006	Forecasting for Decision Making		3	0	8
H1005	Remedial English V		5	0	8	H1031	Contemporary Art and Culture		3	0	8
H1015	Spanish Composition		5	0	8	HS2000	Humanities and Fine Arts		3	0	8
MA1001	Introduction to Mathematics		6	0	16	MT2019	Advertising and Interactive Media		3	0	8
TC1001	Introduction to Computer Science		3	0	8				<b>18</b>	<b>3</b>	<b>52</b>
			<b>39</b>	<b>0</b>	<b>72</b>	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
First Semester			C	L	U	AD2011	Innovation, Markets and Technological Development		3	0	8
AD1005	Management and Business Model Innovation		3	0	8	AV2004	Scriptwriting		3	0	8
CF1008	Financial Information for Decision Making		3	0	8	AV2006	Media Narrative Design and Production		3	0	8
D1021	Business Law		3	0	8	AV2011	Massive Media Lab		0	3	4
H1016	Foreign Language		5	0	8	EM1005	Entrepreneurship		3	0	8
MA1016	Mathematics I		3	0	8	MT2007	Qualitative Marketing Research		3	0	8
MT1005	Introduction to Marketing and Communication Academic Program		3	0	4	NI2018	Analysis and Management of the Value Chain		3	0	8
TI1012	Business Information Technology		3	0	8				<b>18</b>	<b>3</b>	<b>52</b>
			<b>23</b>	<b>0</b>	<b>52</b>	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
Second Semester			C	L	U	AV2009	Media Projects Management and Evaluation		3	0	8
CF1009	Cost and Price Management		3	0	8	AV3001	Interactive Media Design and Production		3	0	8
D1022	Business Law and Intellectual Property		3	0	8	AV3012	Digital Media Lab		0	3	4
DL1002	Design Fundamentals I		4	0	8	HS2005	Citizenship		3	0	8
EC1008	Enterprise Economics		3	0	8	MT2013	Quantitative Marketing Research		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	MT3019	Digital Commerce and Sales		3	0	8
MA1018	Mathematics II		3	0	8	NI2017	Competitive Intelligence and Geo economics		3	0	8
			<b>21</b>	<b>0</b>	<b>48</b>	<b>Eighth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
Third Semester			C	L	U	AD3024	Planning, Innovation and Strategic Sustainability		3	0	8
AV1004	Audiovisual Language and Narrative		3	0	8	AV3011	Design and Production of Communication for Organizations		3	0	8
CC1012	Psychology and Multicultural Environment Leadership		3	0	8	MT3021	Pricing Strategy		3	0	8
CF1011	Managerial Accounting		3	0	8	VA2010	Topics I		3	0	8
H1018	Ethics, Self and Society		3	0	8	VA2011	Topics II		3	0	8
MT1003	Marketing and Creativity		3	0	8	VA2012	Topics III		3	0	8
NI1001	Enterprise, Culture and Business in The World		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
			<b>18</b>	<b>0</b>	<b>48</b>	<b>Ninth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
Fourth Semester			C	L	U	HS2006	Applied Ethics		3	0	8
AV1000	Photography and Digital Imaging		3	0	8	MT3023	Global Brands and Product Development		3	0	8
CD1003	Statistical Methods for Decision Making		3	0	8	MT3026	Introduction to Professional Development		2	0	2
CF2015	Financial Information Analysis		3	0	8	MT3027	Integrated Marketing Communication		3	0	8
EC1009	Macroeconomic Environment		3	0	8	VA2013	Topics IV		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	VA2014	Topics V		3	0	8
MT2006	Consumer Behavior		3	0	8	VA2015	Topics VI		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>				<b>20</b>	<b>0</b>	<b>50</b>

- C Number of class hours per week  
L Number of laboratory hours or activities per week  
U Study hours that must be dedicated to the course (class hours included)

## B.A. Advertising and Marketing Communications (LPM)

Graduates from this program are successful professionals in the field of business who use their knowledge of social behavior and the humanities to construct bridges for communication, understanding and mutual benefit between organizations and their markets.

### Competencies for Graduates:

- Identify and understand the diverse brand audiences and markets, as well as their culture and lifestyles.
- Construct beneficial exchange relations for both consumers and the organization.
- Conceptualize and create persuasive messages and contacts as a means of enlightening consumers about brands, skillfully using the most advanced digital communication tools and platforms.
- Analyze critically and reflexively the social, economic, political and cultural contexts and trends related to their organization and environment on both local and global levels.
- Design, produce and execute comprehensive communication strategies related to markets, advertising, public relations, sales promotion and digital media, considering the company's resources and market knowledge.
- Fluent in business English.
- Communicate appropriately verbally and in writing.
- Knowledgeable and aware of the economic, social and political reality of their environment.
- Generate credibility in relation to the environment in accordance with the ethics and morals inherent to the practice of this profession.
- Develop entrepreneurial and leadership skills in public, private and social enterprises, in national and international settings.



## LPM B.A. Advertising and Marketing Communications Edition 2012

<b>Remedial Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Fifth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
H1001	Remedial English I		5	0	8	AV1000	Photography and Digital Imaging		3	0	8
H1002	Remedial English II		5	0	8	CF2015	Financial Information Analysis		3	0	8
H1003	Remedial English III		5	0	8	CO2003	Quantitative Social Research Methods		3	0	8
H1004	Remedial English IV		5	0	8	CO2008	Communication and Media Studies		3	0	8
H1005	Remedial English V		5	0	8	H1048	Narrative Structures		3	0	8
H1015	Spanish Composition		5	0	8	MT2023	Advertising Design		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8				<b>C</b>	<b>L</b>	<b>U</b>
			<b>39</b>	<b>0</b>	<b>72</b>						
<b>First Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
AD1005	Management and Business Model Innovation		3	0	8	AD2011	Innovation, Markets and Technological Development		3	0	8
CF1008	Financial Information for Decision Making		3	0	8	AV1004	Audiovisual Language and Narrative		3	0	8
D1021	Business Law		3	0	8	EM1005	Entrepreneurship		3	0	8
H1016	Foreign Language		5	0	8	HS2000	Humanities and Fine Arts		3	0	8
MA1016	Mathematics I		3	0	8	MT2019	Advertising and Interactive Media		3	0	8
MT1007	Introduction to Advertising and Marketing Communications Academic Program		3	0	4	MT2024	Persuasive Copywriting		3	0	8
TI1012	Business Information Technology		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
			<b>23</b>	<b>0</b>	<b>52</b>				<b>C</b>	<b>L</b>	<b>U</b>
<b>Second Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
CF1009	Cost and Price Management		3	0	8	AV2006	Media Narrative Design and Production		3	0	8
D1022	Business Law and Intellectual Property		3	0	8	AV3001	Interactive Media Design and Production		3	0	8
EC1008	Enterprise Economics		3	0	8	CO3006	Communication and Globalization		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	HS2005	Citizenship		3	0	8
H2033	Social Anthropology		3	0	8	MT2005	Selling and Sales Management		3	0	8
MA1008	Statistics for Research in the Social Sciences		3	0	8	MT3029	Digital Marketing		3	0	8
			<b>20</b>	<b>0</b>	<b>48</b>				<b>18</b>	<b>0</b>	<b>48</b>
<b>Third Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Eighth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
CC1014	Psychology		3	0	8	CR2002	Public Relations		3	0	8
DL1002	Design Fundamentals I		4	0	8	D1025	Media Legislation		3	0	8
DL1009	Creativity and Innovation		3	0	8	MT3030	Internal Marketing		3	0	8
H1018	Ethics, Self and Society		3	0	8	VA2010	Topics I		3	0	8
MT1003	Marketing and Creativity		3	0	8	VA2011	Topics II		3	0	8
P1000	Sociology		3	0	8	VA2012	Topics III		3	0	8
			<b>19</b>	<b>0</b>	<b>48</b>				<b>18</b>	<b>0</b>	<b>48</b>
<b>Fourth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Ninth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
A1001	Contemporary Visual Culture and Design		3	0	8	HS2006	Applied Ethics		3	0	8
EC1009	Macroeconomic Environment		3	0	8	MT3028	Introduction to Professional Development		2	0	2
H2001	Verbal Expression in the Workplace		3	0	8	MT3031	Integrated Advertising Project		3	0	8
MT2006	Consumer Behavior		3	0	8	MT3032	Branding		3	0	8
MT2007	Qualitative Marketing Research		3	0	8	VA2013	Topics IV		3	0	8
NI1001	Enterprise, Culture and Business in The World		3	0	8	VA2014	Topics V		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>	VA2015	Topics VI		3	0	8
									<b>20</b>	<b>0</b>	<b>50</b>

- C Number of class hours per week  
 L Number of laboratory hours or activities per week  
 U Study hours that must be dedicated to the course (class hours included)







Undergraduate Degree Profiles  
and Curricula of  
**Health Sciences**

## B.S. Biomedical Engineering (IMD)

Graduates from this program are professionals with a solid training in biological and medical sciences, enabling them to generate, implement and evaluate technological solutions in order to successfully meet the needs of the health industry. They have the capacity to develop innovative medical devices, systems and services.

### Competencies for Graduates:

- Solve health problems in hospitals and industry using engineering in order to propose technological solutions, considering human-body, safety, legal, economic and ecological issues.
- Design and conduct experiments, and complete projects related to biomedical engineering topics, such as physiological modeling, clinical engineering, bioinstrumentation and biomechanical design.
- Lead and interact in teams consisting of professionals from diverse areas, in order to discover other ways of working and other points of view.
- Innovate in healthcare businesses, projects and products.



## IMD B.S. Biomedical Engineering Edition 2011

<b>Remedial Semester</b>				<b>C</b>	<b>L</b>	<b>U</b>	<b>Fifth Semester</b>				<b>C</b>	<b>L</b>	<b>U</b>
F1001	Introduction to Physics			3	0	8	BI2005	Biomechanics			3	0	8
H1001	Remedial English I			5	0	8	BI2006	Biomechanics Laboratory			0	3	4
H1002	Remedial English II			5	0	8	EM1005	Entrepreneurship			3	0	8
H1003	Remedial English III			5	0	8	MD1040	Musculoskeletal and Digestive Systems			3	0	8
H1004	Remedial English IV			5	0	8	MD1041	Biocontrol Systems			5	0	12
H1005	Remedial English V			5	0	8	TE2033	Applied Electronics			3	0	8
H1015	Spanish Composition			5	0	8					<b>17</b>	<b>3</b>	<b>48</b>
MA1001	Introduction to Mathematics			6	0	16	<b>Sixth Semester</b>				<b>C</b>	<b>L</b>	<b>U</b>
TC1001	Introduction to Computer Science			3	0	8	BI2007	Healthcare Facility Project			2	0	4
				<b>42</b>	<b>0</b>	<b>80</b>	MA1006	Probability and Statistics			3	0	8
<b>First Semester</b>				<b>C</b>	<b>L</b>	<b>U</b>	MD1045	Vital Processes			5	0	12
BI1001	Introduction to Engineering			3	0	4	MR2004	Control Engineering			3	0	8
F1002	Physics I			3	1	8	TE1010	Digital Systems			3	1	8
H1016	Foreign Language			5	0	8	TE2034	Integral Electronics Laboratory			0	3	4
H1040	Analysis and Verbal Expression			5	0	8	TE2035	Analysis of Signals and Systems			3	0	8
MA1015	Mathematics I			3	0	8					<b>19</b>	<b>4</b>	<b>52</b>
MD1029	Chemical Foundations of Metabolism and Physiology			3	0	8	<b>Seventh Semester</b>				<b>C</b>	<b>L</b>	<b>U</b>
TC1017	Problem Solving with Programming			3	0	8	BI3010	Bioinstrumentation			3	0	8
				<b>25</b>	<b>1</b>	<b>52</b>	BI3011	Bioinstrumentation Laboratory			0	3	4
<b>Second Semester</b>				<b>C</b>	<b>L</b>	<b>U</b>	BI3012	Modeling of Physiological Systems			3	0	8
F1003	Physics II			3	1	8	HS2005	Citizenship			3	0	8
H1018	Ethics, Self and Society			3	0	8	IN2025	Project Evaluation and Management			3	0	8
H2001	Verbal Expression in the Workplace			3	0	8	TE2023	Microcontrollers			3	0	8
MA1017	Mathematics II			3	0	8	TE2024	Microcontroller Laboratory			0	3	4
MD1030	Metabolism and Functional Biochemistry			3	0	8					<b>15</b>	<b>6</b>	<b>48</b>
TE1002	Electrical Circuits I			3	0	8	<b>Eighth Semester</b>				<b>C</b>	<b>L</b>	<b>U</b>
				<b>18</b>	<b>1</b>	<b>48</b>	BI2004	Design in Biomedical Engineering			3	0	8
<b>Third Semester</b>				<b>C</b>	<b>L</b>	<b>U</b>	BI3005	Cardiovascular Engineering			3	0	8
F1005	Electricity and Magnetism			3	1	8	BI3013	Medical Imaging			3	1	8
MA2009	Mathematics III			3	0	8	BI3014	Biomedical Technology Laboratory			0	3	4
MA2010	Differential Equations			3	0	8	BI3015	Biomedical Technologies			3	0	8
MD1031	Cell Biology			3	0	8	VA2010	Topics I			3	0	8
TE1003	Electronics			3	0	8	VA2011	Topics II			3	0	8
TE2032	Electrical Circuits II			3	0	8					<b>18</b>	<b>4</b>	<b>52</b>
				<b>18</b>	<b>1</b>	<b>48</b>	<b>Ninth Semester</b>				<b>C</b>	<b>L</b>	<b>U</b>
<b>Fourth Semester</b>				<b>C</b>	<b>L</b>	<b>U</b>	BI3002	Clinical Engineering			3	0	8
BI1000	Biomaterials			3	0	8	BI3016	Neuroengineering			3	0	8
HS2000	Humanities and Fine Arts			3	0	8	BI3017	Integrative Project			3	0	8
M2025	Numerical Methods in Engineering			3	0	8	BI3018	Introduction to Professional Development			2	0	2
MA3002	Advanced Mathematics			3	0	8	HS2006	Applied Ethics			3	0	8
MD1036	Basic Morphophysiology			5	0	12	VA2012	Topics III			3	0	8
TE1014	Electric Circuits and Measurements Laboratory			0	3	4	VA2013	Topics IV			3	0	8
				<b>17</b>	<b>3</b>	<b>48</b>					<b>20</b>	<b>0</b>	<b>50</b>

- C Number of class hours per week  
 L Number of laboratory hours or activities per week  
 U Study hours that must be dedicated to the course (class hours included)  
 H Total hours

## B.A. Nutrition and Wellness (LNB)

Graduates from this program are professionals who participate in the prevention, diagnosis and treatment of health-related issues. They are leaders in the field of nutrition who display professional competencies oriented toward the promotion and improvement of health through the physical, psychological and social wellbeing of individuals.

### Competencies for Graduates:

- Diagnose the nutritional, physical and comprehensive wellbeing status of individuals and the community.
- Formulate nutritional, physical exercise and behavioral modification intervention programs at local, regional and national levels.
- Analyze the way in which economic, social and cultural conditions related to nutrition and physical activity are determinants of health and disease, and understand the role each factor plays in a disease recovery process.
- Define health promotion and disease prevention programs and actions, and participate in interdisciplinary teams.



## LNB B.A. Nutrition and Wellness

### Edition 2011

Remedial Semester			C	L	U	Seventh Semester			C	L	U
H1001	Remedial English I		5	0	8	HS2005	Citizenship		3	0	8
H1002	Remedial English II		5	0	8	NU2020	Research and Intervention Programs in Nutrition and Physical Exercise		2	2	8
H1003	Remedial English III		5	0	8	NU2022	Obesity and Metabolic Syndrome		3	0	8
H1004	Remedial English IV		5	0	8	NU2023	Nutrition Therapy in Eating Disorders		2	2	8
H1005	Remedial English V		5	0	8	NU2024	Nutrition Therapy in Obesity and Metabolic Syndrome		4	2	12
H1015	Spanish Composition		5	0	8	NU2026	Food Service Administration and Management		2	2	8
MA1001	Introduction to Mathematics		6	0	16				<b>16</b>	<b>8</b>	<b>52</b>
TC1001	Introduction to Computer Science		3	0	8						
			<b>39</b>	<b>0</b>	<b>72</b>	<b>First Trimester</b>			<b>C</b>	<b>L</b>	<b>U</b>
<b>First Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	MC3093	Bioethics		2	0	4
H1040	Analysis and Verbal Expression		5	0	8	NC3006	Multidisciplinary Internal Medicine Clinic		0	20	4
MD1029	Chemical Foundations of Metabolism and Physiology		3	0	8	NC3007	Physical Activity and Disease		2	0	4
MD1031	Cell Biology		3	0	8	NC3008	Clinical Pathologic Entities in Internal Medicine		3	0	8
MD1032	Historical Foundations in Health Sciences		3	0	8	NC3009	Complementary and Alternative Nutrition		2	0	4
MD1047	Research and Technology in Health Sciences		3	0	8	NC3010	Medical Nutrition Therapy in Internal Medicine		3	0	8
NU1000	Bases of Nutrition and Exercise		2	2	8				<b>12</b>	<b>20</b>	<b>32</b>
NU1003	Introduction to the Nutrition and Wellness Academic Program		3	0	4	<b>Second Trimester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>22</b>	<b>2</b>	<b>52</b>	MC3096	Clinical Bioethics		2	0	4
<b>Second Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	NC3000	Multidisciplinary Pediatric Clinic		0	20	4
H1016	Foreign Language		5	0	8	NC3001	Clinical Pathological Entities in Pediatrics		3	0	8
MD1015	Biostatistics		3	0	8	NC3002	Clinical Nutritional Support in Pediatrics		2	0	4
MD1030	Metabolism and Functional Biochemistry		3	0	8	NC3004	Behavioral Modification Therapy		2	0	4
MD1034	Developmental Biology		3	0	8	NC3005	Medical Nutrition Therapy in Pediatrics		3	0	8
MD1036	Basic Morphophysiology		5	0	12				<b>12</b>	<b>20</b>	<b>32</b>
SU1003	Principles of Health Management		2	0	4	<b>Third Trimester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>21</b>	<b>0</b>	<b>48</b>	OP3024	Professional Elective I		3	0	8
<b>Third Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	OP3025	Professional Elective II		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	OP3026	Professional Elective III		3	0	8
MD1039	Microbiology and Parasitology		3	0	8				<b>9</b>	<b>0</b>	<b>24</b>
MD1040	Musculoskeletal and Digestive Systems		3	0	8	<b>Fourth Trimester</b>			<b>C</b>	<b>L</b>	<b>U</b>
MD1041	Biocontrol Systems		5	0	12	OP3027	Professional Elective IV		3	0	8
MD1042	Community I		2	0	4	OP3037	Professional Elective V		3	0	8
NU1002	Exercise Physiology		2	2	8	OP3038	Professional Elective VI		3	0	8
			<b>18</b>	<b>2</b>	<b>48</b>				<b>9</b>	<b>0</b>	<b>24</b>
<b>Fourth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Fifth Trimester</b>			<b>C</b>	<b>L</b>	<b>U</b>
H1018	Ethics, Self and Society		3	0	8	NC3011	Multidisciplinary Surgery Clinic		0	20	4
MD1045	Vital Processes		5	0	12	NC3012	Clinical Pathological Entities in Surgery		3	0	8
MD1048	Community II		2	0	4	NC3013	Food Medication Interactions		2	0	4
NU2000	Exercise in the Life Cycle		3	0	8	NC3014	Clinical Nutrition Support		3	0	8
NU2003	Nutrition in the Life Cycle		3	0	8	NC3015	Medical Nutrition Therapy in Surgery		3	0	8
Q2001	Food Chemistry		3	0	8				<b>11</b>	<b>20</b>	<b>32</b>
TA2008	Food Chemistry Laboratory		0	3	4	<b>Sixth Trimester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>19</b>	<b>3</b>	<b>52</b>	MC3101	Quality Healthcare and Patient Safety		1	0	2
<b>Fifth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	NC3003	Nutrition in Physical Activity and Exercise		2	0	4
EM1005	Entrepreneurship		3	0	8	NC3016	Clinical Pathologic Entities in Gynecology, Obstetrics and Geriatrics		3	0	8
MB2057	Community III		2	2	8	NC3017	Medical Nutrition Therapy in Gynecology, Obstetrics and Geriatrics		3	0	8
NU2014	Clinical Nutrition Assessment		4	2	12	NC3018	Multidisciplinary Gynecology and Obstetrics Clinic		0	20	4
NU2015	Food, Diet Assessment and Planning Lab		0	3	4	NU3016	Introduction to Professional Development		2	0	2
NU2016	Methodology of Physical Activity		2	0	4				<b>11</b>	<b>20</b>	<b>28</b>
NU2017	Clinical Propaedeutic		2	2	8						
NU2025	Diet Assessment and Planning		3	0	8						
			<b>16</b>	<b>9</b>	<b>52</b>	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	HS2000	Humanities and Fine Arts		3	0	8
HS2000	Humanities and Fine Arts		3	0	8	MB2045	Health Psychology		3	0	8
MB2045	Health Psychology		3	0	8	MB2052	Global Health and Preventive Medicine		2	0	4
MB2052	Global Health and Preventive Medicine		2	0	4	NU2019	Design of Physical Exercise Programs		2	2	8
NU2019	Design of Physical Exercise Programs		2	2	8	TA2009	Nutrition and Nutrigenomics		3	0	8
TA2009	Nutrition and Nutrigenomics		3	0	8	TA2015	Food Sciences		3	0	8
TA2015	Food Sciences		3	0	8	TA2016	Food Sciences Lab		0	3	4
TA2016	Food Sciences Lab		0	3	4				<b>16</b>	<b>5</b>	<b>48</b>
			<b>16</b>	<b>5</b>	<b>48</b>						

C Number of class hours per week

L Number of laboratory hours or activities per week

U Study hours that must be dedicated to the course (class hours included)

H Total hours

## B.S. Clinical Psychology and Health (LPS)

Graduates from this program are professionals who use psychology to promote mental health and its impact on comprehensive wellbeing. They implement actions to prevent disease and mental health disorders that affect the behavior of individuals and groups, participating in the design and management of biopsychosocial health programs in multidisciplinary teams to provide treatment for individuals, groups and social groups.

### Competencies for Graduates:

- Apply social science, biological and psychological knowledge and methods to understand human behavior.
- Provide individual and group psychological care to people with mental health disorders.
- Provide individual and group psychological care to patients with health issues or who are in crisis or high-risk situations.
- Participate in biopsychosocial research projects in local and global settings.
- Undertake innovative actions, as an agent of change, to promote healthcare and prevent mental illness at personal, individual and collective levels.
- Knowledgeable and aware of the economic, social and political reality of their environment; act with solidarity and responsibility to improve the quality of life in communities.
- Identify, analyze and assess ethical dilemmas related to their personal lives, profession and environment. Respect others and the environment.
- Communicate the results of clinical notes, psychological reports, projects and/or studies efficiently, both orally and in writing, in Spanish and English.
- Propose supportive, sustainable solutions that can cultivate citizenship competencies in the communities in which they conduct their development projects.





## LPS B.S. Clinical Psychology and Health Edition 2012

Remedial Semester			C	L	U	Sixth Semester			C	L	U
H1001	Remedial English I		5	0	8	AD3018	Planning Processes and Models		3	0	8
H1002	Remedial English II		5	0	8	CC2010	Psychometrics I		3	0	8
H1003	Remedial English III		5	0	8	CC2011	Group Dynamics		3	0	8
H1004	Remedial English IV		5	0	8	EM1005	Entrepreneurship		3	0	8
H1005	Remedial English V		5	0	8	RH1000	Organizational Behavior and Human Talent Development		3	0	8
H1015	Spanish Composition		5	0	8	RI2034	Negotiation and Conflict Management		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8				<b>C</b>	<b>L</b>	<b>U</b>
			<b>39</b>	<b>0</b>	<b>72</b>	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
First Semester			C	L	U	Seventh Semester			C	L	U
AD1005	Management and Business Model Innovation		3	0	8	CC2007	Educational Technology		3	0	8
CC1000	Human Development I		3	0	8	CC2013	Psychometrics II		3	0	8
CC1003	General Psychology I		3	0	8	CC2014	Interview Workshop		3	0	8
CC1016	Introduction to the Psychology Academic Program		3	0	4	CC3004	Psychology Seminar of Vulnerable Groups		3	0	8
H1016	Foreign Language		5	0	8	HS2005	Citizenship		3	0	8
MD1029	Chemical Foundations of Metabolism and Physiology		3	0	8	RH3006	Strategic Training Management		3	0	8
MD1031	Cell Biology		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
			<b>23</b>	<b>0</b>	<b>52</b>	<b>First Trimester</b>			<b>C</b>	<b>L</b>	<b>U</b>
Second Semester			C	L	U	First Trimester			C	L	U
CC1001	Human Development II		3	0	8	CC3005	Personality Disorders and Anxiety		3	0	8
CC1007	General Psychology II		3	0	8	CC3006	Psychotic Disorders and Mood		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	CC3007	Clinical Practice I		0	20	4
MA1016	Mathematics I		3	0	8	CC3008	Clinical Interview		3	0	8
MD1034	Developmental Biology		3	0	8	MC3093	Bioethics		2	0	4
MD1036	Basic Morphophysiology		5	0	12				<b>11</b>	<b>20</b>	<b>32</b>
			<b>22</b>	<b>0</b>	<b>52</b>	<b>Second Trimester</b>			<b>C</b>	<b>L</b>	<b>U</b>
Third Semester			C	L	U	Second Trimester			C	L	U
AD1006	Organizational Learning and Knowledge Management		3	0	8	CC3009	Somatoform Disorders, Factitious Disorders and Simulation		3	0	8
CC1011	Personality Development		3	0	8	CC3010	Psychology of the Patient in Crisis Situations		3	0	8
CF1008	Financial Information for Decision Making		3	0	8	CC3011	Psychology of Obstetric and Gynecological Patients		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	CC3012	Clinical Practice II		0	20	4
MD1032	Historical Foundations in Health Sciences		3	0	8	MC3096	Clinical Bioethics		2	0	4
TI1012	Business Information Technology		3	0	8				<b>11</b>	<b>20</b>	<b>32</b>
			<b>18</b>	<b>0</b>	<b>48</b>	<b>Third Trimester</b>			<b>C</b>	<b>L</b>	<b>U</b>
Fourth Semester			C	L	U	Third Trimester			C	L	U
CC1005	Learning and Cognitive Development		3	0	8	OP3024	Professional Elective I		3	0	8
CC2015	Psychopathology I		3	0	8	OP3025	Professional Elective II		3	0	8
CO2004	Qualitative Research Methods		3	0	8	OP3026	Professional Elective III		3	0	8
H1018	Ethics, Self and Society		3	0	8	OP3027	Professional Elective IV		3	0	8
H2033	Social Anthropology		3	0	8				<b>12</b>	<b>0</b>	<b>32</b>
MA1008	Statistics for Research in the Social Sciences		3	0	8	<b>Fourth Trimester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>18</b>	<b>0</b>	<b>48</b>	CC3003	Introduction to Professional Development		2	0	2
Fifth Semester			C	L	U	CC3013	Psychology of Chronic and Terminal Patients		3	0	8
CC2001	Social Psychology		3	0	8	CC3014	Addiction and Eating Disorders Psychology		3	0	8
CC2012	Scale Design		3	0	8	CC3015	Mental Health Promotion		3	0	8
CC2016	Psychopathology II		3	0	8	CC3016	Clinical Practice III		0	20	4
CO2003	Quantitative Social Research Methods		3	0	8				<b>11</b>	<b>20</b>	<b>30</b>
HS2000	Humanities and Fine Arts		3	0	8						
MD1050	Psychophysiology		5	0	12						
			<b>20</b>	<b>0</b>	<b>52</b>						

- C Number of class hours per week  
L Number of laboratory hours or activities per week  
U Study hours that must be dedicated to the course (class hours included)  
H Total hours

## Physician & Surgeon (MC)

Graduates from this program are leading, innovative professionals in the field of healthcare, with a strong sense of humanity and sensitivity toward the needs of society. They solve health problems, paying attention to the habits, values and beliefs of individuals and their families, and work as part of a healthcare team with professionalism and ethics, in accordance with the principles of medicine and the official health-system regulatory standards.

### Competencies for Graduates:

- Apply the most up-to-date knowledge of medicine to patient care and the prompt identification of diseases.
- Care for patients by applying the strictest scientific quality standards, in a caring, empathetic, ethical manner, always prioritizing their patients' health interests above their own.
- Continuously improve the quality of the care offered, based on the ongoing study of medicine and through the appropriate analysis of medical practice in light of the available scientific evidence.
- Interact with the healthcare team to strengthen, enhance and innovate the existing healthcare systems for the benefit of their patients.
- Refer their patients as soon as possible to the appropriate specialist when a disease becomes complex and surpasses the limits of their knowledge of general medicine.



# MC Physician & Surgeon

## Edition 2011

Remedial Semester				C	L	U	Eighth Semester				C	L	U
H1001	Remedial English I	5	0	8	HS2005	Citizenship	3	0	8				
H1002	Remedial English II	5	0	8	MB2052	Global Health and Preventive Medicine	2	0	4				
H1003	Remedial English III	5	0	8	MB2053	Pathophysiology of Nervous System	3	0	8				
H1004	Remedial English IV	5	0	8	MB2054	Pathophysiology of Reproductive System	3	0	8				
H1005	Remedial English V	5	0	8	MB2055	Family Medicine	2	2	8				
H1015	Spanish Composition	5	0	8	MB2056	Morphological and Functional Pathology IV	2	2	8				
TC1001	Introduction to Computer Science	3	0	8	SU1003	Principles of Health Management	2	0	4				
		<b>33</b>	<b>0</b>	<b>56</b>			<b>17</b>	<b>4</b>	<b>48</b>				
First Semester				C	L	U	First Trimester				C	L	U
H1040	Analysis and Verbal Expression	5	0	8	MC3084	Cardiology and Metabolic Diseases	3	0	8				
MD1029	Chemical Foundations of Metabolism and Physiology	3	0	8	MC3085	Internal Medicine Clinic	0	60	12				
MD1031	Cell Biology	3	0	8	MC3086	Complementary Medicine	1	0	2				
MD1032	Historical Foundations in Health Sciences	3	0	8	MC3087	Internal Medicine	3	0	8				
MD1033	Histology	2	2	8			<b>7</b>	<b>60</b>	<b>30</b>				
MD1047	Research and Technology in Health Sciences	3	0	8	Second Trimester				C	L	U		
MD1049	Introduction to the Medical Doctor Academic Program	3	0	4	MC3088	Surgery	5	0	12				
		<b>22</b>	<b>2</b>	<b>52</b>	MC3089	Surgery Clinic	0	60	12				
Second Semester				C	L	U	MC3090	Otorhinolaryngology and Ophthalmology Clinic	0	10	2		
H1016	Foreign Language	5	0	8	MC3091	Otorhinolaryngology and Ophthalmology	2	0	4				
MD1015	Biostatistics	3	0	8			<b>7</b>	<b>70</b>	<b>30</b>				
MD1030	Metabolism and Functional Biochemistry	3	0	8	Third Trimester				C	L	U		
MD1034	Developmental Biology	3	0	8	MC3093	Bioethics	2	0	4				
MD1035	Genetics for Health Sciences	3	0	8	MC3094	Pediatrics Clinic	0	60	12				
MD1036	Basic Morphophysiology	5	0	12	MC3095	Pediatrics	5	0	12				
		<b>22</b>	<b>0</b>	<b>52</b>	MC3101	Quality Healthcare and Patient Safety	1	0	2				
Third Semester				C	L	U			<b>8</b>	<b>60</b>	<b>30</b>		
H2001	Verbal Expression in the Workplace	3	0	8	Fourth Trimester				C	L	U		
MD1037	Healthy Environment and Self care	2	0	4	MC3092	Legal Issues of Medical Practice	1	0	2				
MD1038	Morphofunctional Laboratory	2	2	8	MC3096	Clinical Bioethics	2	0	4				
MD1039	Microbiology and Parasitology	3	0	8	MC3097	Obstetrics and Gynecology Clinic	0	60	12				
MD1040	Musculoskeletal and Digestive Systems	3	0	8	MC3098	Obstetrics and Gynecology	5	0	12				
MD1041	Biocontrol Systems	5	0	12			<b>8</b>	<b>60</b>	<b>30</b>				
MD1042	Community I	2	0	4	Fifth Trimester				C	L	U		
		<b>20</b>	<b>2</b>	<b>52</b>	MD3000	Introduction to Professional Development	2	0	2				
Fourth Semester				C	L	U	OP3024	Professional Elective I	3	0	8		
H1018	Ethics, Self and Society	3	0	8	OP3025	Professional Elective II	3	0	8				
MD1043	Defense and Hemostasis	3	0	8	OP3039	Professional Elective Clinic	0	60	12				
MD1044	General Pharmacology and Toxicology	3	0	8			<b>8</b>	<b>60</b>	<b>30</b>				
MD1045	Vital Processes	5	0	12	Sixth Trimester				C	L	U		
MD1046	History Taking and Clinical Examination I	2	2	8	MC3099	Critical Appraisal of Medical Literature	1	0	2				
MD1048	Community II	2	0	4	MC3102	Emergency Clinic	0	20	4				
		<b>18</b>	<b>2</b>	<b>48</b>	MC3103	Radiology Clinic	0	20	4				
Fifth Semester				C	L	U	MC3104	Traumatology, Orthopedics and Rehabilitation Clinic	0	20	4		
HS2000	Humanities and Fine Arts	3	0	8	MC3105	Emergencies	2	0	4				
MB2036	Pathophysiology of the Endocrine System	3	0	8	MC3106	Radiology	2	0	4				
MB2037	Morphological and Functional Pathology I	2	2	8	MC3107	Traumatology, Orthopedics and Rehabilitation	3	0	8				
MB2038	Pathophysiology	5	0	12			<b>8</b>	<b>60</b>	<b>30</b>				
MB2039	History Taking and Clinical Examination II	2	2	8	Seventh Trimester				C	L	U		
MB2057	Community III	2	2	8	MC3108	Geriatrics Clinic	0	20	4				
		<b>17</b>	<b>6</b>	<b>52</b>	MC3109	Neurology and Neurosurgery Clinic	0	20	4				
Sixth Semester				C	L	U	MC3110	Psychiatry Clinic	0	20	4		
MB2040	Applied Pharmacology	3	0	8	MC3111	Geriatrics	2	0	4				
MB2041	Pathophysiology of the Digestive System and Nutrition	3	0	8	MC3112	Neurology and Neurosurgery	3	0	8				
MB2042	Renal Pathophysiology	3	0	8	MC3113	Psychiatry	2	0	4				
MB2043	Community Research	2	2	8			<b>7</b>	<b>60</b>	<b>28</b>				
MB2044	Morphological and Functional Pathology II	2	2	8	Eighth Trimester				C	L	U		
MB2045	Health Psychology	3	0	8	MC3114	Dermatology Clinic	0	20	4				
		<b>16</b>	<b>4</b>	<b>48</b>	MC3115	Oncology Clinic	0	20	4				
Seventh Semester				C	L	U	MC3116	Rheumatology and Allergies Clinic	0	20	4		
EM1005	Entrepreneurship	3	0	8	MC3117	Dermatology	2	0	4				
MB2046	Pathophysiology of the Circulatory System	3	0	8	MC3118	Medical Immunology	2	0	4				
MB2047	Pathophysiology of Respiratory System	3	0	8	MC3119	Oncology and Palliative Care	2	0	4				
MB2048	Clinical Pathology Laboratory	0	3	4	MC3120	Rheumatology and Allergies	2	0	4				
MB2049	Legal and Forensic Medicine	3	0	8			<b>8</b>	<b>60</b>	<b>28</b>				
MB2050	Pre hospitalization Care and Clinical Skills	2	2	8									
MB2051	Morphological and Functional Pathology III	2	2	8									
		<b>16</b>	<b>7</b>	<b>52</b>									

The unit's and academic charge definition for the Clinical Medicine (Rotary Internship) DCS student has a different meaning than for the rest of the Tecnológico de Monterrey's academic programs. The academic charge for the student is defined as the weekly work hours that are hoped the student can dedicate to the course and the fulfillment of the objectives of the same; these hours, H or U, (the highest number) include minimum presentable Internship hours, Class, Laboratory, Ambulatory Attention, Clinical Visit, Propaedeutic and Community, as well as hours of individual and/or collaborative autostudy. The units (U) are also used to determine the students tuition fee.

- C Number of class hours per week
- L Number of laboratory hours or activities per week
- U Study hours that must be dedicated to the course (class hours included)
- H Total hours

## Medical and Surgical Dentist (MO)

Graduates from this program are professionals with a broad, sound knowledge of health sciences, and the capacity and skills to diagnose, prevent and treat, with an interdisciplinary approach, oral diseases and disorders using innovative techniques and procedures, in order to contribute to the preservation of people's comprehensive well-being.

### Competencies for Graduates:

- Address oral health requirements in an ethical, professional humanistic manner, applying bio-medical and clinical sciences and using innovative techniques and procedures.
- Diagnose oral diseases by integrating the findings of the patient's medical records, physical examination and auxiliary tests to establish a comprehensive dental treatment plan, considering the individual characteristics of each patient.
- Carry out basic procedures in the diverse areas of dentistry to reestablish the health, function and aesthetics of the tissues that comprise the oral cavity in children, adults, senior citizens and special-needs individuals.



## MO Medical and Surgical Dentist Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
H1001	Remedial English I		5	0	8	H2001	Verbal Expression in the Workplace		3	0	8
H1002	Remedial English II		5	0	8	MB2057	Community III		2	2	8
H1003	Remedial English III		5	0	8	MD1043	Defense and Hemostasis		3	0	8
H1004	Remedial English IV		5	0	8	OD2000	Dental Biomaterials		3	0	8
H1005	Remedial English V		5	0	8	OD2008	Dental Biomaterials Laboratory		0	3	4
H1015	Spanish Composition		5	0	8	OD2009	Oral Surgery and Anesthesia Preclinic		2	2	8
MA1001	Introduction to Mathematics		6	0	16	OD2010	Basic Multidisciplinary Dental Preclinic		2	2	8
TC1001	Introduction to Computer Science		3	0	8				<b>15</b>	<b>9</b>	<b>52</b>
			<b>39</b>	<b>0</b>	<b>72</b>	Sixth Semester			C	L	U
First Semester			C	L	U	EM1005	Entrepreneurship		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	MB2050	Pre hospitalization Care and Clinical Skills		2	2	8
MD1029	Chemical Foundations of Metabolism and Physiology		3	0	8	MD1044	General Pharmacology and Toxicology		3	0	8
MD1031	Cell Biology		3	0	8	OD2011	Multidisciplinary Dentistry		3	0	8
MD1032	Historical Foundations in Health Sciences		3	0	8	OD2012	Dental Research Seminar		2	0	4
MD1033	Histology		2	2	8	OD3016	Multidisciplinary Dental Clinic I		0	6	8
MD1047	Research and Technology in Health Sciences		3	0	8	OD3017	Advanced Multidisciplinary Dental Preclinic		2	2	8
OD1005	Introduction to the Dentistry Academic Program		3	0	4				<b>15</b>	<b>10</b>	<b>52</b>
			<b>22</b>	<b>2</b>	<b>52</b>	Seventh Semester			C	L	U
Second Semester			C	L	U	HS2000	Humanities and Fine Arts		3	0	8
H1016	Foreign Language		5	0	8	MB2052	Global Health and Preventive Medicine		2	0	4
MD1015	Biostatistics		3	0	8	OD1010	Preventive Dentistry		2	0	4
MD1030	Metabolism and Functional Biochemistry		3	0	8	OD2013	Oral Surgery Clinic I		0	6	8
MD1034	Developmental Biology		3	0	8	OD2014	Pediatric and Orthodontic Dental Preclinic		2	2	8
MD1035	Genetics for Health Sciences		3	0	8	OD3018	Multidisciplinary Dental Clinic II		0	6	8
MD1036	Basic Morphophysiology		5	0	12	OD3019	Oral Implantology		3	0	8
			<b>22</b>	<b>0</b>	<b>52</b>				<b>12</b>	<b>14</b>	<b>48</b>
Third Semester			C	L	U	Eighth Semester			C	L	U
MD1037	Healthy Environment and Self care		2	0	4	HS2005	Citizenship		3	0	8
MD1038	Morphofunctional Laboratory		2	2	8	MB2045	Health Psychology		3	0	8
MD1039	Microbiology and Parasitology		3	0	8	OD2015	Prosthodontic Dental Preclinic		2	2	8
MD1041	Biocontrol Systems		5	0	12	OD3020	Oral Surgery II		0	6	8
MD1042	Community I		2	0	4	OD3021	Pediatric and Orthodontic Dental Clinic		0	6	8
OD1006	Oral Morphophysiology Laboratory		2	2	8	OD3022	Preventive Dentistry Clinic		0	6	8
OD1007	Oral Morphophysiology		3	0	8	OD3023	Oral Medicine		2	0	4
			<b>19</b>	<b>4</b>	<b>52</b>				<b>10</b>	<b>20</b>	<b>52</b>
Fourth Semester			C	L	U	Ninth Semester			C	L	U
H1018	Ethics, Self and Society		3	0	8	VA2010	Topics I		3	0	8
MD1045	Vital Processes		5	0	12	VA2011	Topics II		3	0	8
MD1048	Community II		2	0	4	VA2012	Topics III		3	0	8
OD1002	Oral Pathology		2	2	8	VA2013	Topics IV		3	0	8
OD1008	History Taking and Oral Clinical Examination		2	2	8	VA2014	Topics V		3	0	8
OD1009	Dental Radiology		2	2	8	VA2015	Topics VI		3	0	8
			<b>16</b>	<b>6</b>	<b>48</b>				<b>18</b>	<b>0</b>	<b>48</b>
			C	L	U	Tenth Semester			C	L	U
						HS2006	Applied Ethics		3	0	8
						OD3004	Introduction to Professional Development		2	0	2
						OD3024	Oral Surgery III		0	6	8
						OD3025	Special, High Risk and Emergency Dental Clinic		0	6	8
						OD3026	Prosthodontic Dental Clinic		0	6	8
						OD3027	Evidence based Dentistry		2	0	4
						OD3028	Multidisciplinary Dental Seminar		3	0	8
						SU1003	Principles of Health Management		2	0	4
									<b>12</b>	<b>18</b>	<b>50</b>

C Number of class hours per week

L Number of laboratory hours or activities per week

U Study hours that must be dedicated to the course (class hours included)

H Total hours







Undergraduate Degree Profiles  
and Curricula of  
**Humanities and Social  
Sciences**

## B.A. Animation and Digital Art (LAD)

Graduates from this program are professionals with an in-depth knowledge of art, technology and narrative, specializing in the design, development and production of artistic-technological projects for the entertainment and digital media industries (videogames, music, film, advertising, Internet, television, science and technology), which meet their expression and dissemination needs.

### Competencies for Graduates:

- Plan, organize and direct animation projects, creating work teams and using technology efficiently.
- Design, produce and publish animation projects in diverse techniques to fulfill specific objectives and complying with the entertainment and digital media industry standards.
- Collaborate with interdisciplinary teams in the development of applications and interactive projects (videogames, simulation and augmented reality) in art, entertainment, advertising, education, medicine and science settings.
- Participate in art and technology projects related to sustainability to contribute to the development of their communities, with a sense of ethics and responsibility toward the social and cultural environment.



## LAD B.A. Animation and Digital Art Edition 2011

<b>Remedial Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Fifth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
F1001	Introduction to Physics		3	0	8	A1002	Aesthetics		3	0	8
H1001	Remedial English I		5	0	8	AT2005	3D Animation		3	0	8
H1002	Remedial English II		5	0	8	H1018	Ethics, Self and Society		3	0	8
H1003	Remedial English III		5	0	8	H1032	Mexican Identity and Culture		3	0	8
H1004	Remedial English IV		5	0	8	H1048	Narrative Structures		3	0	8
H1005	Remedial English V		5	0	8	TC1021	Videogame Development Project		3	0	8
H1015	Spanish Composition		5	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MA1001	Introduction to Mathematics		6	0	16	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
TC1001	Introduction to Computer Science		3	0	8	AT2006	Theory and Practice of Sound		3	0	8
			<b>42</b>	<b>0</b>	<b>80</b>	AT3001	Advanced Digital Modeling		3	0	8
<b>First Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	AV2004	Scriptwriting		3	0	8
AR1013	Drawing		4	0	8	DL2026	Advanced Digital Representation Techniques		3	0	8
AR1014	Descriptive Geometry		3	0	8	H2003	Contemporary Art and Society		3	0	8
AT1003	Introduction to Animation and Digital Art Academic Program		3	0	4	TC3022	Computer Graphics		3	0	8
DL1002	Design Fundamentals I		4	0	8				<b>18</b>	<b>0</b>	<b>48</b>
H1016	Foreign Language		5	0	8	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
TC1003	Discrete Mathematics		3	0	8	AD2014	Business in the Industry of Music and Entertainment		3	0	8
TC1014	Programming Fundamentals		3	0	8	AT2007	Virtual Environments		3	0	8
			<b>25</b>	<b>0</b>	<b>52</b>	AT3002	Advanced 3D Animation		3	0	8
<b>Second Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	AT3003	Visual Effects Production for Digital Media		3	0	8
AT1001	Artistic Drawing		4	0	8	AV2006	Media Narrative Design and Production		3	0	8
CO1007	Communication, Signs, and Signification		3	0	8	EM1005	Entrepreneurship		3	0	8
DL1004	Design Fundamentals II		4	0	8				<b>18</b>	<b>0</b>	<b>48</b>
H1040	Analysis and Verbal Expression		5	0	8	<b>Eighth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
MA1009	Mathematics for Design		3	0	8	AV2009	Media Projects Management and Evaluation		3	0	8
TC2016	Object Oriented Programming		3	0	8	HS2005	Citizenship		3	0	8
			<b>22</b>	<b>0</b>	<b>48</b>	TC3028	Physical Interfaces		3	0	8
<b>Third Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	VA2010	Topics I		3	0	8
A1000	Form Exploration Workshop I		4	0	8	VA2011	Topics II		3	0	8
AT1002	Fundamentals of Animation		3	0	8	VA2012	Topics III		3	0	8
AV1000	Photography and Digital Imaging		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
DL1009	Creativity and Innovation		3	0	8	<b>Ninth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
F2001	Design Physics		3	0	8	AT3004	Animation and Digital Art Project		3	0	8
TC1018	Data Structures		3	0	8	AT3005	Introduction to Professional Development		2	0	2
			<b>19</b>	<b>0</b>	<b>48</b>	AV3010	Film Production		3	0	8
<b>Fourth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	D1025	Media Legislation		3	0	8
A2001	Form Exploration Workshop II		4	0	8	HS2006	Applied Ethics		3	0	8
AT2000	Digital Modelling		3	0	8	VA2013	Topics IV		3	0	8
AV1004	Audiovisual Language and Narrative		3	0	8	VA2014	Topics V		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
MA1021	Applied Mathematics		3	0	8						
TC1015	Introduction to Interactive Design		3	0	8						
			<b>19</b>	<b>0</b>	<b>48</b>						

- C Number of class hours per week  
L Number of laboratory hours or activities per week  
U Study hours that must be dedicated to the course (class hours included)

## B.A. Communication and Digital Media (LCMD)

Graduates from this program are specialists in designing, implementing and managing content on digital media and interactive platforms, supported by digital production media that meet the expectations of diverse organizations, institutions and the information and knowledge society.

### Competencies for Graduates:

- Design, produce, direct and manage digital and interactive projects, the content of which can be adapted to diverse cultural contexts to be distributed through different channels and platforms.
- Conceptualize and write scripts for digital and interactive productions in diverse formats; create fiction and documentary films, audio, television and media productions with cutting-edge image and sound technologies.
- Promote the creative and entertainment industries in a global environment by carrying out digital and interactive projects that are attractive to and suitable for international audiences.
- Understand, respect and promote the value of cultural diversity and freedom of expression.
- Apply theoretical principles in the use and presentation of images and content.

LCMD

## LCMD B.A. Communication and Digital Media

### Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
H1001	Remedial English I		5	0	8	AV2006	Media Narrative Design and Production		3	0	8
H1002	Remedial English II		5	0	8	CF1010	Accounting and Cost Management		3	0	8
H1003	Remedial English III		5	0	8	CO2008	Communication and Media Studies		3	0	8
H1004	Remedial English IV		5	0	8	CR1000	Strategic Communication Fundamentals		3	0	8
H1005	Remedial English V		5	0	8	EM1005	Entrepreneurship		3	0	8
H1015	Spanish Composition		5	0	8	H1026	Philosophy and Contemporary Thought		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8	Sixth Semester			C	L	U
			<b>39</b>	<b>0</b>	<b>72</b>	AV2007	Digital and Interactive Media Aesthetics		3	0	8
First Semester			C	L	U	AV2008	Multi Platform Audio Production		3	0	8
AD1005	Management and Business Model Innovation		3	0	8	AV3001	Interactive Media Design and Production		3	0	8
CO1006	Introduction to Communication and Digital Media Academic Program		3	0	4	CO2006	Communication and Cultural Studies		3	0	8
CO1007	Communication, Signs, and Signification		3	0	8	CR2003	Applied Strategic Communication		3	0	8
DL1002	Design Fundamentals I		4	0	8	HS2000	Humanities and Fine Arts		3	0	8
H1016	Foreign Language		5	0	8				<b>18</b>	<b>0</b>	<b>48</b>
H1040	Analysis and Verbal Expression		5	0	8	Seventh Semester			C	L	U
MA1009	Mathematics for Design		3	0	8	AV2009	Media Projects Management and Evaluation		3	0	8
			<b>26</b>	<b>0</b>	<b>52</b>	AV2010	Directing and Mise en Scene		3	0	8
Second Semester			C	L	U	AV3008	Documentary Production		3	0	8
AV1004	Audiovisual Language and Narrative		3	0	8	CO3006	Communication and Globalization		3	0	8
AV1005	Digital Design Lab		0	3	4	VA2010	Topics I		3	0	8
CC1014	Psychology		3	0	8	VA2011	Topics II		3	0	8
H1045	Literature and Power in Latin America		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MA1008	Statistics for Research in the Social Sciences		3	0	8	Eighth Semester			C	L	U
P1000	Sociology		3	0	8	AV3009	Multi Platform Television Production		3	0	8
TC1014	Programming Fundamentals		3	0	8	CO3007	Advertising and Integrated Marketing		3	0	8
			<b>18</b>	<b>3</b>	<b>52</b>	D1025	Media Legislation		3	0	8
Third Semester			C	L	U	HS2005	Citizenship		3	0	8
A1001	Contemporary Visual Culture and Design		3	0	8	VA2012	Topics III		3	0	8
AV1000	Photography and Digital Imaging		3	0	8	VA2013	Topics IV		3	0	8
AV1006	Audio Lab		0	3	4				<b>18</b>	<b>0</b>	<b>48</b>
CO2003	Quantitative Social Research Methods		3	0	8	Ninth Semester			C	L	U
H1048	Narrative Structures		3	0	8	AV3010	Film Production		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	AV3011	Design and Production of Communication for Organizations		3	0	8
MT1003	Marketing and Creativity		3	0	8	CO3008	Seminar on Creative and Entertainment Industries		3	0	8
			<b>18</b>	<b>3</b>	<b>52</b>	CO3009	Introduction to Professional Development		2	0	2
Fourth Semester			C	L	U	HS2006	Applied Ethics		3	0	8
AV1007	Video Lab		0	3	4	VA2014	Topics V		3	0	8
AV2004	Scriptwriting		3	0	8	VA2015	Topics VI		3	0	8
AV2005	Advertising and Commercial Photography		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
CO2004	Qualitative Research Methods		3	0	8						
H1018	Ethics, Self and Society		3	0	8						
MI2005	Production for Informative Journalism		3	0	8						
TC1015	Introduction to Interactive Design		3	0	8						
			<b>18</b>	<b>3</b>	<b>52</b>						

- C Number of class hours per week  
 L Number of laboratory hours or activities per week  
 U Study hours that must be dedicated to the course (class hours included)



## B.A. Spanish Literature (LLE)

Graduates from this program are experts in the production, correction and edition of texts. Their humanistic culture allows them to analyze reality with an ethical, critical sense and to situate mankind as the center of all types of reflection and actions.

### Competencies for Graduates:

- Critique a literary text.
- Display an in-depth knowledge of Spanish language and literature.
- Superior written expression skills.
- Generate and edit texts using new technologies.
- Conduct quality research in the areas of Hispanic literature, Spanish language and edition.



## LLE B.A. Spanish Literature Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
H1001	Remedial English I		5	0	8	H2019	Contemporary World Literature		3	0	8
H1002	Remedial English II		5	0	8	H2036	Hispanic Colonial Literature		3	0	8
H1003	Remedial English III		5	0	8	H2040	The Golden Age of Spanish Literature		3	0	8
H1004	Remedial English IV		5	0	8	H3027	Spanish Semantics and Pragmatics		3	0	8
H1005	Remedial English V		5	0	8	HS2000	Humanities and Fine Arts		3	0	8
H1015	Spanish Composition		5	0	8	TC1025	Information Technologies and Edition		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8				<b>C</b>	<b>L</b>	<b>U</b>
			<b>39</b>	<b>0</b>	<b>72</b>	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
First Semester			C	L	U	AV3013	Publications Design and Production		3	0	8
CO1007	Communication, Signs, and Signification		3	0	8	H1026	Philosophy and Contemporary Thought		3	0	8
H1016	Foreign Language		5	0	8	H2043	Modern and Contemporary Spanish Literature		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	H2045	Hispanic American Literature of the 19th and 20th Centuries		3	0	8
H1045	Literature and Power in Latin America		3	0	8	H2047	Mexican Literature of the 19th and 20th Centuries		3	0	8
H1050	Introduction to Spanish Language and Literature Academic Program		3	0	4	H3030	Spanish and Digital Media		3	0	8
MA1008	Statistics for Research in the Social Sciences		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
RI2028	History of Independent Mexico		3	0	8				<b>C</b>	<b>L</b>	<b>U</b>
			<b>25</b>	<b>0</b>	<b>52</b>	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
Second Semester			C	L	U	AV3001	Interactive Media Design and Production		3	0	8
H1018	Ethics, Self and Society		3	0	8	EM1005	Entrepreneurship		3	0	8
H1043	Classical Literature		3	0	8	H2046	Hispanic American Literature of the 20th Century		3	0	8
H1046	Spanish Linguistics I		3	0	8	H2048	Mexican Literature of the 20th Century		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	H3032	Seminar in Literary Criticism I		3	0	8
P1000	Sociology		3	0	8	RI2012	Latin American and Caribbean Regional Scenario		3	0	8
RI2029	History of Contemporary Mexico		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
			<b>18</b>	<b>0</b>	<b>48</b>	<b>Eighth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
Third Semester			C	L	U	H3033	Editing and Text Correction in Spanish		3	0	8
H1031	Contemporary Art and Culture		3	0	8	H3035	Seminar in Literary Criticism II		3	0	8
H1048	Narrative Structures		3	0	8	HS2005	Citizenship		3	0	8
H2034	Medieval and Renaissance Literature		3	0	8	VA2010	Topics I		3	0	8
H2037	Spanish Linguistics II		3	0	8	VA2011	Topics II		3	0	8
H2038	Literary Theory I		3	0	8	VA2012	Topics III		3	0	8
RI1008	World History of the 19th Century		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
			<b>18</b>	<b>0</b>	<b>48</b>	<b>Ninth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
Fourth Semester			C	L	U	H3034	Editorial Project and New Technologies		3	0	8
H1047	Discourse and Power		3	0	8	H3039	Introduction to Professional Development		2	0	2
H1049	European Literature of the 17th to 19th Centuries		3	0	8	H3040	Seminar in Literary Criticism III		3	0	8
H2042	Hispanic Philology		3	0	8	HS2006	Applied Ethics		3	0	8
H2044	Literary Theory II		3	0	8	VA2013	Topics IV		3	0	8
H2049	Spanish Medieval Literature		3	0	8	VA2014	Topics V		3	0	8
RI2030	World History of the 20th and 21st Centuries		3	0	8	VA2015	Topics VI		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>				<b>20</b>	<b>0</b>	<b>50</b>

- C Number of class hours per week  
 L Number of laboratory hours or activities per week  
 U Study hours that must be dedicated to the course (class hours included)

## B.A. Journalism and Media Studies (LMI)

Graduates from this program are professionals with an ethical outlook and global, multicultural insight who perform effectively in diverse information platforms (television, radio, printed media and the Internet), to become an agent of change in the world of journalism in the new information era.

### Competencies for Graduates:

- Create content for traditional, digital and interactive information media.
- Develop informative products and/or services in both the public and private sectors, and information strategies in national and international settings.
- Specialize in one of the fields of journalism: investigation, politics, social, sports, finance, culture and international.
- Innovate, administrate and manage projects and companies in the media industry.
- Produce interactive information media for the digital era.
- Provide solutions to contemporary informative issues from a perspective of ethics and sustainable development.

## LMI B.A. Journalism and Media Studies

### Edition 2011

<b>Remedial Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Fifth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
H1001	Remedial English I		5	0	8	H1026	Philosophy and Contemporary Thought		3	0	8
H1002	Remedial English II		5	0	8	H2019	Contemporary World Literature		3	0	8
H1003	Remedial English III		5	0	8	HS2000	Humanities and Fine Arts		3	0	8
H1004	Remedial English IV		5	0	8	MI2005	Production for Informative Journalism		3	0	8
H1005	Remedial English V		5	0	8	P2010	Politics, Media and Public Opinion		3	0	8
H1015	Spanish Composition		5	0	8	RI2012	Latin American and Caribbean Regional Scenario		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>39</b>	<b>0</b>	<b>72</b>	CO3006	Communication and Globalization		3	0	8
<b>First Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	MI2006	Production for Editorial Journalism		3	0	8
AD1005	Management and Business Model Innovation		3	0	8	MI3001	Photojournalism		3	0	8
H1016	Foreign Language		5	0	8	MI3008	Radio Journalism		3	0	8
H1045	Literature and Power in Latin America		3	0	8	RI2008	North American Regional Scenario		3	0	8
MA1016	Mathematics I		3	0	8	VA2010	Topics I		3	0	8
MI1003	Introduction to Journalism and Media Studies Academic Program		3	0	4				<b>18</b>	<b>0</b>	<b>48</b>
P1002	Fundamentals of Political Science		3	0	8	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
RI2028	History of Independent Mexico		3	0	8	AV3013	Publications Design and Production		3	0	8
			<b>23</b>	<b>0</b>	<b>52</b>	D1025	Media Legislation		3	0	8
<b>Second Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	EM1005	Entrepreneurship		3	0	8
AV1005	Digital Design Lab		0	3	4	MI3009	Television Journalism		3	0	8
EC1008	Enterprise Economics		3	0	8	RI2013	Europe Regional Scenario		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	VA2011	Topics II		3	0	8
H2033	Social Anthropology		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MA1008	Statistics for Research in the Social Sciences		3	0	8	<b>Eighth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
RI1004	International Politics		3	0	8	HS2005	Citizenship		3	0	8
RI2029	History of Contemporary Mexico		3	0	8	MI3004	Digital Journalism		3	0	8
			<b>20</b>	<b>3</b>	<b>52</b>	MI3010	Production of Multimedia Publications		3	0	8
<b>Third Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	RI2016	Asia Pacific Regional Scenario		3	0	8
AV1004	Audiovisual Language and Narrative		3	0	8	VA2012	Topics III		3	0	8
AV1006	Audio Lab		0	3	4	VA2013	Topics IV		3	0	8
CC1014	Psychology		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
CO2003	Quantitative Social Research Methods		3	0	8	<b>Ninth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
CO2008	Communication and Media Studies		3	0	8	AV3008	Documentary Production		3	0	8
H1031	Contemporary Art and Culture		3	0	8	HS2006	Applied Ethics		3	0	8
P1000	Sociology		3	0	8	MI3011	Convergent Journalism		3	0	8
			<b>18</b>	<b>3</b>	<b>52</b>	MI3012	Research and Development Journalism		3	0	8
<b>Fourth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	MI3013	Introduction to Professional Development		2	0	2
AV1007	Video Lab		0	3	4	VA2014	Topics V		3	0	8
CO2004	Qualitative Research Methods		3	0	8	VA2015	Topics VI		3	0	8
D1012	Constitutional Law		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
H1018	Ethics, Self and Society		3	0	8						
H2001	Verbal Expression in the Workplace		3	0	8						
MI1002	Fundamentals of Journalism		3	0	8						
RI2030	World History of the 20th and 21st Centuries		3	0	8						
			<b>18</b>	<b>3</b>	<b>52</b>						

- C Number of class hours per week  
 L Number of laboratory hours or activities per week  
 U Study hours that must be dedicated to the course (class hours included)

## B.A. Psychology (LP)

Graduates from this program apply the principles, techniques and scientific knowledge developed in psychology in order to assess, diagnose, explain, treat, modify and prevent inappropriate behaviors, develop healthy lifestyle conditions, and design the planning and management of individual human capital that significantly affects the organization's climate and culture.



### Competencies for Graduates:

- Apply the knowledge and methods of social, biological and psychological sciences to diagnose and treat human behavior.
- Participate in psychological diagnoses, treatments and prevention in individuals, groups, social groups and organizations.
- Conduct studies on biopsychosocial phenomena and formulate intervention protocols in local and global settings.
- Design and manage programs in multidisciplinary teams to promote the comprehensive wellbeing of individuals and organizations.
- Undertake innovative actions, as agents of change, to promote the development and management of human capital that will impact the climate and culture of organizations.
- Design and organize human capital planning, management and development processes in diverse settings.
- Knowledgeable and aware of the economic, social and political reality of their environment; act with solidarity and responsibility to improve the quality of life in communities.
- Identify, analyze and assess ethical dilemmas related to their personal lives, profession and environment; respect others and the environment.
- Communicate the results of clinical notes, psychological reports, projects and/or studies efficiently, both orally and in writing, in Spanish and in English.
- Propose supportive, sustainable solutions to develop citizenship competencies in the communities in which they conduct their development projects.

## LP B.A. Psychology

### Edition 2012

Remedial Semester			C	L	U	Fifth Semester			C	L	U
H1001	Remedial English I		5	0	8	CC2001	Social Psychology		3	0	8
H1002	Remedial English II		5	0	8	CC2012	Scale Design		3	0	8
H1003	Remedial English III		5	0	8	CC2016	Psychopathology II		3	0	8
H1004	Remedial English IV		5	0	8	CO2003	Quantitative Social Research Methods		3	0	8
H1005	Remedial English V		5	0	8	HS2000	Humanities and Fine Arts		3	0	8
H1015	Spanish Composition		5	0	8	MD1050	Psychophysiology		5	0	12
MA1001	Introduction to Mathematics		6	0	16				<b>20</b>	<b>0</b>	<b>52</b>
TC1001	Introduction to Computer Science		3	0	8						
			<b>39</b>	<b>0</b>	<b>72</b>						
First Semester			C	L	U	Sixth Semester			C	L	U
AD1005	Management and Business Model Innovation		3	0	8	AD3018	Planning Processes and Models		3	0	8
CC1000	Human Development I		3	0	8	CC2010	Psychometrics I		3	0	8
CC1003	General Psychology I		3	0	8	CC2011	Group Dynamics		3	0	8
CC1016	Introduction to the Psychology Academic Program		3	0	4	EM1005	Entrepreneurship		3	0	8
H1016	Foreign Language		5	0	8	RH1000	Organizational Behavior and Human Talent Development		3	0	8
MD1029	Chemical Foundations of Metabolism and Physiology		3	0	8	RI2034	Negotiation and Conflict Management		3	0	8
MD1031	Cell Biology		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
			<b>23</b>	<b>0</b>	<b>52</b>						
Second Semester			C	L	U	Seventh Semester			C	L	U
CC1001	Human Development II		3	0	8	CC2007	Educational Technology		3	0	8
CC1007	General Psychology II		3	0	8	CC2013	Psychometrics II		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	CC2014	Interview Workshop		3	0	8
MA1016	Mathematics I		3	0	8	CC3004	Psychology Seminar of Vulnerable Groups		3	0	8
MD1034	Developmental Biology		3	0	8	HS2005	Citizenship		3	0	8
MD1036	Basic Morphophysiology		5	0	12	RH3006	Strategic Training Management		3	0	8
			<b>22</b>	<b>0</b>	<b>52</b>				<b>18</b>	<b>0</b>	<b>48</b>
Third Semester			C	L	U	Eighth Semester			C	L	U
AD1006	Organizational Learning and Knowledge Management		3	0	8	RH3012	Human Capital Attraction and Retention		3	0	8
CC1011	Personality Development		3	0	8	RH3013	Performance Evaluation		3	0	8
CF1008	Financial Information for Decision Making		3	0	8	RH3016	Organizational Development I		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	VA2010	Topics I		3	0	8
MD1032	Historical Foundations in Health Sciences		3	0	8	VA2011	Topics II		3	0	8
TI1012	Business Information Technology		3	0	8	VA2012	Topics III		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>				<b>18</b>	<b>0</b>	<b>48</b>
Fourth Semester			C	L	U	Ninth Semester			C	L	U
CC1005	Learning and Cognitive Development		3	0	8	CC3002	Introduction to Professional Development		2	0	2
CC2015	Psychopathology I		3	0	8	HS2006	Applied Ethics		3	0	8
CO2004	Qualitative Research Methods		3	0	8	RH3015	Management Compensations		3	0	8
H1018	Ethics, Self and Society		3	0	8	RH3017	Organizational Development II		3	0	8
H2033	Social Anthropology		3	0	8	VA2013	Topics IV		3	0	8
MA1008	Statistics for Research in the Social Sciences		3	0	8	VA2014	Topics V		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>	VA2015	Topics VI		3	0	8
									<b>20</b>	<b>0</b>	<b>50</b>

- C Number of class hours per week  
 L Number of laboratory hours or activities per week  
 U Study hours that must be dedicated to the course (class hours included)

## B.A. Political Science (LPL)

Graduates from this program are professionals who apply political analysis theories and techniques; use strategic information to design, implement and evaluate public policy with ethical responsibility; and generate input for decision making in government, legislative, political, social, business and cultural spaces.

### Competencies for Graduates:

- Generate viable proposals to address social issues in public administration spaces, companies and NGOs.
- Design and implement political consultancy projects for electoral and government campaigns.
- Develop proposals to manage and solve conflicts from a political and regulatory perspective.
- Implement theoretical models to analyze political, social and economic phenomena in diverse geographical and historical contexts.
- Apply political, economic and legal tools to design, implement and evaluate public policy.

## LPL B.A. Political Science Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
H1001	Remedial English I		5	0	8	EM1005	Entrepreneurship		3	0	8
H1002	Remedial English II		5	0	8	H1026	Philosophy and Contemporary Thought		3	0	8
H1003	Remedial English III		5	0	8	P2001	State and Economy		3	0	8
H1004	Remedial English IV		5	0	8	P2003	Contemporary Political Theory		3	0	8
H1005	Remedial English V		5	0	8	P2010	Politics, Media and Public Opinion		3	0	8
H1015	Spanish Composition		5	0	8	RI2008	North American Regional Scenario		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8	Sixth Semester			C	L	U
			<b>39</b>	<b>0</b>	<b>72</b>	D2021	Administrative Law and Public Policy I		3	0	8
First Semester			C	L	U	HS2000	Humanities and Fine Arts		3	0	8
AD1005	Management and Business Model Innovation		3	0	8	P2005	Principles of Public Policy		3	0	8
H1016	Foreign Language		5	0	8	P2011	Mexican Political System		3	0	8
MA1016	Mathematics I		3	0	8	RI2012	Latin American and Caribbean Regional Scenario		3	0	8
P1002	Fundamentals of Political Science		3	0	8	VA2010	Topics I		3	0	8
P1004	Introduction to the Political Science Academic Program		3	0	4				<b>18</b>	<b>0</b>	<b>48</b>
RI1008	World History of the 19th Century		3	0	8	Seventh Semester			C	L	U
RI2028	History of Independent Mexico		3	0	8	D2022	Administrative Law and Public Policy II		3	0	8
			<b>23</b>	<b>0</b>	<b>52</b>	P3000	Comparative Politics		3	0	8
Second Semester			C	L	U	P3005	Political Analysis		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	P3010	Political Parties		3	0	8
H2033	Social Anthropology		3	0	8	P3011	Civil Society and Citizen Participation		3	0	8
MA1008	Statistics for Research in the Social Sciences		3	0	8	VA2011	Topics II		3	0	8
RI1004	International Politics		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
RI2029	History of Contemporary Mexico		3	0	8	Eighth Semester			C	L	U
RI2030	World History of the 20th and 21st Centuries		3	0	8	P3006	Political Marketing		3	0	8
			<b>20</b>	<b>0</b>	<b>48</b>	P3012	Design of Public Policies		3	0	8
Third Semester			C	L	U	P3013	Electoral Systems and Institutions		3	0	8
CC1014	Psychology		3	0	8	RI2033	Mexican Foreign Policy		3	0	8
CO2003	Quantitative Social Research Methods		3	0	8	VA2012	Topics III		3	0	8
EC1008	Enterprise Economics		3	0	8	VA2013	Topics IV		3	0	8
H1045	Literature and Power in Latin America		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
P1000	Sociology		3	0	8	Ninth Semester			C	L	U
P2009	Classical Political Thinking		3	0	8	HS2006	Applied Ethics		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>	P3008	Political Science Seminar		3	0	8
Fourth Semester			C	L	U	P3014	Managing of Social Projects		3	0	8
CO2004	Qualitative Research Methods		3	0	8	P3015	Introduction to Professional Development		2	0	2
D1012	Constitutional Law		3	0	8	RI2034	Negotiation and Conflict Management		3	0	8
EC1009	Macroeconomic Environment		3	0	8	VA2014	Topics V		3	0	8
H1018	Ethics, Self and Society		3	0	8	VA2015	Topics VI		3	0	8
H1047	Discourse and Power		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
H2001	Verbal Expression in the Workplace		3	0	8						
			<b>18</b>	<b>0</b>	<b>48</b>						

- C Number of class hours per week  
L Number of laboratory hours or activities per week  
U Study hours that must be dedicated to the course (class hours included)



## B.A. Organizational Psychology (LPO)

Graduates from this program are specialists in human talent development. Their training in organizational behavioral science enables them to participate in human capital planning, development and management processes, acting as agents of organizational change.

### Competencies for Graduates:

- Design and implement programs to attract and select the best talent for the organization.
- Implement human talent and potential training and development strategies and programs based on strategic and competency models for the different organizational levels, taking cultural diversity into consideration.
- Conduct performance evaluation systems in multidimensional and multicultural settings based on ethical criteria.
- Participate in the development of work teams to promote social responsibility actions within the organization.
- Use qualitative and technological tools to formulate business strategies.



## LPO B.A. Organizational Psychology Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
H1001	Remedial English I		5	0	8	CC2011	Group Dynamics		3	0	8
H1002	Remedial English II		5	0	8	CC2012	Scale Design		3	0	8
H1003	Remedial English III		5	0	8	CC2013	Psychometrics II		3	0	8
H1004	Remedial English IV		5	0	8	CC2014	Interview Workshop		3	0	8
H1005	Remedial English V		5	0	8	CD2006	Forecasting for Decision Making		3	0	8
H1015	Spanish Composition		5	0	8	CF1010	Accounting and Cost Management		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8	Sixth Semester			C	L	U
			<b>39</b>	<b>0</b>	<b>72</b>	AD2011	Innovation, Markets and Technological Development		3	0	8
First Semester			C	L	U	D1002	Labor Law		3	0	8
AD1005	Management and Business Model Innovation		3	0	8	EM1005	Entrepreneurship		3	0	8
CC1010	Human Development		3	0	8	FZ1006	Personal and Business Finance		3	0	8
CC1014	Psychology		3	0	8	NI1002	Negotiation Techniques and International Trade		3	0	8
CC1015	Introduction to the Organizational Psychology Academic Program		3	0	4	RH3012	Human Capital Attraction and Retention		3	0	8
H1016	Foreign Language		5	0	8				<b>18</b>	<b>0</b>	<b>48</b>
H1040	Analysis and Verbal Expression		5	0	8	Seventh Semester			C	L	U
TI1012	Business Information Technology		3	0	8	CF2018	Strategic Information Systems		3	0	8
			<b>25</b>	<b>0</b>	<b>52</b>	CH2006	Corporate Learning Management		3	0	8
Second Semester			C	L	U	HS2005	Citizenship		3	0	8
AD1006	Organizational Learning and Knowledge Management		3	0	8	RH3013	Performance Evaluation		3	0	8
CC1011	Personality Development		3	0	8	VA2010	Topics I		3	0	8
CC1012	Psychology and Multicultural Environment Leadership		3	0	8	VA2011	Topics II		3	0	8
D1021	Business Law		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
H1018	Ethics, Self and Society		3	0	8	Eighth Semester			C	L	U
MA1016	Mathematics I		3	0	8	CH2007	Human Capital Management by Competencies		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>	RH3014	Industrial Security and Labor Relations		3	0	8
Third Semester			C	L	U	RH3015	Management Compensations		3	0	8
CC1013	Behavioral Analysis and Cognitive Learning		3	0	8	RH3016	Organizational Development I		3	0	8
CC2009	Psychopathology		3	0	8	VA2012	Topics III		3	0	8
CO2004	Qualitative Research Methods		3	0	8	VA2013	Topics IV		3	0	8
FZ1005	Financial Mathematics		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MT1003	Marketing and Creativity		3	0	8	Ninth Semester			C	L	U
RI1004	International Politics		3	0	8	AD3024	Planning, Innovation and Strategic Sustainability		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>	CC3001	Introduction to Professional Development		2	0	2
Fourth Semester			C	L	U	HS2006	Applied Ethics		3	0	8
CC2010	Psychometrics I		3	0	8	RH3017	Organizational Development II		3	0	8
CD1003	Statistical Methods for Decision Making		3	0	8	RH3018	Strategic Management of Human Resources		3	0	8
CO2003	Quantitative Social Research Methods		3	0	8	VA2014	Topics V		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	VA2015	Topics VI		3	0	8
HS2000	Humanities and Fine Arts		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
NI1001	Enterprise, Culture and Business in The World		3	0	8						
			<b>18</b>	<b>0</b>	<b>48</b>						

C Number of class hours per week

L Number of laboratory hours or activities per week

U Study hours that must be dedicated to the course (class hours included)

## B.A. International Relations (LRI)

Graduates from this program are professionals who analyze the panorama to make decisions in public and private international spaces; have an in-depth knowledge of the diverse regions of the world; visualize the major trends that comprise the contemporary global agenda; and are trained to design, negotiate and execute international policies and programs in the fields of diplomacy, economics, politics, enterprise and culture.

### Competencies for Graduates:

- Analyze national and international contexts to design sustainable development strategies.
- Design, promote, operate and evaluate action programs in public and private settings to address the challenges of an interdependent world.
- Plan and execute international policies and programs in diplomatic, political, business, social and cultural settings.
- Identify the factors that affect international negotiation processes within the framework of globalization and regionalization.
- Conceive, plan and implement strategic projects with a business vision, based on an in-depth knowledge of international law, international organizations and foreign policy.

## LRI B.A. International Relations Edition 2011

<b>Remedial Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Fifth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
H1001	Remedial English I		5	0	8	H1026	Philosophy and Contemporary Thought		3	0	8
H1002	Remedial English II		5	0	8	HS2000	Humanities and Fine Arts		3	0	8
H1003	Remedial English III		5	0	8	P2001	State and Economy		3	0	8
H1004	Remedial English IV		5	0	8	RI2007	Legal Aspects of International Relations		3	0	8
H1005	Remedial English V		5	0	8	RI2012	Latin American and Caribbean Regional Scenario		3	0	8
H1015	Spanish Composition		5	0	8	RI2032	International Relations Theory I		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>0</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>39</b>	<b>0</b>	<b>72</b>	EC2025	Global Economics		3	0	8
<b>First Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	EM1005	Entrepreneurship		3	0	8
AD1005	Management and Business Model Innovation		3	0	8	RI2008	North American Regional Scenario		3	0	8
H1016	Foreign Language		5	0	8	RI2013	Europe Regional Scenario		3	0	8
MA1016	Mathematics I		3	0	8	RI3016	International Relations Theory II		3	0	8
P1002	Fundamentals of Political Science		3	0	8	VA2010	Topics I		3	0	8
RI1008	World History of the 19th Century		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
RI1009	Introduction to International Relations Academic Program		3	0	4	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
RI2028	History of Independent Mexico		3	0	8	NI3036	International Trade Agreements		3	0	8
			<b>23</b>	<b>0</b>	<b>52</b>	P3011	Civil Society and Citizen Participation		3	0	8
<b>Second Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	RI2014	International Organizations and Institutions		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	RI2016	Asia Pacific Regional Scenario		3	0	8
H2033	Social Anthropology		3	0	8	RI2033	Mexican Foreign Policy		3	0	8
MA1008	Statistics for Research in the Social Sciences		3	0	8	VA2011	Topics II		3	0	8
RI1004	International Politics		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
RI2029	History of Contemporary Mexico		3	0	8	<b>Eighth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
RI2030	World History of the 20th and 21st Centuries		3	0	8	P3014	Managing of Social Projects		3	0	8
			20	0	48	RI2015	Foreign Policy Analysis		3	0	8
<b>Third Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	RI3002	Africa Regional Scenario		3	0	8
CO2003	Quantitative Social Research Methods		3	0	8	RI3005	Strategic Prospective		3	0	8
EC1008	Enterprise Economics		3	0	8	VA2012	Topics III		3	0	8
H1045	Literature and Power in Latin America		3	0	8	VA2013	Topics IV		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
P1000	Sociology		3	0	8	<b>Ninth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
RI2031	Geopolitics and Global Changes		3	0	8	HS2006	Applied Ethics		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>	RI2017	Middle East Regional Scenario		3	0	8
<b>Fourth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	RI2034	Negotiation and Conflict Management		3	0	8
CO2004	Qualitative Research Methods		3	0	8	RI3006	International Relations Seminar		3	0	8
D1012	Constitutional Law		3	0	8	RI3019	Introduction to Professional Development		2	0	2
EC1009	Macroeconomic Environment		3	0	8	VA2014	Topics V		3	0	8
H1018	Ethics, Self and Society		3	0	8	VA2015	Topics VI		3	0	8
MT1003	Marketing and Creativity		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
P2009	Classical Political Thinking		3	0	8						
			<b>18</b>	<b>0</b>	<b>48</b>						

- C Number of class hours per week  
L Number of laboratory hours or activities per week  
U Study hours that must be dedicated to the course (class hours included)







# Undergraduate Degree Profiles and Curricula of Engineering and Architecture



## B.A. Architecture (ARQ)

Graduates from this program are professionals who plan, design, construct and manage the architectural and urban spaces needed by human beings. They are designers of sustainable spaces and promoters of real-estate opportunities, with an urban and environmental awareness and a command of design, representation and construction technologies.

### Competencies for Graduates:

- Conceive architectural and urban spaces that fulfill the needs and aspirations of inhabitants and users, considering all the ethical, social and economic implications.
- Generate projects in the area of architectural and urban design, considering the structural and construction characteristics, complying with safety and construction standards, considering their environmental implications and applying the principles of environmental protection and sustainability.
- Plan, budget and manage the material and financial resources of construction projects and works, applying the principles of reuse, recycle and reduce.
- Identify entrepreneurial opportunities and put them into practice through the development of real-estate investment proposals and economic feasibility projects.

ARQ

## ARQ B.A. of Architecture

### Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	AR2005	History of Architecture and the City III		3	0	8
H1001	Remedial English I		5	0	8	AR2020	Installations and Alternate Systems		4	0	8
H1002	Remedial English II		5	0	8	AR2021	Construction Materials and Procedures II		3	0	8
H1003	Remedial English III		5	0	8	AR2022	Projects III: Educational or Recreational Buildings		6	0	12
H1004	Remedial English IV		5	0	8	CV2026	Structural Systems		3	0	8
H1005	Remedial English V		5	0	8	H2001	Verbal Expression in the Workplace		3	0	8
H1015	Spanish Composition		5	0	8				<b>22</b>	<b>0</b>	<b>52</b>
MA1001	Introduction to Mathematics		6	0	16	Sixth Semester			C	L	U
TC1001	Introduction to Computer Science		3	0	8	AR2007	History of Architecture and the City IV		3	0	8
			<b>42</b>	<b>0</b>	<b>80</b>	AR2023	Construction Projects I		6	0	12
First Semester			C	L	U	AR2024	Projects IV: Community Buildings		6	0	12
AR1013	Drawing		4	0	8	CV3017	Concrete Structures Design		3	0	8
AR1014	Descriptive Geometry		3	0	8	EM1005	Entrepreneurship		3	0	8
AR1019	Introduction to Architecture		3	0	4				<b>21</b>	<b>0</b>	<b>48</b>
DL1002	Design Fundamentals I		4	0	8	Seventh Semester			C	L	U
DL1008	Models and Scale Models		3	0	8	AR2025	Critical Analysis of Architecture and its Context		3	0	8
H1016	Foreign Language		5	0	8	AR2026	Construction Projects II		6	0	12
MA1009	Mathematics for Design		3	0	8	AR3014	Projects V: Mixed use Complexes		6	0	12
			<b>25</b>	<b>0</b>	<b>52</b>	CV2027	Construction Costs		3	0	8
Second Semester			C	L	U	CV3018	Design of Steel Structures		3	0	8
AR1015	Architectural Drawing		4	0	8				<b>21</b>	<b>0</b>	<b>48</b>
AR1016	Applied Geometry		3	0	8	Eighth Semester			C	L	U
DL1004	Design Fundamentals II		4	0	8	AR3015	Building and Energy Efficiency		3	0	8
DL1009	Creativity and Innovation		3	0	8	AR3016	Internship		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	AR3017	Capstone Projects I		6	0	12
H1040	Analysis and Verbal Expression		5	0	8	AR3018	Urban Theories		3	0	8
			<b>22</b>	<b>0</b>	<b>48</b>	CV2016	Construction Site Management		3	0	8
Third Semester			C	L	U	HS2005	Citizenship		3	0	8
AR1007	History of Architecture and the City I		3	0	8				<b>21</b>	<b>0</b>	<b>52</b>
AR1017	Computer aided Drawing		3	0	8	Ninth Semester			C	L	U
AR1018	Architecture Theory and Design Methodologies		3	0	8	AR3006	Urban Design Methods		3	0	8
AR2017	Bioclimatic Design		3	0	8	AR3019	Real estate Projects		3	0	8
AR2018	Projects I: Residential Housing		6	0	12	AR3020	Capstone Projects II		6	0	12
CV2024	Structure Mechanics I		3	0	8	VA2010	Topics I		3	0	8
			<b>21</b>	<b>0</b>	<b>52</b>	VA2011	Topics II		3	0	8
Fourth Semester			C	L	U				<b>18</b>	<b>0</b>	<b>44</b>
AR1010	History of Architecture and the City II		3	0	8	Tenth Semester			C	L	U
AR2004	Digital Visualization		3	0	8	AR3021	Introduction to Professional Development		2	0	2
AR2019	Projects II: Collective Housing		6	0	12	AR3022	Final Project		8	0	16
CV2023	Materials and Construction Procedures I		3	0	8	CV3022	Business Management in the Construction Industry		3	0	8
CV2025	Structure Mechanics II		3	0	8	HS2006	Applied Ethics		3	0	8
H1018	Ethics, Self and Society		3	0	8	VA2012	Topics III		3	0	8
			<b>21</b>	<b>0</b>	<b>52</b>	VA2013	Topics IV		3	0	8
									<b>22</b>	<b>0</b>	<b>50</b>

- C Number of class hours per week  
 L Number of laboratory hours or activities per week  
 U Study hours that must be dedicated to the course (class hours included)

## B.S. Agronomy Engineering (IA)

Graduates from this program apply their knowledge and skills to handle the diverse components of agricultural production systems, considering the principles of innovation and sustainability in natural resource management. They have a vision of the areas of opportunity within value chains for animal-and plant-based products (biotechnological and organic), using efficient, environmentally-compatible processes.

### Competencies for Graduates:

- Design innovative animal and plant production systems to assure the quality and availability of agricultural products.
- Identify the areas that could be improved in food production systems, proposing viable solutions, developing, adapting or transferring technology to the agricultural sector.
- Formulate and implement alternative solutions to problems and evaluate their results in controlled agricultural and livestock production environments, designing and applying oversight and control methods based on new technologies.
- Propose technological innovations with responsibility and social commitment, prioritizing creativity and long-term vision toward sustainable development. .



## IA B.S. Agronomy Engineering Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	AG2020	Soils and Plant Nutrition		3	0	8
H1001	Remedial English I		5	0	8	BT1007	Microbiology Laboratory		0	3	4
H1002	Remedial English II		5	0	8	BT2001	Genetic Engineering		3	0	8
H1003	Remedial English III		5	0	8	BT2003	Microbiology		3	0	8
H1004	Remedial English IV		5	0	8	EC1010	Economy to Business Creation		3	0	8
H1005	Remedial English V		5	0	8	IB3004	Precision Agriculture		3	0	8
H1015	Spanish Composition		5	0	8	MA2010	Differential Equations		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>3</b>	<b>52</b>
TC1001	Introduction to Computer Science		3	0	8	Sixth Semester			C	L	U
			<b>42</b>	<b>0</b>	<b>80</b>	AG2019	Entomology		3	0	8
First Semester			C	L	U	AG2021	Livestock Biosecurity		3	0	8
AG1010	Introduction to Agronomy		3	0	4	AG2022	Irrigations Systems Laboratory		0	3	4
DS1003	Natural Sciences and Sustainable Development		3	0	8	AG2023	Livestock Nutrition and Feeding		3	0	8
F1002	Physics I		3	1	8	AG2024	Irrigation Systems		3	0	8
H1016	Foreign Language		5	0	8	EM1005	Entrepreneurship		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	IN2023	Design and Analysis of Experiments		3	0	8
MA1015	Mathematics I		3	0	8				<b>18</b>	<b>3</b>	<b>52</b>
Q1001	Chemistry		3	0	8	Seventh Semester			C	L	U
			<b>25</b>	<b>1</b>	<b>52</b>	AG2014	Plant Pathology		3	0	8
Second Semester			C	L	U	AG2025	Agricultural Residency		3	0	8
BT1002	Genetics		3	0	8	HS2005	Citizenship		3	0	8
F1003	Physics II		3	1	8	IN2025	Project Evaluation and Management		3	0	8
HS2000	Humanities and Fine Arts		3	0	8	VA2010	Topics I		3	0	8
MA1017	Mathematics II		3	0	8	VA2011	Topics II		3	0	8
Q1007	Structural Organic Chemistry		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
TC1017	Problem Solving with Programming		3	0	8	Eighth Semester			C	L	U
			<b>18</b>	<b>1</b>	<b>48</b>	AG3018	New Product Development		3	0	8
Third Semester			C	L	U	AG3019	Agribusiness Management		3	0	8
AG1008	Agricultural Equipment and Mechanization		3	0	8	AG3020	Livestock Production and Reproduction		3	0	8
BT1003	Molecular Biology		3	0	8	AG3021	Production Systems in Protected Agriculture		3	0	8
H1018	Ethics, Self and Society		3	0	8	VA2012	Topics III		3	0	8
MA1006	Probability and Statistics		3	0	8	VA2013	Topics IV		3	0	8
Q1014	Experimental Chemistry		0	6	8				<b>18</b>	<b>0</b>	<b>48</b>
Q2000	Biochemistry		3	0	8	Ninth Semester			C	L	U
			<b>15</b>	<b>6</b>	<b>48</b>	AG3022	Agricultural Science Capstone Project		3	0	8
Fourth Semester			C	L	U	AG3023	Milk Production Systems		3	0	8
AG1009	Systematic Botany		3	0	8	AG3024	Introduction to Professional Development		2	0	2
AG2000	Animal Anatomy and Physiology		3	0	8	HS2006	Applied Ethics		3	0	8
AG3000	Plant Anatomy and Physiology		3	0	8	TA3006	Postharvest Technology and Physiology		3	0	8
BT2004	Tissue Culture		3	0	8	VA2014	Topics V		3	0	8
BT3000	Tissue Culture Laboratory		0	3	4	VA2015	Topics VI		3	0	8
CF1010	Accounting and Cost Management		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
H2001	Verbal Expression in the Workplace		3	0	8						
			<b>18</b>	<b>3</b>	<b>52</b>						

C Number of class hours per week

L Number of laboratory hours or activities per week

U Study hours that must be dedicated to the course (class hours included)

## B.S. Biobusiness Engineering (IBN)

Graduates from this program are professionals who detect and create opportunities in the application of technological developments to generate products and processes related to biological systems, determining their impact and economic value in new innovation markets.

### Competencies for Graduates:

- Understand the basic principles of biotechnology and its industrial applications to develop products, processes and materials of biological origin.
- Use bioengineering in the fields of agrifood, the environment, energy and medicine.
- Design biotechnological product entrepreneurship and marketing models for both traditional and emerging markets.
- Generate business models for financial resource management and value chain optimization.
- Evaluate the market potential of biotechnological innovations from commercial and legal perspectives to guarantee their competitiveness.
- Develop a strategic vision that makes it possible to translate technological innovations into sustainable, ethically responsible businesses.



## IBN B.S. Biobusiness Engineering Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	BT2001	Genetic Engineering		3	0	8
H1001	Remedial English I		5	0	8	D1022	Business Law and Intellectual Property		3	0	8
H1002	Remedial English II		5	0	8	EC1010	Economy to Business Creation		3	0	8
H1003	Remedial English III		5	0	8	IB2007	Agri food Bioengineering		3	0	8
H1004	Remedial English IV		5	0	8	IB3007	Strategic Information Systems in Biobusiness		3	0	8
H1005	Remedial English V		5	0	8	MA1006	Probability and Statistics		3	0	8
H1015	Spanish Composition		5	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MA1001	Introduction to Mathematics		6	0	16	Sixth Semester			C	L	U
TC1001	Introduction to Computer Science		3	0	8	BT2002	Genetic Engineering Laboratory		0	3	4
			<b>42</b>	<b>0</b>	<b>80</b>	BT2004	Tissue Culture		3	0	8
First Semester			C	L	U	EM1005	Entrepreneurship		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	IB2008	Energy and Environmental Bioengineering		3	0	8
F1002	Physics I		3	1	8	IB3010	Regulatory Framework in Biotechnology		3	0	8
H1016	Foreign Language		5	0	8	IN2023	Design and Analysis of Experiments		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	MT1003	Marketing and Creativity		3	0	8
IB1004	Introduction to Biobusiness Engineering		3	0	4				<b>18</b>	<b>3</b>	<b>52</b>
MA1015	Mathematics I		3	0	8	Seventh Semester			C	L	U
Q1001	Chemistry		3	0	8	AD2011	Innovation, Markets and Technological Development		3	0	8
			<b>25</b>	<b>1</b>	<b>52</b>	BI2008	Medical Technologies		3	0	8
Second Semester			C	L	U	BT2013	Pharmaceutical Bioengineering		3	0	8
BT1002	Genetics		3	0	8	BT3000	Tissue Culture Laboratory		0	3	4
F1003	Physics II		3	1	8	BT3013	Bioprocess Laboratories		0	3	4
MA1017	Mathematics II		3	0	8	CF2015	Financial Information Analysis		3	0	8
Q1007	Structural Organic Chemistry		3	0	8	IN2025	Project Evaluation and Management		3	0	8
Q1014	Experimental Chemistry		0	6	8				<b>15</b>	<b>6</b>	<b>48</b>
TC1017	Problem Solving with Programming		3	0	8	Eighth Semester			C	L	U
			<b>15</b>	<b>7</b>	<b>48</b>	HS2005	Citizenship		3	0	8
Third Semester			C	L	U	IN2030	Manufacturing Models		3	0	8
AD1005	Management and Business Model Innovation		3	0	8	IN3041	Project Feasibility		3	0	8
BT1003	Molecular Biology		3	0	8	NI1002	Negotiation Techniques and International Trade		3	0	8
H1018	Ethics, Self and Society		3	0	8	VA2010	Topics I		3	0	8
HS2000	Humanities and Fine Arts		3	0	8	VA2011	Topics II		3	0	8
MA2009	Mathematics III		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
Q2000	Biochemistry		3	0	8	Ninth Semester			C	L	U
			<b>18</b>	<b>0</b>	<b>48</b>	AG2012	Perishable Products Logistics		3	0	8
Fourth Semester			C	L	U	BT3001	Food Development and Bioproducts		3	0	8
BT1007	Microbiology Laboratory		0	3	4	HS2006	Applied Ethics		3	0	8
BT2003	Microbiology		3	0	8	IB3015	Innovative Project in Biobusiness		3	0	8
CF1010	Accounting and Cost Management		3	0	8	IB3016	Introduction to Professional Development		2	0	2
H2001	Verbal Expression in the Workplace		3	0	8	VA2012	Topics III		3	0	8
IQ2001	Thermodynamics		3	0	8	VA2013	Topics IV		3	0	8
M2025	Numerical Methods in Engineering		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
MA2010	Differential Equations		3	0	8						
			<b>18</b>	<b>3</b>	<b>52</b>						

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L Number of laboratory hours or activities per week  
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## B.S. Biotechnology Engineering (IBT)

Graduates from this program are professionals with an interdisciplinary vision, focusing on biotechnological processes for the development, production and innovation of services for diverse industrial sectors: pharmaceutical, environmental, food, healthcare and bioenergy, among others.

### Competencies for Graduates:

- Develop and design high-value products and commercially viable, innovative biotechnological processes within a framework of legality, ethics and sustainable development.
- Innovate and generate new biotechnological technologies derived from the latest scientific discoveries in the diverse industrial sectors.
- Promote the generation of technology-based companies applying cutting-edge knowledge and making the most of market opportunities.
- Perform specialized consulting and molecular diagnosis services in companies and research centers.



## IBT B.S. Biotechnology Engineering Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	BT2001	Genetic Engineering		3	0	8
H1001	Remedial English I		5	0	8	EC1010	Economy to Business Creation		3	0	8
H1002	Remedial English II		5	0	8	IQ2003	Equilibrium Thermodynamics		3	0	8
H1003	Remedial English III		5	0	8	MA1006	Probability and Statistics		3	0	8
H1004	Remedial English IV		5	0	8	OP3028	Professional Elective I		3	0	8
H1005	Remedial English V		5	0	8	Q1010	Analytical Chemistry		3	0	8
H1015	Spanish Composition		5	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MA1001	Introduction to Mathematics		6	0	16	Sixth Semester			C	L	U
TC1001	Introduction to Computer Science		3	0	8	BT2002	Genetic Engineering Laboratory		0	3	4
			<b>42</b>	<b>0</b>	<b>80</b>	BT2004	Tissue Culture		3	0	8
First Semester			C	L	U	BT2005	Enzymology and Biocatalysis		3	0	8
BT1010	Introduction to Bioengineering		3	0	4	BT3002	Metabolic Engineering		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	EM1005	Entrepreneurship		3	0	8
F1002	Physics I		3	1	8	IN2004	Statistical Quality Control		3	0	8
H1016	Foreign Language		5	0	8	OP3029	Professional Elective II		3	0	8
H1040	Analysis and Verbal Expression		5	0	8				<b>18</b>	<b>3</b>	<b>52</b>
MA1015	Mathematics I		3	0	8	Seventh Semester			C	L	U
Q1001	Chemistry		3	0	8	BT2006	Enzymology and Biocatalysis Laboratory		0	3	4
			<b>25</b>	<b>1</b>	<b>52</b>	BT3000	Tissue Culture Laboratory		0	3	4
Second Semester			C	L	U	HS2005	Citizenship		3	0	8
BT1002	Genetics		3	0	8	IN2023	Design and Analysis of Experiments		3	0	8
F1003	Physics II		3	1	8	IN2025	Project Evaluation and Management		3	0	8
MA1017	Mathematics II		3	0	8	OP3030	Professional Elective III		3	0	8
Q1007	Structural Organic Chemistry		3	0	8	OP3031	Professional Elective IV		3	0	8
Q1014	Experimental Chemistry		0	6	8				<b>15</b>	<b>6</b>	<b>48</b>
TC1017	Problem Solving with Programming		3	0	8	Eighth Semester			C	L	U
			<b>15</b>	<b>7</b>	<b>48</b>	BT3001	Food Development and Bioproducts		3	0	8
Third Semester			C	L	U	BT3013	Bioprocess Laboratories		0	3	4
BT1003	Molecular Biology		3	0	8	MR2012	Process Automation		3	0	8
H1018	Ethics, Self and Society		3	0	8	MR2015	Process Automation Laboratory		0	3	4
HS2000	Humanities and Fine Arts		3	0	8	OP3032	Professional Elective V		3	0	8
IQ1001	Material Balance		3	0	8	VA2010	Topics I		3	0	8
MA2009	Mathematics III		3	0	8	VA2011	Topics II		3	0	8
Q2000	Biochemistry		3	0	8				<b>15</b>	<b>6</b>	<b>48</b>
			<b>18</b>	<b>0</b>	<b>48</b>	Ninth Semester			C	L	U
Fourth Semester			C	L	U	BT3005	Toxicology		3	0	8
BT1007	Microbiology Laboratory		0	3	4	BT3014	Bioengineering Design Project		3	0	8
BT2003	Microbiology		3	0	8	BT3025	Introduction to Professional Development		2	0	2
H2001	Verbal Expression in the Workplace		3	0	8	HS2006	Applied Ethics		3	0	8
IQ2000	Energy Balance		3	0	8	OP3033	Professional Elective VI		3	0	8
IQ2001	Thermodynamics		3	0	8	VA2012	Topics III		3	0	8
M2025	Numerical Methods in Engineering		3	0	8	VA2013	Topics IV		3	0	8
MA2010	Differential Equations		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
			<b>18</b>	<b>3</b>	<b>52</b>						

- C Number of class hours per week  
 L Number of laboratory hours or activities per week  
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## B.S. Civil Engineering (IC)

Graduates from this program are professionals with the skills to plan, design and/or manage construction projects related to transportation infrastructure (bridges, highways, tunnels), buildings (housing, offices, industrial premises) and water management (drinking water networks, sanitation, treatment plants), with a high level of commitment to the environment and ethical and social responsibility.

### Competencies for Graduates:

- Apply basic science and engineering to solve problems in the field of civil engineering: structures, hydraulics, environmental engineering, communication lines, construction and materials management, using the best practices and technological advancements within a framework of sustainable development.
- Identify areas of entrepreneurial opportunity in the construction industry, at national and international levels, and design a business plan for the same.
- Conduct experiments related to water quality, hydraulic phenomena, soil properties and characteristics, and construction materials.



## IC B.S. Civil Engineering Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	CV2006	Construction Materials Laboratory		0	3	4
H1001	Remedial English I		5	0	8	CV2007	Soil Mechanics Lab		0	3	4
H1002	Remedial English II		5	0	8	CV2010	Soil Mechanics		3	0	8
H1003	Remedial English III		5	0	8	CV2026	Structural Systems		3	0	8
H1004	Remedial English IV		5	0	8	EM1005	Entrepreneurship		3	0	8
H1005	Remedial English V		5	0	8	M2021	Fluid Mechanics		3	0	8
H1015	Spanish Composition		5	0	8	MA1019	Linear Algebra		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>15</b>	<b>6</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8	Sixth Semester			C	L	U
			<b>42</b>	<b>0</b>	<b>80</b>	CV2013	Hydrology		3	0	8
First Semester			C	L	U	CV2027	Construction Costs		3	0	8
CV1004	Introduction to Civil Engineering		3	0	4	CV3004	Highway Engineering		3	0	8
CV2001	Geology		3	0	8	CV3005	Foundations Engineering		3	0	8
F1002	Physics I		3	1	8	CV3006	Hydraulics Laboratory		0	3	4
H1016	Foreign Language		5	0	8	CV3016	Computer aided Structural Analysis		3	0	8
MA1015	Mathematics I		3	0	8	CV3017	Concrete Structures Design		3	0	8
Q1001	Chemistry		3	0	8				<b>18</b>	<b>3</b>	<b>52</b>
TC1017	Problem Solving with Programming		3	0	8	Seventh Semester			C	L	U
			<b>23</b>	<b>1</b>	<b>52</b>	CV2016	Construction Site Management		3	0	8
Second Semester			C	L	U	CV2028	Road Infrastructure Laboratory		0	3	4
AR1017	Computer aided Drawing		3	0	8	CV2029	Sustainable water use laboratory		0	3	4
CV2021	Geomatics		3	0	8	CV2030	Sustainable Water Use I		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	CV3018	Design of Steel Structures		3	0	8
F1003	Physics II		3	1	8	CV3019	Water and Drainage Pipeline Networks		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	HS2005	Citizenship		3	0	8
MA1017	Mathematics II		3	0	8				<b>15</b>	<b>6</b>	<b>48</b>
Q1004	Chemistry Laboratory		0	3	4	Eighth Semester			C	L	U
			<b>20</b>	<b>4</b>	<b>52</b>	AR3019	Real estate Projects		3	0	8
Third Semester			C	L	U	CV2031	Sustainable Water Use II		3	0	8
CV2022	Geomatics Laboratory		0	3	4	CV3020	Transport Infrastructure		3	0	8
CV2023	Materials and Construction Procedures I		3	0	8	CV3021	Structural Design Capstone Project		3	0	8
CV2024	Structure Mechanics I		3	0	8	VA2010	Topics I		3	0	8
F1005	Electricity and Magnetism		3	1	8	VA2011	Topics II		3	0	8
H1018	Ethics, Self and Society		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MA2009	Mathematics III		3	0	8	Ninth Semester			C	L	U
MA2010	Differential Equations		3	0	8	CV3007	Hydraulic Constructions Works		3	0	8
			<b>18</b>	<b>4</b>	<b>52</b>	CV3022	Business Management in the Construction Industry		3	0	8
Fourth Semester			C	L	U	CV3023	Construction Engineering		3	0	8
AR2021	Construction Materials and Procedures II		3	0	8	CV3024	Introduction to Professional Development		2	0	2
CV2025	Structure Mechanics II		3	0	8	HS2006	Applied Ethics		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	VA2012	Topics III		3	0	8
HS2000	Humanities and Fine Arts		3	0	8	VA2013	Topics IV		3	0	8
M2025	Numerical Methods in Engineering		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
MA1006	Probability and Statistics		3	0	8						
			<b>18</b>	<b>0</b>	<b>48</b>						

- C Number of class hours per week  
 L Number of laboratory hours or activities per week  
 U Study hours that must be dedicated to the course (class hours included)

## B.S. Automotive Engineering (IDA)

Graduates from this program are professionals with a solid grounding in engineering, who design, analyze, integrate and test automotive systems and components, considering technical and customer requirements, as well as the product lifecycle, from the generation of concepts to waste and recycling. They integrate new technologies in the areas of electronics, materials and power sources to adopt them in electric and hybrid vehicles.

### Competencies for Graduates:

- Apply design methodologies to develop and innovate automotive systems and components.
- Use computer technologies and physical infrastructure to design, analyze and test state-of-the-art automotive systems and components.
- Implement innovations in automotive systems and components, backed by virtual modeling, computer-aided engineering and experimental analysis.
- Promote the creation of service, manufacturing or technical consulting companies related to the new automotive industry technologies.



## IDA B.S. Automotive Engineering Edition 2011

<b>Remedial Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Fifth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
F1001	Introduction to Physics		3	0	8	EM1005	Entrepreneurship		3	0	8
H1001	Remedial English I		5	0	8	IQ2001	Thermodynamics		3	0	8
H1002	Remedial English II		5	0	8	M2001	Fundamentals of Combustion and Emissions		3	0	8
H1003	Remedial English III		5	0	8	M2026	Advanced Methods for Strength of Materials		3	1	8
H1004	Remedial English IV		5	0	8	MA1019	Linear Algebra		3	0	8
H1005	Remedial English V		5	0	8	MR2005	Mechatronic Instrumentation Laboratory		0	3	4
H1015	Spanish Composition		5	0	8	TE1003	Electronics		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>4</b>	<b>52</b>
TC1001	Introduction to Computer Science		3	0	8	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>42</b>	<b>0</b>	<b>80</b>	IN2023	Design and Analysis of Experiments		3	0	8
<b>First Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	M2021	Fluid Mechanics		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	M2027	Advanced CAD and Metrology		3	1	8
F1002	Physics I		3	1	8	M2028	Materials Technology		3	0	8
H1016	Foreign Language		5	0	8	M3028	Internal Combustion Engines		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	MR2003	Actuators		3	0	8
M1007	Introduction to Mechanical Engineering		3	0	4				<b>18</b>	<b>1</b>	<b>48</b>
MA1015	Mathematics I		3	0	8	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
Q1001	Chemistry		3	0	8	HS2005	Citizenship		3	0	8
			<b>25</b>	<b>1</b>	<b>52</b>	M2030	Machine Design and Simulation		3	0	8
<b>Second Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	M2031	Manufacturing Technologies		3	1	8
F1003	Physics II		3	1	8	M3017	Heat Transfer		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	M3035	Mechanical Vibrations		3	0	8
HS2000	Humanities and Fine Arts		3	0	8	MR2013	Control Systems		3	1	8
M1003	Statics		3	0	8				<b>18</b>	<b>2</b>	<b>48</b>
MA1017	Mathematics II		3	0	8	<b>Eighth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
TC1017	Problem Solving with Programming		3	0	8	M2017	Design Methodologies		3	0	8
			<b>18</b>	<b>1</b>	<b>48</b>	M3014	Manufacturing Processes Laboratory		0	3	4
<b>Third Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	M3029	Mold and Die Design		3	0	8
F1005	Electricity and Magnetism		3	1	8	M3030	Vehicle Dynamics		3	0	8
H1018	Ethics, Self and Society		3	0	8	MR3027	Automotive Electronics		3	0	8
M1005	Dynamics		3	0	8	VA2010	Topics I		3	0	8
M1006	Computer Drawing		3	0	8	VA2011	Topics II		3	0	8
M2023	Mechanics of Materials		3	1	8				<b>18</b>	<b>3</b>	<b>52</b>
MA2009	Mathematics III		3	0	8	<b>Ninth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
Q1004	Chemistry Laboratory		0	3	4	HS2006	Applied Ethics		3	0	8
			<b>18</b>	<b>5</b>	<b>52</b>	IN2025	Project Evaluation and Management		3	0	8
<b>Fourth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	M3037	Automotive Engineering Project		3	1	8
EC1010	Economy to Business Creation		3	0	8	M3038	Introduction to Professional Development		2	0	2
M2007	Mechanism Analysis and Simulation		3	1	8	MR3025	Electric and Hybrid Vehicles		3	0	8
M2025	Numerical Methods in Engineering		3	0	8	VA2012	Topics III		3	0	8
MA1006	Probability and Statistics		3	0	8	VA2013	Topics IV		3	0	8
MA2010	Differential Equations		3	0	8				<b>20</b>	<b>1</b>	<b>50</b>
TE1012	Electric Circuits		3	0	8						
			<b>18</b>	<b>1</b>	<b>48</b>						

C Number of class hours per week

L Number of laboratory hours or activities per week

U Study hours that must be dedicated to the course (class hours included)

## B.S. Sustainable Development Engineering (IDS)

Graduates from this program are professionals with who participate in the generation and efficient use of energy, natural resource protection and identification of new business opportunities. They generate and implement comprehensive investment proposals in topics related to energy, the sustainable use of resources and waste management, considering the need to generate wealth, as well as the aspects of social responsibility and public policy.



### Competencies for Graduates:

- Design projects related to energy, waste management and the sustainable use of resources, ensuring their technical and economic feasibility.
- Analyze, evaluate and solve multidisciplinary problems related to the sustainable use of natural resources, the diverse sources of energy and their social, economic, environmental and climate-change impacts.
- Understand the phenomena and mechanisms involved in the generation and efficient use of energy, emission management and minimization, the sustainable use of water, and their environmental impact.
- Apply the prevailing legislation and public policies and incentives, considering sustainability technologies and natural resource conservation.
- Evaluate comprehensive investment proposals for multisource energy and waste management projects, generating innovative business plans to achieve sustainable development.



## IDS B.S. Sustainable Development Engineering Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	CV2030	Sustainable Water Use I		3	0	8
H1001	Remedial English I		5	0	8	EC1010	Economy to Business Creation		3	0	8
H1002	Remedial English II		5	0	8	IN2023	Design and Analysis of Experiments		3	0	8
H1003	Remedial English III		5	0	8	IQ2005	Momentum Transfer Operations		3	0	8
H1004	Remedial English IV		5	0	8	RH1000	Organizational Behavior and Human Talent Development		3	0	8
H1005	Remedial English V		5	0	8	TE1014	Electric Circuits and Measurements Laboratory		0	3	4
H1015	Spanish Composition		5	0	8	TE2032	Electrical Circuits II		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>3</b>	<b>52</b>
TC1001	Introduction to Computer Science		3	0	8						
			<b>42</b>	<b>0</b>	<b>80</b>						
First Semester			C	L	U	Sixth Semester			C	L	U
DS1003	Natural Sciences and Sustainable Development		3	0	8	DS2001	Industrial Ecology		3	0	8
DS1006	Introduction to Sustainable Development Engineering		3	0	4	DS3002	Natural Resources Management and Climate Change		3	0	8
F1002	Physics I		3	1	8	IN2025	Project Evaluation and Management		3	0	8
H1016	Foreign Language		5	0	8	IQ2004	Heat Transfer Operations		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	RI2034	Negotiation and Conflict Management		3	0	8
MA1015	Mathematics I		3	0	8	VA2010	Topics I		3	0	8
Q1001	Chemistry		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
			<b>25</b>	<b>1</b>	<b>52</b>						
Second Semester			C	L	U	Seventh Semester			C	L	U
DS1002	Ecosystems and Biodiversity		3	0	8	DS3003	Social Responsibility and Corporate Sustainability		3	0	8
F1003	Physics II		3	1	8	EM1005	Entrepreneurship		3	0	8
H1018	Ethics, Self and Society		3	0	8	F3024	Alternative Energy		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	IQ3004	Eco efficiency and Sustainable Processes		3	0	8
MA1017	Mathematics II		3	0	8	M2003	Energy Generation Systems		3	0	8
Q1004	Chemistry Laboratory		0	3	4	VA2011	Topics II		3	0	8
TC1017	Problem Solving with Programming		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
			<b>18</b>	<b>4</b>	<b>52</b>						
Third Semester			C	L	U	Eighth Semester			C	L	U
DS1004	Sustainable Development Principles		3	0	8	DS3004	Businesses and Ecosystems Conservation		3	0	8
F1005	Electricity and Magnetism		3	1	8	HS2005	Citizenship		3	0	8
HS2000	Humanities and Fine Arts		3	0	8	IQ3032	Technologies for the Efficient use of Thermal Energy		3	0	8
IQ1001	Material Balance		3	0	8	TE2029	Energy Management and Monitoring Laboratory		0	3	4
MA1006	Probability and Statistics		3	0	8	TE3053	Energy Distribution Systems		3	0	8
MA2009	Mathematics III		3	0	8	VA2012	Topics III		3	0	8
			<b>18</b>	<b>1</b>	<b>48</b>	VA2013	Topics IV		3	0	8
									<b>18</b>	<b>3</b>	<b>52</b>
Fourth Semester			C	L	U	Ninth Semester			C	L	U
IQ2000	Energy Balance		3	0	8	DS3005	Capstone Project for Sustainable Development		3	0	8
IQ2001	Thermodynamics		3	0	8	DS3006	Introduction to Professional Development		2	0	2
M1003	Statics		3	0	8	HS2006	Applied Ethics		3	0	8
M2025	Numerical Methods in Engineering		3	0	8	TE2042	Technologies for the Efficient use of Electricity		3	0	8
MA2010	Differential Equations		3	0	8	TE3052	Energy Project Management		3	0	8
TE1002	Electrical Circuits I		3	0	8	VA2014	Topics V		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>	VA2015	Topics VI		3	0	8
									<b>20</b>	<b>0</b>	<b>50</b>

C Number of class hours per week

L Number of laboratory hours or activities per week

U Study hours that must be dedicated to the course (class hours included)

## B.S. Engineering Physics (IFI)

Graduates from this program are professionals with a solid grounding in physics, mathematics and computer tools and an in-depth knowledge of innovative engineering topics used to develop solutions in diverse areas of science and engineering, contributing to renewable energy projects and conducting research activities.

### Competencies for Graduates:

- Analyze, model and solve complex science and engineering problems analytically and computationally.
- Develop comprehensive solutions in the areas of energy, materials and optics, based on an in-depth knowledge of physics and mathematics, in order to innovate, enhance and find solutions to industrial, scientific research and technological development problems.
- Conduct and manage scientific research and technological development projects, considering their economic and social impact, within a framework of sustainable development, in product and/or process innovation.
- Develop research projects in the area of physics related to the design and/or innovation of products and/or processes individually and/or as a team leader.

## IFI B.S. Engineering Physics

### Edition 2011

<b>Remedial Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Fifth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
F1001	Introduction to Physics		3	0	8	F2003	Analytical Mechanics		3	0	8
H1001	Remedial English I		5	0	8	F2011	Computational Physics I		3	0	8
H1002	Remedial English II		5	0	8	F2012	Mathematical Physics II		3	0	8
H1003	Remedial English III		5	0	8	F3007	Electromagnetic Theory		3	0	8
H1004	Remedial English IV		5	0	8	IN2023	Design and Analysis of Experiments		3	0	8
H1005	Remedial English V		5	0	8	MR2000	Logic Automatisms		3	0	8
H1015	Spanish Composition		5	0	8	TE1014	Electric Circuits and Measurements Laboratory		0	3	4
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>3</b>	<b>52</b>
TC1001	Introduction to Computer Science		3	0	8	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>42</b>	<b>0</b>	<b>80</b>	F2004	Quantum Mechanics		3	0	8
<b>First Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	F2013	Electrodynamics		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	F3020	Experimental Physics I		3	1	8
F1002	Physics I		3	1	8	F3023	Optics		3	0	8
F1006	Introduction to Physics Engineering		3	0	4	F3024	Alternative Energy		3	0	8
H1016	Foreign Language		5	0	8	MR2002	Logic Automatism Laboratory		0	3	4
H1040	Analysis and Verbal Expression		5	0	8	TE1003	Electronics		3	0	8
MA1015	Mathematics I		3	0	8				<b>18</b>	<b>4</b>	<b>52</b>
Q1001	Chemistry		3	0	8	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>25</b>	<b>1</b>	<b>52</b>	EM1005	Entrepreneurship		3	0	8
<b>Second Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	F3013	Statistical Mechanics		3	0	8
F1003	Physics II		3	1	8	F3025	Experimental Physics II		3	1	8
H2001	Verbal Expression in the Workplace		3	0	8	F3026	Physical Engineering Project I		3	1	8
HS2000	Humanities and Fine Arts		3	0	8	VA2010	Topics I		3	0	8
MA1017	Mathematics II		3	0	8	VA2011	Topics II		3	0	8
Q1004	Chemistry Laboratory		0	3	4				<b>18</b>	<b>2</b>	<b>48</b>
Q1005	Chemistry of Materials		3	0	8	<b>Eighth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
TC1017	Problem Solving with Programming		3	0	8	F3027	Computational Physics II		3	0	8
			<b>18</b>	<b>4</b>	<b>52</b>	F3028	Solid State Physics		3	0	8
<b>Third Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	F3029	Physical Engineering Project II		3	1	8
F1005	Electricity and Magnetism		3	1	8	HS2005	Citizenship		3	0	8
H1018	Ethics, Self and Society		3	0	8	VA2012	Topics III		3	0	8
M2025	Numerical Methods in Engineering		3	0	8	VA2013	Topics IV		3	0	8
MA1006	Probability and Statistics		3	0	8				<b>18</b>	<b>1</b>	<b>48</b>
MA2009	Mathematics III		3	0	8	<b>Ninth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
MA2010	Differential Equations		3	0	8	F3030	Physical Engineering Project III		3	1	8
			<b>18</b>	<b>1</b>	<b>48</b>	F3032	Introduction to Professional Development		2	0	2
<b>Fourth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	HS2006	Applied Ethics		3	0	8
EC1010	Economy to Business Creation		3	0	8	IN2025	Project Evaluation and Management		3	0	8
F2010	Mathematical Physics I		3	0	8	Q2016	Advanced Materials and Nanomaterials Laboratory		0	6	8
F3016	Modern Physics		3	0	8	VA2014	Topics V		3	0	8
MA1019	Linear Algebra		3	0	8	VA2015	Topics VI		3	0	8
Q2002	Molecular Thermodynamics		3	0	8				<b>17</b>	<b>7</b>	<b>50</b>
TE1012	Electric Circuits		3	0	8						
			<b>18</b>	<b>0</b>	<b>48</b>						

C Number of class hours per week

L Number of laboratory hours or activities per week

U Study hours that must be dedicated to the course (class hours included)

## B.S. Food Industry Engineering (IIA)

Graduates from this program are professionals who apply and integrate the basic food sciences to develop and innovate food engineering products and processes; develop, optimize and manage quality assurance and food safety systems within a framework of legality, ethics, regulations and sustainability.

### Competencies for Graduates:

- Design products and processes, and resolve food industry issues, considering technical, economic, environmental, legal, social, political, ethical, healthcare and sustainability factors.
- Apply modern technologies, methods and tools, with particular emphasis on molecular function, food production, new product development, production process enhancement, and food quality and safety assurance.
- Start up their own food-industry business.



## IIA B.S. Food Industry Engineering Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	BT1007	Microbiology Laboratory		0	3	4
H1001	Remedial English I		5	0	8	BT2003	Microbiology		3	0	8
H1002	Remedial English II		5	0	8	BT2011	Bioprocess Engineering I		3	0	8
H1003	Remedial English III		5	0	8	EC1010	Economy to Business Creation		3	0	8
H1004	Remedial English IV		5	0	8	MA1006	Probability and Statistics		3	0	8
H1005	Remedial English V		5	0	8	TA2000	Food Analysis		3	0	8
H1015	Spanish Composition		5	0	8	TA2009	Nutrition and Nutrigenomics		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>3</b>	<b>52</b>
TC1001	Introduction to Computer Science		3	0	8						
			<b>42</b>	<b>0</b>	<b>80</b>	Sixth Semester			C	L	U
First Semester			C	L	U	BT2012	Bioprocess Engineering II		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	EM1005	Entrepreneurship		3	0	8
F1002	Physics I		3	1	8	IN2023	Design and Analysis of Experiments		3	0	8
H1016	Foreign Language		5	0	8	TA2010	Sensory Evaluation		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	TA2011	Basic Food Processing		3	0	8
MA1015	Mathematics I		3	0	8	TA2012	Food Analysis Laboratory		0	3	4
Q1001	Chemistry		3	0	8	TA2013	Basic Food Processing Laboratory		0	3	4
TA1002	Introduction to Food Engineering		3	0	4	TA2014	Integral Quality Assurance Laboratory		0	3	4
			<b>25</b>	<b>1</b>	<b>52</b>				<b>15</b>	<b>9</b>	<b>52</b>
Second Semester			C	L	U	Seventh Semester			C	L	U
F1003	Physics II		3	1	8	BT3012	Emerging Process Engineering		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	BT3013	Bioprocess Laboratories		0	3	4
MA1017	Mathematics II		3	0	8	HS2005	Citizenship		3	0	8
Q1007	Structural Organic Chemistry		3	0	8	IN2004	Statistical Quality Control		3	0	8
Q1014	Experimental Chemistry		0	6	8	TA3018	Science and Technology of Meat Products		3	0	8
TC1017	Problem Solving with Programming		3	0	8	TA3019	Science and Technology of Meat Products Laboratory		0	3	4
			<b>15</b>	<b>7</b>	<b>48</b>	VA2010	Topics I		3	0	8
Third Semester			C	L	U				<b>15</b>	<b>6</b>	<b>48</b>
BT1003	Molecular Biology		3	0	8	Eighth Semester			C	L	U
HS2000	Humanities and Fine Arts		3	0	8	BT3001	Food Development and Bioproducts		3	0	8
IQ1001	Material Balance		3	0	8	IN2025	Project Evaluation and Management		3	0	8
MA2009	Mathematics III		3	0	8	TA3020	Science and Technology of Cereals and Oil Crops		3	0	8
MA2010	Differential Equations		3	0	8	TA3021	Science and Technology of Dairy Products		3	0	8
Q2000	Biochemistry		3	0	8	TA3022	Science and Technology of Cereals and Oil Crops Laboratory		0	3	4
			<b>18</b>	<b>0</b>	<b>48</b>	TA3023	Science and Technology of Dairy Products Laboratory		0	3	4
Fourth Semester			C	L	U	VA2011	Topics II		3	0	8
H1018	Ethics, Self and Society		3	0	8				<b>15</b>	<b>6</b>	<b>48</b>
IQ2000	Energy Balance		3	0	8	Ninth Semester			C	L	U
IQ2001	Thermodynamics		3	0	8	BT3014	Bioengineering Design Project		3	0	8
M2025	Numerical Methods in Engineering		3	0	8	HS2006	Applied Ethics		3	0	8
Q1010	Analytical Chemistry		3	0	8	TA3004	Food Packaging		3	0	8
Q2001	Food Chemistry		3	0	8	TA3024	Food Safety		3	0	8
TA2008	Food Chemistry Laboratory		0	3	4	TA3025	Introduction to Professional Development		2	0	2
			<b>18</b>	<b>3</b>	<b>52</b>	VA2012	Topics III		3	0	8
						VA2013	Topics IV		3	0	8
									<b>20</b>	<b>0</b>	<b>50</b>

- C Number of class hours per week  
 L Number of laboratory hours or activities per week  
 U Study hours that must be dedicated to the course (class hours included)

## B.S. Innovation and Development Engineering (IID)

Graduates from this program develop comprehensive sustainable solutions in the emerging fields of engineering, such as nanotechnology, the use of alternative energy sources, bioinformatics. Their in-depth preparation in engineering sciences, development of communication, leadership and international vision competencies enable them to work in interdisciplinary teams to manage and develop technological innovation projects that contribute to an increase in productivity and the enhancement of social wellbeing.

### Competencies for Graduates:

- Analyze, model and solve complex science and engineering issues.
- Develop comprehensive solutions based on an in-depth knowledge of the diverse engineering disciplines.
- Transfer and apply technology in accordance with the cultural and social context of the community.
- Implement interdisciplinary projects, applying engineering sciences to innovate, enhance and find solutions to problems in the emerging fields of engineering, such as nanotechnology, energy sources and many others.
- Evaluate and manage innovation projects, considering their economic and social impact within a framework of sustainable development.



## IID B.S. Innovation and Development Engineering Edition 2012

<b>Remedial Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Fifth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
F1001	Introduction to Physics		3	0	8	EC1010	Economy to Business Creation		3	0	8
H1001	Remedial English I		5	0	8	M2025	Numerical Methods in Engineering		3	0	8
H1002	Remedial English II		5	0	8	NN2001	Innovation Positioning		3	0	8
H1003	Remedial English III		5	0	8	NN2002	Methodologies for Innovation		3	0	8
H1004	Remedial English IV		5	0	8	OP2040	Mathematics Elective II		3	0	8
H1005	Remedial English V		5	0	8	OP2045	Science in Engineering Elective V		3	0	8
H1015	Spanish Composition		5	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MA1001	Introduction to Mathematics		6	0	16	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
TC1001	Introduction to Computer Science		3	0	8	EM1005	Entrepreneurship		3	0	8
			<b>42</b>	<b>0</b>	<b>80</b>	NN2003	Innovation, Design, and Business Context Workshop		3	0	8
<b>First Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	OP2046	Engineering Concentration Elective I		3	0	8
DS1005	Climate Change and Energy Use		3	0	8	OP2047	Engineering Concentration Elective II		3	0	8
F1002	Physics I		3	1	8	OP2048	Engineering Concentration Elective III		3	0	8
H1016	Foreign Language		5	0	8	OP2049	Engineering Concentration Elective IV		3	0	8
H1040	Analysis and Verbal Expression		5	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MA1015	Mathematics I		3	0	8	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
NN1000	Introduction to Innovation in Engineering		3	0	4	HS2005	Citizenship		3	0	8
OP1004	Computation		3	0	8	NN3000	Product and Service Engineering		4	0	12
			<b>25</b>	<b>1</b>	<b>52</b>	OP2050	Engineering Concentration Elective V		3	0	8
<b>Second Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	OP2051	Engineering Concentration Elective VI		3	0	8
H1018	Ethics, Self and Society		3	0	8	OP2052	Engineering Concentration Elective VII		3	0	8
MA1017	Mathematics II		3	0	8	OP2055	Management Skills Elective I		3	0	8
NN1001	Creativity and Innovation Workshop		3	0	8				<b>19</b>	<b>0</b>	<b>52</b>
OP1005	Sciences Laboratory		0	3	4	<b>Eighth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
OP1006	Statistics		3	0	8	IN3041	Project Feasibility		3	0	8
OP2037	Sciences Elective I		3	0	8	NN3001	Engineering Innovation Design Project I		4	0	12
OP2041	Science in Engineering Elective I		3	0	8	OP2053	Engineering Concentration Elective VIII		3	0	8
			<b>18</b>	<b>3</b>	<b>52</b>	OP2054	Engineering Concentration Elective IX		3	0	8
<b>Third Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	OP2056	Management Skills Elective II		3	0	8
CF1010	Accounting and Cost Management		3	0	8	OP3042	Engineering Concentration Elective X		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8				<b>19</b>	<b>0</b>	<b>52</b>
MA2009	Mathematics III		3	0	8	<b>Ninth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
NN1002	Process Innovation and Prototype Design		3	0	8	HS2006	Applied Ethics		3	0	8
OP2038	Sciences Elective II		3	0	8	NN3002	Engineering Innovation Design Project II		6	0	16
OP2042	Science in Engineering Elective II		3	0	8	NN3003	Introduction to Professional Development		2	0	2
			<b>18</b>	<b>0</b>	<b>48</b>	OP2057	Management Skills Elective III		3	0	8
<b>Fourth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	OP3043	Engineering Concentration Elective XI		3	0	8
F1005	Electricity and Magnetism		3	1	8	OP3044	Engineering Concentration Elective XII		3	0	8
HS2000	Humanities and Fine Arts		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
NN2000	Feasibility and Viability of Innovation Projects		3	0	8						
OP2039	Mathematics Elective I		3	0	8						
OP2043	Science in Engineering Elective III		3	0	8						
OP2044	Science in Engineering Elective IV		3	0	8						
			<b>18</b>	<b>1</b>	<b>48</b>						

C Number of class hours per week

L Number of laboratory hours or activities per week

U Study hours that must be dedicated to the course (class hours included)



## B.S. Industrial Engineering with minor in Systems (IIS)

Graduates from this program are professionals who design enhance and control sustainable processes and systems consisting of people, materials, information, equipment, energy and capital. They increase productivity and the quality of goods and services by manufacturing a product or providing a service in a globalized setting.

### Competencies for Graduates:

- Model, analyze and enhance products, processes and services, applying analytical tools related to industrial engineering and structured approaches of systems engineering (strategic management, logistics systems, optimization of processes, manufacturing systems and total quality management).
- Design and conduct experiments to develop a product or process.
- Develop business strategies by transforming organizational systems to enhance productivity and competitiveness, considering their impact in a global, economic, environmental and social context.
- Develop innovative solutions that increase the competitive advantages of organizations in a globalized environment.
- Adapt and adopt new enhancement technologies and tools through a process of ongoing professional development.



## IIS B.S. Industrial Engineering with minor in Systems Engineering Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	CF1010	Accounting and Cost Management		3	0	8
H1001	Remedial English I		5	0	8	EC1010	Economy to Business Creation		3	0	8
H1002	Remedial English II		5	0	8	IN2004	Statistical Quality Control		3	0	8
H1003	Remedial English III		5	0	8	IN2020	Inventory Management		3	0	8
H1004	Remedial English IV		5	0	8	IN2021	Production Management		3	0	8
H1005	Remedial English V		5	0	8	IN2022	Optimization Models		3	0	8
H1015	Spanish Composition		5	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MA1001	Introduction to Mathematics		6	0	16	Sixth Semester			C	L	U
TC1001	Introduction to Computer Science		3	0	8	EM1005	Entrepreneurship		3	0	8
			<b>42</b>	<b>0</b>	<b>80</b>	IN1002	Systems Engineering Laboratory		0	3	4
First Semester			C	L	U	IN2023	Design and Analysis of Experiments		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	IN2024	Decision making Models		3	0	8
F1002	Physics I		3	1	8	IN3013	Integrated Manufacturing Systems Laboratory		0	3	4
H1016	Foreign Language		5	0	8	IN3015	Integrated Manufacturing Systems		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	IN3035	Analysis and Enhancement of Manufacturing Systems		3	0	8
IN1003	Introduction to Industrial Engineering		3	0	4				<b>15</b>	<b>6</b>	<b>48</b>
MA1015	Mathematics I		3	0	8	Seventh Semester			C	L	U
Q1001	Chemistry		3	0	8	HS2005	Citizenship		3	0	8
			<b>25</b>	<b>1</b>	<b>52</b>	IN2005	System Dynamics		3	0	8
Second Semester			C	L	U	IN2025	Project Evaluation and Management		3	0	8
F1003	Physics II		3	1	8	IN2026	Statistical Engineering		3	0	8
H1018	Ethics, Self and Society		3	0	8	IN2027	Discrete Event Simulation		3	0	8
HS2000	Humanities and Fine Arts		3	0	8	IN2028	Knowledge Systems in Organizations		3	0	8
M1003	Statics		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MA1017	Mathematics II		3	0	8	Eighth Semester			C	L	U
Q1004	Chemistry Laboratory		0	3	4	IN3037	Design and Improvement of Logistic Systems		3	0	8
TC1017	Problem Solving with Programming		3	0	8	IN3038	Operational Design and Optimization Laboratory		0	3	4
			<b>18</b>	<b>4</b>	<b>52</b>	IN3039	Problem Solving Methodologies		3	0	8
Third Semester			C	L	U	IN3040	Technological Innovation Systems		3	0	8
F1005	Electricity and Magnetism		3	1	8	IN3041	Project Feasibility		3	0	8
IQ1001	Material Balance		3	0	8	VA2010	Topics I		3	0	8
M1006	Computer Drawing		3	0	8	VA2011	Topics II		3	0	8
M2024	Manufacturing Processes		3	0	8				<b>18</b>	<b>3</b>	<b>52</b>
MA1020	Statistics I		3	0	8	Ninth Semester			C	L	U
MA2009	Mathematics III		3	0	8	HS2006	Applied Ethics		3	0	8
			<b>18</b>	<b>1</b>	<b>48</b>	IN3020	Strategic Planning		3	0	8
Fourth Semester			C	L	U	IN3043	Quality Management Strategies		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	IN3044	Industrial and Systems Engineering Project		3	0	8
IN2017	Facility Design and Materials Management		3	0	8	IN3045	Introduction to Professional Development		2	0	2
IN2018	Work Design		3	0	8	VA2012	Topics III		3	0	8
IN2019	Metrology Laboratory		0	3	4	VA2013	Topics IV		3	0	8
M2025	Numerical Methods in Engineering		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
MA2010	Differential Equations		3	0	8						
MA2011	Statistics II		3	0	8						
			<b>18</b>	<b>3</b>	<b>52</b>						

C Number of class hours per week

L Number of laboratory hours or activities per week

U Study hours that must be dedicated to the course (class hours included)

## B.S. Mechanical Engineering Option A (IMA)

Graduates from this program are professionals who have a solid grasp of mathematics and basic science, specializing in areas related to the design, installation, operation and maintenance of mechanical systems; the optimization of thermal systems; and manufacturing integration and production process management, taking into consideration the correct use of production engineering, as well as financial and sustainable development factors.

### Competencies for Graduates:

- Design mechanical systems and select the appropriate materials for their production, and select and develop manufacturing processes to transform raw materials into end products, using cutting-edge software and technology.
- Plan, design and manage production systems using inventory control, logistics, quality control and engineering economics tools to verify the feasibility of projects.
- Use the available material and human resources efficiently to develop and innovate advanced manufacturing products and processes, considering the use of clean technologies and sustainable development.
- Use the fundamental principles of energy and material conservation to design and optimize devices for fluid flow, heat transfer and power generation based on thermal energy, considering the limitations of non-renewable energy sources and global warming.

## IMA B.S. Mechanical Engineering Option A

### Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	EC1010	Economy to Business Creation		3	0	8
H1001	Remedial English I		5	0	8	IN2004	Statistical Quality Control		3	0	8
H1002	Remedial English II		5	0	8	IN2018	Work Design		3	0	8
H1003	Remedial English III		5	0	8	M2010	Materials Behavior		3	1	8
H1004	Remedial English IV		5	0	8	M2026	Advanced Methods for Strength of Materials		3	1	8
H1005	Remedial English V		5	0	8	MA1019	Linear Algebra		3	0	8
H1015	Spanish Composition		5	0	8				<b>18</b>	<b>2</b>	<b>48</b>
MA1001	Introduction to Mathematics		6	0	16	Sixth Semester			C	L	U
TC1001	Introduction to Computer Science		3	0	8	EM1005	Entrepreneurship		3	0	8
			<b>42</b>	<b>0</b>	<b>80</b>	IN2022	Optimization Models		3	0	8
First Semester			C	L	U	IN2023	Design and Analysis of Experiments		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	M2014	Materials Applications		3	1	8
F1002	Physics I		3	1	8	M2016	Thermodynamics Engineering		3	0	8
H1016	Foreign Language		5	0	8	VA2010	Topics I		3	0	8
H1040	Analysis and Verbal Expression		5	0	8				<b>18</b>	<b>1</b>	<b>48</b>
M1007	Introduction to Mechanical Engineering		3	0	4	Seventh Semester			C	L	U
MA1015	Mathematics I		3	0	8	HS2005	Citizenship		3	0	8
Q1001	Chemistry		3	0	8	IN2020	Inventory Management		3	0	8
			<b>25</b>	<b>1</b>	<b>52</b>	M2020	Manufacturing Engineering		3	0	8
Second Semester			C	L	U	M2021	Fluid Mechanics		3	0	8
F1003	Physics II		3	1	8	M2030	Machine Design and Simulation		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	M3014	Manufacturing Processes Laboratory		0	3	4
HS2000	Humanities and Fine Arts		3	0	8	VA2011	Topics II		3	0	8
M1003	Statics		3	0	8				<b>18</b>	<b>3</b>	<b>52</b>
MA1017	Mathematics II		3	0	8	Eighth Semester			C	L	U
TC1017	Problem Solving with Programming		3	0	8	HS2006	Applied Ethics		3	0	8
			<b>18</b>	<b>1</b>	<b>48</b>	M2017	Design Methodologies		3	0	8
Third Semester			C	L	U	M3015	Thermofluids Laboratory		0	3	4
F1005	Electricity and Magnetism		3	1	8	M3017	Heat Transfer		3	0	8
H1018	Ethics, Self and Society		3	0	8	M3036	Advanced Materials		3	0	8
M1005	Dynamics		3	0	8	MR2013	Control Systems		3	1	8
M1006	Computer Drawing		3	0	8	VA2012	Topics III		3	0	8
M2023	Mechanics of Materials		3	1	8				<b>18</b>	<b>4</b>	<b>52</b>
MA2009	Mathematics III		3	0	8	Ninth Semester			C	L	U
Q1004	Chemistry Laboratory		0	3	4	IN2021	Production Management		3	0	8
			<b>18</b>	<b>5</b>	<b>52</b>	IN2025	Project Evaluation and Management		3	0	8
Fourth Semester			C	L	U	M3016	Advanced Manufacturing		3	0	8
IQ2001	Thermodynamics		3	0	8	M3018	Mechanical Engineering Capstone Project		3	0	8
M2007	Mechanism Analysis and Simulation		3	1	8	M3038	Introduction to Professional Development		2	0	2
M2025	Numerical Methods in Engineering		3	0	8	MR3030	Manufacturing Systems Integration		3	1	8
MA1006	Probability and Statistics		3	0	8	VA2013	Topics IV		3	0	8
MA2010	Differential Equations		3	0	8				<b>20</b>	<b>1</b>	<b>50</b>
TE1013	Electrical and Electronic Engineering		3	1	8						
			<b>18</b>	<b>2</b>	<b>48</b>						

- C Number of class hours per week  
L Number of laboratory hours or activities per week  
U Study hours that must be dedicated to the course (class hours included)

## B.S. Mechanical Engineering Option E (IME)

Graduates from this program are professionals who are competent in the design and innovation of electromechanical systems, their automation and control. They integrate the disciplines of mechanics, electricity and electronics to produce, distribute and use energy efficiently, in order to satisfy its growing demand in a sustainable manner for society.

### Competencies for Graduates:

- Design electromechanical products, machines, tools and systems to streamline production processes; evaluate and select the most suitable materials for production backed by software and leading-edge technology.
- Develop manufacturing processes with the support of automation and control technologies for products and industrial production processes.
- Evaluate and select the type of energy source and the most appropriate technology, using intelligent distribution systems, according to the particular application.
- Identify and propose solutions for the efficient use of energy, using cogeneration technology that integrates the generation of electricity and the extraction of steam from the process.
- Design devices to exploit fluid flow and heat transfer in the recovery of energy, increasing the efficiency of industrial processes.



## IME B.S. Mechanical Engineering Option E

### Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	EC1010	Economy to Business Creation		3	0	8
H1001	Remedial English I		5	0	8	M2016	Thermodynamics Engineering		3	0	8
H1002	Remedial English II		5	0	8	M2026	Advanced Methods for Strength of Materials		3	1	8
H1003	Remedial English III		5	0	8	M2028	Materials Technology		3	0	8
H1004	Remedial English IV		5	0	8	MA1019	Linear Algebra		3	0	8
H1005	Remedial English V		5	0	8	TE1014	Electric Circuits and Measurements Laboratory		0	3	4
H1015	Spanish Composition		5	0	8	TE2032	Electrical Circuits II		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>4</b>	<b>52</b>
TC1001	Introduction to Computer Science		3	0	8	Sixth Semester			C	L	U
			<b>42</b>	<b>0</b>	<b>80</b>	EM1005	Entrepreneurship		3	0	8
First Semester			C	L	U	IN2025	Project Evaluation and Management		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	M2021	Fluid Mechanics		3	0	8
F1002	Physics I		3	1	8	M3035	Mechanical Vibrations		3	0	8
H1016	Foreign Language		5	0	8	TE2036	Electromechanical Energy Conversion		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	TE2039	Electromechanical Energy Conversion Laboratory		0	3	4
M1007	Introduction to Mechanical Engineering		3	0	4	TE2043	Power Electronics		3	1	8
MA1015	Mathematics I		3	0	8				<b>18</b>	<b>4</b>	<b>52</b>
Q1001	Chemistry		3	0	8	Seventh Semester			C	L	U
			<b>25</b>	<b>1</b>	<b>52</b>	HS2005	Citizenship		3	0	8
Second Semester			C	L	U	M2020	Manufacturing Engineering		3	0	8
F1003	Physics II		3	1	8	M2030	Machine Design and Simulation		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	M3017	Heat Transfer		3	0	8
HS2000	Humanities and Fine Arts		3	0	8	MR2004	Control Engineering		3	0	8
M1003	Statics		3	0	8	VA2010	Topics I		3	0	8
MA1017	Mathematics II		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
Q1004	Chemistry Laboratory		0	3	4	Eighth Semester			C	L	U
TC1017	Problem Solving with Programming		3	0	8	M2017	Design Methodologies		3	0	8
			<b>18</b>	<b>4</b>	<b>52</b>	M3014	Manufacturing Processes Laboratory		0	3	4
Third Semester			C	L	U	M3015	Thermofluids Laboratory		0	3	4
F1005	Electricity and Magnetism		3	1	8	MR3033	Computerized Control for Electric Machinery		3	0	8
H1018	Ethics, Self and Society		3	0	8	TE3027	Industrial Power Systems		3	1	8
M1005	Dynamics		3	0	8	VA2011	Topics II		3	0	8
M1006	Computer Drawing		3	0	8	VA2012	Topics III		3	0	8
M2023	Mechanics of Materials		3	1	8				15	7	48
MA2009	Mathematics III		3	0	8	Ninth Semester			C	L	U
			<b>18</b>	<b>2</b>	<b>48</b>	HS2006	Applied Ethics		3	0	8
Fourth Semester			C	L	U	M3019	Electromechanical Prototype Simulation and Construction		3	1	8
IQ2001	Thermodynamics		3	0	8	M3038	Introduction to Professional Development		2	0	2
M2007	Mechanism Analysis and Simulation		3	1	8	MR2020	Computerized Control of Electric Machines Laboratory		0	3	4
M2025	Numerical Methods in Engineering		3	0	8	MR3028	Control Engineering Laboratory		0	3	4
MA1006	Probability and Statistics		3	0	8	TE3028	Efficient Use of Energy		3	0	8
MA2010	Differential Equations		3	0	8	TE3066	Intelligent Electrical Networks		3	0	8
TE1002	Electrical Circuits I		3	0	8	VA2013	Topics IV		3	0	8
			<b>18</b>	<b>1</b>	<b>48</b>				<b>17</b>	<b>7</b>	<b>50</b>

C Number of class hours per week

L Number of laboratory hours or activities per week

U Study hours that must be dedicated to the course (class hours included)

## B.S. Digital Music Production Engineering (IMI)

Graduates from this program are professionals with a solid multidisciplinary training that allows them to innovate in the sound-design and digital-music industries. They are knowledgeable and skillful in state-of-the-art technologies, and use musical language creatively to generate innovative proposals in the media, film, videogames, Internet, mobile devices and marketing, among others.

### Competencies for Graduates:

- Develop high-definition sound engineering projects, using microphoning, sound reinforcement, editing, mastering and equalizing techniques.
- Generate musical production projects, including sound engineering throughout the preproduction, production and postproduction phases.
- Set music to applications in videogames, the Internet, mobile devices, film, video and collaborate with graphic designers and advertising agents.
- Know the legal and administrative bases for understanding the structure, functioning and trends of the music industry, in relation to the mass media, in order to plan and develop music product sales projects.



## IMI B.S. Digital Music Production Engineering Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	AV1004	Audiovisual Language and Narrative		3	0	8
H1001	Remedial English I		5	0	8	CF1010	Accounting and Cost Management		3	0	8
H1002	Remedial English II		5	0	8	F2009	Acoustics		3	0	8
H1003	Remedial English III		5	0	8	MT1003	Marketing and Creativity		3	0	8
H1004	Remedial English IV		5	0	8	TC1015	Introduction to Interactive Design		3	0	8
H1005	Remedial English V		5	0	8	TE1010	Digital Systems		3	1	8
H1015	Spanish Composition		5	0	8				<b>18</b>	<b>1</b>	<b>48</b>
MA1001	Introduction to Mathematics		6	0	16	Sixth Semester			C	L	U
TC1001	Introduction to Computer Science		3	0	8	AV2006	Media Narrative Design and Production		3	0	8
			<b>42</b>	<b>0</b>	<b>80</b>	EC1010	Economy to Business Creation		3	0	8
First Semester			C	L	U	EM1005	Entrepreneurship		3	0	8
AD1005	Management and Business Model Innovation		3	0	8	HS2000	Humanities and Fine Arts		3	0	8
F1002	Physics I		3	1	8	IM2006	MIDI Systems		3	0	8
H1016	Foreign Language		5	0	8	TE1003	Electronics		3	0	8
H1041	Music and Society		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
H1042	Music Theory and Solfège		3	0	8	Seventh Semester			C	L	U
IM1001	Introduction to Digital Music Production Engineering		3	0	4	AD2014	Business in the Industry of Music and Entertainment		3	0	8
MA1015	Mathematics I		3	0	8	AV2009	Media Projects Management and Evaluation		3	0	8
			<b>23</b>	<b>1</b>	<b>52</b>	HS2005	Citizenship		3	0	8
Second Semester			C	L	U	IM2007	Sound Engineering		3	0	8
CO1007	Communication, Signs, and Signification		3	0	8	IM3006	Digital Audio Systems for Web and Mobile Devices		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	IM3007	Music Composition and Digital Arranging Workshop		4	0	8
F1003	Physics II		3	1	8				<b>19</b>	<b>0</b>	<b>48</b>
H1040	Analysis and Verbal Expression		5	0	8	Eighth Semester			C	L	U
H1044	Music Appreciation I		3	0	8	HS2006	Applied Ethics		3	0	8
IM1002	Applied Music Theory Workshop		0	3	4	IM3008	Music Production and Digital Mixing Workshop		4	0	8
MA1017	Mathematics II		3	0	8	IM3009	Recording Techniques		3	0	8
			<b>20</b>	<b>4</b>	<b>52</b>	VA2010	Topics I		3	0	8
Third Semester			C	L	U	VA2011	Topics II		3	0	8
F1005	Electricity and Magnetism		3	1	8	VA2012	Topics III		3	0	8
H1018	Ethics, Self and Society		3	0	8				<b>19</b>	<b>0</b>	<b>48</b>
H2035	Music Appreciation II		3	0	8	Ninth Semester			C	L	U
IM2004	Ear/Instrumental Training Lab		4	0	8	CO3007	Advertising and Integrated Marketing		3	0	8
MA2009	Mathematics III		3	0	8	IM3010	Musical Production Project		3	0	8
TC1017	Problem Solving with Programming		3	0	8	IM3011	Post production and Digital Mastering Workshop		4	0	8
			<b>19</b>	<b>1</b>	<b>48</b>	IM3012	Introduction to Professional Development		2	0	2
Fourth Semester			C	L	U	VA2013	Topics IV		3	0	8
AT2006	Theory and Practice of Sound		3	0	8	VA2014	Topics V		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	VA2015	Topics VI		3	0	8
IM2005	Audio Programming		3	0	8				<b>21</b>	<b>0</b>	<b>50</b>
MA1006	Probability and Statistics		3	0	8						
MA2010	Differential Equations		3	0	8						
TE1012	Electric Circuits		3	0	8						
			<b>18</b>	<b>0</b>	<b>48</b>						

- C Number of class hours per week  
 L Number of laboratory hours or activities per week  
 U Study hours that must be dedicated to the course (class hours included)

## B.S. Mechatronics Engineering (IMT)

Graduates from this program are professionals with a solid multidisciplinary foundation in mechatronics (consisting of mechanics, electronics, programming and control) who specialize in innovating, designing and manufacturing processes and products that include production lines and automatic systems; intelligent machines and buildings; industrial and general-purpose robots; and medical, automotive and aerospace devices, among others.

### Competencies for Graduates:

- Design, innovate, construct and implement products that enhance people's safety and quality of life.
- Design, innovate and implement industrial control and automation systems to increase productivity, quality and efficiency in industrial processes.
- Design and implement mechatronic systems: industrial production lines, robots, numerical control machines, intelligent buildings, medical devices, automotive devices, aerospace devices, in order to improve processes and promote product innovation and enhancement.
- Solve problems, from mechanical and electronic conceptualization and computer-aided control, to implementation.
- Manage and assess mechatronics projects, considering environmental protection and the profession's responsibility toward society.
- Lead multidisciplinary teams.

## IMT B.S. Mechatronics Engineering Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	EC1010	Economy to Business Creation		3	0	8
H1001	Remedial English I		5	0	8	IQ2001	Thermodynamics		3	0	8
H1002	Remedial English II		5	0	8	M2023	Mechanics of Materials		3	1	8
H1003	Remedial English III		5	0	8	MA1006	Probability and Statistics		3	0	8
H1004	Remedial English IV		5	0	8	MR2005	Mechatronic Instrumentation Laboratory		0	3	4
H1005	Remedial English V		5	0	8	TE1003	Electronics		3	0	8
H1015	Spanish Composition		5	0	8	TE2035	Analysis of Signals and Systems		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>4</b>	<b>52</b>
TC1001	Introduction to Computer Science		3	0	8	Sixth Semester			C	L	U
			<b>42</b>	<b>0</b>	<b>80</b>	EM1005	Entrepreneurship		3	0	8
First Semester			C	L	U	M2007	Mechanism Analysis and Simulation		3	1	8
F1002	Physics I		3	1	8	M2028	Materials Technology		3	0	8
H1016	Foreign Language		5	0	8	MR2003	Actuators		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	MR2004	Control Engineering		3	0	8
MA1015	Mathematics I		3	0	8	TE2033	Applied Electronics		3	0	8
MR1002	Introduction to Mechatronics Engineering		3	0	4				<b>18</b>	<b>1</b>	<b>48</b>
Q1001	Chemistry		3	0	8	Seventh Semester			C	L	U
TC1017	Problem Solving with Programming		3	0	8	M2029	Machine Design and Development		3	0	8
			<b>25</b>	<b>1</b>	<b>52</b>	M2031	Manufacturing Technologies		3	1	8
Second Semester			C	L	U	MR2007	Computerized Control		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	MR2009	Industrial Networks		3	0	8
F1003	Physics II		3	1	8	MR2019	Industrial Networks Project		0	3	4
HS2000	Humanities and Fine Arts		3	0	8	TE2023	Microcontrollers		3	0	8
M1003	Statics		3	0	8	TE2034	Integral Electronics Laboratory		0	3	4
MA1017	Mathematics II		3	0	8				<b>15</b>	<b>7</b>	<b>48</b>
MR1001	Industrial Informatics		3	0	8	Eighth Semester			C	L	U
Q1004	Chemistry Laboratory		0	3	4	HS2005	Citizenship		3	0	8
			<b>18</b>	<b>4</b>	<b>52</b>	IN2025	Project Evaluation and Management		3	0	8
Third Semester			C	L	U	MR3009	Mechatronic Design		3	0	8
F1005	Electricity and Magnetism		3	1	8	MR3012	Mechatronics Laboratory		0	3	4
H2001	Verbal Expression in the Workplace		3	0	8	MR3026	Automation of Manufacturing Systems		3	1	8
M1005	Dynamics		3	0	8	MR3029	Integral Automatic Control Laboratory		0	3	4
MA2009	Mathematics III		3	0	8	VA2010	Topics I		3	0	8
MA2010	Differential Equations		3	0	8				<b>15</b>	<b>7</b>	<b>48</b>
TE1002	Electrical Circuits I		3	0	8	Ninth Semester			C	L	U
			<b>18</b>	<b>1</b>	<b>48</b>	HS2006	Applied Ethics		3	0	8
Fourth Semester			C	L	U	MR3016	Project of Mechatronics Engineering		3	0	8
H1018	Ethics, Self and Society		3	0	8	MR3031	Industrial Robotics		3	1	8
M1006	Computer Drawing		3	0	8	MR3032	Introduction to Professional Development		2	0	2
M2025	Numerical Methods in Engineering		3	0	8	VA2011	Topics II		3	0	8
MA3002	Advanced Mathematics		3	0	8	VA2012	Topics III		3	0	8
MR2000	Logic Automatizms		3	0	8	VA2013	Topics IV		3	0	8
MR2002	Logic Automatism Laboratory		0	3	4				<b>20</b>	<b>1</b>	<b>50</b>
TE2032	Electrical Circuits II		3	0	8						
			<b>18</b>	<b>3</b>	<b>52</b>						

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 L Number of laboratory hours or activities per week  
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## B.S. Chemistry and Nanotechnology Engineering (INCQ)

The objective of the Chemistry and Nanotechnology Engineering (INCQ) program is to prepare professionals with a solid grounding in chemistry, specializing in molecular engineering in order to develop nanomaterials and advanced materials.

### Competencies for Graduates

- Design, characterize and construct molecules and materials to obtain nano- and macro-structured products for the pharmaceutical, biomedical, cosmetic, biomaterial and consumer product industries.
- Make use of the particular properties of nanomaterials to generate alternative sources of energy and to protect the environment.



## INCQ B.S. Chemistry and Nanotechnology Engineering Edition 2013

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	HS2005	Citizenship		3	0	8
H1001	Remedial English I		5	0	8	MA1006	Probability and Statistics		3	0	8
H1002	Remedial English II		5	0	8	Q1013	Organic Synthesis Laboratory		0	6	8
H1003	Remedial English III		5	0	8	Q2013	Molecular Kinetics and Dynamics		3	0	8
H1004	Remedial English IV		5	0	8	Q2014	Physical Chemistry Laboratory		0	6	8
H1005	Remedial English V		5	0	8	Q2018	Instrumental Analytical Chemistry and Nanoscopy		3	0	8
H1015	Spanish Composition		5	0	8				<b>12</b>	<b>12</b>	<b>48</b>
MA1001	Introduction to Mathematics		6	0	16	Sixth Semester			C	L	U
TC1001	Introduction to Computer Science		3	0	8	EC1010	Economy to Business Creation		3	0	8
			<b>42</b>	<b>0</b>	<b>80</b>	M2025	Numerical Methods in Engineering		3	0	8
First Semester			C	L	U	Q2003	Metabolic Biochemistry		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	Q2019	Characterization of Materials and Nanomaterials		0	6	8
F1002	Physics I		3	1	8	Q3002	Instrumental Analytical Chemistry Laboratory		0	6	8
H1016	Foreign Language		5	0	8	Q3005	Spectroscopic Analysis		3	0	8
H1040	Analysis and Verbal Expression		5	0	8				<b>12</b>	<b>12</b>	<b>48</b>
MA1015	Mathematics I		3	0	8	Seventh Semester			C	L	U
Q1001	Chemistry		3	0	8	EM1005	Entrepreneurship		3	0	8
Q1017	Introduction to Chemical Sciences, Nanotechnology and their Applications		3	0	4	IN2023	Design and Analysis of Experiments		3	0	8
			<b>25</b>	<b>1</b>	<b>52</b>	Q3016	Macromolecule Design and Synthesis		3	0	8
Second Semester			C	L	U	Q3017	Molecular Structure and Computer aided Design		3	0	8
F1003	Physics II		3	1	8	Q3018	Analytical Biochemistry Laboratory		0	6	8
MA1017	Mathematics II		3	0	8	Q3024	Synthesis of Materials and Nanomaterials Laboratory		0	6	8
Q1007	Structural Organic Chemistry		3	0	8				<b>12</b>	<b>12</b>	<b>48</b>
Q1014	Experimental Chemistry		0	6	8	Eighth Semester			C	L	U
Q1018	Chemistry of Materials and Nanomaterials		3	0	8	Q3025	Nanotechnological Formulation for Industry		3	0	8
TC1017	Problem Solving with Programming		3	0	8	Q3026	Research Project in Chemistry and Nanotechnology		3	0	8
			<b>15</b>	<b>7</b>	<b>48</b>	Q3027	Macromolecular Engineering Laboratory		0	6	8
Third Semester			C	L	U	Q3028	Medicinal Chemistry and Nanomedicine		3	0	8
H1018	Ethics, Self and Society		3	0	8	VA2010	Topics I		3	0	8
HS2000	Humanities and Fine Arts		3	0	8	VA2011	Topics II		3	0	8
MA2009	Mathematics III		3	0	8				<b>15</b>	<b>6</b>	<b>48</b>
Q1010	Analytical Chemistry		3	0	8	Ninth Semester			C	L	U
Q1011	Mechanistic Organic Chemistry		3	0	8	HS2006	Applied Ethics		3	0	8
Q1015	Modern Methods in Analytical Chemistry		0	6	8	Q3021	Introduction to Professional Development		2	0	2
			<b>15</b>	<b>6</b>	<b>48</b>	Q3029	Integration Project in Chemistry and Nanotechnology		9	0	24
Fourth Semester			C	L	U	VA2012	Topics III		3	0	8
BT1003	Molecular Biology		3	0	8	VA2013	Topics IV		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
MA2010	Differential Equations		3	0	8						
Q1009	General Organic Chemistry Laboratory		0	6	8						
Q2000	Biochemistry		3	0	8						
Q2002	Molecular Thermodynamics		3	0	8						
			<b>15</b>	<b>6</b>	<b>48</b>						

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## B.S. Chemical Engineering Option A (IQA)

Graduates from this program are professionals who design, operate and manage chemical processes to promote sustainable development based on the application of natural sciences and engineering, considering productivity, technological development and the profitability of organizations. They are trained to model, develop and enhance chemical processes and products, taking into account technical, economic, social, cultural and ethical considerations.

### Competencies for Graduates:

- Design process equipment or complete chemical processes to produce materials or products that meet specific market demands.
- Develop and enhance innovative products and services for the chemical industry, adhering to the principles of sustainable development.
- Identify business opportunities in the chemical industry, considering market needs, and the technical and economic feasibility of the processes and their environmental impact.
- Plan and manage a production process, focusing on efficient, quality manufacturing, considering the value chain, from the acquisition and handling of inputs to product marketing.



## IQA B.S. Chemical Engineering Option A

### Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	EC1010	Economy to Business Creation		3	0	8
H1001	Remedial English I		5	0	8	IN2004	Statistical Quality Control		3	0	8
H1002	Remedial English II		5	0	8	IQ2003	Equilibrium Thermodynamics		3	0	8
H1003	Remedial English III		5	0	8	IQ2004	Heat Transfer Operations		3	0	8
H1004	Remedial English IV		5	0	8	IQ2005	Momentum Transfer Operations		3	0	8
H1005	Remedial English V		5	0	8	Q2015	Physical Chemistry Measurements Laboratory		0	3	4
H1015	Spanish Composition		5	0	8	Q3001	Product Chemistry		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>3</b>	<b>52</b>
TC1001	Introduction to Computer Science		3	0	8	Sixth Semester			C	L	U
			<b>42</b>	<b>0</b>	<b>80</b>	EM1005	Entrepreneurship		3	0	8
First Semester			C	L	U	IN2022	Optimization Models		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	IN2023	Design and Analysis of Experiments		3	0	8
F1002	Physics I		3	1	8	IQ3003	Chemical Reaction Engineering		3	0	8
H1016	Foreign Language		5	0	8	IQ3006	Thermo mechanical Operations Laboratory		0	3	4
H1040	Analysis and Verbal Expression		5	0	8	IQ3007	Separation Processes		3	0	8
IQ1004	Introduction to Chemical Engineering		3	0	4	IQ3013	New Products Development Workshop		3	1	8
MA1015	Mathematics I		3	0	8				<b>18</b>	<b>4</b>	<b>52</b>
Q1001	Chemistry		3	0	8	Seventh Semester			C	L	U
			<b>25</b>	<b>1</b>	<b>52</b>	HS2005	Citizenship		3	0	8
Second Semester			C	L	U	IN2025	Project Evaluation and Management		3	0	8
F1003	Physics II		3	1	8	IN2027	Discrete Event Simulation		3	0	8
H1018	Ethics, Self and Society		3	0	8	IQ2006	Diffusion Transfer Processes		3	0	8
HS2000	Humanities and Fine Arts		3	0	8	IQ3008	Chemical Process Analysis		3	0	8
MA1017	Mathematics II		3	0	8	IQ3011	Process Engineering Laboratory		0	3	4
Q1014	Experimental Chemistry		0	6	8	MR2012	Process Automation		3	0	8
TC1017	Problem Solving with Programming		3	0	8				<b>18</b>	<b>3</b>	<b>52</b>
			<b>15</b>	<b>7</b>	<b>48</b>	Eighth Semester			C	L	U
Third Semester			C	L	U	DL3016	Innovation, Design and Business Setting		3	0	8
F1005	Electricity and Magnetism		3	1	8	IN3036	Value chain Management		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	IQ3009	Chemical Process Design		3	0	8
IQ1001	Material Balance		3	0	8	IQ3010	Fundamentals of Engineering Microprocesses		3	0	8
MA2009	Mathematics III		3	0	8	VA2010	Topics I		3	0	8
MA2010	Differential Equations		3	0	8	VA2011	Topics II		3	0	8
Q1010	Analytical Chemistry		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
			<b>18</b>	<b>1</b>	<b>48</b>	Ninth Semester			C	L	U
Fourth Semester			C	L	U	HS2006	Applied Ethics		3	0	8
IQ2000	Energy Balance		3	0	8	IN3035	Analysis and Enhancement of Manufacturing Systems		3	0	8
IQ2001	Thermodynamics		3	0	8	IQ3016	Microprocesses Laboratory		0	3	4
M2025	Numerical Methods in Engineering		3	0	8	IQ3017	Processes and Products Innovation Project		3	0	8
MA1006	Probability and Statistics		3	0	8	IQ3039	Introduction to Professional Development		2	0	2
Q1007	Structural Organic Chemistry		3	0	8	MR2015	Process Automation Laboratory		0	3	4
Q2012	Industrial Chemistry		3	0	8	VA2012	Topics III		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>	VA2013	Topics IV		3	0	8
									<b>17</b>	<b>6</b>	<b>50</b>

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L Number of laboratory hours or activities per week  
U Study hours that must be dedicated to the course (class hours included)



## B.S. Chemical Engineering Option S (IQP)

Graduates from this program are professionals who focus on the technological design, operation and innovation of chemical processes on the basis of optimizing the use of energy and the development of sustainable chemical processes. Their solid training in chemical engineering, together with the knowledge, management and application of specialized tools, allow them to perform in the areas of technical processes, technological development for the efficient use of materials and energy, and pollution prevention.

### Competencies for Graduates:

- Design process equipment or complete chemical processes to produce materials or products that meet specific market demands.
- Identify, propose and evaluate alternative technologies for the optimal operation of new or existing processes, from the perspective of energy and material resource utilization.
- Use material and energy resources efficiently when developing and operating transformation processes.
- Propose and assess improvements and technological innovations for production processes through process intensification, the efficient use of energy, the incorporation of alternative energy sources and the implementation of emission reduction strategies.
- Evaluate the technical and economic feasibility of technological modernization alternatives for processes, energy-saving projects, emission reduction strategies and waste management, considering the legal implications in the evaluation.

## IQP B.S. Chemical Engineering Option S Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	EC1010	Economy to Business Creation		3	0	8
H1001	Remedial English I		5	0	8	F3024	Alternative Energy		3	0	8
H1002	Remedial English II		5	0	8	IQ2003	Equilibrium Thermodynamics		3	0	8
H1003	Remedial English III		5	0	8	IQ2004	Heat Transfer Operations		3	0	8
H1004	Remedial English IV		5	0	8	IQ2005	Momentum Transfer Operations		3	0	8
H1005	Remedial English V		5	0	8	OP2018	Chemistry Elective		3	0	8
H1015	Spanish Composition		5	0	8	Q2015	Physical Chemistry Measurements Laboratory		0	3	4
MA1001	Introduction to Mathematics		6	0	16				<b>18</b>	<b>3</b>	<b>52</b>
TC1001	Introduction to Computer Science		3	0	8	Sixth Semester			C	L	U
			<b>42</b>	<b>0</b>	<b>80</b>	EM1005	Entrepreneurship		3	0	8
First Semester			C	L	U	IN2023	Design and Analysis of Experiments		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	IQ3003	Chemical Reaction Engineering		3	0	8
F1002	Physics I		3	1	8	IQ3004	Eco efficiency and Sustainable Processes		3	0	8
H1016	Foreign Language		5	0	8	IQ3006	Thermo mechanical Operations Laboratory		0	3	4
H1040	Analysis and Verbal Expression		5	0	8	IQ3007	Separation Processes		3	0	8
IQ1004	Introduction to Chemical Engineering		3	0	4	IQ3032	Technologies for the Efficient use of Thermal Energy		3	0	8
MA1015	Mathematics I		3	0	8				<b>18</b>	<b>3</b>	<b>52</b>
Q1001	Chemistry		3	0	8	Seventh Semester			C	L	U
			<b>25</b>	<b>1</b>	<b>52</b>	HS2005	Citizenship		3	0	8
Second Semester			C	L	U	IN2025	Project Evaluation and Management		3	0	8
F1003	Physics II		3	1	8	IQ2006	Diffusion Transfer Processes		3	0	8
H1018	Ethics, Self and Society		3	0	8	IQ3008	Chemical Process Analysis		3	0	8
HS2000	Humanities and Fine Arts		3	0	8	IQ3011	Process Engineering Laboratory		0	3	4
MA1017	Mathematics II		3	0	8	IQ3018	Technology Development Strategies		3	0	8
Q1014	Experimental Chemistry		0	6	8	MR2012	Process Automation		3	0	8
TC1017	Problem Solving with Programming		3	0	8				<b>18</b>	<b>3</b>	<b>52</b>
			<b>15</b>	<b>7</b>	<b>48</b>	Eighth Semester			C	L	U
Third Semester			C	L	U	IQ3009	Chemical Process Design		3	0	8
F1005	Electricity and Magnetism		3	1	8	IQ3010	Fundamentals of Engineering Microprocesses		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	IQ3037	Process Modeling		3	0	8
IQ1001	Material Balance		3	0	8	IQ3038	Energy Audit, Diagnosis and Evaluation		3	0	8
MA2009	Mathematics III		3	0	8	VA2010	Topics I		3	0	8
MA2010	Differential Equations		3	0	8	VA2011	Topics II		3	0	8
Q1010	Analytical Chemistry		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
			<b>18</b>	<b>1</b>	<b>48</b>	Ninth Semester			C	L	U
Fourth Semester			C	L	U	HS2006	Applied Ethics		3	0	8
IQ2000	Energy Balance		3	0	8	IQ3016	Microprocesses Laboratory		0	3	4
IQ2001	Thermodynamics		3	0	8	IQ3036	Process and Energy Engineering Capstone Project		3	0	8
M2025	Numerical Methods in Engineering		3	0	8	IQ3039	Introduction to Professional Development		2	0	2
MA1006	Probability and Statistics		3	0	8	IQ3040	Process Sustainability Through Optimization		3	0	8
Q1007	Structural Organic Chemistry		3	0	8	MR2015	Process Automation Laboratory		0	3	4
Q2012	Industrial Chemistry		3	0	8	VA2012	Topics III		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>	VA2013	Topics IV		3	0	8
									<b>17</b>	<b>6</b>	<b>50</b>

- C Number of class hours per week  
 L Number of laboratory hours or activities per week  
 U Study hours that must be dedicated to the course (class hours included)

## B.S. Industrial Design (LDI)

Graduates from this program are professionals who have the capacity to identify design opportunities in any productive, occupational and social area in order to generate products, services and creative business models, and integrate them into attractive proposals that are financially and technologically feasible.

### Competencies for Graduates:

- Implement user-oriented design proposals, considering concepts based on the users' aspirations, habits, behaviors and customs within their socio-cultural and economic-regional setting.
- Handle materials to create functional, aesthetic and productively feasible forms.
- Visualize future scenarios and develop design strategies.
- Analyze and translate socio-cultural and technological trends into the design of meaningful solutions.
- Apply systemic thinking to understand and address the conflicts that affect design sustainability.



## LDI B.A. Industrial Design Edition 2011

<b>Remedial Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Fifth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
F1001	Introduction to Physics		3	0	8	DL2020	User centered Design		3	0	8
H1001	Remedial English I		5	0	8	DL2021	Experience Design I		3	0	8
H1002	Remedial English II		5	0	8	DL2022	Advanced Digital Modeling		3	0	8
H1003	Remedial English III		5	0	8	DL2023	Model and Prototype Workshop II		3	0	8
H1004	Remedial English IV		5	0	8	H1032	Mexican Identity and Culture		3	0	8
H1005	Remedial English V		5	0	8	M2032	Materials Technology		3	0	8
H1015	Spanish Composition		5	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MA1001	Introduction to Mathematics		6	0	16	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
TC1001	Introduction to Computer Science		3	0	8	DL2024	Experience Design II		3	0	8
			<b>42</b>	<b>0</b>	<b>80</b>	DL2025	Language and Meaning of Objects		3	0	8
<b>First Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	DL2026	Advanced Digital Representation Techniques		3	0	8
AR1013	Drawing		4	0	8	HS2005	Citizenship		3	0	8
AR1014	Descriptive Geometry		3	0	8	M3034	Computer aided Prototyping		3	0	8
DL1002	Design Fundamentals I		4	0	8	VA2010	Topics I		3	0	8
DL1008	Models and Scale Models		3	0	8				<b>18</b>	<b>0</b>	<b>48</b>
DL1014	Introduction to Design		3	0	4	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
H1016	Foreign Language		5	0	8	DL2027	Futurology in Industrial Design		3	0	8
MA1009	Mathematics for Design		3	0	8	DL3014	Product and System Design I		6	0	12
			<b>25</b>	<b>0</b>	<b>52</b>	EM1005	Entrepreneurship		3	0	8
<b>Second Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	IN2030	Manufacturing Models		3	0	8
AR1016	Applied Geometry		3	0	8	VA2011	Topics II		3	0	8
AT1001	Artistic Drawing		4	0	8	VA2012	Topics III		3	0	8
DL1004	Design Fundamentals II		4	0	8				<b>21</b>	<b>0</b>	<b>52</b>
DL1009	Creativity and Innovation		3	0	8	<b>Eighth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
DL1010	Model and Prototypes Workshop I		3	0	8	AD3024	Planning, Innovation and Strategic Sustainability		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	DL3015	Product and System Design II		6	0	12
			<b>22</b>	<b>0</b>	<b>48</b>	DL3016	Innovation, Design and Business Setting		3	0	8
<b>Third Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	IN2025	Project Evaluation and Management		3	0	8
DL1011	Product Design		3	0	8	VA2013	Topics IV		3	0	8
DL1012	Design Ergonomics		3	0	8	VA2014	Topics V		3	0	8
DL1013	Design and Ethnography Methods		3	0	8				<b>21</b>	<b>0</b>	<b>52</b>
DS1003	Natural Sciences and Sustainable Development		3	0	8	<b>Ninth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
F2001	Design Physics		3	0	8	AD2012	Business Strategic Foresight		3	0	8
M1006	Computer Drawing		3	0	8	AD3023	Innovation in Business Models and Family Business Management		3	0	8
			<b>18</b>	<b>0</b>	<b>48</b>	DL3017	Professional Insertion Project		3	0	8
<b>Fourth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	DL3018	Introduction to Professional Development		2	0	2
AT2000	Digital Modelling		3	0	8	HS2006	Applied Ethics		3	0	8
AV1004	Audiovisual Language and Narrative		3	0	8	MT3023	Global Brands and Product Development		3	0	8
DL2019	Product and service design		6	0	12	VA2015	Topics VI		3	0	8
H1018	Ethics, Self and Society		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
H2001	Verbal Expression in the Workplace		3	0	8						
M2024	Manufacturing Processes		3	0	8						
			<b>21</b>	<b>0</b>	<b>52</b>						

- C Number of class hours per week  
L Number of laboratory hours or activities per week  
U Study hours that must be dedicated to the course (class hours included)





Undergraduate Degree Profiles  
and Curricula of

# Information Technologies and Electronics

## B.S. Business Informatics (INT)

Graduates from this program specialize in solving diverse organizational issues using process analysis, optimization and innovation methodologies. They enjoy a solid preparation in information technologies and systematic thinking, which translates into an increase in organizations' competitiveness.

### Competencies for Graduates:

- Use critical, systemic thinking to analyze, model and enhance organizational processes, generating comprehensive solutions with the effective use of information technologies.
- Manage and lead technology change and integration projects in organizations, promoting the efficient use of information and collaboration tools.
- Assess the impact of technological solutions, using criteria such as customer satisfaction, costs, response time and risks.
- Design the mechanisms for storing, distributing and visualizing information that favor decision-making processes.



## INT B.S. Business Informatics

### Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	EM1005	Entrepreneurship		3	0	8
H1001	Remedial English I		5	0	8	HS2000	Humanities and Fine Arts		3	0	8
H1002	Remedial English II		5	0	8	IN2004	Statistical Quality Control		3	0	8
H1003	Remedial English III		5	0	8	IN2022	Optimization Models		3	0	8
H1004	Remedial English IV		5	0	8	TC2009	Use and Management of Operating Systems		3	0	8
H1005	Remedial English V		5	0	8	TI2002	Business Process Management		3	0	8
H1015	Spanish Composition		5	0	8				<b>18</b>	<b>0</b>	<b>48</b>
MA1001	Introduction to Mathematics		6	0	16	Sixth Semester			C	L	U
TC1001	Introduction to Computer Science		3	0	8	FZ1006	Personal and Business Finance		3	0	8
			<b>42</b>	<b>0</b>	<b>80</b>	IN1002	Systems Engineering Laboratory		0	3	4
First Semester			C	L	U	IN2020	Inventory Management		3	0	8
AD1005	Management and Business Model Innovation		3	0	8	IN2023	Design and Analysis of Experiments		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	TI2010	Capstone Project I		3	0	8
H1016	Foreign Language		5	0	8	TI2011	Project Evaluation and Management		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	TI3030	Data Management		3	0	8
MA1015	Mathematics I		3	0	8				<b>18</b>	<b>3</b>	<b>52</b>
TC1014	Programming Fundamentals		3	0	8	Seventh Semester			C	L	U
TI1013	Introduction to Business Informatics		3	0	4	HS2005	Citizenship		3	0	8
			<b>25</b>	<b>0</b>	<b>52</b>	IN2025	System Dynamics		3	0	8
Second Semester			C	L	U	IN2021	Production Management		3	0	8
F1002	Physics I		3	1	8	TC2007	Quantitative Methods and Simulation		3	0	8
H1018	Ethics, Self and Society		3	0	8	TI3031	Strategic IT management		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	TI3032	Enterprise Information Systems		3	1	8
MA1017	Mathematics II		3	0	8				<b>18</b>	<b>1</b>	<b>48</b>
RH1000	Organizational Behavior and Human Talent Development		3	0	8	Eighth Semester			C	L	U
TC2016	Object Oriented Programming		3	0	8	AD3002	Management Consulting		3	0	8
			<b>18</b>	<b>1</b>	<b>48</b>	IN3039	Problem Solving Methodologies		3	0	8
Third Semester			C	L	U	TI3028	Change Management		3	0	8
CF1010	Accounting and Cost Management		3	0	8	TI3033	IT Governability		3	0	8
MA1006	Probability and Statistics		3	0	8	VA2010	Topics I		3	0	8
MA2009	Mathematics III		3	0	8	VA2011	Topics II		3	0	8
TC1016	Computer Organization		3	1	8				<b>18</b>	<b>0</b>	<b>48</b>
TC1019	Introduction to Software Engineering		3	0	8	Ninth Semester			C	L	U
TI1010	Creativity and Innovation for Problem Solving		3	0	8	HS2006	Applied Ethics		3	0	8
			<b>18</b>	<b>1</b>	<b>48</b>	TC3011	Management of IT Services		3	0	8
Fourth Semester			C	L	U	TI3029	Capstone Project II		3	0	8
FZ1005	Financial Mathematics		3	0	8	TI3034	Business Intelligence		3	1	8
MA2010	Differential Equations		3	0	8	TI3035	Introduction to Professional Development		2	0	2
TC1020	Databases		3	0	8	VA2012	Topics III		3	0	8
TC2018	Introduction to Networks		3	1	8	VA2013	Topics IV		3	0	8
TC2019	Numerical Methods in Engineering		3	0	8				<b>20</b>	<b>1</b>	<b>50</b>
TI1011	Selling Chain Management		3	0	8						
			<b>18</b>	<b>1</b>	<b>48</b>						

C Number of class hours per week

L Number of laboratory hours or activities per week

U Study hours that must be dedicated to the course (class hours included)

## B.S. Computer Systems Engineering (ISC)

Graduates from this program are highly specialized in the development of software to improve the quality of life of society, support organizational competitiveness and the sustainable development of the country. Their training in the areas of software engineering and computer science allows them to create all types of computer applications, ranging from personal-and daily-use to specialized scientific, technical, engineering and business applications.

### Competencies for Graduates:

- Use software engineering to develop innovative applications to the highest quality standards, employing leading-edge technology to resolve science, industry, education and entertainment issues, with an international vision of society and its cultural requirements.
- Manage technology projects, understanding and solving the problems of diverse institutions and organizations, in a creative, innovative manner, and using resources responsibly.
- Collaborate on the design and administration of technological and communications infrastructure, applying the appropriate security policies to guarantee organizational competitiveness.
- Analyze the local and global impact of information technologies on individuals, organizations and society in order to guide their services with a sense of responsibility and ethics when evaluating ethical dilemmas related to their personal lives, profession and environment.



## ISC B.S. Computer Systems Engineering Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	HS2000	Humanities and Fine Arts		3	0	8
H1001	Remedial English I		5	0	8	MA1019	Linear Algebra		3	0	8
H1002	Remedial English II		5	0	8	TC2004	Analysis and Modeling of Software Systems		3	0	8
H1003	Remedial English III		5	0	8	TC2008	Operating Systems		3	1	8
H1004	Remedial English IV		5	0	8	TC2020	Computational Mathematics		3	0	8
H1005	Remedial English V		5	0	8	TC2022	Network Interconnection		3	1	8
H1015	Spanish Composition		5	0	8				<b>18</b>	<b>2</b>	<b>48</b>
MA1001	Introduction to Mathematics		6	0	16	Sixth Semester			C	L	U
TC1001	Introduction to Computer Science		3	0	8	EM1005	Entrepreneurship		3	0	8
			<b>42</b>	<b>0</b>	<b>80</b>	TC2024	Mobile Application Development Projects		3	0	8
First Semester			C	L	U	TC2025	Advanced Programming		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	TC3041	Advanced Database Systems		3	0	8
F1002	Physics I		3	1	8	TC3045	Software Quality and Testing		3	3	12
H1016	Foreign Language		5	0	8	TI2011	Project Evaluation and Management		3	0	8
MA1015	Mathematics I		3	0	8				<b>18</b>	<b>3</b>	<b>52</b>
TC1003	Discrete Mathematics		3	0	8	Seventh Semester			C	L	U
TC1014	Programming Fundamentals		3	0	8	HS2005	Citizenship		3	0	8
TC1023	Introduction to Computer Systems Engineering		3	0	4	TC2006	Programming Languages		3	0	8
			<b>23</b>	<b>1</b>	<b>52</b>	TC2026	Web Applications Development		3	1	8
Second Semester			C	L	U	TC2027	Computer and Information Security		3	1	8
AD1005	Management and Business Model Innovation		3	0	8	TC3002	Management of Software Engineering Projects		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	VA2010	Topics I		3	0	8
MA1017	Mathematics II		3	0	8				<b>18</b>	<b>2</b>	<b>48</b>
TC1015	Introduction to Interactive Design		3	0	8	Eighth Semester			C	L	U
TC1016	Computer Organization		3	1	8	TC2007	Quantitative Methods and Simulation		3	0	8
TC2016	Object Oriented Programming		3	0	8	TC3022	Computer Graphics		3	0	8
			<b>20</b>	<b>1</b>	<b>48</b>	TC3048	Compiler Design		3	0	8
Third Semester			C	L	U	TC3049	Software Design and Architecture		3	0	8
F1005	Electricity and Magnetism		3	1	8	TC3052	Web Application Development Laboratory		0	3	4
H1018	Ethics, Self and Society		3	0	8	VA2011	Topics II		3	0	8
MA1006	Probability and Statistics		3	0	8	VA2012	Topics III		3	0	8
MA2009	Mathematics III		3	0	8				<b>18</b>	<b>3</b>	<b>52</b>
TC1018	Data Structures		3	0	8	Ninth Semester			C	L	U
TC1019	Introduction to Software Engineering		3	0	8	HS2006	Applied Ethics		3	0	8
			<b>18</b>	<b>1</b>	<b>48</b>	TC2011	Intelligent Systems		3	0	8
Fourth Semester			C	L	U	TC3054	Business Solution Development Capstone Project		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	TI3035	Introduction to Professional Development		2	0	2
TC1020	Databases		3	0	8	VA2013	Topics IV		3	0	8
TC1021	Videogame Development Project		3	0	8	VA2014	Topics V		3	0	8
TC2017	Analysis and Design of Algorithms		3	0	8	VA2015	Topics VI		3	0	8
TC2018	Introduction to Networks		3	1	8				<b>20</b>	<b>0</b>	<b>50</b>
TC2019	Numerical Methods in Engineering		3	0	8						
			<b>18</b>	<b>1</b>	<b>48</b>						

- C Number of class hours per week  
L Number of laboratory hours or activities per week  
U Study hours that must be dedicated to the course (class hours included)

## B.S. Digital Systems and Robotics Engineering (ISD)

Graduates from this program are professionals with a solid background in the areas of digital design and computer and electronics engineering, highlighting their application in robotics. They can generate technological solutions for individuals and organizations through electronic and robotics devices, as well as the corresponding embedded software systems.

### Competencies for Graduates:

- Design, construct and maintain innovative electronic devices and their corresponding embedded software systems, considering performance and sustainability requirements, such as speed, reliability, costs and energy efficiency, among others.
- Work in an interdisciplinary manner in the design and construction of robots for a specific purpose in industrial and service applications, in particular in the areas of medicine, automation, domestic appliances and the entertainment industry.
- Design, program and maintain software systems to control devices and processes in applications that require intelligence.
- Work in an interdisciplinary manner on the design and execution of experiments and projects that help to demonstrate and understand the principles and laws of natural science and electronics, in order to comprehend the behavior of electronic devices and their impact on society.



## ISD B.S. Digital Systems and Robotics Engineering Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	EC1010	Economy to Business Creation		3	0	8
H1001	Remedial English I		5	0	8	MA3002	Advanced Mathematics		3	0	8
H1002	Remedial English II		5	0	8	TC2018	Introduction to Networks		3	1	8
H1003	Remedial English III		5	0	8	TE2023	Microcontrollers		3	0	8
H1004	Remedial English IV		5	0	8	TE2024	Microcontroller Laboratory		0	3	4
H1005	Remedial English V		5	0	8	TE2033	Applied Electronics		3	0	8
H1015	Spanish Composition		5	0	8	TE2034	Integral Electronics Laboratory		0	3	4
MA1001	Introduction to Mathematics		6	0	16				<b>15</b>	<b>7</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8	Sixth Semester			C	L	U
			<b>42</b>	<b>0</b>	<b>80</b>	EM1005	Entrepreneurship		3	0	8
First Semester			C	L	U	MR2018	Sensors and Actuators		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	TC2008	Operating Systems		3	1	8
F1002	Physics I		3	1	8	TC2022	Network Interconnection		3	1	8
H1016	Foreign Language		5	0	8	TE2031	Computer Architecture		3	1	8
MA1015	Mathematics I		3	0	8	TE2035	Analysis of Signals and Systems		3	0	8
Q1001	Chemistry		3	0	8				<b>18</b>	<b>3</b>	<b>48</b>
TC1014	Programming Fundamentals		3	0	8	Seventh Semester			C	L	U
TE1015	Introduction to Digital Systems and Robotics Engineering		3	0	4	IN2025	Project Evaluation and Management		3	0	8
			<b>23</b>	<b>1</b>	<b>52</b>	MR2004	Control Engineering		3	0	8
Second Semester			C	L	U	TC2028	Languages and Translators		3	0	8
F1003	Physics II		3	1	8	TE2038	Computer Equipment Interfaces		3	1	8
H1040	Analysis and Verbal Expression		5	0	8	TE2041	Applied Robotic		3	0	8
HS2000	Humanities and Fine Arts		3	0	8	VA2010	Topics I		3	0	8
MA1017	Mathematics II		3	0	8				<b>18</b>	<b>1</b>	<b>48</b>
Q1004	Chemistry Laboratory		0	3	4	Eighth Semester			C	L	U
TC2016	Object Oriented Programming		3	0	8	HS2005	Citizenship		3	0	8
TE1010	Digital Systems		3	1	8	MR2007	Computerized Control		3	0	8
			<b>20</b>	<b>5</b>	<b>52</b>	MR3028	Control Engineering Laboratory		0	3	4
Third Semester			C	L	U	TC3050	Robot Vision		3	0	8
F1005	Electricity and Magnetism		3	1	8	TE3059	Embedded Systems		3	0	8
H1018	Ethics, Self and Society		3	0	8	TE3060	Embedded Systems Laboratory		0	3	4
MA2009	Mathematics III		3	0	8	VA2011	Topics II		3	0	8
TC1018	Data Structures		3	0	8				<b>15</b>	<b>6</b>	<b>48</b>
TE1002	Electrical Circuits I		3	0	8	Ninth Semester			C	L	U
TE1011	Digital Systems Laboratory		0	3	4	HS2006	Applied Ethics		3	0	8
TE2030	Advanced Digital Systems		3	0	8	TC2026	Web Applications Development		3	1	8
			<b>18</b>	<b>4</b>	<b>52</b>	TE3045	Robotics Project		3	0	8
Fourth Semester			C	L	U	TE3061	Multiprocessors		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	TE3065	Introduction to Professional Development		2	0	2
M2025	Numerical Methods in Engineering		3	0	8	VA2012	Topics III		3	0	8
MA1006	Probability and Statistics		3	0	8	VA2013	Topics IV		3	0	8
MA2010	Differential Equations		3	0	8				<b>20</b>	<b>1</b>	<b>50</b>
TE1003	Electronics		3	0	8						
TE1014	Electric Circuits and Measurements Laboratory		0	3	4						
TE2032	Electrical Circuits II		3	0	8						
			<b>18</b>	<b>3</b>	<b>52</b>						

C Number of class hours per week

L Number of laboratory hours or activities per week

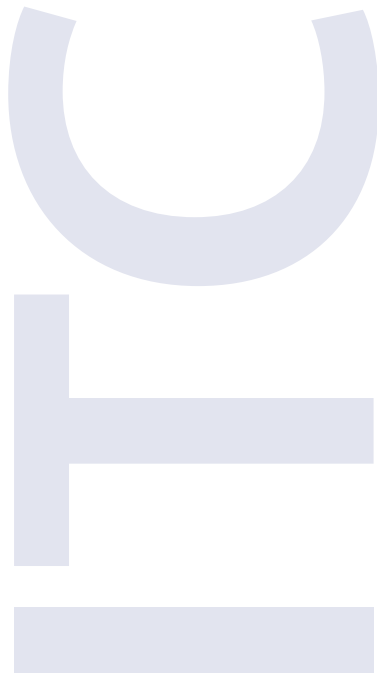
U Study hours that must be dedicated to the course (class hours included)

## B.S. Computer Science and Technology (ITC)

Graduates from this program are highly specialized in the development of software to improve the quality of life of society, support organizational competitiveness and the sustainable development of the country. Their training in the areas of software engineering and computer science allows them to create all types of computer applications, ranging from personal-and daily-use to specialized scientific, technical, engineering and business applications.

### Competencies for Graduates:

- Use software engineering to develop innovative applications to the highest quality standards, employing leading-edge technology to resolve science, industry, education and entertainment issues, with an international vision of society and its cultural requirements.
- Manage technology projects, understanding and solving the problems of diverse institutions and organizations, in a creative, innovative manner, and using resources responsibly.
- Collaborate on the design and administration of technological and communications infrastructure, applying the appropriate security policies to guarantee organizational competitiveness.
- Analyze the local and global impact of information technologies on individuals, organizations and society in order to guide their services with a sense of responsibility and ethics when evaluating ethical dilemmas related to their personal lives, profession and environment.



## ITC B.S. Computer Science and Technology Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	HS2000	Humanities and Fine Arts		3	0	8
H1001	Remedial English I		5	0	8	MA1019	Linear Algebra		3	0	8
H1002	Remedial English II		5	0	8	TC2004	Analysis and Modeling of Software Systems		3	0	8
H1003	Remedial English III		5	0	8	TC2008	Operating Systems		3	1	8
H1004	Remedial English IV		5	0	8	TC2020	Computational Mathematics		3	0	8
H1005	Remedial English V		5	0	8	TC2022	Network Interconnection		3	1	8
H1015	Spanish Composition		5	0	8				<b>18</b>	<b>2</b>	<b>48</b>
MA1001	Introduction to Mathematics		6	0	16	Sixth Semester			C	L	U
TC1001	Introduction to Computer Science		3	0	8	EM1005	Entrepreneurship		3	0	8
			<b>42</b>	<b>0</b>	<b>80</b>	TC2024	Mobile Application Development Projects		3	0	8
First Semester			C	L	U	TC2025	Advanced Programming		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	TC3041	Advanced Database Systems		3	0	8
F1002	Physics I		3	1	8	TC3045	Software Quality and Testing		3	3	12
H1016	Foreign Language		5	0	8	TI2011	Project Evaluation and Management		3	0	8
MA1015	Mathematics I		3	0	8				<b>18</b>	<b>3</b>	<b>52</b>
TC1003	Discrete Mathematics		3	0	8	Seventh Semester			C	L	U
TC1014	Programming Fundamentals		3	0	8	HS2005	Citizenship		3	0	8
TC1022	Introduction to Computer Science and Technology		3	0	4	TC2006	Programming Languages		3	0	8
			<b>23</b>	<b>1</b>	<b>52</b>	TC2026	Web Applications Development		3	1	8
Second Semester			C	L	U	TC2027	Computer and Information Security		3	1	8
AD1005	Management and Business Model Innovation		3	0	8	TC3002	Management of Software Engineering Projects		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	VA2010	Topics I		3	0	8
MA1017	Mathematics II		3	0	8				<b>18</b>	<b>2</b>	<b>48</b>
TC1015	Introduction to Interactive Design		3	0	8	Eighth Semester			C	L	U
TC1016	Computer Organization		3	1	8	TC2007	Quantitative Methods and Simulation		3	0	8
TC2016	Object Oriented Programming		3	0	8	TC3022	Computer Graphics		3	0	8
			<b>20</b>	<b>1</b>	<b>48</b>	TC3048	Compiler Design		3	0	8
Third Semester			C	L	U	TC3049	Software Design and Architecture		3	0	8
F1005	Electricity and Magnetism		3	1	8	TC3052	Web Application Development Laboratory		0	3	4
H1018	Ethics, Self and Society		3	0	8	VA2011	Topics II		3	0	8
MA1006	Probability and Statistics		3	0	8	VA2012	Topics III		3	0	8
MA2009	Mathematics III		3	0	8				<b>18</b>	<b>3</b>	<b>52</b>
TC1018	Data Structures		3	0	8	Ninth Semester			C	L	U
TC1019	Introduction to Software Engineering		3	0	8	HS2006	Applied Ethics		3	0	8
			18	1	48	TC2011	Intelligent Systems		3	0	8
Fourth Semester			C	L	U	TC3054	Business Solution Development Capstone Project		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	TI3035	Introduction to Professional Development		2	0	2
TC1020	Databases		3	0	8	VA2013	Topics IV		3	0	8
TC1021	Videogame Development Project		3	0	8	VA2014	Topics V		3	0	8
TC2017	Analysis and Design of Algorithms		3	0	8	VA2015	Topics VI		3	0	8
TC2018	Introduction to Networks		3	1	8				<b>20</b>	<b>0</b>	<b>50</b>
TC2019	Numerical Methods in Engineering		3	0	8						
			<b>18</b>	<b>1</b>	<b>48</b>						

- C Number of class hours per week  
L Number of laboratory hours or activities per week  
U Study hours that must be dedicated to the course (class hours included)



## B.S. Electronic and Computer Engineering (ITE)

Graduates from this program are highly specialized in engineering sciences. They integrate electronics, computation and the fundamental aspects of communications systems, microelectronics, control and instrumentation to develop innovative technologies that provide human beings with a better quality of life, and help to increase organizational competitiveness while ensuring environmental responsibility and commitment.

### Competencies for Graduates:

- Design electronic and computer systems based on digital and analogue systems, microprocessors, programmable devices and integrated circuits, with optimal characteristics regarding speed, reliability and energy efficiency.
- Implement electronic and computer systems using state-of-the-art computer tools and languages, focused on embedded and reconfigurable systems for applications in the diverse fields of electronics.
- Verify and validate the electronic and computer systems developed, using standardized testing methodologies.
- Identify and develop business opportunities in electronics-related areas of application.
- Work in an interdisciplinary manner on the design, evaluation, construction and integration of innovative electronic systems for applications in healthcare, modern communications systems, control and instrumentation of processes and entertainment, among others, to solve industry-and society-specific issues.

## ITE B.S. Electronic and Computer Engineering Edition 2011

Remedial Semester			C	L	U	Fifth Semester			C	L	U
F1001	Introduction to Physics		3	0	8	EC1010	Economy to Business Creation		3	0	8
H1001	Remedial English I		5	0	8	F2006	Optics and Modern Physics		3	0	8
H1002	Remedial English II		5	0	8	MA3002	Advanced Mathematics		3	0	8
H1003	Remedial English III		5	0	8	TC1018	Data Structures		3	0	8
H1004	Remedial English IV		5	0	8	TC2018	Introduction to Networks		3	1	8
H1005	Remedial English V		5	0	8	TE1003	Electronics		3	0	8
H1015	Spanish Composition		5	0	8				<b>18</b>	<b>1</b>	<b>48</b>
MA1001	Introduction to Mathematics		6	0	16	Sixth Semester			C	L	U
TC1001	Introduction to Computer Science		3	0	8	EM1005	Entrepreneurship		3	0	8
			<b>42</b>	<b>0</b>	<b>80</b>	TC2022	Network Interconnection		3	1	8
First Semester			C	L	U	TE2023	Microcontrollers		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	TE2024	Microcontroller Laboratory		0	3	4
F1002	Physics I		3	1	8	TE2033	Applied Electronics		3	0	8
H1016	Foreign Language		5	0	8	TE2034	Integral Electronics Laboratory		0	3	4
MA1015	Mathematics I		3	0	8	TE2035	Analysis of Signals and Systems		3	0	8
Q1001	Chemistry		3	0	8				<b>15</b>	<b>7</b>	<b>48</b>
TC1014	Programming Fundamentals		3	0	8	Seventh Semester			C	L	U
TE1017	Introduction to Electronic and Computer Engineering		3	0	4	MR2004	Control Engineering		3	0	8
			<b>23</b>	<b>1</b>	<b>52</b>	TC2008	Operating Systems		3	1	8
Second Semester			C	L	U	TE2019	Digital Signal Processing Laboratory		0	3	4
F1003	Physics II		3	1	8	TE2038	Computer Equipment Interfaces		3	1	8
H1040	Analysis and Verbal Expression		5	0	8	TE2040	Digital Signal Processing		3	0	8
HS2000	Humanities and Fine Arts		3	0	8	VA2010	Topics I		3	0	8
MA1017	Mathematics II		3	0	8	VA2011	Topics II		3	0	8
Q1004	Chemistry Laboratory		0	3	4				<b>18</b>	<b>5</b>	<b>52</b>
TC2016	Object Oriented Programming		3	0	8	Eighth Semester			C	L	U
TE1010	Digital Systems		3	1	8	HS2005	Citizenship		3	0	8
			<b>20</b>	<b>5</b>	<b>52</b>	MR3028	Control Engineering Laboratory		0	3	4
Third Semester			C	L	U	TE3032	Digital Communications		3	0	8
H1018	Ethics, Self and Society		3	0	8	TE3059	Embedded Systems		3	0	8
MA2009	Mathematics III		3	0	8	TE3060	Embedded Systems Laboratory		0	3	4
MA2010	Differential Equations		3	0	8	VA2012	Topics III		3	0	8
TE1002	Electrical Circuits I		3	0	8	VA2013	Topics IV		3	0	8
TE1011	Digital Systems Laboratory		0	3	4				<b>15</b>	<b>6</b>	<b>48</b>
TE2030	Advanced Digital Systems		3	0	8	Ninth Semester			C	L	U
			<b>15</b>	<b>3</b>	<b>44</b>	HS2006	Applied Ethics		3	0	8
Fourth Semester			C	L	U	IN2025	Project Evaluation and Management		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	TE3038	Communications Systems Laboratory		0	3	4
M2025	Numerical Methods in Engineering		3	0	8	TE3062	Integral Electronic Technologies Project		3	0	8
MA1006	Probability and Statistics		3	0	8	TE3064	Introduction to Professional Development		2	0	2
TE1014	Electric Circuits and Measurements Laboratory		0	3	4	VA2014	Topics V		3	0	8
TE2005	Electromagnetic Fields		3	0	8	VA2015	Topics VI		3	0	8
TE2031	Computer Architecture		3	1	8				<b>17</b>	<b>3</b>	<b>46</b>
TE2032	Electrical Circuits II		3	0	8						

C Number of class hours per week

L Number of laboratory hours or activities per week

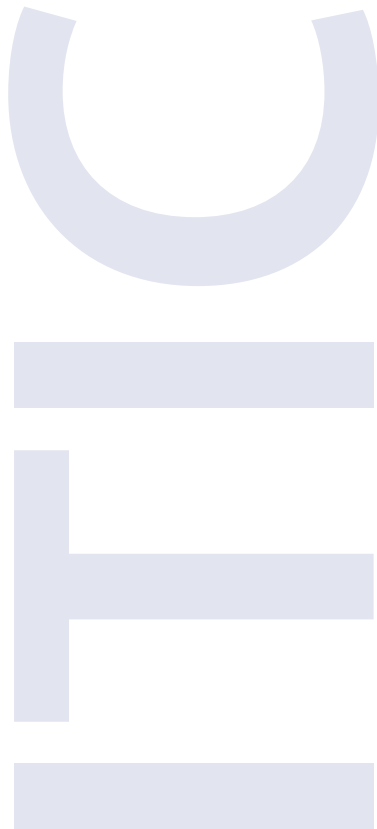
U Study hours that must be dedicated to the course (class hours included)

## B.S. Information and Communication Technologies (ITIC)

Graduates from this program are specialists in the design, implementation and management of the IT infrastructure required by all organizations in order to be competitive. Their in-depth knowledge of computation, informatics and electronics enables them to generate and implement architecture to represent, create, store, process and distribute information in a safe, sustainable manner inside and outside the organization.

### Competencies for Graduates:

- Design the efficient, safe architecture of technological infrastructure, planning its growth to guarantee operational continuity and the fulfillment of organizational goals.
- Manage and lead technological infrastructure design and implementation projects, interacting efficiently in multidisciplinary teams.
- Participate in the development of IT applications in which computation and electronics are integrated to provide innovative automation solutions.
- Analyze the local and global impact of information technologies on individuals, organizations and society in order to guide their services with a sense of responsibility and ethics when evaluating ethical dilemmas related to their personal lives, profession and environment.



## ITIC B.S. Information and Communication Technologies Edition 2011

<b>Remedial Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Fifth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
F1001	Introduction to Physics		3	0	8	HS2000	Humanities and Fine Arts		3	0	8
H1001	Remedial English I		5	0	8	MA1019	Linear Algebra		3	0	8
H1002	Remedial English II		5	0	8	TC2008	Operating Systems		3	1	8
H1003	Remedial English III		5	0	8	TC2019	Numerical Methods in Engineering		3	0	8
H1004	Remedial English IV		5	0	8	TC2022	Network Interconnection		3	1	8
H1005	Remedial English V		5	0	8	TE1003	Electronics		3	0	8
H1015	Spanish Composition		5	0	8				<b>18</b>	<b>2</b>	<b>48</b>
MA1001	Introduction to Mathematics		6	0	16	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
TC1001	Introduction to Computer Science		3	0	8	EM1005	Entrepreneurship		3	0	8
			<b>42</b>	<b>0</b>	<b>80</b>	TC2023	Automation and Domotics Project		3	0	8
<b>First Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	TC3046	Advanced Networks		3	3	12
DS1003	Natural Sciences and Sustainable Development		3	0	8	TE2023	Microcontrollers		3	0	8
F1002	Physics I		3	1	8	TI2002	Business Process Management		3	0	8
H1016	Foreign Language		5	0	8	TI2011	Project Evaluation and Management		3	0	8
MA1015	Mathematics I		3	0	8				<b>18</b>	<b>3</b>	<b>52</b>
TC1003	Discrete Mathematics		3	0	8	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
TC1014	Programming Fundamentals		3	0	8	HS2005	Citizenship		3	0	8
TC1024	Introduction to Information and Communication Technologies		3	0	4	TC2007	Quantitative Methods and Simulation		3	0	8
			<b>23</b>	<b>1</b>	<b>52</b>	TC2020	Computational Mathematics		3	0	8
<b>Second Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	TC2026	Web Applications Development		3	1	8
AD1005	Management and Business Model Innovation		3	0	8	TC3047	System Server Administration		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	TI3032	Enterprise Information Systems		3	1	8
MA1017	Mathematics II		3	0	8				<b>18</b>	<b>2</b>	<b>48</b>
TC1015	Introduction to Interactive Design		3	0	8	<b>Eighth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
TC1016	Computer Organization		3	1	8	TC2027	Computer and Information Security		3	1	8
TC2016	Object Oriented Programming		3	0	8	TC3011	Management of IT Services		3	0	8
			<b>20</b>	<b>1</b>	<b>48</b>	TC3051	IT Business Architectures		3	0	8
<b>Third Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	TC3052	Web Application Development Laboratory		0	3	4
F1005	Electricity and Magnetism		3	1	8	VA2010	Topics I		3	0	8
H1018	Ethics, Self and Society		3	0	8	VA2011	Topics II		3	0	8
MA2009	Mathematics III		3	0	8	VA2012	Topics III		3	0	8
TC1018	Data Structures		3	0	8				<b>18</b>	<b>4</b>	<b>52</b>
TC1019	Introduction to Software Engineering		3	0	8	<b>Ninth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
TE1010	Digital Systems		3	1	8	HS2006	Applied Ethics		3	0	8
			<b>18</b>	<b>2</b>	<b>48</b>	TC3053	IT Architecture Capstone Project		3	0	8
<b>Fourth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	TC3055	Advanced Computer and Information Security		3	1	8
H2001	Verbal Expression in the Workplace		3	0	8	TI3035	Introduction to Professional Development		2	0	2
MA1006	Probability and Statistics		3	0	8	VA2013	Topics IV		3	0	8
TC1020	Databases		3	0	8	VA2014	Topics V		3	0	8
TC1021	Videogame Development Project		3	0	8	VA2015	Topics VI		3	0	8
TC2018	Introduction to Networks		3	1	8				<b>20</b>	<b>1</b>	<b>50</b>
TE1012	Electric Circuits		3	0	8						
			<b>18</b>	<b>1</b>	<b>48</b>						

C Number of class hours per week

L Number of laboratory hours or activities per week

U Study hours that must be dedicated to the course (class hours included)

## B.S. Telecommunications and Electronic Systems (ITS)

Graduates from this program are professionals who analyze, define and develop products, processes and devices with microelectronic components, which offer innovative solutions in the areas of telecommunications, such as data networks, personal and multimedia communication, audio, video, network infrastructure digital data processing.

### Competencies for Graduates:

- Create cutting-edge electronic applications, such as cell phones, portable music and video players, high-definition television, acoustic systems and digital products (game consoles, computers, controls and PDAs, among others).
- Process video images, audio or data for biometrics, tracking and locating applications.
- Transform data into digital formats, such as MP3, MP4, AVI, Blu-Ray and DLDVD, among others, to facilitate their remote transmission, storage and protection.
- Design and construct personal, corporate, public and industrial networks for voice, data and video transmission using technologies such as WiFi, Bluetooth, WiMAX, 4G, GPS and satellite, among others.
- Design, construct and maintain innovative electronic systems that include microelectronic devices.
- Analyze, design and implement telecommunications infrastructure –wired or wireless remote communication– and electronics infrastructure, using computer tools and instrumentation equipment.



## ITS B.S. Telecommunications and Electronic Systems Edition 2011

<b>Remedial Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	<b>Fifth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
F1001	Introduction to Physics		3	0	8	EC1010	Economy to Business Creation		3	0	8
H1001	Remedial English I		5	0	8	TE2005	Electromagnetic Fields		3	0	8
H1002	Remedial English II		5	0	8	TE2023	Microcontrollers		3	0	8
H1003	Remedial English III		5	0	8	TE2024	Microcontroller Laboratory		0	3	4
H1004	Remedial English IV		5	0	8	TE2033	Applied Electronics		3	0	8
H1005	Remedial English V		5	0	8	TE2034	Integral Electronics Laboratory		0	3	4
H1015	Spanish Composition		5	0	8	TE2035	Analysis of Signals and Systems		3	0	8
MA1001	Introduction to Mathematics		6	0	16				<b>15</b>	<b>6</b>	<b>48</b>
TC1001	Introduction to Computer Science		3	0	8	<b>Sixth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>42</b>	<b>0</b>	<b>80</b>	EM1005	Entrepreneurship		3	0	8
<b>First Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	F2006	Optics and Modern Physics		3	0	8
DS1003	Natural Sciences and Sustainable Development		3	0	8	MA2007	Random Processes		3	0	8
F1002	Physics I		3	1	8	TE2019	Digital Signal Processing Laboratory		0	3	4
H1016	Foreign Language		5	0	8	TE2037	Semiconductors		3	0	8
MA1015	Mathematics I		3	0	8	TE2040	Digital Signal Processing		3	0	8
Q1001	Chemistry		3	0	8	TE3007	Transmission Media		3	0	8
TC1014	Programming Fundamentals		3	0	8				<b>18</b>	<b>3</b>	<b>52</b>
TE1016	Introduction to Telecommunications Engineering		3	0	4	<b>Seventh Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>23</b>	<b>1</b>	<b>52</b>	HS2005	Citizenship		3	0	8
<b>Second Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	TC2022	Network Interconnection		3	1	8
F1003	Physics II		3	1	8	TE3032	Digital Communications		3	0	8
H1040	Analysis and Verbal Expression		5	0	8	TE3034	Microelectronics		3	0	8
MA1017	Mathematics II		3	0	8	TE3054	Engineering Project Laboratory I		0	3	4
Q1004	Chemistry Laboratory		0	3	4	TE3055	Embedded Systems for Telecommunications Laboratory		0	3	4
TC2016	Object Oriented Programming		3	0	8	TE3056	Embedded Systems for Telecommunications		3	0	8
TE1002	Electrical Circuits I		3	0	8				<b>15</b>	<b>7</b>	<b>48</b>
TE1010	Digital Systems		3	1	8	<b>Eighth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>20</b>	<b>5</b>	<b>52</b>	MR2004	Control Engineering		3	0	8
<b>Third Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	TE3036	Wireless Communications		3	0	8
H1018	Ethics, Self and Society		3	0	8	TE3038	Communications Systems Laboratory		0	3	4
HS2000	Humanities and Fine Arts		3	0	8	TE3057	Wireless Communications Laboratory		0	3	4
MA2009	Mathematics III		3	0	8	TE3058	Engineering Project Laboratory II		0	3	4
MA2010	Differential Equations		3	0	8	VA2010	Topics I		3	0	8
TE1014	Electric Circuits and Measurements Laboratory		0	3	4	VA2011	Topics II		3	0	8
TE2030	Advanced Digital Systems		3	0	8				<b>12</b>	<b>9</b>	<b>44</b>
TE2032	Electrical Circuits II		3	0	8	<b>Ninth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>
			<b>18</b>	<b>3</b>	<b>52</b>	HS2006	Applied Ethics		3	0	8
<b>Fourth Semester</b>			<b>C</b>	<b>L</b>	<b>U</b>	IN2025	Project Evaluation and Management		3	0	8
H2001	Verbal Expression in the Workplace		3	0	8	TE3062	Integral Electronic Technologies Project		3	0	8
M2025	Numerical Methods in Engineering		3	0	8	TE3063	Telecommunication Networks		3	0	8
MA1006	Probability and Statistics		3	0	8	TE3064	Introduction to Professional Development		2	0	2
MA3002	Advanced Mathematics		3	0	8	VA2012	Topics III		3	0	8
TC2018	Introduction to Networks		3	1	8	VA2013	Topics IV		3	0	8
TE1003	Electronics		3	0	8				<b>20</b>	<b>0</b>	<b>50</b>
TE1011	Digital Systems Laboratory		0	3	4						
			<b>18</b>	<b>4</b>	<b>52</b>						

C Number of class hours per week

L Number of laboratory hours or activities per week

U Study hours that must be dedicated to the course (class hours included)





## Course content by academic discipline

This section presents the general description of the courses that make up the undergraduate curricula offered by Tecnológico de Monterrey, ordered by academic discipline. This information is also available on the website of the Vice Rector for Academic Regulations at ([http://sitios.itesm.mx/va/planes\\_de\\_estudio/](http://sitios.itesm.mx/va/planes_de_estudio/)) following the menu options: Planes de estudio / Profesional

### A

### Art

#### **A1000 Form Exploration Workshop I**

**(4 - 0 - 8. Prerequisites:** [DL1004, A2000, AT1001]. 3 LAD11)

**Equivalence:** None

The aim of this basic art course is to explore figurative and realistic sculptural forms. The main topics studied are the total and partial human body, and art object, with diverse raw and industrialized materials. The students' artistic visualization, fluid interpretation and personal expressiveness will be primordial aspects of the formal sculptural exploration promoted at this level. This course requires prior knowledge of basic composition and drawing of the human figure. Learning outcome: students will create an original work in small format, models and virtual media for the larger format. Individual work will be exhibited museologically on the campus.

**General objective:** Upon completion of this course, students will be able to express the aesthetics of shape in their own sculpturic projects, with conceptual fluidity and plastic attributes. Students will learn about modeling techniques with traditional and innovative materials in order to enrich their perspective of the art of sculpture and to start on the path to finding their own styles. Students will also be able to develop smaller-scale sculptures with pure and mixed techniques, focused on the profession of animation, alternately using the abstract and realistic languages of plastic arts.

**Key words:** Stylization. Form. Conceptualization process. Semiotics of sculptural forms. Plastic influences. Character design. Anthropomorphism.

**Bibliography:** \* Simblet, Sarah., Anatomía para el artista / Sarah Simblet ; fotografía John Davis., Barcelona : Blume, 2002., spaeng, [8480764309], [9788480764308].

#### **A1001 Contemporary Visual Culture and Design**

**(3 - 0 - 8. Prerequisites:** None. 3 LCMD11, 4 LPM12)  
**Equivalence:** None

This introductory course surveys the development of visual culture and design in the twentieth century, with particular attention focused on their relationship with other major art and design movements in the context of political, scientific, and cultural developments that occurred throughout modern history. No previous knowledge required. The student will study literature and authors in order to solve quizzes and written exams. At the end of the term, the student will produce, using basic media equipment and software, a design proposal that fuses various design currents and styles for a specific functional purpose defined by the instructor.

**General objective:** Upon completion of this course, students will understand distinctions on the effectiveness of texts and expressions of visual culture in commercial and art environments, within the framework of aesthetic and ideological discourses from which they emerged; identifying the main authors and works reviewed.

**Key words:** Importance of contemporary visual culture and design. Modernism and the Artistic forefronts. Visual culture, design, popular culture, and national identity. Visual culture, design, digital media,

and information society. Postmodernism and retro design.

**Bibliography:** \* Helfand, Jessica., Screen : essays on graphic design, new media, and visual culture / Jessica Helfand, ; [introduction by John Maeda], 1st ed., New York : Princeton Architectural Press, 2001., [1568983107].

## A1002 Aesthetics

( 3 - 0 - 8. Prerequisites: None. 5 LAD11 )

**Equivalence: None**

The purpose of this basic-level art course is to provide students with the tools for learning and understanding the subjective value of artistic work within and outside of the specialized record of museums, theaters and books as well as in the public sphere of the street and the plaza. No previous knowledge required. The learning outcome of this course is for students to add and justify esthetic criteria in original productions and to be able to analyze works and trends in contemporary art using esthetic criteria.

**General objective:** Students will study art theory in depth, recognizing it as an area of knowledge that facilitates and provides input for conceptual argumentation in art works. Students will be familiar with the classical discourse and precepts of aesthetics, its philosophical roots and the contemporary theoretical trends.

**Key words:** Stylization. Game aesthetics. Aesthetics of images in motion. Aesthetics of nature. Aesthetics of objects. Kitsch. Naive. Emotional geometry. Prismatic aesthetics. Graffiti. Contemporary aesthetics.

**Bibliography:** \* MediaArtHistories / edited by Oliver Grau., Cambridge, Mass. : MIT Press, c2007., [0262072793 (papel alcalino)], [9780262072793 (papel alcalino)].

## A2001 Form Exploration Workshop II

( 4 - 0 - 8. Prerequisites: [ A1000 ]. 4 LAD11 )

**Equivalence: None**

Intermediate art course that focuses on exploring the sculptural form of installations and scenery, real and virtual ephemeral architecture, highlighting abstract topics, and the handling of industrial materials for mounting sculptures and scenery on a scale of one to one. This course requires prior knowledge and a command of the concepts of art form. Learning outcome: students will create a scene, specifying dimensions, materials, lighting, components, considering the perception of the target audience. They will also conceptualize, design and create a space where the production will take place (animation, scenery, etc.).

**General objective:** Upon completion of this course, students will be able to express the sculptural form in exhibitions and displays, with conceptual fluidity, plastic attributes, and technological solvency. Students will learn about mounting and simulation techniques with traditional and innovative materials, in order to enrich their personal perspectives of three-dimensional art and to facilitate their ability to design virtual environments. Students will also learn to use concepts of duality between form and space, the polyvalent concept of meaning, time, and application of the sculptural space.

**Key words:** Installation. Stop motion. Perception. Descriptive geometry. Art object. Scenic design. Conceptualization of space. Art space. Scale model. Architectural perspective.

**Bibliography:** \* Brierton, Tom, 1957-, Stop-motion puppet sculpting : a manual of foam injection, build-up, and finishing techniques / Tom Brierton, Jefferson, N.C. : McFarland & Co., c2004., North Carolina, c2004., eng, [0786418737 (rústica : papel alcalino)], [9780786418732 (rústica : papel alcalino)].

## AD Management

### AD1005 Management and Business Model Innovation

( 3 - 0 - 8. Prerequisites: None. 3 IBN11, 1 IMI11, 1 INT11, 2 ISC11, 2 ITC11, 2 ITIC11, 1 LAE11, 1 LAF11, 1 LCDE11, 1 LCMD11, 1 LCPF11, 1 LCS11, 1 LDN11, 1 LEM11, 1 LIN11, 1 LLN11, 1 LMC11, 1 LMI11, 1 LP 12, 1 LPL11, 1 LPM12, 1 LPO11, 1 LPS12, 1 LRI11 )  
**Equivalence:** AD1000

This is a basic course in the field of business studies. It has no previous requirements and introduces students to the field of management and innovation of business models from a current perspective, where innovation and technology are critical in identifying and generating the key elements of the business model. As a result of this learning students will be able to analyze the case of a real company and identify the business model and elements of the strategic processes involved. Teamwork is requested as well as submission of a document which provides the strategic analysis of the business model involved so that this document can be included in a case study competition.

**General objective:** The student will be able to analyze and identify how the strategies for the management and business model innovation generate value in organizations. Students should also be able to understand the role of technology in order to respond with greater strategic flexibility to the ever-changing business environment.

**Key words:** Innovation in contemporary management processes. Innovation as key success factor. Management and innovation in business models. Information technology as a key success factor.

**Bibliography:** \* Richard L. Daft y Dorothy Marcic, Introducción a la Administración, Sexta, CENGAGE Learning, Español, [9786074810325].

### AD1006 Organizational Learning and Knowledge Management

( 3 - 0 - 8. Prerequisites: None. 2 LAE11, 3 LAF11, 2 LCDE11, 2 LDN11, 2 LEM11, 2 LLN11, 3 LP 12, 2 LPO11, 3 LPS12 )  
**Equivalence:** AD1002

This is a basic course in the area of management that enables students to get an innovative point of view that let them identify the process of organizational learning and knowledge management systems as key elements for the development of organizations. It requires prior knowledge of management. As a learning outcome students are expected to solve cases on the themes discussed.

**General objective:** At the end of the course the student will be able to understand how permanent learning brings out the skills and attitudes of employees to facilitate high-performance teamwork so as to generate competitive advantages by the organization. Also he will be able to draw up proposals to support decision making and analyze how to manage knowledge in learning organizations.

**Key words:** Knowledge management.

**Bibliography:** \* Dalkir, Kimiz., Knowledge management in theory and practice / Kimiz Dalkir ; foreword by Jay Liebowitz., 2nd ed., Cambridge, Mass. : MIT Press, c2011., [9780262015080 (hardcover : alk. paper)].

### AD1007 Introduction to the Business Administration Academic Program

( 3 - 0 - 4. Prerequisites: None. 1 LAE11 )  
**Equivalence:** None

The purpose of this basic course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also gen-

erate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Código de ética del licenciado en administración / Colegio Nacional de Licenciados en Administración., 7a ed., México : ECAFSA : Thomson Learning, 2000., [9687681012].

### AD1008 Introduction to Business Direction and Innovation Academic Program

( 3 - 0 - 4. Prerequisites: None. 1 LDN11 )

**Equivalence: None**

Basic level course focused on introducing the students to university life and the career in which they are enrolled. It does not require any previous knowledge. As a result of the learning process it is expected of the students to attain a clear vision of the career and the institution in which they are being enrolled. Also, they will generate an academic and professional life and career plan.

**General objective:** Upon completion of this course, students will be familiar with the graduate characteristics from the major in which they are enrolled, including competencies, career field and professional development. They will also know the organizational structure of the Tecnológico de Monterrey as well as its principal rules and regulations.

**Key words:** Innovation. Business management. Business strategy.

### AD1009 Business Creativity Lab and Workshop

( 0 - 3 - 4. Prerequisites: None. 4 LDN11 )

**Equivalence: None**

Basic course which focuses on enabling the students to learn to detect business opportunities using methodologies that encourage creativity and innovation, whether for starting their own business or for generating a new and different economic activity in an already operating firm. As learning program students will use databases and sources of information to strengthen the preliminary design of a business idea.

**General objective:** Upon completion of this course, students will be able to visualize a variety of opportunities and ideas for starting a business or for creating new businesses from already existing firms using electronic information, business databases, the technological observatory of the Institute and other creative and technological tools, in order to generate ideas and to identify strategic business opportunities.

**Key words:** Business creation. Business opportunities. Business innovation.

**Bibliography:** \* Robinson, Alan G., Creatividad empresarial : un nuevo concepto de mejoramiento e innovación corporativos / Alan G. Robinson y Sam Stern ; traducción Jorge Abenamar Suárez Arana., México : Prentice Hall : Pearson Educación : Addison Wesley, c2000., spaeng, [9701703561].

### AD2011 Innovation, Markets and Technological Development

( 3 - 0 - 8. Prerequisites: None. 7 IBN11, 6 LAE11, 4 LAF11, 4 LCDE11, 5 LEM11, 6 LIN11, 5 LLN11, 6 LMC11, 6 LPM12, 6 LPO11 )

**Equivalence: DE2001, EM3001**

This is an intermediate level course in the area of business that seeks to help the student identify, through prospecting processes of analysis of technology and life cycle of the industry, the impact of technological development on the markets, the changes generated on consumer needs, and the opportunities to create value. Through this, the course is aimed in

understanding the process and dynamics of innovation in the markets, the impact of technology on this innovation, identify business opportunities, and ways from which organizations can create, deliver and capture value of innovation. The course requires prior knowledge of marketing and administration. As a result of this learning the student is expected to resolve cases to identify the changes that have been generated due to technological development in products and/or services, consumer needs and business models, as well as identifying opportunities from the perspective of marketing and technology.

**General objective:** Upon graduation, students will be able to analyze and understand the impact of technological development on the dynamics of markets and industries; understand the process of innovation and the identification of market opportunities; understand design thinking knowledge for value creation; identify the necessary elements of a business model to take advantage of market opportunities; develop an innovation strategy that allows them to integrate technology, the market and its industrial context.

**Key words:** Technological innovation. Market intelligence. Analysis and identification of megatrends and opportunities. Technological development and its impact on business models.

**Bibliography:** \* Dogson, Mark; Gann, David; Salter, Ammon, Think, Play, Do: Technology, Innovation and Organization, [0199268096].

**AD2012 Business Strategic Foresight**  
( 3 - 0 - 8. Prerequisites: [ CD2006 , DL3016 ]. 5 LAE11, 9 LDI11 )  
**Equivalence: None**

This is an intermediate course in the field of administration that seeks to provide students with an overview of Strategic Foresight as a tool for decision-making process. It emphasizes the importance and validity of prospective studies as tools to identify business opportunities through the creation and analysis of future scenarios. It require previous knowledge of economics and statistical methods. As a result of learning the student is expected to build a portfolio of business opportunities.

**General objective:** Upon graduation, students will be able to: Understand the basics of the Foresight and Strategy. Know and use essential tools to elaborate prospective and strategic models. Know the instrumental aspects and scopes of foresight and strategy. Build future scenarios for both industries and for organizations. Develop strategies and solutions to the problems of the organization.

**Key words:** Business strategy. Strategic foresight. Construction and analysis of scenarios.

### **AD2013 Project and Process Strategic Management**

( 3 - 0 - 8. Prerequisites: None. 7 LAE11, 8 LAF11, 7 LCDE11, 6 LCPF11, 8 LIN11, 7 LLN11 )

**Equivalence: None**

This is a mid-level course in the area of management that pretends to introduce the student in the design, management and optimization of the process and projects in the organizations. The course requires previews knowledge in management of the productive chain. After taking this course the student is expected to understand and apply its knowledge in process management and with it develop a project that may serve to certify him in the Certified Associate (CAPM) in Project Management Institute (PMI).

**General objective:** At the end of the course the student will be able to analyze the importance of the administration of process; align the operation and administration of process with the global strategy of the company; analyze the role of the effective project administration through the analysis of the control methods (time and quality of the project), the impact analysis in the cost and the risk valuation en the improvement of the organization.

**Key words:** Project management. Process modeling.



## AD2014 Business in the Industry of Music and Entertainment

( 3 - 0 - 8. Prerequisites: None. 7 IMI11, 7 LAD11 )  
Equivalence: AD3016

In this business course students will learn how to identify, using prospective and megatrend analysis processes, the impact of technological development on markets and the changes that are generated in the needs of musical and entertainment production consumers. Therefore, the course will focus on the detection of business opportunities through the identification of products and services that, thanks to innovative models, will generate value for musical and entertainment production consumers. It requires prior knowledge of marketing and business administration. The learning outcome for this course is that the students will be able to solve cases in which they identify any changes that have been generated in business models, products and/or services, consumer needs as a result of changes resulting from the manner in which musical productions are produced and consumed.

**General objective:** Students will be able to analyze the environment of the music and entertainment industry, its key players in Mexico and the world and the way in which its evolution and transformation generates new business opportunities through innovative models; understand the concept of business model and how to apply it in the music and entertainment industry; understand the concept of intellectual property and its application in the music and entertainment industry; understand the environment and the implications of the different distribution channels, as well as electronic commerce in the music and entertainment industry; develop and negotiate agreements and contracts, with total adherence to the laws and regulations protecting intellectual property.

**Key words:** Business model design in the music industry. Business model design in the entertainment industry. Distribution and marketing in the music industry. Distribution and marketing in the entertainment industry. Intellectual property and regulatory organisms in the music industry and entertainment.

**Bibliography:** \* Osterwalder, Alexander., Business model generation : a handbook for visionaries, game changers, and challengers / written by Alexander Osterwalder and Yves Pigneur ; design, Alan Smith ; editor and contributing co-author, Tim Clark ; production, Patrick van der Pijl ; co-cre, [Amsterdam, The Netherlands] : Alexander Osterwalder & Yves Pigneur, c2009., [9782839905800].

## AD2015 International Commercial Law and Policies

( 3 - 0 - 8. Prerequisites: [ NI1002 ]. 6 LDN11 )  
Equivalence: None

Intermediate course in the study of businesses which will strengthen the vision of the student with regards to the possibilities of Mexican firms and products taking advantage of international trade, learning and assimilating Mexican trade regulations and also those of its major trade partners. Require prior knowledge of negotiation skills and international marketing. As learning program students are expected to resolve cases in which they analyze Mexico's foreign trade regulations and customs and the international terms of sale.

**General objective:** Upon completion of this course, students will be able to understand Mexican law regarding foreign trade as well as customs, and the international commercial terms for trading, including prices, distribution logistics, financial operations, and the commercial law of Mexico's major international trade partners.

**Key words:** International trade. Mexican regulations. Marketing techniques. International trading.

**Bibliography:** \* Witker, Jorge., Régimen jurídico de comercio exterior : Volumen ajustado al Nuevo Programa Reformado en 2010/ Jorge Witker y Joaquín Piña., 1a ed., México : Instituto de Investigaciones Jurídicas, Universidad Nacional Autónoma de México, 2010., [9786070033902].

## AD2016 Innovation Project on Human Capital Development

( 3 - 0 - 8. Prerequisites: None. 6 LDN11 )

**Equivalence: None**

Intermediate course in the field of business studies that requires prior knowledge of negotiation skills and international marketing. As a result of this learning program students will carry out a project through which they will understand and learn to install an improvement program related to the development of competencies, abilities and profiles of the human resource within a firm currently in existence in the region, generating benefits in the fulfillment of the organizational objectives and goals of the personnel occupying middle-management and managerial positions.

**General objective:** Upon completion of this course, students will be able to implement a new program or model regarding the management of human capital and resources within a regional enterprise, which might improve the productivity and efficiency of the organization, and might at the same time, develop talent for the growth of its middle management and high directive positions.

**Key words:** International trading. Negotiation techniques. Human resources.

**Bibliography:** \* Werther, William B., Administración de recursos humanos : el capital humano de las empresas / William B. Werther, Jr., Keith Davis ; traducción y adaptación de Joaquín Mejía Gómez., 6a ed., en español., México, D. F. : Mc Graw Hill, 2008., spaeng, [9701059131],[9789701059135].

## AD2017 Innovation Project on Enterprise Strategy

( 3 - 0 - 8. Prerequisites: None. 7 LDN11 )

**Equivalence: None**

This is an intermediate course in the study of business innovation processes that requires prior knowledge of negotiation skills and international marketing. As a result of the learning program students will understand and learn to install a strategic project that strengthens the operations of an already exist-

ing firm in the region and translates into tangible benefits in any of its major functional areas, such as management, finance, production or commercialization.

**General objective:** Upon completion of this course, students will be able to implement a new program or model regarding the financial, commercial, operational or managerial strategy within a regional enterprise, which might improve the economic results of the business or its opportunities for growth and expansion.

**Key words:** Strategic execution plan . Business strategies. Strategic project. Business strategic planning. Value generation. Business competitive advantages.

**Bibliography:** \*Thompson, Arthur A., 1940-, Crafting and executing strategy : the quest for competitive advantage : concepts and cases / Arthur A. Thompson, A. J. Strickland III, John E. Gamble., 16th ed., New York, N.Y. ; México : McGraw-Hill/Irwin, 2008., [0071285903 (ed. internacional)], [0073381241 (ed. internacional)], [9780071285902 (rústica)], [9780073381244 (rústica)].

## AD2018 Innovation Project on Business Processes

( 3 - 0 - 8. Prerequisites: None. 5 LDN11 )

**Equivalence: None**

Intermediate course in the field of business studies that requires prior knowledge of negotiation skills and international marketing. As part of the learning program students will learn to install an improvement program within the operation of currently existing firms, in any of their major functional areas, generating benefits in times, costs, market penetration or customer service.

**General objective:** Upon completion of this course, students will be able to implement a new program or model regarding a process or activity within a regional enterprise, which might improve the operation of said functional activity, whether it be of an industrial, commercial or services class, guaranteeing cost efficiency and satisfaction of internal and external customers.



**Key words:** Business innovation. Business processes. Functional areas.

## AD2019 Business Incubator Lab and Workshop

( 0 - 3 - 4. Prerequisites: [ AD1009 ]. 6 LDN11 )

**Equivalence:** None

Intermediate level course that requires knowledge of creativity, innovation, information data bases where the students deepen their knowledge regarding the professionalization, institutionalization and corporate governance of a family business, in order to allow him to understand how to generate new businesses in accordance to policies and rules that are in line with the equity structure and with the roles and objectives of family members in the business. As learning program students will designs a family business and develops policies to institutionalize and corporate governance for the company.

**General objective:** Upon completion of this course, students will be able to develop a business plan for a new enterprise project, which includes all the functional disciplines of a business, and having access at all times to the tutoring, tools and methodology of the business incubator of the Institute.

**Key words:** Business plan. Business Incubation.

**Bibliography:** \* Barringer, Bruce R., Preparing effective business plans : an entrepreneurial approach / Bruce R. Barringer., Upper Saddle River, N.J. : Pearson Prentice Hall, c2009., [0132318326].

## AD2020 Family Business Lab and Workshop

( 0 - 3 - 4. Prerequisites: [ AD2019 ]. 8 LDN11 )

**Equivalence:** None

Intermediate level course that requires knowledge of creativity, innovation, information data bases where the students deepen their knowledge regarding the professionalization, institutionalization and corporate governance of a family business, in order to allow him to understand how to generate new businesses in accordance to policies

and rules that are in line with the equity structure and with the roles and objectives of family members in the business. As learning program students will designs a family business and develops policies to institutionalize and corporate governance for the company.

**General objective:** Upon completion of this course, students will be able to generate the institutionalization and corporate governance policies of a family business, as well as design a new business derived from said family business, documenting the business plan accordingly for the new enterprise.

**Key words:** Family business. New businesses. Corporate government.

**Bibliography:** \* Belausteguigoitia Rius, Imanol., Empresas familiares : su dinámica, equilibrio y consolidación / Imanol Belausteguigoitia Rius., 2a ed., México, D.F. : McGraw-Hill, c2010., [9786071502315], [6071502314].

## AD3002 Management Consulting

( 3 - 0 - 8. Prerequisites: [ AD2002 , TI2002 ]. 8 INT11 )

**Equivalence:** AD3022, OR00892, OR3003

This is an advanced course, considered to be one of the integral courses for students of the Management Degree. It is essential for every businessman and executive to know how to develop an administrative consulting plan. The analytical, conceptual and diagnostic knowledge acquired throughout his or her major will be applied in this course.

**General objective:** Through this course, the student will understand the characteristics of professional management consulting services, as well as the necessary process to develop methodologies of evaluation and diagnosis in order to identify problems and their possible solutions. For this the following topics are suggested: The consultancy industry. Structuring agreements (client consultant). Implementing agreements (client consultant). Learning through experts. Developing consultancy skills. The international context in the consultancy industry.

**Key words:** Statistic models application. Customer service. Management consulting. Consulting costs. Consulting price determination. Consultant development. General framework. Customer proposal presentation. General processes. Professional and legal responsibility. Customer feedback session. Management consulting. Problem identification and problem solving. Evaluation and diagnose methodologies. Methodology. Diagnosis.

**Bibliography:** \* Cohen, William A., 1937-, How to make it big as a consultant / William A. Cohen., 3rd ed., New York : Amacom, 2001., New York, 2001., eng, [0814470734],[9780814470732].

### **AD3017 Family Business and Corporate Governance**

( 3 - 0 - 8. Prerequisites: [ FZ1006 ]. 6 LAE11, 6 LCDE11 )

**Equivalence:** AD3000

It is an advanced level course, in the administration area that pursues students to identify the unique challenges related to a family business in contexts characterized by an intense global competition and learning how to unify efforts to increase the strengths of the company and to count on the capacity to implement successful practices, for present and future performances. Moreover, it establishes how to regulate its operation through family protocols, and prepares the process for successions, with the purpose of protecting and increasing its patrimony, the process to maintain the company's safe legal conditions and maintains one family relations. It requires previous knowledge related to organizational design: innovation; and strategic planning. As a learning product, student generate a document that includes the analyzes of real family businesses, and recommendations to professionalize the company functions. It also requires work groups, problem solving and the elaboration of a proposal of corporative government for a family business.

**General objective:** When finalizing the course the student will be able to propose strategies with leadership and vision to let grow the business. To administer the process of succession of a familiar company; to design and to administer the familiar protocols; to

administer the family and administration advice; to identify opportunities to increase the familiar patrimony.

**Key words:** Family business. Corporate governance.

### **AD3018 Planning Processes and Models**

( 3 - 0 - 8. Prerequisites: None. 6 LAE11, 8 LCS11, 6 LP 12, 6 LPS12 )

**Equivalence:** AD2000

An intermediate level course in the management area, that seeks closely the development of the student with respect to the ability to analyze and evaluate the strategic and operational planning company and institution processes through the understanding of different tools, techniques, and models toward the analysis of the environment and the development of a competitive advantage of an organization. Previous knowledge of marketing, business opportunities scanning tools are required. As a learning product it is expected that the student should develop a report with the displays of the diagnosis of a critical situation of a real business and should provide solutions to strategic issues.

**General objective:** At the end of this course the student will be able to analyze the strategic management process, strategic analysis tools, the determination of key business processes to define the strategic lines, to promote the implementation of the strategic objectives of an organization; use foresight as a way to achieve the strategic objectives of a company.

**Key words:** Strategic management. Industry analysis. Key business. Business strategies.

**Bibliography:** \* Pearce, John A., Strategic management : formulation, implementation, and control / John A. Pearce II, Richard B. Robinson, Jr., 11th ed., Boston : McGraw-Hill Irwin, c2011., [9780073381367 (papel alcalino)], [0073381365 (papel alcalino)].

## AD3019 Organizational Culture and Technological Innovation

( 3 - 0 - 8. Prerequisites: [ RH1000 ]. 7 LAE11 )

Equivalence: None

This is an advanced course in the field of administration which seeks that students know and apply the concepts of organizational culture, innovation, technology and their relevance both in business development and in the achievement of strategic and operational objectives of the organization. The student will analyze technology management in the company as part of its organizational culture, and the application of a set of practices that will allow him to establish a technology strategy consistent with its business plans. Prior knowledge is required of learning, learning styles, intelligent organizations, knowledge management, knowledge cycles, intellectual capital, knowledge economy, knowledge management models. As a result of learning it is expected that the student, through analyzing the case of a real company, develop the strategy so that the company under study assumes technological innovation as the core of the development strategies.

**General objective:** The student will be able to understand that an organizational culture focused towards innovation and technology can become a competitive advantage that differentiates a company from others, where the new culture of working brings about progressively higher productivity with long term sustainability, contributing to the profitability of the organization.

**Key words:** Organizational culture. Leadership. Technological innovation. Cultural change. Strategic innovation.

**Bibliography:** \* Schein, Edgar H., Organizational culture and leadership / Edgar H. Schein., 3rd ed., San Francisco : Jossey-Bass, 2004., [0787968455 (papel alcalino)], [9780787968458 (papel alcalino)].

## AD3020 Design and Organizational Structures

( 3 - 0 - 8. Prerequisites: [ AD3018 ]. 7 LAE11 )

Equivalence: AD2002

It is an advanced course in the business area, which aims that the student should develop an insight into new trends in the design of organizational architecture in order to be able to address competition successfully at all levels (national, regional, international and global) architectural design course. As a result of this learning the student is expected to solve case studies in which he designs structures that strengthen the organizational objectives in order to generate value.

**General objective:** At the end of the course the student will be able to identify the key elements in the design of a flexible, organizational architecture in order to respond to challenges of the business environment, which should be designed to provide both vertical and horizontal information between processes, with the aim of meeting the strategic objectives that add value to the organization. In order to achieve this, the main concepts are considered to be these: the systemic approach of organizational architecture, theories and models of organizational structures, formal authority and command relationships, department divisions, design processes to ensure effective coordination within the organization, horizontal versus vertical aspects of the organization, design and architecture in learning organizations. As a learning product it is expected that the student should be able to analyze cases in which he designs structures that strengthen the objectives of the organization to generate value.

**Key words:** Organizational technology. Organizational design. Organizational environment. Strategic change.

**Bibliography:** \* Franklin Fincowsky, Enrique Benjamín., Organización de empresas / Enrique Benjamín Franklin Fincowsky., 3a ed., México : McGraw-Hill/Interamericana, 2009., [9789701069356].

## AD3022 Administrative Consultancy and Business Intelligence

( 3 - 0 - 8. Prerequisites: [ AD2012 , CD2007 ]. 8 LAE11 )

Equivalence: AD3002

In this advanced business course, the student should understand and implement the activities required to generate organizational change and to achieve the objectives of the organization. Knowledge related to management, organizational behavior, bivariate statistics, financial accounting, operations management, strategic planning, and organizational structures is required. As a learning product, the students will be able to apply the elements of the consultancy process in an organization and use business intelligence tools to provide actionable recommendations that generate value to customers.

**General objective:** This course provides the opportunity to integrate and apply concepts learned in previous semesters. The student learns the elements of the management consulting process, understanding and applying in a real environment, methods of diagnosis, evaluation of administrative processes and business intelligence. This offers students the opportunity to identify problems and / or areas of opportunity in an organization. It is also expected that students will be able to identify solutions and propose feasible recommendations to be implemented by members of the client or company. Statistical techniques, financial tools and intelligence business tools are widely used in the diagnostic process.

**Key words:** Administrative process. Organizational diagnosis and consulting methodologies. Business intelligence.

**Bibliography:** \* Howson, Cindi., Successful business intelligence : secrets to making BI a killer app / Cindi Howson., New York : McGraw-Hill, c2008., [0071498516 (papel alcalino)], [9780071498517 (papel alcalino)].

## AD3023 Innovation in Business Models and Family Business Management

( 3 - 0 - 8. Prerequisites: None. 8 LAE11, 9 LDI11 )

Equivalence: None

It is an advanced level business course, in which the student understands and uses the business model concepts, for the design and analysis of logic and fundamentals of business for the creation, delivery and capture value markets The student will explore the concept of business model which is fundamental to understanding the creation of sources of sustainable competitive advantages in the current context, characterized by rapid change, hyper-competition and the knowledge economy. As a learning product, the student will be able to analyze and evaluate cases identifying the change or changes that have been generated in business models, products and/or services, consumer needs, due to the changes that have occurred.

**General objective:** At the end of this course, students will be able to analyze the elements of a business model, its configuration and relevance to the development of strategic analysis in family businesses in the current context. At the same time they understand and apply design tools and concepts of strategic analysis and innovation for the creation, development and innovation of business models that create value. Students will be able to assess the impact of business model in the management of family businesses.

**Key words:** Innovation process. Business model. Family business management. Strategic decisions.

**Bibliography:** \* Osterwalder, Alexander., Business model generation : a handbook for visionaries, game changers, and challengers / written by Alexander Osterwalder and Yves Pigneur ; design, Alan Smith ; editor and contributing co-author, Tim Clark ; production, Patrick van der Pijl ; co-cre, [Amsterdam, The Netherlands] : Alexander Osterwalder & Yves Pigneur, c2009., [9782839905800].

### AD3024 Planning, Innovation and Strategic Sustainability

( 3 - 0 - 8. Prerequisites: None. 9 LAE11, 9 LAF11, 8 LCDE11, 9 LCPF11, 8 LDI11, 9 LEM11, 9 LIN11, 9 LLN11, 8 LMC11, 9 LPO11 )

**Equivalence: None**

It is an advanced course in the area of management study that integrates knowledge, in which students work in multidisciplinary teams and are able to integrate all the elements required to carry out the development of the strategic planning process in an organization, oriented towards the development of innovation as a strategic component. It requires prior knowledge of statistical methods, marketing and creativity as well as topics related to the impact of technological development in business. As a result of learning it is expected that students will develop in a team project enabling students to create an improvement proposal for the organization analyzed. This proposal should include elements of high impact innovation, through the use of knowledge management systems, creativity and business innovation. Profitable and sustainable proposals should be drawn up for innovation in processes, products, services and/or the construction of business models.

**General objective:** At the end of this course, students will be able to analyze and identify the strategic innovation process as a critical force for generation and organizational growth. They should be aware of the most efficient strategic innovation processes, which, for an organization, may mean the difference between being the market leader with a particular innovative product, process or service. They should recognize the importance of innovation, as a strategic element, in the transformation of organizations.

**Key words:** Profitability. Strategic management. Competitive advantage. Business strategies. Environmental analysis. Strategic planning.

**Bibliography:** \* Charles W. L. Hill, Gareth R. Jones, Strategic management: an integrated approach, 8th ed., Houghton Mifflin Company, [9780618894697].

### AD3025 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 LAE11, 9 LDN11 )

**Equivalence: None**

This is a university course that is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the program. Students will have the opportunity to reflect on the professional stage they are about to start and to explore the available career alternatives. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York: DK Pub., 2003., [0789493551 (papel alcalino)].

### AD3026 Innovation Project on Technology-Based Businesses

( 3 - 0 - 8. Prerequisites: None. 9 LDN11 )

**Equivalence: None**

This is an advanced course in the field of business studies that requires prior knowledge of negotiation skills and international marketing. As a result of the learning program students will understand how to create business projects that greater economic value, taking advantage of driving activities or greater national or international growth, technological innovations and successful experiences in the business world.

**General objective:** Upon completion of this course, students will be able to design a business plan for the creation of an industrial, commercial or services busi-



ness, which might be intensive in the use of information technologies, manufacturing, or industrial and business innovation.

**Key words:** International trading. Negotiation techniques. Technology fundamentals.

**Bibliography:** \* Byers, Thomas (Thomas H.), Technology ventures : from idea to enterprise / Thomas H. Byers, Richard C. Dorf, Andrew J. Nelson., 3rd ed., Dubuque, Iowa : McGraw-Hill, 2010., [9780073380186 (papel alcalino)].

### **AD3027 Innovation Project on Regional Businesses**

**( 3 - 0 - 8. Prerequisites: None. 8 LDN11 )**

**Equivalence: None**

This is an intermediate/ advanced course in the field of business studies that requires prior knowledge of negotiation skills and international marketing. As a result of this learning the students will become familiar with the main economic activities in their region, the source of the raw materials and the destination of the finished goods, the suppliers, technology, competitors and customers, using the methodology of Michael Porter. At the same time they will have the opportunity of designing the Specifications and Business Plan for the creation of a company whilst taking advantage of the information acquired.

**General objective:** Upon completion of this course, students will be able to design a business plan for the creation of a business related to any of the major economic activities of the region, and which takes advantage of the technology, human talent, innovation and commercial and negotiation opportunities that are available within said region.

**Key words:** International trading. Negotiation techniques. Regional business.

**Bibliography:** \* Porter, Michael E., 1947-, Estrategia competitiva : técnicas para el análisis de los sectores industriales y de la competencia / Michael E. Porter., Ed. rev., México : Compañía Editorial Continental, c2000., spaeng, [9682611849].

## AG

## Agronomy

**AG1008 Agricultural Equipment and Mechanization****( 3 - 0 - 8. Prerequisites: None. 3 IA 11 )****Equivalence: None**

This is a basic level course, designed to help students understand and recognize the machinery and equipment, as well as the mechanization and automation, of various types of field work. Previous knowledge is required in physics and biology. This course will include activities and concepts of mechanization, sustainable development and efficient use of the resources that enrich the course. The learning outcome for this course is that the students know the purpose and operation of the main equipment used in agriculture and animal husbandry. The students will recognize the different types of equipment used during production (animal and vegetable), which will support decision making in various intensive and extensive production systems.

**General objective:** Students will be able to recognize the main equipment, how they work and their applications, depending on the characteristics of the agricultural production system, in order to improve the efficiency of intensive and extensive production systems in the agricultural sector.

**Key words:** Equipment. Machinery. Automation.

**Bibliography:** \* Levine, Gilbert., El desempeño de los sistemas de riego y sus implicaciones para la agricultura de riego mexicana / Gilbert Levine, Carlos Garcés-Restrepo., México : International Water Management Institute, 1999.

**AG1009 Systematic Botany****( 3 - 0 - 8. Prerequisites: None. 4 IA 11 )****Equivalence: None**

This is a basic level course, designed to help students apply their knowledge of vegetable morphology in the identification of plants of interest to agronomists, as well as in the evaluation of their importance as biotic resources within the framework of sustainable development. Previous knowledge is required

in plant anatomy and physiology. The learning outcome for this course is that the students collect plants and prepare herbarium samples, identify and classify leaves, flower parts and fruit types and identify, by sight and with botanical keys, plants of interest in agriculture, animal husbandry or forestry.

**General objective:** Upon completion of this course, students will be able to: Use collection equipment and apply botanizing techniques; depict plant and floral morphology; explain the pressure and environmental impact on biotic plant resources and the problem of their depletion in the absence of sustainable management; identify families, genera and species using keys and with the naked eye.

**Key words:** Classification, nomenclature and collection methods. Leaf, flower and fruit morphology. Plant taxonomy and sustainable development.

**Bibliography:** \* Dimitri, Milan Jorge., Tratado de morfología y sistemática vegetal / Por Milan Jorge Dimitri y Edgardo Nolberto Orfila., Buenos Aires : Acme Agency, 2009., [9505661266],[9789505661268].

**AG1010 Introduction to Agronomy****( 3 - 0 - 4. Prerequisites: None. 1 IA 11 )****Equivalence: None**

The purpose of this basic-level course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.



**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

## AG2000 Animal Anatomy and Physiology

( 3 - 0 - 8. Prerequisites: [ Q2000 ]. 4 IA 11 )  
Equivalence: SA00852

This intermediate course focuses on the anatomy and physiology of body organs and systems of productive animal species. This course requires a basic knowledge of biology and chemistry. The learning outcome for this course is that the students will recognize the anatomical parts and physiological processes of the different systems related to the presence of diseases and production in production animals.

**General objective:** The objective of this course is that students recognize the anatomical and physiological processes of the different systems which are related to the presence of disease and production in production animals.

**Key words:** Physiology. Anatomy. Animal welfare.

**Bibliography:** \* 5. Tresguerres, J.A.F, Fisiología Humana, 2da., McGraw-Hill Interamericana.

## AG2012 Perishable Products Logistics

( 3 - 0 - 8. Prerequisites: None. 9 IBN11 )  
Equivalence: None

The purpose of this intermediate level course is to offer students the opportunity to develop their knowledge and skills in the optimization of logistical processes, using numerical methods in order to support decision-making in national and international problems of plant distribution, supplies, and perishable products. This course requires previous knowledge in operations management. Students will be able to develop competencies for the optimal distribution of resources and perishable products.

**General objective:** Students will be able to propose an appropriate plant distribution system; select a suitable distribution channel; apply the correct inventory models for perishables; design adequate storage space for a variety of perishable goods; select the most convenient packing and packaging; choose the best transportation system; and explain the procedures for marketing a product internationally.

**Key words:** Logistics as a competitive strategy. Plant layout. Distribution channels. Inventory models for perishable goods. Warehouse design and operation. Packaging and distribution of perishable goods. Transportation system management. International logistics.

**Bibliography:** \* Integral logistic structures : developing customer-oriented goods flow / edited by Sjoerd J. Hoekstra and Jac Romme ; authors, S.M. Argello . [et al.], New York : Industrial Press, c1992., engdut, [0831130377 :],[49.95 (est.)].

## AG2014 Plant Pathology

( 3 - 0 - 8. Prerequisites: [ AG3000 ]. 7 IA 11 )  
Equivalence: RN00865

This intermediate course focuses on the taxonomy, etiology and epidemiology of the different types of pathogens that affect agricultural crops and their impact on production. This course requires prior knowledge of biology and botany. Learning outcome: students will be able to recognize the main crop diseases based on laboratory techniques, sign and symptoms. They will also be able to monitor diseases according to their climatic requirements.

**General objective:** Upon completion of this course, students will be able to establish the importance of the different groups of phytopathogens (fungi, viruses, nematodes, viroids, protozoa) and of abiotic production limiting factors.

**Key words:** Plant disease control methods. Morphology, biology, physiology phytopathogen habits. Abiotic and non-parasitic diseases. Chemical control of plant diseases.

**Bibliography:** \* Agrios, G.N., Plant pathology, 3rd., Academic Press, Inglés.

### **AG2019 Entomology** ( 3 - 0 - 8. Prerequisites: None. 6 IA 11 ) Equivalence: RN00851

This is an intermediate level course aimed at understanding insect anatomy and physiology and their relation to ecology and human health. The course requires prior knowledge of biology and chemistry. Learning outcome: students will recognize and know how to implement tactics and methods for combating insect pests which cause harm to crop plants, stored products and domestic animals.

**General objective:** The objective of the course is to establish the importance of the members of the Phylum Arthropoda as phytosanitary problems and limiting factors in systems of vegetable production, by means of a study of the coevolution of the group and of its morphophysiological and ethological characteristics in order to identify and combat it. In this course, emphasis will be placed upon the different options in the rational use of pesticides and in particular the study of integrated pest management.

**Key words:** Integrated pest management. Phytosanitary protection.

**Bibliography:** \* Gillott, Cedric, Entomology / Cedric Gillott, 2nd ed, New York : Plenum Press, c1995, New York, c1995, eng, [0306449668 : HRD \$125.50].

### **AG2020 Soils and Plant Nutrition** ( 3 - 0 - 8. Prerequisites: [ Q2000 ]. 5 IA 11 ) Equivalence: None

This is an intermediate level course, which enables students to understand soil classification systems according to pedological and edaphological characteristics, as well as the potential uses of land. Previous knowledge is required in physics and agricultural mechanization. This course includes outings and field work, resource management and sustainable development, all of which complement the general scope of the course. The learning outcome for this course is that the students be able to diagnose soil problems, correct soil fertility problems and design plant nutrition programs.

**General objective:** Students will be able to analyze harvesting practices in irrigated soils; understand the erosion processes and how to control them; analyze soil salinity and sodicity problems and their appropriate management; understand semi-desert soil management methods; describe management methods for soil pH problems; learn to select and use green manures and crop rotation; diagnose and remedy soil fertility problems.

**Key words:** Soil classification. Soil management. Physical and chemical changes in soil. Plant nutrients.

**Bibliography:** \* Manual Internacional de Fertilidad de Suelos., Instituto de la Potasa y el Fosforo.

### **AG2021 Livestock Biosecurity** ( 3 - 0 - 8. Prerequisites: None. 6 IA 11 ) Equivalence: None

This is an intermediate level course designed to teach students about the various pathogens that cause disease and the associated physical, chemical, and biological systems. No previous knowledge is required. The learning outcome for this course is that students be able to apply this knowledge in the control of disease by designing biosafety programs.

**General objective:** Students will be able to understand the distribution and control mechanisms of diseases in livestock production; understand the bases of the immune response process; determine the physical, chemical and biological barriers that comprise a biosafety program for livestock; know and interpret national and international legislation that governs animal health.

**Key words:** Immunology. Biosafety. Epizootiology. Disease control. Regulations.

**Bibliography:** \* Current veterinary therapy 5 : food animal practice / [edited by] David E. Anderson Michael Rings., Edinburgh : Saunders, 2009., [9781416035916 (encuadrado)], [1416035915 (encuadrado)].

## AG2022 Irrigations Systems Laboratory

( 0 - 3 - 4. Prerequisites: None. 6 IA 11 )

**Equivalence: None**

The purpose of this intermediate-level agronomy course is for students to be able to identify the fundamental elements of water management for agricultural and livestock production. Requires previous knowledge of physics and irrigation systems. This subject puts major emphasis on the practical aspects of water management to achieve sustainable development of water resources and complements classroom knowledge with fieldwork and visits to producers in order to understand irrigation system management. The relationships among the ground, water, climate and plant life are considered in the practice of water management. The learning outcome of this course is for students to be able to develop and evaluate gravity, spray and drip irrigation systems to permit optimized water use in agriculture.

**General objective:** Upon completion of the course, students will be able to measure and interpret topographical and plane surveys, perform and calculate land leveling for irrigation, measure flows in channels and piping, estimate water demands in crops, directly and indirectly measure soil moisture levels, evaluate and operate irrigation systems.

**Key words:** Efficient use of water in agriculture. Water-soil-plant relationship.

**Bibliography:** \* Baver, Leonard David., Física de suelos / L. D. Baver, Walter H. Gardner, Wilford R. Gardner., 1a Ed., México : Limusa , 1991., spa, [9681840429].

## AG2023 Livestock Nutrition and Feeding

( 3 - 0 - 8. Prerequisites: None. 6 IA 11 )

**Equivalence: None**

This is an intermediate level course, designed to provide students with the necessary knowledge to evaluate and design nutrition systems, considering food composition, its digestion and metabolism for animals' well-being and productivity. This course will

include outings and fieldwork. Previous knowledge is required in biology, biochemistry, anatomy and animal physiology. The learning outcome for this course is that the students create nutrition programs for the various species considered for zootechnical purposes, supported by the use of specialized software.

**General objective:** Students will be able to evaluate and design cattle feeding systems and optimize the sustainable production of healthy animal products.

**Key words:** Livestock feeding. Ration formulation. Food analysis.

**Bibliography:** \* Basic animal nutrition and feeding / W.G. Pond . [et al.], 5th ed., Hoboken, NJ : Wiley, c2005., [0471215392 (rústica)].

## AG2024 Irrigation Systems

( 3 - 0 - 8. Prerequisites: None. 6 IA 11 )

**Equivalence: None**

The purpose of this intermediate-level agronomy course is for students to be able to identify the fundamental hydrologic and hydraulic watering systems and storage structures. Requires previous knowledge of physics. This subject includes activities for sustainable development, resource management and field visits that complement the understanding of the material. The course takes into consideration the relationship among the ground, water and plant life in water management. The learning outcome of this course is for students to be able to design and evaluate irrigation systems that permit optimized use of water in agriculture.

**General objective:** Upon completion of the course, students will be able to understand the fundamental components of topographical and plane surveys, which allow for the development of irrigation and watering troughs; dimension structures for watering crops; and study the behavior of groundwater and well hydraulics.

**Key words:** Efficient use of water in agriculture. Water-soil-plant relationships.

**Bibliography:** \* Chow, Ven Te., Hidrología aplicada / Ven Te Chow, David R. Maidment, Larry W. Mays ; tr. Juan G. Saldarriaga., Santafé de Bogotá : McGraw-Hill, 1994., spaeng, [9586001717].

### **AG2025 Agricultural Residency**

**( 3 - 0 - 8. Prerequisites: None. 7 IA 11 )**

**Equivalence: None**

This is an intermediate level course, which helps students learn how to identify the main variables involved in agricultural production systems. Previous knowledge is required in Biology, Soils and Irrigation. The learning outcome for this course is that the students, upon identifying the main variables in production systems, propose alternative solutions to make them more efficient, productive and sustainable.

**General objective:** Students strengthen their learning of knowledge, skills, attitudes and values, by becoming actively involved in all of the tasks carried out within a production system.

**Key words:** Direction. Control. Planning. Organization. Integration.

**Bibliography:** \* Morales Felgueres, Carlos., Control y valuación de inventarios / Carlos Morales Felgueres., México, D.F. : ECASA, 1993., [9686317074].

### **AG3000 Plant Anatomy and Physiology**

**( 3 - 0 - 8. Prerequisites: [ Q2000 ]. 4 IA 11 )**

**Equivalence: RN00842**

This advanced course focuses on the anatomy and physiology of the organs, apparatuses and systems that make up the diverse plant species. This course requires a basic knowledge of biology and chemistry. Learning outcome: students will be able to integrate the structure and functioning of plants and deduce the probable response of plants in different environments. They will also comprehend the importance of the ethical management of plant systems that lead to a greater productivity of fruits and vegetables that contribute to the population's health.

**General objective:** The objective of this course is that students be able to: explain, based on the vegetable structure and the environment, the physiological processes of plants. Students will be able to predict the behavior of plants under the effect of various environmental factors as well as the impact on production. Students will also be able to develop a practical demonstration of a physiological process in a greenhouse or farm.

**Key words:** Anatomy and physiology of plant structures (root, stem, leaf, flower, fruit, seed).

**Bibliography:** \* Hopkins, William G., Introduction to plant physiology / William G. Hopkins., 2nd ed., New York : J. Wiley, c1999., [0471192813 (acid-free paper)].

### **AG3018 New Product Development**

**( 3 - 0 - 8. Prerequisites: None. 8 IA 11 )**

**Equivalence: None**

This is an advanced level course, designed to improve the students' skills in the design of innovative nutritional development projects. Previous knowledge is required in entrepreneurship. The learning outcome for this course is that the students design an experimental plan for the development of a highly innovative nutritional product, justifying a demand for it in the world-wide market.

**General objective:** Students will be able to develop an agrifood innovation project, applying their knowledge of the areas of experiment design and entrepreneurship.

**Key words:** New products. Food market.

**Bibliography:** \* Developing new food products for a changing marketplace / editado por Aaron L. Brody y John B. Lord., Lancaster, Pa. : Technomic Pub. Co., 2000., [1566767784 (encuadernado : papel alcalino)].

### **AG3019 Agribusiness Management**

**( 3 - 0 - 8. Prerequisites: None. 8 IA 11, 8 IAB11 )**

**Equivalence: None**

This is an advanced level course, designed to develop business administration strategies. Previous

knowledge is required in animal production systems, vegetable production systems and entrepreneurial development. The learning outcome for this course is that the students define and establish the parameters of competition in agribusinesses.

**General objective:** Students will be able to understand and determine the importance of planning and internal leadership in organizations through Service Learning, with a strong commitment to active participation through productive projects.

**Key words:** Management. Projects. Processes, Concurrency.

**Bibliography:** \* Ricketts, Cliff., Agribusiness : fundamentals and applications / Cliff Ricketts, Kristina Ricketts., 2nd ed., Clifton Park, N.Y. : Delmar/Cengage Learning, c2009., [9781418032319],[141803231X].

### AG3020 Livestock Production and Reproduction

( 3 - 0 - 8. Prerequisites: None. 8 IA 11 )

**Equivalence: None**

This is an advanced level course, designed to analyze and plan solutions in pertinent areas of production and reproduction in the livestock industry. Previous knowledge is required in animal biology, anatomy and physiology. The learning outcome for this course is that the students be able to understand the various reproductive processes, infertility problems, reproductive techniques and methods for improving production, as well as to evaluate the parameters of various types of profitable livestock in order to make informed decisions with regard to their cultivation.

**General objective:** Students will be able to understand and apply the basics of reproductive physiology, livestock biotechnology and the current productive parameters to determine optimal production practices.

**Key words:** Reproduction. Biotechnology. Productive parameters.

**Bibliography:** \* McDonald, L E., Reproduccion y endocrinologia veterinaria., 2 Ed., Interamericana , 1978., spa.

### AG3021 Production Systems in Protected Agriculture

( 3 - 0 - 8. Prerequisites: None. 8 IA 11 )

**Equivalence: None**

This is an advanced level course, designed to provide students with an understanding of the main interactions in agricultural production in controlled environments. Previous knowledge is required in physics, vegetable anatomy and physiology, and soils. The learning outcome for this course is that the students apply their knowledge and use environmental control technologies in order to optimize production systems in protected agriculture.

**General objective:** Students will be able to analyze the way in which production factors affect crop yield in protected agriculture as well as evaluate greenhouse production systems according to biological and economic variables.

**Key words:** Plant production in greenhouses. Changing variables in controlled environments.

**Bibliography:** \* Nelson, Paul V., Greenhouse operation & management / Paul V. Nelson., 6th ed., Upper Saddle River, NJ : Prentice Hall, c2003., [0130105775].

### AG3022 Agricultural Science Capstone Project

( 3 - 0 - 8. Prerequisites: None. 9 IA 11 )

**Equivalence: None**

This is an advanced collegiate course, designed to integrate knowledge gained throughout the degree program, by means of a research and/or development project, the goal being to innovate or provide a benefit to the agricultural industry, attempting to solve a set of problems in the industry. The learning outcome for this course is that students produce a project, applied to a process or an organization, based on the methods and techniques that are used in the professional activity of an agricultural engineer.

**General objective:** Students will be able to apply the knowledge acquired throughout their major, developing the capacity to identify problems that affect



productivity in the agricultural industry, by diagnosing, analyzing, evaluating and applying results. They will also develop the capacity for teamwork, proposing alternative solutions within a framework of ethics, honesty and social responsibility that contributes to sustainable development.

**Key words:** Research and/or development project on innovation in the agricultural sector. Identification of agricultural issues. Application of methodologies and techniques in agricultural production.

**Bibliography:** \* Morris T. R., Experimental design and analysis in animal sciences / T. R. Morris., New York : CABI, 1999., [0851993494].

### AG3023 Milk Production Systems

( 3 - 0 - 8. Prerequisites: None. 9 IA 11 )

**Equivalence: None**

This is an advanced level course, designed to provide students with an understanding of the factors involved in the productivity of a dairy system. Previous knowledge is required in animal anatomy and physiology, nutrition and reproduction. The learning outcome for this course is that the students develop the skills to design, plan, operate and diagnose the operational efficiency of a dairy production system.

**General objective:** Upon completion of this course, students will have developed the competencies to design, analyze and operate milk production systems by integrating the basic areas, with emphasis on the sustainability of production systems.

**Key words:** Milk production in Mexico and world-wide. Milk production system. Design, planning and operation of milk production systems.

**Bibliography:** \* Ganado lechero : principios, prácticas, problemas y beneficios / Donald L. Bath. [et al.] ; traducción Agustín Contín Sanz ; revisión técnica Sergio S. González Muñoz., 1a ed., México : Nueva Editorial Interamericana, 1982., [9682507820].

### AG3024 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 IA 11 )

**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## AR

## Architecture

**AR1007 History of Architecture and the City I****( 3 - 0 - 8. Prerequisites: [ DL1006 , DL1009 ]. 3 ARQ11 )****Equivalence: AR99841**

This basic level course provides students with tools for analyze architecture and the city within a socio-cultural, geographic and time-related context ranging from the first prehistoric settlements in the East and Europe; the development of the first cities and their architecture in the Middle East, Egypt and Ancient Mexico; and the evolution of architecture and the city within the framework of western culture after the Pre-Hellenic cultures, to the Early-Christian and Byzantine architecture. The analysis is based on variables depicting form, space and structure. Students start by studying the architectural theory developed in the aforementioned periods. Concepts of universal history are included to reinforce, complement and broaden the general aim of the course. No prior knowledge is required, except for the information acquired beforehand as general culture. The learning outcome for this course is that the students will be able to recognize, analyze and interpret the fundamental characteristics of the buildings and cities from the previously mentioned periods, as well as recognize the context in which they were developed.

**General objective:** Upon completion of this course, students will be able to recognize and analyze the characteristics of form, space, and structure of the architectural and urban styles associated with the historical periods studied; recognize the socio-cultural context in which the urban architecture was generated and develop a culture of appreciation for historically valuable urban architectural expressions.

**Key words:** Architecture and cities of ancient Mexico. Prehistory. Architecture and cities of the ancient world: Near East, Egypt. Architecture and city in the western world: the Pre-Greek Cultures, Greece, Etruscan Culture, Rome, the Paleochristian and Byzantine eras. Architecture and cities of the western world from Egypt, Greece, Rome.

**Bibliography:** \* Kostof, Spiro, A History of Architecture, Oxford University Press.

**AR1010 History of Architecture and the City II****( 3 - 0 - 8. Prerequisites: [ AR1007 ]. 4 ARQ11 )****Equivalence: AR99842**

This course continues with the chronological study of architecture and the city within a socio-cultural, geographical and temporal context that includes Islamic, Pre-Romanesque, Carolingian, Romanesque, Gothic, Renaissance and Palladian architectural expressions, as well as the architecture in the colonial period in 16th-century Mexico. The analysis is based on the variables of form, space and structure. Students would require to learn about the architectural theories and the concepts of world history developed in the aforementioned periods to reinforce and expand the general aim of the course. As a prerequisite, students require to have approved History of Architecture and the City I. The learning outcome for this course is that students will be able to analyze and recognize the relevant characteristics of buildings and cities pertaining to these periods and be able to recognize the urban context in which they were developed.

**General objective:** Upon completion of this course, students will be able to recognize and analyze the characteristics of form, space, and structure of the architectural as well as the urban settings associated with the concerned periods; identify the most relevant authors; recognize the social and cultural context, and develop a sense of appreciation for historically valuable buildings and its urban expression framework.

**Key words:** Islamic architecture. Architecture in Europe in the middle Ages. Architecture and cities in the 15th and 16th centuries. Architecture in Mexico in the 16th century.

**Bibliography:** \* Kostof, Spiro, A history of architecture : settings and rituals / Spiro Kostof ; original drawings by Richard Tobias, New York : Ox-



ford University Press, 1985, New York, 1985, eng, [0195034724],[0195034732 (rústica)].

### AR1013 Drawing

( 4 - 0 - 8. Prerequisites: None. 1 ARQ11, 1 LAD11, 1 LDI11 )

Equivalence: AR1003

This is a basic course designed to train students in the graphical systems of manual representation most commonly used in architecture, industrial design, and digital animation. Students will also be trained in the various procedures and methods that will allow them to represent and interpret diverse objects, spaces, persons, and environments, in order to help them in a design or in a project. This course offers students the possibility of developing their ability to represent and comprehend, through the study, analysis, and resolution of graphical representation exercises, utilizing various representation techniques. As a prerequisite, this course requires that students have basic knowledge of drawing and manual ability, and the ability of observation. The learning outcome for this course is that students develop their ability to manual graphic tools and basic techniques of graphical representation ; develop a spatial understanding through study, analysis and problem-solving with freehand drawing of objects or environments; and acquire the ability to represent graphically in two and three dimensions.

**General objective:** Upon completion of this course, students will be able to appreciate drawing as a means of communication to achieve the understanding, expression of ideas and the perceptive habit of the diverse universal freehand drawing systems; identify the most appropriate systems and techniques for the representation and freehand drawing of sketches, perspective views and drawings of objects, ideas and situations in order to express their design concepts graphically; apply their prior knowledge of geometry, such as spatial analysis and shapes, using expressive media, such as perspectives and shading, appropriately.

**Key words:** Perspective. Shadows. Drawing. Scale. Background. Figure. Proportion. Axonometry. Setting. Lights.

**Bibliography:** \* Iglesias Guillard, Jorge., Croquis : dibujo para arquitectos y diseñadores / Jorge Iglesias Guillard., 1a ed., Mexico : Trillas, c1989, 2005, 2007., [968243100X],[9789682431005].

### AR1014 Descriptive Geometry

( 3 - 0 - 8. Prerequisites: None. 1 ARQ11, 1 LAD11, 1 LDI11 )

Equivalence: AR1002

This is a basic level course designed to introduce students to a system of representation which will allow them to interpret and express three-dimensional space in two-dimensional form, as well as allowing them the possibility of communicating the results of their own creations. Students will study the basic concepts of descriptive geometry so that they may express themselves correctly from a professional point of view. This course does not require previous knowledge or any other knowledge related to the subject. The learning outcome for this course is that students develop the capacity for spatial abstraction and comprehension through the study, analysis, and resolution of geometric problems, and that they model or form their mental ability in the comprehension of the third dimension and the means to represent it two-dimensionally.

General objective: Upon completion of this course, students will be able to use the necessary media and tools to understand the third dimension so that they can use it in the graphical description of objects; apply diverse descriptive geometry methods to solve graphical representation problems; apply the principles of representation in orthographic projection to communicate ideas clearly; and handle the universal language of elevation illustration appropriately.

Key words: Visualization. Descriptive geometry. Drawing instruments. Euclidean space. Multiview orthographic projections. Equidistant cylindrical projection. Intersections. Types of drawing scales. Views. Volumes. Regular solids. Prisms. Polygons. Parallels.

**Bibliography:** \* Uddin, Mohammed Saleh., Axonometric and oblique drawing : a 3-D construction, rendering and design guide / M. Saleh Uddin., New York : McGraw-Hill, c1997., [0070657556].

**AR1015 Architectural Drawing**  
 ( 4 - 0 - 8. Prerequisites: [ AR1013 ]. 2 ARQ11 )  
**Equivalence: AR1005**

This is a basic level course designed to train students in the graphical systems of manual representation most commonly used in architecture. Students will also be trained in the various procedures and methods that will allow them to represent and interpret technical drawings in order to carry out a design or a project. This course offers students the possibility of developing their ability to represent and comprehend, through the study, analysis, and resolution of representation problems. As a prerequisite, this course requires that students have the basic knowledge and general concepts covered in the Geometry and Drawing course. The learning outcomes for this course are that students learn about the technical tools for the graphical resolution of professional-type problems and that they develop an excellent spatial ability and comprehension through study, analysis, and problem-solving in architectural project drawing; and that students acquire the ability to represent graphically in two and in three dimensions.

**General objective:** Upon completion of this course, students will be: Familiar with the most advanced architectural drawing systems and techniques through the representation, expressivity, graphical resolution, and perceptive habit of the diverse universal architectural drawing systems. Able to identify the most suitable systems and techniques for architectural projects. Apply their prior knowledge of geometry, such as spatial analysis and shapes, by using expressive media such as perspectives, shadows and their corresponding application.

**Key words:** Architectural drawing. Perspectives. Setting. Blueprints. Floors. Elevations. Sections. Axonometries. Human scale. Furniture. Solar orientation. Site analysis. Conceptual diagrams.

**Bibliography:** \* Yee, Rendow., Architectural drawing : a visual compendium of types and methods / Rendow Yee., New York : John Wiley, 1997., [0471165735].

**AR1016 Applied Geometry**  
 ( 3 - 0 - 8. Prerequisites: [ AR1014 ]. 2 ARQ11, 2 LDI11 )  
**Equivalence: AR1004**

This purpose of this basic level course is to instruct students in the two- and three-dimensional systems of graphical representation of shapes, spaces, and surfaces. Students will also be trained in the various procedures that allow them to interpret any given spatial shape for execution in a design or project, and to represent the results of their creations legibly. This course will offer students the possibility of developing their capacity for spatial abstraction and comprehension through the study, analysis, and resolution of graphical and representation problems. As a prerequisite, this course requires that students have the basic knowledge and general concepts covered in the Descriptive Geometry course. The learning outcomes for this course are that students represent, based on a two-dimensional working drawing, a three-dimensional model using basic modeling techniques (with foam materials), which will help students to learn the third dimension in practice.

**General objective:** Upon completion of this course, students will be able to: Understand projection systems through the representation, expressivity, graphical resolution and perceptive habit of the diverse universal descriptive geometry systems. Identify the most appropriate systems and positions to deal with each case clearly and simply, in order to strengthen the system's effectiveness, assessing the degrees of geometric concretion and its representations; select analytical or expressive positions according to the objectives. Practice spatial analysis so that students can imagine a shape based on its flat projections. Facilitate and apply the spatial analysis of shapes using expressive media such as perspectives and shadows. Analyze their knowledge of geometry as needed, in a rigorous, practical and not overly theoretical manner. Understand and appreciate the geometries that are implicit in shapes, highlighting the properties, combinatory possibilities and spatial articulation of surfaces, linking them to practical design solutions.

**Key words:** Perspectives. Shadows. Projection systems. Oblique drawing. Perspective (military, cavalier, vanishing point, etc.). Oblique shadows. Shadows in

perspective. Shadows in axonometric. Axonometric shadows.

**Bibliography:** \* Torre Carbó, Miguel de la., Geometría descriptiva / Miguel de la Torre Carbó., 1 Ed., 1965., México : UNAM , 1965., spa.

### **AR1017 Computer-aided Drawing** ( 3 - 0 - 8. Prerequisites: None. 3 ARQ11, 2 IC 11 ) **Equivalence: AR1006**

This is a basic level course, designed to train students in the digital technology of integral modeling applied in the design and construction of buildings, for which standard computer applications, like CAD and BIM, will be used. The graphic regulations and standards of the Architectural discipline will also be applied in a two-dimensional visualization of the architectural draft. This course will include the basic techniques of photorealism, animation and presentation for improved project communication. Previous knowledge is required in basic calculation, as well as an understanding and mastery of technical architectural drafting by hand and with instruments, in two- and three-dimensional representations. The learning outcome for this course is that the students draft virtual models, routes, depiction of plants, facades and architectural and construction cross sections, as well as electronic draft and basic photorealism views. The students will integrate these products in blueprints and digital documents.

**General objective:** Upon completion of this course, students will be able to: Apply electronics technology of their discipline to the design and representation of buildings (CAD). Use the appropriate computer programs to illustrate the plans, façades, cut away views and isometric projections of a building project. Observe the graphical regulations and standards for the 2D representation of a building's preliminary plans. Create conceptual virtual mockups and electronic sketches and basic photorealism designs of perspective views in order to enhance the communication of their projects. Produce sets of printed plans and plans in digital documents for the documentation and technical illustration of projects.

**Key words:** Modeling, computer-aided simulation and construction using CAD and BIM. Modeling, gen-

eration de plans, visualization and computer graphics. Photorealism.

**Bibliography:** \* Demchak, Greg., Mastering Revit architecture 2010 / Greg Demchak, Tatjana Dzambazova, Eddy Krygiel., 1st ed., Indianapolis, Ind. : Wiley Pub., Inc., 2009., [9780470456491 (paper/website)].

### **AR1018 Architecture Theory and Design Methodologies** ( 3 - 0 - 8. Prerequisites: [ DL1009 ]. 3 ARQ11 ) **Equivalence: AR1009**

This is a basic course, designed to help students understand and analyze theories, treatises and manifestos on architectural ideology throughout history, with an emphasis on the theories of contemporary (twentieth century) architects and their practical expression. The intention of this course is to reflect on personal practices and to formulate a critical opinion with regard to historical and contemporary reality. Previous knowledge is required in basic architectural design, in order to relate theoretical knowledge to personal practices in design courses. The learning outcome for this course is that the students recognize the various theories in the field of architecture and that they have the necessary tools for formulating an initial personal opinion regarding the discipline.

**General objective:** Upon completion of this course, students will be able to recognize the diverse theoretical trends in architecture and the city, from the first authors to the contemporary era.

**Key words:** Sustainability, contextualism and appropriate technology. Theory in Mexico and Latin America in the 20th century. Ideas and projects of the guest lecturer to the Luis Barragán Chair. Contemporary theories and manifestos. Architecture treaties before the modern movement. Theories and manifestos of the 20th century: modernity and post-modernity.

**Bibliography:** \* Forty, Adrian., Words and buildings : a vocabulary of modern architecture / Adrian Forty., London : Thames & Hudson, 2000., [0500341729 : HRD],[50.00].

### **AR1019 Introduction to Architecture** ( 3 - 0 - 4. Prerequisites: None. 1 ARQ11 )

**Equivalence:** None

The purpose of this basic course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The intention of this course is that students have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Lewis, Roger K., --Así que quieres ser arquitecto / Roger K. Lewis ; traducción Rodolfo Piña García., 1a ed., México : Limusa/Noriega, 2001., spaeng, [9681857267],[9789681857264].

### **AR2004 Digital Visualization** ( 3 - 0 - 8. Prerequisites: [ AR1017 , AR1006 ]. 4 ARQ11 )

**Equivalence:** AR99825

This is an intermediate course intended to develop the following student skills: BIM three-dimensional modeling, creativity in the exploration of tools, development of geometrical and construction skills for complex models. The course includes BIM modeling techniques and management of building models; techniques of photorealism, illumination effects and complex materials; animation and virtual reality theory; exploration of graphic tools for professional of their projects. This course requires prior knowledge of basic CAD. The final work for this course is the modeling of a complex architectural project, includ-

ing architectural plans, Sections BIM Model, rendering and virtual reality presentation.

**General objective:** Upon completion of this course, students will be able to model complex architectural projects using the BIM model structure, render outdoor and indoor views, export models to virtual reality applications, and make powerful presentations on different media formats.

**Key words:** 3D Modeling. Photo-realistic rendering. BIM Modeling for Architects. Professional project presentation and communication. Animation and virtual reality tools.

### **AR2005 History of Architecture and the City III**

( 3 - 0 - 8. Prerequisites: [ AR1010 ]. 5 ARQ11 )

**Equivalence:** AR99843

This is an intermediate level course intended to continue the chronological study of architecture and the city in a socio-cultural, geographical and temporal context covering the 17th to 19th centuries in Europe and America, corresponding to the development of the Baroque, Neoclassical and Historicism, the architecture of the Industrial Revolution, the Avant-Garde at the end of the 19th century, and the Chicago school. The analysis is based on the variables of form, space and structure. The study of architectural theories developed in the periods observed is continued. Concepts of universal history which reinforce, complement and broaden the general intention of the course will be included. This course requires prior knowledge from History of Architecture and the City II. Learning outcome: students will recognize, analyze and interpret the fundamental characteristics of buildings and cities within the periods described, as well as recognize the context in which they develop.

**General objective:** Upon completion of this course, students will be able to: Recognize and analyze the formal, special, and structural characteristics of the architectural and urban styles associated with the historical periods studied. Identify the principal representatives in the history of architecture. Recognize the socio-cultural context in which the urban architecture was generated. Develop a culture of appre-

ciation for historically valuable urban architectural expression.

**Key words:** Baroque, neoclassical, historicist architecture and urbanism in Europe and America. Architecture and city during the Industrial Revolution. Architecture of the avant-gardes in the late 19th century.

**Bibliography:** \* Kostof, Spiro, A history of architecture : settings and rituals / Spiro Kostof ; original drawings by Richard Tobias, New York : Oxford University Press, 1985, New York, 1985, eng, [0195034724],[0195034732 (rústica)].

## AR2007 History of Architecture and the City IV

( 3 - 0 - 8. Prerequisites: [ AR2005 ]. 6 ARQ11 )

**Equivalence:** AR99844

This is an intermediate level course intended to continue the chronological study of architecture and the city within a sociocultural, geographical and temporal context covering the 20th and beginnings of the 21st centuries, corresponding to the development of modern architecture, its variants, and the architecture associated with postmodernism. The analysis is based on the variables of form, space and structure. Concepts of universal history which reinforce, complement and broaden the general intention of the course will be included. This course requires prior knowledge from History of Architecture and the City III. Learning outcome: students will recognize, analyze and interpret the fundamental characteristics of buildings and cities within the periods described, as well as recognize the context in which they develop.

**General objective:** Upon completion of this course, students will be able to: Recognize and analyze the formal, special, and structural characteristics of the architectural and urban styles associated with the historical periods studied. Identify the principal representatives in the history of architecture. Recognize the socio-cultural context in which the urban architecture was generated. Develop a culture of appreciation for historically valuable urban architectural expression.

**Key words:** Postmodern architecture and urbanism. Contemporary architecture and urbanism. Modern architecture and urbanism. Transformations of modern architecture and urbanisms.

**Bibliography:** \* Anda, Enrique X. de, Evolución de la arquitectura en México : épocas prehispánica, virreinal, moderna y contemporánea / Enrique X. de Anda, México : Panorama Editorial, 1987, Mexico, 1987, spa, [9683801862].

## AR2017 Bioclimatic Design

( 3 - 0 - 8. Prerequisites: [ AR1019 ]. 3 ARQ11 )

**Equivalence:** AR2002

This is an intermediate level course, designed to provide students with the vision and the necessary analytical and design techniques for creating sustainable architecture from the standpoint of energy efficiency and environmental friendliness. Previous knowledge is required in basic architectural design. The learning outcome for this course is that the students propose design solutions in accordance with environmental conditions and user needs, by applying bioclimatic design tools.

**General objective:** Upon completion of this course, students will be familiar with and able to use the bioclimatic architectural design methodology.

**Key words:** Heat transfer. Climate variables. Hygrothermal and lighting comfort. Solar orientation and natural lighting analysis tools. Natural lighting and ventilation, and radiation control.

**Bibliography:** \* Serra, Rafael., Arquitectura y climas / Rafael Serra., 1a ed., Barcelona : G. Gili, c1999., [8425217679],[9788425217678].

## AR2018 Projects I: Residential Housing

( 6 - 0 - 12. Prerequisites: [ DL1004 ]. 3 ARQ11 )

**Equivalence:** AR1008

This is an intermediate level course, which integrates the basic concepts of design fundamentals, such as function, form, space, sustainability and materials. It will enable students to understand and apply the ba-



sic principles of livability that apply to RESIDENCES, based on the study of analogous cases. Emphasis will be placed on livability, sustainability and architectural illustration. Previous knowledge and skills are required from the two first courses in design fundamentals. The learning outcome for this course is that the students draft 3 residential projects of various sizes and architectural disciplines.

**General objective:** Upon completion of this course, students will be able to apply the concept of habitability in housing projects by studying analogue and typological cases and resolving the ergonomic and functional aspects.

**Key words:** Residential house. Basic design and habitability. Ergonomics and anthropometry. Scale and proportion.

**Bibliography:** \* Eco, Umberto., La estructura ausente : introducción a la semiótica / Umberto Eco : [traducción, Francisco Serra Cantarell], Barcelona : Editorial Lumen, 1978, c1968., spaita, [8426410766].

### **AR2019 Projects II: Collective Housing ( 6 - 0 - 12. Prerequisites: [ AR2018 ]. 4 ARQ11 )** **Equivalence: AR1011**

This is an intermediate level course, which integrates the basic concepts of architectural design, such as function, form, space, discipline, context, end-user, sustainability and materials. It will enable students to understand and apply the basic principles of livability, as they apply to APARTMENT COMPLEXES, in a national and international context, based on the study of analogous and typological cases. Emphasis will be placed on the aspects of livability and sustainability, considering knowledge related to computerized architectural illustration, architectural theories and design methodologies. Previous knowledge is required in Architectural Projects. The learning outcome for this course is that the students draft 3 apartment complex projects with different architectural disciplines and different locations.

**General objective:** Upon completion of this course, students will be able to apply the concept of habitability in housing complex projects, in national and international contexts, by studying analogue and

typological cases and resolving the ergonomic, functional and environmental aspects.

**Key words:** Basic design and habitability. Ergonomics and anthropometry. Scale and proportion. Housing complexes.

**Bibliography:** \* Klein, Alexander., Vivienda mínima : 1906-1957 / Alexander Klein., Barcelona : Gili, 1980., [842520965X].

### **AR2020 Installations and Alternate System**

**( 4 - 0 - 8. Prerequisites: [ AR1015 ]. 5 ARQ11 )**  
**Equivalence: None**

This is an intermediate level course, which enables students to understand the various electrical, mechanical or alternative utilities that must be planned out and considered during the architectural design of any building; the criteria that regulate their operation and calculations; the integration of these systems with each other; their viability according to the construction method that will be employed; and the way in which these systems interact with the architectural space and volume. Previous knowledge is required in design and construction, in order to understand how the utilities interact with the buildings. The learning outcome for this course is that the students be able to propose and fully conceptualize the various utility systems that are required for the function and operations of a building.

**General objective:** Upon completion of this course, students will be able to identify, plan and propose the necessary and appropriate installation systems as part of a project's architectural design solution; know and apply the proposal and execution criteria that regulate the diverse installation systems during a construction process; interpret, evaluate and integrate the information stemming from related consultancies or specializations into the architectural project.

**Key words:** Energy. Sustainability. Installations and equipment. Integration of installation systems. Installation project.

**Bibliography:** \* Stein, Benjamin., Mechanical and electrical equipment for buildings / Benjamin Stein, John S. Reynolds., 8th ed., New York : J. Wiley & Sons, c1992., [0471525022 (alk. paper)].

## AR2021 Construction Materials and Procedures II

( 3 - 0 - 8. Prerequisites: [ CV2023 ]. 5 ARQ11, 4 IC 11 )

**Equivalence:** AR2003

The purpose of this intermediate-level architecture course is for students to study the materials used in building finishes and fixtures and their influence on construction processes. Requires previous knowledge of basic materials and their use in the construction of buildings. The learning outcome of this course is for students to be trained to build appropriate finishes and fixtures for construction as well as to control the construction processes involved.

**General objective:** Upon completion of this course, students will be able to design the facilities and services required by all types of buildings, and plan and supervise the construction processes used to prepare buildings for their proper operation.

**Key words:** Construction finishes. Installations, equipment, frames, and conditioning. Facades. Construction process typologies.

**Bibliography:** \* Barbará Zetina, Fernando., Materiales y procedimientos de construcción / Fernando Barbará Z., 8 ed., México : Editorial Herrero, 1986.

## AR2022 Projects III: Educational or Recreational Buildings

( 6 - 0 - 12. Prerequisites: [ AR2019 ]. 5 ARQ11 )

**Equivalence:** AR2006

This is an intermediate course which integrates architectural design concepts such as function, form, space, end-user, structure, architectural programming, context, sustainability and materials. It will enable students to employ these basic principles and apply them in the development of projects related to ECOLOGICAL SPACES AND BUILDINGS, through ex-

ercises focused on genres, such as research centers, community centers, theme parks, hostels and eco-tourism facilities. Emphasis on the aspects of livability, sustainability and materials, considering knowledge related to materials behavior, facilities and alternative systems, supported by computerized architectural drafting will be placed. Previous knowledge in passive systems and environmental sustainability is required. The learning outcome for this course is that the students will develop 3 sustainable architecture projects.

**General objective:** Upon completion of this course, students will be able to develop architectural projects linked to green spaces and buildings, such as research centers, community centers and tourist facilities among others, solving the functional, environmental and construction factors.

**Key words:** Ecological buildings. Architectural design associated with the generation of public buildings.

**Bibliography:** \* Edwards, Brian, 1944-, Rough guide to sustainability / by Brian Edwards., 2nd ed., London : RIBA Enterprises, 2005., [1859461743].

## AR2023 Construction Projects I

( 6 - 0 - 12. Prerequisites: None. 6 ARQ11 )

**Equivalence:** AR2009

This is an intermediate course which will entail the development of an architectural housing project at a medium or high socioeconomic level and the corresponding project plans, including structural criteria and drafts, brickwork, woodwork, ironwork and fixtures, as well as the formulation of construction specifications. Previous knowledge in construction materials and procedures, fixtures, construction technologies, concrete structures and design methodologies is required. The learning outcome for this course is that the students will design project plans for a residential home.

**General objective:** Upon completion of this course, students will be able to complete a house design that makes it possible to visualize and resolve technical and construction problems; formulate the structure and installation calculation log and the correspond-



ing plans, as well as the brickwork, carpentry, ironwork plans of the architectural project; generate the set of construction specifications that complement the set of final plans and draw up the documents to process the construction permits.

**Key words:** Home design. Structure design: slabs, beams, foundations, retaining walls, staircases, cistern. Brickwork, construction elevations and sections; finishes. Carpentry and ironwork: frames, doors, windows. Plumbing, electrical, air-conditioning systems. Design, calculation and formulation of construction plans. Set of specifications. Official plan.

**Bibliography:** \* Bovill, Carl., Architectural design : integration of structural and environmental systems / Carl Bovill., New York : Van Nostrand Reinhold, c1991., [0442004400].

## AR2024 Projects IV: Community Buildings

( 6 - 0 - 12. Prerequisites: [ AR2022 ]. 6 ARQ11 )  
Equivalence: AR2008

This is an intermediate course which integrates intermediate architectural design concepts, enabling students to apply them in projects related to PUBLIC SPACES AND BUILDINGS. Using analogous and typological cases and exercises, focused on public buildings, like libraries, museums, schools, sports facilities and houses of worship, among others, students will design with a special emphasis in the aspects of habitability, sustainability and materials, considering knowledge related to material behavior, structural analysis, facilities and alternative systems, supported by computerized architectural drafting. Previous knowledge in architectural design is required -medium level- and in the development of different building types. The learning outcome for this course is that the students design 2 projects related to public spaces and buildings in national or international contexts.

**General objective:** Upon completion of this course, students will be able to complete projects linked to public spaces, such as schools, museums and public libraries, among others, and resolve the related functional, environmental, construction and structural aspects.

**Key words:** Public buildings. Sustainability and architecture. Sustainable architectural and urban design. Passive systems.

**Bibliography:** \* Salles Bergés y Chapital, Marcelo., Condominios / Marcelo Salles Bergés y Chapital., 1a ed., Chicago : Real Estate Education Company, c2000., [0793130077].

## AR2025 Critical Analysis of Architecture and its Context

( 3 - 0 - 8. Prerequisites: [ AR1018 ]. 7 ARQ11 )  
Equivalence: AR99854

This is an intermediate level course, which enables students to analyze projects, theories and architectural viewpoints, using analytical tools that allow them to identify, evaluate and summarize the essentials and bases that give rise to them, support them and motivate them. It enables students to recognize the interaction of architecture with other disciplines, particularly with philosophy and the realm of ideas, in order to perform a critical analysis of contemporary architects and their work. Previous knowledge is required in Theory and History of Architecture. The learning outcome for this course is that the students develop a critical stance on architectural theory and design, with the goal of formulating their own viewpoint to be applied in support of their proposals for architectural projects.

**General objective:** Upon completion of this course, students will be able to analyze contemporary problems in the field of architectural theory and practice, based on a multidisciplinary outlook, in particular philosophy; recognize the effect of architecture in other areas of knowledge so that, through reflection, analysis and discussion, they can take a critical stance that combines theory and practice, recognizing the reality imposed by today's world.

**Key words:** Architectural theories and viewpoints. Interaction of architecture with other disciplines such as philosophy. Appropriate theoretical position to support proposals in design workshops.

**Bibliography:** \* Montaner, Josep Maria, Arquitectura y crítica / Josep Maria Montaner., 2a ed. rev. y

ampliada. , Barcelona ; México: Gustavo Gili, 2007., [9788425217685].

### **AR2026 Construction Projects II** ( 6 - 0 - 12. Prerequisites: [ AR2023 ]. 7 ARQ11 ) **Equivalence: AR2011**

This is an intermediate level course, which enables students to develop an architectural project for a medium-height building or for medium or large clearings, in addition to introducing structural and utility criteria and the corresponding plans for putting together a project that includes brickwork (use of prefabricated materials), steel and glass (facade systems); and to write the construction specifications. Previous knowledge is required in construction projects and structures. The learning outcome for this course is that the students develop a project for a medium-height office building or commercial complex with a basement, in an area that allows the inclusion of landscaping.

**General objective:** Upon completion of this course, students will be able to develop a construction project of a commercial or office building, defining the structural systems and the solution to the technical implications of the installations and generating the documents (plans, specifications and log) that form part of the final plan set.

**Key words:** Design of a two- to five-floor, open floor plan office or commercial building. Landscape design and an industrial project. Structure design: joist slabs, reinforced concrete frames, foundations, retaining walls, metal staircases, cistern and ramps. Brickwork, construction elevations and sections (uses of prefabricated and glass components); finishes, excavations and foundation courses. Plumbing.

**Bibliography:** \* Bovill, Carl., Architectural design : integration of structural and environmental systems / Carl Bovill., New York : Van Nostrand Reinhold, c1991., [0442004400].

### **AR3006 Urban Design Methods** ( 3 - 0 - 8. Prerequisites: [ AR3005 , AR3018 ]. 9 ARQ11 ) **Equivalence: None**

This is an advanced course that introduces the students to the knowledge of different urban design methodologies, based on frameworks such as philosophy, modernity, postmodernity, phenomenology, deconstruction and deep ecology, applying them to urban design proposals. As a learning outcome, it is expected that the student will be able to identify and apply the methods studied in class to a specific city analysis and urban design project.

**General objective:** Upon completion of this course, students will be able to utilize the methodologies and tools of urban planning; propose and develop urban projects in existing contexts and propose models of urban development.

**Key words:** Urban design basic concepts. Urban design methodologies. Urban design technological tools.

**Bibliography:** \* Gandelsonas, Mario, 1938-, The urban text / Mario Gandelsonas ; essays by Joan Copjec, Catherine Ingraham, John Whiteman., Cambridge, Mass. : MIT Press, c1991., Massachusetts, c1991., eng, [026257084X (rústica)].

### **AR3014 Projects V: Mixed-use Complexes** ( 6 - 0 - 12. Prerequisites: [ AR2024 ]. 7 ARQ11 ) **Equivalence: AR2010**

This is an advanced level course, which integrates intermediate concepts of architectural design, with the intention that students apply them in areas focused on MIXED-USE and WORK-SPACE projects, through exercises, such as mixed complexes, hospitals, offices and factories. Emphasis will be placed on the relationship between urban context and matters of livability, sustainability, materials, structure and construction, through the application of theoretical and critical knowledge, supported by the information and visualization systems that are necessary for resolving problems. Previous intermediate knowledge is required in architectural design and various prac-

tices in the development of different types of projects. The learning outcome for this course is that students be able to develop 2 mixed-use or work-space construction projects.

**General objective:** Upon completion of this course, students will be able to apply the principles of design and construction in mixed-use building projects and their relationship with the landscape, and resolve functional, environmental, construction, structural and landscape issues.

**Key words:** Urban projects. Landscaping. Mixed-use projects.

**Bibliography:** \* Sandaker, Bjørn Normann, 1954-, *The structural basis of architecture* / Bjørn Normann Sandaker and Arne Petter Eggen ; translation by Steven Kirwin., New York : Whitney Library of Design, 1992., [0823049361 :],[,\$35.00].

### AR3015 Building and Energy Efficiency

( 3 - 0 - 8. Prerequisites: [ AR2017 ]. 8 ARQ11 )  
Equivalence: None

This is an advanced level course in Architecture, designed to emphasize the importance of sustainable architecture in the present and the future through the use of energy management software solutions that make architectural designs more efficient in general. Previous basic knowledge is required in Passive Architecture Systems, ArchiCad, SketchUp and Microsoft Office. The learning outcome for this course is that students be able to develop an energy-efficient real estate/architectural product that would satisfy the principles of sustainability and commercial feasibility in the local market.

**General objective:** Upon completion of this course, students will be able to: Be proficient in computer constructive technology concepts and programs related to energy efficiency in buildings. Apply theoretical and practical tools in a specific project on energy efficiency in buildings.

**Key words:** Building. Energy efficiency. Technology.

**Bibliography:** \* McLean-Conner, Energy Efficiency: Principles and Practices, 2009.

### AR3016 Internship ( 3 - 0 - 8. Prerequisites: None. 8 ARQ11 ) Equivalence: AR3011

This is an advanced course designed to apply to professional practice the knowledge gained throughout students' studies in an architectural office, project management office, construction company office, government office, in the area of design, development, or urban planning. Students might also be placed in other companies in the departments of design and/or construction. Requires previous advanced knowledge and abilities in all disciplines of architecture, the goal being that students be able to perform in various areas of professional architectural firms. The learning outcome of this course is that students collaborate in a professional office and elaborate the design of their own personal images for use in future professional performance.

**General objective:** Upon completion of this course, students will be able to perform adequately in diverse offices or companies as part of their entry into professional practice; generate media to make themselves known, such as portfolios, curriculum vitae and Websites; identify the ways in which they can support the different tasks carried out in diverse working environments in relation to their major; and create an individual work plan at the beginning of the semester.

**Key words:** Integrate the knowledge acquired. Internship. Individual work plan. Professional image design.

**Bibliography:** \* Ramsey, Charles George, 1884-1963., *Architectural graphic standards* / Ramsey/Sleeper., 9th ed /John Ray Hoke, Jr., editor in chief., New York ; Chichester : Wiley, c1994., [0471533696 :],[£157.00].

### AR3017 Capstone Projects I ( 6 - 0 - 12. Prerequisites: [ AR3014 ]. 8 ARQ11 ) Equivalence: None

This is an advanced course, which integrates advanced concepts of architectural design, with the intention that students apply them in exercises focused on design built in areas with heritage designation. Special emphasis will be placed in aspects such as habitability, sustainability, context, materials, structure, building and urban analysis, considering their relationship with urban planning, all this supported by information and visualization systems. Previous knowledge and skills are required for the development of architectural projects that relate to specific urban contexts. The learning outcome for this course is that the students will be able to develop an architectural project related to the patrimonial and urban environment in which they are placed.

**General objective:** Upon completion of this course, students will be able to apply the principles of architectural design, considering the study, analysis and solution of the theoretical, functional, environmental, plastic, building, structural and contextual aspects; managing architectural and urban projects in order to respect and adapt to the patrimonial urban and landscape context.

**Key words:** Heritage Buildings.

**Bibliography:** \* Reid, Esmond., Understanding buildings : a multidisciplinary approach / Esmond Reid., Cambridge, Massachusetts : MIT Press, 1988., [0262680548].

### AR3018 Urban Theories ( 3 - 0 - 8. Prerequisites: [ AR2007 ]. 8 ARQ11 ) Equivalence: AR3005

This is an advanced course designed to identify the various subsystems of urban planning and development, as well as integrating various subjects in urban planning through analysis of urban and regional components and identification of the spatial, functional, social, economic and infrastructural aspects of urban and regional planning. Previous knowledge in urban history, architectural theory and advanced computer tools is required. The learning outcomes

for this course are that the students understand the basic concepts of the cities and urban contexts, have clear awareness of the problems in our modern cities and recognize the potential of urban and regional planning.

**General objective:** Upon completion of this course, students will be able to identify the diverse stages of evolution of cities; describe and apply the concept of public space as the basis for comprehending urban spaces; identify the tools for planning the growth of cities; analyze their potentials and propose development alternatives.

**Key words:** Evolution of the city. Contemporary cities. Current urban issues. Urban and regional planning.

**Bibliography:** \* Ecological design and planning / George F. Thompson and Frederick R. Steiner, editors., New York : John Wiley, 1997., [0471156140 (cloth : alk. paper)].

### AR3019 Real-estate Projects ( 3 - 0 - 8. Prerequisites: [ CV2027 ]. 9 ARQ11, 8 IC 11 ) Equivalence: AR3008

This is an advanced level course in Civil Engineering and Architecture, which defines the bases for the promotion and management of real-estate projects. Previous knowledge is required in urban planning and construction costs. The learning outcome for this course is that students be able to manage every phase of a real-estate project, from the feasibility study phase through the initiation and finalization of the project.

**General objective:** Upon completion of this course, students will be able to: Evaluate and select the best investment and implementation alternative to meet the customer's or investor's goals in the real-estate business sector. Plan, manage and control the adequate use of human, material and technological resources for executing a real-estate project.

**Key words:** Real estate project management. Project feasibility.

**Bibliography:** \* Achour, Dominique., *Inversión en bienes raíces : análisis y valuación de bienes raíces en el contexto mexicano* / Dominique Achour, Gonzalo Castañeda., México, D.F. : Limusa/Noriega Editores, c1992., spafre, [968184341x],[9789681843410].

**AR3020 Capstone Projects II**  
( 6 - 0 - 12. Prerequisites: [ AR3014 ]. 9 ARQ11 )  
**Equivalence: None**

This is an advanced level course, which integrates advanced concepts of architectural design, with the intention that students understand and apply basic principles of construction, management and urban planning, through analogous and typological case studies and exercises focused on HIGH-RISE BUILDINGS in mixed use developments, in the conception of innovative projects with new materials and new concepts of functionality and use, through the application of profound practical and theoretical knowledge and knowledge of sustainability and urban management and planning, supported by the information and visualization systems that are necessary for resolving problems. Previous knowledge and skills are required for the development of architectural projects that relate to specific urban contexts. The learning outcome for this course is that the students will be able to develop a major architectural project, that includes a mid-rise or high-rise building, including the urban project for the zone in which it is located.

**General objective:** Upon completion of this course, students will be able to apply the principles of architectural design, considering the study, analysis and solution of the theoretical, functional, environmental, plastic, construction, structural and contextual aspects; and manage architectural and urbanism projects in exercises focusing on architectural and urban recycling.

**Key words:** Recycling, renovation and reuse of spaces and buildings.

**Bibliography:** \* Correa, Charles, 1930-, *Housing and urbanisation* / Charles Correa., London ; New York : Thames & Hudson, 2000., [0500282102].

**AR3021 Introduction to Professional Development**  
( 2 - 0 - 2. Prerequisites: [ AR3014 ]. 10 ARQ11 )  
**Equivalence: None**

This is an undergrad course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied along the students' undergrad program. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools needed in order to successfully make the transition between student to professional life and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

**AR3022 Final Project**  
( 8 - 0 - 16. Prerequisites: [ AR3020 ]. 10 ARQ11 )  
**Equivalence: AR3010**

This is an advanced course which integrates advanced concepts of architectural design. It is designed to help students apply design, construction and management concepts in an urban architectural project, through the study of similar and typological cases and exercises focused on urban architectural projects at the executive level. Emphasis on matters of livability, sustainability, materials, structure and construction, supported by the information and visualization systems that are necessary for resolving problems will be placed. Previous knowledge in design, construction, theory, history, promotion and urban planning is required. The learning outcome for



this course is that the students will be able to apply design concepts thoroughly, through the study, analysis and application of basic principles of construction, management and urban planning, based on the study of similar cases and supported by the necessary information and visualization systems.

**General objective:** Upon completion of this course, students will be able to analyze in depth and apply the principles of architectural design, considering the study, analysis and solution of theoretical, functional, environmental, plastic, construction, structural, budgetary and contextual aspects, as well as the management of architectural and urban projects, through exercises focusing on architectural-urban projects.

**Key words:** Design methodology. Completion of an executive level project. Applications of the theoretical framework. Timeline and work schedule.

**Bibliography:** \* Ramsey, Charles George, 1884-1963., *Architectural graphic standards* / Ramsey/Sleeper., 9th ed / John Ray Hoke, Jr., editor in chief., New York ; Chichester : Wiley, c1994., [0471533696 :], [£157.00].

## AT

## Art and Technology

**AT1001 Artistic Drawing****( 4 - 0 - 8. Prerequisites: [ AR1013 ]. 2 LAD11, 2 LDI11 )****Equivalence: None**

The purpose of this basic-level animation course is to introduce students to the use of freehand drawing and digital illustration techniques oriented toward the search for visual solutions for animation projects. This is done through traditional processes, such as pencil techniques, sketching and manual methods of traditional drawing applied to the design of characters and scenes in animation projects. The human figure, in repose and in motion, receives special consideration. Requires previous knowledge of fundamentals of drawing. The learning outcome of this course is for students to generate a short animation as a sequence of drawings and present their work.

**General objective:** Upon completion of this course, students will be able to draw characters in diverse poses and with different expressions, as well as environments and sceneries for animation.

**Key words:** Expressive line. Form and proportion. Animation. Storyboard. Anatomy. Gestures. Character poses. Acting. Texture and value. Color models. Image manipulation.

**Bibliography:** \* Paul Wells, Joanna Quinn, Les Mills, Basics Animation: Drawing for Animation, AVA Publishing, Inglés, [ISBN-10: 2940373701, ISBN-13: 978-2940373703].

**AT1002 Fundamentals of Animation****( 3 - 0 - 8. Prerequisites: [ AT1001 ]. 3 LAD11 )****Equivalence: None**

The purpose of this basic 2D animation course is to introduce students to knowledge of movement, creative decision making and techniques for the effective employment of basic animation tools, such as weight, acceleration, deceleration, spacing, rhythm, overlap, object rigidity and volume modification, by means of traditional tools like pencil, paper and objects. The course requires previous knowledge of

drawing, preferably through a course in animation drawing. The learning outcome of this course is for students to generate a basic 2D animation.

**General objective:** Upon completion of this course, students will be able to identify the basic principles of traditional animations and generate a short 2D animated film.

**Key words:** Movement analysis. Classic animation. Biped and quadruped movement.

**Bibliography:** \* Besen, Ellen, 1953-, Animation unleashed : 100 principles every animator, comic book writer, filmmaker, video artist and game developer should know / by Ellen Besen ; illustrated by Bryce Hallett., Studio City, CA : M. Wiese Productions, 2008., [9781932907490],[1932907491].

**AT1003 Introduction to Animation and Digital Art Academic Program****( 3 - 0 - 4. Prerequisites: None. 1 LAD11 )****Equivalence: None**

The purpose of this basic-level course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic



Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* ITESM, Misión, Visión y Objetivos del Tecnológico de Monterrey.

### AT2000 Digital Modelling

( 3 - 0 - 8. Prerequisites: [ A1000 , DL1010 ]. 4 LAD11, 4 LDI11 )

**Equivalence:** None

Intermediate art and technology course that introduces students to the digital representation of three-dimensional organic and inorganic objects. This course requires prior knowledge of sculpture (human body). The learning outcome of this course is for students to create realistic or ludic organic and inorganic models of the human body using diverse materials.

**General objective:** Upon completion of this course, students will be able to apply the basic computer principles, techniques and tools to generate three-dimensional models, as well as the necessary steps to integrate them into any type of 35mm, 16mm and HDTV professional productions; use modeling programs for the representation of virtual objects, characters and sceneries.

**Key words:** 3D Modeling. Texturizing. Workflows. Polygonal modeling. Character modeling.

**Bibliography:** \* 3D modeling and animation : synthesis and analysis techniques for the human body / editado por Nikos Sarris y Michael G. Strintzis., Hershey PA : IRM Press, 2004, 2005., Pennsylvania, 2004, 2005., eng, [1931777985 (rústica)], [1591402999 (en-cuadernado)].

### AT2005 3D Animation

( 3 - 0 - 8. Prerequisites: [ AT2000 , AT1002 ]. 5 LAD11 )

**Equivalence:** None

The purpose of this intermediate-level course in art and digital technology is for students to learn the basic principles of 3D animation (timing and spac-

ing), applying animation techniques through distortion, introduction to the automation of 3D elements through animation, and application of cinematic, inverse/direct and scripting rigging-control techniques. Requires knowledge of digital modeling. The learning outcome of this course is for students to be able to animate and automate such elements as: objects (props), vehicles, humans (bipeds) and animals (quadrupeds, amphibians, steel or terrestrial).

**General objective:** Upon completion of this course, students will be competent in the 3D animation production process, applying techniques and tools to create animations of characters, vehicles and dynamic scenery.

**Key words:** Kinematics. Animation. Walk cycles. Cycle repetition. Key frames.

**Bibliography:** \* Gauthier, Jean-Marc, Building interactive worlds in 3D : pre-visualization for games, film, and the Web, Focal Press, Inglés, [0240806220 (alk. paper)].

### AT2006 Theory and Practice of Sound

( 3 - 0 - 8. Prerequisites: None. 4 IMI11, 6 LAD11 )

**Equivalence:** AT2002

The purpose of this intermediate-level sound-production course is to introduce students to basic concepts of sound, its physical properties and how to produce and post-produce sound using specialized applications to create and edit audio with the goal of using it in diverse applications, such as education, entertainment and publicity, among others. The learning outcome of this course is for students to generate the audio for a promotion, an entertainment system and dubbing, among others.

**General objective:** Upon completion of this course, students will be able to understand and handle the characteristics of analogue sound in a digital setting; process and apply techniques related to sound capture, editing and processing in audio editing software for the postproduction of multitrack dialogues and music in audiovisual productions.

**Key words:** Digital sound. Filters. Analog sound. Equalizer. Synthesizer. Mixer. MIDI. Audio production process. Audio production and editing software. Audio output formats.

**Bibliography:** \* Iglesias Simón, Pablo., Postproducción digital de sonido por computadora / Pablo Iglesias Simón., México : Alfaomega ; Madrid : Ra-Ma, 2002., [9701508262 (Alfaomega)], [847897508X (Ra-Ma)].

### **AT2007 Virtual Environment** ( 3 - 0 - 8. Prerequisites: [ TC3022 ]. 7 LAD11 ) **Equivalence: AT2003**

The purpose of this intermediate computer-technology course is for students to understand the fundamentals of virtual and augmented reality and experience how it changes the interaction between people and technology. This is accomplished through the visualization of information and processes as well as the creative expression of ideas. The course requires previous knowledge of human-computer interaction, programming and modeling. The learning outcome of this course is for students to develop a virtual reality or augmented reality project using diverse interaction tools through the basic administration of computer-science projects.

**General objective:** Upon completion of this course, students will be able to understand the history and the theoretical, technical, development and organizational principles of producing virtual worlds; be familiar with the broad variety of applications, development and experimental production topics; design and implement a virtual reality or augmented reality project using diverse interaction tools.

**Key words:** Modeling. Virtual reality. Human factors. Virtual environment. Interaction devices: sensors, gloves, glasses, speakers, haptic devices (touch and force feedback). Computer architectures. Virtual reality programming.

**Bibliography:** \* Hernández García, Iliana., Mundos virtuales habitados : espacios electrónicos interactivos / Iliana Hernández García., 1a ed., Bogotá, Colombia : Centro Editorial Javeriano, 2002., [9586835456].

### **AT3001 Advanced Digital Modeling** ( 3 - 0 - 8. Prerequisites: [ AT2000 ]. 6 LAD11 ) **Equivalence: None**

This is an advanced art and technology course, with the purpose of strengthen students' knowledge and skills in 3D modeling, emphasizing the quality and realism of organic models as well as the precision and correct interpretation of inorganic models to be used with different presentation purposes. The course requires previous knowledge of 3D modeling at intermediate level. The learning outcome of this course is for students to have the ability and sufficient training to generate objects, spaces and characters professionally, using the 3D environment and producing results that can be used for animation and/or representation.

**General objective:** On finalizing this course the student will be able to model organic objects and digital environments, and apply textures to models at expert level.

**Key words:** Modeling. Primitive objects. Pivots. Layout and views. Grid. Layers. Lighting. NURBS. Libraries. Polygons. Rendering.

**Bibliography:** \* Lanier, Lee, 1966-, Advanced Maya texturing and lighting / Lee Lanier., 2nd ed., Hoboken, NJ : Wiley Technology Pub., 2008., [9780470292730 (rústica : CD-ROM)].

### **AT3002 Advanced 3D Animation** ( 3 - 0 - 8. Prerequisites: [ AT2005 , AT2001 ]. 7 LAD11 ) **Equivalence: None**

The purpose of this advanced 3D animation course is for the students to learn techniques for animating bipeds, quadrupeds, arachnids and insects, complementing them with movement capture (MOCAP). The course requires previous knowledge of 3D animation and character 3D setup. The learning outcome of this course is for students to apply advanced animation techniques for animating characters, incorporating the use of different facial expressions and body language, in order to create fluid, natural action. They will apply techniques and tools from physics and mathematics to perfect the expression of movement.

**General objective:** Upon completion of this course, students will be able to apply advanced 3D animation techniques to express movement in a realistic and natural manner.

**Key words:** Animation. Characters. Animation techniques. Motion capture (mocap).

**Bibliography:** \* Roberts, Steve, 1941-, Animación de personajes en 3D : utilizando técnicas de animación tradicional para producir animaciones por ordenador increíbles / Steve Roberts., Guipúzcoa, España : Escuela de Cine y Vídeo, 2005., spaeng, [8493431915],[9788493431914].

### AT3003 Visual Effects Production for Digital Media

( 3 - 0 - 8. Prerequisites: [ AV2006 Corequisite , AT2005 ],[ AV2001 , AT2001 ]. 7 LAD11 )

**Equivalence:** None

The purpose of this advanced-level visual arts course is to teach students to understand and master the technological techniques and tools used in the creation of professional visual effects. By means of theoretical and practice sessions, students learn to take maximum advantage of alternative approaches to visual effects, at the same time forming criteria to determine the pertinent resources for an audiovisual project. Requires knowledge of 3D animation and audiovisual production. The learning outcome of this course is for students to prepare an individual demo reel of visual effects demonstrating the use of techniques learned during the course. Working in teams, they develop an audiovisual project that makes effective use of visual effects within the framework of a complete digital production process.

**General objective:** Upon completion of this course, students will be able to apply the principle design and creation techniques of visual effects, such as: physics-based animation, destruction and integration, particle systems, fluid simulation, digital video composition and morphing; use visual effects properly, consistent with the desired message or impression to be transmitted.

**Key words:** 3D animation. Simulation. Visual effects. Particle systems.

**Bibliography:** \* Lee, Lanier, Professional Digital Compositing: Essential tools and techniques, Wiley Pub, Inglés, [0470452617].

### AT3004 Animation and Digital Art Project

( 3 - 0 - 8. Prerequisites: [ AT3002 , AT2007 ]. 9 LAD11 )

**Equivalence:** None

The purpose of this advanced-level animation course is for students to integrate their knowledge gained in all previous courses. Requires knowledge and skills for advanced interactive design or modeling and/or advanced animation for creating a project involving animation, audiovisual or interactive production, whether in short animation, interactive media or a short-subject film with visual effects. Within the national and international standards of the industry, students learn to combine various human, technological and financial resources in the project, taking into consideration such themes as author's rights and project administration up to release to the target audience for which the production is intended. The learning outcome of this course is for students to produce a demo reel, short subject or interactive project.

**General objective:** Upon completion of this course, students will be able to conceptualize, design, develop and validate the functioning of a product that combines art and technology in the areas of animation and digital art for entertainment, education, science and technology.

**Key words:** Digital art. Modeling. Simulation. 3D animation. Visual effects. Interactive art. Texturization. Production.

**Bibliography:** \* Peter Ratner, 3-D Human Modeling and Animation, Third Edition, Wiley, Inglés, [978-0470396674].

## **AT3005 Introduction to Professional Development**

**( 2 - 0 - 2. Prerequisites: None. 9 LAD11 )**

**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## AV

## Audiovisual Media

**AV1000 Photography and Digital Imaging****( 3 - 0 - 8. Prerequisites: None. 3 LAD11, 3 LCMD11, 4 LMC11, 5 LPM12 )****Equivalence: AV00833, CO00833, CO95833**

Basic graphic and visual media course that introduces students to the history, theory, technique and practice of photography so that they can apply their knowledge and skills to photographic production, either as part of communication projects that include the use of other media or independently. The course also provides the bases for the production of media whose operation and production are based on photographic concepts and techniques. This course requires a basic knowledge of computer studies. The learning outcome for this course is that students have a portfolio of photographs resulting from camera handling, composition, creative, and analogue and digital image processing exercises, thus integrating the knowledge and skills acquired during the course.

**General objective:** Upon completion of this course, students will be able to produce photographs for different purposes, understanding and applying concepts and techniques related to the characteristics and behavior of light, and the formation, capture, and processing of digital and analog images, the use and operation of photographic equipment, photographic aesthetics and composition, the techniques used in approaching different themes or subjects, the management of software for the administration and editing of digital photographs, and the ethical, legal, and professional aspects of photography. Students will understand and appreciate the historical evolution of photography and the works of important photographers, and will find creative solutions to the photographic projects assigned to them while developing a personal perspective and style.

**Key words:** Analog and digital photography. Photographic equipment, materials and processes. Photographic composition and aesthetics. Photo management and editing software. Professional specializations in photography.

**Bibliography:** \* London, Barbara, 1936-, Photography / Barbara London, Jim Stone, John Upton., 10th ed., Upper Saddle River, N.J. : Prentice Hall, c2011., [0205711499].

**AV1001 Graphic Design****( 3 - 0 - 8. Prerequisites: None. 5 LMC11 )****Equivalence: CO00845, CO95831**

This intermediate level course in the graphical and visual media field does not require that the student have previous theoretic knowledge or technical experience. Its intention is to introduce to the students the basic knowledge of design and visual communication and allow them to apply their creativity and the visual composition principles in the design of print and digital graphical images, using present day computational tools. As learning product of this course it is expected that the students be able to apply the elements in visual communication and use the design tools in the production of basic graphical and printed materials for diverse ends.

**General objective:** Upon completion of this course, students will be able to identify, analyze, and reproduce the components of graphical communication language; develop the skills to choose and use the most suitable tools for visual communication; design and produce graphical and printed material.

**Key words:** Updated computer applications for printed graphic message design. Composition and color theory. Graphical creativity. Design and visual communication. Principles of visual composition.

**Bibliography:** \* Swann, Alan C, 1946-, Basic design and layout. Español. "Bases del diseño gráfico / Alan Swann.", 6a ed., Barcelona : Gustavo Gili, 2004., Spain, 2004., spa, [8425218756].



## AV1004 Audiovisual Language and Narrative

( 3 - 0 - 8. Prerequisites: None. 5 IMI11, 4 LAD11, 2 LCMD11, 4 LDI11, 3 LMC11, 3 LMI11, 6 LPM12 )  
**Equivalence: AV1002**

This introductory course takes a theoretical and productive approach to the understanding and the application of the basic elements of film language to the film production process. The student will understand how to use the narrative, creative, and technical basic elements of the moving image in linear and fragmentary narratives. The student will design and produce short audiovisual practices to apply elements and concepts such as the shot and the basis of montage, film directing, visual structures, and mise-en-scène, cinematography and lighting, and film sound. At the end of the course the student will integrate all these elements in a short film narration using basic digital technologies to register and edit image and sound.

**General objective:** Upon completion of this course, students will comprehend the narrative, creative, and technical management of the basic elements of audiovisual language and of the production process in order to adapt the concepts for linear and interactive audiovisual narratives. Students will design and produce brief audiovisual practice projects in which they will apply the basic concepts of the audiovisual narrative: shooting, staging, visual structures, mise en scène, and cinematographic sound through the use of basic digital technologies of recording and editing image and sound. Students will also integrate the elements of audiovisual language in a final project, producing a short fiction film in digital video.

**Key words:** The shot and film editing. Directing, mise-en-scène, and narrative visual structures. Film sound. Interactive audiovisual language. The film production process.

**Bibliography:** \* Bordwell, David., Film art : an introduction / David Bordwell, Kristin Thompson., 7th ed., Boston : McGraw-Hill, 2004., [0072484551 (papel no a'cido)], [0071215921 (edición internacional : papel no a'cido)], [0071216960], [0072484578 (Film Viewers' Guide)].

## AV1005 Digital Design Lab

( 0 - 3 - 4. Prerequisites: None. 2 LCMD11, 2 LMI11 )  
**Equivalence: None**

This basic laboratory course seeks to develop students' competencies in handling digital editing software for pixel- and vector-based images, so that they can apply these skills in future courses. No prior knowledge is required. Learning outcome: students will complete various exercises to demonstrate their capacity to handle digital imaging concepts and digital image editing tools.

**General objective:** Upon completion of this course, students will be capable of using the principal tools and application functionalities of digital editing software for pixel- and vector-based images, in order to apply them in future courses.

**Key words:** Adobe Illustrator. Digital image editing software. Adobe Photoshop. Digital imaging.

**Bibliography:** \* Dayley, Lisa DaNae., Photoshop CS5 bible / Lisa DaNae Dayley and Brad Dayley., Indianapolis, IN : Wiley, c2010., [9780470584743 (pbk.)], [0470584742 (pbk.)].

## AV1006 Audio Lab

( 0 - 3 - 4. Prerequisites: None. 3 LCMD11, 3 LMI11 )  
**Equivalence: None**

The aim of this introductory laboratory course is for students to acquire sufficient technical skills in the use of audio equipment for diverse types of products. No prior knowledge is required. Throughout the semester, students will complete brief exercises to demonstrate their technical skill. Learning outcome: students complete a video production applying the skills acquired during this workshop.

**General objective:** Upon completion of this course, students will be able to use basic audio production and editing equipment correctly in diverse formats and for different technological platforms.

**Key words:** Audio editing software. Dubbing.

**Bibliography:** \* Drew O. McDaniel, Rick C. Shriver & Kenneth R. Collins, *Fundamentals of Audio Production*, Allyn & Bacon, Inglés, [0205462332].

### AV1007 Video Lab

( 0 - 3 - 4. Prerequisites: None. 4 LCMD11, 4 LMI11 )

**Equivalence:** None

The aim of this introductory laboratory course is for students to acquire sufficient technical skills in the use of audiovisual equipment for diverse types of productions. No prior knowledge is required. Throughout the semester, students will complete brief exercises to demonstrate their technical skill. Learning outcome: students complete a video production applying the skills acquired during this workshop.

**General objective:** Upon completion of this course, students will be able to use basic video production and editing equipment correctly in diverse formats and for different technological platforms.

**Key words:** Video editing software. Basic lighting triangle.

**Bibliography:** \* Producción de video : disciplinas y técnicas / Thomas D. Burrows. [et al.] ; traducción Edgar Rubén Cosío Martínez., 1a ed. en español., México, D.F. : McGraw-Hill, c2003., spaeng, [9701037871],[9789701037874].

### AV2002 Digital and Graphic Design Laboratory

( 0 - 3 - 4. Prerequisites: [ AV1001 Corequisite ]. 5 LMC11 )

**Equivalence:** None

In this workshop, students will gain the practical experience needed to design graphical and digital messages. A basic knowledge of graphic design and digital imaging is required. Learning outcome: students will create designs using the available technologies and their applications.

**General objective:** At the end of the course the student will be able to develop the abilities that allow him to choose and to use tools for the design of visu-

ally attractive form of graphical and digital messages.  
**Key words:** Graphic design. Digital graphic design. Digital campaign design.

**Bibliography:** \* Adobe Creative Team , *Adobe Illustrator CS5 Classroom in a Book*, Adobe Press, [032170178X].

### AV2004 Scriptwriting

( 3 - 0 - 8. Prerequisites: None. 6 LAD11, 4 LCMD11, 6 LMC11 )

**Equivalence:** AV1003

In this intermediate audiovisual media course, students will understand and apply narrative structures and formats to write screenplays for audiovisual productions on any platform. Previous knowledge required are basic creative writing in Spanish, audiovisual language and visual narrative. The learning outcome for this course is that students create, individually, at least one screenplay for an audiovisual production on any platform in keeping with the characteristics of narrative structure and format for writing screenplay texts.

**General objective:** At the end of this course, students will be able to understand, select and use narrative structures and formats in screenwriting for audiovisual productions on any platform. They will develop the skills to analyze and write creative, innovative scripts that can be adapted to technical-narrative resources for every platform, as well as to the particular circumstances of each audiovisual production and the specific characteristics of each audience.

**Key words:** Script writing. Audiovisual narrative. Audiovisual productions. Dramatic and documental structure. Script formats.

**Bibliography:** \* McKee, Robert, 1941-, *El guión : sustancia, estructura, estilo y principios de la escritura de guiones* / Robert McKee ; traducción Jessica Lockhart., 5a ed., Barcelona : Alba Editorial, 2006., spaeng, [848428168X],[9788484281689].



## AV2005 Advertising and Commercial Photography

( 3 - 0 - 8. Prerequisites: [ AV1000 ]. 4 LCMD11, 5 LMC11 )

**Equivalence: None**

This intermediate graphic and visual media course provides students with the technical, creative and business tools that will reinforce and enhance their knowledge and skills in the field of photography in order to facilitate their introduction to the world of product, food, fashion, editorial, architectural, industrial corporate, event, sports, commercial portrait and social photography. Students will learn how to formulate a professional photography business plan and budget; become familiar with the ethical and legal aspects of professional photography; discover and manage workflow processes for diverse outputs; and carry out photographic production exercises and projects from the conceptualization to delivery stages. The course provides students with creative technical and work experiences that will enable them to extend their vision of still images to animated images in future courses. Prior knowledge of photography and digital imaging is required. Learning outcome: students will conclude the course with a portfolio of photographs including product and commercial portrait photography exercises conducted in the studio and in indoor and outdoor locations. Moreover, students will complete a commercial project in a specialization including product, food, fashion, editorial, architectural, industrial corporate, event, sports, commercial portrait and social photography, completing all the necessary stages according to the nature of the project, such as project generation, conceptualization, budget, legal issues, location search and selection, obtaining permits, model search and selection, production design, model direction and photo shoots, digital post-production and the delivery in the corresponding medium and output format.

**General objective:** Upon completion of this course, students will be competent in all the stages of photographic projects from the beginning to delivery, handling photographic equipment, lighting equipment and digital imaging equipment and software appropriately to obtain results with a high level of technical quality and in accordance with the requirements and specifications of each particular project. Students will have acquired the technical, creative and busi-

ness tools that will facilitate their entry into the world of professional photography and allow them to work in one or more commercial photography specializations and apply their experience, knowledge and skills in future still photography or audiovisual production courses.

**Key words:** Studio photography. Commercial photography. Product photography. Portrait photography. Professional photography. Photographic specializations. Digital workflow in photography.

**Bibliography:** \* Lesko, L. & Lane, B., Advertising Photography: A Straightforward Guide to a Complex Industry, Thomson Course Technology, Inglés, [978-1598634068].

## AV2006 Media Narrative Design and Production

( 3 - 0 - 8. Prerequisites: [ AV1004 ]. 6 IMI11, 7 LAD11, 5 LCMD11, 6 LMC11, 7 LPM12 )

**Equivalence: AV2001**

This introductory course takes a theoretical and a pragmatic approach to the application of audiovisual language and narrative concepts in order to design and produce audio, video, film, and television projects. The goals of these fiction and non-fiction media projects are to inform about social, organizational and/or cultural issues or to entertain, and are produced working in teams and using digital recording and editing technologies. The purpose of this course is to apply the basic elements of audiovisual language and the principles of narrative theory to the design and the production of media projects in audio, video, film, and television. Students will work on audiovisual narrative solutions in fiction and non-fiction audio and video media projects and will explore their personal strengths in various media technologies, their abilities to work in teams, and to develop individual roles within the production process.

**General objective:** Upon completion of this course, students will understand the practical application of the concepts of audiovisual narrative, audiovisual language and will be able to produce fictional and documentary scripts by completing audio, video, film and television projects in teams through the use of digital recording and editing technologies of im-

age and sound with the objective of disseminating information on social, organizational and/or cultural issues.

**Key words:** Live television program. Radio drama. Radio and television public service announcement. Experimental short film or literary adaptation short film. Radio and television news reporting.

**Bibliography:** \* Kindem, Gorham Anders., Introduction to media production : from analog to digital / Gorham Kindem, Robert Musburger., 2nd ed., Boston : Focal Press, c2001., [0240804082 (pbk. : alk. paper)].

### AV2007 Digital and Interactive Media Aesthetics

( 3 - 0 - 8. Prerequisites: None. 6 LCMD11 )  
Equivalence: None

In this intermediate audiovisual media course, students will analyze and understand the elements and factors, from the artistic avant-garde to technological advancements, that give shape and content to contemporary audiovisual media. Prior knowledge of contemporary art and culture is required. The learning outcome for this course is that students offer an oral presentation and write an essay to explore, in a highly critical sense, a personal reflection based on the theoretical research of diverse aesthetic questions related to the audiovisual media.

**General objective:** Upon completion of this course, students will be able to use critical thinking to analyze and question in detail the origins, forms and aesthetics of the messages that are transmitted on a daily basis by the contemporary audiovisual media through discussions about readings and visual examples, as well as theoretical research and lectures.

**Key words:** Audiovisual realism. Video art. Avant-garde art movements. New media aesthetics in the digital era.

**Bibliography:** \* Gale, Mathew, Dada and Surrealism, Phaidon Press Limited, Inglés, [0714832618].

### AV2008 Multi-Platform Audio Production

( 3 - 0 - 8. Prerequisites: [ AV2006 ]. 6 LCMD11 )  
Equivalence: AV3004

The aim of this intermediate audiovisual media production course is to develop student's critical, creative, technical and project management skills in the field of audio production for diverse audiovisual and digital platforms. Prior knowledge of audiovisual production and screenwriting structures and formats is required. Learning outcome: In teams, students will produce diverse formats of radio and digital audio programs, and will also create a portfolio of audio and radio productions.

**General objective:** Upon completion of this course, students will be able to participate in the preproduction, production, postproduction and distribution of audio projects diverse formats for radio and the Internet, including the generation of the idea, concept development, activity planning, budget formulation, screenwriting, budget formulation, the search and selection of artistic talent, recording, editing and mixing, preparation of the project for distribution, and assessment of the project based on artistic, technical, administrative, financial and social criteria.

**Key words:** Radio formats. Radio stations. Online radio. Digital audio. Audio pre-production, production and post-production. Basics of sound in radio production.

**Bibliography:** \* Drew O. McDaniel, Rick C. Shriver & Kenneth R. Collins, Fundamentals of Audio Production, Allyn & Bacon, Inglés, [0205462332].

### AV2009 Media Projects Management and Evaluation

( 3 - 0 - 8. Prerequisites: None. 7 IMI11, 8 LAD11, 7 LCMD11, 7 LMC11 )  
Equivalence: None

This intermediate audiovisual media and management interdisciplinary course develops students' administrative and planning skills to generate, coordinate and promote audiovisual projects. Prior knowledge of audiovisual language, management,

accounting and marketing is required. The learning outcome for this course will be the creation of an executive portfolio comprising the production, promotion and distribution of an audiovisual project.

**General objective:** Upon completion of this course, students should have completed the production, promotion and distribution planning for an audiovisual project with all the logistical, administrative, financial and legal matters considered.

**Key words:** Planning, scheduling and budgeting for audiovisual projects. Legal and contractual aspects of audiovisual production. Accounting, financial and fiscal aspects of audiovisual production. Audiovisual production funding. Location selection and obtaining permits. Distribution and exhibition of audiovisual projects.

**Bibliography:** \* Koster, Robert., The on production budget book / Robert J. Koster., Boston : Focal Press, c1997., [0240802985 (acid-free paper)].

### **AV2010 Directing and Mise en Scene**

**( 3 - 0 - 8. Prerequisites: None. 7 LCMD11 )**

**Equivalence: None**

This intermediate audiovisual media production course focuses on stage direction, production design and acting, providing students with the necessary audiovisual construction tools and techniques to design a suitable production for each audiovisual project. Prior knowledge of photography, audiovisual language, screenwriting, audiovisual production and media aesthetics is required. Learning outcome: students will complete audiovisual stage production projects using the basic staging techniques. Students will submit stage design proposals consisting of: lighting design, scenery design, costume and make up design, camera locations and scene blocking.

**General objective:** Upon completion of this course, students will be able to design a stage production project for audiovisual media that involves directing actors and designing sets, on the basis of the objectives, conflicts and motivations found in the script.

**Key words:** Stage directing applied to audiovisual media. Cast selection. Scenery and set design. Mise en scène. Illumination design.

**Bibliography:** \* Edgar-Hunt, Robert, Bases del cine. 03: Dirección, Parramón Ediciones, Español, [9788434236646].

### **AV2011 Massive Media Lab**

**( 0 - 3 - 4. Prerequisites: None. 6 LMC11 )**

**Equivalence: None**

In this laboratory course, student will become familiar with and understand the nature of the different mass communication media in areas such as design, production and editing. Prior knowledge of audiovisual language and communication strategy is required. Learning outcome: student will be conversant with and able to use the components of audiovisual language, as well as the components peculiar to radio, television and digital press production, to design and produce programs with an integral concept that meets their objectives.

**General objective:** On finalizing the course, the student will be able to understand the operation and application of different massive media, like radio, television and presses in digital format, developing aspects of design production and edition.

**Key words:** Marketing. Radio. Television. Digital press.

**Bibliography:** \* Modern radio production : production, programming, and performance / Carl Hausman . [et al.], 6th ed., Belmont, CA : Wadsworth/Thomson, c2004., [0534563961].

### **AV3001 Interactive Media Design and Production**

**( 3 - 0 - 8. Prerequisites: None. 6 LCMD11, 7 LLE11, 7 LMC11, 7 LPM12 )**

**Equivalence: CO00865**

This advanced course in the area of audio-visual and graphic media seeks to help the student understand the global context and the influence of digital technologies on the communicative actions of the

social organizations. It requires basic knowledge of interactive design. As a result of learning the student will identify and solve problems derived from the technological practice to contribute directly towards competitiveness in a new digital environment.

**General objective:** Upon completion of this course, the student will be able to understand the convergence of communication technologies. Learn to plan, budget, design, produce, and evaluate interactive multimedia projects with suitable software and hardware tools; develop the skills to produce and assess whether a product meets the customer's needs.

**Key words:** Internet. Interactive media. Image manipulation. Digital audio and video production. Websites. Digital production.

**Bibliography:** \* Tim Frick, Managing Interactive Media Projects, 1st. Edition, Thomson Delmar Learning, Inglés, [978-1418050016].

### **AV3008 Documentary Production** ( 3 - 0 - 8. Prerequisites: None. 7 LCMD11, 9 LMI11 ) **Equivalence: AV3003**

This advanced course in audiovisual media production seeks to develop students' critical, creative, technical and project management skills for creating documentary videos. Prior knowledge of audiovisual production and documentary screenwriting structures and formats is required. Learning outcome: in teams, students will produce a documentary video; each student will be assigned a specific task, such as direction, production, photography direction (camerawork) and editing.

**General objective:** Upon completion of this course, students will be able to participate in the preproduction, production and postproduction of documentaries in video format, including the generation of the idea, concept development, activity planning, budget formulation, documentary and field research, recording the material, narrative structure design, scriptwriting, editing, preparation of the project for distribution, and assessment of the project based on artistic, technical, administrative, financial and social criteria.

**Key words:** Production and fieldwork. Edition and post-production. Introduction to image and sound in documentary production. Promotion, distribution and exhibition of audiovisual products. History of documentary film. Documentary theory and aesthetics. Technical tools for documentary film production. Collaboration process in media production. Documentary case studies.

**Bibliography:** \* Producción de video : disciplinas y técnicas / Thomas D. Burrows. [et al.] ; traducción Edgar Rubén Cosío Martínez., 1a ed. en español., México, D.F. : McGraw-Hill, c2003., spaeng, [9701037871], [9789701037874].

### **AV3009 Multi-Platform Television Production**

( 3 - 0 - 8. Prerequisites: [ AV2006 ]. 8 LCMD11 )  
**Equivalence: AV3005**

This advanced course in audiovisual media production seeks to develop students' critical, creative, technical and project management skills for creating television content to be distributed in traditional television and in other platforms. Prior knowledge of audiovisual production and television screenwriting structures and formats is required. Learning outcome: in teams, students will produce television programs in formats such as newscasts, live programs, music videos, soap operas, comedy series or drama series. They will also submit a production file that documents production-related matters, such as the production plan, budget and delegation of responsibilities.

**General objective:** Upon completion of this course, students will be able to participate in the preproduction, production and postproduction of programs in diverse television formats, including the generation of the idea, concept development, activity planning, budget formulation, the generation of pre-recorded material, set design and construction, lighting, camera directing, narrative structure design, preparation of the project for distribution in traditional and emerging platforms, and assessment of the project based on artistic, technical, administrative, financial and social criteria.

**Key words:** Television formats. Audiovisual production. Television production. Television content production.

**Bibliography:** \* Utterback, Andrew, Studio-Based Television Production and Directing, Focal Press, Inglés, [9780240808734].

### AV3010 Film Production

( 3 - 0 - 8. Prerequisites: [ AV2006 ]. 9 LAD11, 9 LCMD11 )

**Equivalence:** AV3002

This advanced course in audiovisual media production seeks to develop students' critical, creative, technical and project management skills in the field of filmmaking. Prior knowledge of audiovisual production and screenplay structures and formats is required. Learning outcome: in teams, students will produce a short fiction film; each student will perform one of the diverse roles in filmmaking.

**General objective:** Upon completion of this course, students will be able to participate in the preproduction, production and postproduction of short fiction films, including the generation of the idea, concept development, activity planning, screenwriting, budget formulation, the search and selection of artistic talent, set design and production, lighting, shooting, editing, preparation of the project for distribution, and assessment of the project based on artistic, technical, administrative, financial and social criteria.

**Key words:** Film edition and post-production. Film promotion, distribution and exhibition. Production and staging. Introduction to image and sound in film production. Filming pre-production, tools and planning.

**Bibliography:** \* Steven Ascher y Edward Pincus, The Filmmaker's Handbook: A Comprehensive Guide for the Digital Age, Plume, Inglés, [0452286786].

### AV3011 Design and Production of Communication for Organizations

( 3 - 0 - 8. Prerequisites: [ AV2006 ]. 9 LCMD11, 8 LMC11 )

**Equivalence:** None

In this advanced audiovisual media course, students will integrate the knowledge and skills acquired throughout their degree program in the design and completion of business and institutional audiovisual productions, such as orientation and training videos, promotional videos, commercials, live corporate event filming and webcasting, and music videos. Prior knowledge of screenwriting, audiovisual media production and advertising is required. The learning outcome of this course is an audiovisual project for a real company or client in any of the proposed formats produced by students working in teams.

**General objective:** Upon completion of this course, students will be able to create, design, produce and promote business and institutional audiovisual projects, such as orientation and training videos, promotional videos, commercials, live corporate event filming and webcasting, and music videos, applying the knowledge acquired throughout their degree program.

**Key words:** Corporate and institutional videos. Audiovisual productions for orientation and training. Audiovisual productions for promotional purposes. Television commercials. Audiovisual production for corporate events. Music videos.

**Bibliography:** \* DiZazzo, Raymond, Corporate media production, Focal Press, Inglés, [0240803655].

### AV3012 Digital Media Lab

( 0 - 3 - 4. Prerequisites: None. 7 LMC11 )

**Equivalence:** None

This advanced marketing course will develop students' IT literacy skills applied to the area of commerce, through the use of software tools, electronic media and web applications, in order to disseminate the different strategies for competitiveness in organi-



zations, based on advertising and promotion. Learning outcome: students will formulate marketing strategies using software tools.

**General objective:** On finalizing the course the student will be able to understand and use different technologies applied to the commercial arena to support market research strategies. The student will also carry out an internship focused towards the use of electronic media to learn about current trends in design and publicity.

**Key words:** Project management. Digital channels. Web impact. Mobile systems. Digital media. Digital communication. Digital convergence. Web 2.0. Digital Marketing. Mobile devices.

**Bibliography:** \* Wertime, Kent; Fenwick, Ian, Digital Marketing: The Essential Guide to New Media and Digital Marketing, [978-0470-822319].

## AV3013 Publications Design and Production

( 3 - 0 - 8. Prerequisites: None. 8 LCS11, 6 LLE11, 7 LMI11 )

**Equivalence:** AV3000

The purpose of this advanced-level graphics and visual media course is to provide students with the knowledge and tools to design and produce either print or electronic publications, including idea generation and development, planning and preparation of text and visual content, conceptualization and preparation of graphic and editorial design, product distribution, and attention to administrative, financial and legal issues. Requires previous knowledge of design and production for graphics and visual media. The learning outcome of this course is for students to prepare one or more editorial projects, such as newspapers, magazines, bulletins, catalogs, brochures and books, for print or electronic distribution.

**General objective:** Upon completion of this course, students will be able to apply the principles, techniques and tools of publishing design in the planning, design and production of print or electronic publications, with the aim of solving and fulfilling diverse communication needs.

**Key words:** Editorial production. Typography. Publication editing. Editorial design.

**Bibliography:** \* Zappaterra, Yolanda., Editorial design : for print and electronic media / Yolanda Zappaterra., Crans-Pre`s-Céligny : Hove : RotoVision, c2002., [2880467187].

## BI Biomedical Sciences

**BI1000 Biomaterials**  
**( 3 - 0 - 8. Prerequisites: [ MD1019 , MD1010 Corequisite , MD1036 Corequisite , MD1036 ]. 4 IMD11 )**  
**Equivalence: BI00861**

This basic course offers students an overview of the biomaterials that are used in direct contact with the human body, such as dental and implant materials. This course requires prior knowledge of mathematics, physics, anatomy and physiology. Learning outcome: students will be able to select the materials that can be used in the human body safely in the situations and cases described during the class.

**General objective:** Students will be able to: identify the materials used in implants; understand the chemistry of bacterial and macrophage adhesion to implanted materials; comprehend concepts of enzyme engineering; identify the use of artificial cells as infusion systems; understand the functioning of biodegradable drug infusion systems.

**Key words:** Material-tissue interaction. Implant materials. Biocompatible materials. Ceramic, metal and polymer materials. Biomaterial regulations.

**Bibliography:** \* Bhat, Sujata V., Biomaterials/Sujata V. Bhat, 2nd. Edition, Harrow: Alpha Science International, c2005, England, 2005, eng, [1842652079].

**BI1001 Introduction to Engineering**  
**( 3 - 0 - 4. Prerequisites: None. 1 IMD11 )**  
**Equivalence: None**

Basic course focused towards the concept of what biomedical engineering consists of, from reviewing its history to the latest advances and the future of this field of study. It is also designed so that the student can experience the most representative areas of work of Biomedical Engineering through both indoors and outdoors activities. No prior knowledge is required. As a learning outcome students are expected to produce a document that explains the specialty area of biomedical engineering in which they want to work after graduation and also describes

the strategy to be implemented in order to achieve this. This document should include the selection of elective courses, areas of academic development, internships, exchange programs, cultural, sporting and social activities.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the career in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**BI2004 Design in Biomedical Engineering**

**( 3 - 0 - 8. Prerequisites: [ BI00871 , BI00871 Corequisite , BI3010 Corequisite , BI3010 ]. 8 IMD11 )**  
**Equivalence: None**

In this advanced course, students will become familiar with design techniques and put them into practice during the course through the resolution a design problem in the healthcare area. This course requires a basic knowledge of circuits and electronics. Learning outcome: students will be able to design and develop the rough prototype of an innovative biomedical device, using and integrating the knowledge acquired in previous courses.

**General objective:** Students will be able to understand the methodology of design and acquire the basic tools for the development of a design project which will involve devices, systems, and processes in biomedical engineering; students also will be able to recognize how important is for design in the biomedical engineering field to adhere to the regulations set forth by national and international regulatory entities; that they learn to determine client or user speci-



fications so they could propose an optimal solution within the limits of national and international regulations.

**Key words:** Design. Biomedical engineering. Biomedical devices.

### BI2005 Biomechanics

( 3 - 0 - 8. Prerequisites: F1003, [ MA3002, MA2003 ], [ MD1040 Corequisite, MD1018 ]. 5 IMD11 )

**Equivalence:** BI2003

This is an intermediate course with the intention that students learn the different motor activities of the human body and its behavior. Requires basic knowledge of physics, mathematics, Structure and Function. As a learning outcome the student is expected to analyze and solve problems in mechanics of the human body through mathematical models and computer simulation.

**General objective:** On completion of this course, students will be able to understand, select and analyze diverse physical parameters; understand the characteristics of human movement and the methods used to portray and resolve them; understand the basic behavior of materials under stress; assess the human, economic, ethical and social impact associated with solving biomechanical problems.

**Key words:** Biomechanics. Mechanics of materials. Biomaterials. Movement studies. Biodynamics. Prosthesis. Biomedical instrumentation.

**Bibliography:** \* Winter, David A., 1930-, Biomechanics and motor control of human movement / David A. Winter., 4th ed., Hoboken, N.J. : Wiley, c2009., [9780470398180 (tela)].

### BI2006 Biomechanics Laboratory

( 0 - 3 - 4. Prerequisites: [ BI2005 Corequisite, BI2005, BI2003 ]. 5 IMD11 )

**Equivalence:** None

The course is of intermediate level that requires basic knowledge of physics, anatomy and physiology. The intention is that student acquires knowledge and skills related to the instrumentation required to mea-

sure mechanical parameters of human body movement and about the instruments and methodology needed to test mechanic resistance of materials. As a learning outcome the student will prepare reports that show the findings in laboratory practices, as well as a final project team.

**General objective:** On completion of this course, students will be able to conduct tests to analyze the capacities and movements of the human body and perform mechanical tests on materials, using the appropriate methods and technologies.

**Key words:** Biomechanics. Biomedical instrumentation. Biomechanics laboratory.

**Bibliography:** \* Ozkaya, Nihat, Fundamentals of biomechanics : equilibrium, motion, and deformation, Inglés, [978-1441931160].

### BI2007 Healthcare Facility Project

( 2 - 0 - 4. Prerequisites: [ TE2032, TE2001 ]. 6 IMD11 )

**Equivalence:** None

Health care facilities project is a course of intermediate level. It requires basic knowledge of physics, mathematics, and electric circuits. It is intended to instruct the student about the main technical aspects of architectural design and installations for the safe operation of health care facilities. As a learning outcome is expected that students be able to use this knowledge to plan the installation of systems and high technology medical equipment in health care centers.

**General objective:** On completion of this course, students will be able to classify medical healthcare facilities and determine which facilities are required for specific purposes; understand boiler, electrical installation and lighting requirements; and be familiar with the construction and architectural requirements of white, gray and black areas, as well as radiological shielding.

**Key words:** Hospitals. Hospital installations. Electric installations in hospitals. Hospital design. Biomedical equipment installation.

### **BI2008 Medical Technologies** ( 3 - 0 - 8. Prerequisites: None. 7 IBN11 ) **Equivalence: None**

It is an intermediate level course oriented to learn about technologies used for diagnosis and treatment in clinical contexts. No prior knowledge is required. As a learning outcome, student develops a research on a newly medical device, considering its general features, applications, benefits and competitive advantages.

**General objective:** On completion of this course, students will understand the characteristics and applications of the most representative medical equipment used in clinical practice for monitoring, diagnosis and healthcare; be familiar with the language and needs of the clinical environment; and appreciate the benefits of these technologies in prevention and healthcare.

**Key words:** Medical devices. Medical technologies.

**Bibliography:** \* The biomedical engineering handbook / edited by Joseph D. Bronzino., 3rd ed., Boca Raton : CRC/Taylor & Francis, c2006., [0849321247 (juego)], [0849321212 (v. 1 : papel alcalino)], [0849321220 (v. 2 : papel alcalino)], [0849321239 (v. 3 : papel alcalino)], [9780849321214 (v. 1 : papel alcalino)], [9780849321221 (v. 2 : papel alcalino)], [9780849321238 (v. 3 : papel alcalino)].

### **BI3002 Clinical Engineering** ( 3 - 0 - 8. Prerequisites: [ BI00871 , BI00871 Corequisite , BI3015 , BI3015 Corequisite , BI2000 ]. 9 IMD11 ) **Equivalence: None**

This advanced course will prepare students to work in the operation and running of a hospital's biomedical engineering department. This course requires a basic knowledge of biomedical devices and healthcare facilities. Learning outcome: students will be able to write a report that includes the situational analysis, technology investment assessment, and performance indicator evaluation to diagnose and/or improve the functioning of a hospital's biomedical engineering department, emphasizing the quality of the patient care.

**General objective:** On completion of this course, students will be able to understand and interpret the primary regulations regarding medical equipment. They will also be able to perform a situational analysis in a biomedical engineering department, make an investment evaluation for medical technology, and develop a performance evaluation of a biomedical engineering department.

**Key words:** Medical equipment maintenance. Situational analysis. Medical equipment control. Risk and safety factors. Health technology.

**Bibliography:** \* YADIN DAVID, CLINICAL ENGINEERING, CRC PRESS, INGLES, [0849318130].

### **BI3005 Cardiovascular Engineering** ( 3 - 0 - 8. Prerequisites: [ BI2003 , BI2005 , M2023 ]. 8 IMD11 ) **Equivalence: None**

This is an advanced course in Biomedical Engineering that provides students with knowledge of Cardiovascular Fluid Biomechanics, Mechanics of the Myocardium, Prostheses Design, Atherosclerosis, Ischemic heart disease - Acute Myocardial Infarction, Coronary Blood Flow, Biofluids and Analysis of fluid-structure interactions of blood with vessel tissue. It also provides knowledge of the cardiovascular physiology and skills in computational techniques so that the student can be competitive in the design of cardiovascular prostheses and rehabilitation systems, both nationally and internationally. Prior knowledge in biomechanics is required. The learning process requires students to develop a project that solves a biomechanical problem with applications in the cardiovascular system.

**General objective:** Students will study the cardiovascular system from a mechanical engineering perspective; they will analyze the physiology of the cardiovascular system and the hemodynamic and rheological behavior of blood in arteries and veins; they will study biofluid mechanics in normal conditions and in the presence of vascular pathological conditions, such as atherosclerosis and aneurysms; they will conduct studies on the structural functionality of intravascular device designs, such as artificial valves, stents, filters, ventricular assist devices, etc.; they will

study computer techniques for optimizing medical device designs. Upon completion of this course, students will submit a research project on the structural analysis of a specific physiological condition or the design of cardiovascular medical devices.

**Key words:** Cardiovascular system. Stents. Heart. Heart valves.

### BI3010 Bioinstrumentation

( 3 - 0 - 8. Prerequisites: [ TE2006 , TE2033 , F3010 ]. 7 IMD11 )

**Equivalence:** None

This is an advanced course intended to provide the student with knowledge of electronics used for the acquisition of physiological signals. It requires basic knowledge of electronics and human physiology. As a result of learning, students will be able to design systems for physiological signal acquisition, identification and assessment of functional and performance characteristics of sensors and transducers.

**General objective:** Students will be able to understand and design physiological signal acquisition systems.

**Key words:** Medical instrumentation. Bioinstrumentation.

**Bibliography:** \* Carr, Joseph J., Introduction to biomedical equipment technology / Joseph J. Carr, John M. Brown., 4th ed., Upper Saddle River, N.J. ; Columbus, OH. : Prentice Hall, c2001., [0130104922], [9780130104922].

### BI3011 Bioinstrumentation Laboratory

( 0 - 3 - 4. Prerequisites: [ BI00871 , BI3010 , BI3010 Corequisite ]. 7 IMD11 )

**Equivalence:** None

It is an advanced level course is intended for the student to apply knowledge of electronics for the acquisition and study of physiological signals and the development of virtual instrumentation. Requires basic knowledge of analog electronics and programming. As a result of learning the student is expected to de-

sign and implement a prototype of a basic circuit for physiological signal acquisition.

**General objective:** Students will be able to design and build electronic circuits using common amplifiers and instrumentation to acquire physiological signals and to develop basic virtual instrumentation.

**Key words:** Medical instrumentation. Bioinstrumentation. Physiological signal acquisition.

**Bibliography:** \* Carr, Joseph J., Introduction to biomedical equipment technology / Joseph J. Carr, John M. Brown., 4th ed., Upper Saddle River, N.J. ; Columbus, OH. : Prentice Hall, c2001., [0130104922], [9780130104922].

### BI3012 Modeling of Physiological Systems

( 3 - 0 - 8. Prerequisites: M2025 ,[ MD1041 Corequisite , MD1041 ],[ MR2004 , MR2001 ],[ MA3002 , MA2003 ]. 7 IMD11

**Equivalence:** None

This course is intended to integrate the areas of engineering and health in the formulation of mathematical models that can be used as a basis for research and prediction of physiological processes, and for the development of biomedical devices and control systems. This course promotes competencies that prepare the students for subsequent specialization in rehabilitation engineering. The course requires previous knowledge of human physiology and anatomy, differential equations, advanced mathematics (Laplace transform and Z transform) and control theory. As a learning outcome, the student will develop physiological models and their computational simulation for the study of their dynamics and their interactions with other systems (instruments and controllers) for their monitoring and control.

**General objective:** On completion of this course, students will be able to integrate their knowledge of physiological systems and mathematical modeling in order to conduct computer simulations that will allow them to understand and predict the behavior of physiological systems.

**Key words:** Computer simulation. Physiological systems. Mathematical modeling. Physiological process control.

**Bibliography:** \* Enderle, John., Physiological Modeling : An Introductory Course for Biomedical Engineers., : Academic Press, 2010., [9780123747075].  
ngineers.,: Academic Press, 2010., [9780123747075].

### BI3013 Medical Imaging

( 3 - 1 - 8. Prerequisites: [ MA2001 , MA2010 ],[ TE2004 , TE2035 ]. 8 IMD11 )

**Equivalence: None**

This is an advanced course designed to teach students to understand the most representative diagnostic imaging modalities in the hospital environment. It requires knowledge of physics and mathematics. As a result of learning the student is expected to prepare a report which identifies and assesses the functional characteristics and performance of imaging systems from an assigned case in the hospital setting, based on technical guidelines, diagrams and specialized literature.

General objective: On completion of this course, students will understand the clinical justification and the principles of design and operation of the most representative diagnostic imaging modalities used to diagnose diseases.

Key words: Radiology systems. Tomography. Mammography systems and special radiodiagnosis systems. Magnetic resonance and ultrasound. Radiology information systems and picture archiving and communication systems (RIS/PACS).

**Bibliography:** \* Webb, Andrew R. (Andrew Roy), Introduction to biomedical imaging / Andrew Webb., Hoboken, New Jersey : Wiley, c2003., [0471237663].

### BI3014 Biomedical Technology Laboratory

( 0 - 3 - 4. Prerequisites: [ BI3015 , BI3015 Corequisite , BI2000 ]. 8 IMD11 )

**Equivalence: None**

This is an advanced course intended for the student to observe the operation of equipment used in medical practice for monitoring, diagnosing and treating patients and to practice on simulators. It requires basic knowledge of electronics, anatomy, physiology and bioinstrumentation. As a learning outcome the student will submit reports on the observations and simulations related to the mechanisms and electronics of the most representative medical instrumentation.

**General objective:** Upon completion of this course, students will be able to understand the principles of design and operation of the most representative medical equipment used for monitoring, diagnosis and treatment.

**Key words:** Medical instrumentation. Medical devices.

**Bibliography:** \* The biomedical engineering handbook / Joseph D. Bronzino., 2nd ed., Boca Raton, FL: CRC Press, c2000., [084930461X (alk. paper)], [0849304628 (v. 2)].

### BI3015 Biomedical Technologies

( 3 - 0 - 8. Prerequisites: [ BI00871 , BI3010 ]. 8 IMD11 )

**Equivalence: None**

This is an advanced course that is intended for the student to understand the most representative biomedical diagnostic and monitoring technologies in the hospital setting. It requires intermediate knowledge of physics, mathematics, electronics and human physiology. As a result of learning the student will prepare a report which identifies and assesses the functional characteristics and performance of the biomedical devices most representative of the hospital setting, based on technical guidelines, diagrams and specialized literature.

**General objective:** Upon completion of this course, students will understand the clinical justification and the principles of design and operation of the most representative medical devices used to diagnose diseases and monitor patients.

**Key words:** Medical instrumentation. Diagnostic technology. Patient monitoring.

**Bibliography:** \* R. Khandpur, Biomedical Instrumentation: Technology and Applications, McGraw-Hill, Inglés, [978-0071447843].

### BI3016 Neuroengineering

( 3 - 0 - 8. Prerequisites: [ F1005 , F1004 ], [ MD1041, MD1022 ], [ BI00871 , BI3010 ]. 9 IMD11 )

**Equivalence:** None

The Neuroengineering course is an advanced course that is intended for the students to integrate the concepts of neuroanatomy, neurophysiology, circuit theory, dynamic systems, biomaterials, cell biology, electronics and nervous system biochemistry. Previous knowledge is required of differential equations, electronics, physiology and anatomy of the nervous system. As a learning outcome, the student is expected to develop a prototype with applications to diagnostic and therapeutic processes of the nervous system.

**General objective:** Upon completion of this course, students will be able to understand the techniques for studying the nervous system based on mathematical and computer models, process and analyze its signals; and understand the interfaces with the sensory (sight and hearing) and musculoskeletal systems.

**Key words:** Nervous system. Nervous system modeling. Bioelectrodes. Electroencephalography(EEG). Electromyography (EMG). Neuroprosthetics.

**Bibliography:** \* Neuroengineering / edited by Daniel J. DiLorenzo, Joseph D. Bronzino., Boca Raton : CRC Press, c2008., [9780849381744 (encuadernado : papel alcalino)], [0849381746 (encuadernado : papel alcalino)].

### BI3017 Integrative Project

( 3 - 0 - 8. Prerequisites: [ BI2004 ]. 9 IMD11 )

**Equivalence:** None

The Capstone Project course is an advanced course in which students develop a project to solve a real problem in the field of Biomedical Engineering. It requires knowledge of design tools and project management, which is acquired in a previous course in Biomedical Engineering Design. As a learning outcome students are expected to design, construct and document the prototype of a tool or innovative biomedical device, through which they demonstrate that have developed skills and attitudes required to reach the milestones of the project, showing that they are able to perform their role in the biomedical device industry, both nationally and internationally.

**General objective:** Upon completion of this course, students will be able to develop a biomedical engineering project that integrates knowledge of basic sciences, biological sciences and engineering, concluding with the creation of a prototype.

**Key words:** Biomedical engineering design. Integrative project. Simulation of biomedical models and prototypes.

**Bibliography:** \* King, Paul H., 1941-, Design of biomedical devices and systems / Paul H. King, Richard C. Fries., 2nd ed., Boca Raton : CRC Press, c2009., [9781420061796 (papel alcalino)], [1420061798 (papel alcalino)].

### BI3018 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 IMD11 )

**Equivalence:** None

This is a professional level course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. The students will have the opportunity to reflect on this new stage of their lives as professionals and explore the career alternatives that are available to them, with guidance offered to help them identify professional options, graduate and professional certifications. The learning outcome for this course is that

students acquire the tools they need in order to successfully make the transition from student to professional.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].



## BT

## Biotechnology

**BT1002 Genetics**

( 3 - 0 - 8. Prerequisites: None. 2 IA 11, 2 IAB11, 2 IBN11, 2 IBT11 )

**Equivalence:** None

Basic genetics course that provides students with the bases for understanding diverse inheritance patterns and effects of mutations on the genome. This course requires prior knowledge of basic biology. As a learning outcome, students will be able to analyze real problems and perform calculations to predict and explain the mathematical proportions of the laws of inheritance.

**General objective:** Upon completion of this course, students will be able to describe the mechanisms which control genetic inheritance and the variation of characters between organisms, solve Mendelian and non-Mendelian inheritance problems, classify chromosomal mutations, and explain the origin of genetic disorders.

**Key words:** Genetics. Mendelian inheritance. Non-Mendelian inheritance. Chromosomes. Mutations.

**Bibliography:** \* Klug, W. S. y Cummings, M.R, Essential of Genetics, Fifth Edition, Pearson Prentice Hall. , Inglés.

**BT1003 Molecular Biology**

( 3 - 0 - 8. Prerequisites: [ BT1002, Q1007 ]. 3 IA 11, 3 IAB11, 3 IBN11, 3 IBT11, 3 IIA11, 4 INCQ13 )

**Equivalence:** BT00847

Basic course that provides students with knowledge of the structure, regulation and expression of genes, as well as basic molecular analysis techniques. This course requires prior knowledge of basic biology, chemistry and genetics. As a learning outcome students will be familiar with the processes of gene expression and their regulation, as well as the fundamental methodologies and tools for studying molecular biology.

**General objective:** Upon completion of this course, students will be able to understand genetic structure and organization, comprehend replication mechanisms, transcription, translation, as well as their regulation. Students will also understand the techniques and methods of molecular biology.

**Key words:** Molecular biology. Genetic expression. Molecular biology techniques. DNA.

**BT1007 Microbiology Laboratory**

( 0 - 3 - 4. Prerequisites: None. 5 IA 11, 3 IAB11, 4 IBN11, 4 IBT11, 5 IIA11 )

**Equivalence:** None

Basic microbiology course that provides students with the skill and tools to isolate, identify and quantify microorganisms. This course requires prior knowledge of basic biology, general chemistry, biochemistry and microbiology. As a learning outcome students will acquire the skill to isolate, identify and quantify microorganisms.

**General objective:** Upon completion of this course, students will be able to implement various methods of isolation, identification, and quantification of microorganisms.

**Key words:** Microbiology. Isolation techniques. Sterilization. Sterilization techniques. Microbial count.

**Bibliography:** \* Crueger, Wulf, Biotecnología : manual de microbiología industrial / Wulf Crueger, Anneliese Crueger ; tr. por Paloma Liras Padín, Zaragoza, España : Acribia, [1993], Spain, [1993], spa, [8420007439].

**BT1010 Introduction to Bioengineering**

( 3 - 0 - 4. Prerequisites: None. 1 IBT11 )

**Equivalence:** None

The purpose of this basic-level course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is



required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Brown, Sheldon S., 1937-, Opportunities in biotechnology careers / Sheldon S. Brown., Rev. ed., New York ; México : McGraw Hill, c2007., New York, c2007., eng, [9780071476058], [0071476059].

### **BT2001 Genetic Engineering**

**( 3 - 0 - 8. Prerequisites: [ BT1003 ]. 5 IA 11, 5 IAB11, 5 IBN11, 5 IBT11 )**

**Equivalence: BT00863**

This is an intermediate course providing students with knowledge of processes for manipulating the genetic material(s) of organisms. The course requires prior knowledge of industrial microbiology and molecular biology. The learning outcome of this course is for students to know and be able to analyze the processes of genetic manipulation and design a system for gene cloning.

**General objective:** Upon completion of this course, students will be able to understand and analyze the processes of genetic manipulation which utilizes recombinant DNA methods; understand the uses and applications of genetic vectors to the cloning and expression of recombinant proteins; explain the genetic diagnostic test for the analysis of genetically modified organisms, genetic disorders, metabolic dysfunctions, and the identification of pathogens.

Key words: Genetic engineering.

**Bibliography:** \* Nicholl, Desmond S. T., An introduction to genetic engineering / Desmond S.T. Nicholl, Cambridge University Press, New York , 2002, eng, [0521808677 : HRD \$70.00].

### **BT2002 Genetic Engineering Laboratory**

**( 0 - 3 - 4. Prerequisites: [ BT2001 , BT2001 Corequisite ]. 6 IAB11, 6 IBN11, 6 IBT11 )**

**Equivalence: None**

This is an intermediate course intended to allow students to acquire practical skill in manipulating DNA, carry out cloning, transformations and other techniques for genetic analysis and diagnosis. The course requires prior knowledge of industrial microbiology and molecular biology. The learning outcome of this course is for students to construct and analyze cloning vectors and generate genetically modified cells.

**General objective:** Upon completion of this course, students will be able to develop competent cells for DNA incorporation, manipulate plasmid vectors, analyze cloned DNA, generate genetically modified organisms, and perform genetic identification.

**Key words:** Genetic identification. Cloning. Bacterial transformation. Plasmid vectors. Genetically modified organisms.

**Bibliography:** \* Sambrook, Joseph., Molecular cloning : a laboratory manual / J. Sambrook, E.F. Fritsch, T. Maniatis., 2nd ed., Cold Spring Harbor, N.Y. : Cold Spring Harbor Laboratory, 1989., [0879693096].

### **BT2003 Microbiology**

**( 3 - 0 - 8. Prerequisites: None. 5 IA 11, 3 IAB11, 4 IBN11, 4 IBT11, 5 IIA11 )**

**Equivalence: None**

Intermediate microbiology course that provides students with the necessary tools to become familiar with the general concepts of microbiology and the potential of microbiological processes in different areas. This course requires prior knowledge of basic biology, general chemistry and biochemistry. As a

learning outcome of this course students will be able to understand the biological processes that occur in microorganisms and their industrial relevance and potential.

**General objective:** Upon completion of this course, students will be able to identify the general characteristics of microorganisms and their relationship with the environment. Students will be able to apply concepts in order to identify, analyze, and control microbial industrial processes in chemical, industrial, foods, and environmental areas.

**Key words:** Microbiology. Microorganisms. Microbial control. Applied microbiology.

**Bibliography:** \* Pommerville, Jeffrey C., *Alcama's fundamentals of microbiology* / Jeffrey C. Pommerville., 8th ed., Sudbury, Mass. : Jones and Bartlett Publishers, 2007., [0763737623 (papel alcalino)], [9780763737627 (papel alcalino)].

### BT2004 Tissue Culture

( 3 - 0 - 8. Prerequisites: [ BT1003 , Q2000 ]. 4 IA 11, 4 IAB11, 6 IBN11, 6 IBT11 )

**Equivalence:** BT00866

This is an intermediate course that provides students with the theoretical knowledge required to carry out in vitro propagation of plant and animal tissues. This course requires prior knowledge of microbiology and microbiology laboratory. As a learning outcome of this course students are expected to be able to understand the process of plant and animal tissue development, their in vitro micropropagation and organogenesis.

**General objective:** Upon completion of this course, students will be able to comprehend the process of tissue development, analyze various tissue propagation techniques, control the development and formation of organs in a tissue, and identify the commercial applications of micropropagation.

**Key words:** Propagation. Organogenesis. Micropropagation. Plant tissue. Animal tissue. Tissue culture.

**Bibliography:** \* Smith, Roberta H, *Plant tissue culture : techniques and experiments* / by Roberta H. Smith, 2nd ed., San Diego : Academic Press, c2000, California, c2000, eng, [0126503427].

### BT2005 Enzymology and Biocatalysis

( 3 - 0 - 8. Prerequisites: [ Q2000 , Q1014 , Q1004]. 6 IBT11 )

**Equivalence:** BT00864

This is an intermediate enzymology and biocatalysis course focused on both basic scientific and technological applications. The course requires prior knowledge of biochemistry, molecular biology, general chemistry and analytical chemistry. As a learning outcome students will apply a basic knowledge of enzymology and solve problems related to enzymatic kinetics, considering the effect of experimental parameters on reaction speed, and will be familiar with the most relevant enzyme applications.

**General objective:** Upon completion of this course, students will be able to apply basic knowledge related to the use, analysis, and recuperation of enzymes and the fundamental theory of kinetic model estimation.

**Key words:** Properties of enzymes. Enzyme isolation. Enzymatic kinetics. Enzyme applications.

**Bibliography:** \* Copeland, Robert Allen., *Enzymes : a practical introduction to structure, mechanism, and data analysis* / Robert A. Copeland., 2nd ed., New York : Wiley, c2000., New York, c2000., eng, [0471359297 (papel no ácido)], [9780471359296 (papel no ácido)].

### BT2006 Enzymology and Biocatalysis Laboratory

( 0 - 3 - 4. Prerequisites: [ Q2000 , BT2005 , BT2005 Corequisite ]. 7 IBT11 )

**Equivalence:** BT00956

This is a practical advanced course focused on applying experimentally the theoretical knowledge students have acquired in the Enzymology and Biocatalysis course. This course requires prior knowledge of biochemistry, molecular biology, general chemis-

try and analytical chemistry. As a learning outcome of this course, students will apply the knowledge acquired on the theoretical course of Enzymology and Biocatalysis appropriately and will become familiar with the use of laboratory instruments used to determine enzymatic activity.

**General objective:** At the end of the course, the student will be able to recuperate and purify enzymes and determine enzymatic activity. He or she will also be able to apply kinetic analysis to experimental data and analyze the effect of different factors affecting enzymatic action.

**Key words:** Properties of enzymes. Enzyme isolation. Enzymatic kinetics. Enzyme applications.

**Bibliography:** \* Copeland, Robert Allen, Enzymes: a practical introduction to structure, mechanism, and data analysis / Robert A. Copeland, 2nd ed., Wiley, New York, c2000, eng, [0471359297 (papel no ácido)].

### **BT2011 Bioprocess Engineering I** ( 3 - 0 - 8. Prerequisites: [ IQ2001 ]. 5 IIA11 ) **Equivalence: TA2005**

Intermediate course that provides students with the basic notions of momentum transfer in the context of bioprocesses. Prior knowledge of differential and integral calculus, differential equations and basic physics is required. Learning outcome: students will design momentum transfer equipment and assess its performance.

**General objective:** Upon completion of this course, students will be able to design and assess the performance of separation equipment for momentum transfer equipment for handling fluids and momentum transfer.

**Key words:** Enzymatic kinetics. Enzyme applications. Fluid flow. Mixing and stirring.

**Bibliography:** \* Geankoplis, Christie J., Transport processes and separation process principles. Español\“Procesos de transporte y principios de procesos de separación : incluye operaciones unitarias / Christie John Geankopolis ; [traducción, Ma. Teresa

Aguilar Ortega]”, 4a ed., México, D. F. : CECSA, c2006, Mexico, c2006, spa, [9702408563],[9789702408567].

### **BT2012 Bioprocess Engineering II** ( 3 - 0 - 8. Prerequisites: [ BT2011 ]. 6 IIA11 ) **Equivalence: IQ00862**

This is an intermediate level course, which is designed to provide students with basic concepts of heat conduction in the context of bioprocesses. Previous knowledge is required in differential and integral calculus, differential equations, the principles of physics and transfer of momentum. The learning outcome for this course is that the students design heat conduction equipment and evaluate its performance.

**General objective:** Upon completion of this course, students will be able to design and assess the performance of thermal treatment equipment for biomaterials.

**Key words:** Conductive heat transfer. Convective heat transfer. Transient heat transfer.

**Bibliography:** \* Geankoplis, Christie J., Transport processes and separation process principles. Español\“Procesos de transporte y principios de procesos de separación : incluye operaciones unitarias / Christie John Geankopolis ; [traducción, Ma. Teresa Aguilar Ortega]”, 4a ed., México, D. F. : CECSA, c2006, Mexico, c2006, spa, [9702408563], [9789702408567].

### **BT2013 Pharmaceutical Bioengineering** ( 3 - 0 - 8. Prerequisites: None. 7 IBN11 ) **Equivalence: None**

This intermediate course is aimed at making students understand the relevance and scope of pharmaceutical bioengineering in biotechnological processes at laboratory and industrial levels. The students will be given an overview of the variables and steps involved in bioprocess engineering: different expression systems and types of reactors, product release technology, primary recovery, and purification and polishing of pharmaceutical compounds. Prior knowledge of

thermodynamics is required. As a learning outcome the student will have a general knowledge of pharmaceutical bioengineering, the stages this consists of, the existing technology and its advantages, disadvantages and scope, and they will demonstrate this knowledge through answering questions, case studies and practical problems that involve selecting the technology required to carry out the production, recovery, purification and polishing of a compound of interest.

**General objective:** On completing the course students will be able to understand the basic stages in which a bioprocess is divided; learn about the stages of a bioprocess and the parameters that must be specified for each one; select the technology to carry out the production, recovery, purification and polishing of a compound of interest; and specify the advantages, disadvantages and scope of existing technology.

**Key words:** Bioproducts. Bioprocesses. Biopharmaceutical products. Biological compounds.

**Bibliography:** \* Bioseparations science and engineering / Roger G. Harrison . [et al.], Oxford, N.Y. ; México : Oxford University Press, c2003., [0195123409 (papel alcalino)], [9780195123401 (papel alcalino)].

### BT3000 Tissue Culture Laboratory

( 0 - 3 - 4. Prerequisites: [ BT2004 , BT2004 Corequisite , BT1006 , Q1004 ]. 4 IA 11, 5 IAB11, 7 IBN11, 7 IBT11 )

**Equivalence:** BT00957

This is an advanced course, in which students will apply and integrate their previously acquired knowledge in the areas of general biology, molecular biology and genetic engineering, as well as chemistry and basic biochemistry, where they will manage basic practices in cultivation systems for cells, organs and tissues in animals and plants through their understanding and application of theoretical principles and experimental approximations in the laboratory.

**General objective:** Upon completion of this course, students will be able to apply various methods of plant cloning, implement techniques for the propa-

gation of plant and animal cells, promote the development of complete plant organisms using a cellular approach, and perform cytotoxicity and viability tests.

**Key words:** Plant tissue. Plant cloning. Plant propagation. Animal cells. Mammalian cells.

**Bibliography:** \* Plant tissue culture concepts and laboratory exercises / edited by Robert N. Trigiano, Dennis J. Gray., 2nd ed., Boca Raton, Fla. : CRC Press, c2000., Florida, c2000., eng, [0849320291 (papel alcalino)].

### BT3001 Food Development and Bioproducts

( 3 - 0 - 8. Prerequisites: [ IN2002 , IN2023 ]. 8 IAB11, 9 IBN11, 8 IBT11, 8 IIA11 )

**Equivalence:** TA3003

The purpose of this advanced biotechnology course is to develop student skills in designing innovation and development projects for foods and biotechnological products. This course deals with environmental, social and economic aspects of sustainable development. It requires previous knowledge of biochemistry, chemical kinetics, enzymology, microbiology, genetic engineering, statistics and experiment design as well as the use of Excel and MsProject. The learning outcome of this course for students is to carry out an experimental plan to develop a highly innovative food or biotechnological product and to know how to determine the shelf life of foods.

**General objective:** On finishing the course the student will be able to apply the scientific method and innovation and development methodology to the design of a technological innovation and development project in the food or biotechnology industry, and solve problems related to the determining shelf life.

**Key words:** Product innovation. Shelf life.

**Bibliography:** \* Developing new food products for a changing marketplace / editado por Aaron L. Brody y John B. Lord, Lancaster, Pa. : Technomic Pub. Co., 2000, Pennsylvania, 2000, eng, [1566767784 (en-cuadernado : papel alcalino)].

**BT3002 Metabolic Engineering****( 3 - 0 - 8. Prerequisites: [ BT2001 , BT2005 Corequisite , BT2005 ]. 6 IBT11 )****Equivalence: BT00865**

This is an intermediate level course, which enables students to understand metabolic regulation and control in organisms and to design metabolic management protocols for organisms. This course will include activities and concepts of sustainable development that reinforce and complement the general scope of the course. Previous knowledge is required in Genetic Engineering, Tissue Cultivation, Enzymology and Biocatalytics. The learning outcome for this course is that the students be able to design systems for the overproduction of compounds of interest, by means of metabolic engineering in organisms.

**General objective:** The students should be able to understand metabolic regulation and control in organisms; obtain molecular and enzyme information through bioinformatics; analyze the tools used in altering metabolic pathways; and analyze the required analytical techniques for evaluating metabolic changes.

**Key words:** Metabolic engineering. Metabolism control. Bioinformatics. Genetic transformation. Metabolic flux analysis.

**Bibliography:** \* Stephanopoulos, G., Metabolic engineering : principles and methodologies / Gregory N. Stephanopoulos, Aristos A. Aristidou, Jens Nielsen, Academic Press, San Diego , c1998, eng, [126662606].

**BT3005 Toxicology****( 3 - 0 - 8. Prerequisites: [ DS1003 , BT1001 , Q2000 ]. 9 IBT11 )****Equivalence: BT00897**

In this advanced level course, students evaluate the effects of toxic compounds in environment, food, cosmetic and pharmaceutical industries, as well as the analytical methodologies to evaluate them. The students also learn to interpret information provided by national and international regulatory agencies, in order to propose new programs related to contaminants in food, additives, cosmetic and pharmaceuti-

cal industries. This course requires prior knowledge of biochemistry and molecular biology. As a learning outcome, students will develop a project to analyze a specific aspect of Toxicology in depth, including development of oral and written skills.

**General objective:** Upon completion of this course, students will be able to understand the concepts of environmental toxicology in foods, and pharmaceuticals; apply the main tests used to identify of toxic substances and determine toxicological damage; analyze toxicology regulations in national and international contexts; and appreciate the importance of toxicology and the critical role that it plays in the production of innocuous and safe products.

**Key words:** Toxicology. Toxicology assays. Legislation and regulation. Toxic effect modeling. Analytical biochemistry.

**Bibliography:** \* Handbook of toxicology / edited by Michael J. Derelanko, Manfred A. Hollinger., 2nd ed., Boca Raton : CRC Press, c2002., Florida, c2002., eng, [0849303702 (papel alcáline)].

**BT3012 Emerging Process Engineering****( 3 - 0 - 8. Prerequisites: [ BT2012 ]. 7 IIA11 )****Equivalence: None**

This is an advanced level course, designed to provide students with the basic concepts of mass transfer and emerging technologies in the area of bioprocesses. Previous knowledge is required in differential and integral calculus, differential equations and the principles of physics, momentum transfer and heat conduction. The learning outcome for this course is that students design equipment for separation processes and evaluate their performance.

**General objective:** Upon completion of this course, students will be able to design and assess the performance of separation equipment for recovering and purifying biomaterials.

**Key words:** Emergent technologies. Extraction, recovery and purification.



**Bibliography:** \* Emerging technologies for food processing / edited by Da-Wen Sun., San Diego, CA. : Elsevier Academic Press, c2005., [0126767572 (rústica)], [9780126767575 (rústica)].

### **BT3013 Bioprocess Laboratories**

( 0 - 3 - 4. Prerequisites: None. 7 IBN11, 8 IBT11, 7 IIA11 )

**Equivalence: None**

The purpose of this advanced biotechnology course is to provide students with knowledge concerning the use of equipment necessary for the separation, concentration, purification and/or conversion of diverse biomaterials and, where applicable, to let them use previously acquired knowledge of bioprocess engineering as well as emerging technologies. The course requires prior knowledge of momentum transfer, heat transfer, mass transfer and emerging technologies. The learning outcome of this course is for students to discover the operational characteristics of equipment used in the laboratory, applying principles of bioprocessing and emerging technologies. Students will develop the ability to design, analyze and synthesize experimental procedures.

**General objective:** Upon completion of this course, students will be able to use their knowledge of bioprocessing and emerging technologies to design, operate and analyze the operation of the equipment used in separation, concentration, purification and/or transformation processes for diverse biomaterials.

**Key words:** Extraction of biomaterials. Purification of biomaterials. Concentration of biomaterials. Transformation of biomaterials.

**Bibliography:** \* Bioseparations science and engineering / Roger G. Harrison . [et al.], Oxford, N.Y. ; México : Oxford University Press, c2003., [0195123409 (papel alcalino)], [9780195123401 (papel alcalino)].

### **BT3014 Bioengineering Design Project**

( 3 - 0 - 8. Prerequisites: None. 9 IBT11, 9 IIA11 )

**Equivalence: None**

The purpose of this advanced biotechnology course is to provide students with the skills to integrate prior knowledge in order to define the basis of a design project for a biomaterials processing plant, from product concept and characterization to economic evaluation of the project as well as its social and environmental impact. The course requires previous knowledge of engineering concepts and biomaterials technology, the development of foods and bioproducts, and the design and evaluation of projects. The learning outcome of this course is for students to be able to analyze the stages involved in the development of an industrial or commercial bioproducts plant. Students will be able to integrate operations and technologies in a complete production process.

**General objective:** Upon completion of this course, students will be able to integrate their knowledge to design, complete and evaluate the stages and necessary elements to conceptualize innovative bio-products, develop the processing plant required to manufacture them, conduct their economic and market evaluation, and ascertain their social and environmental impact.

**Key words:** Bioproduct processing plant design. Technological, economic, social and environmental analysis of bioengineering projects.

**Bibliography:** \* Cussler, E. L., Chemical product design / E.L. Cussler, G.D. Moggridge., Cambridge, UK ; New York, N.Y. : Cambridge University Press, 2001., [0521791839 (encuadernado)], [0521796334 (rústica)].

### **BT3025 Introduction to Professional Development**

( 2 - 0 - 2. Prerequisites: None. 9 IBT11 )

**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examina-

tion given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].



## CC

## Behavioral Science

**CC1000 Human Development I**  
 ( 3 - 0 - 8. Prerequisites: None. 1 LP 12, 1 LPS12 )  
 Equivalence: CC00813, CC95813

This course will be basic level, where the main vital development cycle theories until teenage will be overhauled. It will be the preamble to the Human Development Course II, in which the most meaningful themes will be: Inheritance and environment, Freud theories, Erikson, and Piaget.

**General objective:** Furthermore, identifying the human being stages in life as well as their implications, not only about behavior, but also the influence in the society in which he is living, in order to have a balanced vision of the human being periods in life. Finally evaluating several perspectives and fact sources to compare them to his personal experience to frame his own point of view.

**Key words:** Theories of human development. Stages of human development. Vital cycle of development. inheritance and environment. prenatal development. Psychodynamic theories. Cognitive theories.

**Bibliography:** \* Blos, Peter., Psicoanálisis de la adolescencia., 1 Ed., Mexico. : Joaquin Mortiz. , 1981., Sin información, 1981., spa, [9682701252].

**CC1001 Human Development II**  
 ( 3 0 8. Requisitos: No tiene. 2 LP 12, 2 LPS12 )  
 Equivalencias: CC00814

Basic course that addresses the principal lifecycle development theories about the young adult, middle-aged adult and older adult stages, and finally the dying process. The most significant topics are: the Erikson, Levinson and Kübler-Ross theories; physical, cognitive and psychosocial development in adulthood and old age; work and gender; and retirement.

**General objective:** To identify the characteristics of the human being development stages and their implications, not only of his/her behavior but also the

impact on the society in which he/she lives. To have a balanced vision of the human being life periods. To evaluate the different perspectives and fact sources to compare them with his/her personal experience so as to elaborate his/her own point of view.

**Key words:** Importance of the adult age. Aspects of old age. Adulthood. Psychosocial theories. Vital cycle of development. Agony and death. Aging.

**Bibliography:** \* Erikson, Erik Homburger comp, La adultez, 1 Ed, México : FCE , 1986, Sin información, 1986, spa, [9681607600].

**CC1003 General Psychology I**  
 ( 3 - 0 - 8. Prerequisites: None. 1 LP 12, 1 LPS12 )  
 Equivalence: CC00811, CC95811

This is a basic level course oriented to know the principles of psychology. It does not require previous knowledge. As a learning outcome it is expected that the students understand the theoretical basis of Psychology and its principles, as well as the factors that affect behavior.

**General objective:** Upon completion of this course, students will be able to integrate their basic knowledge of psychology, by means of its historical origins, application, and research methods as a scientific discipline, as well as relate performance to the basic psychological processes of a person's behavior.

**Key words:** Fundamentals of psychology. Heredity and behavior. Sensation and perception. Learning and memory. States of consciousness.

**Bibliography:** \* Coon, Dennis., Psicología / Dennis Coon ; traducción José Carmen Pecina Hernández., 10a ed., México : Thomson, 2005., Mexico, 2005., spa, [9706863958], [9789706863959].

## CC1005 Learning and Cognitive Development

( 3 - 0 - 8. Prerequisites: None. 4 LP 12, 4 LPS12 )  
Equivalence: CC00821, CC95821

This is a basic course in which the student will know, analyze and evaluate the theoretical antecedents in the main learning models that exist now, which are the behavioral, social cognitive and cognitive, as well as the applications these theories have to daily life. It does not require previous knowledge. As a learning result the student will analyze the theoretical antecedents of the main learning models that exist nowadays.

**General objective:** Upon completion of this course, students will be able to analyze the theoretical background of the classical learning theories, i.e. classical and operant conditioning; understand Bandura's cognitive social theory; understand the cognitive learning models of Tolman, Piaget, Vygotsky, Gestalt's theory and constructivism; furthermore they will analyze and appraise the everyday use of each of these theories within organizations.

**Key words:** Classical conditioning. Operant conditioning. Cognitive learning models. Organizational and educational applications.

**Bibliography:** \* Ormrod, Jeanne Ellis., Aprendizaje humano / Jeanne Ellis Ormrod ; traducción Alfonso J. Escudero, y Marina Olmos Soria., 1a ed. en español., Madrid : Pearson Prentice Hall, 2005, Spain, 2005, spa, [8420545236], [9788420545233].

## CC1007 General Psychology II

( 3 - 0 - 8. Prerequisites: [ CC1003 ]. 2 LP 12, 2 LPS12 )  
Equivalence: CC00812, CC95812

This is a basic course in which topics and concepts are used as introduction to higher and specialized courses that will be reviewed later. Among the most important are: personality theories, psychopathology, and interview workshop. It requires previous knowledge in Basic Psychology, Heredity and Behavior, Sensation and Perception, States of consciousness, Learning and Memory. As a learning outcome the student will identify the main theories of motivation, distinguish between emotions and emotional states,

will have basic knowledge to identify and cope with stress, will know personality theories, will recognize the main psychological disorders and know the most classic and contemporary therapeutic alternatives from a general perspective.

**General objective:** Upon completion of this course, students will be able to understand and interrelate the biological, psychological and social elements that constitute a human being, identifying the motivational, emotional and mood processes that trigger behavior. Furthermore, students will begin studying personality theories, psychological disorders and the most well-known alternative therapies.

**Key words:** Learning. Strategic planning for behavioral intervention. Behavior modification. Observation. Conditioning. Scientific method.

**Bibliography:** \* Coon, Dennis, Fundamentos de psicología / Dennis Coon, 8a ed, México : International Thompson, 2001, Mexico, 2001, spa, [9706860495].

## CC1010 Human Development

( 3 - 0 - 8. Prerequisites: None. 1 LPO11 )  
Equivalence: CC1006

Basic course in which the student will learn about the developmental stages in the human being. It does not require previous knowledge. As a learning result it is expected that students investigate the different perceptions each person has of the stages in their life through the analysis of the real life problems and interviews carried out during visits to schools (from kindergarten to high school level) and old people's homes.

**General objective:** Upon completion of this course, students will be able to identify the different stages of human development: infancy, adolescence, adulthood, old age, and death, and also analyze the impact of these stages on human behavior.

**Key words:** Childhood. Adolescence. Death. Theory of human development. Adulthood/Old age.

**Bibliography:** \* Papalia, Diane E., Desarrollo humano / Diane E. Papalia, Sally Wendkos Olds, Ruth Duskin Feldman ; en consulta con Dana Gross ; traducción

de María Elena Ortiz Salinas., 9a ed., México : McGraw Hill Interamericana, 2005., spaeng, [9701049217], [9789701049211].

### **CC1011 Personality Development** ( 3 - 0 - 8. Prerequisites: None. 3 LP 12, 2 LPO11, 3 LPS12 )

**Equivalence: None**

This is a basic course aimed at studying the various theories of personality. This course, from their origins to the present, as well as the different philosophical positions that support these theories and the psychotherapeutic models proposed. As a learning outcome the student is expected to resolve a case where he can identify the different components of the various personality theories and hence comprehensively explain the behavior of an individual.

**General objective:** By the end of the course, the student will be capable of identifying the different components of the various personality theories and explaining the behavior of an individual in its entirety.

**Key words:** Personality theory. Psychodynamic model and features theory. Existential humanistic model. Cognitive behavioral model.

**Bibliography:** \* Schultz, Duane P., Teorías de la personalidad / Duane P. Schultz, Sydney Ellen Schultz., 9a ed., México, D.F. : Cengage Learning, 2010., spaeng, [9786074810066].

### **CC1012 Psychology and Multicultural Environment Leadership**

( 3 - 0 - 8. Prerequisites: None. 3 LMC11, 2 LPO11 )  
**Equivalence: CC2001**

Basic course in the area of individual and social psychology that aims for the student to understand the basic dynamics concerning motivations and human emotions, and how these are related when we form part of a group, confronting biases related to cultural differences. In addition students will study what leads us to help the others, be altruistic and be socially responsible. The course doesn't need prior knowledge. As a result of the learning process the student will develop a concrete action to encourage

work, altruism and teamwork, through the learning technique - service.

**General objective:** At the end of the course, students will be able to perceive the motives and basic emotions that allow the individual to be part of a team, confronting biases related to cultural differences and being able to interact, assist and cooperate with society to which he belongs.

**Key words:** Motivation and emotion. Stress. Social interaction. Stereotypes and prejudices. Multiculturalism.

**Bibliography:** \* Myers, David G., Psicología social / David G. Myers ; traducción José Francisco Javier Dávila Martínez, Magda Elizabeth Treviño Rosales, Leticia Esther Pineda Ayala., 4a ed. en español., México : McGraw-Hill, c2005., spaeng, [9701053982].

### **CC1013 Behavioral Analysis and Cognitive Learning**

( 3 - 0 - 8. Prerequisites: [ CC1014 ]. 3 LPO11 )  
**Equivalence: None**

Basic course in Psychology that introduces the student to the field of learning theories, focusing on Behavioral and Cognitive Theories, in order to generate processes of analysis, description and behavioral control in organizational environments. It will provide support for the Corporate Administration of Learning course. Basic knowledge of psychology is required hence it is advisable to have taken the Psychology course. As a learning outcome students are expected to develop an economy based on tokens as a motivational process within a company, using observation, analysis and description of behavior and of the environmental and interpersonal factors that promote conduct.

**General objective:** After taking this course the student will know the principal learning theories; explain the Cognitive and Behavioral Theories in different fields of application: Educational, Organizational and Clinical; apply conduct modification processes according to the environmental situation; be able to develop an economy using tokens as a motivational element within an organization.

**Key words:** Learning theories. Principles and methodology of behavioral analysis. Intervention and behavior modification in diverse settings. Cognitive learning.

**Bibliography:** \* Martin G, Modificación de la Conducta, qué es y como aplicarlo, Pearson, español, [9788483223802].

### CC1014 Psychology

( 3 - 0 - 8. Prerequisites: None. 2 LCMD11, 3 LCS11, 3 LMI11, 3 LPL11, 3 LPM12, 1 LPO11 )

**Equivalence:** None

This introductory level course in the field of psychology offers the student a review of the field and the basic theories of this discipline. The student will understand the physiological bases of human behavior, the processes of sensation and perception of the subject, the development of language and its relationship to thought processes; memory and attention, the relationship of the human being to the world; the development of identity and the shaping of the individual's personality; and emotional intelligence. As a learning result, the student will demonstrate knowledge of the concepts and the basic theories of psychology through exams and essays, as well as reports carried out in teams, in which the student applies the knowledge to real life situations.

**General objective:** By the end of the course, the student will understand the field of study and the basic theories of psychology and will understand the physiological bases of human behavior, the processes of sensation and perception of the subject, the development of language and its relationship to thought, memory and the relationship of man to the world, the development of identity and the shaping of the individual's personality, and emotional intelligence.

**Key words:** Sensation and perception. Personality and identity. Memory and intelligence. Psychophysiology. Language, thinking and creativity.

**Bibliography:** \* Morris, Charles G., Psicología / Charles G. Morris, Albert A. Maisto ; traducción, María Elena Ortiz Salinas., 13a ed., México : Pearson, 2009., [9786074423143].

### CC1015 Introduction to the Organizational Psychology Academic Program

( 3 - 0 - 4. Prerequisites: None. 1 LPO11 )

**Equivalence:** None

The purpose of this basic-level course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Landy, Frank J., Psicología industrial : introducción a la psicología industrial y organizacional / Frank J. Landy, Jeffrey M. Conte ; traducción Lourdes Reyes Ponce., 1a ed. en español., México, D. F. : McGraw-Hill, c2005., spaeng, [9701048296], [9789701048290].

### CC1016 Introduction to the Psychology Academic Program

( 3 - 0 - 4. Prerequisites: None. 1 LP 12, 1 LPS12 )

**Equivalence:** None

The purpose of this basic course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also gen-

erate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Psychology. Life Sciences.

**Bibliography:** \* Landy, Frank J., Psicología industrial : introducción a la psicología industrial y organizacional / Frank J. Landy, Jeffrey M. Conte ; traducción Lourdes Reyes Ponce., 1a ed. en español., México, D. F. : McGraw-Hill, c2005., spaeng, [9701048296], [9789701048290].

### **CC2001 Social Psychology** (3 - 0 - 8. Prerequisites: [CC1007, CC1009, AD1001]. 5 LP 12, 5 LPS12 ) Equivalence: CC00822, CC1012, CC95822

Intermediate course that covers the basic psychosocial processes from attitudes up to the theory of social representation. It covers topics related to sustainable development such as demography, employment and unemployment, poverty and equity. The course requires prior knowledge in basic psychological processes, behavior, personality and its disorders and determinants, both genetic and environmental. As a learning result the student is expected to be able to identify the psychosocial phenomenon in his environment, such as: communal, political, social, etc.

**General objective:** Upon completion of this course, students will be able to identify and become involved in group processes inside and outside organizations, and will also help with understanding the cultural differences that affect them.

**Key words:** Social psychology. Group. Social perception and attribution. Attitudes. Conflicts. Socialization and culture.

**Bibliography:** \* Myers, M., Exploring social psychology, Mc Graw Hill .

### **CC2007 Educational Technology** (3 - 0 - 8. Prerequisites: [ CC1005 ]. 7 LP 12, 7 LPS12) Equivalence: CC00842, CC95842

Intermediate course that offers the student a vision of training and development in national and international environments. As a learning result the student will decide on the most suitable technology to use in training and development situations with the goal of achieving specific work competencies.

**General objective:** Upon completion of this course, students will be able to describe, analyze, and assess the new trends in educational technology that have influenced training and development both nationally and internationally. They will understand training guidance and participate responsibly in the attainment of the working values and competencies that are pursued through the application of technology as a didactic resource in organizational contexts.

**Key words:** Digital era in education. Learning. Conductivism, cognitivism, and constructivism. Multiple intelligence theories. Competencies.

**Bibliography:** \* Hernández Hernández, Pedro., Psicología de la educación: Corrientes actuales y teorías aplicadas/Pedro Hernández Hernández, 1era. Edición, México: Trillas, 1991, México, 1991, español, [9682439175].

### **CC2009 Psychopathology** ( 3 - 0 - 8. Prerequisites: [ CC1011 ]. 3 LPO11 ) Equivalence: CC2000

Intermediate course that provides appropriate identification of systematic manifestations to detect those cases in which channeling is required for psychological treatment with a specialist or intervention is needed for decision making in emergency situations. In an organizational context this course helps to provide the best tools for speech analysis which enables the best possible interviews to be carried out, especially when selecting for key positions. Resources can be developed to identify symptomatic manifestations that may interfere with functioning in social groups. It can also allow for better \*coaching\* by listening, analyzing and intervening in situations of stress and conflict.



**General objective:** The student will be able to acquire, identify, compare and question different “psychological disorders” from the perspective of DSM and hence improve his critical capacity for resolving problems and conflicts in human relationships.

**Key words:** Anxiety and its consequences. Personality disorders. Paraphilias. Depression-mania. Psychosis.

**Bibliography:** \* Manual diagnóstico y estadístico de los trastornos mentales : DSM-IV., Barcelona : Masson, 2001., [8445802976].

### CC2010 Psychometrics I

( 3 - 0 - 8. Prerequisites: [ CD1003 Corequisite , CD1003 , CC2012 Corequisite , CC2012 ]. 6 LP 12, 4 LPO11, 6 LPS12

**Equivalence:** CC2003

This is an intermediate course in the field of psychology that requires previously acquired knowledge related to psychology and social leadership. Students are expected to learn and use traditional and current methodologies in conjunction with the use of information technology-based methodologies to manage psychometric tests, which help to understand and measure intellectual and personality-related aspects of human behavior in an ethical fashion and create psychometric reports. As a learning outcome the student is expected to carry out an evaluation of a child or adolescent previously unknown to him and produce a report of the results, written and drawn up correctly.

**General objective:** At the end of the course, students will be able to evaluate different intellectual and personality characteristics and apply, interpret and integrate psychometric tests (individual and group) using both traditional and computer based methods as required.

**Key words:** Statistical measures of central trends and inferential statistical functions. Adaptation of measurement of Terman intelligence and the scale of the Weschler intelligence (WAIS). Gordon allport values test. Moss test of the abilities for the supervision and solving of conflict in interpersonal relations. Incomplete phrases test. Test to measure occupational

stress. HTP. WAIS, WISC WPSSI. Personality test. Raven. Machover. Bender. DTVP-2. Frostig. Woodcock.

**Bibliography:** \* Anastasi, Anne, 1908-, Psychological testing / Anne Anastasi, Susana Urbina., 7th ed., Upper Saddle River, N.J. : Prentice Hall, c1997., [0023030852].

### CC2011 Group Dynamics

( 3 - 0 - 8. Prerequisites: None. 6 LP 12, 5 LPO11, 6 LPS12 )

**Equivalence:** CC2004

This is an integrative, intermediate course in which the student has the opportunity to integrate his knowledge of social psychology, personality theories, learning and other subjects. Similarly, he will analyze individual behavior and its transformation when interacting within a group. As a learning result, the student will lead an organizational group through holding a human relations workshop and will draw up a report based on the topics covered in the course.

**General objective:** By the end of the course the student will be able to lead a group, analyze the dynamics of the group, and carry out interventions that improve the coexistence of its members, through the design and delivery of a human relations workshop, using experiential activities.

**Key words:** Leadership. Group integration and development. Evaluation of groups. Groups. Decision making. Communication process.

**Bibliography:** \* Napier, Rodney., Grupos : teoría y experiencia / Rodney W. Napier, Mattik Gershenfeld ; traducción Elizabeth Hahn., 4a ed., México : Trillas, 2000., spaeng, [9682458986].

### CC2012 Scale Design

( 3 - 0 - 8. Prerequisites: [ CD1003 , CO2003 Corequisite , CO2003 ]. 5 LP 12, 5 LPO11, 5 LPS12 )

**Equivalence:** CC2002

Intermediate course focused on the review of concepts and the development of basic skills in order to construct psychological and psychosocial mea-



surement instruments. It doesn't require any previous knowledge. As a learning result the student is expected to carry out reliability and validity calculations on measurement tools and to be capable of building Likert scales.

**General objective:** By the end of the course the student will be capable of using statistical design tools in order to build psychological and psychosocial measurement instruments.

**Key words:** Factorial analysis. The concept of measurement. Development of measurement instruments. Validity. Reliability.

**Bibliography:** \* DeVellis, Robert F., Scale development : theory and applications / Robert F. DeVellis., 2nd ed., Thousand Oaks, California : Sage Publications, Inc., 2003., [0761926046 (tela)], [0761926054 (rústica)].

### CC2013 Psychometrics II

( 3 - 0 - 8. Prerequisites: [ CC2010 ]. 7 LP 12, 5 LPO11, 7 LPS12 )

**Equivalence:** CC2005

Intermediate course oriented towards testing intelligence, personality, aptitude, and interests in adolescents and adults. It requires knowledge of Psychometry I. As a learning result the student will draw up psychological sets with which he can measure competencies, intellectual and emotional skills, and relevant abilities for a specific position.

**General objective:** Upon completion of this course, students will have acquired the necessary elements to evaluate personality through the application, tabulation, and interpretation of the projective and objective tests most commonly used in industry.

**Key words:** Job profiles based on competencies and related psychological tests. Personality inventory. Software review (e.g. PSICOWIN). Generation of complete psychometric evaluation files. BETA III. CIPSA. IPP. Dominó. BARSIT. Draw-a-person-in-the-rain test. MMPI2. TAT. Cleaver. SIV, SPV. 16 FP. Evaluation of adults.

**Bibliography:** \* Anastasy, Anne, Los tests psicológicos, Aguilar.

### CC2014 Interview Workshop

( 3 - 0 - 8. Prerequisites: [ CC1011 ]. 7 LP 12, 5 LPO11, 7 LPS12 )

**Equivalence:** CC2006

Intermediate course aimed at the student understanding, acquiring and developing the skills to carry out a workplace interview. The course requires previous knowledge in personality theories, psychopathology, and labor competencies. As a learning result the student will carry out any type of interview by competencies: personnel selection, evaluation, confrontation or exit.

**General objective:** Upon completion of this course, students will be able to conduct interviews for personnel selection, participant coaching, support, and feedback purposes, thus achieving closer ties with coworkers and guaranteeing their successful performance.

**Key words:** Interviewer abilities. Interview techniques. Tutoring. Interview. Interview modes.

**Bibliography:** \* Camp Rick; Vielhaber M.; Simonetti J., Qué persona para qué puesto, Ediciones Deusto.

### CC2015 Psychopathology I

(3 - 0 - 8. Prerequisites: [ CC1011 ]. 4 LP 12, 4 LPS12)

**Equivalence:** None

This is an intermediate course which focuses on the abnormality of human beings from the perspectives of feeling, thinking and acting in order to enable the student to establish criteria, based on scientific evidence, of people's state of normality/abnormality. Students are required to have prior knowledge of human development at its different stages, development theory, and personality theory in order to have a complete understanding of different pathological states and be able to establish the appropriate criteria to formulate differential diagnostics. The course consists of making diagnoses based on information gathering. Hence students are expected to learn how to compile clinical histories, carry out interviews and

use instruments that help them make an exact diagnosis. As a learning outcome, students are expected to integrate all the information obtained from interviews, diagnostic tests and the clinical history in order to form a diagnosis and prognosis and suggest a treatment.

**General objective:** Upon completion of this course, students will be able to explain the historical development, concept and models of psychopathology; provide criteria for the main current approaches to psychopathology; manage and know how to use different diagnostic classification systems; identify and distinguish different psychological disorders in human cognitive, emotional and behavioral processes; identify and differentiate anxiety disorders; identify mood disorders and differentiate child and youth disorders.

**Key words:** Medical history. Mental disorders. Differential diagnosis. Classification of mental disorders. Treatment and prognosis.

**Bibliography:** \* Belloch, Amparo., Manual de psicopatología / Amparo Belloch, Bonfacio Sandín, Francisco Ramos., Madrid ; México : McGraw-Hill, 1995., [8448117778 (obra completa)], [8448118340 (V.1)],[844811776X (V.2)].

### **CC2016 Psychopathology II** (3 - 0 - 8. Prerequisites: [ CC2015 ]. 5 LP 12, 5 LPS12) **Equivalence: None**

This is an intermediate course that deals with the study of complex syndromes using the classifications of the APA and WHO. These are the criteria established in both ICD and DSM requirements for dealing with the nosological categories that make up contemporary psychopathology. The course requires basic knowledge of psychopathology. As a result of learning, the student is expected to integrate the results of interviews, diagnostic tests and the clinical history of those patients whose conditions match some of the pathologies reviewed on this course.

**General objective:** Upon completion of this course, students will be able to establish criteria for differential diagnosis in the following conditions: psychosomatic, somatoform and dissociative disorders; psy-

chotic and schizophreniform disorders; personality disorders; psychosexual disorders; organic disorders and substance abuse; eating disorders; and impulse control disorders.

**Key words:** Differential diagnosis. Disorder. Schizophreniform. Dissociative. Psychosexual.

**Bibliography:** \* Belloch, Amparo., Manual de psicopatología / Amparo Belloch, Bonfacio Sandín, Francisco Ramos., Madrid ; México : McGraw-Hill, 1995., [8448117778 (obra completa)], [8448118340 (V.1)],[844811776X (V.2)].

### **CC3001 Introduction to Professional Development**

( 2 - 0 - 2. Prerequisites: None. 9 LPO11 )

**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## CC3002 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 LP 12 )

Equivalence: None

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Psychology. Life Sciences.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## CC3003 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 11 LPS12 )

Equivalence: None

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Psychology. Life Sciences.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## CC3004 Psychology Seminar of Vulnerable Groups

( 3 - 0 - 8. Prerequisites: [ CC1000 , CC1001 , CC2001 ]. 7 LP 12, 7 LPS12 )

Equivalence: None

This is an advanced course which promotes schemes for the diagnosis and psychological treatment of vulnerable groups such as the elderly, the disabled, women, street children, detainees, indigenous people, those with mental illness, those marginalized due to their sexual preference, migrants etc. in order to restore their quality of life. The course requires prior knowledge of human development, psychopathology, social psychology and clinical interviewing. As a learning outcome the students are expected to prepare a report describing the intervention made with a patient in a vulnerable situation, framing the criteria for diagnosis, prognosis and treatment and describing the development of the intervention and its results.

**General objective:** Student will be able to diagnose, prevent and implement therapeutic activities for people whose situations of vulnerability put them at social risk. Students will understand and implement the main counseling techniques to reduce the psychosocial impact on individuals and vulnerable groups.

**Key words:** Differential diagnosis. Vulnerability. Critical situation. Vulnerable situation. Primary, secondary and tertiary prevention.

**Bibliography:** \* A. Marchesi, M. Carretero y J. Palacios (Comp.), Psicología evolutiva 1. Teoría y Métodos, Alianza editorial.

## CC3005 Personality Disorders and Anxiety

( 3 - 0 - 8. Prerequisites: None. 8 LPS12 )  
Equivalence: None

It is an advanced level course that is intended for the student to improve understanding of the most recurrent personality disorders and anxiety. It includes descriptive and explanatory aspects of these disorders and their clinical approach, including differential diagnosis, treatment, prognosis and evolution. It requires prior knowledge of psychopathology and therapeutic process. As learning outcome the student integrates the diagnosis and management of real or simulated clinical cases.

**General objective:** Students will be able to: Identify and understand the signs and symptoms of the different psychopathological personality disorders and anxiety disorders, in order to integrate the differential diagnosis. To analyze the genetic etiology, biological and / or psychosocial disorders such as psychodynamic explanation to underpin psychotherapeutic intervention and formulation of prognosis and evolution of specific disorders within these classifications.

**Key words:** Anxiety disorders. Differential diagnosis. Personality disorders. Therapeutic guidelines.

**Bibliography:** \* Sadock, B. , Manual de Bolsillo de Psiquiatría Clínica, Lippincott, Williams & Wilkins.

## CC3006 Psychotic Disorders and Mood

( 3 - 0 - 8. Prerequisites: None. 8 LPS12 )  
Equivalence: None

It is an advanced level course that is intended for the student to improve understanding of psychotic disorders and mood. It includes descriptive and explanatory aspects of these disorders and their clinical approach, including differential diagnosis, treatment, prognosis and evolution. It requires prior knowledge of psychopathology and therapeutic process. As learning outcome the student integrates the diagnosis and management of real or simulated clinical cases.

**General objective:** Students will be able to: Identify and understand the signs and symptoms of the different psychopathological psychotic disorders and mood, in order to integrate the differential diagnosis. To analyze the genetic etiology, biological and / or psychosocial disorders such as psychodynamic explanation to underpin psychotherapeutic intervention and formulation of prognosis and evolution of specific disorders within these classifications.

**Key words:** Differential diagnosis. Psychotic disorders. Mood disorders. Therapeutic guidelines.

**Bibliography:** \* Sadock, B. , Manual de Bolsillo de Psiquiatría Clínica, Lippincott, Williams & Wilkins.

## CC3007 Clinical Practice I

( 0 - 20 - 4. Prerequisites: [ CC3005 Corequisite , CC3005 , CC3006 Corequisite , CC3006 ]. 8 LPS12 )  
Equivalence: None

It is an advanced level course in which the students take care of patients in different clinical settings and supervision. Involves the use of theoretical bases for the understanding of problems and implementation, as appropriate, of any of the different therapeutic approaches with psychoanalytic bases like the brief therapies, cognitive-behavioral and those derived from the humanistic approach, required in the care of personality, anxiety, psychotic and mood disorders. It is required prior knowledge of psychopathology, interviewing techniques, psychometrics and psychotherapies. Learning outcomes: The final product is expected that students develop integrated reports of psychological intervention performed on patients treated at health centers, clinics, community centers, hospitals or other settings. It is also hoped that students demonstrate skills to perform with ethics and professionalism, interdisciplinary teams.

**General objective:** Students will be able to: Implement any intervention for the diagnosis, treatment and / or follow up of personality, anxiety, psychotic and mood disorders, according to the therapeutic approaches and appropriate clinical guidelines. Perform with ethics and professionalism in clinical settings. Develop skills and attitudes that promote collaborative and interdisciplinary, as well as the com-

mitment to the needs of the patient and the community.

**Key words:** Brief intervention. First-order intervention. Cognitive behavior therapy. Psychoanalytic-oriented treatment. Humanistic therapies.

**Bibliography:** \* Trull, Timothy J., 1960-, *Psicología clínica : conceptos, métodos y aspectos prácticos de la profesión* / Timothy J. Trull, E. Jerry Phares ; traducción Jorge A. Velázquez., 6a ed., México : Thomson, c2003., spaeng , [9706861106].

### CC3008 Clinical Interview

( 3 - 0 - 8. Prerequisites: [ CC2016 ]. 8 LPS12 )

**Equivalence: None**

It is an advanced level course in which the student addresses the skills to handle the technical and theoretical aspects of the psychological interview, in its various forms of approach and areas of insertion. The use of the interview is an essential tool in the task of the psychologist, being an essential tool for understanding human behavior. It requires prior knowledge of Psychometrics Psychopathology I and II and I and II. As a result of learning the student is expected to integrate the results of his interviews with the ability to help establish a diagnosis and / or treatment suggested.

**General objective:** Students will be able to: Consolidate theoretical and practical elements necessary to guide him in the proper use of the clinical interview. Properly handle the different aspects and moments of psychological interview and that distinguish it from other types of interview. Differentiate the various types of interview, standing in the clinical setting (at the family level, group and individual).

**Key words:** Diagnosis. Interview. Rapport. Confrontation. Clarification.

**Bibliography:** \* Fernández, A.: , *La consulta psicológica y el psicodiagnóstico*, Editorial Fin de Siglo.

### CC3009 Somatoform Disorders, Factitious Disorders and Simulation

( 3 - 0 - 8. Prerequisites: None. 9 LPS12 )

**Equivalence: None**

It is an advanced level course that is intended for the student to improve understanding of somatoform disorders, factitious and of simulation. It includes descriptive and explanatory aspects of these disorders and their clinical approach, including differential diagnosis, treatment, prognosis and evolution. It requires prior knowledge of psychopathology and therapeutic process. As learning outcome the student integrates the diagnosis and management of real or simulated clinical cases.

**General objective:** Students will be able to: Identify and understand the signs and symptoms of the different psychopathological somatoform disorders, factitious and of simulation in order to integrate the differential diagnosis. To analyze the genetic etiology, biological and / or psychosocial disorders such as psychodynamic explanation to underpin psychotherapeutic intervention and formulation of prognosis and evolution of specific disorders within these classifications.

**Key words:** Differential diagnosis. Somatoform disorders. Factitious disorders and simulation. Treatment guidelines.

**Bibliography:** \* Sadock, B. , *Manual de Bolsillo de Psiquiatría Clínica*, Lippincott, Williams & Wilkins.

### CC3010 Psychology of the Patient in Crisis Situations

( 3 - 0 - 8. Prerequisites: None. 9 LPS12 )

**Equivalence: None**

Advanced course on the psychophysiological processes experienced by patients in crisis situations, at the cognitive, motor, vegetative and behavioral levels. Students will conduct semi-structured interviews with this type of patients, thus enabling them to diagnose the disorder properly and, in this way, develop a first-aid intervention that will help the patients to overcome the crisis and recover their biopsychological



social wellbeing. Psychopathology I and II are prerequisites for this course so students can understand and distinguish the mental disorders described in the DSM-IV. Learning outcome: students will write a report on a semi-structured interview of a patient in a real or simulated crisis situation, according to previously established criteria.

**General objective:** The student will be capable of practicing interventions that help the re-establishment of patients in real or simulated crisis.

**Key words:** Traumatic events. Patients in crisis situations. Semi-structured interview for patients in crisis. Crisis interventions.

**Bibliography:** \* Miller, Karen et al., The Crisis Manual for Early Childhood Teachers: How to Handle the Really Difficult Problems, Gryphon House, Inc.

### **CC3011 Psychology of Obstetric and Gynecological Patients**

**( 3 - 0 - 8. Prerequisites: None. 9 LPS12 )**

**Equivalence: None**

It is an advanced level course that is intended for the student to understand the psychosocial aspects of obstetrical and gynecological patient and / or human reproduction. It includes the description of these aspects and psychological care to patients, their partners, their families and caregivers. It requires basic knowledge of reproductive psychophysiology, psychology, human development and psychotherapeutic processes. As learning outcome the student integrates the accompanying plan and therapeutic approach to patients and / or caregivers, real or simulated.

**General objective:** Students will be able to: Recognize the physical and psychosocial obstetrical and gynecological patients. Decide and plan psychological care that the patient and / or their families must receive.

**Key words:** Obstetrician-gynecologist patient. Reproductive psychophysiology. Human development psychology. Psychotherapeutic processes.

**Bibliography:** \* Psicología de la reproducción humana : un enfoque integral / Instituto Nacional de Perinatología., México : Editorial Trillas, c2002., [9682464722].

### **CC3012 Clinical Practice II**

**( 0 - 20 - 4. Prerequisites: [ CC3009 , CC3009 Corequisite ]. 9 LPS12 )**

**Equivalence: None**

It is an advanced level course in which the students take care of patients in different clinical settings and supervision. Involves the use of theoretical bases for the understanding of problems and implementation of any of the different therapeutic approaches with psychoanalytic bases like the brief therapies, focused and of support, cognitive-behavioral and those derived from the humanistic approach required in the care of somatoform, factitious and simulated disorders. It also addresses the psychological care to gynecological and obstetrical patients and critical patients. Requires prior knowledge of Psychometrics, Psychopathology and Theories of Personality. Learning outcomes: The final product is expected that students develop integrated reporting of psychological intervention performed on patients treated at health centers, clinics, community centers, hospitals or other settings. It is also hoped that students demonstrate skills to perform in an ethical, professional, interdisciplinary teams.

**General objective:** Students will be able to: Design and implement any intervention for the diagnosis, treatment and / or follow up of somatoform, factitious, and simulated disorders, according to the therapeutic approaches and appropriate clinical guidelines. Design and implement processes of psychological care to gynecological and obstetrical patients and critical patients. Perform with ethics and professionalism in clinical settings.- Develop skills and attitudes that promote collaborative and interdisciplinary, as well as the commitment to the needs of the patient and the community.

**Key words:** Brief intervention. First-order intervention. Cognitive behavior therapy. Psychoanalytic-oriented treatment. Humanistic therapies.



**Bibliography:** \* Trull, Timothy J., 1960-, Psicología clínica : conceptos, métodos y aspectos prácticos de la profesión / Timothy J. Trull, E. Jerry Phares ; traducción Jorge A. Velázquez., 6a ed., México : Thomson, c2003., spaeng , [9706861106].

### CC3013 Psychology of Chronic and Terminal Patients

( 3 - 0 - 8. Prerequisites: None. 11 LPS12 )

**Equivalence: None**

It is an advanced level course that is intended for the student to explore the psychosocial aspects involving chronic degenerative diseases and terminals. It includes descriptive aspects of these disorders and psychological care to patients and their caregivers. It requires prior knowledge of psychophysiology and therapeutic processes. As learning outcome the student integrates the accompanying plan and therapeutic approach to patients and / or caregivers, real or simulated.

**General objective:** Students will be able to: Recognize the physical and psychosocial status of patient suffering from chronic degenerative disease or terminal. Decide and plan psychological care that patient and / or their families must receive.

**Key words:** Chronic degenerative diseases. Terminal illness. Psychological care to patients and families.

**Bibliography:** \* Oblitas, Luis Armando y Cols , Psicología de la salud y enfermedades crónicas, PSICOM Editores, [9589783678, 9789589783672].

### CC3014 Addiction and Eating Disorders Psychology

( 3 - 0 - 8. Prerequisites: None. 11 LPS12 )

**Equivalence: None**

Advanced course in which students will explain the biopsychosocial implications involved in addictive processes and eating disorders that will help them to design interventions to prevent these disorders and for the different stages of change for unhealthy habits: precontemplation, contemplation, action, maintenance, relapse. They will learn about the different

psychotherapeutic approaches and medications to help these patients to recover. Psychopathology I and II are prerequisites for this course so students can understand and distinguish the mental disorders described in the DSM-IV. Learning outcome: students will write a report on a semi-structured interview of a patient with a real or simulated addiction and/or eating disorder, according to previously established criteria.

**General objective:** The student will be capable of: designing a psychosocial intervention for the prevention of addiction or eating disorders for a specific population. Design an intervention plan for a real or simulated person with addictive and/or eating disorder problems, taking under consideration the different stages of the process of changing habits and will indicate the psychotherapeutic approach convenient to that patient.

**Key words:** Addictions. Eating disorders. Biopsychosocial aspects of addicted. Process of changing habits. Addictions and eating disorders psychotherapy.

**Bibliography:** \* Heyman, Gene M., Addiction: A Disorder of Choice, Harvard University Press .

### CC3015 Mental Health Promotion

( 3 - 0 - 8. Prerequisites: None. 11 LPS12 )

**Equivalence: None**

Advanced course in which students review the mental health promotion activities that lead to the creation of the individual, social and environmental conditions for an optimal psychological and psychophysiological development to improve people's quality of life. They will also learn about the public health principles that are characterized by the reduction of risk factors and the promotion of protection factors related to a mental disorder or behavioral problem, in order to reduce their prevalence or incidence. Learning outcome: students will design and/or formulate a mental health plan for a real or simulated relevant population and write a report on the outcome of said intervention in accordance with previously established criteria.

**General objective:** The student will be capable of designing and creating a mental health plan for a needed population.

**Key words:** Mental health. Promotion. Prevention. Life quality. Mental disorders.

**Bibliography:** \* Vandiver Vikki L., Integrating Health Promotion and Mental Health: An Introduction to Policies, Principles, and Practices, 1a, Oxford University Press.

### **CC3016 Clinical Practice III**

( 0 - 20 - 4. Prerequisites: [ CC3013 Corequisite , CC3013 ]. 11 LPS12 )

**Equivalence: None**

It is an advanced level course in which the students take care of patients in different clinical settings and supervision. Involves the use of theoretical bases for the understanding of problems and implementation, as appropriate, of any of the different therapeutic approaches with psychoanalytic bases like the brief therapies, focused and of support, cognitive-behavioral and those derived from the humanistic approach, required in the psychological care of patients with chronic degenerative diseases, terminal patients, people with addictions and people with eating disorders. Requires prior knowledge of Psychometrics, Psychopathology and Theories of Personality. Learning outcomes: The final product is expected that students develop integrated reports of psychological intervention performed on patients treated at health centers, clinics, community centers, hospitals or other settings. It is also expected that students demonstrate skills to perform with ethics, professionalism, interdisciplinary teams.

**General objective:** Students will be able to: Design and implement processes of psychological care in patients with chronic degenerative diseases, terminal patients, patients with addictions and patients with eating disorders. Serve with ethics and professionalism in clinical settings. Develop skills and attitudes that promote collaborative and interdisciplinary work and the commitment to the needs of the patient and the community.

**Key words:** Brief intervention. First-order intervention. Cognitive behavior therapy. Psychoanalytic-oriented treatment. Humanistic therapies.

**Bibliography:** \* Trull, Timothy J., 1960-, Psicología clínica : conceptos, métodos y aspectos prácticos de la profesión / Timothy J. Trull, E. Jerry Phares ; traducción Jorge A. Velázquez., 6a ed., México : Thomson, c2003., spaeng , [9706861106].

## CD Administrative Sciences

### CD1003 Statistical Methods for Decision Making

( 3 - 0 - 8. Prerequisites: [ MA1016 , FZ1005 , MA1018 ]. 3 LAE11, 3 LCDE11, 3 LCPF11, 4 LDN11, 3 LEM11, 3 LIN11, 3 LLN11, 4 LMC11, 4 LPO11 )

**Equivalence:** CD1000

This is a basic course in the area of administrative sciences, through which we will develop in students the ability to analyze information to support the decision-making process using basic statistical tools. Knowledge of the fundamentals of statistical analysis will give students the opportunity to become more competitive, impacting positively on the environment in which they develop. The course will promote values such as discipline, self-learning ability and the ability to synthesize information, to investigate, analyze and make inferences based on statistical theory, which should contribute to their academic and professional development and hence to the development of their environment. Prior knowledge of integral calculus is required to carry out the course content. As a result of learning students are expected to be able to develop research and analysis activities for decision making based on real or pseudoreal cases supported by statistical analysis methodology.

**General objective:** Upon completion of this course, students will be able to analyze the information from a population of interest, by collecting, organizing and analyzing data, increasing and improving the quality of knowledge of the variables involved in the decision making process in the areas of business and administration; know the parts that statistical research consists of and its contribution to the decision-making process, and also recognize the different techniques of data analysis, the theory that underpins them, their application and use, and the generation of indicators that describe populations of interest and through which some important characteristics of these populations can be identified; propose and facilitate decision making in the context of ethics and sustainable development.

**Key words:** Probability distributions. Inferential statistics. Descriptive statistics.

**Bibliography:** \* Newbold, Paul., Estadística para administración y economía / Paul Newbold, William L. Carlson, Betty M. Thorne ; traducción, Esther Rabasco Espáriz., 6a ed., Madrid : Pearson/Prentice Hall, 2008., spaeng, [9788483224038].

### CD2006 Forecasting for Decision Making

( 3 - 0 - 8. Prerequisites: [ CD1003 ]. 4 LAE11, 4 LCDE11, 4 LCPF11, 5 LDN11, 4 LEM11, 4 LIN11, 4 LLN11, 5 LMC11, 5 LPO11 )

**Equivalence:** CD1002

This is an intermediate course in the field of administrative science intended for students to obtain a clear understanding of the concepts and methodologies used in the practice of forecasting applied to the field of business, supporting the process of competitive and creative decision making. The course requires prior knowledge of descriptive and inferential statistics, which are covered in the course of statistical methods for decision making. As a result of learning, the student is expected to identify the forecasting model(s) suitable for use in various situations in the field of business and organizations, and solve them, applying the concepts and methodologies to practice forecasts and using statistical forecasting software (Minitab, SPSS, among others).

**General objective:** Upon completion of this course, students will be able to understand the limitations and possibilities of the various methods of qualitative and quantitative prediction; apply different methods of smoothing or decomposition to a real situation using both manual procedures and statistical software; apply simple and multiple linear regression methods for point estimates and predictions, calculating confidence and prediction intervals and making statistical inferences; develop regression models using advanced methods to compare forecasting models using statistical software (Minitab, SPSS, etc.); all the above are used to make predictions that support the decision making process, and provide competitive and creative solutions to improve the economic, social and cultural environments both nationally and internationally.

**Key words:** Regression analysis. Time series analysis. Forecasting.

**Bibliography:** \* Hanke, John E., 1940-, Pronósticos en los negocios / John E. Hanke, Arthur G. Reitsh ; traducción Sergio Kourchenko Barrena, 5a ed., México : Prentice Hall Hispanoamerica, 1996., spaeng, [9688806811].

## **CD2007 Quantitative and Optimization Models**

**( 3 - 0 - 8. Prerequisites: None. 5 LAE11, 4 LAF11, 5 LCDE11, 5 LCPF11, 6 LDN11, 5 LEM11, 5 LIN11, 5 LLN11 )**

**Equivalence: CD2000**

This is an intermediate course, which is intended to introduce students to learn and apply the concept of problem solving through quantitative modeling and optimization. They include concepts of linear programming, assignment and transportation models, queuing theory, theory and decision trees and Markov analysis. Requires knowledge of calculus, probability and statistics. As a result of learning, the student is expected to analyze a problem situation, decide what is the best way to solve the problem by developing the ability to not only solve problems but to evaluate what would be the best way to model the problem given the resources available in that moment.

**General objective:** After completing the course, the student will be able to solve problems and make decisions through the use of quantitative and optimization models.

**Key words:** Linear programming. Decision theory. Queueing theory. Markov analysis.

**Bibliography:** \* Render, Barry., Quantitative analysis for management / Barry Render, Ralph M. Stair, Jr., 7a ed., Upper Saddle River, N.J. : Prentice Hall, c2000., [0130215384].

## CF Financial and Administrative Accounting

### CF1008 Financial Information for Decision Making

( 3 - 0 - 8. Prerequisites: None. 1 LAE11, 1 LAF11, 1 LCDE11, 1 LCPF11, 1 LDF11, 1 LDN11, 1 LEM11, 1 LIN11, 1 LLN11, 1 LMC11, 3 LP 12, 1 LPM12, 3 LPS12 )

**Equivalence:** CF1000

This is a basic course in the area of financial accounting studies that introduces students to the application of accounting for financial decision making. It requires no prior knowledge. As a learning outcome the student is expected to prepare a report on the financial performance of a company listed on the stock exchange with reference to up-to-date economic and financial reports.

**General objective:** On finishing the course the student will be able to draw up basic financial statements that enable him to establish the effect of business decisions on the accounting equation and hence on the financial accounts; apply accounting concepts, understand the presentations of financial statements and be able to analyze the basic financial performance of a company. This course includes an introduction to information technology through the use of financial databases such as Bloomberg, Economática, and Infosel financiero, these being the foundation for financial analysis.

**Key words:** Accounting and financial concepts. Transactions and the accounting equation. Business transactions and accounting cycle. Financial statements.

**Bibliography:** \* Guajardo Cantú, Gerardo., Contabilidad financiera / Gerardo Guajardo Cantú, Nora E. Andrade de Guajardo., 5a ed. en español., México : McGraw-Hill, 2008., [9701066219],[9789701066218].

### CF1009 Cost and Price Management

( 3 - 0 - 8. Prerequisites: [ CF1008 , CF1000 ]. 2 LAE11, 2 LAF11, 2 LCDE11, 2 LCPF11, 2 LDN11, 2 LEM11, 2 LIN11, 2 LLN11, 2 LMC11, 2 LPM12 )

**Equivalence:** CF1005

This is a basic course in financial and managerial accounting that introduces students to cost systems and pricing techniques. It requires prior knowledge of financial accounting. As a learning outcome, the student is expected to prepare a report which shows the execution of a costing system and the determination of a suggested retail price of a product or service using advanced Excel tools.

**General objective:** At the end of this course, the student will be able to estimate the cost of a product or a service, and determine a competitive price, considering other relevant aspects to the business environment (marketing, operations, as well as the micro and macroeconomic aspects). The course includes determining margins, once the price and cost are known, in order to analyze which are the products and services with the greatest added value.

**Key words:** Activity based costing. Order and process costing. Direct and absorption cost systems. Pricing techniques. Profit margin calculations.

**Bibliography:** \* Torres Salinas, Aldo S., Contabilidad de costos : análisis para la toma de decisiones / Aldo S. Torres Salinas., 3a ed., México, D.F. : McGraw-Hill, 2010., [9786071502971].

### CF1010 Accounting and Cost Management

( 3 - 0 - 8. Prerequisites: None. 4 IA 11, 4 IBN11, 3 IID12, 3 IIN12, 5 IIS11, 5 IMI11, 3 INT11, 5 LCMD11, 3 LEC11, 2 LEF11, 5 LPO11 )

**Equivalence:** CF1007

This is a basic course intended to teach students to understand the financial statements for different types of enterprises. In this course students will develop the ability to define and assess the different

types of costs that exist in the operational area of an organization and apply diverse costing techniques to manufacturing and service environments. As a learning outcome students are expected to be able to identify the basic financial statements of companies as well as understand the accounting process and use the costing information to increase competitiveness.

**General objective:** The student must be able to understand the basics concepts of financial accounting and the fundamentals of analysis of financial statements in order to support decision making; and understand, analyze, use and relate cost accounting information to new developments in processes and operations in the manufacturing area.

**Key words:** Costing systems. Accounting and financial concepts. Accounting equation. Financial statements. Accumulative cost methods.

**Bibliography:** \* Reeve, James M., 1953- Warren, Carl S., Principles of financial and managerial accounting / James M. Reeve, Carl S. Warren, Jonathan E. Duchac., 10th ed., Mason, Ohio ; México : South-Western Cengage Learning, c2009., [0324664761], [9780324664768].

### CF1011 Managerial Accounting

( 3 - 0 - 8. Prerequisites: [ CF1009 ]. 3 LAE11, 3 LAF11, 3 LCDE11, 3 LCPF11, 3 LDN11, 3 LEM11, 3 LIN11, 3 LLN11, 3 LMC11 )

**Equivalence:** CF1003

This is a basic management accounting course that prepares student to understand and apply accounting tools for process planning, management and control of business, thus making decision making easier. Prior knowledge of cost and price management is required. As a learning outcome students are expected to prepare an Integrated Financial Planning Project (in advanced Excel) in which they apply marginal analysis and costing tools and integrate knowledge from other business areas (such as marketing, operations, and the microeconomic environment).

**General objective:** On finishing the course the student will be able to combine marketing, economic and operational concepts with accounting analysis

tools to develop models for financial management planning and decision making.

**Key words:** Cost classification and segmentation. Financial planning (Budgeting). Cost volume profit model. Costing systems. Marginal analysis and introduction to management control.

**Bibliography:** \* Ramírez Padilla, David Noel, Contabilidad administrativa / David Noel Ramírez Padilla., 8a ed., México, D.F. : McGraw-Hill, 2008., [9701066308], [9789701066300].

### CF1012 Tax Accounting Fundamentals

( 3 - 0 - 8. Prerequisites: [ D1022 ]. 5 LCPF11 )

**Equivalence:** None

This is a basic course on the field of Tax Accounting, where students are expected to analyze, comprehend and apply the policy assumptions from the legal Mexican tax framework.

**General objective:** Students will be able to explain the definition, characteristics and constitutional support of tax law; describe the structure and functioning of the internal revenue service; identify tax credits arising from taxes, land use and products; analyze the classification and financial effects of taxes; understand the rights and obligations of taxpayers; recognize the powers of tax authorities; examine violations and tax offenses; know the basic aspects of the resources for repeal and appeal and understand how to interpret and apply the rules contained in the Federal Tax Code.

**Key words:** Taxpayers' rights and obligations.

**Bibliography:** \* Mabarak Cerecedo, Doricela., Derecho financiero público / Doricela Mabarak Cerecedo., 3a ed., México : McGraw-Hill, 2007., [9789701062371], [970106237X].

### CF1013 Taxes and Business Strategies

( 3 - 0 - 8. Prerequisites: None. 9 LAF11 )

**Equivalence:** CF3009

This is a basic course in the tax field which gives an overview of what tax regulation in businesses con-



sists of at federal and local levels, with special emphasis on financial transactions inside and outside the stock exchange with a view to optimizing resources through tax strategies. As a result of learning the students will understand the fiscal framework that regulates the internal revenue service both at individual and company levels in Mexico and international treaties that may be invoked to benefit domestic corporate activity. The students will be able to resolve specific cases working together to design fiscal strategies, always framed within the tax law.

**General objective:** Students will be able to analyze each of the tax regimes and recognize the operational characteristics and fiscal cost of each decision for reinvestment or withdrawal of earnings through dividends; know the countries that offer highest cost given their statuses as tax havens.

**Key words:** Fiscal strategy. Constitutional principles. Appeal mechanisms. Formal and material obligations.

**Bibliography:** \* Problemas actuales del derecho empresarial mexicano / coordinadores José Heriberto García Peña, Emilio Rabasa Gamboa., 1a ed., México : Porrúa : Tec de Monterrey, Campus Ciudad de México, 2005., [970075636X].

### CF1014 Introduction to the Public Accounting and Finance Academic Program

( 3 - 0 - 4. Prerequisites: None. 1 LCPF11 )

**Equivalence:** None

The purpose of this basic-level course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and profes-

sional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Instituto Mexicano de Contadores Públicos, Código de Ética Profesional del Contador Público.

### CF2006 Intermediate Accounting: Operating Cycle and Investment

( 3 - 0 - 8. Prerequisites: [ CF2005 , CF1011 ]. 5 LCPF11 )

**Equivalence:** CF00851

As a learning outcome of this course, students are expected to apply the national and international accounting standards related to the accounts that comprise the operating and investment cycle of a business, as well as producing complementary information, using notes, of the above.

**General objective:** By the end of this course, students will be able to: 1. appraise, present and report correctly and adequately each of the items on the Balance Sheet belonging to a company's operating and investment cycles. 2. Demonstrate the effects of inflation on the figures of this Financial Statement. 3. Generate notes that describe all the circumstances that influence such figures.

**Key words:** Comparison with international accounting standards. The effect of inflation on accounting. Identification of accountable records. National accounting standards. Notes to the Financial Statements. Particular rules (evaluation and presentation) relatives to the operative cycle and the business investment cycle.

**Bibliography:** \* Kieso y Weigandt, Contabilidad intermedia, 7ma, Wiley, 1992, ESP.

## CF2007 Intermediate Accounting: Financing Cycle and Updating Information

( 3 - 0 - 8. Prerequisites: [ CF2006 ]. 6 LCPF11 )  
Equivalence: CF00852

Once this course is completed, the student should be able to explain the underlying reasons behind the accounting entries that deal with short and long term liabilities as well as owner's equity; value, present and report all of the entity's activities within the financing cycle, incorporating the inflationary effects in the information presented in the Financial Statements; produce the accompanying notes to the Financial Statements in order to comply with existing Accounting Regulations, so that the end user of these Financial Statements has a more thorough understanding of the numbers and circumstances taken into consideration for the purpose of portraying the Economic Entity.

**General objective:** Upon the completion of the course, the student will be able to correctly assess, present and inform on all of the elements related to the financing cycle within the financial statements and assess each special entry that might affect the company's operational performance; incorporate the effects of inflation in the financial information; produce the accompanying notes to the financial statements in order to highlight special circumstances that might have an effect on the information being reported; provide an opinion on the company's financial well-being that is supported by his personal analysis of the financial statements.

**Key words:** Accounting record alternatives. The quality of financial statements. Comparison between national and international accounting regulations. National accounting regulations. Financial statement forecasting. Recognizing inflation in financial information. Writing and analyzing notes in financial statements. Particular rules (evaluation and presentation) related to entries in the financial cycle of a business firm. Analysis, interpretation and evaluation of financial statements. Deferred taxes and other special entries that affects results (pcga series).

**Bibliography:** \* Kieso, Donald E., Contabilidad intermedia / Donald E. Kieso, Jerry J. Weygandt ;[ traducción, Hugo Iván Escoffíé Martínez], 2a ed., Méxi-

co, D. F. : Limusa ; Wiley, 1999., Mexico, 1999., spa, [9681853083],[9789681853082].

## CF2015 Financial Information Analysis

( 3 - 0 - 8. Prerequisites: [ CF1008 , CF1010 Corequisite , CF1010 ]. 7 IBN11, 4 LAE11, 4 LAF11, 4 LCDE11, 4 LCPF11, 2 LDF11, 4 LDN11, 3 LEF11, 4 LEM11, 4 LLN11, 4 LMC11, 5 LPM12 )  
Equivalence: CF1004, CF2009

This is an intermediate course in the field of financial accounting that prepares students to take investment, operational and finance decisions by analyzing financial information, integrating knowledge related to industry analysis and the macroeconomic environment. Basic knowledge of accounting and finance is required. As a learning outcome the student is expected to produce a prospective analysis report for a company that is listed on the Mexican stock exchange, or in another country, that integrates the conclusions drawn from analysis of the business strategy and competitive dynamics, by means of financial analysis and interpretation and analysis of the accounting system, using the most suitable information technologies.

**General objective:** On finishing the course the student will be able to apply financial analysis tools; evaluate the financial performance of a company and predict its future operational and financial sustainability; integrate knowledge of macroeconomics and strategy using primary and secondary information from databases such as Euromonitor, Infosel Financiero and Bloomberg. This includes the analysis of non-financial information and the complete annual report, including the letter from the CEO, strategies, reports, notes on financial statements, for companies from all over the world

**Key words:** Financial analysis tools. Analysis and interpretation of profitability, liquidity, leverage and operations. Growth and financial strategy analysis. Prospective analysis.

**Bibliography:** \* Subramanyam y Wild, Financial Statement Analyses, 10th, Mc. Graw Hill, [139780073379432].

## CF2016 Activity Based Costing for Products and Services

( 3 - 0 - 8. Prerequisites: [ CF1011 ]. 5 LCPF11 )

Equivalence: CF2004

This is an intermediate course in accounting where students specialize in the process of estimating and costing, supporting the administrative control and inventory valuation. It requires prior knowledge of cost analysis and prices. As a learning outcome students will develop a project in which they value finished goods and inventories and generate information in support of administrative control (with attributes of the Project).

**General objective:** At the end of this course the student will be able to finance products and services using activity based costing; calculate product costs in special processes; and provide information supporting administrative control.

**Key words:** Activity based costing. Process costing. Standard costing.

**Bibliography:** \* Administración de costos : un enfoque estratégico / Edward J. Blocher . [et al.], 1a ed. en español., México, D.F. : McGraw Hill, c2008., spaeng, [9701066464],[9789701066461].

## CF2017 Financial Statement Auditing

( 3 - 0 - 8. Prerequisites: [ CF2007 ]. 7 LCPF11 )

Equivalence: CF2010

This is an intermediate course in financial accounting during which students obtain the knowledge and skills to audit financial statements for the use and application of research techniques and collection of audit evidence in accordance with national and international regulations, it also includes the generation of audit reports and follow-up observations. The course requires prior knowledge of accounting regulations. As a learning outcome students are expected to perform comprehensive audit examinations in which they evaluate audit mechanisms of financial statements. Students are also expected to carry out an audit in a simulated environment and develop a research report on a audit topic.

**General objective:** Upon completion of the course, students will be able to apply the basic theory of auditing financial statements, specifying the application of the technique and professional auditing judgment. He will also be able to manage and document the main tasks involved in performing the audit, implementing national and international regulations, and he will understand the importance of ethics related to auditing.

**Key words:** Internal control. Auditing financial statements. Auditing procedures. Accountants' report.

**Bibliography:** \* Messier, William F., Auditing & assurance services : a systematic approach / William F. Messier, Jr., 3rd ed., Boston ; México : McGraw-Hill, c2003., [0072478772 (papel alcalino)], [007119858X (ed. international)], [9780072478778 (papel alcalino)].

## CF2018 Strategic Information Systems

( 3 - 0 - 8. Prerequisites: None. 8 LAE11, 7 LAF11, 7 LCDE11, 6 LCPF11, 7 LEM11, 7 LIN11, 6 LLN11, 7 LPO11 )

Equivalence: None

This is an intermediate course in accounting that prepares students to integrate business processes with the accounting system and strategic use of financial and management information. It requires prior knowledge of financial and management accounting. As a learning outcome, students develop an application in an ERP (SAP for example) which configures the operation cycles of a business accounting system and generates a report for making strategic decisions.

**General objective:** On completing the course, students will be able to apply systemic thinking to integrate the operation cycles of a business with an organization's accounting system using the philosophy of ERP (SAP for example).

**Key words:** Systems Methodology. Marketing process. Production and distribution processes. Accounting architecture (System). Internal control, security and fraud.

**Bibliography:** \* Williams, Glynn C., Implementing SAP ERP sales & distribution / Glynn C. Williams., New York : McGraw-Hill, c2008., [9780071497053 (papel alcalino)], [0071497056 (papel alcalino)].

## CF2019 Control and Business Development

( 3 - 0 - 8. Prerequisites: [ CF2015 ]. 7 LAE11, 8 LCPF11 )

**Equivalence:** CF2013

This is an intermediate course in the area of management accounting that seeks to teach the student to develop an accounting system by areas of responsibility within an organization. It requires prior knowledge of cost-volume-profit, marginal analysis, financial and administrative planning (master budget) and standard cost system. As a learning outcome the student is expected to create an implementation project to solve an administrative problem, using accounting by areas of responsibility.

**General objective:** At the end of the course, the student will be able to organize an accounting system by areas of responsibility, which allows a performance evaluation with a strategic focus that favors business development.

**Key words:** Strategic planning. Responsibility centers. Transfer prices. Incentives. Compensations.

**Bibliography:** \* Anthony, Robert N. (Robert Newton), 1916-2006., Sistemas de control de gestión / Robert N. Anthony, Vijay Govindrajan, 1a ed. en español., México, D. F. : McGraw Hill, 2008., spaeng, [9701066413],[9789701066416].

## CF3006 International Taxation

( 3 - 0 - 8. Prerequisites: [ CF2012 , CF2015 ]. 9 LCPF11 )

**Equivalence:** CF3023

This is an advanced course in the Fiscal area. As a learning product students are expected to know external commerce laws and international treaties; calculate the taxes derived from international transactions; in addition handle special aspects of income tax as well as those related to transfer pricing, mul-

tinational business firms and fiscal opinions. They should also be aware of other special regimes and international agreements of fiscal character.

**General objective:** This course gives students a grounding in legislation regarding taxes on foreign trade, focusing on organizations with special characteristics, as well as in international regulations for free trade agreements and to avoid double taxation, thus providing them with the specific skills required to solve queries and generate a fiscal plan. They will also study some topics of specific interest that are related to this area.

**Key words:** Fiscal consolidation. Tax report. International taxes. Free trade agreements (FTAs). Treaties to avoid double taxing, applicable to financial, consolidation and insurance institutions.

**Bibliography:** \* México, Código Fiscal de la Federación 2007, 21a ed., México : Ediciones Fiscales ISEF, 2007., mx, spa, [9706769862].

## CF3008 Strategic Accounting

( 3 - 0 - 8. Prerequisites: [ CF2013 , CF2019 ]. 9 LCPF11 )

**Equivalence:** None

This is an advanced course in the Strategic Accounting field, in which the students integrate the concepts and tools of costs, financial information, and planning and control, among others, in order to generate reports both for external and internal users. As a learning product students are expected to apply an accountable-administrative report methodology that allows them to transform the financial information into strategic decisions to impact positively on the results of the company.

**General objective:** By the end of this course, students will be able to determine which indicators are needed to measure performance and develop an indicator-based compensation system in order to transform data from accounting records into strategic information for planning and control functions.

**Key words:** Compensation. Performance indicators. Integral accounting reports.

**Bibliography:** \* Financial and managerial accounting : the basis for business decisions / Jan R. Williams . [et al.], 14th ed., New York : McGraw-Hill, 2008, New York, 2008, eng, [0071101217],[9780071101219].

### CF3018 Corporate Taxation

( 3 - 0 - 8. Prerequisites: [ CF1012 ]. 6 LCPF11 )

Equivalence: CF2008

This is an advanced course in accounting aimed at teaching students the effect of the provisions of tax laws (Income Tax, Flat Tax and VAT) applicable to the operations of corporations. It requires prior knowledge of financial law. As a learning outcome, the student is expected to draw up a report and solve a real case, applying the knowledge acquired during the course and identifying the tax effects, the financial and administrative aspects of the 3 charges (Income Tax, Flat Tax and VAT), the income and deductions and also identifying the rights and tax liabilities generated by the operation of an organization.

**General objective:** Upon completion of the course, students will be able to identify the general scheme of the taxes studied and understand the different alternatives related to income and tax deductions; determine the tax deductibility of investments to obtain financial benefit from the application of tax losses; determine the taxable and financial effects of payable taxes: 1) income tax, 2) flat tax 3) value added tax on interim, annual and definitive payments, whilst observing a state of fiscal balance and reconciliation with the accounts; include an introductory topic on international taxes for companies.

**Key words:** Taxed income. Deduction. Corporate taxes.

**Bibliography:** \* José Francisco Javier, MANUAL DE CONTABILIDAD PRACTICA, EDITORIAL TRILLAS SA DE C, [9786071700261].

### CF3019 Corporate Accounting

( 3 - 0 - 8. Prerequisites: [ CF2007 ]. 7 LCPF11 )

Equivalence: CF3002

This is an advanced course in the field of accounting that requires prior knowledge related to international

accounting regulations, inflation in accounting, accounting records, domestic accounting regulations, adding notes to financial statements, and specific rules (of evaluation and presentation) related to the company's operating cycle and the investment cycle. As a result of learning, the student will carry out exercises to prepare consolidated or combined financial statements, such as preparing and presenting financial information derived from business acquisitions, mergers, liquidations and joint ventures, according to international standards in financial reporting, including the effects that variations in the exchange rate and hyperinflation can have on them.

**General objective:** Upon completion of this course, students will be able to prepare and understand corporate accounting in business combinations in an international environment.

**Key words:** Accounting concepts and criteria related to business acquisition, business combinations and joint ventures. Process and procedure for preparing financial statements resulting from the consolidation/combination, merger and liquidation of companies. Analysis and interpretation of consolidated financial statements. Effects of exchange rate variations from foreign currency transactions and overseas operations. Agency, head office and branch accounting.

**Bibliography:**\* Advanced accounting/Floyd A. Beams . [et al.], 10th ed., Upper Saddle River, N.J. : Pearson Prentice Hall, 2009., [0136033970],[9780136033974].

### CF3020 Personal Taxation

( 3 - 0 - 8. Prerequisites: [ CF3018 ]. 7 LCPF11 )

Equivalence: CF2011

This is an advanced course in accounting that prepares students to incorporate personal and professional integrity as a behavioral norm within their professional training, emphasizing in particular the social, ethical and professional responsibility of the public accountant in his capacity as an auditor, in accordance with national regulations and international law, and based on codes of conduct for organizations and the code of best corporate practices. The course requires prior knowledge of insurance and risk assessment. As a learning outcome the student is



expected to resolve cases in which he demonstrates his professional responsibility in making ethical decisions, especially in his role as an auditor.

**General objective:** On completing the course, students will be able to determine the tax liabilities of individuals, and to calculate the corresponding tax burden, incorporating the social welfare aspects related to wages and salaries, including an introductory item related to international taxes for individuals.

**Key words:** Taxable income and deductions. Taxation of individuals. Social welfare. Special regimes.

**Bibliography:** \* JOSE FRANCISCO JAVIER, MANUAL DE CONTABILIDAD PRACTICA/ ACCOUNTING PRACTICE GUIDE., EDITORIAL TRILLAS SA DE C, [9786071700261].

### CF3021 International Financial Reports

( 3 - 0 - 8. Prerequisites: [ CF3019 ]. 8 LCPF11 )  
Equivalence: CF3003

This is an advanced course in financial accounting studies that introduces students to the application of accounting for financial decisions. It requires intermediate accounting and advanced accounting knowledge. As a learning outcome, the student will produce a report on the financial performance of a company listed on the stock exchange, by referring to up-to-date economic and financial news.

**General objective:** On completing this course, students will be able to recognize, analyze and evaluate the financial information generated by multinational companies, by reviewing databases such as Bloomberg and others to check their financial statements, notes, etc, and by being able to analyze financial and non-financial information concerning strategies to create value for the company.

**Key words:** Derivatives accounting. International financial analysis. Profit quality. Proforma financial statements.

**Bibliography:** \* Alan Melville, International Financial Reporting, Published By Pearson Education .

### CF3022 Assurance and Risk Evaluation

( 3 - 0 - 8. Prerequisites: [ CF2017 ]. 8 LCPF11 )  
Equivalence: CF3004

This is an advanced course in financial accounting that aims for students obtain the knowledge and skills that will enable them to carry out the functions related to internal auditing and administration of the system of corporate regulations, taking into consideration the risk assessment process. The course includes reflection on the legal and professional responsibilities of auditors, as well as ethical behavior. Prior knowledge is required of auditing financial statements. As a learning product, the student is expected to take examinations in which the logical understanding of the concepts that constitute the mechanism of auditing financial statements will be assessed. The students will also work in teams to carry out a project where they build a system of norms according to predetermined criteria and / or develop a research report on an audit topic.

**General objective:** Student will understand the structure of a corporate system of internal norms and the structuring of an internal audit program to verify the level of compliance. He will also know the role of internal control in regulations, corporate governance and fraud prevention.

**Key words:** Internal auditing. Compliance auditing. Policies and procedures, tax audit.

**Bibliography:** \* TIPSON, FREDERICK SAMSON, Auditing, GENERAL BOOKS, [9780217334068].

### CF3025 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 LCPF11 )  
Equivalence: None

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportu-



nity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## CH Human Capital

### CH2006 Corporate Learning Management

( 3 - 0 - 8. Prerequisites: [ CH2004 , RH3013 Corequisite , CH2008 ]. 7 LPO11 )

**Equivalence:** None

This is an intermediate course in the field of human capital management that requires previous knowledge in competencies management and performance consolidation; it also requires abilities in process application, practices and innovation models, as well as strategic management of human capital and knowledge. Students will analyze and evaluate the approaches, processes, methods and different workplace learning techniques, as well as structural administrative changes required that are in line with the dynamics imposed by competitiveness in the context of the Knowledge Society. As a learning outcome, students are expected to integrate and demonstrate the practical application of the knowledge and abilities required in a real project

**General objective:** The student will be able to implement and evaluate the approaches, methods and diverse workplace learning techniques within organizations.

**Key words:** Description of learning theories. Strategic learning alignment. Individual, collective and organizational learning processes. Corporate universities. Adult and self-directed learning. Mentoring and coaching. Promotion of communities of practice. Facilitated learning. Virtual learning.

**Bibliography:** \* Cross, R. & Sam I. , Strategic Learning in Knowledge Economy. Individual, Collective and Organizational Learning Process, Butterworth Heine- mann.

### CH2007 Human Capital Management by Competencies

( 3 - 0 - 8. Prerequisites: None. 7 LAE11, 8 LPO11 )

**Equivalence:** None

This is an intermediate course in the field of human resource management where students gain an overview of the processes of human capital based on competencies and redefine the traditional approach to human resources. The course requires prior knowledge related to administrative processes and human behavior at work. As a learning outcome, students are expected to identify the different factors related to the proper management of human capital and to implement a management model, based on competencies, in a real company, which will help lay the foundation for promoting the agenda of the company's talent and will impact on its results and develop a high performance culture.

**General objective:** Upon the completion of this course, the student will be able to understand the management of human resources in the field of national and international companies, handle concepts and management techniques that are applicable in that context; understand the different approaches to the management of human resources in the service, commercial and manufacturing sectors, assessing the impact of the new global context on the development of policies and administrative practices; apply a comprehensive model of resource management based on competencies in a company; examine the processes of human resources: human capital planning, identifying talent, retaining talent, training, development, compensation, performance evaluation in a global environment; identify technological tools that enable appropriate talent administration.

**Key words:** Importance of human capital as a competitive advantage. Human capital management models. Talent identification and selection. Development and training. Compensation systems.

**Bibliography:** \* Alles, Martha., Desarrollo del talento humano : basado en competencias / Martha Alles., 2a ed., Buenos Aires; México : Granica, 2008., [9789506415273].

## CO Communication

### CO1006 Introduction to Communication and Digital Media Academic Program

( 3 - 0 - 4. Prerequisites: None. 1 LCMD11 )

Equivalence: None

This introductory course offers students an overview of the profession of Communication and Digital media, as well as of the different career tracks available on graduating. No prior knowledge is required. as a learning outcome students will be able to identify the main areas that define the career of a Communication and Digital Media graduate.

**General objective:** Upon completion of this course, students will be able to identify the different areas of specialization for a Bachelor of Communication and Digital Media graduate, as well as the skills and knowledge required by the same.

**Key words:** Digital media production. Media industries. Cultural and entertainment industries. Communication.

**Bibliography:** \* Sartori, Giovanni, 1924-, Homo videns : la sociedad teledirigida / Giovanni Sartori ; traducción de Ana Díaz Soler., México : Punto de Lectura, 2006., [9789707311176].

### CO1007 Communication, Signs, and Signification

( 3 - 0 - 8. Prerequisites: None. 2 IMI11, 2 LAD11, 1 LCMD11, 3 LCS11, 1 LLE11 )

Equivalence: H1029

This introductory course provides the student with the means to understand and analyze processes of communication and meaning that human beings use in order to relate to each other through the production and use of cultural scripts that utilize linguistic, visual and/or auditory systems of expression, as well as human interactions with different types of technology mediated by interfaces that draw on the use of these means of expression. This course does not require any previous knowledge. As a learning

outcome, each student should answer individually three assessment examinations and one final exam, in order to demonstrate their understanding of the concepts and ability to analyze communicative messages related to systems of linguistic, visual and auditory expression on diverse technological platforms through which concepts seen throughout the course will be shown.

**General objective:** Upon completion of this course, students will be able to identify and explain processes of communication and meaning used by humans to relate to others through the production and use of cultural scripts that involve the use of linguistic, visual and/or auditory systems of expression, as well as human interactions with diverse technologies mediated by interfaces that involve the use of such systems of expression.

**Key words:** Visual semiotics. Structural semiotics. Foundations of language. Cognitive semiotics and biosemiotics. Cybersemiotics and hypertext semiotics.

**Bibliography:** \* Barthes, Roland., Elements of semiology / Roland Barthes ; translated from the French by Annette Lavers and Colin Smith., 1st American ed., New York : Hill and Wang, 1973., engfre, [0374521468].

### CO2003 Quantitative Social Research Methods

( 3 - 0 - 8. Prerequisites: [ H1017 , MA1008 ],[ H1040 , MA1008 ],[ H1040 , CD1003 Corequisite ],[ MA1020 , H1040 ]. 3 LCMD11, 3 LCS11, 4 LEC11, 5 LEF11, 3 LMI11, 5 LP 12, 3 LPL11, 5 LPM12, 4 LPO11, 5 LPS12, 3 LRI11 ) Equivalence: MI00821, MI99821

Intermediate course on research methodology for social science, which introduces students to the handling of methodological and quantitative tools for research project design using the hypothetical-deductive model and applying descriptive and inferential statistical measures. This course requires prior knowledge of and practice in documentary research methodology and statistics. As a learning outcome,

in teams, students will be able to complete a quantitative research project, collecting data by administering surveys or using the content analysis technique and using descriptive and inferential statistical tools properly with a computer package. This project must include the design of indicators, hypothesis testing and a written report. The use of computer packages for qualitative data analysis, such as SPSS, SAS and NCSS, is recommended.

**General objective:** Upon completion of this course, students will be able to understand the techniques of social research and their characteristics in terms of a quantitative paradigm; design and develop a quantitative social research project which will include the different phases of the project including the proposal of the research question, a review of the literature, definition of the hypothesis, construction of variables and indicators, data collection and interpretation, hypothesis contrasting, and the writing of the final report, using either the interview or content analysis technique and utilizing a computational package in order to process data.

**Key words:** Research methodology. Survey research and questionnaire design. Statistical analysis. Social science research. Quantitative research methods.

**Bibliography:** \* Fowler, Floyd J., Survey research methods / Floyd J. Fowler, Jr., 3rd ed., Thousand Oaks, Calif. : Sage Publications, c2002., California, c2002., eng, [9780761921905],[9780761921912],[0761921907],[0761921915].

**CO2004 Qualitative Research Methods**  
( 3 - 0 - 8. Prerequisites: [ H1017 , H1040 , H1040 Corequisite ]. 4 LCMD11, 4 LCS11, 2 LED11, 4 LMI11, 4 LP 12, 4 LPL11, 3 LPO11, 4 LPS12, 4 LRI11)  
**Equivalence:** CO00834, CO99834

Intermediate course on research methodology for social science, which seeks to provide students with an integral vision of social research so that they will be able to explain and understand the social reality and offer alternatives for studying it. Students will learn about the characteristics of research with an open design and apply the qualitative techniques to a social research project, and also assess the importance of conducting this project in accordance with the

rules, standards and codes accepted by the academic community and by social research and scientific associations. This course requires prior knowledge of and practice in documentary research methodology and social science research methodology. As a learning outcome, in teams, students will be able to complete a qualitative research project, collecting data by conducting in-depth interviews, discussion groups and participant observation. The use of computer packages for quantitative data analysis, such as NVivo, MAXQDA and ATLAS. Ti, is recommended.

**General objective:** Upon completion of this course, students will be able to understand the techniques of social research and their characteristics in terms of a qualitative paradigm, being especially attentive to the ethical aspects in the generation and management of information; apply the techniques of an in-depth interview, discussion groups, and participative observation to generate data; carry out a team research project including the proposal of the research question, the definition of the research objective, categories, the interpretation of results, and conclude with the writing of the research report.

**Key words:** Research methodology. Social science research. Qualitative methods. In-depth interview. Discussion and participative observation groups. Ethnography, case study and life story.

**Bibliography:** \*Taylor, S. y Bogdan, R., Introducción a los métodos cualitativos, Paidós.

## CO2006 Communication and Cultural Studies

( 3 - 0 - 8. Prerequisites: [ CO2005 , CO2008 ]. 6 LCMD11 )  
**Equivalence:** CO00836

Intermediate communications course that introduces students to the study of communication phenomena from European, North American and Latin American perspectives; the analysis of media in daily life, new media and new ways of using media; and forms of communication other than mass communication. This course requires prior knowledge of sociology and mass communication. As a learning outcome students will write a final essay in which they will demonstrate that they are capable of analyzing a

current cultural phenomenon, based on one or several of the theories studied during the course.

**General objective:** Upon completion of this course, students will be able to comprehend the theoretical-methodological proposals of European, North American, and Latin American cultural studies related to the study of mass media and social phenomena as communicative processes, in order to understand the concepts of culture, hegemony, ideology, and cultural economy as well as the applications of said concepts in the analysis of cultural phenomena in the media.

**Key words:** Cultural studies. Postmodernity. Cultural phenomena. Target audience.

**Bibliography:** \* Barker, Chris, 1955-, Cultural studies : theory and practice / Chris Barker ; with a foreword by Paul Willis, 2nd ed., London ; Thousand Oaks, Calif. : SAGE Publications, c2003., England, c2003., eng, [076194155X (encuadrado)], [0761941568 (rústica)].

## CO2008 Communication and Media Studies

( 3 - 0 - 8. Prerequisites: None. 5 LCMD11, 3 LMI11, 5 LPM12 )

**Equivalence:** None

This intermediate communication course provides students with the theoretical tools to study audiences and comprehend the relationship between mass communication and political power. Prior knowledge of basic sociology, anthropology, psychology and political science is required. Learning outcome: students will formulate a critical analysis of a current mass communication product, emphasizing its clear or hidden political orientation.

**General objective:** Upon completion of this course, students will know how power relationships are applied to mass communication studies and how media property, work routines, content selection and economic, public and private interests affect message construction.

**Key words:** Mass communication theory. Ideology and hegemony. Critical theory. Theory of power.

**Bibliography:** \* Lozano, José Carlos, 1958-, Teoría e investigación de la comunicación de masas / José Carlos Lozano Rendón., 2a ed., México, D. F. : Pearson Educación, 2007., [9702608279],[9789702608271].

## CO3006 Communication and Globalization

( 3 - 0 - 8. Prerequisites: None. 7 LCMD11, 6 LMI11, 7 LPM12 )

**Equivalence:** CO2007

This advanced communication course will provide students with the theoretical and analytical foundations of the phenomena of power in the international context of communication and politics. Students will explore the new public spaces of global communication through traditional media and new technologies. A basic knowledge of communication theory and international relations is required for this course. As a learning outcome, in teams, students will complete a research project that addresses topics related to international communication, political communication and public opinion, the role of the media in disseminating global issues and the promotion of solutions to these issues through communication.

**General objective:** Upon completion of this course, students will be able to understand and analyze the communication processes that take place in an international setting; distinguish which factors affect the generation of the phenomena of political culture and national and international public opinion; and understand cases in which the intervention of the media has been a determining factor in actions or the generation of strategies for solving global issues.

**Key words:** Global citizenship. International politics. Political communication. International politics. Communication. International communication media. Globalization. International communication.

**Bibliography:** \* New media and politics / edited by Barrie Axford and Richard Huggins., London ; Thousand Oaks, Calif. : SAGE, 2001., [0761961992],[076196200X (pbk)].



## CO3007 Advertising and Integrated Marketing

( 3 - 0 - 8. Prerequisites: None. 9 IMI11, 8 LCMD11 )  
Equivalence: CO3003

The aim of this advanced interdisciplinary communication, media production and marketing course is to develop students' skills in the creative production of graphical and audiovisual materials that support communication strategies for marketing brands, products, services or organizations. The course also provides students with the basics of planning, design, management and assessment of communication strategies for marketing. Prior knowledge of graphic design and digital media production is required. As a learning outcome students will design a marketing communication strategy for a real-life or fictitious brand, product, service or organization, and produce the graphical and audiovisual materials for said campaign, such as logotypes and identity, posters, brochures, catalogues, specification sheets, magazine advertisements, newspaper advertisements, television commercials, radio commercials, websites, microsites, direct mail, in-store merchandising, point-of-sale displays, packaging, promotional materials, press kits, and informative and training materials for employees and distributors, among others. Students will design strategies and materials in an ethical, socially responsible manner, observing relevant legal regulations for the activity.

**General objective:** Upon completion of this course, students will be able to plan, design, produce, manage and assess marketing communication strategies for brands, products, services and organizations, highlighting the design and creative production of graphic and audiovisual materials and applying communication, marketing, consumer behavior, advertising, corporate image, public relations, graphic design, photography, audiovisual production and interactive design concepts, tools and techniques. Students will reflect on the ethical, legal and social issues of marketing and advertising, as well as the possible consequences for themselves as individuals, their organization and society of not observing the activity's codes of ethics and regulatory framework.

**Key words:** Advertising. Integrated marketing communications. Marketing communications. Publicity campaigns. Media strategy.

**Bibliography:** \* Belch, G. & Belch, M., Advertising and Promotion: An Integrated Marketing Communications Perspective (8a. ed.), 8a. ed., McGraw-Hill, Inglés.

## CO3008 Seminar on Creative and Entertainment Industries

( 3 - 0 - 8. Prerequisites: None. 9 LCMD11 )  
Equivalence: None

This advanced audiovisual media course encourages students to analyze the economic, technological, political and social environment of the audiovisual industry and its future trends. Prior knowledge of project management in the field of audiovisual media and audiovisual media production is required. As a learning outcome students will conduct case analyses of companies, technologies, economic, political and social policies and situations related to the audiovisual industry.

**General objective:** Upon completion of this course, students will gain an overview of the audiovisual media industry and its current situation, trends and challenges by analyzing the environment of the audiovisual industry.

**Key words:** New image and sound technologies. Audiovisual and interactive media production trends. Legal and regulatory framework of the creative industries. Social impact of the creative industries. Ethics and social responsibility of media. Audiovisual entertainment industry economics.

**Bibliography:** \* Benjamin, Walter, 1892-1940., Illuminations / Walter Benjamin ; edited and with an introduction by Hannah Arendt ; translated by Harry Zohn ; preface by Wieseler., New York : Schocken Books, 2007., engger, [0805202412 (rústica)].

## CO3009 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 LCMD11 )  
Equivalence: None

This is a university course which is designed to prepare students in their area of specialization for the



CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## CR Organizational Communication and Public Relations

### CR1000 Strategic Communication Fundamentals

( 3 - 0 - 8. Prerequisites: None. 5 LCMD11, 7 LCS11 )  
Equivalence: CR2000

This basic course will help students to understand the components of strategic communication in organizations, as well as the players and communication scenarios that are involved in the strategic process of communication. No prior knowledge is required. As a learning outcome students will analyze the communication scenarios of an organization.

**General objective:** Upon completion of this course, students will be able to understand, analyze and explain the theoretical concepts and fundamental principles of strategic communication (image, culture, identity, knowledge management).

**Key words:** Identity . Knowledge management. Strategic communication. Image. Culture. Public relations.

**Bibliography:** \* Barquero Cabrero, José Daniel., Comunicación estratégica : relaciones públicas, publicidad y marketing / José Daniel Barquero Cabrero., Madrid : McGraw-Hill, 2005., [8448198883].

### CR2002 Public Relations

( 3 - 0 - 8. Prerequisites: None. 8 LPM12 )  
Equivalence: CO95007

This intermediate course seeks to strengthen the area of organizational communication, therefore students should already be familiar with this discipline. The aim of the course is that students should study in depth the field of public relations in companies or public, private and non-governmental institutions. Students will understand their function and the importance of creating, maintaining and improving organizations' relations with all their audiences in both real and virtual environments. As a learning outcome students will develop the skills to design public relations programs and apply strategies and tools that contribute to improving organizational performance.

**General objective:** Upon completion of this collaborative learning course, students will be familiar with

and be able to assess and use the basic theory, models, tools and key techniques involved in public relations, acquiring a comprehensive view of this field and understanding the role that it plays in any organization and the importance of its professional, responsible and ethical management.

**Key words:** Public relations' nature, precedents, characteristics and functions. Basic models of public relations and the types of public. Ethical implications in public relations. Investigation to develop public relations plan. Media in public relations and the relationship with the media.

**Bibliography:** \* Communication of politics : cross-cultural theory building in the practice of public relations and political marketing / Bruce I. Newman, Dejan Veric, editors., New York : Haworth Political Press, 2002., New York, 2002, eng, [0789021587 (caja : papel alcalino)],[0789021595 (soft : papel alcalino)].

### CR2003 Applied Strategic Communication

( 3 - 0 - 8. Prerequisites: None. 6 LCMD11 )  
Equivalence: None

This intermediate course provides students with the skills to plan, execute and assess a strategic communication plan (internal and external) in an organization. The CAD modality is recommended for this course. Prior knowledge of strategic communication is required. As a learning outcome students will formulate a communication plan for a specific organization (internal and external).

**General objective:** Upon completion of this course, students will be able to conceive and design communication strategies for organizations.

**Key words:** Strategic communication. Target audiences. Communication plan. Message design.

**Bibliography:** \* Villafañe, Justo., La buena reputación : claves del valor intangible de las empresas / Justo Villafañe., Madrid : Pirámide, c2004., [8436818393], [9788436818390].

## CV Civil Engineering

### CV1004 Introduction to Civil Engineering

( 3 - 0 - 4. Prerequisites: None. 1 IC 11 )

Equivalence: None

The purpose of this basic-level course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Reglamento general de servicio social comunitario y profesional para alumnos del Tecnológico de Monterrey/ Instituto Tecnológico y de Estudios Superiores de Monterrey., [s. l.] : Instituto Tecnológico de Estudios Superiores de Monterrey, 2007.

### CV2001 Geology

( 3 - 0 - 8. Prerequisites: None. 1 IC 11 )

Equivalence: None

This is an intermediate course within the basic sciences oriented to providing students with knowledge and understanding of the successive changes that have taken place in the organic and inorganic realms in nature through geological processes and their effects. This course requires prior knowledge of chemistry. As a learning outcome students will know and understand the geological processes which have

generated successive changes in nature and be familiar with the new terminology used in the classifications of geological eras, types of rocks, types of soils, types of deposits and mineral resources.

**General objective:** Upon completion of this course, students will know about and understand the theoretical aspects of geology relevant to the structure of the planet, its origin, geological processes, and the formation and composition of minerals and rocks in order to have a basic understanding of the behavior of the soils used in the construction of civil works.

**Key words:** Soil structure. Rock formation. Geological exploration. Rock mechanics.

**Bibliography:** \* Kehew, Alan E, General geology for engineers / Alan E. Kehew, Englewood Cliffs, N.J. : Prentice Hall, c1988, New Jersey, c1988, eng, [0133504069 :].

### CV2006 Construction Materials Laboratory

( 0 - 3 - 4. Prerequisites: [ CV2001 Corequisite , CV2001 , CV2008 Corequisite , CV2008 , AR2021 Corequisite , AR2021 ]. 5 IC 11 )

Equivalence: CV00943

This is an intermediate course oriented toward providing practical knowledge about construction materials through laboratory tests. The course requires prior knowledge of mechanics of materials, mechanical properties of materials and probability and statistics. As a learning outcome students will identify the limitations of the properties of construction materials through practical experimentation.

**General objective:** Upon completion of this course, students will understand the different standards for conducting laboratory tests of construction materials and evaluate their physical and mechanical properties needed to compute the behavior of civil engineering structures.

**Key words:** Wood. Cementitious materials. Aggregates. Ceramic products. Reinforcing steel. Binding

materials. Properties of plastic products. Properties of flat glass. Materials testing standards.

**Bibliography:** \* Gómez Domínguez, Jorge, Manual del laboratorio de materiales de construcción / Jorge Gómez Domínguez, 2a ed., ITESM Departamento de Ingeniería Civil, Monterrey, N.L., 2002, spa.

### CV2007 Soil Mechanics Lab

( 0 - 3 - 4. Prerequisites: [ CV2010 Corequisite , CV2010 ]. 5 IC 11 )

**Equivalence:** None

This is an intermediate course oriented toward knowledge of the basic tests carried out on soils to determine their physical properties. The course requires prior knowledge of solids and fluid mechanics. As a learning outcome students are expected to identify and apply the laboratory tests required to characterize soils.

**General objective:** Upon completion of this course, students will be able to understand the importance of laboratory tests applied to soils in order to characterize them. Students will also be able to evaluate values of soils' physical properties such as particle-size distribution, plasticity, compaction, moisture content, porosity, and shear strength, and compare these values to the required specifications in civil works.

**Key words:** Plasticity. Moisture content. Weight-volume relationships. Compaction. Permeability. Soil consolidation. Shear strength of soils.

**Bibliography:** \* Das, Braja M., 1941-, Soil mechanics laboratory manual / Braja M. Das, 6th ed, New York : Oxford University Press, 2002, New York, 2002, eng, [0195150465 (pbk. : alk. paper)].

### CV2010 Soil Mechanics

( 3 - 0 - 8. Prerequisites: [ CV2001 , CV2009 Corequisite , CV2009 , CV2025 ]. 5 IC 11 )

**Equivalence:** CV00847

This is an intermediate course oriented toward learning about and solving civil engineering problems involving geomaterials, as well as getting to know the

theories and principles used in soil mechanics. This course requires prior knowledge of solids and fluid mechanics. As a learning outcome students are expected to identify, classify and characterize the different types of soils used in civil structures, solving problems involving soils and rocks.

**General objective:** Upon completion of this course, students will be able to understand the theories and principles used in soil mechanics and solve engineering problems which involve soil and rocks as construction materials, in order to be able to characterize soils by means of weight-volume relationships, shear strength, plasticity, density, hydraulic behavior, and stability.

**Key words:** Plasticity. Moisture content. Weight-volume relationships. Compaction. Permeability. Soil consolidation. Shear strength of soils.

**Bibliography:** \* Crespo Villalaz, Carlos, Mecánica de suelos y cimentaciones / Carlos Crespo Villalaz, 6a ed., México : Limusa, 2007., Mexico, 2007., spa, [9681864891],[9789681869632].

### CV2013 Hydrology

( 3 - 0 - 8. Prerequisites: [ M2025 , M2009 , MA1006 ]. 6 IC 11 )

**Equivalence:** CV00868

This is an intermediate course oriented toward the study and estimation of the different hydrological processes occurring within watershed. The course requires prior knowledge of basic sciences (physics and mathematics), probability, statistics and geomantics. As a learning outcome students are expected to analyze, validate and integrate the meteorological and hydrometric databases within a basin in order to carry out hydrological studies.

**General objective:** Upon completion of this course, students will be able to manipulate hydrological databases in order to establish relationships between the factors of the hydrologic cycle; model and validate the behavior of runoff flows applying the theories of hydrographs and flow routing; model flow routing in reservoirs and understand subterranean water flow.

**Key words:** Surface runoff. The hydrological cycle and watershed morphology. Probability and applied statistics. Rainfall. Evaporation. Underground infiltration and aquifers. Flood routing.

**Bibliography:** \* Chin, David A, Water-resources engineering / David A. Chin, Prentice Hall, Upper Saddle River, NJ , c2000, eng, [201350912].

## CV2016 Construction Site Management

( 3 - 0 - 8. Prerequisites: [ CV2018 , CV2027 ]. 8 ARQ11, 7 IC 11 )

**Equivalence:** AR99847

Intermediate civil engineering course that provides students with the necessary tools to oversee both public and private construction works, including time, cost, quality and income control. This course requires prior knowledge of construction costs. As a learning outcome students will complete the entire control process of a construction project based on a technical-financial proposal for this project.

**General objective:** On completing the course the student will be familiar with and able to carry out the control process of a public or private construction from the builder's perspective.

**Key words:** Construction management. Resource management.

**Bibliography:** \* Suárez Salazar, Carlos., Costo y tiempo en edificación / Carlos Suárez Salazar., 3a ed., México, D.F. : Limusa, c2008, Mexico, c2008, spa, [9681800672],[9789681800673].

## CV2021 Geomatics

( 3 - 0 - 8. Prerequisites: None. 2 IC 11 )

**Equivalence:** None

This is an intermediate course, oriented to the use of basic science in order to process topographical, planimetric and altimetric surveys, urban and rural lot and building configurations, integrating them into a geographical information system for their analysis with engineering applications. Previous knowledge is required in Mathematics, Geography and Comput-

erized Drafting. The learning outcome of this course is that the students will be able to process the data obtained from planimetric and altimetric surveys, using various techniques, and integrate those results and other spatial data into a geographic information system for their analysis.

**General objective:** Upon completion of this course, students will be able to apply techniques to calculate open polygons, closed polygons, horizontal and vertical curves; understand the techniques used to control elevations and alignment in buildings; and integrate surveys, databases and other spatial data formats in a geographic information system for analysis.

**Key words:** Geographic information systems. Basic geodesy, units of measurement and error theory. Distance measurements, angle and direction measurements, leveling. Topographic applied techniques. Global positioning system. Basic cartography for the presentation of results.

**Bibliography:** \* Ghilani, Charles; Wolf, Paul, Elementary Surveying: An Introduction to Geomatics, 12, [9780136154310].

## CV2022 Geomatics Laboratory

( 0 - 3 - 4. Prerequisites: [ CV2021 ]. 3 IC 11 )

**Equivalence:** None

This is an intermediate course oriented towards the application of land and/or building surveying techniques for processing and analysis using Geographic Information Systems. It requires previous knowledge of Mathematics, Geography and Computerized Drawing. As a result of the learning process the student is expected to conduct planimetric and leveling surveys with different applications using specialized surveying equipment and Geographic Information Systems software for the analysis and presentation of results.

**General objective:** Upon completion of this course, students will be able to apply techniques to trace and calculate open polygons, closed polygons, horizontal and vertical curves, and the techniques used to control elevations and alignment in buildings, integrating the results in a geographic information system.



**Key words:** GPS surveying using the static differential method. Basic geodesy. Planimetric survey. Differential leveling. Horizontal curves. Planimetric survey using GPS. Distance measurements and use of conventional theodolite.

**Bibliography:** \* Ghilani, Charles; Wolf, Paul, Elementary Surveying: An Introduction to Geomatics, 12, [9780136154310].

## CV2023 Materials and Construction Procedures I

( 3 - 0 - 8. Prerequisites: None. 4 ARQ11, 3 IC 11 )

**Equivalence: None**

Course oriented toward the study of basic construction materials and their application to construction processes. The course requires previous knowledge about elemental principles of mathematics, physics and environmental sciences. As a result of the course the student is expected to be able to understand the physical and mechanical properties of different materials used in construction and their correct use in construction processes.

**General objective:** Upon completion of this course, students will be familiar with the properties of basic construction materials and will be able to supervise technical processes during the construction of engineering works; they will be able to adopt the standards and specifications according to the significance of the work in order to obtain optimal performance and service whilst attaining sustainable construction.

**Key words:** Construction materials. Concretes, steel, and reinforced concrete. Construction processes.

**Bibliography:** \* Barbara Z., Fernando., Materiales y procedimientos de construcción / Fernando Barbara Z., 8 Ed., Mexico : Herrero , 1982., spa, [9684200536].

## CV2024 Structure Mechanics I

( 3 - 0 - 8. Prerequisites: None. 3 ARQ11, 3 IC 11 )

**Equivalence: None**

This is an intermediate course which provides knowledge of engineering science. Students will learn about bar elements subjected to axial load, and the

associated stresses and strains. Also, the analysis of bars and trusses subjected to different patterns of external loading are subject of study. This course requires prior knowledge of basic mathematics and physics. The learning outcome for this course is the development of the capacity to analyze the behavior of deformable bar systems and the application of basic concepts of design for both, axially loaded bars and direct shear problems.

**General objective:** Upon completion of this course, students will be familiar with the concepts of rigid body statics. They will apply them to analyze axially loaded bars, trusses and direct shear problems. They will use, as well, the concepts of deformation in axially loaded bars.

**Key words:** Statics. Area section properties. Equilibrium. Bars under axial loads. Direct shear. Structural behavior.

**Bibliography:** \* Gere, James M., Mechanics of materials / James M. Gere, Barry J. Goodno., 7th ed. , México : Cengage Learning, c2009., [0495438073], [9780495438076].

## CV2025 Structure Mechanics II

( 3 - 0 - 8. Prerequisites: [ CV2024 ]. 4 ARQ11, 4 IC 11 )

**Equivalence: None**

The purpose of this intermediate structural-engineering course is for students to acquire the basic knowledge and concepts of structural engineering. The course considers the study of the behavior of torsion bars, beams and columns under various types of external stress. It requires previous knowledge of differential and integral calculus, trigonometry, and material statics and mechanics. The learning outcome of this course is for students to analyze and evaluate the behavior of flexed or cut beams and torsion bars and buckled columns and to evaluate the associated forces, distortions and deflections.

**General objective:** Upon completion of this course, students will be familiar with and use the concepts of statics to analyze the behavior of beams subjected to generalized bending, as well as the stress, deformation and deflection of these. They will be able to



analyze bars under torsion, determine the conditions for column buckling, and understand and handle the concepts of generalized analysis of stress and fault criteria.

**Key words:** General beam analysis. Generalized analysis of strains. Column buckling. Members in torsion. Shear and flexural diagrams for beams and frames.

**Bibliography:** \* Gere, James M., Mechanics of materials., 7th ed. /James M. Gere, Barry J. Goodno., Toronto, ON ; [Clifton Park, NY] : Cengage Learning, c2009., [0534553974], [9780534553975].

### CV2026 Structural Systems (3 - 0 - 8. Prerequisites: [CV2025]. 5 ARQ11, 5 IC 11) Equivalence: None

This is an intermediate course in which students study the concepts and procedures of structural analysis. The course includes the fundamentals of classic analysis, a description and study of analysis methods, based on the aspects of flexibility and rigidity, as well as the study of the behavior of conventional and special structural systems. Previous knowledge is required in structural mechanics. The learning outcome for this course is that the students be able to analyze rectilinear constructions and understand structural typologies.

**General objective:** Upon completion of this course, students will be able to understand the origin and function of the different structural systems; determine gravitational loads, origin, simplification, considerations, and specifications as well as the proportion of elements and structures; use structural analysis methods, considering classical theory and methods, computer methods, including the use of programs; develop structural applications.

**Key words:** Loads. Structural systems. Structural member sizing. Structural analysis methods.

**Bibliography:** \* Hibbeler, R. C., Structural analysis / R. C. Hibbeler., 7th ed., Upper Saddle River, N.J. : Pearson/Prentice Hall, c2009., [0136020607 (encuadrado)], [9780136020608 (encuadrado)], [9780136020325 (código de acceso)], [0136020321 (código de acceso)].

### CV2027 Construction Costs (3 - 0 - 8. Prerequisites: [ CV2023 ]. 7 ARQ11, 6 IC 11 )

**Equivalence: None**

This intermediate civil engineering course will provide students with the tools to prepare construction estimates and schedules. The student will acquire the tools required to analyze direct and indirect costs; understand the procedure of public and private construction bids in order to prepare technical and economical proposals. The course requires prior knowledge of construction materials and methods. As a learning outcome students will produce a proposal for a project, including the budget and schedule, and present this in a simulation of a construction bid for a public work.

**General objective:** Upon completion of this course, students will be able to formulate technical and financial proposals for construction projects, through cost analysis, budgets and construction schedules, in order to provide technically and financially viable options.

**Key words:** Public works tender. Budget and work scheduling.

**Bibliography:**\*Suárez Salazar, Carlos., Costo y tiempo en edificación / Carlos Suárez Salazar., 3a ed., México, D.F. : Limusa, c2008., [9681800672],[9789681800673].

### CV2028 Road Infrastructure Laboratory

(0 - 3 - 4. Prerequisites: [ CV3004 ]. 7 IC 11 )

**Equivalence: None**

This is an intermediate course, which enables students to design materials to be employed in the different layers of flexible and rigid road surfaces. It will also enable students to understand the use of alternative materials for these layers, considering the theoretical, economic and environmental aspects that have an impact on the viability of the project. Previous knowledge is required in geology and construction materials. The learning outcome for this course is that the students differentiate the asphalt, rock and asphalt mixtures commonly used in road surfaces.

**General objective:** Upon completion of this course, students will be familiar with the mechanical and rheological characteristics of conventional asphalt cements and polymer-modified asphalt cements; understand the laboratory testing methods for determining the mechanical and rheological characteristics of asphalt cements before and after the thin film aging processes; know the consensus and source properties of the stone aggregate used in the sub-base, base and surface asphalt layers; conduct tests to design dense mixes, open and draining mixes; and be familiar with the criteria and specifications of the SUPERPAVE methodology.

**Key words:** Conventional asphalt cement. Modified asphalt cement. Consensus properties. Original properties. Dense-graded asphalt mixes. Open-graded asphalt mixes. SUPERPAVE methodology.

**Bibliography:** \* Secretaría de Comunicaciones y Transportes, Normativa de infraestructura del transporte (Normativa SCT), Carreteras, Español.

### CV2029 Sustainable water use laboratory

( 0 - 3 - 4. Prerequisites: [ CV2030 Corequisite , CV2030 ]. 7 IC 11 )

**Equivalence:** CV2014

This is an intermediate course, which enables students to understand the testing methodologies that are used for diagnosing and interpreting water quality levels and the efficiency of contamination removal methods, in order to identify and propose solutions to pollution problems within a sustainable framework. Previous knowledge is required in sustainable water usage. The learning outcome for this course is that the students be able to select analytical parameters and apply testing methodologies, in order to evaluate purification processes, interpreting the results in a sustainable and regulated environment.

**General objective:** Upon completion of this course, students will be able to select parameters, perform measurements and then interpret the results obtained in order to assess the process and use the data to design purification units.

**Key words:** Water quality parameters. Sedimentation. Filtration. Coagulation, flocculation. Softening and neutralization. Chlorination, ozonation, ultraviolet, bacterial count. Ultrafiltration. Aeration reactor, biofilter. Bioremediation. Digestion.

**Bibliography:** \* Davis, Mackenzie Leo, 1941-, Introduction to environmental engineering / Mackenzie L. Davis, David A. Cornwell., 4th ed., New York, N.Y. ; Boston, Mass. : McGraw-Hill, c2008., New York, c2008., eng, [0071259228 (ed. internacional)], [9780071259224 (ed. internacional)], [0072424117], [9780072424119].

### CV2030 Sustainable Water Use I

( 3 - 0 - 8. Prerequisites: None. 7 IC 11, 5 IDS11 )

**Equivalence:** None

This is an intermediate course designed to introduce students to the study of domestic water consumption problems and to develop their ability to propose water purification and collection systems using alternative sources, and propose domestic wastewater treatment systems and systems for treatment of the plant mud generated in the process, while considering sustainability regulations and criteria. This course requires previous knowledge in chemistry, natural sciences, sustainable development, and fluid mechanics. The learning outcome for this course is that students propose sustainable water purification and domestic wastewater treatment systems and evaluate alternative storage options.

**General objective:** Upon completion of this course, students will be familiar with the standards, consumption, quality and economic value of water for domestic use; design, at a basic engineering level, the unitary operations for purification and domestic wastewater and sludge treatment.

**Key words:** Overview and sustainability. Domestic use, consumption, economic value, operating bodies, centralized and decentralized systems. Water purification for domestic use. Domestic wastewater treatment. Managing sludge from wastewater treatment. Alternative water sources.

**Bibliography:** \* Wastewater engineering : treatment and reuse / Metcalf & Eddy, Inc., 4a ed. /revised by

George Tchobanoglous, Franklin L. Burton, H. David Stensel., Boston : McGraw-Hill, 2004., [007124140x].

### CV2031 Sustainable Water Use II

( 3 - 0 - 8. Prerequisites: [ CV2030 ]. 8 IC 11 )

**Equivalence: None**

The purpose of this intermediate civil engineering course is to help students develop their ability to propose systems for water conditioning and treatment of industrial wastewater and employ sustainable technologies and strategies for minimizing and reusing this waste in compliance with applicable laws and regulations. In addition, students identify problems and develop the ability to analyze agricultural and ecological water use. The course requires previous knowledge of fluid mechanics and sustainable water use. The learning outcome of this course is for students to develop capabilities for self-directed learning and critical analysis in the development and implementation of industrial water conditioning and treatment systems as well as the ability to analyze agricultural and ecological water use.

**General objective:** Upon completion of this course, students will be familiar with the standards, consumption, quality, economic value, conditioning strategies, minimization, treatment and reuse of industrial water and water for agriculture, as well as with the characteristics of environmentally friendly water use: consumption, quality, value, impacts and water quality models.

**Key words:** Industrial water conditioning. Industrial wastewater treatment. Use of water in agriculture. Environmentally friendly use of water.

**Bibliography:** \* Wastewater engineering : treatment and reuse / Metcalf & Eddy, Inc., 4a ed. /revised by George Tchobanoglous, Franklin L. Burton, H. David Stensel., Boston : McGraw-Hill, 2004., [007124140x].

### CV3004 Highway Engineering

( 3 - 0 - 8. Prerequisites: [ CV2010 ]. 6 IC 11 )

**Equivalence: CV00885**

This advanced course focuses on the final geometric design project of a highway, considering the theoret-

ical, financial and environmental factors that affect the project's feasibility. The course considers aspects and activities related to sustained development by means of the Environmental Impact Manifesto (EIM). This course requires prior knowledge of topography, geographic information system and soil mechanics. As a learning outcome, students will be able to design a technically, financially and environmentally feasible traffic solution that would benefit the community by applying the components of the final geometric design project, according to the type of road.

**General objective:** Upon completion of this course, students will be able to design a stretch of highway, considering horizontal alignment, vertical alignment, cross sections, mass curves, and drainage, and the technical specifications which correspond to the type of road. In addition, students will be able to integrate this knowledge into an executive project which complies with economic and environmental restrictions.

**Key words:** Traffic engineering. Highway classification. Geometric design. Quality of materials for highway construction. Mitigation of environmental impact.

**Bibliography:** \* Highway design reference guide / Kenneth B. Woods, editor-in-chief, Steven S. Ross, project editor, McGraw-Hill, New York , c1988, eng, [70539243].

### CV3005 Foundations Engineering

( 3 - 0 - 8. Prerequisites: [ CV2010 , CV2011 , CV2024 ]. 6 IC 11 )

**Equivalence: CV00872**

This advanced course focuses on foundation design and the proposal of diverse solutions according to soil, climate and load conditions. This course requires prior knowledge of soil mechanics and design of concrete structures. As a learning outcome students will be able to determine the bearing capacity and to design different types of shallow and deep foundations.

**General objective:** Upon completion of this course, students will be able to identify the most important characteristics which will allow them to recommend

a type of foundation and efficiently design all of its elements, in order to provide civil works with either deep or shallow foundations, according to the site requirements.

**Key words:** Deep foundations. Bearing capacity. Shallow foundations. Structural design of foundations.

**Bibliography:** \* Das, Braja M., 1941-, Principles of foundation engineering / Braja M. Das, 5th ed, Thomson/Brooks/Cole, Pacific Grove, CA , 2004, eng, [534407528].

### CV3006 Hydraulics Laboratory

( 0 - 3 - 4. Prerequisites: [ CV2012 , M2021 , CV2013 Corequisite , CV2013 ]. 6 IC 11 )

**Equivalence:** CV00971

This is an advanced course that focuses on the application of experimental methodologies for diagnosing and interpreting hydraulic phenomena. This course requires prior knowledge of fluid mechanics. As a learning outcome students will be able to apply procedures for measuring the behavior of water in hydrostatic and hydrodynamic conditions, and analyze and model resistance to flow in enclosed and open conduits.

**General objective:** Upon completion of this course, students will be able to apply experimental procedures in order to measure the behavior of fluids, experiment with models of hydrostatic pressure, use fluid flow measurement equipment, model the hydraulics of conduction in open and closed systems, perform pressure and energy balances, and apply the laws of similarity and of dimensional analysis.

**Key words:** Hydrostatics and liquids kinematics. Office spillways. Closed-channel flow. Open-channel flow. Applications in hydrology. Plumbing installations in buildings. Experimental models and software application.

**Bibliography:** \* French, Richard H, Open-channel hydraulics / Richard H. French, McGraw-Hill, New York ; London , 1994, eng, [0070221340 (pbk)].

### CV3007 Hydraulic Constructions Works

( 3 - 0 - 8. Prerequisites: [ CV3006 , CV3006 Corequisite , CV2012 ]. 9 IC 11 )

**Equivalence:** CV00869

The aim of this advanced course is to identify, analyze and propose structural solutions to the problems of storing water for diverse uses in reservoirs. This course requires prior knowledge of hydrology, soil mechanics and water and drainage pipe networks. As a learning outcome students will be able to organize, use field and calculation procedures properly to perform preliminary topographical, geological, and hydrological works applied to the design of reservoirs and their complementary works.

**General objective:** Upon completion of this course, students will be able to utilize hydrometric databases in the design of hydraulic works for the control, collection, storage, and conduction of hydraulic resources.

**Key words:** Preliminary field studies and site selection. Waterway diversion and construction site preparation. Control and overflow works. Energy dissipators. Dam design. General construction aspects. Intake and pressure pipeline works. Entrainment of solids and erosion problems, erosion control and flooding protection works.

**Bibliography:** \* Torres Herrera, Francisco, Obras hidráulicas / Francisco Torres Herrera, 2 ed, México : Editorial Limusa, 1994, Mexico, 1994, spa, [9681811577].

### CV3016 Computer-aided Structural Analysis

( 3 - 0 - 8. Prerequisites: [ CV2026 ]. 6 IC 11 )

**Equivalence:** None

The purpose of this advanced structural engineering course is for students to use modern computing techniques to perform structural analysis. It requires previous knowledge of structural systems. The learning outcome of this course is for students to be capable of analyzing reticular structures, plates, shells and solids for static and dynamic loads.

**General objective:** Upon completion of this course, students will be able to analyze structures made up of trussing, frameworks, slabs and shells, as well as solid bodies, using computer mechanics concepts and programs; use static and dynamic mode procedures to simulate wind and seismic loads in structures.

**Key words:** Bar, frame, beam, solid, slab and shell elements. Computational structural analysis. Finite elements. Wind analysis. Earthquake analysis.

**Bibliography:** \* Gallegos Cázares, Sergio., Análisis de sólidos y estructural mediante el método de elementos finitos / Sergio Gallegos Cázares., México : Limusa : ITESM, 2008., [9786075000183].

### **CV3017 Concrete Structures Design** (3 - 0 - 8. Prerequisites: [CV2026]. 6 ARQ11, 6 IC 11) **Equivalence: None**

The purpose of this advanced structural engineering course is for students to use valid building codes for reinforced concrete in order to design simple members and structures. The course requires previous knowledge of structural design. The learning outcome of this course is for students to be capable of generating structural plans for basic concrete structures.

**General objective:** Upon completion of this course, students will be able to design the basic members that comprise reinforced concrete structures in compliance with current building codes and norms.

**Key words:** Loads. Building codes. Shear and bending stress design. Short columns. Reinforcement.

**Bibliography:** \* Reglamento para las construcciones de concreto estructural ACI 318-02 y comentarios ACIR 318-02., México : Instituto Mexicano del Cemento y del Concreto, c2004., spaeng, [9684641370].

### **CV3018 Design of Steel Structures** (3 - 0 - 8. Prerequisites: [CV2026]. 7 ARQ11, 7 IC 11) **Equivalence: None**

The purpose of this advanced structural engineering course is for students to use effective codes in

order to design basic steel members and structures. The course requires previous knowledge of structural design. The learning outcome of this course is for students to be capable of generating building structural plans for basic steel structures.

**General objective:** Upon completion of this course, students will be able to design the basic members that comprise steel structures in compliance with effective building codes.

**Key words:** Steel beams. Structural connections. Structural loads. Axial loaded members. Building codes.

**Bibliography:** \* Salmon, Charles G., Steel structures : design and behavior : emphasizing load and resistance factor design / Charles G. Salmon, John E. Johnson., 4th ed., New York, NY : HarperCollins College Publishers, c1996., [0673997863].

### **CV3019 Water and Drainage Pipeline Networks**

(3 - 0 - 8. Prerequisites: [ CV2013 , M2021 ]. 7 IC 11 )

**Equivalence: CV3009**

This is an advanced course, geared toward analysis and design of open and closed waterways, standardization, water supply and waste water removal in urban areas. Previous knowledge is required in fluid mechanics and hydrology. The learning outcome for this course is that the students be able to apply hydraulic concepts to the design of optimal water supply, sewage and drainage systems.

**General objective:** Upon completion of this course, students will be able to estimate water demands for the design period; design pressure and gravity-flow conduits; dimension equalization tanks; design open and closed water distribution networks, sewage systems and lined channels.

**Key words:** Pipelines. Open networks. Closed networks. Sewer system design. Storm-drain system design. Channel hydraulics.

**Bibliography:** \* Obradovic, Dusan., Public water supply : data, models, and operational manage-



ment / Dusan Obradovic and Peter Lonsdale., London : E & FN Spon ; New York, NY : Routledge, 1998., [0419232206].

### **CV3020 Transport Infrastructure**

**( 3 - 0 - 8. Prerequisites: None. 8 IC 11 )**

**Equivalence: None**

This is an advanced course, geared toward the creation of a geometric design project in the various components that make up the infrastructure of different modes of transportation, considering the theoretical, economical and environmental aspects that have an impact on the viability of the project. Previous knowledge is required in geographical information systems, soil mechanics and construction materials. The learning outcome for this course is that the student design flexible and rigid road surfaces, an airport runway and a railroad track, all in an economical and environmentally-friendly way, which benefits the community, by applying the elements making up the geometric design project, depending on the project type.

**General objective:** Upon completion of this course, students will be able to design the layers that comprise flexible or rigid paving, landing and taxiing strips, sleepers, rails, switches in rubber-supported tracks, and integrate these elements in a final design that meets financial and environmental restrictions.

**Key words:** Rigid road surfaces. Flexible road surfaces. Landing strips. Taxiways. Sleepers, tracks and railroad switch. Elastic track.

**Bibliography:** \* Huang, Yang H. (Yang Hsien), 1927-, Pavement analysis and design / Yang H. Huang., Englewood Cliffs, N.J. : Prentice Hall, c1993., [0136552757].

### **CV3021 Structural Design Capstone Project**

**( 3 - 0 - 8. Prerequisites: [ CV3016 , CV3017 , CV3018 ]. 8 IC 11 )**

**Equivalence: None**

The purpose of this advanced structural engineering course is for students to use structural norms for seismic and wind design in both concrete and steel,

integrating the structural project and the construction project. The course requires previous knowledge of concrete-structure design, steel-structure design and computational structural analysis. The learning outcome of this course is for students to deliver a calculation log as well as the construction specifications for a structural project.

**General objective:** Upon completion of this course, students will be able to design concrete and steel structures subjected to wind and earthquake hazards, using the current regulations; generate final construction plans and specifications.

**Key words:** Structural walls. Biaxial and asymmetric flexure in steel beams. Bracing. Wind braces. Seismic design. Design construction integration. Long concrete columns.

**Bibliography:** \* Salmon, Charles G., Steel structures : design and behavior : emphasizing load and resistance factor design / Charles G. Salmon, John E. Johnson., 4th ed., New York, NY : HarperCollins College Publishers, c1996., [0673997863].

### **CV3022 Business Management in the Construction Industry**

**( 3 - 0 - 8. Prerequisites: None. 10 ARQ11, 9 IC 11 )**

**Equivalence: CV3010**

This is an advanced course, designed to provide tools and management and financial concepts in the construction industry, as well as the necessary skills for decision making and administration of a construction company. This course will deal with topics related to development that is sustainable from an environmental, economical and social perspective. Previous knowledge is required in construction and construction costs. The learning outcome for this course is that the students understand and apply concepts of business management, accounting and financial principles and their knowledge of construction costs and resource control in the area of construction.

**General objective:** Upon completion of this course, students will have sufficient knowledge of and competency in business administration and finance, as well as the necessary related tools, to manage and



create a construction company at the operational and strategic levels.

**Key words:** Business administration. Planning, organization, leadership and control. Entrepreneurship.

**Bibliography:** \* Dressel, Gerhard., Organización de la empresa constructora., 2 ed., Barcelona : Editores Técnicos Asociados, 1969.

### CV3023 Construction Engineering

( 3 - 0 - 8. Prerequisites: None. 9 IC 11 )

**Equivalence: None**

This is an advanced civil engineering course oriented toward developing abilities and knowledge in order to participate in major civil engineering projects including aspects of operation research, productivity, quality, safety and prefabrication. The course requires prior knowledge in construction methods, costs and construction management. As a learning outcome the student is expected to be able to incorporate elements that improve performance in major civil engineering projects.

**General objective:** Upon completion of this course, students will be familiar with productivity, quality and safety concepts and tools in relation to construction, as well as aspects of operational and prefabrication studies, and will be able to handle construction equipment and machinery in the context of major civil engineering projects.

**Key words:** Planning construction operations. Rationalization elements of construction processes. Civil projects. Construction engineering.

**Bibliography:** \* Serpell B., Alfredo., Administración de operaciones de construcción / Alfredo Serpell B., 2a ed., México : Alfaomega : Ediciones Universidad Católica de Chile, 2002., [9701504275].

### CV3024 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 IC 11 )

**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## D

## Law

**D1002 Labor Law****( 3 - 0 - 8. Prerequisites: None. 5 LAE11, 4 LDN11, 7 LDP11, 6 LPO11 )****Equivalence: D 00864, D 95864**

This is a basic labor law course. Upon completion of this course, students will establish the appropriate legal framework of labor relations in individual, collective and social security settings. This course requires prior knowledge of and practice in the basic notions of law. The learning outcome for this course is for students to use the Mexican employer-worker relations legal framework and generate individual work contracts; know how to integrate salaries and the modalities of legal settlement upon terminating a labor relationship.

**General objective:** Upon completion of this course, students will be able to understand the legal framework of employer-worker relationships in México, by means of the study of labor law and its practical application in their professional lives. Students will study the legal and economic consequences of the correct application and of the non-application of said labor law in the administration of micro- or macro-businesses and in the importance of knowledge about the current labor environment in order to prevent conflicts, the objective being harmony in owner-worker relationships and obtaining optimal productivity results.

**Key words:** Labor regulations. The company and its workers. Labor authorities. Individual and collective labor contract. Internal working regulations. Internal working regulations, Integrated salary and severances.

**Bibliography:** \* Lemus Raya, Patricia., Derecho del trabajo / Patricia Lemus Raya., 2a ed., México: Cengage Learning, 2009., [9789706868169],[970686816X].

**D1003 Assets, Real Rights and Successions****( 3 - 0 - 8. Prerequisites: [ D1010 ]. 3 LDF11, 3 LDP11, 3 LED11 )****Equivalence: D 00823**

This is a basic course of study within the field of civil law, oriented toward the student knowing and understanding assets from a legal standpoint, the set of real rights and substantive succession law. It requires prior knowledge of the characteristics of individuals and corporations as well as the characteristics of family law. As a result of learning students will develop projects in which they will apply the knowledge acquired concerning assets, the set of real rights and substantive succession law.

**General objective:** Upon completion of this course, students will be able to identify and differentiate real rights, property and assets; property law; the different ways of acquiring property; co-ownership; the dismemberments of ownership as well as legitimate and testamentary possession and inheritance.

**Key words:** Patrimony. Possession. Real and personal obligations. Real property law. Real and personal rights. Dismemberments of ownership. Inheritance law. Joint ownership. Assets.

**Bibliography:** \* Rojina Villegas, Rafael., Compendio de derecho civil II : bienes, derechos reales y sucesiones , 36a ed., Porrúa, Mexico, 2004, Español, [9700749002].

**D1005 Law Theory****( 3 - 0 - 8. Prerequisites: None. 1 LDF11, 1 LDP11, 1 LED11 )****Equivalence: D 00812**

This is a basic course of study within the field of law. After completing this course the student will understand and know the law as legal science, the disciplines into which it is divided, and fundamental legal concepts. No previous knowledge is required. As a learning outcome, the student will understand individual rights, legal status and legal technique;

he will be able to establish the characteristics of the Law compared to other legislative rules and produce a definition; and also be able to distinguish different meanings of the law as well as its processes of creation.

**General objective:** Upon completion of this course, students will be able to analyze and explain the concept, origins, and classification of law, the various theories of law, as well as fundamental legal concepts and their role in legal science and in the law itself. Students will learn about problems posed by technical jurisprudence, the solution to those problems that it has offered, and the ways in which it can be used in order to solve practical cases.

**Key words:** Theories of law. Legal formalism. Legal realism. Difference between legal methodology and legal technique. Diverse schools of interpretation. Logical operations for solving interpretation and integration issues.

**Bibliography:** \* Rodríguez Molinero, Marcelino., *Introducción a la ciencia del derecho* / Marcelino Rodríguez Molinero., 4a ed., Salamanca : Librería Cervantes, 1999., Spain, 1999., spa, [8495195135].

**D1007 General Procedural Theory**  
( 3 - 0 - 8. Prerequisites: [ D1005 ]. 3 LDF11, 3 LDP11, 3 LED11 )  
**Equivalence: D 00825**

Basic procedural law course that introduces students to the fundamentals of the profession. Upon completion of this course, students will be familiar with the concepts and institutions common to the diverse special procedural disciplines. This course requires prior knowledge of theory of law. As a learning outcome students will understand, by means of analysis, the different ways of solving conflicts of interest, integrate the concepts learned, relate them to each other and identify them with real or hypothetical situations through collaborative work and individual and group evaluations.

**General objective:** Upon completion of this course, students will be able to understand and apply the principles, institutions, and fundamental concepts which govern the jurisdictional process, as an ideal

instance for conflict resolution; comprehend the functions which correspond to each of the entities that take part in the legal process relationship: jurisdictional office, parties, and third parties; identify the steps and phases by which the process is carried out.

**Key words:** Jurisdictional function. Means of conflict resolution. Procedural law. Competence. Jurisdiction management. Law in action . Exception. Procedural relationship subjects. Procedure.

**Bibliography:** \* Pina, Rafael de., *Instituciones de derecho procesal civil* / Rafael de Pina, José Castillo Larrañaga, 27a ed., revisada y aum., México : Editorial Porrúa, 2003, Mexico, 2003, spa, [9700743705].

**D1010 Introduction to Civil and Family Law**

( 3 - 0 - 8. Prerequisites: None. 2 LDF11, 2 LDP11, 2 LED11 )  
**Equivalence: D 00813**

Basic course in the field of civil law, in which the student develops an overview of family law. It requires previous knowledge concerning the theory of the juridical act in order to be able to understand marriage, divorce and other aspects of family law. As a result of learning the student will solve legal problems related to the topics of the course.

**General objective:** Upon completion of this course, students will be able to identify the legal institutions which concern the person, in the realm of civil law, by means of the distinction of the subjects of this law: individuals and corporations, and through the analysis of their corresponding attributes, in order to know and appreciate the importance of the legal relations which are dealt with in family law.

**Key words:** Adoption. Divorce. Filiations. Marriage. Kinship and family supplies. Cohabitation. Child custody. Inheritance. Guardianship.

**Bibliography:** \* Rojina Villegas, Rafael, *Compendio de derecho civil II: bienes derechos reales y sucesiones* / Rafael Rojina Villegas, 38a ed., México : Porrúa, 2006., Mexico, 2006, spa, [9700764893 (v. 2)].

## **D1011 Criminal Law I** ( 3 - 0 - 8. Prerequisites: None. 2 LED11 ) Equivalence: D 00835

Basic criminal law course in which students will develop the basic concepts and competencies related to the diverse schools of thought that have attempted to explain the nature and concept of the theory of crime. This course requires prior knowledge of the theory of crime, particular crimes and constitutional crime. As a learning outcome students will identify, analyze, explain, develop diverse elements: iter criminis, attempted crime, consummation, "impossible" crime, abandonment and rescission and the diverse forms of perpetration and participation, ideal and material joinder; as well as accumulation, repetition and habitualness.

**General objective:** Upon completion of this course, students will be able to explain, analyze, and associate the theories, assumptions, and structure of crimes; the elements which define them, and those which lead to imprisonment, as well as the circumstances which exclude imprisonment in our system of criminal law.

**Key words:** Theory of crime. Elements of the offence: iter criminis, tentative, consummation, tentative "impossible", relinquishment and repentance. Elements of: iter criminis, attempt, perpetration. Impossible attempt. Abandonment and rescission.

**Bibliography:** \* Pavón Vasconcelos, Francisco Herberto., Derecho penal mexicano : parte general / Francisco Pavón Vasconcelos ; prólogo de Mariano Jiménez Huerta., 21a ed. debidamente corregida y actualizada., México : Editorial Porrúa, 2010., [9700774060].

## **D1012 Constitutional Law** ( 3 - 0 - 8. Prerequisites: [ D1005 , D1005 Corequisite , D1018 , P1002 , RI2029 ]. 4 LCS11, 2 LDF11, 2 LDP11, 2 LED11, 4 LMI11, 4 LPL11, 4 LRI11 ) Equivalence: D 00822

Basic law course focusing on the analysis of the constitutional framework of the Mexican State. Upon completion of this course, students will be familiar with the fundamental structures of the political and

social organization of the State through the Constitution. This course requires prior knowledge of the general concepts and theory of law. As a learning outcome students will complete assignments that incorporate aspects of Mexico's constitutional framework.

**General objective:** Upon completion of this course, students will be able to comprehend the constitutional structure of the nation to which they belong, in order to understand the basic theory behind its social and political organization; develop a sense of their social and political duty and the real dimension for their effective participation in the construction of philosophies for peaceful coexistence. Moreover, students will be able to gain the necessary skills for the effective practice of the legal profession and the attitudes which will produce an ethical perspective of the controversies in which they will participate.

**Key words:** Mexican electoral system. State and municipal constitutional law, Mexico City's legal system.

**Bibliography:** \* Fix-Zamudio, Héctor., Derecho constitucional mexicano y comparado / Hector Fix-Zamudio, Salvador Valencia Carmona., 4a ed., Mexico : Editorial Porrúa : Universidad Nacional Autónoma de México, Instituto de Investigaciones Ju, Mexico, 2005, spa, [9700755940].

## **D1013 Political Theory of the State** ( 3 - 0 - 8. Prerequisites: None. 1 LDP11, 1 LED11 ) Equivalence: D 00826

Basic course in which students will analyze the Mexican State in light of the political theory of the State. Upon completion of this course, students will understand the political theory of the State in a systemic and systematized manner and will develop social awareness and responsibility. No prior knowledge is required. As a learning outcome students will display a critical and analytical spirit regarding political acts, phenomena and issues that arise both in Mexico and abroad, and will provide alternatives and proposals for development and adequate solutions, not just as professionals, but also as citizens who are more aware and responsible as a result of their knowledge of law.

**General objective:** Upon completion of this course, students will be able to analyze, understand, and relate the nature, the objective, and the method of political state theory; political facts and phenomena; the history, basic concepts, structure, and governmental functions of the modern state; as well as the distinctive aspects of the different forms of State and forms of government, emphasizing the justification of the existence of the State and of the government.

**Key words:** Theories of the state. Nature of the State. Aims and functions of the State. The structure of the state. The present state and the Mexican state.

**Bibliography:** \* Andrade Sánchez, Eduardo., Teoría general del Estado / Justino Eduardo Andrade Sánchez., 2a ed., México, D. F. : Oxford University Press, c2003., Mexico, c2003., spa, [9706131019].

## D1015 Business Corporations

( 3 - 0 - 8. Prerequisites: [ D1010 ]. 7 LDF11, 7 LDP11, 7 LED11 )

**Equivalence:** D 00824

Basic course in the field of commercial law. Upon completion of this course, the student will be able to understand the act of commerce, as well as different types of corporations, the legal nature, forms, classification and merger-demerger agreements of corporations. Prior knowledge of commercial law is required. As a learning outcome students will be able to describe corporation groupings such as controlling, financial and corporate groups; they will explain the criteria for defining a commercial corporation as foreign; the legal requirements for doing business in Mexico; and the assumptions concerning bankruptcy of a foreign company and the establishment of a Mexican corporation abroad.

**General objective:** Upon completion of this course, students will be able to identify and explain the acts, entities, institutions, and regulations put into place in order to regulate production or intermediation activity in the exchange of goods or services, with special reference to other contemporary systems of commerce, as well as the most relevant aspects of corporations regulated by the General Law of Commercial Corporations, their dissolution, liquidation, merging,

transformation, and grouping at the national and international level.

**Key words:** Commercial law in the legal system. Sources of commercial law. Limited liability companies. Diverse types of corporations and their transformation. Liquidation and merger of companies. Joint-stock company. Variable capital companies. Foreign companies. Irregular companies. Subject to commercial law. Corporate groups. Holding company. Corporations control. Cross-investment companies. Bankruptcy in a foreign corporation. Mexican corporations established abroad. Criteria for determining a corporation's nationality.

**Bibliography:** \* Mantilla Molina, Roberto L., DERECHO MERCANTIL : INTRODUCCION Y CONCEPTOS FUNDAMENTALES. SOCIEDADES / ROBERTO MANTILLA MOLINA, JESUS MARIA ABASCAL., 24a ed., MEXICO : PORRUA, 1986., spa, [9684322194].

## D1019 Criminal Law

( 3 - 0 - 8. Prerequisites: None. 3 LDF11, 3 LDP11 )

**Equivalence:** None

Intermediate law course. Upon completion of this course, students will be know the elements of criminal law ( Actus reus, mens Rea, scope of criminal liability, and inchoate Offenses), sanctions and defenses. This course requires prior knowledge of constitutional law. As a learning outcome students will analyze the principles and foundation of criminal law by examining the different types of crimes, their structure and their components, touching on criminal responsibility in the field of business operations and the diverse financial institutions.

**General objective:** Upon completion of this course, students will be able to explain, analyze, and associate the theories, assumptions, and the structure of crimes; the elements which define them, and those which lead to criminal liability, as well as the circumstances which exclude liability in our system of criminal law. Students will identify, analyze, and define the crimes which are typified in the Criminal Code and other laws that establish crimes.

**Key words:** Legal nature of criminal law. Sources of criminal law. Elements of crimes and scope of criminal



liability. Theory of criminal justice and security measures. Crimes in particular (Fatal offenses, personal offenses, property offenses, and participatory offenses).

**Bibliography:** \* Castellanos, Fernando, Lineamientos elementales de derecho penal / Fernando Castellanos, 46a ed., México, DF. : Editorial Porrúa, 2005, Mexico, Editorial Porrúa, "2005", spa, [9700761436].

## D1021 Business Law

( 3 - 0 - 8. Prerequisites: None. 1 LAE11, 1 LAF11, 3 LCDE11, 1 LCPF11, 1 LDN11, 1 LEM11, 1 LIN11, 1 LLN11, 1 LMC11, 1 LPM12, 2 LPO11 )

**Equivalence:** D1000

This is a basic course in the field of law that is focused toward the student acquiring an overall vision of the basic principles of the Law and understanding contractual regulation in civil and commercial environments. Prior knowledge is not required. As a learning outcome, students are expected to solve cases in which they demonstrate an understanding of the concepts of legal science, civil contracts, commercial corporations, negotiable instruments, and commercial proceedings.

**General objective:** The student will be capable of recognizing and understanding the basic elements of law, as well as the legal and economic consequences of the correct or incorrect application of regulations to organizations, considering civil and commercial contractual aspects.

**Key words:** Contracts. Introduction to law. Business associations. Negotiable instruments. Commercial proceedings.

**Bibliography:** \* Rangel Charles Juan Antonio, Derecho de los negocios tópicos de derecho privado, 3ª, Cengage Learning, Español.

## D1022 Business Law and Intellectual Property

( 3 - 0 - 8. Prerequisites: None. 5 IBN11, 2 LAE11, 2 LAF11, 2 LCPF11, 2 LDN11, 2 LEM11, 2 LIN11, 2 LLN11, 2 LMC11, 2 LPM12 )

**Equivalence:** D1001

This is a basic course in the field of law that provides students with the knowledge of corporate law by examining the legal and practical implementation. The course will provide the student with a perspective of the main international and national trends in intellectual property, knowledge of the different ways of protection as well as domestic law and international treaties related to this issue, in order to take fullest advantage of business opportunities. The course requires prior knowledge of the fundamental principles of law, contracts, corporations, securities, and insolvency. As a learning result it is expected that the student solve practical cases in which he demonstrates knowledge of corporate law and intellectual property.

**General objective:** With completion of this course, the student should be able to identify the general requirements of corporate law, economic law, intellectual property, banking and finance law, tax law, foreign commerce, foreign investment, employment law, and their legal consequences.

**Key words:** Banking and finance law. Corporate law. Employment law. Intellectual property law. Foreign investment.

**Bibliography:** \* Derecho Corporativo y la Empresa, Sanromán Aranda, Roberto, 1ª.ed, Cengage Learning, Español.

## D1023 Roman Law

( 3 - 0 - 8. Prerequisites: None. 1 LDF11, 1 LDP11, 1 LED11 )

**Equivalence:** None

Basic course in law in which the student involves in the study of the law. No previous knowledge is needed. As a learning outcome, the student will understand and recognize the roman legal institutions that still influence our current legal system.

**General objective:** Upon completion of this course, students will be able to identify, interpret, and explain the importance of studying Roman Private Law and its development throughout the different stages of history, from the foundation of Rome to the Justinian Code and its reception in the East and West, up to our present-day legislation.



**Key words:** Corpus Iuris Civilis. Magistracy. Jurisconsults. Constitutio (mandata, rescripta, epistole, subscriptio, edicta). Codex Justinianus Repetitae Praelectionis. Magistrate's edicts (edicta repentina).

**Bibliography:** \* Bernal, Beatriz, Historia del derecho romano y de los derechos neorromanos : desde los orígenes hasta la alta edad media / Beariz Bernal, José de Jesús Ledesma, 11a ed., México : Editorial Porrúa, c2003., [9700725332].

## D1024 Tax and Fiscal Framework of Social and Cultural Institutions

( 3 - 0 - 8. Prerequisites: None. 6 LCS11 )

**Equivalence: None**

The purpose of this basic law course is that students understand the national legal and fiscal framework that applies to social, cultural and business activities, permitting an integrated perspective for effective decision making. No previous knowledge is required. The learning outcome of this course is for students to make decisions related to the development of social and cultural activities nationwide, based on conformance with the legal and fiscal framework.

**General objective:** Students will be familiar with the most outstanding features of taxation laws, the relevant taxation and social and occupational aspects contained in these laws. They will understand the differentiation of commercial activities and identify the characteristics of commercial legal documents and their legal foundation, the most significant characteristics of foreign trade for enterprise, and the fundamental aspects of social welfare included in the corresponding legislation.

**Key words:** Contracts. Public records. Tax payment history. General outlines of tax law. Financial activity of the state and the taxpayer: bilateralism of legal regulations. The contributive obligation. Federal income and expenditure budget law. National tax coordination system. Tax credit: its origin and settlement. Faculties of the tax authorities. Administrative execution procedure. Means of defense in tax matters.

**Bibliography:** \* Baqueiro Rojas, Edgard., Derecho civil : introducción y personas / Edgard Baqueiro Rojas, Rosalía Buenrostro Báez., 2a ed., México, D.F. : Oxford University Press, 2010., [9786074260106].

## D1025 Media Legislation

( 3 - 0 - 8. Prerequisites: None. 9 LAD11, 8 LCMD11, 7 LMI11, 8 LPM12 )

**Equivalence: None**

Basic course in the field of law focused on acquiring concepts and skills to implement the required legislation for organizations to operate and hiring in the communication's field. No prior knowledge is required. The learning outcome for students is to understand the regulations applying to journalistic organizations, radio and television industries, as well as for cable television and software development industries.

**General objective:** Upon completion of this course, students will be familiar with the regulatory bodies that norm the activities of the media and new information and communications technologies; understand the legal framework that governs principles of press operations, publishing industry, radio, television, telecommunications, cable television, telephony and the software industry, related to the production of news and entertainment programs. Students will be able to distinguish the principles and obligations that regulate both media producers and owners, as well as the entitlement to protect authors and users of these media.

**Key words:** Professional secrecy of journalists. Piracy and price abuse. Brands and copyrights in Mexico and worldwide. Application of criminal law to crimes such as slander and libel. Electronic media and the difficulties in their control and regulation. Restrictions in freedom of expression and the press.

**Bibliography:** \* Pinto Mazal, Jorge., Régimen legal de los medios de comunicación colectiva : lecturas básicas / Jorge Pinto Mazal., Mexico : UNAM, 1977.

## **D1026 Introduction to Law Field** ( 3 - 0 - 4. Prerequisites: None. 1 LDF11, 1 LDP11, 1 LED11 )

**Equivalence: None**

The purpose of this basic course is to induct students into the setting of university life and the majors in which they are enrolled. Previous knowledge is not required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* García Máynez, Eduardo, 1908-, *Introducción al estudio del derecho* / Eduardo García Máynez ; prólogo de Virgilio Domínguez., 59a ed., México, D.F. : Porrúa, c2006., Mexico, c2006., spa, [9700765970],[9789700765976].

## **D2004 Oral Judgments** ( 3 - 0 - 8. Prerequisites: [ D1012, D1019 ]. 7 LDF11, 5 LDP11, 5 LED11 )

**Equivalence: None**

The purpose of this intermediate law course is for students to understand the most relevant aspects relating to how oral proceedings are carried out in some federal entities in Mexico and other countries, and to know the procedural stages for these types of hearings and how they should behave at each stage. No previous knowledge is required. The learning outcome of this course is for students to conduct an oral proceeding, presenting oral legal arguments in public.

**General objective:** Upon completion of this course, the student will know the advantages and disadvantages of the adversarial system and oral proceedings in relation to the inquisitorial system and written proceedings. He will know which countries use oral proceedings to resolve their legal disputes and will learn which states have included oral trials in their legislation and in which cases they are used.

**Key words:** Oral argumentation. Stages of oral proceedings . Oral trials.

**Bibliography:** \* Carbonell, Miguel, *Los juicios orales en México* / Miguel Carbonell, México : Porrúa, 2009., [9786070903748].

## **D2006 Legal Research** ( 3 - 0 - 8. Prerequisites: None. 2 LDP11, 2 LED11 )

**Equivalence: D 00837**

This is an intermediate course in the field of law. Upon completion of this course, students will identify the different research methods and techniques, becoming aware of the importance of applying them to the study of juridical science. No prior knowledge is required. As a learning outcome students will complete a juridical research project (dissertation) and carry out the different steps of the research, such as the selection, delimitation and justification of the topic, related to the selected material. Students will identify and use the collection media for juridical research; refine and formulate a final structure, by chapters, of the collected material in a coherent, fundamental unit that allows them to communicate their achievements, using the diverse communication media at their disposal.

**General objective:** Upon completion of this course, students will be able to identify, organize, and master the correct legal research techniques to be used in different cases; students will be able to identify various information sources and locate the principal places where they can be found, as well as the services offered and the correct way to utilize those services. Students will be able to describe the different ways to consult and correctly cite various types of references, how to select, define, and justify the research topic, and how to collect material for the topic through the utilization of various types of index

cards. Students will also be able to explain the analysis, organization, and presentation of collected data; the correct utilization of grammar rules for composition, and the critical apparatus in the presentation of findings.

**Key words:** Analysis of concepts from an etymological, linguistic and content-related point of view. Research techniques applied to law.

**Bibliography:** \* Fix-Zamudio, Héctor., Metodología, docencia e investigación jurídicas / Hectór Fix-Zamudio, 13a ed., México : Editorial Porrúa, 2006, Mexico, 2006, spa, [9700761533].

### D2009 Fundamental Rights

( 3 - 0 - 8. Prerequisites: [ D1012 ]. 3 LDF11, 3 LDP11, 3 LED11 )

**Equivalence:** D 00865

Course of intermediate whose purpose is that students know the fundamental rights granted by the Constitution and begin to visualize how to protect them and make them effective. It requires prior knowledge of constitutional law. As a result of learning the student will complete assignments in which he manifests the knowledge acquired during the course.

**General objective:** Upon completion of this course, students will be able to understand and analyze the nature, function, and importance of the fundamental rights and freedoms in national and international contexts. Students will also examine each one of the mechanisms set forth for the protection of said rights and freedoms.

**Key words:** Fundamental rights in the constitution. Fundamental rights and freedoms. Defense and protection of fundamental rights and freedoms. Theory of the constitution and fundamental rights.

**Bibliography:** \* Burgoa, Ignacio., Las garantías individuales / Ignacio Burgoa O., 37a ed., México : Porrúa, 2004., Mexico, 2004., spa, [9700753409].

### D2010 Obligation Law II

( 3 - 0 - 8. Prerequisites: [ D2013 ]. 5 LDF11, 5 LDP11, 5 LED11 )

**Equivalence:** D 00832

Intermediate course of study within the field of civil law, whose purpose is for students to study in depth the characteristics of individuals and corporations, family law, assets, property rights and inheritance rights, the nature and structure of the obligation or credit right, the laws on matters of existence and conditions of validity of the legal act in general and the specific contract as well as the different private sources of obligations, identifying the ways to operate each of them. The course requires prior knowledge of civil, family, and inheritance law and the nature and structure of the obligation or right to credit. As a result of learning the student will carry out a practical and theoretical assignment which reflects the problems arising from fulfillment of obligations.

**General objective:** Upon completion of this course, students will be able to comprehend the problems that can occur regarding the fulfillment of obligations, keeping in mind their distinct modalities, the actions which can be taken as a result of non-fulfillment of obligations, and the transmission of rights and obligations.

**Key words:** Effect of obligations. Special effects of obligations. Specific effects of the acts that lead to reciprocal obligations. Discharge of obligations. Complex obligations or obligations with modalities. Transfer of obligations.

**Bibliography:** \* Gutiérrez y González, Ernesto., Derecho de las obligaciones / Ernesto Gutiérrez y González., 15a ed., México : Editorial Porrúa, 2005., Mexico, 2005., spa, [9700754979].

### D2011 Mercantile Contracts

( 3 - 0 - 8. Prerequisites: [ D2017 , D2022 ]. 6 LED11 )

**Equivalence:** D 00003

Intermediate course within the field of commercial law. Upon finishing the course the student will have an understanding of the characteristics of contracts. The course requires prior knowledge of the charac-

teristics of the contract, as well as the acts that create them. As a result of learning, the students will produce commercial contracts.

**General objective:** Upon completion of this course, students will be able to understand and utilize commercial contracts; the definition or concept of each type, their origins, classifications, structure, personal elements, characteristics and effects, and models of the main common contracts; international contracts, reasons for their execution, contents, effects, dépeçage; INCOTERMS; international commercial uses carried out by UNCITRAL, and the principles behind UNIDROIT's international commercial contracts.

**Key words:** Financial leasing. Brokerage. Financial factoring. Insurance. Purchase for resale. Trust deed. Supply agreement. Transport agreement. Editing contract. Performance bond. Commercial collateral. Commercial commission. Concession. Industrial property contracts.

**Bibliography:** \* Vásquez del Mercado, Óscar., Contratos mercantiles / Óscar Vásquez del Mercado., 11a ed., México : Porrúa, 2001., Mexico, 2001., spa, [9700711056].

## D2012 Criminal Law II

( 3 - 0 - 8. Prerequisites: [ D1011 ]. 3 LED11 )

Equivalence: D 00836

Intermediate course in the field of criminal law. Upon completion of this course, students will analyze and highlight the different types of aggravating and attenuating circumstances in our criminal legislation. As a learning outcome students will analyze practical cases in accordance with dogmatic study. They will describe and identify particular crimes, especially from our criminal system, their classes and distinguishing elements according to the structure of the crime.

**General objective:** Upon completion of this course, students will be able to explain and systematize crimes against human life, body integrity, and assets in our criminal law regime. Students will moreover analyze and define the legal implications of this classification. They will identify, analyze, and define

crimes against public health; sexual crimes; those committed by public servants; electoral crimes and those regarding the National Registry of Citizens; ecological crimes as well as those typified in the special laws of tax nature.

**Key words:** Crimes against individual's patrimony. General sexual crimes. Kidnapping. Theft. Bankruptcy. Assisted suicide and homicide with the victim's consent. General injury. Extenuated injury and homicide. Premeditated injury and homicide. Parricide. Penalties for general injury. Suicide.

**Bibliography:** \* Pavón Vasconcelos, Francisco Herberito., Derecho penal mexicano : parte especial / Francisco Pavón Vasconcelos, Gilberto Vargas López., México : Porrúa, 2005-, Mexico, -2005, spa, [9700754308 (v.5)], [9789700774107 (v. 6)].

## D2013 Obligation Law I

( 3 - 0 - 8. Prerequisites: [ D1003 ]. 4 LDF11, 4 LDP11, 4 LED11 )

Equivalence: D 00831

Intermediate course of study within the field of civil law which is intended to familiarize students with the characteristics of individuals and corporations, family law, assets, proprietary rights and inheritance rights. This course requires prior knowledge in all of the above areas. As a result of learning the student will carry out projects which involve the application of the concepts of nature and structure of credit rights and obligations, regulations on matters of existence and conditions of validity of the juridical act in general and contracts in particular as well as different specific origins of obligations, explaining the way in which each one operates.

**General objective:** Upon completion of this course, students will be able to define the nature and structure of credit rights and obligations, apply to concrete cases the legal dispositions related to elements of existence and validity requirements of the legal action in general and of contracts in particular, and identify and examine the different specific origins of obligations, explaining the way in which each one operates.

**Key words:** Classification of contracts. Elements of existence of a contract. Illicit enrichment. Juridical facts and acts. Will of the contracting parties. Form. Credit obligation or right. Vitiating consent (error, violence and injury).

**Bibliography:** \* Bejarano Sánchez, Manuel, *Obligaciones civiles* / Manuel Bejarano Sánchez., 3 ed, México : Oxford University Press, 2001, Mexico, 2001, spa, [9706134026].

## D2015 Tax Law

( 3 - 0 - 8. Prerequisites: [ D2008 , D1020 , D2022 ]. 7 LDF11, 7 LDP11, 7 LED11 )

**Equivalence:** D 00863

Intermediate course of study in the field of tax law. Upon completion of the course, students will be able to determine and justify the three main Mexican federal taxes – income tax, value-added tax and single-rate business tax (ISR, IVA and IETU). The course requires prior knowledge of financial law, such as State revenue, taxes, formal and substantive tax obligations, legal principles of contributions. As a learning outcome students will solve problems related to the legality of the taxes studied.

**General objective:** Upon completion of this course, students will be able to identify and understand the main contributions that constitute Mexico's fiscal regime, as well as the estimates leading to income tax, value-added tax, and business tax, in order to determine each contribution. Additionally, students will be able to analyze and interpret the relevant tributary legislation in concrete cases studied in order to respond to and solve them.

**Key words:** Income tax (ISR). Determination of ISR for corporations. Determination of ISR for individuals. Determinations of value-added tax (IVA). General guidelines of the flat-rate business tax (IETU).

**Bibliography:** \* Venegas Álvarez, Sonia., *Derecho fiscal* / Sonia Venegas Álvarez., México : Oxford University Press, 2010., [9786074260809].

## D2016 Public International Law

( 3 - 0 - 8. Prerequisites: [ D1012 , D2009 ]. 5 LDF11, 5 LDP11, 5 LED11 )

**Equivalence:** D 00867, RI2007

Intermediate course of study in the field of international law. Upon completion of this course, students will understand the basic concepts and principles which govern the international legal community. These include international legal negotiations, the organs of the international relations, the rights and responsibilities of the State, the organization of the international community, the legal order of international economy, the subjects of international law, as well as the international defense of human rights. This course requires prior knowledge of constitutional law. As a learning outcome students will solve cases involving international legal issues and express them in theoretical-practical assignments.

**General objective:** Upon completion of this course, students will be able to develop their analytical and critical abilities on topics related to public international law.

**Key words:** International organizations. Concept, principles and doctrine of international public law. Peaceful settlement of disputes between states. Organization of the international community. International legal negotiations. International responsibility of the state.

**Bibliography:** \* Sломanson, William R., *Fundamental perspectives on international law* / William R. Sломanson., 5th ed., Belmont, CA : Thomson/Wadsworth, c2007., California, c2007., eng, [0495007455].

## D2017 Credit Titles

( 3 - 0 - 8. Prerequisites: [ D1015 ]. 8 LDF11, 8 LDP11, 8 LED11 )

**Equivalence:** D 00838

Intermediate course of study in the field of commercial law. Upon completion of this course, students will be capable of distinguishing the special legal principles and standards that regulate the creation and use of the different types of credit instruments. This course requires prior, basic knowledge of commercial law and of commercial transactions. As a



learning outcome students will correctly apply the principles of credit instruments and their qualities as the ideal vehicles for the circulation of credit, their resulting transactions and their opposable exceptions.

**General objective:** Upon completion of this course, students will be able to analyze, describe, and define the nature, classification, content, scope, actions and exceptions related to credit instruments, as well as their legal regime and the actions that can be performed with them. Students will be trained to distinguish the special legal principles and regulations which govern the creation and the utilization of credit instruments, so that they know how to utilize them as a factor in the optimization of financial resources, correctly applying their qualities as ideal vehicles for the circulation of credit and as a way to adjust future assets.

**Key words:** Bill of exchange. Check. Promissory note. Documentary relationship. Stock exchange. Actions and obligations. Credit instruments and the application of national law. Fundamental principles of credit instruments and documentary relationship. Commercial bankruptcy proceedings. Certificate of deposit and pledge bonds. Fundamental principles of credit instruments. Check. Promissory note. Bill of exchange.

**Bibliography:** \* Castrillón y Luna, Victor M., Títulos mercantiles : títulos de crédito y otros títulos / Victor M. Castrillón y Luna., 2a ed. corr. y aum., México, D.F. : Porrúa, 2008., [9700777696].

## D2021 Administrative Law and Public Policy I

( 3 - 0 - 8. Prerequisites: [ D1012 , P2005 ]. 4 LDF11, 4 LDP11, 4 LED11, 6 LPL11 )

**Equivalence:** D1008

Intermediate course of study in the field of administrative law. The purpose of this course is to introduce students to the concept of administrative law and the principal criteria proposed to characterize the administrative function, using analytical-deductive techniques. The course requires previous knowledge of private and public law, such as the basis for each law, location in terms of branch in the general legal context and knowledge of relationships originating

in the field of law as well as constitutional fundamentals and principles. The learning outcome of this course is for students to prepare projects that apply their acquired knowledge of administrative law.

**General objective:** Upon completion of this course, students will be familiar with and able to understand the concept of administrative law; the elements for integrating the notion of administrative law; other criteria proposed for characterizing administrative function; the concept of administrative law; legislative function; the functions of the Mexican Constitution; administrative law relationships; sources of administrative law; regulations as a source of administrative law; other sources of administrative law; public administration and the problem of the state's legal status; the administrative agencies; public function; the forms of administrative organization; Theory of Administrative Action, and the characteristics, types and rights that emerge from Administrative Procedure.

**Key words:** Public administration and the problem of the legal status of the state. Concept of administrative law. Administrative decentralization. Decentralization of services. Territorial or regional decentralization. Elements to integrate the notion of administrative law. Forms of administrative organization. Sources of administrative organization.

**Bibliography:** \* Sánchez Gómez, Narciso., Primer curso de derecho administrativo / Narciso Sánchez Gómez., 3a ed., México, D.F. : Editorial Porrúa, c2003., [9700742466].

## D2022 Administrative Law and Public Policy II

( 3 - 0 - 8. Prerequisites: [ D2021 ]. 5 LDF11, 5 LDP11, 5 LED11, 7 LPL11 )

**Equivalence:** D1009

Intermediate course of study in the field of law. The purpose of this course is to introduce students to the analysis and understanding of the different relationships derived from public administration in the principal contexts of the public interest and its relationship to individuals. On completing this course, students understand precisely the specific activities related to formal administrative functions. The course



requires previous knowledge of public law, such as the basis for norms and their placement in the general context of the law, and knowledge of constitutional fundamentals and principles related to the State and the general theory of administrative law. The learning outcome of this course is for students to participate in planning public administration activities as well as in the involvement of the Executive Branch in the principal activities of different sectors, including those related to resolution of conflicts between the State and individuals.

**General objective:** Upon completion of this course, students will understand the basis of the government's control of the economy and planning, its property regime including government franchise, and the diverse ways in which individuals can acquire assets to efficiently achieve their objectives; know the different types of public administration contracts and specifically the Executive Branch's involvement in activities such as the population, migratory policy, healthcare, environment, energy, consumer protection, financial services, human rights, among others, and the relationship with regard to administrative justice.

**Key words:** Legal ownership of assets. Originating ownership assets. Litigious-administrative matters in Mexico. Jurisdictional control of administration. Administrative procedure. State financial system. Enforcement of the income and expenditure budget law. Legal protection of individuals against the administration. Irregular administrative acts. Administrative contracts. Individuals rights and obligations regarding the administration. The effects of administrative acts.

**Bibliography:** \* Martínez Morales, Rafael I., Derecho administrativo. 1er. curso / Rafael I. Martínez Morales., 5a ed., México, D. F. : Oxford University, 2004., [9706137947].

## D2023 Labor Law I

( 3 - 0 - 8. Prerequisites: [ D1012 ]. 5 LDF11, 5 LED11 )

**Equivalence:** D2014

Intermediate course of study in the field of social law. The purpose of this course is for students to acquire

the knowledge and skills necessary to understand the labor implications of the provision of personal services and the type of contract that should govern that provision. They should also be able to analyze working conditions, know how to integrate salaries and be able to evaluate whether severance pay is in compliance with the law. The course requires previous knowledge of the law regarding civil obligations and contracts. The learning outcome of this course is for students to prepare individual labor contracts, dismissal papers and other documents related to labor settlements, including the corresponding legal liquidations, thus putting into practice the knowledge acquired during the course.

**General objective:** Upon completion of this course, students will be able to understand the legal framework that governs personal relationships that, as a result of the provision of a subordinate service, arise between the employer and the employee, as well as the institutions that determine the minimal rights that employees must enjoy with respect to employers and their obligations to each other.

**Key words:** Suspension. Labor relations. Individual labor contract. Obligations of the related parties. Working conditions. Termination and rescission of labor relations. Modification of working conditions.

**Bibliography:** \* Garrido Ramón, Alena., Derecho individual del trabajo / Alena Garrido Ramón., 1a. ed., Mexico : Oxford University Press, 1999., spa, [9706134395].

## D2024 Intellectual Property Law

( 3 - 0 - 8. Prerequisites: None. 7 LDF11, 7 LED11 )

**Equivalence:** None

Intermediate course in the field of law. At the end of this course, students will be able to analyze and systematize the fundamental concepts related to intellectual rights as well as administrative and judicial proceedings related to the acquisition, storage, transmission, compliance and termination of the exclusive rights granted as regards to industrial property rights and Copyright. The course requires prior knowledge of administrative law. As a learning outcomes, students will identify and explain the basic concepts of intellectual rights as a legal disci-

pline, their autonomy as a legal discipline and their own terminology, their classification, protection, processing, rights and obligations that entail risk and reasons for termination. The students will recognize the classification of crime and offenses with respect to industrial property copyrights, as well as the way in which unfair competition is carried out. They will identify and explain the general concepts relating to the transfer of technology, its relationship to intellectual rights, economic and regulatory considerations.

**General objective:** On completion of this course, students will possess basic knowledge regarding the correlation between new technologies and the law, considering, on one hand, technology as an instrument of law and, on the other, Informatics Law as the judicial regulation of the information society. They will be familiar with the diverse legal phenomena that might stem from the new technologies, their regulations and the way in which they have been resolved not only in the Mexican legal System, but also from a comparative perspective. They will understand the regulations for this subject in Mexico, Latin America, the United States and the European Union.

**Key words:** Description of probative value of computer backup and computer crimes. Sources of legal information. Electronic sources of legal informatics. Legal informatics.

**Bibliography:** \* Castrejón García, Gabino Eduardo., *El derecho marcario y la propiedad industrial* / Gabino Eduardo Castrejón García, 3a ed., México : Cárdenas Editor Distribuidor, 2003., [9684013868].

### **D3000 Civil Contracts**

( 3 - 0 - 8. Prerequisites: [ D2010 ]. 6 LED11 )

**Equivalence: D 00853**

Advanced course in the field of civil law. Upon completion of this course, students will recognize and understand the juridical institutions of private law, such as individuals and corporations, family law, goods, real property rights and succession law, the nature and structure of creditor's obligation or right, legal provisions on essential elements and validity requirements of the legal act, the effects of breach and compliance of obligations, as well as the transmission of rights and obligations. This course requires previous

knowledge on legal institutions of private law, as well as on obligations. As a learning outcome students will draft different types of civil contracts ruled under Mexican legislation.

**General objective:** Upon completion of this course, students will be able distinguish and understand the different civil contracts ruled under Mexican legislation, analyzing their concepts, classification, elements (essential and validity), their legal effects or consequences, their modalities when applicable, their peculiarities, and the termination causes. Additionally, students will be able to perceive which of the contracts is the ideal instrument for satisfying each particular case's necessities.

**Key words:** Guarantee contracts. Aleatory contracts. Corporate and common-purpose contracts. Service agreements. Preparatory contracts: pre-contract. Contracts that foresee and resolve controversy. Ownership transfer contracts. Use and enjoyment transfer contracts. General doctrine of contracts.

**Bibliography:** \* Rafael Rojina Villegas, *Compendio de derecho civil Tomo IV*, Editorial Miguel Angel Porrúa, ESP.

### **D3010 Private International Law**

( 3 - 0 - 8. Prerequisites: [ D2016 ]. 7 LDF11, 6 LDP11, 6 LED11 )

**Equivalence: D 00882**

Advanced course in the field of law. After conclusion of the course the student will understand general concepts of private international law. The course requires basic knowledge of public international law . As a learning outcome the student will develop papers and practices covering the specific aspects of the process and its application in various foreign countries.

**General objective:** Upon completion of this course, students will understand local regulations and international conventions for the solution of legal disputes between private parties that involve the application of different laws in various jurisdictions.

**Key words:** Foreign investment. Foreign law. International procedural cooperation. Nationality. Immigra-

tion matters. Mexico in conventional international law. Mexican law.

**Bibliography:** \* Juenger, Friedrich K., *Derecho internacional privado y justicia material* / Friedrich K. Juenger ; traducción, Diego P. Fernández Arroyo, Cecilia Fresnedo de Aguirre., 1a ed., México, D. F. : Editorial Porrúa : Universidad Iberoamericana, c2006., Mexico, c2006., spa, [9700766357].

### **D3014 Amparo Trial**

**( 3 - 0 - 8. Prerequisites: [ D2009 ]. 9 LDP11 )**

**Equivalence: None**

Advanced course that is intended to help students acquire knowledge of the amparo, its characteristics, processing, effects and background resources. The course requires prior knowledge of constitutional and fundamental rights. As a result of learning, students draw up protections based on case studies and in accordance with what they have learned in the course.

**General objective:** Upon completion of this course, students will understand the rules of merit and process for a protection of constitutional rights trial, in direct as well as indirect channels. Students will also study the legal nature of judgments handed down, the different means for contesting them, and the mechanisms devised to fulfill them.

**Key words:** System of laws and constitutional supremacy. Jurisdictional means of control of constitutionality. Proceeding for relief parties. Inadmissibility and stay of proceedings. Direct and indirect legal protection proceedings.

**Bibliography:** \* Fernández Fernández, Vicente., *El juicio de amparo en la jurisprudencia* / Vicente Fernández Fernández., 1a ed., México, D.F. : Porrúa : Tecnológico de Monterrey, c2007., [9789700775906].

### **D3017 Civil Trial Law**

**( 3 - 0 - 8. Prerequisites: [ D1007 ]. 4 LDF11, 4 LDP11, 4 LED11 )**

**Equivalence: D3003**

Advanced course in the area of civil law. Upon completion of this course, students will understand judg-

ments in civil matters, processing, requirements and effects. The course requires prior knowledge of the general theory of the process, as well as of the main legal institutions and the effects of compliance and breach of duty. As a learning outcome the students will draft lawsuits, defense documents, and evidence presentation.

**General objective:** Upon completion of this course, students will distinguish the different types of proceedings through which trials are conducted before the judicial authorities. Will be able to distinguish the different cases of admissibility for each type of legal proceedings and the requirements provided by law for admitting lawsuits and other petitions presented by the parties. Will be capable of precisely establish the stages and phases of proceedings and the timeliness in which each and every one of the procedural acts must be effected.

**Key words:** Civil proceeding. Civil ordinary trial. Means of contestation. Execution of judgment. Specific evidence. Special civil suits.

**Bibliography:** \* Ovalle Favela, José., *Derecho procesal civil* / José Ovalle Favela., 9a ed., México: Oxford University Press, 2003., [9706137521],[9789706137524].

### **D3018 Criminal Law Clinic**

**( 3 - 0 - 8. Prerequisites: [ D1019 , D2012 ]. 4 LDF11, 4 LDP11, 4 LED11 )**

**Equivalence: D3002**

The purpose of this advanced criminal law course is for students to be able to explain and give counsel regarding the essence, location, and scope of procedural criminal law and the sphere of action for subjects related to the judicial-procedural relationship. They also learn to explain characteristics of the jurisdictional body and the parts of the process. The course requires previous knowledge of criminal law. The learning outcome of this course is for students, using hypothetical cases, to understand the rulings of the Public Ministry regarding felonies, to prepare briefs for offers, acceptance, and resolution of evidence, identifying the importance of the conclusions. They also learn the diverse ways in which one can request modification or revocation of various judicial rulings in a criminal proceeding and they are able to

explain the legal basis, procedures, effects and other aspects of refutation.

**General objective:** Upon completion of this course, students will be able to analyze, describe and systemize the processes that comprise criminal procedure, from the creation of the material legal relationship of Criminal Law to its natural conclusion; the advanced forms of resolution; the parties involved and their difference from the parties in the proceedings; and resources and incidents that can be promoted. They will also know how to write the criminal briefs generated during the proceedings.

**Key words:** Final hearing and sentencing. Incident substantiation procedure. Contestation process. Criminal procedure. History of criminal procedure law. Criminal action. Proof in criminal procedures. Special procedures. People involved in criminal procedures. Stages of the adversarial system. Oral trial.

**Bibliography:** \* Monarque Ureña, Rodolfo., Derecho procesal penal esquemático / Rodolfo Monarque Ureña., 4a ed., México, D.F. : Editorial Porrúa, 2010., [9789700777030].

### **D3019 Civil and Mercantile Contracts** ( 3 - 0 - 8. Prerequisites: [ D2010 ]. 6 LDF11, 6 LDP11 )

**Equivalence: None**

The purpose of this advanced course in the field of civil and business law is for students to learn the characteristics of contracts. The course requires previous knowledge of judicial institutions for private law in the civil and business spheres. The learning outcome of this course is for students to apply the characteristics and effects of civil and business contracts to preparing contracts.

**General objective:** Upon completion of this course, students will become familiar with the components of contracts, as well as with the different civil and mercantile contracts regulated by law, their nature, classification, the obligations they generate for the contracting parties and the forms of termination.

**Key words:** Guarantee contracts. Brokerage. Financial factoring. Insurance. Aleatory contracts. Corpo-

rate and common-purpose contracts. Service agreements. Preparatory contracts: pre-contract. Contracts that foresee and resolve controversy. General doctrine of contracts. Purchase for resale. Trust deed. Supply agreement. Transport agreement. Turnkey and shelter contracts. Industrial property contracts. Editing contract. Performance bond. Commercial collateral.

**Bibliography:** \* Treviño García, Ricardo., Los contratos civiles y sus generalidades / Ricardo Treviño García., 7a ed., México : McGraw Hill, c2008., [9701063996], [9789701063996].

### **D3020 Labor Law II**

( 3 - 0 - 8. Prerequisites: None. 6 LDF11, 6 LED11 )

**Equivalence: None**

The purpose of this advanced law course is for students to acquire knowledge and skills that train them to analyze requirements in preparation for collective bargaining, whether contract- or conflict-related, and to discover possible solutions made possible by knowledge of work rules when confronting a labor problem of a collective nature. The course requires previous knowledge of individual work laws. The learning outcome of this course is for students to prepare the necessary documents for forming and registering a union. Students write a set of petitions for collective bargaining as well as management's response to those petitions. They understand collective bargaining techniques and write a collective work contract.

**General objective:** Upon completion of this course, students will be familiar with the legal framework of the Collective Labor Law, which, as part of the Labor Law instruments, governs relations between employee-employer groups and associations that are incorporated in order to achieve social balance and justice between the factors of capital and labor.

**Key words:** Introduction and general concepts. Internal work regulations. Professional association. Work-related collective bargaining. Strikes and lock-out and the labor authorities. Legal and financial work disputes.

**Bibliography:** \* Climént Beltran, Juan B., Ley federal del trabajo : comentarios y jurisprudencia / Juan B. Climént Beltrán., 29 ed. rev. y actualizada., México : Esfinge, 2008., [9789707822375].

### **D3021 Public Financial Law**

( 3 - 0 - 8. Prerequisites: [ D2022 ]. 6 LDP11, 6 LED11 )

**Equivalence: D2008**

The purpose of this advanced law and finance course is for students to learn to use legal norms related to fundamental themes of taxation by the State. The course requires previous knowledge of constitutional, civil and administrative law. The learning outcome of this course is for students to master the fundamentals of public finance law.

**General objective:** Upon completion of this course, students will understand the fundamental concepts of Public Finance Law; have acquired the necessary skills to interpret the legislation that contains the obligations and rights of individuals before the tax authorities; know the structure, organization and functioning of the Internal Revenue; identify the inspection tasks conducted by the tax authorities and the events that constitute tax offences and the cases and degrees of responsibility.

**Key words:** Public treasury. Federal public spending. Contributions for public spending. Tax obligations. Control of obligations. Infractions and sanctions. International tax regulations.

**Bibliography:** \* Mabarak Cerecedo, Doricela., Derecho financiero público / Doricela Mabarak Cerecedo., 3a ed., México : McGraw-Hill, 2007., [9789701062371], [970106237X].

### **D3022 Procedural Labor Law**

( 3 - 0 - 8. Prerequisites: [ D1002 ]. 8 LDP11 )

**Equivalence: D3005**

Advanced course in the area of labor law oriented toward students acquiring a working knowledge of adjective or procedural labor law. The course requires prior knowledge of substantive labor law. As a result of learning the student will face a labor demand, in-

dividually or collectively, and will be able to follow a procedure before any labor court and write and present developments related to labor matters.

**General objective:** Upon completion of this course, students will be able to analyze and solve concrete cases involving a worker or an employer in a work environment; and understand the ordinary Local and Federal Conciliation Boards' procedures, as well as the stages and procedures required by the Mexican Social Security Institute (IMSS). The course focuses on the rights of the IMSS affiliates and the procedure in the event of strikes and on writing the resources that need to be presented at each stage of the conciliation process.

**Key words:** Actions and exceptions regarding labor. Allegations in plenary suits. Mexican law regarding strikes. Plenary labor suit. Jurisdiction and competence. Strikes. Proof in labor matters. Incidental action. Resolutions in labor proceedings. Arbitration in labor proceedings.

**Bibliography:** \* Buen L., Néstor de (Buen Lozano), Derecho procesal del trabajo / Néstor de Buen Lozano., 18a ed., México, D.F. : Editorial Porrúa, 2008., [9789700767741].

### **D3023 Procedural, Administrative and Tax Law**

( 3 - 0 - 8. Prerequisites: [ D2015 ]. 8 LDF11, 8 LED11 )

**Equivalence: D3008**

Advanced course of study within the field of tax law and administrative law. On completion of this course, students will analyze and explain the means available to the individual against the government in defense of their legitimate interests. The course requires prior knowledge of tax law, fiscal and administrative. As a result of learning the student will differentiate the concepts of process and administrative procedure, and the phases that make up the latter, and the provisions to which it is subject, determining what constitutes administrative challenge, protection in administrative and tax matters.

**General objective:** Upon completion of this course, students will be able to analyze and explain the



theory of public function; the legal situation of civil servants and their principles of responsibility; the legal situation of individuals before the administration and the principles that govern the State's responsibility; means of defense of individuals against administrative actions and the administrative courts in which they are substantiated.

**Key words:** Legal protection in tax matters. Right of petition and consultancy in tax matters and implied negative response. Administrative lawsuit. Defense against acts established in domiciliary visit records. Discharge of legal tax obligations. Prescription and caducity in tax matters. Administrative resources. Means of defense in state legislations. Means of discharge of tax obligations. Principles of administrative proceedings. Proceeding and process.

**Bibliography:** \* Ortega Carreón, Carlos Alberto., Derecho procesal fiscal / Carlos Alberto Ortega Carreón., 1a ed., México : Porrúa, 2007., [9789700775500].

### **D3024 Amparo Trial I**

( 3 - 0 - 8. Prerequisites: [ D2009 ]. 8 LDF11, 8 LED11 )

**Equivalence:** D3011

Advanced course in the field of law that provides students with the constitutional and legal framework of the organization and regular operation of the Federal Judiciary with reference to judicial intervention concerning knowledge and substantiation of amparo law. The course requires previous knowledge of constitutional and fundamental rights. As a result of learning the student will understand the institution of amparo in a generic way, knowledge that can be applied in subsequent assignments.

**General objective:** Upon completion of this course, students will be familiar with and understand the legal framework of the constitution, as well as how the Federal Judicial Branch operates. They will also know the nature, origins, principles, structure and functioning of amparo (remedy for the protection of rights) in Mexico.

**Key words:** Proceeding for relief parties. Causes of inadmissibility of proceedings for relief. Petition for

legal protection . Appeal. Suspension of appeal. Direct legal protection . Indirect legal protection .

**Bibliography:** \* Fernández Fernández, Vicente., El juicio de amparo en la jurisprudencia / Vicente Fernández Fernández., 1a ed., México, D.F. : Porrúa : Tecnológico de Monterrey, c2007., [9789700775906].

### **D3025 Environmental Law and Sustainable Development**

( 3 - 0 - 8. Prerequisites: None. 8 LDP11, 7 LED11 )  
**Equivalence:** None

Advanced course which explores the various phases of an area that should guide the action of humanity in this century: environmental law. This course integrates governing regulations of the environment at the national and international level, and allows students to learn the legal bases and implications for sustainable development, which itself is the main principle of environmental law. Prior knowledge of Administrative Law is required. As the learning outcome, students will be able to understand and apply the basics of legal regulation in environmental matters.

**General objective:** Students will be able to successfully address legal issues linked to the environment by applying techniques and knowledge, as well as their capacity for analysis, argumentation and decision making, all of which are essential to achieve environmental legal ordinances.

**Key words:** Legislation. Sustainable development. Environmental law. Ecological law.

**Bibliography:** \* BRAÑES Ballesteros, Raúl, Manual de derecho ambiental mexicano, LIMUSA, Español.

### **D3026 Mercantile Trial Law**

( 3 - 0 - 8. Prerequisites: [ D3017 , D2011 ],[ D3017 , D3019 ]. 9 LDF11, 9 LED11 )

**Equivalence:** D3001

Advanced course in commercial law focused toward students acquiring specialized knowledge of the different commercial proceedings regulated in Mexico,



allowing them to develop their practice of commercial procedural law. The course requires previous knowledge of procedural law as well as knowledge of leading institutions and legal concepts in commercial matters. As a result of learning the student will conduct any kind of process of a commercial nature.

**General objective:** Upon completion of this course, students will become familiar with and be able to distinguish the different commercial procedures stipulated by Mexican laws; appreciate the actions that comprise the procedure and their appropriateness, and decide which procedure to use in a specific case; offer opinions and solutions, based on legal criteria, regarding commercial procedure issues.

**Key words:** Commercial executive trial. Evolution of commercial procedural law. Commercial plenary suit / trial. Bankruptcy proceeding. General rules for commercial proceedings. Preliminary means. Precautionary judgments.

**Bibliography:** \* Fernández Fernández, Vicente., Derecho procesal mercantil / Vicente Fernández Fernández, 2a ed., México D.F. : Porrúa c2008., [9789700776668].

### D3027 Amparo Trial II

( 3 - 0 - 8. Prerequisites: None. 9 LDF11, 9 LED11 )  
Equivalence: D3006

Advanced course in the area of law in which the student will obtain theoretical and practical knowledge on the handling of the defense, obtaining the perspective of amparo as a means of constitutional control. The course requires prior knowledge of the generalities of amparo. As a result of learning the student will process an injunction, whether direct or indirect, and know perfectly all these elements and resources that can be filed.

**General objective:** Upon completion of this course, students will be able to analyze and explain the forms of processing, jurisdiction and inadmissibility of both the direct and indirect amparo (remedy for the protection of rights), including the sentence and execution; delimit the cases of suspension and appeal in amparo lawsuits, highlighting the types of responsi-

bilities contained in these; and know the most common ways of writing briefs for processing an amparo.

**Key words:** Appeals. Direct legal protection . Proceeding for relief. Indirect legal protection by area. Legal protection proceedings. Stay in direct legal protection . Sentencing in legal protection . Fulfillment of legal protection sentences.

**Bibliography:** \* Fernández Fernández, Vicente., El juicio de amparo en la jurisprudencia / Vicente Fernández Fernández, 1a ed., México, D.F. : Porrúa : Tecnológico de Monterrey, c2007., [9789700775906].

### D3028 Alternatives for Dispute Resolution

( 3 - 0 - 8. Prerequisites: [ D3010 ]. 9 LDF11, 9 LDP11, 9 LED11 )

Equivalence: None

The purpose of this advanced law course is to provide students with substantive and procedural understanding for alternative dispute resolution through the study and practical application of knowledge acquired primarily through role plays. The course requires previous knowledge of the national judicial and political systems. The learning outcome of this course is for students to prepare a series of legal documents necessary for carrying out alternative procedures for dispute resolution, offering services in negotiation, mediation and arbitration.

**General objective:** Upon completion of this course, students will be able to analyze the importance of alternative methods for solving controversies, as one of the major mechanisms for solving conflicts in a peaceful manner, avoiding the use of traditional court proceedings, and reducing the disadvantages and problems of the same.

**Key words:** Negotiation. Alternative methods for solving controversy. Arbitration clause. Mediation and conciliation. Mediation agreement. Commercial, public, private and international arbitration. Arbitration decision. Execution of arbitration decision.

**Bibliography:** \* Silva Silva, Jorge Alberto., Arbitraje comercial internacional en México / Jorge Alberto Silva Silva, 2a ed., México : Oxford, 2001., [9706134689].

## **D3029 Introduction to Professional Development**

**( 2 - 0 - 2. Prerequisites: None. 9 LDF11, 9 LDP11, 9 LED11 )**

**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## DE Corporate Development

### DE1004 Business Technology and the OET

( 3 - 0 - 8. Prerequisites: None. 2 LCDE11 )

Equivalence: DE1003

This is a basic course in which students learn about the state of the art technologies that exist in the most important manufacturing and services sectors in a region. In addition students comprehend the international technological trends of each economic sector. As a result, the students are able to visualize and identify regional and global business opportunities by making use of the website "Observatorio Estratégico Tecnológico".

**General objective:** Students will be able to recognize the state of the art technologies used by enterprises from different economic sectors; identify business opportunities through the use of strategic databases ("Observatorio Estratégico Tecnológico"); identify technological trends of the high impact economic sectors regionally and globally in order to identify opportunities.

**Key words:** Business technology. Technology trends. Business opportunities in the field of technology .

**Bibliography:** \* Enríquez Cabot, Juan., El reto de México : tecnología y fronteras en el siglo XXI, una propuesta radical / Juan Enríquez Cabot., 1a ed., México : Planeta, 2000., [9706901450],[9789706901453].

### DE1005 Introduction to the Business Creation and Development Academic Program

( 3 - 0 - 4. Prerequisites: None. 1 LCDE11 )

Equivalence: None

This is a basic-level course where students are introduced to the university lifestyle and the major in which they are enrolled. No prior knowledge is required. At the end of the course, students will have a clear idea of the major and the university. They will also develop a personal and professional life plan.

**General objective:** At the end of the course, students will be aware of the graduate profile of their career, the competencies that they will develop, the labor field in which they may work, as well as the options for their professional development. They will also know the organizational structure of Tecnológico de Monterrey, its policies and academic regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Harvard business review on entrepreneurship., Boston, Mass. : Harvard Business School, 1999., [0875849105 (papel alcalino)], [9780875849102].

### DE2002 Innovation and Designing a Product or Service

( 3 - 0 - 8. Prerequisites: None. 5 LCDE11 )

Equivalence: DE2001

This is an intermediate course in which students apply their knowledge to create and design an innovative product or service. Concepts of creativity, innovation, and marketing are included in the development of a final project. The course requires prior knowledge of creativity, innovation, and project management. As a result, the student is able to analyze the processes of innovation and design that are applied in the development of new products or services. Students will also solve problems and analyze the impact of using innovation in new product development.

**General objective:** At the end of the course the student will be able to develop an innovative project concerning the design of a new product/service for a defined market, developing assessment of the customer experience with the new products.

**Key words:** Innovation. Opportunity. Customer. Design.

**Bibliography:** \* Davila, Tony., Making innovation work how to manage it, measure it, and profit from it/Tony Davila; Marc J Epstein; Robert D Shelton, Upper Saddle River, N. J.: Wharton School Pub., 2006, [0132044889 (electronic bk.)].

### DE3013 Pre-Incubation and Business Feasibility

( 1 - 4 - 8. Prerequisites: None. 6 LCDE11 )  
Equivalence: DE3005

This is an advanced entrepreneurship course where students create new product or service concepts; they also evaluate their marketing and financial feasibility in order to determine the enterprise's viability. Prior knowledge of functional prototype design, product design, innovation, and marketing, is required. As a result, students are able to generate marketing and financial feasibility reports for two business ideas.

**General objective:** At the end of this course, students will be able to identify business opportunities; they will also define products or services that solve these business opportunities. Students will be able to make feasibility reports in order to detect whether the defined product or service has a real market and a potential client; elaborate financial statements to determine the profitability of the company; and establish if the creation of the new venture is feasible. Finally they will decide on the business concept that they will develop to create their own enterprise.

**Key words:** Market feasibility. Business opportunities. Business idea: product or service. Financial feasibility. Coaching.

**Bibliography:** \* Echeverría, Rafael., La ontología del lenguaje / Rafael Echeverría., 6a ed., Santiago, Chile : J.C. Sáez., 2003., [9562012263].

### DE3014 Incubation and Business Models

( 1 - 4 - 8. Prerequisites: [ DE3013 ]. 7 LCDE11 )  
Equivalence: DE3006

This is a high level course in the area of Entrepreneurship where the student will build and validate a repeatable and scalable business model based on innovation and value creation. It requires previous knowledge on marketing and financial feasibility. As a result of this course, the student is expected to build an innovative business model and initiate the process of incubation based on the validation of the model in real market.

**General objective:** At the end of the course the student will be able to apply the knowledge acquired on innovation of business models; develop innovative and sustainable business models; develop business plans; create businesses. The content of this course includes: business models based on innovation and sustainability; business plan steps; development of business plans. Steps and development for a formal opening of a business.

**Key words:** Generation of businesses based on innovative business models.

**Bibliography:** \* Slywotzky, Adrian J., The upside : the 7 strategies for turning big threats into growth breakthroughs / Adrian J. Slywotzky with Karl Weber., 1st ed., New York : Crown Business, 2007., [9780307351012].

### DE3015 Business Incubation and Starting Up Strategic Operations

( 1 - 4 - 8. Prerequisites: [ DE3014 ]. 8 LCDE11 )  
Equivalence: DE3007

This is an advanced course in the field of entrepreneurship which is focused toward providing students with the techniques and tools that will allow them to create the strategy for starting up a new company. The course requires prior knowledge of business models, business plans, funding for new businesses, and sources for funding. As a learning outcome, the

student is expected to design the legal, operational, and marketing plans for the new company.

**General objective:** At the end of the course the student will be able to design and execute the implementation of a legal and operational plan, as well as the marketing of the company; analyze the importance of social capital and strategies in the context of the business; finally, define the systems of management of the company.

**Key words:** Strategic alliances. Business Incubation. Small business management. Sales. Networking.

### DE3016 Incubation and Financing of New Ventures

( 1 - 4 - 8. Prerequisites: [ DE3014 ]. 8 LCDE11 )

**Equivalence:** DE3008

This is an advanced course in the field of entrepreneurship that intends students to understand different aspects of financing new enterprises. The course requires prior knowledge of valuing businesses, accountancy, negotiation strategies. As a learning outcome, the student is expected to obtain the paperwork (contract, agreement) that guarantees the resources obtained from the financing source.

**General objective:** Upon completion of this course, students will be able to value companies since their establishment; seek financing schemes for setting up companies; understand the necessary procedures and access financing for entrepreneurial initiatives. To this end, the following topics are considered: financial models for valuing new businesses; funding sources; schemes to search for funding for entrepreneurial projects.

**Key words:** Financing. New ventures. Angel investors. Venture capital.

**Bibliography:** \* Timmons, Jeffry A., New venture creation : entrepreneurship for the 21st century / Jeffry A. Timmons and Stephen Spinelli, Jr., 7th ed., Boston, MA. ; Mexico City : McGraw-Hill/Irwin, c2007., [0073102792 (papel alcalino)], [0071254382 (ed. internacional)], [9780073102795 (papel alcalino)], [9780071254380 (ed. internacional)].

### DE3017 Strategies for Market Positioning

( 3 - 0 - 8. Prerequisites: None. 9 LCDE11 )

**Equivalence:** None

This is an advanced-level course in the entrepreneurship discipline where students develop marketing positioning and penetration strategies, as well as the development of a sales system in a family start-up.

**General objective:** Upon completion of this course, students will be able to create, develop and implement marketing strategy and sales systems to develop a sustainable competitive advantage in family start-up businesses.

**Key words:** Market penetration strategy for family start-up businesses. Sales & commercialization systems design for family start-up businesses. Family start-up business positioning.

**Bibliography:** \* Samama, Nel, 1963-, Global positioning : technologies and performance / Nel Samama., Hoboken, N.J. : Wiley-Interscience, c2008., [9780471793762 (cloth)], [0471793760 (cloth)].

### DE3018 Incubation and Strategic Control of Cash Flow

( 1 - 4 - 8. Prerequisites: None. 9 LCDE11 )

**Equivalence:** DE3009

In this advanced entrepreneurship course students learn the importance of cash flow in management control, sustainability, and future business growth. This course requires prior knowledge of management, business models, business plans, and sources of funding. As an outcome of the course, students develop a performance evaluation program for the new venture.

**General objective:** At the end of the course, students will be able to understand the relevance of management control in the operation of his/her company, analyze the performance indicators in the context of the new venture, analyze the importance of the role played by cash flow in the company's sustainability.

**Key words:** Incubation. Management control. New business operations.

## DE3019 Family Business Acceleration Models

( 3 - 0 - 8. Prerequisites: None. 9 LCDE11 )  
**Equivalence: DE3004**

This is an advanced course, which is intended to teach different business acceleration processes and develop analysis and synthesis skills, applying a business diagnostics model that enables the critical elements for generating a process of acceleration within the company to be identified. This course requires basic management and business strategy knowledge. As a learning outcome, students are expected to understand different acceleration models, and also carry out the diagnostic process on a family business, focusing on the development of a sustainable and feasible acceleration plan, and hereby developing their abilities in consulting, innovation and analysis of business processes.

**General objective:** At the end of the course, students will understand and will be able to apply the initial consultancy process to a family business. Within this course, students will develop a business plan for a gazelle venture, focusing on sustainable sales growth and identifying areas of opportunity to create value and increase profitability in established businesses.

**Key words:** Business acceleration. Management consultancy. Organizational diagnostics. Business acceleration.

**Bibliography:** \* Milan Kubr (coordinador), La consultoría de empresas. Guía para la profesión. , (3a edición). , Organización Internacional del Trabajo,.

## DE3020 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 LCDE11 )  
**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The outcome learning for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** At the end of this course, students have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to be employed.

**Key words:** Job-seeking tools. Life and Career Center. Professional development alternatives.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].



## DL Industrial Design

### DL1002 Design Fundamentals I

( 4 - 0 - 8. Prerequisites: None. 1 ARQ11, 1 LAD11, 1 LCMD11, 1 LDI11, 2 LMC11, 3 LPM12 )

**Equivalence:** AR00817, AR99817

This is a basic course for the Architecture, Industrial Design and Digital Art majors and aims to help students to acquire visual skills, basic psychomotor skills and the appropriate terminology for practicing creative design. It provides the formal and intellectual bases to train students in the area of design projects. No prior knowledge is required. As a learning outcome students will be able to conceive, complete and review two-dimensional works in diverse materials and techniques, accompanied by a dossier and a glossary of basic terms.

**General objective:** Upon completion of this course, students will be able to analyze and synthesize creative two-dimensional expressions. Students will develop their capability for observation, sensitivity, and perception. Students will apply the basic language of visual design and generate evidence of their representation, visual, and verbal skills.

**Key words:** Proportion. Shape. Color. Aesthetics. Open-channel flow.

**Bibliography:** \* Arnheim, Rudolf, Arte y percepción visual. Psicología de la visión creadora, Eudeba.

### DL1004 Design Fundamentals II

( 4 - 0 - 8. Prerequisites: [ DL1002 ]. 2 ARQ11, 2 LAD11, 2 LDI11 )

**Equivalence:** AR00826, AR99826, PV1004

This is a basic course for the Architecture, Industrial Design and Digital Art majors in which students will apply three-dimensional formal concepts and techniques. Students will use basic design methods and geometry to analyze and synthesize the forms. This course requires prior knowledge of basic design, geometry and techniques for creating models and mockups. As a learning outcome students will be able to develop and depict three-dimensional mod-

els and forms by applying the fundamental theory of aesthetics and perception. Students will also develop their depictive skills based on formal theories.

**General objective:** Upon completion of this course, students will be able to apply spatial language, discovering its creative possibilities; develop their three-dimensional composition skills with different materials and techniques, employing a self-discipline of clean and precise work; learn and apply a nomenclature specific to design, perception, and aesthetics.

**Key words:** Three-dimensional shapes. Meaning. Movement.

**Bibliography:** \* Dondis, Donis A, La organización visual, Gustavo Gili.

### DL1008 Models and Scale Models

( 3 - 0 - 8. Prerequisites: None. 1 ARQ11, 1 LDI11 )

**Equivalence:** DL1003

Basic course for architecture and industrial design in which students understand and experience the process of building mock-ups and physical models in order to present ideas and design concepts. No prior knowledge is required. As a result of learning the student will know the ideal material with which to create three-dimensional shapes based on basic shapes using different scales and will be able to manipulate materials using different processes, such as cutting, assembly, joining, sanding and finishing for presenting preconceived and personal ideas.

**General objective:** Students will be able to select and use suitable materials and techniques to represent their ideas in three dimensions with models and mock-ups.

**Key words:** Physical design models (Sketch Models, Visual Models and Functional Models). Design mock-ups. Safety equipment and procedures. Materials and equipment for modeling. Basic cutting, sticking, filing, smoothing and finishing techniques.

**Bibliography:** \* Navarro Lizandra, José Luis., Maquetas, modelos y moldes : materiales y técnicas para dar forma a las ideas / José Luis Navarro Lizandra., Castelló de la Plana : Publicacions de la Universitat Jaume I, 2000., [8480215437],[8480213043].

**DL1009 Creativity and Innovation**  
( 3 - 0 - 8. Prerequisites: None. 2 ARQ11, 3 LAD11, 1 LCDE11, 2 LDI11, 3 LPM12 )  
**Equivalence: DE1001, DL1006**

The purpose of this basic industrial design course, which applies across disciplines, is for students to develop ambidextrous thinking techniques (synchronized use of the right brain and the left brain) and techniques for adductive reasoning. In this course, students generate creative proposals, ideas and concepts using a playful, intuitive approach, differentiating creative and innovative principles and applying methodologies to accelerate, increase, evaluate and select innovative concepts derived through adductive reasoning. No previous knowledge is required. The learning outcome of this course is for students to be able to formulate problems and select specific methodologies to generate ideas that are \*outside of the box\* and produce possible solutions. Students demonstrate a creative attitude in approaching design projects, applying adductive reasoning as a tool for seeking and generating various innovative possibilities.

**General objective:** Students will be able to distinguish and create the conditions for creativity and innovation by generating innovative proposals individually or collaboratively and being able to handle the ambiguity and uncertainty of the creative process.

**Key words:** Creativity and innovation. Creative methodologies. Abductive thinking.

**Bibliography:** \* De Bono, Edward, 1933-, El pensamiento lateral: manual de creatividad / Edward De Bono; revisión científica de Bernardo Muniesa., México : Paidós, 1998., spaeng, [9688532339],[9789688532331].

**DL1010 Model and Prototypes Workshop I**  
( 3 - 0 - 8. Prerequisites: None. 2 LDI11 )  
**Equivalence: DL2002**

This is a basic level course, intended to develop skills for physical three-dimensional modeling based on dimensions, specific materials and finishes. Previous knowledge of geometry and basic techniques for making models is required. As a result of learning, the student is expected to possess skills and knowledge concerning to the use of tools, materials and finishes to develop and obtain professional prototypes. The student will learn the importance of planning for a prototype as well as its variables. In addition the student will use different finishing techniques on various materials to obtain professional models and prototypes.

**General objective:** Students will be able to use manual and machine techniques to create models and prototypes of industrial products. They will know, apply and have a good command of finishing techniques and new applications for materials. They will be able to plan the steps for generating prototypes with existing materials to be used, including working with suppliers. Students will focus on producing quality work in the assembly, cuts, sticking, dimensioning and finish of the prototype.

**Key words:** Gestural Models. Conceptual Models. Ergonomic Models. Mechanical Models. Geometric Models (details of the products' geometry). Appearance model (finishes). Final Model.

**Bibliography:** \* The origin of things : sketches, models, prototypes / Thimo te Duits ; with contributions by Philip van Daalen . [et al.], Rotterdam : Museum Boijmans Van Beuningen : NAI Publishers, 2003., [9056623184 (hd. bd.)].

**DL1011 Product Design**  
( 3 - 0 - 8. Prerequisites: [ DL1004 ]. 3 LDI11 )  
**Equivalence: None**

This is a basic course intended to apply elemental design methodologies to project development. In this course the student will consider the expressive importance of forms as well as their semantic mean-

ings and their relationship to human and functional factors. Topics related to form and function will be studied together with the product significance, placing particular emphasis on the role of design in the sustainable development of the material culture. This course requires previous experience in fundamental design, drawing and geometry. As a learning outcome students are expected to carry out design projects based on low complexity products that fulfill basic requirements of function and form. They will demonstrate the relationship between form/function and the product's adaptation to the human being as well as expression of cultural values.

**General objective:** Upon completion of this course, students will understand the importance of the form-function relationship in product design; be familiar with the design process; recognize the aesthetic, cultural and functional values of the region's artisanal and semi-industrial design; apply their knowledge and skills to create ceramic and plastic foam three-dimensional models; generate production drawings.

**Key words:** The design process. Identification of real and potential needs. Human factors, socio-cultural factors. Form-function relationship and emotional design. Models, prototypes and production drawings.

**Bibliography:** \* Ricard, Andre, 1929-, *Diseno y calidad de vida* Andre Ricard., [Barcelona] Fundacion BCD, Departamento de Promocion del Diseno [1985], . Promoción del Diseño [1985], .

### **DL1012 Design Ergonomics** ( 3 - 0 - 8. Prerequisites: None. 3 LDI11 ) **Equivalence: DL2008**

The purpose of this basic-level industrial design course is to offer students the theoretical tools and fundamental practices to understand and identify the relationships established among the user, the object and the environment in developing any activity. No previous knowledge is required. The learning outcome of this course is for students to recognize the ergonomic system as indissoluble by applying the user-object-environment-activity relationship in

simple design projects that use basic research techniques to generate ergonomic requirements based on object use.

**General objective:** Students will identify and recognize the leading role of human beings as users of industrial design products; understand the basic theory of human factors and ergonomics; apply basic observation techniques to identify the relationship of the user with the object and the environment during the activities conducted; apply basic analysis techniques to define the design opportunities arising from observation techniques; propose design solutions according to the problems analyzed during the research.

**Key words:** Universal and inclusive design. Human factors and ergonomics. Ethnographical research techniques. Anatomy, physiology and anthropometry. Sensation, perception and cognitive processes. Social and cultural considerations during the use of objects. Ergonomicity and usability.

**Bibliography:** \* Kroemer, K. H. E., 1933-, *Ergonomics : how to design for ease and efficiency* / Karl Kroemer, Henrike Kroemer, Katrin Kroemer-Elbert., 2nd ed., Upper Saddle River, NJ. : Prentice-Hall, 2001., [0137524781].

### **DL1013 Design and Ethnography Methods** ( 3 - 0 - 8. Prerequisites: None. 3 LDI11 ) **Equivalence: None**

Basic course for Industrial Design students where they will be introduced to Design Thinking methods as well as to the methodology and techniques used in design and new product development processes. This will include need identification factors, ethnography and design research, generation of creative ideas and detailed design of selected concepts. This course does not require previous related knowledge. As a result of this course, the student will learn and be able to perform identification, research and design activities, as well as use methodology tools efficiently in the design projects.

**General objective:** Students will be able to apply the tools, theories and methods used in the process of product design, services and experiences, employing ethnographic techniques used in the professional practice of design; and apply the findings of these studies into design requirements.

**Key words:** Ethnography. Abductive thinking. Design requirements. Design and new product development. Value perception in users.

**Bibliography:** \* Fetterman, David M., *Ethnography : step by step* / David M. Fetterman., Newbury Park Ca. : Sage , c1989., [0803928904], [0803928912],[pbk].

### **DL1014 Introduction to Design**

**( 3 - 0 - 4. Prerequisites: None. 1 LDI11 )**

**Equivalence: None**

The purpose of this basic course is to induct students into the setting of university lifestyle and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled; including the competencies, the working field and the professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: professional development area.

**Bibliography:** \* bruno munari, artista y diseñador, [88-420-6439-4].

### **DL2019 Product and service design**

**( 6 - 0 - 12. Prerequisites: [ DL1011 ]. 4 LDI11 )**

**Equivalence: DL2005**

This is an intermediate level course, which is designed to help students work on design projects related to the necessities of packaging, display, promotion and sales of consumer products. These projects will be developed mainly from standardized presentation materials and will include important considerations in terms of brand management and utilization of graphics. Previous knowledge is required in product design, ergonomics and design methods. The learning outcome for this course is that the students create design projects that meet requirements for assembly, lightness, transport, warehousing and pliability in the product concept and consider criteria of traffic, visibility, safety, etc., for example, in the conception of commercial display spaces.

**General objective:** Students will integrate identity and brand criteria into the product and service design process; add space, storage, assembly and production requirements to the formal and functional factors; apply their knowledge and skills in the creation of three-dimensional models with laminated materials and assemblages; generate production plans and digital presentation slides.

**Key words:** Design requirements. Laminates. Brand identity. Trade fair. Packaging and point-of-sale.

**Bibliography:** \* Cross, Nigel, 1942-, *Métodos de diseño : estrategias para el diseño de productos* / Nigel Cross ; traducción Fernando Roberto Pérez Vázquez., México : Limusa Noriega, 2003., spaeng , [9681853024],[9789681853020].

### **DL2020 User-centered Design**

**( 3 - 0 - 8. Prerequisites: [ DL1012 ]. 5 LDI11 )**

**Equivalence: DL2013**

The purpose of this intermediate industrial design course is for students to be able to apply knowledge of human factors and ergonomics in user-centered design projects offering concrete ergonomic solutions. The course requires previous knowledge of ergonomics, design methods and ethnographic research techniques. The learning outcome of this

course is for students to apply ethnographic research techniques to a project aimed at the use of objects; complete a user-centered design project based on ethnographic research, ergonomic concepts and human factors; propose ergonomic recommendations and design solutions, depending on the project theme; apply usability methodology within the projects.

**General objective:** Students will apply the concepts of ergonomics, human factors and interfaces when undertaking a user-centered design project; apply ethnographic techniques to design instruments to be used in field research; analyze the results obtained in order to establish the ergonomic requirements; propose the appropriate recommendations and design concepts for the project in question; and use product evaluation techniques based on the concepts of usability to conclude the project.

**Key words:** Usability. Design centered on the user, ergonomics and human factors. Ethnography and field research. Interfaces and human interaction.

**Bibliography:** \* Jordan, Patrick W., An introduction to usability / Patrick W. Jordan., London : Taylor & Francis, c1998., [0748407626 (rústica)], [0748407944 (caja)].

### **DL2021 Experience Design I** ( 3 - 0 - 8. Prerequisites: [ DL2019 ]. 5 LDI11 ) **Equivalence: None**

This is an intermediate course, which enables students to develop design projects that, in terms of their concept, consider the end-users and, in terms of functionality, include assemblies and basic mechanical elements. The course will include topics related to the social and economic aspects of sustainable development. Previous knowledge is required in product and service design, ergonomics, design methods and ethnographic research techniques. The learning outcome for this course is that the students develop design projects that meet emotional and symbolic requirements in the product concept and consider manufacturing criteria in the combination of materials.

**General objective:** Students will integrate ergonomic and cultural identity criteria into the product and service design process; add emotional design and usability requirements to the formal, functional and production factors; include decisions on plastic materials, assembly and basic mechanisms into the design decision process; generate production and assembly plans and instruction manuals, as well as digital models and digital presentation slides.

**Key words:** Mechanisms. Emotional design. Ethnographic methods. Polymer design. Assemblies. Computer-aided modeling.

**Bibliography:** \* Hernández Osoria, Saulo., Usabilidad y diseño centrado en el usuario utilizando prototipos : un enfoque práctico / Saulo Hernández Osoria., Monterrey : 2003.

### **DL2022 Advanced Digital Modeling** ( 3 - 0 - 8. Prerequisites: None. 5 LDI11 ) **Equivalence: None**

This is an intermediate course, designed to help students use surface modeling programs to virtually depict their design ideas. Previous knowledge is required in two-dimensional graphic programs, such as Illustrator and Photoshop, as the students should understand spatial movement and management of the tools used to generate basic two-dimensional shapes and create digital renderings and representations of the objects that are designed. The learning outcome for this course is that the students execute their designs on surfaces, utilizing these software programs as design tools rather than considering them as limitations.

**General objective:** Students will be able to understand the basic principles for advanced digital modeling, the components of which result in a specific product or the combination of several products; understand the basic principles of using lighting, materials and visual textures to generate product and scenery simulations (renders); and depict their 2D designs with the support of virtual digital models consisting of 3D surfaces.



**Key words:** Three-dimensional formal value. Space and rotation of three-dimensional products in a two-dimensional plane in sceneries. Formal model with different planes on the surface. Value generated in modeling, values and weight in rendering. Formal classification of surfaces by and for products.

**Bibliography:** \* Cozzens, Richard., Catia V5 Workbook Releases 8 & 9., Cedar City, Utah. : SDC Publications, 2002.

### **DL2023 Model and Prototype Workshop II**

**( 3 - 0 - 8. Prerequisites: None. 5 LDI11 )**  
**Equivalence: DL2006**

The purpose of this intermediate industrial design course is for students to design, test, assemble and manage materials for constructing models and prototypes intended to solve concrete problems of design, ergonomics, esthetics, feasibility, etc. The course requires previous knowledge of materials management, the iterative design process, the use of machinery and characteristics of materials. The learning outcome of this course is for students to generate high-quality prototypes for different phases of the design process, including design analysis and promotion of design iteration and improvement.

**General objective:** Students will be able to integrate techniques for handling materials (foam, wood, metal, plastics, etc.) in the different phases of the design process that will result in the construction of models and prototypes, and experiment and learn about the diverse surface finish techniques; plan the steps to obtain a prototype with specific characteristics according to its use, evaluation, analysis, market testing, etc. by means of rapid applied projects based on real design cases.

**Key words:** Models and their use. Prototypes and their use. Materials and techniques of use.

**Bibliography:** \* Chavarría, Joaquim., The big book of ceramics : a guide to the history, materials, equipment, and techniques of hand-building, molding, throwing, kiln-firing, and glazing pottery and other ceramic objects / Joaquim Chavarría., New York : Watson-Guptill, c1994., engspa, [0823005089 (rústica)].

### **DL2024 Experience Design II**

**( 3 - 0 - 8. Prerequisites: [ DL2021 ]. 6 LDI11 )**  
**Equivalence: None**

This is an intermediate level course, which enables students to develop design projects that, in terms of their concept, consider special populations, commitment to the community and the incorporation of mechanical elements in kinetic design. The course will include topics related to the social aspect of sustainable development. Previous knowledge is required in the design of products, services and experiences, design methods, ethnographic research techniques, ergonomics and creative techniques. The learning outcome for this course is that the students develop projects that meet the requirements of high social content in relation to public institutions or in support of special populations.

**General objective:** Students will integrate mobility and physical and cognitive rehabilitation criteria into the product, service and experience design process; include universal (inclusive) design decisions in the process using advanced mechanisms; generate production and assembly plans and instruction manuals, as well as advanced prototypes.

**Key words:** Usability. Physical rehabilitation. Cognitive rehabilitation. Advanced prototypes. Kinetic design.

**Bibliography:** \* Flores, Cecilia., Ergonomía para el diseño / Cecilia Flores., 1a ed., México : Librería, 2001., [9685374023],[9685850265].

### **DL2025 Language and Meaning of Objects**

**( 3 - 0 - 8. Prerequisites: None. 6 LDI11 )**  
**Equivalence: DL2009**

This is an intermediate course, which enables students to understand that usable objects and their systems are message carriers in multi-sensory human communication and are closely related to technology, culture and the socioeconomic environment of their users. Previous knowledge is required in ergonomics, design fundamentals and the design of products, services and experiences. The learning



outcome for this course is that the students be able to understand the research methodologies used to identify, interpret and analyze the aesthetic-symbolic and emotional values of users in relation to their environment, as well as apply observation and research techniques related to the meaning of objects during the design process.

**General objective:** Students will be able to identify the messages, meanings, sensations, feelings and emotions that their designs should convey and inspire, and translate them on the basis of the semantic features of the product and/or service.

**Key words:** Emotional design. Levels of object significance. Extraction of symbolic requirements. Design and communication. Semantic analysis of shape.

**Bibliography:** \* Norman, Donald A., El diseño emocional : por qué nos gustan (o no) los objetos cotidianos / Donald A. Norman., Barcelona ; México : Paidós, c2005., spaeng, [8449317290],[9788449317293].

## DL2026 Advanced Digital Representation Techniques

( 3 - 0 - 8. Prerequisites: None. 6 LAD11, 6 LDI11 )  
Equivalence: DL2007

This is an intermediate level course which will enable students to learn and combine various techniques with a diversity of tools and digital or manual representations, using different media or technologies, such as digital tablets, programs like Illustrator, Photoshop, Painter X, Wacom tablets, Scanner, 3DRhino, etc. Previous knowledge is required in freehand drawing, computerized drawing and digital modeling. The learning outcome for this course is that the students create drawings and illustrations using advanced expression and communication techniques.

**General objective:** Students will be able to apply and choose different manual and digital techniques according to their own knowledge and the system selected for presenting their designs. They will also be able to generate a suitable technique for each representation, as appropriate.

**Key words:** Virtual modeling. Parametrical modeling. Digital technical drawing. Vector drawing. Pixel drawing. Scanning and digital animation. Virtual scenarios. Three-dimensional modeling.

**Bibliography:** \* Eissen, Koos., Sketching : drawing techniques for product designers / Koos Eissen and Roselien Steur., Amsterdam : Bis, c2007., [9789063691714].

## DL2027 Futurology in Industrial Design

( 3 - 0 - 8. Prerequisites: None. 7 LDI11 )  
Equivalence: DL2003

This is an intermediate course in industrial design which enables students to understand and reflect on the historical origin, past and present of Industrial Design, relating it to its socioeconomic, scientific and technological context, to understand current trends in order to project future scenarios within the discipline. This course does not require previous knowledge. The learning outcome for this course is that the students reflect on the historical evolution of industrial design, relating it to the development of science, technology and the arts; adopt a critical stance on the current state of design; and create perspective-based future scenarios for the profession.

**General objective:** Students will appreciate the evolution of humanity in connection with the development of technology, science and design; understand the value of design as a fundamental component of humanity's material culture; link art and aesthetic trends with industrial design; identify international contemporary design trends; set parameters to define future career paths.

**Key words:** Science and technology. Art movements. Industrial revolution. Schools of industrial design. Design tendencies of 21st century.

**Bibliography:** \* Salinas Flores, Oscar, Historia del diseño industrial / Oscar Salinas Flores, Trillas.

### **DL3014 Product and System Design I** ( 6 - 0 - 12. Prerequisites: [ DL2024 ]. 7 LDI11 ) **Equivalence: DL3001**

This is an advanced level course, designed to help students develop design projects that consider future scenarios, cutting-edge technologies and technological innovation. The course will deal with topics related to development that is sustainable in its environmental, social and economic aspects. Previous knowledge is required in the design of products, services and pilot programs, semantics and human factors. The learning outcome for this course is that the students execute design projects that fulfill the requirements for technological prospects and their significant application for end-users, specifically in responsible social projects.

**General objective:** Students will integrate innovative electronic technology-based product or product system forecasting into the product, service and experience design process. By exploring new social scenarios and behaviors, they will instigate the search for and application of new user-oriented materials and technologies.

**Key words:** Prospective. Electronic design. Social intelligence. Applied technology.

**Bibliography:** \* Flores, Carol A. Hrvol, 1944-, Owen Jones : design, ornament, architecture, and theory in an age in transition / Carol A. Hrvol Flores., New York : Rizzoli, 2006., [0847828042],[9780847828043].

### **DL3015 Product and System Design II** ( 6 - 0 - 12. Prerequisites: [ DL3014 ]. 8 LDI11 ) **Equivalence: DL3006**

This is an advanced course, which is designed to help students develop design projects for pilot programs and systems. The course includes concepts of complex, holistic and systemic thinking, with the goal of contributing to development that is sustainable in its environmental, social and economic aspects. Previous knowledge is required in the design of products, services and pilot programs, semantics and human factors. The learning outcome for this course is that the students develop projects that fulfill the basic so-

cial, economic and environmental requirements for sustainable development.

**General objective:** Students will integrate design management, cultural identity, environmental sustainability and strategic vision criteria into the product, service and experience design process, focusing on the use of validation studies to analyze the impact of the proposals.

**Key words:** Systems thinking. Sustainable design. Design validation. Design of experiences and services.

**Bibliography:** \* Diseño industrial : herramienta de competitividad para la pequeña y mediana empresa / coordinador, Francisco Javier Gutiérrez Ruiz., 1a ed., México : UAM, Unidad Azcapotzalco, División de Ciencias y Artes para el Diseño, Departamento de Eval, [9706549420].

### **DL3016 Innovation, Design and Business Setting** ( 3 - 0 - 8. Prerequisites: None. 8 IQA11, 8 LDI11 ) **Equivalence: None**

This is an advanced course designed to provide students from diverse disciplines with the ability to understand the principles of value innovation driven by design, applying these principles to a strategic business environment. This course will focus on the principles of additive design thinking, beginning with the creation of scenarios through creative visualizations (inspiration) of the exploration of business opportunities and generation of innovative products and services (ideation) and the realization of the value innovation project through the construction of models and prototypes (implementation). This course requires previous knowledge of creativity and innovation techniques. The learning outcome for this course is that students be able to develop proposals for value innovation in which the product, service, or experience designed are just as important as the generation of creative business models.

**General objective:** Students will be able to identify business opportunities and, through systemic thinking, propose, validate and effectively communicate

innovative proposals for products, services, business models and/or sustainable business systems.

**Key words:** Value, perception of value, practical value and economic value, value equation in the design. Incremental, progress and disruptive evaluation. Business model. Value proposal.

**Bibliography:** \* Brown, Tim, 1954-, Change by design : how design thinking can transform organizations and inspire innovation / Tim Brown., 1st ed., New York, NY : HarperCollins Publishers, 2009., [9780061766084].

### **DL3017 Professional Insertion Project** ( 3 - 0 - 8. Prerequisites: [ DL3015 ]. 9 LDI11 ) **Equivalence: None**

This is an advanced course, which aims to encourage student leadership in design teams and the students' ability to formulate a strategic product plan and create innovative business and marketing models. The course will include topics related to the environmental and economic aspects of sustainable development. Previous knowledge is required in advanced design processes and human, technological, business and production factors. The learning outcome for this course is that the students develop a project that includes the practice of experiential design as a complement to their learning and that they participate in the development of their community.

**General objective:** Students will integrate criteria for management, negotiations and professional liaison with local industry into the product, service and experience design process.

**Key words:** Strategic design. Professional practice of design. Project management. Innovative design-based business models.

**Bibliography:** \* Industrial design : reflection of a century / edited by Jocelyn de Noblet., Paris : Flammarion/APCI, c1993., [2080135392].

### **DL3018 Introduction to Professional Development**

( 2 - 0 - 2. Prerequisites: None. 9 LDI11 )  
**Equivalence: None**

This is an end of degree program course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## DS Sustainable Development

### DS1002 Ecosystems and Biodiversity ( 3 - 0 - 8. Prerequisites: None. 2 IDS11 )

**Equivalence:** None

This is a basic course intended to present the inherent complexity of ecosystems and their relationship with biodiversity, as well as an understanding of the vulnerability of ecosystems in the face of climate change, and the ecological and economic value of biodiversity, as well as the services provided by ecosystems. No previous knowledge is required. As a learning outcome students will analyze and value the role of biodiversity in the health of ecosystems, and appreciate the value, both ecological and economic, of biodiversity.

**General objective:** At the end of the course the student will be able to understand the basic principles of the science of ecology, the role of climatic factors in the configuration of ecosystems and their biodiversity, biological populations and ecological relationships: balance, carrying capacity, competition and predation; analyze the dynamics of biological populations, habitat fragmentation, its causes and effects, as well as the vulnerability of biodiversity and ecosystems to climate change; understand the bases and criteria for the adaptive management of ecosystems and biodiversity, its services and elements for the protection of biological diversity and its functions; value biodiversity ecologically and economically; and analyze the importance of biodiversity for different cultures and societies.

**Key words:** Biodiversity. Population dynamics. Ecosystems.

**Bibliography:** \* Nature and human society : the quest for a sustainable world : proceedings of the 1997 Forum on Biodiversity / Board on Biology, National Research Council ; Peter H. Raven, editor ; Tania Williams, associate editor., Washington, D.C. : National Academy Press, 1997., [0309065550 (encuadrado)].

### DS1003 Natural Sciences and Sustainable Development

( 3 - 0 - 8. Prerequisites: None. 2 ARQ11, 1 IA 11, 1 IAB11, 1 IBN11, 1 IBT11, 2 IC 11, 1 IDA11, 1 IDS11, 1 IFI11, 1 IIA11, 1 IIS11, 1 IMA11, 1 IME11, 2 IMI11, 2 IMT11, 1 INCQ13, 1 INT11, 1 IQA11, 1 IQP11, 1 ISC11, 1 ISD11, 1 ITC11, 1 ITE11, 1 ITIC11, 1 ITS11, 3 LDI11 )

**Equivalence:** None

The purpose of this basic-level natural science course is for students to observe the relationships between society and scientific and technological developments as a reference point for their personal, professional and civic actions and decisions. No previous knowledge is required. The learning outcome of this course is for students to acquire a critical outlook regarding the impact of science and technology on factors that limit sustainable development.

**General objective:** Upon completion of this course, students will be able to analyze critically and judge for themselves the impact of science and technology on society.

**Key words:** Science and technology. Climate change. Sustainable development. Environmental science. Molecular biology and its implications. Environmental sociology.

### DS1004 Sustainable Development Principles

( 3 - 0 - 8. Prerequisites: None. 3 IDS11 )

**Equivalence:** None

This is a basic course intended to present the basic dimensions of sustainability, as well as the interactions between these dimensions in a systemic context. No previous knowledge is required. As a learning outcome students will utilize the basic dimensions of sustainability to sketch out strategies that underpin sustainable development.

**General objective:** Upon completion of this course, students will be able to understand the concept of sustainable development and sustainability, as well as its four basic dimensions: economic, environmental, social and temporal; identify the diverse interactions and synergies between the components within systemic- and lifecycle-oriented frameworks, as well as the concepts of sustainable consumption and production within a supply chain; understand the availability of ecological resources, as well as of population trends and their ties with the demand and appropriation of resources; analyze and comprehend the socioeconomic and political challenges regarding the availability of natural resources and the problems arising from the loss or decline of these resources, including financial costs related to the possible deficit of natural resources, such as water, forests, soil, etc; discuss the nature of sustainable development strategies and current practices, and understand the key stages for initiating or improving sustainable development strategies.

**Key words:** Sustainable development. Natural resource assessment.

**Bibliography:** \* In search of sustainability / edited by Jenny Goldie, Bob Douglas and Bryan Furnass., Collingwood, Vic. : CSIRO Publishing, c2005., [0643090622].

## DS1005 Climate Change and Energy Use

( 3 - 0 - 8. Prerequisites: None. 1 IID12, 1 IIN12 )  
Equivalence: None

This is an entry level course that aims to present scientific evidence of the impact of trace components on the composition of the atmosphere, and their relationship to solar radiation and climate change. Furthermore, the course aims to develop an understanding of the relationship to energy supplied by fossil fuels. The course requires previous knowledge of general chemistry and physics. As a learning result, the student will evaluate the effect of fossil fuels on the atmosphere and the possibility of inflicting man-made climate change on Earth; as well as the role of current and future technology fixtures in the efficient use of energy in reducing its impact on the global climate.

**General objective:** Upon completion of the course, students will be able to understand the role that low concentration of gaseous compounds play on the terrestrial atmosphere in reference to climate change, as well as the potential for acidification of the oceans and destruction of the ozone layer; explain in basic terms the function of carbon dioxide and other greenhouse gases and their potential in reinforcing atmospheric re-radiation, as well as the potential acidification of oceans due to carbon dioxide and the subsequent degradation of marine ecosystems; understand and explain the basic principles of renewable energy sources, such as solar collectors, photovoltaic systems, tides and waves, wind, and the availability of energy through biomass using agricultural and forest residues, as well as passive elements in construction and linking the basic principles of renewable energy to relevant technology for the student's professional career; understand the impact of climate change and the strategies for mitigation and adaptation.

**Key words:** Climate change. Greenhouse gases. Renewable energy sources.

**Bibliography:** \* Burroughs, William James., Climate change : a multidisciplinary approach / William James Burroughs., 2nd ed., Cambridge ; New York : Cambridge University Press, 2007., [9780521690331 (pbk.)],[0521690331 (pbk.)],[9780521870153 (hbk.)],[0521870151 (hbk.)].

## DS1006 Introduction to Sustainable Development Engineering

( 3 - 0 - 4. Prerequisites: None. 1 IDS11 )  
Equivalence: None

The purpose of this basic course is to introduce students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.



**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Enero 2011, Legislación Académica para Alumnos de Profesional.

### **DS2001 Industrial Ecology** ( 3 - 0 - 8. Prerequisites: [ IQ2004 Corequisite ]. 6 IDS11 ) **Equivalence: None**

This is an intermediate course, which introduces students to the concept of industrial ecology and exposes them to the structure of material and energy input and output as it applies to products, processes and services. The course will include discussion of a systemic vision's purpose for industrial ecology and its relation to the concept of lifecycle. This course does not require previous knowledge. The learning outcome of this course is that students will be able to quantify the efficiency of system integration and propose strategies for improvement.

**General objective:** Upon completion of this course, students will be able to understand the principles of industrial ecology, systems and industrial symbiosis; analyze industries' input-output to improve the efficiency and effectiveness of system integration; evaluate the integration efficiency of industrial parks, including raw material, product, waste and personnel transportation systems; understand and establish balance analysis boundaries; and link industrial ecology to life cycle thinking.

**Key words:** Life-cycle analysis. Industrial ecology. Industrial symbiosis.

**Bibliography:** \* Graedel, T. E., Industrial ecology and sustainable engineering / T.E. Graedel, B.R. Allenby., Upper Saddle River, NJ : Prentice Hall, c2010., [9780136008064 (papel alcalino)], [0136008062 (papel alcalino)].

### **DS3002 Natural Resources Management and Climate Change**

( 3 - 0 - 8. Prerequisites: [ DS1002 ]. 6 IDS11 )  
**Equivalence: None**

This is an advanced course that is aimed at presenting and discussing the impact of misusing resources on climate change and ecosystems. As a learning outcome, the student will propose strategies for the sustainable management of natural resources and strategies for the mitigation and adaptation of systems to support sustainability.

**General objective:** On completing the course the student will be able to understand and analyze the carrying capacity of ecosystems; understand the concept of ecosystem management, traditional management systems, a model for ecosystem management, uncertainty and complexity in the management of natural systems, and adaptive management; understand the interaction between nature and human beings, taking into consideration communities, interest groups and collaborative work; analyze and understand the taking over of resources and its impact on climate change and ecosystems; discuss and generate mitigation, adaptation and sustainability strategies; analyze and discuss the use of carbon credits and related legislation; and understand and discuss the social impact of climate change and the management of natural resources.

**Key words:** Ecosystem management. Carrying capacity of ecosystems. Mitigation of and adaptation to climate change.

**Bibliography:** \* Orostegui, Vicente , Thresholds of Climate Change in Ecosystems (Climate Change and Its Causes, Effects and Prediction). , 2010, Nova Science Pub Inc. , [13:978-1607414872].



### DS3003 Social Responsibility and Corporate Sustainability

( 3 - 0 - 8. Prerequisites: [ DS3002 ]. 7 IDS11 )

Equivalence: None

This advanced course introduces the concept of corporate social responsibility and its relationship to sustainability, and presents the importance of interest groups in achieving this relationship and the relevance of the social dimension. No prior knowledge is required. As a learning outcome students will evaluate the strategies of businesses and corporations for connecting with the community and ecosystems, and propose measures to improve their performance.

**General objective:** At the end of the course the student will be able to identify legislation and codes of conduct, both domestic and international, focused toward the protection and improvement of energy, the environment, and societies; review the concepts of viability, philanthropy, business perspective, corporate social responsibility and corporate sustainability, including the Global Compact; understand the business system and its relation to interest groups and the environment within the framework of sustainability; and apply the principles of strategic planning so that the company makes a better contribution to sustainable development.

**Key words:** Sustainable development. Viability. Business Ethics.

### DS3004 Businesses and Ecosystems Conservation

( 3 - 0 - 8. Prerequisites: [ DS3003 ]. 8 IDS11 )

Equivalence: None

This advanced course introduces students to and gives them the opportunity to discuss the link between the services supplied and regulated by ecosystems and the opportunities to create businesses that promote the conservation of these ecosystems and biodiversity. No prior knowledge is required. As a learning outcome students will evaluate the risks and opportunities of these businesses. They will also know how to use the Equator Principles for conservation-related financing and international policies.

**General objective:** On completing the course the student will be able to understand the Millennium Ecosystem Assessment; understand and analyze markets for domestic and international ecosystem services as economic income alternatives for rural, primary industrial and other types of sustainable development; identify business risks and opportunities related to the conservation and production of forest and livestock ecosystems; discuss how best to make use of international policies for the conservation of ecosystems and the development of green businesses; understand the Equator Principles for project financing.

**Key words:** Millennium ecosystem assessment. Ecosystem services. Equator principles.

**Bibliography:** \* World Business Council for Sustainable Development; Meridian Institute, World Resources Institute, Corporate Ecosystem Services Review. Guidelines for Identifying Business Risks and Opportunities Arising from Ecosystem Change, Inglés, [978-1-56973-679].

### DS3005 Capstone Project for Sustainable Development

( 3 - 0 - 8. Prerequisites: None. 9 IDS11 )

Equivalence: None

This is an advanced course where the students are faced with a real problem. The students work in teams and are asked to apply the knowledge and skills developed through their undergraduate courses to propose alternatives to solve the problem. Students must consider the different aspects of sustainable development: environmental, social and economic, in their analysis and proposal. As a result of this course, the students will be able to apply knowledge on sustainability and efficient use of energy to an open ended problem.

**General objective:** Upon completion of the course students will develop a project based on an open problem and generate possible solutions, from the preliminary economic justification to definition of process equipment required; verify the economic feasibility of the project; and present and defend the final report before a panel of professors.

**Key words:** Integration project. Sustainable development. Sustainable development. Project assessment. Energy efficiency. Efficient energy use.

## **DS3006 Introduction to Professional Development**

**( 2 - 0 - 2. Prerequisites: None. 9 IDS11 )**

**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## EC

## Economics

**EC1007 Economic History**

( 3 - 0 - 8. Prerequisites: None. 1 LEC11, 1 LEF11 )

**Equivalence: EC1004**

The purpose of this basic economics course is for students to analyze economic history, from the causes of the Industrial Revolution to the present day. The course deals with themes related to sustainable development, such as the political environment, GDP, productivity, production and consumption patterns, demographics, employment and unemployment, income distribution, poverty, equity and health. It requires previous knowledge of general history and economics, acquired in earlier education. The learning outcome of this course is for students to identify the economic and social implications of the evolution of society, starting with the Industrial Revolution.

**General objective:** Upon completion of this course, students will be able to explain the economic development process, from the causes of the Industrial Revolution to the present day, emphasizing the problematic and conceptualization of the economic phenomena that shaped its structural transformation; explain the development of the economy in the context of the diverse forms of social organization; know the different stages of the evolution of society in order to identify and explain the events that shaped its structural transformation; analyze the social effects of the economic performance of every society or of the economic blocs during the last two centuries.

**Key words:** The Industrial Revolution. Diffusion of industrialization. The gold standard. The First World War. The Russian Revolution. The Great Depression. The Second World War. Third-world countries. Globalization and the beginning of the new millennium. Slave and feudal systems. Nineteenth-century international economics. Centralized planning economies.

**Bibliography:** \* Heilbroner, Robert L., La evolución de la sociedad económica / Robert Heilbroner y William Milberg ; traducción de Verania de Parrés Cárdenas., 1a ed. en español., México, D.F. : Prentice-Hall, 1999., spaeng, [9701702751].

**EC1008 Enterprise Economics**

( 3 - 0 - 8. Prerequisites: [ MA1016 , MA1015 , MA1015 Corequisite ]. 2 LAE11, 2 LAF11, 2 LCDE11, 2 LCPF11, 3 LCS11, 2 LDF11, 2 LDN11, 3 LDP11, 2 LEC11, 4 LED11, 2 LEF11, 2 LEM11, 2 LIN11, 2 LLN11, 2 LMC11, 2 LMI11, 3 LPL11, 2 LPM12, 3 LRI11 )

**Equivalence: EC1002**

The purpose of this basic economics course is for students to understand how markets work as well as to apply analytical tools for understanding and analyzing the behavior of consumers and producers through their decisions in the marketplace. The course requires previous knowledge of basic mathematics. The learning outcome of this course is for students to analyze how the market works through variables that affect supply and demand; determine the equilibrium price/quantity ratio prevailing in the marketplace; and understand consumer and producer optimization models.

**General objective:** Upon completion of this course, students will be able to understand how the market works, analyzing the way in which consumers and manufacturers make their decisions and considering the impact of elasticity and government intervention in markets. Students will also perceive how prices and optimum production levels are determined in diverse market structures.

**Key words:** Producer theory. Market structures. Perfect competition. Monopoly. Oligopoly. Monopolistic competition. Factor market. Consumer theory. Market equilibrium. Supply and demand applications.

**Bibliography:** \* Samuelson, Paul A. (Paul Anthony), 1915-2009., Microeconomics / Paul A. Samuelson, William D. Nordhaus ; with contributions by Michael J. Mandel., 15th ed., New York : McGraw-Hill, c1995., [0070549931 (rústica)], [0070548900 (rústica)].

**EC1009 Macroeconomic Environment**  
 ( 3 - 0 - 8. Prerequisites: [ EC1008 , EC1008 Corequisite ]. 4 LAE11, 5 LCDE11, 3 LCPF11, 4 LCS11, 3 LDF11, 3 LDN11, 4 LDP11, 2 LEC11, 2 LEF11, 4 LEM11, 4 LIN11, 4 LLN11, 4 LMC11, 4 LPL11, 4 LPM12, 4 LRI11 )  
**Equivalence: EC1000**

The purpose of this basic economics course is for students to analyze the fundamental concepts of macroeconomic theory and policy. It requires previous knowledge of basic mathematics. The learning outcome of this course is for students to analyze the fundamentals and basic principles of macroeconomics, based on readings and economic statistics for Mexico, and evaluate the impact of fiscal policy measures, monetary policy and foreign trade policy on the macroeconomic equilibrium of the Mexican economy.

**General objective:** After completing this course, students will be able to understand the macroeconomic performance of a country, the national accounting methodology that will allow you to understand the processes of economic crises and economic growth, economic policy measures taken to fight unemployment and inflation, as well as how they impact international finance to economic growth.

**Key words:** Circular flow of income. Fiscal policy. Aggregate supply and demand. Domestic accounts. Determinants of national income. Money market and income level. Money market and asset market equilibrium.

**Bibliography:** \* Parkin, Michael, 1939-, *Economía* / Michael Parkin ; traducción Miguel ángel Sánchez Carrión., 8a ed., México : Pearson Educación, c2009., spaeng, [9702612799],[9789702612797].

**EC1010 Economy to Business Creation**  
 ( 3 - 0 - 8. Prerequisites: None. 5 IA 11, 5 IAB11, 5 IBN11, 5 IBT11, 4 IDA11, 5 IDS11, 4 IFI11, 5 IIA11, 5 IID12, 5 IIN12, 5 IIS11, 5 IMA11, 5 IME11, 6 IMI11, 5 IMT11, 6 INCQ13, 5 IQA11, 5 IQP11, 5 ISD11, 5 ITE11, 5 ITS11 )  
**Equivalence: EC1001**

The purpose of this basic economics course is for students to understand how the economic business en-

vironment functions and to apply tools for economic analysis of consumer and producer behavior in the marketplace. The course requires previous knowledge of basic mathematics. The learning outcome of this course is for students to develop strategic capabilities in business development by analyzing the functioning of the markets, determining the equilibrium price/quantity ratio, and understanding models for setting prices in markets.

**General objective:** Upon completion of this course, students will be able to analyze the environment through the field of economics, thus promoting strategic thinking among entrepreneurs by means of business-oriented economic concepts.

**Key words:** Pricing. Production. Costs. Market equilibrium. Supply and demand applications. Macroeconomic environment.

**Bibliography:** \* Mankiw, N. Gregory., *Principios de economía* / N. Gregory Mankiw ; traducción a cargo de New World Spanish by Pros., 5a ed., México : Cengage Learning, 2009., engspa, [9786074810349],[6074810346].

**EC1011 Introduction to Economics Field**

( 3 - 0 - 4. Prerequisites: None. 1 LEC11, 1 LEF11 )  
**Equivalence: None**

The purpose of this basic course is to lead students into the university environment and the majors in which they are enrolled in. No previous knowledge is required. As a result of this course, students are expected to have a clearer vision of their majors and the institution they have joined. Students will also design their life, academic and professional plans.

**General objective:** Upon the completion of this course, students will be familiar with the profile of graduates from the major they are enrolled in, including their competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the gradu-

ate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* García Páez, Benjamín., El oficio de los economistas / Benjamín García Páez., 1a ed., México : Universidad Autónoma de Sinaloa, 2005., [9706601295].

### **EC2003 Financial Econometrics I** ( 3 - 0 - 8. Prerequisites: [ MA1000 , MA1020 ]. 5 LAF11 )

**Equivalence: None**

To acquire skills in the use of statistical and econometric tools as they applied to financial problems.

**General objective:** Upon completion, students will be able to use econometric estimation tools and techniques for financial and economic models, generate models, analyze results, and make inferences based on econometric models and on their concrete financial application. Also, they will be able to appraise articles in this discipline.

**Key words:** Models with qualitative dependent variables. Econometric financial models. Violation of assumptions. Multiple regression.

**Bibliography:** \* Gujarati, Damodar N., Econometría / Damodar N. Gujarati ; traducción Demetrio Gardmendia Guerrero, Gladys Arango Medina., 4a ed., México : McGraw-Hill, 2007., Mexico, 2007., spa, [9701039718],[9789701039717].

### **EC2004 Financial Econometrics II** ( 3 - 0 - 8. Prerequisites: [ EC2003 ]. 6 LAF11 )

**Equivalence: None**

This is an intermediate statistics course and therefore students will already be familiar with the concepts, tools and methodology of basic multiple regressions econometric models. As a result of the course, students will understand and interpret the most common estimation techniques used in financial econometrics models; particularly, empirical analysis of financial time series, using econometric software to generate and interpret econometric results.

**General objective:** Upon completion of this course, students will be able to use econometric techniques in financial models, as well as generate models, analyze and interpret results in an economic-financial setting.

**Key words:** Co-integration and models for error correction. Regime change models for performance. Conditional heteroscedasticity models. Univariate time series. Simulation. Autoregressive vectors.

**Bibliography:** \* Brooks, Chris, 1971-, Introductory econometrics for finance / Chris Brooks., Cambridge ; New York : Cambridge University Press, 2002.

### **EC2007 History of Economic Thought** ( 3 - 0 - 8. Prerequisites: None. 3 LEC11 )

**Equivalence: EC00861**

Intermediate economics course focusing on the analysis of the main schools of economic thought that provide the bases for economic theory, economic development and courses related to the curriculum. It allows students to combine a historical vision with the beginning of modern economic theories. This course requires prior knowledge of universal economic history, as well as basic microeconomics and macroeconomics. As a learning outcome students will understand the formation of economic science and will be able to visualize the origin of theories in relation to their historical contexts.

**General objective:** Upon completion of this course, students will be able to comprehend, through an analysis of the relationship between historical facts and their interpretation, the principal schools of thought in economics, in order to identify modern currents in economic science and their tendencies for the 21st century. Additionally, students will be able to understand the continuities, changes, or ruptures, and critical periods in the philosophy of economics, considering social, cultural, political, and economic circumstances. At the same time, students will be able to explain the influence that economic thinking can have on the aforementioned circumstances in modern times.



**Key words:** Classical school. Neoclassical school. Economics as a science. Marxism. Mercantilism. Physiocracy. Historicism. The Keynesian Revolution. Monetarism. Neoinstitutionalism. Economic thinking for the 21st century.

**Bibliography:** \* Landreth, Harry., Historia del pensamiento económico / Harry Landreth, David C. Colander ; traductor Esther Rabasco., 4a ed. en espan~ol., Madrid : McGraw Hill, c2006., spaeng, [8448150252],[9788448150259].

**EC2009 Intermediate Microeconomics**  
( 3 - 0 - 8. Prerequisites: [ EC1002 , EC1008 ]. 3 LEC11, 3 LEF11 )  
**Equivalence: EC00831**

Intermediate economics focuses on the application of analytical tools to address topics of consumer choice in less restrictive scenarios, such as existence of goods, uncertainty and inefficient information. This course requires prior knowledge of basic microeconomics and calculus. Students will apply diverse market models, highlighting supply (through Producer Theory) and demand (responding to Consumer Theory).

**General objective:** Upon completion, students will be able to understand how economic theory assumes consumers and producers behavior. Students will analyze multiple market structures and markets of inputs of production (labor and capital), as well as the study of intertemporal consumption.

**Key words:** Consumer theory. Individual and market demand. Producer theory. Market structure analysis. Factors of production models (labor and capital) and intertemporal consumption models.

**Bibliography:** \* Varian, Hal R., Intermediate microeconomics : a modern approach / Hal R. Varian., 7th ed., New York, N.Y. : W.W. Norton & Co., c2006, New York, c2006, eng, [0393927024],[9780393927023].

**EC2013 Econometrics I**  
( 3 - 0 - 8. Prerequisites: [ MA2000 ],[ MA2004 , MA2011 ]. 5 LEC11, 5 LEF11 )  
**Equivalence: EC00851, EC95851**

Intermediate economics course focusing on the study of regression analysis for obtaining relevant data for economic analyses. This course requires prior knowledge of statistics and inferential procedures. As a learning outcome students will analyze economic data through regression estimation and testing to verify the validity of the estimated parameters.

**General objective:** Upon completion of this course, students will be able to apply statistical tools for the estimation, prediction, and testing of economic hypotheses; reach a level of econometrics that allows them to not only do empirical econometric work, but also have the ability to critique the empirical work of others.

**Key words:** Fundamentals of statistical inference and estimation. Simple and multiple regression model. Model specification tests. Multicollinearity. Heteroscedasticity.

**Bibliography:** \* Griffiths, William E., Learning and practicing econometrics / William E. Griffiths, R. Carter Hill, George G. Judge., New York : Wiley, c1993., [0471513644 (acid-free paper)].

**EC2016 Monetary Theory and Politics**  
( 3 - 0 - 8. Prerequisites: [ EC2008 , EC2010 , EC2023 , EC3021 ]. 5 LEC11, 6 LEF11 )  
**Equivalence: EC00873, EC95873**

Intermediate economics course focusing on supply and demand of money and the formulation and impact of monetary policy. This course requires prior knowledge of national accounting, determination of income and price level, and the currency exchange market. As a learning outcome students will analyze the instrumentation, management and impact of the monetary policy implemented in Mexico and other countries.

**General objective:** Upon completion of this course, students will be able to understand the process of the creation of money and the determinants of the



demand for money; students will also be able to identify the elements which a monetary program should contain, the impact of monetary policy, the advantages and disadvantages of implementing discretionary and fixed-rule policy, and the importance of the credibility and independence of the Central Bank on the effectiveness of monetary policy.

**Key words:** Money demand theories. Instrumentation of monetary politics . Monetary politics debate. Central Bank independence and credibility. Analysis of the monetary policy of diverse countries . Monetary policy.

**Bibliography:** \* Thomas Harrilesky y T. Boorman, Money supply, money demand and macroeconomic models, 2da, H. Davidson, ING.

### EC2023 Intermediate Macroeconomics

**(3 - 0 - 8. Prerequisites: [EC1009]. 3 LEC11, 3 LEF11) Equivalence: EC2008**

The purpose of this intermediate economics course is for students to analyze macroeconomic variables (e.g. GDP, inflation and unemployment) from the perspective of the closed and open economy. It requires previous knowledge of the fundamentals of macroeconomics and differential calculus. The learning outcome of this course is for students to evaluate the consequences of economic policy, beginning with concrete situations, and set out alternative solutions.

**General objective:** Upon completion of this course, students will be able to analyze the assumptions and relations established in open and closed economies with different exchange rate systems; understand the implications of liberalization and the exchange parity system in the structure and functioning of the economy, as well as the need to coordinate economic policy with internal and external balance.

**Key words:** National accounts and balance of payments. Equilibrium income and inflation. Aggregate demand. Aggregate supply. Fiscal and monetary policy.

**Bibliography:** \* Abel, Andrew B., 1952-, Macroeconomics / Andrew B. Abel, Ben S. Bernanke., 5th ed., Boston : Addison Wesley, c2005., [0321162129].

### EC2024 Game Theory and Strategic Decisions

**(3 - 0 - 8. Prerequisites: [ MA1020 , EC2009 ]. 4 LEC11, 4 LEF11 )**

**Equivalence: EC2011**

The purpose of this intermediate economics course is for students to analyze and model conflict situations involving two or more parties and evaluate decision making using game theory. It requires previous knowledge of mathematics, statistics and microeconomics. The learning outcome of this course is for students to analyze and model the strategic behavior of two or more parties, using the approach of statistical games and/or dynamics that support decision making.

**General objective:** Upon completion of this course, students will be able to understand the assumptions and components of game theory in order to analyze the way in which game theory can be adapted to real-life situations when two or more people relate and conflict situations are created.

**Key words:** Simultaneous and dynamic games. Game theory. Games in normal- and strategic-form. Nash equilibrium of pure- and mixed-strategy . Repeated games.

**Bibliography:** \* Fernández Ruiz, Jorge., Teoría de juegos : su aplicación en economía / Jorge Fernández Ruiz., 1a ed., México : El Colegio de México, Centro de Estudios Económicos, 2002., [9681210638].

### EC2025 Global Economics

**(3 - 0 - 8. Prerequisites: [ EC1009 ]. 6 LRI11 )**

**Equivalence: None**

The purpose of this intermediate economics course is for students to learn the economic fundamentals that underpin international trade relations as well as the analysis and evolution of international economic policy. It requires previous knowledge of microeconomics and macroeconomics. The learning outcome

of this course is for students to analyze how countries benefit from international trade, the trade restrictions that apply and the way in which changes to the world economic order modify the political and social structures of the State.

**General objective:** Upon completion of this course, students will be able to apply the concepts of international economics and international political economics, such as dual economy, modern world-system, hegemonic stability, economic structure, monetary system, trade policy and multinational firms, in order to understand the functioning of the Mexican economy and find solutions and alternatives to Mexico's problems, for example, the incorporation and adaptation of the Mexican economy into the current international economic structure, the dependence on foreign direct investment, trade liberalization, institutional reform, and the production and technology gap.

**Key words:** Foreign direct investment. Globalization. International economics. Tariffs. International monetary system. Transnational firms.

**Bibliography:** \* Pugel, Thomas A., International economics / Thomas A. Pugel., 14th ed., international ed., Boston ; México :

McGraw-Hill/Irwin, c2009., [0073375756 (papel alcalino)], [0071280790 (ed. internacional)], [9780073375755 (papel alcalino)], [9780071280792 (ed. internacional)].

## EC2026 Economics for International Business

( 3 - 0 - 8. Prerequisites: [ EC1009 ]. 6 LIN11 )  
Equivalence: EC2005

This is an intermediate course in the field of international economics, which enables students to learn and understand the fundamentals of various international business theories, as well as to study the fundamentals of economic theory that support commercial relations among the different countries of the world, covering intermediate concepts of economy and introductory concepts of monetary policy. Previous knowledge is required in microeconomics and macroeconomics (supply, demand, elasticity,

etc.). The learning outcome for this course is that the students, working in teams, will solve practical and theoretical problems. Additionally, the students will present case studies and exams individually, in order to demonstrate their interpretation of a theoretical model, or an applied analysis by means of a paper.

**General objective:** Upon completion, students will be able to understand the different economic models that support international among countries, and their evolution; understand concepts such as trade gains, comparative advantage and the strategic role of the government in trade; understand global economic indicators and how monetary policies affect international financial conditions; understand how economic problems are formalized and analyzed using applied mathematical and graphic tools; use quantitative analysis tools to assess the theories studied in class.

**Key words:** Comparative advantage. Economic development. International economics. International trade theories. Factor movement. International monetary policy. International trade barriers.

**Bibliography:** \* Yarbrough, Beth V., The world economy : trade and finance / Beth V. Yarbrough, Robert M. Yarbrough., 7th ed., Mason, OH : Thomson/South-Western, c2006., [0324203977],[0324315414 (ed. internacional)], [9780324203974],[9780324315417 (ed. internacional)].

## EC3002 Econometrics II

( 3 - 0 - 8. Prerequisites: [ EC2013 ]. 6 LEC11, 6 LEF11 )  
Equivalence: EC00852, EC95852

Advanced economics course that focuses on the study of estimation methods that are more sophisticated than the ordinary least squares method and integrates knowledge of microeconomics, macroeconomics, statistics and mathematics. This course requires prior knowledge of basic econometrics, intermediate economic, mathematical and statistical theory. As a learning outcome students will use econometric tools for modeling, estimation, inference and forecasts in the context of real-world economic issues.

**General objective:** Upon completion of this course, students will be able to detect and correct endogeneity problems; estimate models of multiple and simultaneous equations; estimate non-linear models; recognize panel data information; and perform the most appropriate econometric techniques.

**Key words:** Matrix algebra. Qualitative election models. Crossed section data combination. Multiple and simultaneous equation models.

**Bibliography:** \* Griffiths, William E., Learning and practicing econometrics / William E. Griffiths, R. Carter Hill, George G. Judge, Hoboken, N.J. : John Wiley, c1993, New Jersey, c1993, eng, [0471513644 (papel no ácido)], [04715133645], [9780471513643].

### EC3008 Time Series Analysis

( 3 - 0 - 8. Prerequisites: [ EC3002 ]. 7 LEC11, 7 LEF11 )

**Equivalence:** EC00875

Advanced economics course focusing on the comprehension and application of time series models for financial economics. This course requires prior knowledge of difference equations, matrix calculus, estimation methods and economic theory. As a learning outcome students will understand and apply the contemporary time series models (ARIMA, VAR, VEC and ARCH) to solve real problems in the area of economics and finance that involve the forecasting relevant variables by means of their behavior over time and their relation to other variables.

**General objective:** Upon completion of this course, students will be able to identify, estimate, and diagnose the models that follow time series variables, utilizing ARIMA, VAR, VEC, and ARCH models in order to solve real problems in the fields of economics and finance.

**Key words:** ARIMA models. VAR models. VEC models. ARCH models.

**Bibliography:** \* Harris, Richard I. D., 1957-, Applied time series modelling and forecasting / Richard Harris and Robert Sollis., Chichester, West Sussex, England ; Hoboken, NJ : J. Wiley, c2003., [0470844434 (rústica : papel no ácido)].

### EC3009 Theory and Politics of International Commerce

( 3 - 0 - 8. Prerequisites: [ EC2013 ], [ EC2012 , EC3022 ]. 6 LEC11, 7 LEF11 )

**Equivalence:** EC00874, EC95874

Advanced economics course focusing on the analysis of patterns of trade and commercial policy instruments. This course requires prior knowledge of consumer theory, welfare theory and market structures. As a learning outcome students will be able to understand the variables that determine a country's comparative advantages, the effects of trade liberalization programs and of the application of particular commercial policy instruments.

**General objective:** Upon completion of this course, students will be able to understand the factors that determine countries' patterns of trade, the benefits derived from this trade, and the effects of commercial policy instruments.

**Key words:** Trade policy. General equilibrium. Ricardian model. Specific-factors model. Heckscher-Ohlin model. Trade integration.

**Bibliography:** \* Krugman y Obstfeld, International economics, Theory and policy, 3era, Harper Collins, USA, 1994, ING.

### EC3010 Multivariate Economic Analysis

( 3 - 0 - 8. Prerequisites: [ EC3002 ]. 8 LEC11 )

**Equivalence:** MT00874

Advanced economics course that goes back to students' basic knowledge of statistics and econometrics in order to introduce them to the different approaches that are used in market research or "market engineering". This is done by using multivariate analysis tools for consumer, demand, competition and environment analysis and, in general, what is known as strategic market analysis. This course requires prior knowledge of descriptive statistics and econometric models. As a learning outcome students will analyze the market conditions using multivariate analysis tools.

**General objective:** Upon completion of this course, students will be able to apply the most representative non-parametric and some parametric methods in order to identify, hierarchize, and establish relationships between variables which are extracted from different populations or which have a certain connection between them.

**Key words:** Multivariate analysis. ANOVAS and MANOVAS tables. Latent variable models. Canonic correlation analysis. Cross-section tables of diverse dimensions.

**Bibliography:** \* Multivariate data analysis / Joseph F. Hair, Jr. [et al.], 7th ed., Upper Saddle River, NJ ; México : Prentice Hall, c2010., [0138132631 (encuadernado : papel alcalino)], [9780138132637 (encuadernado : papel alcalino)].

### **EC3012 Social Evaluation of Projects** ( 3 - 0 - 8. Prerequisites: [ EC2012 , EC3022 ]. 8 LEC11, 8 LEF11 ) **Equivalence: EC00883, EC95883**

Advanced economics course focusing on presenting and applying diverse methods for evaluating the economic and social impact of projects, as part of the planning and optimal resource allocation processes. This course requires prior knowledge of microeconomics, financial mathematics and demand estimation. As a learning outcome students will evaluate social projects using scenarios, feasibility, alternative techniques and impacts on national, regional and sectorial social development.

**General objective:** Upon completion of this course, students will be able to understand and apply various methods for evaluating or deciding on investment projects from a social and economic point of view, as part of the processes of optimal planning and assignment of resources.

**Key words:** Project and alternatives. Current and optimized situation. Benefit and cost. Impact and effect. Prices over net present value.

**Bibliography:** \* Pautas para la evaluacion de proyectos., 1a Ed., Nueva York, E.U.A : ONUDI , 1972., ESP.

### **EC3014 Regional Economics** ( 3 - 0 - 8. Prerequisites: [ EC3011 , EC3028 ]. 8 LEC11 ) **Equivalence: EC00894**

Advanced economics course focusing on the study of economics in its territorial setting, by combining relevant theoretical and empirical elements. It addresses topics related to sustainable development, such as pollution, resource depletion, productivity and consumption patterns, employment, unemployment and equity. This CAD course requires prior knowledge of economic growth and development. As a learning outcome students will understand the behavior of the economy at regional level, in particular the territorial concentration and dispersal processes, as well as the marked disparities in economic development at the subnational level and the logic that determines the localization of productive activities.

**General objective:** Upon completion of this course, students will be able to extend economic analysis to its territorial dimension by means of the combination of theoretical and empirical elements relevant to Mexico, but from an international perspective.

**Key words:** Region. Urban and rural. Economic integration. Development. Localization and concentration.

### **EC3016 Mexican Economics Seminar** ( 3 - 0 - 8. Prerequisites: [ EC3011 , EC3028 ]. 9 LEC11 ) **Equivalence: EC00893, EC95893**

Advanced course in which students integrate the theory and study methods of economic science in the scientific analysis of the Mexican economy. This course requires prior knowledge of economic theory and economic science study methods. As a learning outcome students will conduct a scientific research project using economic theory and a topic related to the Mexican economy.

**General objective:** Upon completion of this course, students will be able to develop a publication or academic congress-level research project about some aspect related to Mexico's economy. Students will

be able to select the relevant theory for the thematic analysis and present current and prospective conditions for each of the topics to be studied.

**Key words:** Production factors. Internal sector. External sector. Trade patterns. Social affairs economics. Social politics.

**Bibliography:** \* La Economía mexicana después de la crisis del peso / Miguel Angel Rivera Ríos, Alejandro Toledo Patiño, coordinadores., 1. ed., México, D.F. : Universidad Autónoma Metropolitana, Unidad Iztapalapa : Universidad Nacional Autónoma, [9706542213].

### EC3021 International Finance and Open Economy

( 3 - 0 - 8. Prerequisites: [ EC2023 ]. 4 LEC11, 4 LEF11 )

**Equivalence:** EC2010

The purpose of this advanced economics course is for students to know and understand international capital markets and their behavior as well as their effect on other markets. The course requires previous knowledge of macroeconomics and differential calculus, open macroeconomics, imbalance in the balance of payments and the effects of international flows on the exchange rate. The learning outcome of this course is for students to analyze the behavior of the economic variables that prevail in international financial markets (such as the cash exchange rate and futures), and their impact on the performance of private and public corporations.

**General objective:** Upon completion of this course, students will be able to identify the main causes of volatility in international markets by analyzing the behavior of the most important financial variables; understand and manage the principal financial instruments to increase the value of a business while minimizing its exposure to risk through problem solving; use diverse financial instruments to design coverage strategies for companies.

**Key words:** International finance. Exchange rate. International financial markets. Derivatives. Mundell-Fleming Model.

**Bibliography:** \* Levich, Richard M., International financial markets : prices and policies / Richard M. Levich., 2nd ed., Boston, Mass. ; México : McGraw-Hill/Irwin, 2001., [0072338652 (papel alcalino)], [9780071181235 (papel alcalino)].

### EC3022 Consumer Theory

( 3 - 0 - 8. Prerequisites: [ EC2009 , MA2000 ]. 4 LEC11, 4 LEF11 )

**Equivalence:** EC2012

The purpose of this advanced economics course is for students to learn the application of analytical tools, with the goal of modeling consumer choices in different environments. It requires previous knowledge of consumer choice theory and differential calculus. The learning outcome of this course is for students to apply analytical and mathematical tools for deriving models of consumer behavior.

**General objective:** Upon completion of this course, students will be able to use analytical models to portray consumer decision making.

**Key words:** Economic well-being. Utility function. Utility choice and maximization. Choice under uncertainty. Information asymmetries. Pure exchange and time allocation. Savings and investment. Choice under uncertainty and information asymmetry.

**Bibliography:** \* Nicholson, Walter., Teoría micro-económica : principios básicos y ampliaciones / Walter Nicholson., 9a ed., México, D.F. : Thomson : Cengage Learning, c2007., spaeng, [9706865489], [9789706865489].

### EC3023 Mathematical Economics

( 3 - 0 - 8. Prerequisites: [ MA3001 ]. 5 LEC11, 5 LEF11 )

**Equivalence:** EC1006

The purpose of this advanced economics and mathematics course is the study of optimization techniques required to analyze the main dynamic, deterministic and stochastic economic models. The course requires previous knowledge of differential equations and static optimization techniques. The learning outcome of this course is for students to analyze dynam-



ic models using dynamic, deterministic (calculation of variations, optimal control and dynamic programming) and stochastic optimization techniques.

**General objective:** Upon completion of this course, students will be able to handle calculus of variations, optimal control and dynamic programming to analyze dynamic economic models.

**Key words:** Optimal control. Dynamic programming. Stochastic processes. Calculus of variations. Euler equations. Bellman equation.

**Bibliography:** \* Takayama, Akira, 1932-, *Mathematical economics / Akira Takayama.*, 2nd ed., Cambridge [Cambridgeshire] ; New York : Cambridge University Press, 1985., [0521257077],[0521314984 (pbk.)].

**EC3024 Dynamic Macroeconomics**  
( 3 - 0 - 8. Prerequisites: [ EC2023 , MA3001 ]. 5 LEC11, 6 LEF11 )  
**Equivalence: EC2014**

The purpose of this advanced economics course is to analyze the main models of dynamic macroeconomics and their implications for economic policy. The course deals with themes of sustainable development, such as GDP, productivity and employment/unemployment. It requires previous knowledge of macroeconomics and dynamic optimization programming. The learning outcome of this course is for students to analyze the implications of economic policy design in the context of closed and open economies.

**General objective:** Upon completion of this course, students will be able to analyze dynamic macroeconomics formally and empirically by reviewing a variety of dynamic models; as well as analyze the methodology for reviewing and implementing the models they studied.

**Key words:** Keynesian dynamic macroeconomics. Representative agent model in discrete time and continuous time. Overlapping generations model. Nominal economic models.

**Bibliography:** \* Wickens, Mike., *Macroeconomic theory : a dynamic general equilibrium approach / Mi-*

*chael Wickens.*, Princeton : Princeton University Press, c2008., [9780691116402 (papel alcalino)].

**EC3025 Theory and Pricing Strategies**  
( 3 - 0 - 8. Prerequisites: [ EC3022 ]. 5 LEC11, 5 LEF11 )  
**Equivalence: EC2015**

The purpose of this advanced economics course is for students to understand the way in which companies operate in conformance with the characteristics imposed by competition, among them market structure and the regulatory mechanisms used. The course requires previous knowledge of microeconomic production theory. The learning outcome of this course is for students to apply analytical and mathematical tools for deriving complex behavioral models from producers and to apply all the acquired tools to characterize the general market equilibrium.

**General objective:** Upon completion of this course, students will be able to use analytical models to portray producer decision making in more complex settings and define the market equilibrium on the basis of the participants' individual decisions.

**Key words:** Perfect competition. Production function. Production costs. Monopoly market. Oligopoly and strategic behavior.

General equilibrium model. Factor demand and supply. Maximization of benefits. Imperfect competition market.

**Bibliography:** \* Varian, Hal R., *Análisis micro-económico / Hal R. Varian ; traducción de Ma. Esther Rabasco y Luis Toharia.*, 3a. ed., Barcelona : Antoni Bosch, 1992., [8485855639].

**EC3026 Industrial Organization and Regulation**  
( 3 - 0 - 8. Prerequisites: [ EC2024 , EC3025 ]. 6 LEC11, 6 LEF11 )  
**Equivalence: EC3004**

The purpose of this advanced economics course is for students to be able to model company decisions in different market structures and study the con-



sequences of those decisions. The course requires previous knowledge of production theory, costs and market structures. The learning outcome of this course is for students to have a broad understanding of how analytical tools are used to model the way in which companies behave and interact in industry.

**General objective:** Upon completion of this course, students will be familiar with the diverse mechanisms used by companies to compete (patent race, pricing, leading company, etc.), and the consequences of these mechanisms at industry level.

**Key words:** Enterprise theory. Product differentiation and monopolistic competition. Pricing practices. Vertical integration and vertical restraints. Patents, technological change, mergers and regulations. Advertising and strategic behavior.

**Bibliography:** \* Tirole, Jean., *La teoría de la organización industrial* / Jean Tirole ; edición y traducción española a cargo de Carmen Matutes., 1a Ed., Barcelona : Ariel, 1990., spa, [8434420430].

### EC3027 Economic Growth

( 3 - 0 - 8. Prerequisites: [ EC3025 ]. 6 LEC11, 7 LEF11 )

**Equivalence:** EC3006

The purpose of this advanced economics course is for students to understand different growth models as well as the hypotheses derived from them regarding economic growth determiners. It requires previous knowledge of producer theory and market structures. The learning outcome of this course is for students to know and understand neoclassic and endogenous growth models which are necessary to explain the diverse factors that permit the economic growth of a country as well as the reasons for divergence or convergence in the growth path of nations.

**General objective:** Upon completion of this course, students will be conversant with the principal economic growth models, including their structure and mechanics, as well as the resulting hypotheses about the determining factors of economic growth in countries or regions and their comparison with empirical evidence. The course focuses on the models of a sector, including the so-called endogenous growth achieved by the accumulation of the physical and

human capital, technological innovations and institutional quality of the countries.

**Key words:** Endogenous growth models. Solow neoclassical growth model. Romer model. Schumpeter model. Ramsey-Cass-Koopmans model.

**Bibliography:** \* Romer, David., *Macroeconomía avanzada* / David Romer ; traductor, Gloria Trinidad., 3a ed., Madrid ; México : McGraw-Hill, c2006., spaeng, [8448148096],[9788448148096].

### EC3028 Economic Development

( 3 - 0 - 8. Prerequisites: [ EC3027 , EC3027 Corequisite ]. 7 LEC11 )

**Equivalence:** EC3011

The purpose of this advanced economics course is for students to develop the ability to combine policy-related theories, techniques and design, as they relate to the evolution of economic structures and their determiners, in order to promote economic well-being. The course deals with themes of sustainable development, such as environmental policy, productivity, exhaustion of resources, employment, unemployment, poverty and equity, and requires previous knowledge of economic growth theories. The learning outcome of this course is for students to analyze and apply fundamental concepts of economic development to the evolution of national structures in a global context as a basis for the design of sustainable economic and social policies.

**General objective:** Upon completion of this course, students will be able to diagnose the most significant problems, general theories and approaches in the evolution of economic structures, and propose policies and programs to solve these issues.

**Key words:** Growth. Structures. Development and underdevelopment. Theories and policies. Well-being issues.

**Bibliography:** \* *Development and underdevelopment : the political economy of inequality* / edited by Mitchell A. Seligson, John T. Passé-Smith., Boulder, Colo. : L. Rienner Publishers, 1993., [1555874002 (pbk. : alk. paper) :],[22.00].

### EC3029 Managerial Economics and Incentives

( 3 - 0 - 8. Prerequisites: [ EC3025 ]. 7 LEC11, 7 LEF11 )

Equivalence: EC3007

The purpose of this advanced economics course is to help students define the circumstances under which companies theoretically produce profit within a market-based economy to permit an efficient solution for allocation of resources. It requires previous knowledge of microeconomic theory and industrial organization. The learning outcome of this course is for students to use analytical tools to solve problems involving efficient assignment of resources, coordination and incentive alignment (motivation) within a company as an alternative mechanism to market solutions.

**General objective:** Upon completion of this course, students will be able to search for and select relevant information to conduct a study of an organization; understand the methodology for diagnosing companies' organizational problems; and critically analyze the diverse solutions according to the neo-institutional and neoclassical approaches, in order to find viable alternative solutions to organizations' and, in particular, companies' problems.

**Key words:** Moral risk, shared risk and linear contracts with incentives. Vertical and horizontal boundaries of the firm. Company as a contractual association. Markets, efficiency, competitive equilibrium and transfer prices. Salary efficiency.

**Bibliography:** \* Macho-Stadler, Inés., An introduction to the economics of information : incentives and contracts / Inés Macho-Stadler, J. David Pérez-Castrillo ; translated by Richard Watt., 2nd ed., Oxford ; New York : Oxford University Press, 2001., spaeng, [0199243271],[0199243255 (rústica)].

### EC3030 Financial Economics

( 3 - 0 - 8. Prerequisites: [ EC2013 , EC3022 ]. 7 LEC11, 6 LEF11 )

Equivalence: EC2017

The purpose of this advanced economics course is to provide students with tools for traditional financial

analysis. It requires previous knowledge of consumer choice theory. The learning outcome of this course is for students to analyze and make decisions, choosing among various investment products.

**General objective:** Upon completion of this course, students will be able to use financial theory models to make investment decisions and design coverage strategies for companies.

**Key words:** Uncertainty. Portfolio valuation. Mean-variance investing. CAPM model. Investment decisions. APT model. Capital markets.

**Bibliography:** \* Ross, Stephen A., Corporate finance / Stephen A. Ross, Randolph W. Westerfield, Jeffrey Jaffe., 9th ed., Boston : McGraw-Hill/Irwin, 2010., [9780073382333 (papel alcalino)], [0073382337 (papel alcalino)].

### EC3031 Macroeconomics and Business Cycles

( 3 - 0 - 8. Prerequisites: [ EC3024 ]. 7 LEC11, 7 LEF11 )

Equivalence: EC3005

The purpose of this advanced economics course is the study of macroeconomic models in order to understand Mexico's aggregate cyclical fluctuations. It requires previous knowledge of dynamic macroeconomics, consumer behavior and enterprise behavior theory as well as econometrics. The learning outcome of this course is for students to analyze and construct macroeconomic models and use quantitative methods to analyze theoretical implications against the performance of the real economy.

**General objective:** Upon completion of this course, students will be able to analyze economic cycles through real economic cycle models, Neo-Keynesian models, consumption models, investment and capital asset valuation models; and use macroeconomic models to understand fluctuations in production, consumption, capital and behavior of financial asset prices.

**Key words:** Speculative bubbles. The new Keynesian economics. Consumption theories. Investment theo-

ries. Search and matching model. Real business cycle theory.

**Bibliography:** \* Romer, David., Macroeconomía avanzada / David Romer ; traductor, Gloria Trinidad., 3a ed., Madrid ; México : McGraw-Hill, c2006., spaeng, [8448148096],[9788448148096].

### EC3032 Public Sector Economics and Social Well-Being

( 3 - 0 - 8. Prerequisites: [ EC2024 , EC3025 ]. 6 LEC11, 8 LEF11 )

**Equivalence:** EC3003

The purpose of this advanced-level economics course is for students to study the economic efficiency, distribution and economic policy of government. The course covers diverse themes, such as market failures due to the existence of external factors, public good, imperfect competition, the impact of taxes and explanations of how certain bureaucratic decisions are made. The course requires previous knowledge of microeconomic and game theory. The learning outcome of this course is for students to understand how the government makes decisions and what decisions should be made.

**General objective:** Upon completion of this course, students will be able to understand how the participation of the public sector affects a market economy; the mechanisms used by this sector to solve issues related to the efficient allocation of resources, understanding their effects on economic welfare.

**Key words:** Social welfare. Market efficiency and failures. Public spending policy. Private goods and public goods. Social choice. Arrow's impossibility theorem.

**Bibliography:** \* Cornes, Richard, 1946-, The theory of externalities, public goods, and club goods / Richard Cornes, Todd Sandler., 2nd ed., Cambridge ; New York : Cambridge University Press, 1996., [0521471486 (hc)].

### EC3033 Natural Resources Economics and Sustainability

( 3 - 0 - 8. Prerequisites: [ EC2009 ]. 9 LEC11 )

**Equivalence:** None

The purpose of this advanced economics course is to enable students to analyze sustainability problems generated by economic activity. It requires previous knowledge of production functions, costs and general equilibrium models. The learning outcome of this course is for students to connect efficient use of natural resources with the dynamics of origin, storage, renewal, consumption and extinction of natural resources.

**General objective:** Upon completion of this course, students will be able to use the concepts and tools of economic theory to address issues related to human resources and the environment, in order to make decisions or discuss policies that help to solve these problems.

**Key words:** Natural resources. Externalities. Market failures. Environmental policy instruments. Growth and sustainability.

**Bibliography:** \* Kahn, James R., The economic approach to environmental and natural resources / James R. Kahn., 3rd ed., Mason, Ohio : Thomson/South-Western, c2005., [0030314542 (encuadernado)].

### EC3034 Seminar on Economic, Financial and Political Analysis

( 3 - 0 - 8. Prerequisites: None. 9 LEC11, 9 LEF11 )

**Equivalence:** None

The purpose of this advanced research course is to permit students to apply knowledge of economic theory to the interaction between finance and policy by designing projects that use quantitative and qualitative tools. It requires knowledge of economic theory, research methodology and quantitative tools. The learning outcome of this course is for students to work in a team to prepare a scientific research project in which economic theory is applied along with quantitative, qualitative and technological tools.

**General objective:** Upon completion of this course, students will be able to write a scientific research report, applying their theoretical knowledge and using quantitative tools and databases to propose solutions to problems identified in the enforcement and development of economic, financial and social policies; and identify the challenges faced by an economy in a global, competitive, uncertain environment.

**Key words:** Economic policy. Research methods. Globalization. Financial systems. Finance.

**Bibliography:** \* La política económica y social de México en la globalización / Diana R. Villarreal González, compiladora., México. : Universidad Autónoma Metropolitana, Unidad Xochimilco : Porrúa, 2000., [970701086X].

## **EC3035 Introduction to Professional Development**

**( 2 - 0 - 2. Prerequisites: None. 9 LEC11, 9 LEF11 )**  
**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## EM Entrepreneurs

### EM1005 Entrepreneurship

( 3 - 0 - 8. Prerequisites: None. 6 ARQ11, 6 IA 11, 6 IAB11, 6 IBN11, 6 IBT11, 5 IC 11, 5 IDA11, 7 IDS11, 7 IFI11, 6 IIA11, 6 IID12, 6 IIN12, 6 IIS11, 6 IMA11, 5 IMD11, 6 IME11, 6 IMI11, 6 IMT11, 7 INCQ13, 5 INT11, 6 IQA11, 6 IQP11, 6 ISC11, 6 ISD11, 6 ITC11, 6 ITE11, 6 ITIC11, 6 ITS11, 7 LAD11, 6 LAE11, 6 LAF11, 6 LCDE11, 5 LCMD11, 6 LCPF11, 7 LCS11, 5 LDF11, 7 LDI11, 6 LDN11, 6 LDP11, 5 LEC11, 6 LED11, 6 LEF11, 6 LEM11, 6 LIN11, 7 LLE11, 6 LLN11, 6 LMC11, 7 LMI11, 5 LNB11, 6 LP 12, 5 LPL11, 6 LPM12, 6 LPO11, 6 LPS12, 6 LRI11, 7 MC 11, 6 MO 11 )

**Equivalence:** EM1001

The Entrepreneurial Development Course in accordance with the Mission 2015 expects that students be leaders, entrepreneurs and innovators by detecting business opportunities in the local, national and international markets. Students will contribute to the creation of competitive enterprises with incubator potential by generating business plans for the private, public and social sectors. They will develop the skills, responsibility and a clear sense of respect and ethical consistency as individuals, professionals and citizens, as well as critical assessment of companies based on knowledge, innovation, technological and sustainable development needed to contribute to national progress.

General objective: Students will select a course that contributes to the enhancement of their entrepreneurial potential through the development of their skills to conceive and plan an innovative project in response to a problem, need or opportunity detected in the community.

Key words: Entrepreneurial spirit. Teamwork. Business plan. Entrepreneur potential. Creativity and innovation.

**Bibliography:** \* Alcaraz Rodríguez, Rafael E., El emprendedor de éxito : guía de planes de negocios / Rafael Eduardo Alcaraz Rodríguez., 1a ed., México, D.F. : McGraw-Hill, c1995., [9701008642],[9789701008645].

## F

## Physics

**F1001 Introduction to Physics**

( 3 - 0 - 8. Prerequisites: None. 0 ARQ11, 0 IA 11, 0 IAB11, 0 IBN11, 0 IBT11, 0 IC 11, 0 IDA11, 0 IDS11, 0 IFI11, 0 IIA11, 0 IID12, 0 IIN12, 0 IIS11, 0 IMA11, 0 IMD11, 0 IME11, 0 IMI11, 0 IMT11, 0 INCQ13, 0 INT11, 0 IQA11, 0 IQP11, 0 ISC11, 0 ISD11, 0 ITC11, 0 ITE11, 0 ITIC11, 0 ITS11, 0 LAD11, 0 LDI11 )

**Equivalence:** F 00801, F 95801, F 99801

This is an introductory course in the field of physics focused toward reviewing fundamental concepts and basic applications of vectors, statics, kinematics, and dynamics, developing observational skills and the ability to relate physics events in everyday life to concepts of physics. Previous knowledge of algebra, trigonometry, geometry and analytical geometry is required. As a learning result, the student is expected to understand the laws of physics that govern kinematics and dynamics and to be able to solve basic problems.

**General objective:** The course is focused toward training the student in the solution of fundamental classical mechanics problems (statics, linear and angular kinematics, rotational and translational dynamics). As a result of the course, the student acquires the ability to extract quantitative information for typical approaches to problems and will be able to solve them applying a series of general principles of classical physics. Use of differential and integral calculus is not emphasized.

**Key words:** Rotational equilibrium. Translational equilibrium. Work, energy and power.

**Bibliography:** \* Blatt, Frank J., Fundamentos de física / Frank J. Blatt ; traducción de Virgilio González Pozo., 3a ed. en inglés; 1a ed. en español., México : Prentice Hall Hispanoamericana, c1991., Mexico, c1991., spa, [9688801933].

**F1002 Physics I**

( 3 - 1 - 8. Prerequisites: [ F1001 ]. 1 IA 11, 1 IAB11, 1 IBN11, 1 IBT11, 1 IC 11, 1 IDA11, 1 IDS11, 1 IFI11, 1 IIA11, 1 IID12, 1 IIN12, 1 IIS11, 1 IMA11, 1 IMD11, 1 IME11, 1 IMI11, 1 IMT11, 1 INCQ13, 2 INT11, 1 IQA11, 1 IQP11, 1 ISC11, 1 ISD11, 1 ITC11, 1 ITE11, 1 ITIC11, 1 ITS11 )

**Equivalence:** F 00811, F 99802

This basic course develops students' skills in kinematic and dynamic problem-solving through the application of their knowledge and the fundamental laws of physics; understanding of the concepts of physics related to mechanics through the theoretical and practical analysis of physical phenomena; capacity for observation and ability to relate the physical events of daily life to the concepts of physics. This course requires prior knowledge of algebra, trigonometry and geometry, and single-variable differential and integral calculus. As a learning outcome students will be able to solve problems that involve objects in motion from the perspectives of kinematics and dynamics.

**General objective:** On completing the course the student will be able to apply physical and mathematical concepts to linear and angular kinematics and dynamics using vector language; apply concepts from the laws of physics to propose solutions to scenarios involving particles in movement and/or objects in rotation.

**Key words:** Vectors. Newton's Laws. Linear and rotational kinematics and dynamics. Conservation of energy and conservation of linear and angular momentum.

**Bibliography:** \* Serway, Raymond A., Física para ciencias e ingeniería / Raymond A. Serway, John W. Jewett ; traducción, Víctor Campos Olguín., 7a ed., México, D.F. : Cengage Learning, c2008., spaeng, [9706868224],[9789706868220].



## F1003 Physics II

( 3 - 1 - 8. Prerequisites: F1002, [ MA1002, MA1015 ], 2 IA 11, 2 IAB11, 2 IBN11, 2 IBT11, 2 IC 11, 2 IDA11, 2 IDS11, 2 IFI11, 2 IIA11, 3 IIN12, 2 IIS11, 2 IMA11, 2 IMD11, 2 IME11, 2 IMI11, 2 IMT11, 2 INCQ13, 2 IQA11, 2 IQP11, 2 ISD11, 2 ITE11, 2 ITS11 )

**Equivalence:** F 00812, PV1016

This basic course develops students' capacity to apply the physical principles of fluid mechanics, oscillations, wave propagation, sound and thermodynamics to problem solving and the description of simple physical devices. This course requires prior knowledge of linear and rotational kinematics and dynamics and of energy conservation and momentum. As a learning outcome students will be able to solve problems that involve fluid analysis, wave oscillations and thermodynamics.

**General objective:** On finishing the course the student will be able to apply the concepts and physical principles of fluid mechanics, undulatory phenomena and thermodynamics for problem solving and the description of simple devices; apply the laws of thermodynamics, fluid mechanics and undulatory movement to determine the physical characteristics (heat, temperature, pressure, equilibrium, movement, etc.) of a physical system.

**Key words:** Oscillations. Sound. Thermodynamics. Static and fluid dynamics. Wave motion.

**Bibliography:** \* Serway, Raymond A., Física para ciencias e ingeniería / Raymond A. Serway, John W. Jewett ; traducción, Víctor Campos Olguín., 7a ed., México, D.F. : Cengage Learning, c2008., spaeng, [9706868224],[9789706868220].

## F1005 Electricity and Magnetism

( 3 - 1 - 8. Prerequisites: [ F1003, MA1017 ], [ F1002, MA1017 ]. 3 IC 11, 3 IDA11, 3 IDS11, 3 IFI11, 4 IID12, 4 IIN12, 3 IIS11, 3 IMA11, 3 IMD11, 3 IME11, 3 IMI11, 3 IMT11, 3 IQA11, 3 IQP11, 3 ISC11, 3 ISD11, 3 ITC11, 3 ITIC11 )

**Equivalence:** F1004

This is a basic course, designed to develop students' abilities to use the electric and magnetic interaction of charges in the operation of simple devices and in-

crease their knowledge of electricity and magnetism in order to study various engineering disciplines in depth. Previous knowledge is required in mechanics and differential and integral calculus. The learning outcome for this course is that the students solve problems involving electricity and magnetism.

**General objective:** Upon completion of this course, students will be able to: 1) understand the electrical interaction between point charges and distributed charges, the interaction between charges and magnetic fields, and the relationship between electric and magnetic fields; 2) apply the concepts of electricity and magnetism to design and describe the operation of simple electrical devices.

**Key words:** Electric fields. Simple electric circuits. Electrical devices. Maxwell's equations. Magnetic Fields.

**Bibliography:** \* Serway, Raymond A., Física : para ciencias e ingeniería con física moderna / Raymond A. Serway, John W. Jewett, Jr. ; traducción Víctor Campos Olguín., 7a ed., México, D.F. : Cengage Learning, 2009., spaeng, [9706868372 (v. 2)], [9789706868374 (v. 2)].

## F1006 Introduction to Physics Engineering

( 3 - 0 - 4. Prerequisites: None. 1 IFI11 )

**Equivalence:** None

The purpose of this basic-level course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Reglamento general de alumnos / Tecnológico de Monterrey., Versión Agosto 2008., México : Tecnológico de Monterrey, 2008.

## F2001 Design Physics

(3 - 0 - 8. Prerequisites: [ F1001 ]. 3 LAD11, 3 LDI11)

**Equivalence:** None

This is an intermediate course and it was aimed to develop students' skills to use mathematical and physical tools to find solutions to conventional design problems from a formal-visual perspective. This is achieved by addressing design problems that are solved through the creation, definition, evaluation and/or verification of diverse aspects using mathematical and physical models. The course requires previous knowledge of Mathematics for Design. As a result of the course, students will be able to use mathematical and physical tools to solve design problems.

**General objective:** Students will be able to acquire the fundamentals of physics that rationally support design; apply the concepts of vectors and the Newton's Laws to create physical models of real design-related situations.

**Key words:** Algebra and operations with vectors. Applications using vectors. Systems in equilibrium. Dynamics. Rotational equilibrium. Newton's Laws.

**Bibliography:** \* Física universitaria / Francis W. Sears . [et al.] ; contribución de A. Lewis Ford., 11a ed., México : Pearson Educación, c2004., spaeng, [9702605113].

## F2003 Analytical Mechanics

(3 - 0 - 8. Prerequisites: [ F2010 , F3005 ]. 5 IFI11 )

**Equivalence:** F 00871

This is an intermediate course in industrial physical engineering in which students learn to propose and solve the differential equations of movement of classical mechanics and also learn to interpret their

solutions. This course requires prior knowledge of vector calculus and differential equations. As a learning outcome students will apply the Newtonian formulation, the laws of conservation, the Lagrangian formulation and the principle of least action to construct mathematical models which correctly describe the behavior of a classical dynamic system, as well as solve problems in classical mechanics and interpret the results.

**General objective:** Upon completion of this course, students will be able to construct mathematical models which correctly describe the behavior of a classic dynamical system.

**Key words:** Coordinate transformations. Newtonian mechanics. Lagrange mechanics. Principle of least action. Central Forces and Oscillations.

**Bibliography:** \* Thornton, Stephen T., Classical dynamics of particles and systems / Stephen T. Thornton, Jerry B. Marion., 5th ed., Thomson Brooks/Cole, Belmont, California , c2004., eng, [534408966].

## F2004 Quantum Mechanics

(3 - 0 - 8. Prerequisites: [ F2010 , F2012 , F3016 , F3005 ]. 6 IFI11 )

**Equivalence:** F 00882

Intermediate course in physics that provides the fundamentals of non-relativistic quantum mechanics as the basis for studying advanced topics, such as statistical mechanics, solid-state physics, atomic and nuclear physics. This course requires previous knowledge of the Schrodinger equation, Bohr's atom, calculus of variations, complex analysis and Hermitian operators. As a learning outcome students will describe quantum systems and predict the physical observables.

**General objective:** Upon completion of this course, students will be able to identify physical systems which require a description given by quantum mechanics, to describe these quantum systems and to predict the result of measurements of physical quantities represented by Hermitian operators.

**Key words:** Hydrogen atom. Fundamental quantum mechanics experiments. Dirac notation. Postulates of

quantum mechanics. Quantum harmonic oscillator. Angular momentum systems. Spin.

**Bibliography:** \* Townsend, John S, A modern approach to quantum mechanics / John S. Townsend, Sausalito, Calif. : University Science Books, c2000, California, c2000, eng, [1891389130 (papel no ácido)].

## **F2006 Optics and Modern Physics** ( 3 - 0 - 8. Prerequisites: [ TE2005 ], 5 ITE11, 6 ITS11 ) **Equivalence: None**

An intermediate course that provides students with the tools needed to design and conduct experiments related to the handling of light and optical phenomena; to model the atom, understand its structure and its emission and absorption of energy processes; and understand the basic concepts of quantum mechanics. This course requires prior knowledge of wave motion, electricity and magnetism, as well as integral and differential calculus. As a learning outcome students will understand the nature and propagation of light, analyzing optical phenomena such as reflection, refraction, interference, polarization and diffraction by means of practical applications. They will also use quantum principles to model the interaction between radiation and matter.

**General objective:** Upon completion of this course, students will be able to comprehend the nature of light and its propagation, analyzing the phenomena of reflection, refraction, interference, polarization, and diffraction, by means of practical applications. In addition, students will model the atom, demonstrating comprehension of its structure and the processes of emission and absorption of energy as well as basic concepts of quantum mechanics.

**Key words:** Light and electromagnetic waves. Light phenomena. Atomic models. Quantum principles.

**Bibliography:** \* Jewett, John W., Physics for scientists and engineers / John W. Jewett, Jr., Raymond A. Serway., 7th ed., Belmont, Calif. : Thomson-Brooks/Cole, 2008., California, 2008., eng, [9780495013129],[0495013129],[0495112232],[9780495112235].

## **F2009 Acoustics** ( 3 - 0 - 8. Prerequisites: [ F1003 ]. 5 IMI11 ) **Equivalence: None**

Intermediate sound physics course in which students acquire the necessary tools to know, understand and apply the basic concepts of sound and acoustic physics, as well as concepts of musical instruments, auditoriums acoustics and the transmission, propagation and reception of sound. This course requires prior knowledge of mechanics; waves, fluids and heat; electricity and magnetism; and differential and integral calculus. As a learning outcome students will solve specific sound problems, by applying their knowledge of basic sound physics, acoustic musical instruments and the generation, propagation and reception of sound in both open and enclosed spaces, working both individually and in teams.

**General objective:** Upon completion of this course, students will be able to understand and apply the basic theories of the science of sound, including the physics of sound, acoustic string instruments, wind and brass instruments, percussion, and the human voice, as well as the basic theories of acoustics in open and closed environments, by means of solution of exercises and practical problems related to generation, propagation, reception, and perception of sound.

**Key words:** Musical instruments. Sound. Hearing. Acoustics.

**Bibliography:** \* Rossing, Thomas D., 1929-, The science of sound / Thomas D. Rossing., 2nd ed., Reading Mass. : Addison-Wesley, c1990., [0201157276].

## **F2010 Mathematical Physics I** ( 3 - 0 - 8. Prerequisites: [ F1003 , F1005 , MA2009 , MA2010 ]. 4 IFI11 ) **Equivalence: F3005**

The purpose of this intermediate course in industrial engineering physics is to provide students with the necessary mathematical tools to study and analyze different problems in advanced physics, such as analytical mechanics, electromagnetic theory, electrodynamics, optics, quantum mechanics, solid state and other related areas. The course requires prior knowl-

edge of differential and integrated calculus, differential equations, electricity and magnetism. The learning outcome of this course is for students to analyze, build and solve mathematical models for the study of physical phenomena.

**General objective:** Upon completion of this course, students will be able to propose and solve mathematical models applied to the areas of physics and engineering; solve ordinary and partial differential equations that describe the behavior of physical phenomena; understand the linear systems theory; study problem using Fourier analysis.

**Key words:** Fourier analysis. Vector analysis. Frobenius method. Partial differential equations. Curvilinear coordinates. Special functions.

**Bibliography:** \* Arfken, George B. (George Brown), 1922-, *Mathematical methods for physicists* / George B. Arfken, Hans J. Weber., 5th ed., San Diego : Harcourt/Academic Press, c2001., [0120598256],[0120598264].

## F2011 Computational Physics I

( 3 - 0 - 8. Prerequisites: [ M2025 , F3007 Corequisite ]. 5 IFI11 )

**Equivalence:** F2002

This is an intermediate level course, which introduces students to the use of various computer techniques for modeling in science and engineering. It will allow students to develop skills in the use of numerical analysis in physical engineering problems. The course will include examples, problems and case studies related to scientific topics and concepts. Numerical methods can be classified as basic, advanced and cutting-edge algorithms. This course will cover the basic and advanced methods. Previous knowledge is required in basic programming and analytical mechanics. The learning outcome for this course is that the students program efficient algorithms, based on the mathematical models that explain physical processes.

**General objective:** Upon completion of this course, students will be able to: 1. Analytically discuss physics problems based on fundamental principles. 2 Determine the need to use a numerical solution to a physics problem. 3 Model a physics problem using

efficient algorithms; evaluate the performance of a numerical algorithm. 4. Define the validity limitations of a model and numerical simulation.

**Key words:** Numerical methods. Computer simulations.

**Bibliography:** \* Garcia, Alejandro L., 1959-, *Numerical methods for physics* / Alejandro L. Garcia., 2nd ed., Upper Saddle River, N.J. : Prentice Hall, c2000., [0139067442].

## F2012 Mathematical Physics II

( 3 - 0 - 8. Prerequisites: [ F2010 ]. 5 IFI11 )

**Equivalence:** None

The purpose of this intermediate course is to provide students with the necessary mathematical tools to study and analyze different problems in advanced physics, such as fluid mechanics, electrodynamics, optics, quantum mechanics, relativity, non-linear physics and other related areas. The course requires previous knowledge of differential and integral calculus, differential equations and linear algebra. The learning outcome of this course is for students to present solutions for physics and engineering problems using techniques like complex analysis and linear algebra. Students analyze and solve optimization problems using variational calculus techniques.

**General objective:** Upon completion of this course, students will be able to propose and solve mathematical models applied to different areas of physics and engineering; to use complex variable analysis for solving differential equations, to evaluate integrals that describe a physical quantity and apply it to linear systems and integral transforms; solve optimization problems using variational techniques.

**Key words:** Calculus of variations. Complex variable analysis. Vector spaces. Hermite operators.

**Bibliography:** \* Arfken, George B. (George Brown), 1922-, *Mathematical methods for physicists* / George B. Arfken, Hans J. Weber., 5th ed., San Diego : Harcourt/Academic Press, c2001., [0120598256],[0120598264].

### **F2013 Electrodynamics** ( 3 - 0 - 8. Prerequisites: [ F3007 ]. 6 IFI11 ) Equivalence: None

The present is an introduction to an intermediate course in which the solutions and applications of Maxwell's equations are learned. The electromagnetic wave propagation as well as the way in which they are generated are also studied. The analytical skills required to pursue applied research in electrodynamics are developed. The course includes examples, problems and case studies related to topics and concepts of electromagnetism. Previous knowledge is required in electromagnetic theory and computational physics. The learning outcome of this course is highly rich since at the end the students are able to propose, model and solve analytically as well as numerically physics problems involving various electromagnetic processes. Throughout the course problem solving skills are developed, critical analysis is practiced and computational simulation is strengthened.

**General objective:** Upon completion of this course, students will be able to analytically discuss electromagnetism problems based on fundamental principles; solve basic electromagnetic propagation equations in diverse linear media; model an electrodynamics problem using efficient algorithms.

**Key words:** Electromagnetic propagation. Electromagnetic radiation. Special relativity. Maxwell's equations.

**Bibliography:** \* Griffiths, David J. (David Jeffery), 1942-, Introduction to electrodynamics / David J. Griffiths., 3rd ed., Upper Saddle River, N.J. : Prentice Hall, c1999., [013805326X (rústica)], [9780138053260].

### **F3007 Electromagnetic Theory** ( 3 - 0 - 8. Prerequisites: [ F2010 , F3005 ]. 5 IFI11 ) Equivalence: F 00873

This advanced course in Industrial Engineering Physics focuses on advanced electromagnetism topics. The course requires prior knowledge of mathematical methods for physics in specific topics such as advanced vector calculus, the solution of differential equations of several variables and series. As a learning outcome students will solve advanced electro-

statics, magnetism and electromagnetic problems, and use the knowledge acquired to solve problems and interpret Maxwell's equations.

**General objective:** Upon completion of this course, students will be able to solve advanced electrostatics, magnetostatics, and electromagnetic problems utilizing Maxwell's equations. Students will also be able to develop a conceptual understanding of Maxwell's equations which will allow students to interpret them.

**Key words:** Electromagnetism. Electrostatics. Magnetostatics. Maxwell's equations.

**Bibliography:** \* Griffiths, David J. (David Jeffrey), 1942-, Introduction to electrodynamics / David J. Griffiths, 3rd ed., Prentice Hall, Upper Saddle River, N.J., c1999, eng.

### **F3013 Statistical Mechanics** ( 3 - 0 - 8. Prerequisites: [ F2004 ]. 7 IFI11 ) Equivalence: F 95084

This advanced course in physics provides students with the fundamentals of statistical mechanics in preparation for dealing with complex problems that connect the quantum behavior of microscopic and observable physical systems on the macroscopic scale. This course requires prior knowledge of quantum mechanics and statistical probability. As a learning outcome students will connect the quantum behavior of microsystems and observable physical quantities on the macroscopic scale.

**General objective:** Upon completion of this course, students will be able to utilize tools of statistical mechanics in order to describe macroscopic (thermodynamic) systems in terms of the behavior of constituent microscopic units which behave according to the laws of quantum mechanics.

**Key words:** Elements of the Theory of Probabilities. Statistical equilibrium. Entropy. Free energies. Assembly theory.

**Bibliography:** \* Reif, F., Fundamentals of statistical and thermal physics., [0070518009].



**F3016 Modern Physics**  
**( 3 - 0 - 8. Prerequisites: [ F1003 , F1005 , MA2009 , MA2010 ]. 4 IFI11 )**  
**Equivalence: F3006**

The purpose of this advanced course in industrial engineering physics is to prepare students to use mathematical analysis and apply scientific criteria for modeling the atom and understanding its structure and its processes for energy emission and absorption. Students also apply tools of calculus and equations to understand the fundamental concepts of quantum mechanics. The course requires previous knowledge of electricity and magnetism as well as knowledge of integral and differential calculus. The learning outcome of this course is for students to use quantum principles to correctly model the interaction between materials and radiation and, in addition, to calculate kinematic and dynamic values using equations from the special theory of relativity.

**General objective:** Upon completion of this course, students will be able to build mathematical models that correctly describe the interaction of radiation with matter.

**Key words:** Special theory of relativity. Photons. Uncertainty principle. Schrodinger equation. Bohr atom.

**Bibliography:** \* Serway, Raymond A., Física moderna / Raymond A. Serway, Clement J. Moses, Curt A. Meyer., 3a ed., México, D. F. : Thomson, c2006., spaeng, [970686492X], [9789706864925].

**F3020 Experimental Physics I**  
**( 3 - 1 - 8. Prerequisites: [ F3023 Corequisite ]. 6 IFI11 )**  
**Equivalence: F3010**

This advanced course in physics provides the students with the tools required to design and perform experiments related to handling measurements, and to analyze and interpret the data obtained in order to solve industrial and research problems. It requires previous knowledge of modern physics, electromagnetic theory and electrical engineering. As a result of learning the student develops the capacity to apply current technology to the measurement process,

specifically in order to verify the theory seen on other courses, as well as develop specialized measurement techniques, such as interferometry or optical metrology.

**General objective:** Upon completion of this course, students will be able to conduct experiments using data analysis, measurement systems, sensors and transducers; and will be familiar with industrial safety standards.

**Key words:** Sensors. Geometric optics. Light interference and polarization. Basic measurements. Spectroscopy.

**Bibliography:** \* Dunn, Patrick F., Measurement and data analysis for engineering and science / Patrick F. Dunn., Boston : McGraw-Hill Higher Education, c2005., [0072825383 (paper no a'cido)], [0071112308].

**F3023 Optics**  
**( 3 - 0 - 8. Prerequisites: [ F3007 ]. 6 IFI11 )**  
**Equivalence: F3011**

This is an advanced course in physics with the purpose of providing students with the tools required to design and perform experiments related to the use of visible and invisible light as well as analyze and interpret the information obtained in order to solve industrial or research problems. The course requires previous knowledge of undulating movement, electricity and magnetism. The learning outcome of this course is to develop in the students the ability to apply current optical technology to research as well as propose solutions to industrial problems.

**General objective:** Upon completion of this course, students will be able to describe the theories of light behavior from the perspective of geometric and wave optics. The course includes the following topics: Electromagnetic Wave Theory, Laws of Reflection and Refraction in Dielectric Interfaces, Geometric Optics, Superposition of Waves and Polarization.

**Key words:** Electromagnetic waves. Light interference and polarization. Light propagation. Geometric optics.



**Bibliography:** \* Hecht, Eugene., Optics / Eugene Hecht., 4th ed., San Francisco, CA. ; México : Addison-Wesley, c2002., [0805385665],[9780805385663].

### **F3024 Alternative Energy**

( 3 - 0 - 8. Prerequisites: [ F1003 , F1005 ]. 7 IDS11, 6 IFI11, 5 IQP11 )

**Equivalence:** F3009, IQ3002

This is an advanced course in engineering physics with the purpose of providing students with a vision of the different renewable energy options as well as the principles of physics that govern their conversion. The course requires previous knowledge of electricity, magnetism, fluid mechanics and thermodynamics. The learning outcome of this course is for students to be able to quantitatively identify available energy flows, beginning with renewable sources of energy, and perform conceptual engineering of projects that use renewable energy technology.

**General objective:** Upon completion of this course, students will be able to identify the potential of diverse renewable energy sources, such as solar, wind and bioenergy, in a specific location, select the appropriate technologies and perform preliminary designs.

**Key words:** Solar energy. Sustainable development. Bioenergy. Wind power.

**Bibliography:** \* Oliver Probst, Lecture Notes on Renewable Energy Sources, ITESM, Español.

### **F3025 Experimental Physics II**

( 3 - 1 - 8. Prerequisites: [ F3016 , F3020 ]. 7 IFI11 )

**Equivalence:** F3012

This is an advanced course in physics intended to develop the student's ability to perform specialized measurements and handle data acquisition systems in an appropriate fashion. It requires knowledge of experimental physics, mathematics, electrical engineering, programming, optics, modern physics and electromagnetic theory. As a learning result, the student will evaluate different measurement systems, analyze relevant information for creating statistical

models applied to experiments, understand the operation of several special instruments, and apply the different measurement techniques to the equipment in advanced physics laboratories.

**General objective:** Upon completion of this course, students will be able to evaluate different types of measurement systems, analyzing the relevant data to create statistical models; understand how specialized instruments work; and apply diverse measurement techniques in advanced physics laboratory equipment.

**Key words:** Sensors. Microscopy. Basic measurements. Alternative fuels. Spectroscopy.

**Bibliography:** \* Dunn, Patrick F., Measurement and data analysis for engineering and science / Patrick F. Dunn., Boston : McGraw-Hill Higher Education, c2005., [0072825383 (papel no a´cido)], [0071112308].

### **F3026 Physical Engineering Project I**

( 3 - 1 - 8. Prerequisites: [ F3025 Corequisite , F3020 ]. 7 IFI11 )

**Equivalence:** F3017

This is an advanced course in which students will begin their science projects on the topic they have selected as part of their specialization. Students will finish a research report on the project's introduction and an extensive bibliographical review, and select their project advisor. The learning outcome for this course is that students select and plan their research topics, perform a bibliographical review, and present antecedents for and an introduction to their chosen topic.

**General objective:** Upon completion of this course, students will be able to select and propose a research topic within their science project; conduct bibliographic research on the research topic; select at least one professor or researcher as a project advisor; present background information on the research topic; write the introduction of the research project; and present a research project progress report.

**Key words:** Research methodology. Research project. Science project progress report.

**Bibliography:** \* Holman, J. P. (Jack Philip), Métodos experimentales para ingenieros / J.P. Holman., México : Mc Graw-Hill , 1981., spa, [9684512953].

**F3027 Computational Physics II**  
( 3 - 0 - 8. Prerequisites: [ F2011 ]. 8 IFI11 )  
**Equivalence: None**

This is an advanced course, which introduces students to the use of the various computer techniques used to model science and engineering problems. The course seeks to develop the students' skills in using numeric analysis in the context of physics engineering problems. This course will include examples, problems, case studies and scientific topics and concepts. Previous knowledge is required in electromagnetic theory, quantum mechanics and basic computer physics. The learning outcome for this course is that students be able to present, model and solve numerically physics problems that involve various processes of statistical mechanics, electromagnetism, thermodynamics and quantum mechanics, developing skills in problem solving, critical analysis and computer modeling.

**General objective:** Upon completion of this course, students will be able to analytically discuss physics problems based on fundamental principles; determine the need to use a numerical solution to a physics problem; model a physics problem using efficient algorithms; evaluate the performance of a numerical algorithm; and define the validity limitations of a model and numerical simulation.

**Key words:** Numerical methods. Computer simulations. Stochastic methods.

**Bibliography:** \* Harrison, P. (Paul), Computational methods in physics, chemistry, and biology : an introduction / Paul Harrison., Chichester ; New York : Wiley, c2001., [047149562X],[0471495638].

**F3028 Solid-State Physics**  
( 3 - 0 - 8. Prerequisites: [ F2004 , F3013 ]. 8 IFI11 )  
**Equivalence: None**

The purpose of this advanced physics course is to provide students with a vision of structural and elec-

tronic phenomena of solids at microscopic level as well as mathematical tools for their description. The course requires previous knowledge of statistical and quantum mechanics. The learning outcome of this course is for students to relate macroscopic phenomena to underlying microscopic processes, interpret experimental results and design mathematical models.

**General objective:** Upon completion of this course, students will be able to identify the microscopic processes that are responsible for the mechanical, thermal, electric and magnetic phenomena observed in solids.

**Key words:** Mechanical properties. Thermal properties. Electronic properties.

**Bibliography:** \* Kittel, Charles., Introduction to solid state physics / Charles Kittel., 8th ed., Hoboken, NJ : Wiley, c2005., [047141526X (papel no a'cido)],[0471680575].

**F3029 Physical Engineering Project II**  
( 3 - 1 - 8. Prerequisites: [ F3026 ]. 8 IFI11 )  
**Equivalence: F3021**

This is an advanced course in which students will continue with their science projects on the topic they have selected as part of their specialization. Students will finish a research report on the theoretical framework and on the initial part of the experimental phase of the project. The learning outcome for this course is that students complete the theoretical framework and present their progress with respect to their first experimental findings.

**General objective:** Upon completion of this course, students will be able to present the theoretical framework of their scientific research project; demonstrate their progress in the project; present the first test results; and write a research project progress report.

**Key words:** Scientific method. Research project. Science project progress report.

**Bibliography:** \* Holman, J. P. (Jack Philip), Métodos experimentales para ingenieros / J.P. Holman., México : Mc Graw-Hill , 1981., spa, [9684512953].

### F3030 Physical Engineering Project III

( 3 - 1 - 8. Prerequisites: [ F3029 ]. 9 IFI11 )  
**Equivalence:** F3022

This is an advanced course in which students will conclude their research projects in their selected areas. Students will complete a comprehensive report on the research project, equivalent to a university degree thesis paper, which will be presented before a committee according to the institution's policy. The learning outcome for this course is that students completely develop and conclude their science project by writing the final report which will include the presentation of experimental findings and conclusions from the work performed and be presented before an evaluation committee.

**General objective:** Upon completion of this course, students will be able to complete their science project; present sufficient test results; write the final report, including the experimental results and conclusions; and present their science project to an evaluation committee.

**Key words:** Scientific method. Research project. Final science project report.

**Bibliography:** \* Holman, J. P. (Jack Philip), Métodos experimentales para ingenieros / J.P. Holman., México : Mc Graw-Hill , 1981., spa, [9684512953].

### F3032 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 IFI11 )  
**Equivalence:** None

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## FZ Finance

### FZ1005 Financial Mathematics

( 3 - 0 - 8. Prerequisites: None. 4 INT11, 3 LAE11, 2 LAF11, 3 LCDE11, 3 LCPF11, 3 LDF11, 3 LDN11, 3 LEM11, 3 LIN11, 3 LLN11, 3 LPO11 )

**Equivalence:** FZ1000

This is a basic course in the area of financial management introducing students to the fundamental concept of the Time Value of Money. The following concepts and their interrelations form the backbone of the course: simple and compound interest calculations; rates of return and discount rates; real, nominal and effective interest rates and interest-rate conversions; annuities (ordinary, due and deferred); present value, net present value, future value and internal rate of return; amortization; sinking-fund calculations; arithmetic and geometric gradients. These tools facilitate making optimal decisions when given several alternative courses of action and will be used to solve many practical problems. Students will also learn how to structure and solve problems in Excel. In addition to exams and individual assignments, students are expected to work in small groups and hand in the following deliverables: a project in which they evaluate the annual effective cost (or CAT) of an actual financial product, credit or other source of financing; at least two documents in which they present a comparative cost-benefit analysis of different financial institutions and/or their products, for example, credit- or debit cards, Afores (pension funds), mutual funds, etc.

**General objective:** The course is designed to develop analytical skills for sound decision-making. After this course, it is expected that students understand and are able to apply the main concepts, measures, and tools of interest-rate mathematics, to make optimal decisions when faced with alternative financial products, proposals, or courses of action, both in a personal or business context.

**Key words:** Annuities. Simple interest. Compound interest. Amortization and capitalization schedule. Present and future value, internal rate of return. Gradients.

**Bibliography:** \* Héctor M. Vidaurri, Matemáticas financieras, cuarta, CENGAGE, Español.

### FZ1006 Personal and Business Finance

( 3 - 0 - 8. Prerequisites: [ FZ1005 , MA1017 , CF2015 Corequisite ]. 6 INT11, 5 LAE11, 5 LAF11, 5 LCDE11, 4 LCPF11, 6 LDF11, 5 LDN11, 4 LEF11, 5 LEM11, 5 LIN11, 5 LLN11, 6 LPO11 )

**Equivalence:** None

Basic course in the field of finance which introduces students to personal and corporate finance. It requires prior knowledge of the value of money over time, interest rates, yields. As a learning outcome students are expected to make an estimate of their personal finances at different stages of their lives and produce a report identifying a fixed-rate investment fund or an equity fund, such as those that middle-income individuals commonly have access to and that are offered by insurance companies, and / or a comparative report on the cash flow and capital structure of Mexican and foreign companies. The student is expected to be familiar with the use and processing of databases containing detailed historical information of companies, such as the database Economática.

**General objective:** Upon completion of this course, students will be able to develop and define strategies for a personal finance budget at different stages of life, support decision-making related to investment and financing; identify different financial sources and capital structure and differentiate their costs; understand the procedure for calculating the Weighted Average Cost of Capital (WACC); understand the basic differences between investment in debt instruments and investment in equities; understand the concept of cash flow and net working capital and the importance to companies of the proper management of these.

**Key words:** Personal finance, investment, credit, savings, working capital management, capital structure and costs.

**Bibliography:** \* Colquitt, Joetta., Credit risk management : how to avoid lending disasters and maximize earnings / Joetta Colquitt., 3rd ed., New York, N.Y. : McGraw-Hill, c2007., [0071446605 (encuadernado : papel alcalino)],[9780071446600 (encuadernado : papel alcalino)].

## FZ1007 Introduction to the Finance Management Academic Program

( 3 - 0 - 4. Prerequisites: None. 1 LAF11 )

Equivalence: None

The purpose of this basic course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Ross, Stephen A., Fundamentos de finanzas corporativas / Stephen A. Ross, Randolph W. Westerfield, Bradford D. Jordan ; traducción, Guadalupe Meza Staines, Martha E. Mauri Hernández, Pilar Carril Villarreal., 4a ed. en español., México, D.F. : McGraw-Hill, 2010., spaeng, [9786071502988],[6071502985].

## FZ2006 Money and Capital Markets

( 3 - 0 - 8. Prerequisites: [ FZ1000 , FZ1005 , MA1017 ]. 4 LAF11, 5 LCPF11, 6 LDF11, 5 LEF11 )

Equivalence: FZ00863, FZ2001

This intermediate level course will help students to identify the different alternatives for investment and financing through financial markets; calculate prices and returns of existing financial instruments; evaluate and analyze investment alternatives using fundamental and technical analysis tools; locate in the con-

text of the Mexican Financial System the activities related to intermediary, operating and regulatory institutions that participate in the Mexican Stock Exchange, as well as the legal framework under which such institutions perform.

**General objective:** In this course, students are expected to examine the diverse investment and financing alternatives available in the Mexican financial markets; be able to calculate prices and returns of financial instruments used by the money and capital markets; use the basic fundamental analysis tools and techniques to evaluate investment alternatives in these markets. Furthermore, students will learn how to identify the different factors that affect the determination of prices and interest rates traded in the financial markets in the current economic, political, and social context.

**Key words:** Economic, political and social factors that influence both prices and interest rates. Financial instruments that quote on the Mexican stock market. Mexican stock market. Regulation through the national regulatory framework, general international regulations. Mexican financial system.

**Bibliography:** \* Kohn, Meir G., Financial institutions and markets / Meir Kohn., 2nd ed., New York : Oxford University Press, 2004., [0195134729 (pasta dura : papel alcalino)].

## FZ2013 Regulation and Structure of Financial Institutions

( 3 - 0 - 8. Prerequisites: [ D1022 , EC1009 ]. 4 LAF11, 5 LDF11 )

Equivalence: FZ2002

This is an intermediate course in the field of finance, intended to provide the student with knowledge of the structure and legal framework under which financial institutions are regulated, in such a way as to promote the country's growth in a sustainable manner, increasing the value of companies and promoting social welfare. For this course students are required to have previous knowledge of Business Law, Accounting, Economics, and Financial and Regulatory Mathematics. As a learning outcome students are expected to prepare a final project in which they solve a case that has occurred in a financial institu-



tion and apply the concepts learned about theoretical structure, regulation, normative and applied ethics; analyze at least ten current financial news reports; prepare a presentation and a report for at least two financial institutions in which the student becomes the “consultant” for the structure, regulation and current issues affecting these institutions.

**General objective:** Upon completion of this course, students will understand the role, structure, functioning, objectives, legal, ethical and organizational framework of financial institutions (Credit Auxiliary Organizations, Insurance and Bonding Companies, Development Banks, Brokerage, Mutual Funds, etc.) and their regulatory organizations (SHCP, BANXICO, NBSC, IPAB, CONSAR, CNSF, CONDUSEF), to analyze current issues and regulations focusing on economic and ethical implications of financial practices.

**Key words:** The financial system.

**Bibliography:** \* Dieck Assad, Flory Anette, 1975-, *Instituciones financieras* / Flory Anette Dieck Assad., 1a ed., México, D.F. : McGraw Hill, c2004., [9701039637].

## **FZ2014 Management of Banks and Financial Groups**

( 3 - 0 - 8. Prerequisites: [ FZ2013 , EC3021 ]. 5 LAF11, 5 LEF11 )

**Equivalence:** FZ2003

This is an intermediate course in the field of financial management that aims to teach the student to formulate banking management strategies focused toward improving the performance of financial groups and/or financial intermediate groups of non-bank credit institutions. The course requires that students be familiar with the instruments of the money and capital market, time value of money, as well as the history of banking in Mexico and the current Mexican financial system. The student should place particular emphasis on understanding the regulations of the Mexican financial system and comparing these with regulations in the rest of the world. As a learning outcome, it is expected that students be able to understand financial group management; and assess the financial performance and formulate operation strategies for products and financial services, bearing in mind the regulatory framework.

**General objective:** Upon completion of this course, the student will be able to understand the structure and strategies followed by banks, financial groups and non-bank credit institutions; identify the regulatory framework in Mexico, as well as the main differences and similarities between the Mexican system and the financial systems in the countries that have the most commercial and financial exchanges with Mexico; formulate bank management strategies to improve the performance of financial groups and/or non-bank credit institutions.

**Key words:** Performance measurements. Financial intermediaries. Regulatory institutions. Financial services.

**Bibliography:** \* Rose, Peter S., *Bank management & financial services* / Peter S. Rose, Sylvia C. Hudgins., 7th ed., New York ; México : McGraw-Hill, c2008., [0071259384 (ed. internacional)], [9780071259385 (ed. internacional)], [007304623X (papel alcalino)], [9780073046235 (papel alcalino)].

## **FZ2015 Financial Structure and Corporate Governance**

( 3 - 0 - 8. Prerequisites: [ FZ1005 , CF2015 ]. 5 LAF11, 7 LCPF11, 8 LDF11 )

**Equivalence:** CF2002, FZ2007

This is an intermediate course in the field of financial management intended to teach the student to design, manage, and evaluate the capital structure of the company, by means of the optimal mix of debt, equity, and other sources of finance, taking into consideration that the company should be managed according to good corporate governance practices. Previous knowledge related to the time value of money, money and capital markets, and financial mathematics is required. As a learning outcome the student is expected to solve a case in which he carries out an assessment of the financial structure of a company and proposes a plan of corporate governance practices.

**General objective:** At the end of the course the student will be able to understand and explain the financial role within a company; determine the cost of the different sources of funding; learn and apply the main valuation models of investments and finance



sources to achieve the optimal financial structure; analyze the impact of dividend policies to maximize the value of a company; and understand and explain the main practices of corporate governance in organizations in order to maximize shareholder wealth and guarantee the rights of stakeholders, based on the current law.

**Key words:** Capital structure. Capital Cost. Corporate governance. Financial structure. Corporate finance.

**Bibliography:** \* Ross, Stephen A., Corporate finance / Stephen A. Ross, Randolph W. Westerfield, Jeffrey Jaffe., 9th ed., Boston : McGraw-Hill/Irwin, 2010., [9780073382333 (papel alcalino)], [0073382337 (papel alcalino)].

### FZ2016 Project Valuation and Financing

( 3 - 0 - 8. Prerequisites: [ FZ1005 ]. 6 LAE11, 6 LAF11, 6 LCDE11, 6 LCPF11, 8 LDF11, 6 LDN11, 6 LEM11, 6 LIN11, 6 LLN11 )

**Equivalence:** FZ2004

This is an intermediate course in the field of finance, which promotes the evaluation of projects of high added value, through estimating the project's financial performance, financial assessment and the feasibility of project, taking into consideration its sustainability and access to funding sources. The course requires knowledge of basic finance, personal and corporate finance, innovation, marketing and business fundamentals, in order to integrate learning projects. As a learning outcome students are expected to develop a finance and risk analysis projection for a real business proposal, evaluating finance alternatives and feasibility studies endorsed by the client. Students are expected to use advanced Excel and other tools in order to simulate different scenarios.

**General objective:** At the end of the course, students are expected to be able to develop the analysis and financial assessment for a real project, characterized by its high content of innovation, added value and technological development; propose innovative financing strategies by measuring the impact they may have on the environment and promoting their

implementation in a sustainable manner; carry out capital budget analysis; use project assessment techniques; analyze and evaluate various financing alternatives and the feasibility of the projects, through scenario and sensitivity analysis.

**Key words:** Capital budgeting. Project valuation. Funding. Feasibility.

**Bibliography:** \* Seitz, Neil, 1943-, Capital budgeting and long-term financing decisions / Neil Seitz, Mitch Ellison., 4th ed., Mason, Ohio : Thomson/South-Western, c2005., [0324258089 (encuadernado)].

### FZ2017 Debt Instruments and Securitization

( 3 - 0 - 8. Prerequisites: [ FZ2006 , FZ3027 ]. 7 LAF11, 9 LEF11 )

**Equivalence:** FZ3007

This is an intermediate course in the field of financial markets. Previous knowledge of the characteristics of debt instruments in both local and international markets is required as well as a full understanding of these instruments both quantitatively and through the use of technology. As a learning outcome the student will prepare a prospect for issue and securitization of a bond to generate funds for a local company. The students will prepare a presentation to the company executives for evaluation.

**General objective:** At the end of this course, students will understand and use the yield curves, design bond investment strategies and immunization of bond portfolios; and understand the characteristics of asset-backed securities.

**Key words:** Yield curves. Fixed income instruments. Stock markets. Fixed income portfolios.

**Bibliography:** \* Millán García, Mayoral, Instrumentos Derivados para la empresa, 1a ed., España : McGraw Hill, 2008., [9788448168834].

## FZ3009 International Financial Management

( 3 - 0 - 8. Prerequisites: [ FZ2000 , FZ2001 , CF2015 ]. 7 LAF11, 8 LCPF11 )

**Equivalence:** FZ00881, FZ3005

As a learning outcome students are expected to design hedging strategies for exchange rate risk, and evaluate investment and financing alternatives on an international level.

**General objective:** At the end of this course, students will know the main international financial management concepts, methodologies, and techniques, focusing mainly on the evaluation of international investment and financing decisions, as well as on foreign-exchange risk management.

**Key words:** International investment and financing. Derivatives markets. International financial system. Exchange market.

**Bibliography:** \* Madura, Jeff., International financial management / Jeff Madura., 8th ed., Mason, Ohio : Thomson / South-Western, c2006.

## FZ3025 Credit Management

( 3 - 0 - 8. Prerequisites: [ FZ2014 ]. 7 LAF11 )

**Equivalence:** FZ3002

This is an advanced course in the field of finance aimed at helping students develop a value added profile in the labor market for professionals in finance, in terms of their ability for financial risk management and managing the relationship of funding and credit risk. It is intended that the students, using the analytical and quantitative skills learned on this course, be able to determine the price of a credit portfolio and manage the profitability and risk adjusted returns to improve the functioning of the organization where they work at. Prior knowledge is required in Bank and Financial Group Management, structure and regulation of financial institutions, statistics and Excel management tools. Students are expected to develop a project in which they show their ability to determine the price of a loan portfolio.

**General objective:** Upon completion of this course, students will be able to identify whether an organi-

zation requires additional funding; carry out simulations under different scenarios to determine the amount of capital and reserves a credit institution must maintain to pay for credit risk losses, including measures of profitability and risk adjusted returns for monitoring and portfolio optimization; analyze and apply different methodologies and strategies to determine credit needs, to ensure whether a person or company is eligible for credit and make funding decisions within an organization.

**Key words:** Credit. Credit recipient. Value at risk. Credit risk. Credit Management.

**Bibliography:** \* Colquitt, Joetta., Credit risk management : how to avoid lending disasters and maximize earnings / Joetta Colquitt., 3rd ed., New York, N.Y. : McGraw-Hill, c2007., [0071446605 (encuadrado : papel alcalino)], [9780071446600 (encuadrado : papel alcalino)].

## FZ3026 Valuation, Mergers and Acquisitions

( 3 - 0 - 8. Prerequisites: [ FZ2016 ]. 7 LAF11 )

**Equivalence:** None

This is an advanced course in the area of finance, which seeks that students determine the value of a public company, as well as an acquisition, merger or division of national and multinational companies. The course requires prior knowledge of financial analysis, financial forecasting, capital budgeting, estimating cost of financing, weighted average cost of capital and valuation of derivatives. As a learning outcome is expected that the students, in teams, make a valuation of a public or private company, delivering a report which shows the methodology used, both discounted cash flow and by multiples.

**General objective:** After completing this course, students will be able to value public and private companies, use simulators and apply the knowledge of corporate finance and securities.

**Key words:** Business valuation. Mergers and acquisitions. Discounted cash flow. Multiple analysis.

**Bibliography:** \* Titman, Sheridan., Valuation : the art and science of corporate investment decisions /

Sheridan Titman, John D. Martin., Boston ; México : Pearson/Addison Wesley, c2008., [9780321336101], [0321336100].

### **FZ3027 Derivatives Valuation**

( 3 - 0 - 8. Prerequisites: [ CD1003 , FZ2006 , MA1020 ]. 6 LAF11, 7 LCPF11, 7 LEF11 )

**Equivalence:** FZ3011, FZ3013

This is an advanced course in the field of finance aimed at the students using financial instruments to manage business risks. It requires prior knowledge of financial mathematics, statistics, and the functioning of financial markets. As a learning outcome the student is expected to resolve cases on hedging strategies and valuation of derivatives.

**General objective:** Upon completion of this course, students will be able to understand the development of derivatives markets; use the main financial instruments to manage risk in businesses; calculate the value of such instruments; identify opportunities for arbitrage; and design optimal hedging strategies.

**Key words:** Forward. Futures. Options. Swaps. Arbitration and risk hedging.

**Bibliography:** \* Hull, John, 1946-, Fundamentals of futures and options markets / John C. Hull., 4th ed., Upper Saddle River, N.J. : Prentice Hall, c2002., [0130176028].

### **FZ3028 Investment Management**

( 3 - 0 - 8. Prerequisites: [ FZ3027 ]. 8 LAF11 )

**Equivalence:** FZ3008

This is a Finance Management advanced course that requires students to select and value investment portfolios taking into account technical criteria, the needs of potential investors and markets trends. In addition, the course prepares the students for the exam leading to AMIB certification (Mexican Financial Brokers Association). Previous knowledge of the money and capital market, statistics, mathematics and econometrics is required. The active learning process will be based on two aspects: firstly, promoting internal competition by acting as investors with

market portfolios, and evaluating two indicators: the portfolio risk-return performance and the investor profile; secondly creating a mutual fund with only Mexican stocks to be graded by market professionals in conjunction with the course professor.

**General objective:** Upon completion of this course, students will be able to make an investment decision related to selecting a stock for formulating portfolios or selecting mutual funds based on analysis and optimization tools, the kind of investors, and factors such as market efficiency and investor behavior.

**Key words:** Stock market. Stocks. Portfolio management. CAPM. Markowitz. Efficient markets.

**Bibliography:** \* Reilly, Frank K., Investment analysis and portfolio management / Frank K. Reilly, Keith C. Brown., 9th ed., Australia : South-Western Cengage Learning, c2009., [9780324656121 (student ed. package)], [0324656122 (student ed. package)], [9780324656329 (student ed.)], [0324656327 (student ed.)], [9780324235968 (Thomson one business sch ed.)], [0324235968 (Thomson one business sch ed.)].

### **FZ3029 International Finance and Risk Management**

( 3 - 0 - 8. Prerequisites: [ FZ1006 ]. 8 LAE11, 8 LCDE11, 7 LDN11, 8 LIN11, 9 LLN11 )

**Equivalence:** FZ3005

This is a Finance advanced course, focused in teaching the students how the foreign exchange market works, the exchange rate determinants and different strategies to manage risk arising from foreign currency exposure and financial decisions. It requires prior knowledge of statistics, financial mathematics, financial management, economics, and databases of economic and financial information. As a learning outcome, the student is expected to use methodologies for forecasting exchange rates and resolve cases by applying different strategies to quantify financial and exchange rate risks from financial decisions and/or organizational investments.

**General objective:** Upon completion of this course, students will be able to apply methodologies for es-

timating and predicting the exchange rate, as well as develop strategies enabling them to manage financial and currency risk using derivative instruments in the business units and / or portfolios of financial instruments.

**Key words:** Foreign exchange market. Purchasing power parity. International Fisher Effect. Currency and Interest Rate Derivatives. Currency and financial risk.

**Bibliography:** \* Madura, Jeff., International Financial Management / Jeff Madura., 10th Ed., Eagan, MN : Cengage Learning, 2010., [9781439038338], [1439038333].

### FZ3030 Financial Modeling

( 3 - 0 - 8. Prerequisites: [ FZ3027 ]. 8 LAF11, 8 LEF11 )

**Equivalence:** FZ3006

This is an advanced course in the field of finance in which students learn to solve financial problems through modeling development by means of technology management. It requires prior knowledge of investments, derivatives and econometrics. Students are expected to develop and implement a program in VBA, MatLab or C++ in any of the following topics: Portfolio investment, Study of betas, Linear Regression, Valuation of options with Monte Carlo simulation and / or binomial trees.

**General objective:** Upon completion of this course, students will be able to manage databases in order to solve problems; represent a financial problem from the perspective of computational mathematics and solve the problem preferably considering optimization criteria.

**Key words:** Programming cycles, Monte Carlo, arrangements, algorithmic efficiency, recursivity.

**Bibliography:** \* S. Christian Albright , VBA for Modelers: Developing Decision Support Systems Using Microsoft® Excel (with VBA Program CD-ROM) , .

### FZ3031 Risk Management and Regulation

( 3 - 0 - 8. Prerequisites: [ FZ3027 ]. 9 LAF11, 9 LEF11 )

**Equivalence:** FZ3010

This is an advanced course in the area of financial management aimed at undergraduate students in finance during their final semester(s). A sound working knowledge of and familiarity with the following aspects is required: the concepts, tools, and essential methodology of statistics; databases for economic and financial information; and Excel programming tools for the elaboration of simple financial models. This course requires prior knowledge regarding the main characteristics of both the national and international capital markets, assets traded and the main institutional actors operating in these markets. Additionally, it is assumed that students know how to value and use the basic financial derivatives (forwards, futures, swaps, and options), and are familiar with traditional methodologies of credit analysis and management. After finishing this course, students are expected to evaluate strengths and limitations of the discussed risk valuations and management methodologies; solve at least two cases in which they are required to apply different tools to quantify the risks of investment and/or financing decisions of a financial or non-financial firm; carry out two projects in which they identify and quantify, according to previously established criteria, the financial risks facing a particular financial or non-financial corporation. In addition, students are expected to be familiar with global trends in the area of financial and operational risk (management and regulations) as well as with best practices and recommendations, encouraged and issued by, the most important national and international organizations in the field.

**General objective:** On finishing this course, students will be able to understand and apply a core body of risk management concepts, procedures, and tools to identify, measure and manage (or control) financial and operational risks of business entities and/or portfolios of financial assets. Additionally, students are expected to be current on national regulations regarding financial risk and risk management, as well as best practices and recommendations encouraged and issued by the most important national and international organizations in the field.

**Key words:** Credit risk. The risk management process. Market risk. Value at Risk: measurement, management, and validation. Capital at risk and risk-adjusted measures of return. Operational risk. Risk related regulation and best practices.

**Bibliography:** \* Saunders, Anthony & Marcia Millon Cornett, Financial Institutions Management: A risk management approach, quinta o superior (edición internacional), McGraw-Hill, Inglés.

### FZ3032 Seminar of Finance

( 3 - 0 - 8. Prerequisites: [ FZ3026 ]. 9 LAF11 )

**Equivalence:** FZ3003, FZ3012

This is an advanced course in the area of finance which seeks to integrate all the knowledge and skills acquired by students in previous courses up to last semester. It is intended that the student deploys this global knowledge in the process of analysis and decision making for the financial management of enterprises. The course requires prior knowledge of financial mathematics, financial analysis, working capital management, project evaluation, structure and cost of capital, financial planning, and sources of funding. As a result of this learning the students, working in teams, are expected to produce reports based on the case analyses and evaluation of alternative solutions put forward, providing the appropriate reasoning and justification for the selected alternative, by means of calculations and evaluation of procedures, developed with the help of spreadsheets (Excel) and relevant software applications.

**General objective:** On finishing the course, students will be able to solve practical cases, use simulators and apply the knowledge of corporate finance and securities to solve case studies.

**Key words:** Financial planning. Financial analysis. Financial management of working capital. Financial evaluation. Financial structure, sources of financing and mergers and acquisitions.

**Bibliography:** \* Bruner, Robert F., 1949-, Case studies in finance : managing for corporate value creation / Robert F. Bruner, Kenneth M. Eades, Michael J. Schill., 6th ed., Boston : McGraw-Hill Irwin, c2010., [9780073382456 (papel alcalino)], [0073382450 (papel alcalino)], [9780071267526 (International ed. : rústica)], [0071267522 (International ed. : rústica)].

### FZ3033 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 LAF11 )

**Equivalence:** None

The purpose of this basic course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].



## H Humanities

### H1001 Remedial English I

( 5 - 0 - 8. Prerequisites: [ ],. 0 ARQ11, 0 IA 11, 0 IAB11, 0 IBN11, 0 IBT11, 0 IC 11, 0 IDA11, 0 IDS11, 0 IFI11, 0 IIA11, 0 IID12, 0 IIN12, 0 IIS11, 0 IMA11, 0 IMD11, 0 IME11, 0 IMI11, 0 IMT11, 0 INCQ13, 0 INT11, 0 IQA11, 0 IQP11, 0 ISC11, 0 ISD11, 0 ITC11, 0 ITE11, 0 ITIC11, 0 ITS11, 0 LAD11, 0 LAE11, 0 LAF11, 0 LCDE11, 0 LCMD11, 0 LCPF11, 0 LCS11, 0 LDF11, 0 LDI11, 0 LDN11, 0 LDP11, 0 LEC11, 0 LED11, 0 LEF11, 0 LEM11, 0 LIN11, 0 LLE11, 0 LLN11, 0 LMC11, 0 LMI11, 0 LNB11, 0 LP 12, 0 LPL11, 0 LPM12, 0 LPO11, 0 LPS12, 0 LRI11, 0 MC 11, 0 MO 11 )

**Equivalence:** H 00801, H 95801, H 97801, H 99801

The aim of this English course is for students to develop their communicative skills in social and academic environments. It requires previous knowledge of the enunciation system in English: syntax of simple sentences; simple tenses of the present, past and future. As a learning outcome students will be able to recognize and use the syntactic structures of the English language correctly.

**General objective:** Upon completion of the course, students will be able to identify and produce sounds and intonation patterns of the English language; participate in basic communicative interactions; understand and formulate basic descriptions of places, objects and clothes in terms of size, color and shape; understand and produce basic descriptions of people and their occupations, professional activities and fields; identify the time frame and logical and chronological order when actions or events take place; recognize and use collocations or idiomatic expressions properly; understand basic information on headlines, advertisements, forms, labels, signs and instructions; and take notes at a basic level.

**Key words:** English as a foreign language.

**Bibliography:** \* Milner, Martin., World English intro : real people, real places, real language / Milner, Martin., 1st ed., Boston, MA : Heinle Cengage Learning : National Geographic, c2010., [9781424034765].

### H1002 Remedial English II

( 5 - 0 - 8. Prerequisites: [ , H1001 ]. 0 ARQ11, 0 IA 11, 0 IAB11, 0 IBN11, 0 IBT11, 0 IC 11, 0 IDA11, 0 IDS11, 0 IFI11, 0 IIA11, 0 IID12, 0 IIN12, 0 IIS11, 0 IMA11, 0 IMD11, 0 IME11, 0 IMI11, 0 IMT11, 0 INCQ13, 0 INT11, 0 IQA11, 0 IQP11, 0 ISC11, 0 ISD11, 0 ITC11, 0 ITE11, 0 ITIC11, 0 ITS11, 0 LAD11, 0 LAE11, 0 LAF11, 0 LCDE11, 0 LCMD11, 0 LCPF11, 0 LCS11, 0 LDF11, 0 LDI11, 0 LDN11, 0 LDP11, 0 LEC11, 0 LED11, 0 LEF11, 0 LEM11, 0 LIN11, 0 LLE11, 0 LLN11, 0 LMC11, 0 LMI11, 0 LNB11, 0 LP 12, 0 LPL11, 0 LPM12, 0 LPO11, 0 LPS12, 0 LRI11, 0 MC 11, 0 MO 11 )

**Equivalence:** H 00802, H 95802, H 97802, H 99802

This English course aims to help students to develop their communicative skills in social and academic environments. It requires previous knowledge of the enunciation system in English: Syntax of simple, compound and complex sentences; form and function of words in a sentence, simple and perfect tenses in the present, simple tenses in the future and the past. As a learning outcome students will be able to recognize and use the syntactic structures of the English language correctly.

**General objective:** Upon completion of the course, students will be able to identify and produce sounds, stress, and intonation patterns of the English language; participate in basic communicative interactions; describe people, objects, places, and known surroundings; understand and produce phrases of certain extension and complexity, related to personal experience and needs; establish logical and chronological order in actions or events; identify main ideas and facts in simple and moderately complex texts; write short compositions and formulate short sentences using fixed expressions; and provide information in simple documents and forms.

**Key words:** English as a foreign language.

**Bibliography:** \* Johannsen, Kristin., World English 2 : real people, real places, real language / Kristin Johannsen, Rebecca Tarver-Chase., Boston, MA : Heinle Cengage Learning : National Geographic, c2010., [1424051037],[9781424051038].



**H1003 Remedial English III**

( 5 - 0 - 8. Prerequisites: [ , H1002 ]. 0 ARQ11, 0 IA 11, 0 IAB11, 0 IBN11, 0 IBT11, 0 IC 11, 0 IDA11, 0 IDS11, 0 IFI11, 0 IIA11, 0 IID12, 0 IIN12, 0 IIS11, 0 IMA11, 0 IMD11, 0 IME11, 0 IMI11, 0 IMT11, 0 INCQ13, 0 INT11, 0 IQA11, 0 IQP11, 0 ISC11, 0 ISD11, 0 ITC11, 0 ITE11, 0 ITIC11, 0 ITS11, 0 LAD11, 0 LAE11, 0 LAF11, 0 LCDE11, 0 LCMD11, 0 LCPF11, 0 LCS11, 0 LDF11, 0 LDI11, 0 LDN11, 0 LDP11, 0 LEC11, 0 LED11, 0 LEF11, 0 LEM11, 0 LIN11, 0 LLE11, 0 LLN11, 0 LMC11, 0 LMI11, 0 LNB11, 0 LP 12, 0 LPL11, 0 LPM12, 0 LPO11, 0 LPS12, 0 LRI11, 0 MC 11, 0 MO 11 )

**Equivalence:** H 00803, H 95803, H 97803, H 99803

The objective of this English course is to help students to develop their communicative skills in social and academic environments. It requires previous knowledge of the enunciation system in English: Syntax of simple and compound sentences; form and function of words in a sentence, simple and perfect tenses in the present, simple tenses in the future and the past: active and passive voice of the simple tenses. As a learning outcome students will be able to recognize and use the syntactic structures of English language correctly.

**General objective:** Upon completion of the course, students will be able to identify and establish communicative intentions through the recognition of English intonation patterns; interact adequately in different communicative contexts of everyday life; identify and describe personal experiences, needs, emotions, plans and projects; recognize and express personal opinions, complaints, advice, etc. in conversations and interviews; establish a logical and chronological order of actions and events in different temporal contexts; identify the main idea and specific details in different texts; write paragraphs and short texts using different language functions; and produce simple messages and paragraphs.

**Key words:** English as a foreign language.

**Bibliography:** \* Johannsen, Kristin., World English 3 : real people, real places, real language / Kristin Johannsen, Rebecca Tarver-Chase., Boston, MA : Heinle Cengage Learning : National Geographic, c2010., [97 81424051045],[1424051045],[9781424050161 (rústica)],[1424050162 (rústica)].

**H1004 Remedial English IV**

( 5 - 0 - 8. Prerequisites: [ , H1003 ]. 0 ARQ11, 0 IA 11, 0 IAB11, 0 IBN11, 0 IBT11, 0 IC 11, 0 IDA11, 0 IDS11, 0 IFI11, 0 IIA11, 0 IID12, 0 IIN12, 0 IIS11, 0 IMA11, 0 IMD11, 0 IME11, 0 IMI11, 0 IMT11, 0 INCQ13, 0 INT11, 0 IQA11, 0 IQP11, 0 ISC11, 0 ISD11, 0 ITC11, 0 ITE11, 0 ITIC11, 0 ITS11, 0 LAD11, 0 LAE11, 0 LAF11, 0 LCDE11, 0 LCMD11, 0 LCPF11, 0 LCS11, 0 LDF11, 0 LDI11, 0 LDN11, 0 LDP11, 0 LEC11, 0 LED11, 0 LEF11, 0 LEM11, 0 LIN11, 0 LLE11, 0 LLN11, 0 LMC11, 0 LMI11, 0 LNB11, 0 LP 12, 0 LPL11, 0 LPM12, 0 LPO11, 0 LPS12, 0 LRI11, 0 MC 11, 0 MO 11 )

**Equivalence:** H 00804, H 95804, H 97804, H 99804

The objective of this English course is to help students to develop their communicative skills in social and academic environments. It requires previous knowledge of the enunciation system in English: Syntax of simple, compound and complex sentences; form and function of words in a sentence, simple and perfect tenses in the present; simple tenses of the future and the past; active and passive voice of the simple tenses. As a learning outcome students will be able to recognize and use the syntactic structures of English language correctly.

**General objective:** Upon completion of the course, students will be able to identify and establish the communicative intention through the intonation patterns of the English language and recognize regional and international intonation patterns; perform efficiently in a variety of communicative tasks and social situations; express personal interests and everyday activities; recognize nuances in conversations and talks about academic topics; establish logical relations between actions or events in different time frames; comprehend information from different sources; identify main ideas and specific information in texts with social or academic content; and produce simple letters, brief synopses and paragraphs.

**Key words:** English as a foreign language.

**Bibliography:** \* Saslow, Joan M., Summit 1 : english for today's world / Joan Saslow, Allen Ascher., White Plains, N.Y. : Longman, c2006., [0131106252 (rústica)], [9780131106253 (rústica)], [0131106295 (workbook)], [9780131106307 (teacher's)].

**H1005 Remedial English V**

( 5 - 0 - 8. Prerequisites: [ , H1004 ]. 0 ARQ11, 0 IA 11, 0 IAB11, 0 IBN11, 0 IBT11, 0 IC 11, 0 IDA11, 0 IDS11, 0 IFI11, 0 IIA11, 0 IID12, 0 IIN12, 0 IIS11, 0 IMA11, 0 IMD11, 0 IME11, 0 IMI11, 0 IMT11, 0 INCQ13, 0 INT11, 0 IQA11, 0 IQP11, 0 ISC11, 0 ISD11, 0 ITC11, 0 ITE11, 0 ITIC11, 0 ITS11, 0 LAD11, 0 LAE11, 0 LAF11, 0 LCDE11, 0 LCMD11, 0 LCPF11, 0 LCS11, 0 LDF11, 0 LDI11, 0 LDN11, 0 LDP11, 0 LEC11, 0 LED11, 0 LEF11, 0 LEM11, 0 LIN11, 0 LLE11, 0 LLN11, 0 LMC11, 0 LMI11, 0 LNB11, 0 LP 12, 0 LPL11, 0 LPM12, 0 LPO11, 0 LPS12, 0 LRI11, 0 MC 11, 0 MO 11 )

**Equivalence:** H 00809

The objective of this English course is to help students to develop their communicative skills in social, academic, and working environments. It requires previous knowledge of the enunciation system in English: Syntax of simple, compound and complex sentences; form and function of words in a sentence, simple and perfect tenses in the present and the past; simple tenses in the future; active and passive voice of the simple tenses. As a learning outcome students will be able to recognize and use the syntactic structures of English language correctly.

**General objective:** Upon completion of the course, students will be able to express themselves with moderate fluency; interact properly in personal, academic, and social situations; initiate, sustain, and close general, moderately structured conversations; identify main ideas and some details of connected discourse on a variety of topics; establish logical and chronological relations between the elements of a text; interpret texts that deal with factual or academic information; recognize the main ideas and specific information in academic readings; and write comprehensible, descriptive, and narrative texts based on familiar and academic topics.

**Key words:** English as a foreign language.

**Bibliography:** \* Saslow Joan, Ascher Allen, Summit 2 Student Book, Pearson Longman , Inglés, [9780132320122].

**H1015 Spanish Composition**

( 5 - 0 - 8. Prerequisites: None. 0 ARQ11, 0 IA 11, 0 IAB11, 0 IBN11, 0 IBT11, 0 IC 11, 0 IDA11, 0 IDS11, 0 IFI11, 0 IIA11, 0 IID12, 0 IIN12, 0 IIS11, 0 IMA11, 0 IMD11, 0 IME11, 0 IMI11, 0 IMT11, 0 INCQ13, 0 INT11, 0 IQA11, 0 IQP11, 0 ISC11, 0 ISD11, 0 ITC11, 0 ITE11, 0 ITIC11, 0 ITS11, 0 LAD11, 0 LAE11, 0 LAF11, 0 LCDE11, 0 LCMD11, 0 LCPF11, 0 LCS11, 0 LDF11, 0 LDI11, 0 LDN11, 0 LDP11, 0 LEC11, 0 LED11, 0 LEF11, 0 LEM11, 0 LIN11, 0 LLE11, 0 LLN11, 0 LMC11, 0 LMI11, 0 LNB11, 0 LP 12, 0 LPL11, 0 LPM12, 0 LPO11, 0 LPS12, 0 LRI11, 0 MC 11, 0 MO 11 )

**Equivalence:** H 00806, H 99806

Introduction to composition is a basic course in Spanish that provides students with the mastery of communication skills, such as sentence structure and paragraph construction with coherence, cohesion, adequacy, and the correct application of grammar rules (spelling, accentuation and punctuation).

**General objective:** At the end of the course, students will have developed the basic linguistic competencies required to satisfy the demands of their university assignments.

**Key words:** Paragraph characteristics. Text features. Paragraph types. Text types. Coherence. Cohesion. Communicative situation. Grammatical accuracy (accentuation, spelling and punctuation).

**Bibliography:** \* González, R. y León, A., Redacción, composición y estilo., LIMUSA, Español.

**H1016 Foreign Language**

( 5 - 0 - 8. Prerequisites: [ H1005 ]. 1 ARQ11, 1 IA 11, 1 IAB11, 1 IBN11, 1 IBT11, 1 IC 11, 1 IDA11, 1 IDS11, 1 IFI11, 1 IIA11, 1 IID12, 1 IIN12, 1 IIS11, 1 IMA11, 1 IMD11, 1 IME11, 1 IMI11, 1 IMT11, 1 INCQ13, 1 INT11, 1 IQA11, 1 IQP11, 1 ISC11, 1 ISD11, 1 ITC11, 1 ITE11, 1 ITIC11, 1 ITS11, 1 LAD11, 1 LAE11, 1 LAF11, 1 LCDE11, 1 LCMD11, 1 LCPF11, 1 LCS11, 1 LDF11, 1 LDI11, 1 LDN11, 1 LDP11, 1 LEC11, 1 LED11, 1 LEF11, 1 LEM11, 1 LIN11, 1 LLE11, 1 LLN11, 1 LMC11, 1 LMI11, 2 LNB11, 1 LP 12, 1 LPL11, 1 LPM12, 1 LPO11, 1 LPS12, 1 LRI11, 2 MC 11, 2 MO 11 )

**Equivalence:** H 00805, H 00810, H 95805, H 99805, HI1011, HI1012, HI1014, HI2007, HI3001

**General objective:** This course focuses on improving the student's use of English at an intermediate level; developing the ability to understand and speak the language, as well as the student's critical thinking skills; providing the student with the methodology required to write an academic paper in English. Social themes and environmental problems will be discussed. Students will practice analyzing and synthesizing ideas and information, as well as working on reasoning and debating skills. They will review informal and technical vocabulary and practice writing skills, in addition to developing and understanding specific issues.

**Key words:** Listening comprehension and oral expression in English. Reading comprehension and written expression in English: English grammar.

**Bibliography:** \* Blass, Laurie, 1952-, Mosaic I. A content-based writing book / Laurie Blass, Meredith Pike-Baky., 2nd ed., New York : McGraw-Hill, c1990., [007557554X (pbk. )].

### H1018 Ethics, Self and Society

( 3 - 0 - 8. Prerequisites: [ H1017 , H1017 Corequisite , H1040 , H1040 Corequisite ]. 4 ARQ11, 3 IA 11, 3 IAB11, 3 IBN11, 3 IBT11, 3 IC 11, 3 IDA11, 2 IDS11, 3 IFI11, 4 IIA11, 2 IID12, 2 IIN12, 2 IIS11, 3 IMA11, 2 IMD11, 3 IME11, 3 IMI11, 4 IMT11, 3 INCQ13, 2 INT11, 2 IQA11, 2 IQP11, 3 ISC11, 3 ISD11, 3 ITC11, 3 ITE11, 3 ITIC11, 3 ITS11, 5 LAD11, 3 LAE11, 3 LAF11, 4 LCDE11, 4 LCMD11, 4 LCPF11, 4 LCS11, 4 LDF11, 4 LDI11, 3 LDN11, 4 LDP11, 2 LEC11, 4 LED11, 3 LEF11, 4 LEM11, 4 LIN11, 2 LLE11, 4 LLN11, 3 LMC11, 4 LMI11, 4 LNB11, 4 LP 12, 4 LPL11, 3 LPM12, 2 LPO11, 4 LPS12, 4 LRI11, 4 MC 11, 4 MO 11 )

**Equivalence:** None

This course offers students an environment of philosophical reflection that helps them to understand the issues existing in contemporary society and the interdependence between these issues and their life project, thus helping them to make ethical decisions in the face of the dilemmas in their personal lives.

**General objective:** Students will comprehend the importance and foundations of ethics in today's world, allowing them to make responsible decisions in order to complete their personal life project and to learn how to interact constructively in their social environment.

**Key words:** Fundamentals of ethics. Ethics and society. Ethics for life.

**Bibliography:** \* Rachels, James, 1941-, Introducción a la filosofía moral / James Rachels ; traducción de Gustavo Ortíz Millán., 1a ed., ed. conmemorativa del 60 aniversario de Breviarios., México, D.F. : Fondo de Cultura Económica, 2008., spaeng, [9789681679064], [9681679067].

### H1026 Philosophy and Contemporary Thought

( 3 - 0 - 8. Prerequisites: None. 5 LCMD11, 5 LCS11, 6 LLE11, 5 LMI11, 5 LPL11, 5 LRI11 )

**Equivalence:** None

Basic humanities course in which students learn from contemporary philosophical thinking the possibility of options for interpreting current events in such a way that, through their decisions, students can contribute to the development of an ethical, sustainable world. No prior knowledge is required. As a learning outcome students will understand contemporary philosophical discussions and thus have access to the debate of ideas and develop ideas on ethics, aesthetics and epistemology that will allow them to generate multidisciplinary interpretations of the current reality on the basis of cultural diversity and the challenges of technology.

**General objective:** Upon completion of this course, students will be able to comprehend contemporary philosophical knowledge in order to enter the debate on current ideas, and to develop critical thinking skills and competencies of an ethical, aesthetic, and epistemological nature, which will allow students to generate multidisciplinary interpretations of the current reality from a perspective of cultural diversity.

**Key words:** Knowledge society. Existence and textuality of life. Individual freedom. Common welfare.

**Bibliography:** \* N. ABBAGNANO, Historia de la filosofía. La filosofía contemporánea, vol. 4.

## H1031 Contemporary Art and Culture

( 3 - 0 - 8. Prerequisites: None. 4 LCS11, 3 LLE11, 5 LMC11, 3 LMI11 )

**Equivalence:** H 00838

Basic humanities course focused on guiding, familiarizing and making students aware of the multicultural outlook of the modern, contemporary era through its diverse art and cultural expressions. No prior knowledge is required. As a learning outcome students will use the basic concepts related to multiculturalism and art and identify some of the most representative art and cultural expressions of the five continents and establish their interconnection in today's world.

**General objective:** Upon completion of this course, students will be able to recognize the existence of multicultural diversity and its interactions and presence in modern life. This will occur as a result of their knowledge of traditional artistic and cultural expressions as well as of the alternatives in the various cultures which coexist and have coexisted in the modern and contemporary world.

**Key words:** What is art?. How do you approach art?. Art in culture. Artistic creation and expression. New proposals in art.

**Bibliography:** \* Acha, J, Arte y sociedad. Latinoamérica.

## H1032 Mexican Identity and Culture

( 3 - 0 - 8. Prerequisites: None. 5 LAD11, 5 LDI11 )

**Equivalence:** None

Basic humanities course in which students will understand, identify and analyze aspects of Mexico's culture so that they can assimilate them and integrate them into their cultural knowledge. No prior knowledge is required. As a learning outcome students will carry out dynamics related to the diverse art expressions.

**General objective:** Upon completion of this course, students will be able to comprehend the diverse popular artistic expressions as an important part of Mexican identity and culture.

**Key words:** Applied arts: graphic design, industrial design. Artistic forms and dialogues of the fine arts: architecture, painting, Mexican cinema, sculpture and other plastic arts. Popular art: silverwork, basket weaving, pottery and ceramics, textiles.

**Bibliography:** \* Florescano, Enrique, Etnia, estado y nación.

## H1040 Analysis and Verbal Expression

( 5 - 0 - 8. Prerequisites: [ H1015 ]. 2 ARQ11, 1 IA 11, 1 IAB11, 1 IBN11, 1 IBT11, 2 IC 11, 1 IDA11, 1 IDS11, 1 IFI11, 1 IIA11, 1 IID12, 1 IIN12, 1 IIS11, 1 IMA11, 1 IMD11, 1 IME11, 2 IMI11, 1 IMT11, 1 INCQ13, 1 INT11, 1 IQA11, 1 IQP11, 2 ISC11, 2 ISD11, 2 ITC11, 2 ITE11, 2 ITIC11, 2 ITS11, 2 LAD11, 2 LAE11, 2 LAF11, 1 LCDE11, 1 LCMD11, 2 LCPF11, 2 LCS11, 1 LDF11, 2 LDI11, 2 LDN11, 2 LDP11, 1 LEC11, 2 LED11, 1 LEF11, 2 LEM11, 2 LIN11, 1 LLE11, 2 LLN11, 2 LMC11, 2 LMI11, 1 LNB11, 2 LP 12, 2 LPL11, 2 LPM12, 1 LPO11, 2 LPS12, 2 LRI11, 1 MC 11, 1 MO 11 )

**Equivalence:** H1017

In accordance with the 2015 Tech of Monterrey Mission, this workshop is intended to: 1) provide the student with the skills needed to read, understand, analyze and transmit messages in texts that he or she will be required to create during his academic career. Thus the course will help him to develop his critical thinking and reasoning skills; 2) Encourage the development of verbal abilities, written and orally, that will allow the student to communicate his ideas and knowledge effectively, in the proper order and reflectively; 3) Instill academic rigor into research.

**General objective:** Upon completion of the course, the students will have developed their skills in analysis and critical thinking, through organized, reflective practice in the processes of reading, writing, investigation and oral communication.

**Key words:** Analytical reading. Written communication. Oral communication. Bibliographic research. Critical Thinking.

**Bibliography:** \* Sáenz, Dolores., Investigación académica con apoyo en tecnologías de información [recurso electrónico] / Dolores Sáenz., Monterrey, Nuevo León, México : Editorial Digital del Tecnológico de Monterrey, 2012., [9786075010687].

### **H1041 Music and Society** ( 3 - 0 - 8. Prerequisites: None. 1 IMI11 ) **Equivalence: EH1005**

The purpose of this basic music-education course is for students to study the relationships between musical production and society, enjoy diverse types of music and better understand the world, both socially and personally. No previous knowledge is required. The learning outcome of this course is for students to increase levels of interest, understanding and appreciation of music and become sensitized to the transformative value of the musical experience.

**General objective:** Upon completion of this course, students will have increased their aesthetic awareness and understanding of the world by studying historical contexts, studying musical works, reading texts, using diverse analysis tools, attending concerts and musical events and conducting research projects.

**Key words:** Functions of music through time. Musical expression and social context. Artistic creation and Interculturality.

**Bibliography:** \* García Martínez, José María, 1957-, La música étnica : un viaje por las músicas del mundo / José María García Martínez., Madrid : Alianza, 2002., [8420640581],[9788420640587].

### **H1042 Music Theory and Solfège** ( 3 - 0 - 8. Prerequisites: None. 1 IMI11 ) **Equivalence: H2000**

The purpose of this basic-level music-education course is to introduce students to the study of music theory. This term encompasses harmonic analy-

sis, form analysis, and auditory, rhythmic, melodic and texture recognition. No previous knowledge is required. The learning outcome of this course is for students to develop the ability to recognize and use the elements of musical language in exercises and compositions assigned as part of the course.

**General objective:** Upon completion of this course, students will be able to read scores, sing melodies and create simple musical compositions and/or arrangements; and perform a general analysis of musical pieces from the viewpoints of melody, rhythm and harmony.

**Key words:** Music theory. Solfège. Dictation. Harmony.

**Bibliography:** \* Takesue, Sumy., Music fundamentals : a balanced approach / Sumy Takesue., New York : Routledge, 2010., [9780415873376 (encuadernado : papel alcalino)], [0415873371 (encuadernado : papel alcalino)], [9780415997249 (rústica : papel alcalino)], [0415997240 (rústica : papel alcalino)].

### **H1043 Classical Literature** ( 3 - 0 - 8. Prerequisites: None. 2 LLE11 ) **Equivalence: H1022**

This is a basic course within the field of Universal Literature whose objective is to introduce the student to classical tradition and provide the bases for a basic literary culture. It does not require previous knowledge. As a learning result the student will carry out a project that demonstrates his knowledge of classical literature and an awareness of its importance in present times.

**General objective:** Upon completion of the course, the student will obtain a general view of the development of Greek and Latin literatures and will become aware of the classical tradition and observe its relevance in present times.

**Key words:** Classical tradition. Classical mythology. Epic, lyric and tragedy. Politics and oratory. Philosophy and poetry.

**Bibliography:** \* Cicerón, Marco Tulio., Sobre la república / M. Tulio Cicerón ; introducción, traduc-



ción, apéndice y notas de álvaro D'ors., 1a ed., Madrid : Editorial Gredos, 1984., [842490964X].

### **H1044 Music Appreciation I**

**( 3 - 0 - 8. Prerequisites: None. 2 IMI11 )**

**Equivalence: H1014**

The purpose of this basic music-education course is to provide students with basic tools to understand a musical work in its context of production (14th-17th centuries), taking into consideration the essential characteristics of that period, as well as developing the critical ability to better appreciate a wide variety of works, including analysis of the repertoire for post-modern and contemporary musical production. No previous knowledge is required. The learning outcome of this course is for students to understand the general structure of Western classical music from the 14th to the 17th centuries, following its historical and structural evolution by relating this to postmodernity.

**General objective:** Upon completion of this course, students will be able to appreciate the influence of historical evolution on musical composition and on the comprehension of the structure of music. Students will develop the capacity for critique and analysis by studying the vocabulary, genres, forms and styles of Western 16th to 17th century music in relation to post-modern musical production. To do so, students are supposed to attend music events and actively participating in a concert through an activity such as playing music, visual art creation, stage management or research work.

**Key words:** Medieval, Renaissance and Baroque music.

**Bibliography:** \* Kerman, Joseph, 1924-, Listen [sound recording] / Joseph Kerman ; Gary Tomlinson., Brief 4th ed., Boston ; New York : Bedford/St. Martin's, [p2000], [1572597968].

### **H1045 Literature and Power in Latin America**

**( 3 - 0 - 8. Prerequisites: None. 2 LCMD11, 3 LCS11, 1 LLE11, 1 LMI11, 3 LPL11, 3 LRI11 )**

**Equivalence: None**

The purpose of this basic literature course is to offer students an overview of contemporary Latin American literature, starting with analysis of representative readings dealing with the problems of abuse of power, migration, social changes and border issues. No previous knowledge is required. The learning outcome of this course for students is to analyze in writing the literary texts studied regarding the problems of power and border-related issues.

**General objective:** Upon completion of this course, students will be conversant with the aesthetic transformations of Hispano-American literature within the broader framework of western 20th century literature; He will also be able to appreciate the diverse authors and literary styles of the most representative Hispano-American countries in order to analyze them within the context of power and borders.

**Key words:** What is Hispano-America?. Regional issues. Literary influences. Boom and avant-garde authors. Power in literature. The frontier in literature.

**Bibliography:** \* Bellini, Giuseppe, 1923-, Nueva historia de la literatura hispanoamericana / Giuseppe Bellini., 3a ed. corregida y aumentada., Madrid : Castalia, 1997., [8470397575].

### **H1046 Spanish Linguistics I**

**( 3 - 0 - 8. Prerequisites: None. 2 LLE11 )**

**Equivalence: H1020**

This basic course in the field of Spanish language seeks to teach the student the characteristic elements of phonetics, phonology, morphology and syntax in the Spanish phrase, from descriptive and normative perspectives. The course does not require previous knowledge. As a learning result, the student will be able to describe and characterize the linguistic elements that constitute Spanish and also carry out phonetic, phonologic, morphologic and syntactic analysis of different types of linguistic production in Spanish.



**General objective:** Upon completion of the course, the student will be able to recognize the importance of Spanish and its modalities as a linguistic system from the study and analysis of the phonetic, phonological, morphological and syntactic levels.

**Key words:** Language system. Spanish description level. Phonetics and phonology. Spanish morphology and syntax.

**Bibliography:** \* Real Academia Española y Asociación de Academias Americanas, Nueva Gramática de la Lengua Española, 1, Nueva Gramática de la Lengua Española, Español.

### H1047 Discourse and Power

( 3 - 0 - 8. Prerequisites: None. 5 LCS11, 4 LLE11, 4 LPL11 )

**Equivalence:** H2017

The purpose of this basic-level humanities course is to introduce the student to the study of the relationship between discursive production and the different social, economic and political variables that make up a discursive event. No previous knowledge required. The learning objective of this course is for students to apply their learning to analyze and interpret political, ideological, publicity-oriented and/or journalistic discourse.

**General objective:** Upon completion of this course, students will be able to recognize and appreciate the control forces that are involved in the production, dissemination and reception of discourses, in particular political, ideological, advertising and journalistic discourse.

**Key words:** Ideology. Discourse and discursive practice. Power relations. Discourse control procedures.

**Bibliography:** \* Wood, Linda A., Doing discourse analysis : methods for studying action in talk and text / by Linda A. Wood, Rolf O. Kroger., Thousand Oaks, Calif. : Sage Publications, c2000., [0803973500 : HRD],[,\$70.00].

### H1048 Narrative Structures

( 3 - 0 - 8. Prerequisites: None. 5 LAD11, 3 LCMD11, 3 LLE11, 5 LPM12 )

**Equivalence:** H1033

The purpose of this basic literature course is to acquire the tools for understanding basic story structures and apply them to critical reflection on traditional stories and preparation of short narrative texts for digital media. No previous knowledge is required. The learning outcome of this course is to make presentations (written and alive to the group) of the results of different story-structure analyses applied to various narrative genres (story, joke, animated drawing, etc.). Students will also prepare a story and design a \*dummy\* for presentation with digital media.

**General objective:** At end of this course, students will be able to understand the basic concepts of the structural analysis of narratives and apply them to the analysis of any narrative text; identify these elements in traditional story structure as well as in narratives presented in digital media (cinema, cartoons, games, etc.).

**Key words:** Story structure. Audiovisual narrative and interactive story. Aesthetics of the new media. New spectators. Image-text relationship.

**Bibliography:** \* Trifonas, Peter Pericles, 1960-, Barthes y el imperio de los signos / Peter Pericles Trifonas., 1a ed., Barcelona : Gedisa, 2004., spaeng, [8497840364],[9788497840361].

### H1049 European Literature of the 17th to 19th Centuries

( 3 - 0 - 8. Prerequisites: None. 4 LLE11 )

**Equivalence:** H2012

This is a basic course in the field of Universal Literature whose objective is to introduce the student to European literature from the XVII to the XIX centuries. The course requires knowledge of Classical Literature, and Medieval and Renaissance Literature. As a learning result the student will write an essay to demonstrate his critical and research abilities.

**General objective:** Upon completion of the course, the student will have obtained an overview of the

development of European literature from the 17th to the 19th century and will be able to place the main authors, works and literary movements.

**Key words:** Realism. Romanticism. Rationalism and classicism. Illustration. Poetry and Modernity.

**Bibliography:** \* Historia de las mujeres / bajo la dirección de Georges Duby y Michelle Perrot., 1a ed., México : Taurus, 2005., spaita, [9707701129 (obra completa)], [9707701072 (v. 1)], [9707701080 (v. 2)], [9707701099 (v. 3)], [9707701102 (v. 4)], [9707701110 (v. 5)].

### **H1050 Introduction to Spanish Language and Literature Academic Program**

**( 3 - 0 - 4. Prerequisites: None. 1 LLE11 )**

**Equivalence: None**

The purpose of this basic-level course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Culler, Jonathan D., Breve introducción a la teoría literaria / Jonathan Culler ; traducción castellana de Gonzalo García., 2a ed. en Biblioteca de bolsillo., Barcelona : Crítica, 2004., Spain, 2004., spa, [8484321339],[9788484321873].

### **H1051 Introduction to Cultural and Social Entrepreneurship Academic Program**

**( 3 - 0 - 4. Prerequisites: None. 1 LCS11 )**

**Equivalence: None**

This is a basic course through which the student will learn about the areas of humanities and social sciences related to cultural and social development of a community and his/her country, by examining cultural and social organizations, and his role in the social and economic development of his community. The student will also understand the relevance of the cultural and social sector as a field of study in development forecasts. In addition, the student will reinforce the knowledge acquired during the course, by activities connected to the topics seen in class. These activities will be held inside and outside the classroom. No previous knowledge is required. As a learning outcome the student is expected to produce a document explaining in which area he would like to specialize on graduation, whether in the field of the cultural industry, civil society or non-governmental organisms. In this document he will include his selection of optional courses, areas of academic development, internships, international exchanges, cultural, sporting and social activities.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* ITESM, Misión, Visión y Objetivos del Tecnológico de Monterrey.

## H2001 Verbal Expression in the Workplace

( 3 - 0 - 8. Prerequisites: [ H1017 , H1040 ]. 5 ARQ11, 4 IA 11, 4 IAB11, 4 IBN11, 4 IBT11, 4 IC 11, 2 IDA11, 2 IDS11, 2 IFI11, 2 IIA11, 3 IID12, 3 IIN12, 4 IIS11, 2 IMA11, 2 IMD11, 2 IME11, 4 IMI11, 3 IMT11, 4 INCQ13, 2 INT11, 3 IQA11, 3 IQP11, 4 ISC11, 4 ISD11, 4 ITC11, 4 ITE11, 4 ITIC11, 4 ITS11, 4 LAD11, 4 LAE11, 4 LAF11, 2 LCDE11, 3 LCMD11, 4 LCPF11, 4 LCS11, 4 LDF11, 4 LDI11, 4 LDN11, 3 LDP11, 2 LEC11, 3 LED11, 2 LEF11, 4 LEM11, 4 LIN11, 2 LLE11, 3 LLN11, 4 LMC11, 4 LMI11, 3 LNB11, 3 LP 12, 4 LPL11, 4 LPM12, 4 LPO11, 3 LPS12, 3 LRI11, 3 MC 11, 5 MO 11 )

**Equivalence: None**

In accordance with the 2015 Mission, this workshop is intended to provide the student with the tools needed to read, understand, analyze and transmit the messages in the texts that she or he will be required to read during her or his academic career, thus helping her or him to develop his critical reasoning skills; encourage the development of written and oral verbal abilities that will allow the student to communicate his ideas and knowledge effectively, in an orderly and considered way; instill academic rigor in his investigations and expositions.

**General objective:** By the end of this course, students will have developed the necessary skills to express themselves verbally in an appropriate manner for writers and speakers, having completed exercises in argumentation, value judgments, and the use of specialized vocabulary.

**Key words:** Review. Critical essay. Academic paper. Roundtable. Panel discussion. Conference.

**Bibliography:** \* Leal Isida, María Roberta., Expresión verbal con fines específicos [recurso electrónico] / Roberta Leal Isida, Patricia Barranco Ortega, Martha Flores Guajardo., Monterrey, Nuevo León, México : Editorial Digital del Tecnológico de Monterrey, 2012., [9786075010557].

## H2003 Contemporary Art and Society

( 3 - 0 - 8. Prerequisites: [ H1017 , H1017 Corequisite , H1040 , H1040 Corequisite ]. 6 LAD11 )

**Equivalence: None**

Intermediate course in which students will become familiar with, analyze and enjoy diverse contemporary artistic expressions in order to understand the world and their social and personal reality. Through the cross-disciplinary, contextualized analysis of concepts relevant to today's world, students will: Study the relationships that exist between artistic production and society; understand the artistic expressions that are social products to be analyzed and interpreted; be conversant in the theory and methodologies that will increase their capacity to enjoy art and respect cultural diversity; become aware of the ethical dimension of art as a social phenomenon; reinforce their oral and written communication, logical and critical reasoning, creativity and research capacities. No prior knowledge is required. As a learning outcome students will analyze diverse contemporary artistic expressions.

**General objective:** Students will study the various artistic proposals, trends in critical interpretation, and social practices in contemporary art, in order to increase their artistic sensitivity and their understanding of the world. Through the study of historical contexts, works of art, texts, practice with analytical tools, trips to expositions and cultural events, and the development of research projects, students will experience increased interest, understanding and appreciation of art, and sensitivity to the transforming value of the artistic experience.

**Key words:** Production, promotion and consumption of contemporary art. Art for art's sake and art for society. Artistic vanguards, modernism and post-modernism. Definitions, functions, terminology, and interpretation trends in the plastic arts. Politics, ethics, and identity in contemporary art.

## H2019 Contemporary World Literature

( 3 - 0 - 8. Prerequisites: None. 5 LCS11, 5 LLE11, 5 LMI11 )

Equivalence: H 00843, H 95843, H 99843

Intermediate literature course that offers students a broad overview of contemporary world literature based on the reading and analysis of works that are representative of the avant-garde and innovating. No prior knowledge is required. As a learning outcome, students will demonstrate their knowledge by means of a written literary analysis.

**General objective:** Upon completion of this course, students will have a broad perspective of twentieth-century world literature, through the analysis and interpretation of some of the most outstanding works of that century.

**Key words:** What is avant-garde?. Avant-garde authors. The crisis of modernity. Man's alienation. Fragility of truth. The absurd. Otherness and gender.

**Bibliography:** \* Benito Varela, *Renovación de la novela en el siglo XX*, Destino, ESP.

## H2033 Social Anthropology

( 3 - 0 - 8. Prerequisites: None. 2 LCS11, 2 LMI11, 4 LP 12, 2 LPL11, 2 LPM12, 4 LPS12, 2 LRI11 )

Equivalence: EH2003

This is an intermediate level course which provides students with tools for the interpretation of the main socio-anthropological problems in contemporary debate. It requires basic knowledge in sociology. The learning outcome for this course is that students critically analyze theoretical and methodological assumptions and anthropological practice. Students will interpret the central socio-anthropological problems in contemporary debate.

**General objective:** By understanding the relationship between anthropology as a science and as a fundamental part of the humanities, students will be able to recognize and critically analyze the main anthropological theories and their most representative exponents.

**Key words:** Ethnography. Anthropology. Ethnology. Man Science. Human ecology. Knowledge and belief. Tradition and development. Communication and language.

**Bibliography:** \* G. LIENHARDT, *Antropología social*, FCE, Español.

## H2034 Medieval and Renaissance Literature

( 3 - 0 - 8. Prerequisites: None. 3 LLE11 )

Equivalence: None

Intermediate course in the field of Universal Literature whose objective is to introduce the student to Medieval and Renaissance European literature and culture. The course requires knowledge of Classical Literature. As a learning result the student will write an essay to demonstrate his/her bibliographic investigation and critical reading capacities.

**General objective:** Upon completion of the course, the student will obtain a general view of Medieval and Renaissance European literature.

**Key words:** Middle Ages and Renaissance. Christian latin literature. Court poetry and narrative. Human dignity. Humanism and renaissance.

**Bibliography:** \* Dante Alighieri, 1265-1321., *Comedia / Dante Alighieri ; traducción, prólogo y notas de ángel Crespo.*, 1a ed. en Biblioteca Formentor., Barcelona : Seix Barral, 2004., spaitaita , [8432227811 (obra completa)], [8432227781], [843222779X], [8432227803].

## H2035 Music Appreciation II

( 3 - 0 - 8. Prerequisites: [ H1044 ]. 3 IMI11 )

Equivalence: H2029

The purpose of this intermediate course in music education is to provide students with the basic tools to place a work in the musical period in which it was written (18th-21st centuries), taking into consideration the essential characteristics of that era, in addition to developing the critical ability to best appreciate a wide variety of works, including analysis of repertory in post-modern and contemporary musical

production. The course requires basic knowledge of music theory. The learning outcome of this course is for students to understand the general structure of western classical music in the 18th to the 21st centuries, according to its structural and historical evolution, linking it to post-modern musical production.

**General objective:** Upon completion of this course, students will appreciate the influence of historical evolution on musical composition and on the comprehension of the structure of music. Students will develop the capacity of criticism and analysis by studying the vocabulary, genres, forms and styles of western 17th to 21st century music in relation to post-modern musical production; attending events and actively participating in a concert through an activity such as playing music, visual art creation, stage management or research work.

**Key words:** Classical, modern and contemporary music. Postmodernity.

**Bibliography:** \* Kerman, Joseph, 1924-, Listen / Joseph Kerman, Gary Tomlinson with Vivian Kerman., Brief 4th ed., Boston ; New York : Bedford/St. Martin's, c2000., [1572594225 (rústica)].

## H2036 Hispanic Colonial Literature

( 3 - 0 - 8. Prerequisites: None. 5 LLE11 )

Equivalence: H2014

Intermediate course in the Hispanic Literature area that introduces the student to the study and analysis of Literature from New Spain through its most important manifestations, from its pre-Hispanic origins up to colonial times. The course does not require previous knowledge. As a learning result the student will read and analyze the most representative literary works from Peru and New Spain.

**General objective:** Upon completion of the course, the student will, through analytical reading, become familiar with New Spain's literary production, both pre-Hispanic and colonial, and will observe the relationship these texts have with their environment.

**Key words:** Nahuatl literature. Indian chronicles. Culture of New Spain. Colonial literature. Literary pro-

duction in Mesoamerica.

**Bibliography:** \* Bloom, Harold, Shakespare, la invención de lo humano, Anagrama, Español.

## H2037 Spanish Linguistics II

( 3 - 0 - 8. Prerequisites: [ H1046 ]. 3 LLE11 )

Equivalence: H1024

Intermediate course in the Spanish language area whose objective is that students strengthen and develop their knowledge in the syntactic structures of simple and complex phrases in Spanish. The course requires previous knowledge of Spanish phonetics, phonology, morphology and syntax. As a learning result the student will analyze the syntactic and textual components of Spanish.

**General objective:** Upon completion of the course, the student will be able to carry out syntactical analysis of the simple and complex structures in Spanish.

**Key words:** Spanish syntax. Textual cohesion. Syntactical categories. Simple, compound and subordinate sentences.

**Bibliography:** \* Real Academia Española y Asociación de Academias Americanas, Nueva Gramática de la Lengua Española. Sintaxis II, 1, Espasa-Calpe, Español.

## H2038 Literary Theory I

( 3 - 0 - 8. Prerequisites: None. 3 LLE11 )

Equivalence: H2016

Intermediate course in the field of literary theory that offers the student an introduction to the phenomenon of literature and the formalist and structuralist theories on which contemporary literary criticism is based: these theories being indispensable frameworks of thought in order to understand literary texts and cultural productions in depth. The course requires knowledge of the literary phenomenon, its characteristics and its main typologies. As a learning result the student will carry out an analysis project in which he/she will apply the key concepts and the basic principles of the theories of literary criticism studied.



**General objective:** Upon completion of the course, the student will be able to recognize the principles that rule the main trends in present literary theory and will value their importance in the analysis and interpretation of literary texts.

**Key words:** Story analysis. Plurivocality and viewpoints. Literary story categories. Textual contents. Isotopes.

**Bibliography:** \* Silva, Víctor Manuel de Aguiar e., *Teoría de la literatura* / Víctor Manuel de Aguiar e Silva., Madrid : Gredos, 1986., spa, [8424900466].

### H2039 Epistemology of Social Sciences

( 3 - 0 - 8. Prerequisites: None. 5 LCS11 )  
Equivalence: EH1003

The purpose of this intermediate course in social-scientific education is to prepare students to build a critical vision around the knowledge of the social sciences and humanities and their validity in current society. The course requires previous knowledge of economics, psychology, history, art, literature, sociology and philosophy. The learning outcome of this course is for students to formulate a critical discourse regarding current cultural and scientific products and identifying knowledge-production processes in the human and social spheres with the goal of developing a solid academic and intellectual discipline.

**General objective:** Students will be able to point out the epistemological differences between humanistic disciplines and social science, distinguishing theoretical and applied research, empirical, phenomenological, quantitative and qualitative methods, conceptual universes, external influences and the internal dynamics that determine scientific production.

**Key words:** Social technologies. Validity of social scientific knowledge. Academic production in social sciences and the humanities. Scientific and academic publications. Scientific and academic communities in Mexico.

**Bibliography:** \* *Epistemología de las ciencias sociales : breve manual* / Francisco Osorio, editor., 1a ed., Santiago, Chile : UCSH, 2007., [9789567947560].

### H2040 The Golden Age of Spanish Literature

( 3 - 0 - 8. Prerequisites: None. 5 LLE11 )  
Equivalence: H1028

This is an intermediate course in the Hispanic Literature area whose purpose is that students recognize and value the cultural and literary legacy of Spain's Golden Age and its influence on Hispanic America. The course does not require previous knowledge. As a learning result students will identify the main characteristics of Spain's Golden Age through diverse genres and its importance in the voice of Sor Juana in Hispanic America.

**General objective:** Upon completion of the course, the student will obtain a panoramic view of Spanish literature from the XVI and XVII centuries and will familiarize him or herself with the main genres, authors and works.

**Key words:** Baroque and Renaissance. Spanish humanism. Picaresque novel. Cervantes and the novel. Italianizing poetry.

**Bibliography:** \* RICO, F, *Historia crítica de la literatura española*, vol. III.

### H2041 Philosophy of Culture

( 3 - 0 - 8. Prerequisites: None. 5 LCS11 )  
Equivalence: EH2001

This is an intermediate course which allows students to learn about modern cultural theories and be able to relate them to the analysis of cultural products, such as artistic expression, social institutions, and cultural customs. It requires previous knowledge in sociology and anthropology. The learning outcome for this course is for the students to be able to perform an analysis of cultural phenomena, as well as an evaluation of the problems in the community that presents these phenomena.

**General objective:** Upon completion of this course, students will be able to identify and critically analyze the different theoretical positions that have been proposed regarding cultural phenomena, and evaluate the most relevant problems within the cultural framework of their particular communities.



**Key words:** Reflection and culture. Cultural formation processes. Globalization and restoration of traditions. Interculturality, transculturality and multiculturalism. Minorities and culture.

**Bibliography:** \* Filosofía de la cultura en México / Mario Teodoro Ramírez, coordinador., 1a ed., Morelia, Michoacán : Universidad Michoacana de San Nicolás de Hidalgo ; México, D.F. : Plaza y Valdé, [9688568545].

## H2042 Hispanic Philology

( 3 - 0 - 8. Prerequisites: [ H2037 ]. 4 LLE11 )

**Equivalence:** H1027

This intermediate course in the field of the Spanish language introduces the student to the knowledge of the origin and evolution of Spanish. Subjects of study considered are linguistic change as well as critical edition of the literary text through time, using the appropriate tools for philological analysis, developing projects focusing on critical edition of texts. The course requires knowledge in and experience of linguistic analysis, as well as some familiarity with the classical and medieval texts. As a learning result the student should produce individually two philological projects: a Latin-Spanish glossary and a study of the state of the Spanish language at three moments in history; and, in teams, a final project focused on the critical edition of texts.

**General objective:** Upon completion of the course, the student will be able to analyze the origins of the Spanish language in the geographical context of the romantic languages and its evolution and influx in the American continent; as well as apply philological methods to textual analysis and critical edition, even with computer support.

**Key words:** Philological studies. Latin. Linguistic change. Critical text edition. America's Spanish.

**Bibliography:** \* Renzi, L., Introducción a la filología románica, Gredos, Español.

## H2043 Modern and Contemporary Spanish Literature

( 3 - 0 - 8. Prerequisites: None. 6 LLE11 )

**Equivalence:** H2010

This is an intermediate course in the field of Hispanic Literature whose objective is to introduce the student to modern and contemporary Spanish literature. The course requires knowledge of 17th to 19th century European literature. As a learning result the student will produce a literary review that demonstrates his/her bibliographic investigation and analysis skills.

**General objective:** Upon completion of the course, the student will have a general view of Spanish literature from Realism up to present times.

**Key words:** Realism and naturalism. Generation of 98. Generation of 27. Postwar novel. New Spanish narrative.

**Bibliography:** \* Sobejano, Gonzalo, La novela española de nuestro tiempo, Prensa Española.

## H2044 Literary Theory II

( 3 - 0 - 8. Prerequisites: [ H2038 ]. 4 LLE11 )

**Equivalence:** None

This is an intermediate course in the field of literary theory that offers students a general view of the contemporary literary theory paradigms from post-structuralism onwards and familiarizes them with the plurality of contemporary theoretical postures. The course requires knowledge of literary genres, their main characteristics and the basic tools for their analysis. As a learning result, the student will produce a review in which he/she will analyze, evaluate and apply the different literary analysis proposals from the second-half of the 20th century onward to literary works of different genres.

**General objective:** Upon completion of the course, the student will be able to understand the present trends in literary theory and value their importance in the analysis and interpretation of texts, emphasizing the construction of poetic significance and systematization in the study of literary genres and the

different post-structuralist paradigms; apply the theoretical principal to the analysis of the literary text; and interpret and evaluate literary work in light of the most recent theories.

**Key words:** Hermeneutics. Deconstruction. Literary semiotics. Feminisms. Reception theory. Narratology.

**Bibliography:** \* García Berrio, Antonio, *Teoría de la literatura*.

## H2045 Hispanic American Literature of the 19th and 20th Centuries

( 3 - 0 - 8. Prerequisites: None. 6 LLE11 )

**Equivalence:** H2018

This is an intermediate course in the field of literature that offers the student a review of the definitive aspects and the foundational themes of Hispano-American national literature through the study of the diverse aesthetic trends from Independence up to Modernism. The course does not require previous knowledge. As a learning result the student will identify the main trends in 19th century Hispano-American literature.

**General objective:** Upon completion of the course, the student will be able to analyze literary works from the Hispano-American 19th century in light of their historical context and the predominant aesthetic trends.

**Key words:** Neoclassicism and Independence. Romanticism in poetry and the novel. Realism, positivism and naturalism in the canonic novel. Historical novel. Rubén Darío, José Martí and other modernist poets. Civilization and barbarity in Argentina's narrative prose.

**Bibliography:** \* América Latina en su literatura / coordinación e introducción de César Fernández Moreno., México : Siglo XXI, UNESCO, 1972.

## H2046 Hispanic American Literature of the 20th Century

( 3 - 0 - 8. Prerequisites: None. 7 LLE11 )

**Equivalence:** H3009

This is an intermediate course in the field of literature in which the main aesthetic innovations and themes in Hispano-American literatures are reviewed through some of the most representative works from the vanguard to the post-boom era. The course requires previous knowledge in Hispano-American literature. As a learning result the student will observe the value of contemporary literary expression and its relationship to the social-historical context.

**General objective:** Upon completion of the course, the student will be able to analyze and evaluate some of the most representative literary works in 20th century Hispano-American literature, based on their aesthetic innovations and thematic proposals.

**Key words:** Vanguard poetry. The fantastic short story. The new novel and the boom phenomenon. Poetry and colloquialism. Narrative renovation in the 40s. Existential novel. Narrative postboom representatives and characteristics.

**Bibliography:** \* América Latina en su literatura / coord. e introd. César Fernández Moreno., 13a ed., México : Siglo XXI , 1992., [968230136X].

## H2047 Mexican Literature of the 19th and 20th Centuries

( 3 - 0 - 8. Prerequisites: None. 6 LLE11 )

**Equivalence:** None

This is an intermediate course in the field of literature in which the main contributions of Mexican literature to the world are reviewed. The course requires previous knowledge of the literature of New Spain. As a learning result the student will identify the main literary trends in 19th century Mexico from Modernism onwards and the influence of the historical context on national literature, while recognizing the value of the Mexican authors.

**General objective:** Upon completion of the course, the student will be able to identify, comprehend, an-

alyze and value the literary expressions from the second half of the 19th century in Mexico that imply the following styles: romanticism, realism, modernism and naturalism. These styles are covered in diverse genres of poetry and prose.

**Key words:** Modernism. From the Independence to the Porfirianism. Mexican illustrations. Romanticism and realism. Baroque heritage.

**Bibliography:** \* Azuela, Mariano, Cien años de novela mexicana, Botas. Año 1947.

## H2048 Mexican Literature of the 20th Century

( 3 - 0 - 8. Prerequisites: None. 7 LLE11 )

**Equivalence:** H3013

This is an intermediate course in the field of literature during which students read the most well-known Mexican works of literature on a national and international level, allowing the students to familiarize themselves with the various styles of contemporary literature. The course requires previous knowledge of Mexican literature and literary theory. The student will have the opportunity to delve into a thematic panorama that includes history, the "Revolución", family life, politics, economy, social changes, character psychology, and the evolution of Mexican literature through the modes of Social Realism, "La Onda", the Antinovel (Nouveau Roman), the Experimental Novel, the Trash Novel, the Crack, the Literature of the North, among other literary trends.

**General objective:** Upon completion of the course, the student will be able to assess and analyze the main works in 20th century Mexican narrative and understand through them the history and social aspects of contemporary Mexico.

**Key words:** Historical novel. Mexican narrative. Mexican Revolution. Existential novel. Experimental novel. Crack. The narrative of the north. La Onda literature. Writing.

**Bibliography:** \* Olea Franco, Rafael, Doscientos años de narrativa Mexicana, Siglo XX, El Colegio de México. Año 2010.

## H2049 Spanish Medieval Literature

( 3 - 0 - 8. Prerequisites: None. 4 LLE11 )

**Equivalence:** None

This is an intermediate course in the field of Hispanic Literature whose objective is to introduce the student to Spanish literature from the Medieval Age. The course requires knowledge of Classical Literature and Medieval and Renaissance Literature. As a learning result the student will produce a research project that demonstrates his familiarity with the Spanish Medieval literature bibliography and his capacity for critical analysis.

**General objective:** Upon completion of the course, the student will possess a general view of the development of Spanish medieval literature.

**Key words:** Spanish epic. Ministry of Clergy. Humanistic comedy. Sentimental novel. Galician-Portuguese lyric.

**Bibliography:** \* Miguel Ángel Pérez, Teatro medieval, Año 2009, Cátedra.

## H3024 Studies on Cultural Industries

( 3 - 0 - 8. Prerequisites: [ EH2000 , AV1001 , H3028 ]. 7 LCS11 )

**Equivalence:** None

This is an advanced course in the field of Humanities intended to introduce the student to the current complexity and operation of the cultural industry in order to become an agent of change. The course requires previous knowledge of economy, sociology, social anthropology, and arts. As a learning outcome, the student will present a written critical discourse on the functioning of international cultural industries and their presence in Mexico, as well as the current state of cultural industries in Mexico.

**General objective:** By the end of this course, students will be able to identify and depict the economical, social and cultural importance of cultural industries as well as the modern dynamics of production and reproduction.

**Key words:** Cultural industries. Museums and galleries. Cultural management. Art industry. To understand cultural industries. To understand the role of cultural industries nowadays. To understand the functioning of cultural industries.

**Bibliography:** \* Acha, Juan., *Las actividades básicas de las artes plásticas* / Juan ácha., 2a ed., México : Coyoacan, 2006., [9706333177],[9789706333179].

### **H3026 Cultural Heritage and its Institutions**

**( 3 - 0 - 8. Prerequisites: None. 8 LCS11 )**

**Equivalence: None**

This is an advanced course on the field of Humanities intended to provide a general vision of the legislation, the economic difficulties, the state of conservation, the diffusion and accessibility of Mexican cultural heritage as well as of the institutions dedicated to it. The course requires previous knowledge of Mexican law and Mexican and Latin American art history. As a result of the student's learning process, he/she will present a theoretical proposal for the conservation, dissemination and sustainability of one expression of Mexican cultural heritage.

**General objective:** Upon completion of this course, students will be able to identify diverse types of Mexican and international cultural heritage; and be familiar with the national and international regulations related to cultural heritage, as well as the institutions for promotion and conservation and best sustainability practices for the social and economic maximization of cultural heritage.

**Key words:** Cultural heritage legislation. Forms of Mexican cultural heritage. Cultural heritage conservation and sustainability. Private cultural heritage institutions. Public cultural heritage institutions. Museums and cultural centers.

**Bibliography:** \* Ballart Hernández, Josep., *Gestión del patrimonio cultural* / Josep Ballart Hernández, Jordi Juan i Tresserras., 2a ed., Barcelona : Ariel, c2005., [8434466430].

### **H3027 Spanish Semantics and Pragmatics**

**( 3 - 0 - 8. Prerequisites: [ H2037 ]. 5 LLE11 )**

**Equivalence: H2011**

This is an advanced course in the field of the Spanish language that allows the student to deepen his knowledge of Spanish through the study of the main topics of semantics and pragmatics with exclusive application to the Spanish language and its discursive manifestations. The course requires previous knowledge in Spanish phonetics, phonology, morphology and syntax. As a learning result the student will apply his or her knowledge to the semantic-pragmatic analysis of the language and discourse.

**General objective:** Upon completion of the course, the student will be able to identify the characteristics of semantic and pragmatic levels in Spanish, as well as the semantic-pragmatic resources the language offers its users for effective communication.

**Key words:** Sense. Reference and referentiality. Pragmatic resources. Deixis. Speaker modality and attitude.

**Bibliography:** \* Levinson, Spehen C., *Pragmatics*, Cambridge University Press, Inglés.

### **H3028 Critique of Art and Spectacles**

**( 3 - 0 - 8. Prerequisites: None. 6 LCS11 )**

**Equivalence: EH2000**

The purpose of this advanced humanities course is to allow students to put into practice their theoretical knowledge related to artistic and cultural production with academic elements and those of historic contextualization. The course requires previous knowledge of art history, general history, contemporary art, economics, sociology and social anthropology. The learning outcome of this course is for students to write essays of publishable quality about an area of culture or show business, proposing ways to renew production in a specific field of the culture industry.

**General objective:** Upon completion of this course, students will be familiar with the critical theories of contemporary art and be able to apply their meth-

odological tools to the diverse cultural, art and entertainment expressions of today.

**Key words:** Aesthetics. Cultural industries. Prose and poetry on contemporary art. Creation, production and marketing of culture. Art and entertainment. Leisure and markets.

**Bibliography:** \* Historia de la crítica del arte : textos escogidos y comentados / a cargo de Jesús-Pedro Lorente., 1a ed., Zaragoza : Prensas Universitarias de Zaragoza, 2005., [8477337977].

### H3029 Overview of the Arts and Popular Cultures

( 3 - 0 - 8. Prerequisites: None. 7 LCS11 )

**Equivalence:** None

The purpose of this advanced arts course is to provide students with a systematic vision of cultural and artisanal production in different regions of Mexico with special attention to urban/rural, male/female, indigenous/mestizo, traditional/avant-garde and artistic/commercial diversity. The course requires previous knowledge of art criticism and analysis of cultural industries. The learning outcome of this course is for students to be able to carry out a descriptive analysis of the status of popular art in the country as well as to evaluate problems related to the community framework in which it takes place.

**General objective:** Upon completion of this course, students will be able to describe the variety of popular cultural productions in Mexico and analyze the possibilities for sustainability of these activities.

**Key words:** Productive traditions. Sustainability of traditional craft activities. Development of culture and popular traditions. Equity capital and popular culture. Local and regional development based on traditional knowledge.

**Bibliography:** \* Storey, John, 1950-, Teoría cultural y cultura popular / John Storey ; traducción de ángels Mata., Barcelona : Octaedro, 2002., spaeng , [8480635673].

### H3030 Spanish and Digital Media

( 3 - 0 - 8. Prerequisites: None. 6 LLE11 )

**Equivalence:** None

This is an intermediate course in the field of editing in which the present situation of the Spanish language on a worldwide scale is reviewed, the main problems it faces, as well as its incorporation in new digital media and globalization. By carrying out research, as well as identifying and considering the various problems that Spanish faces, the student will be able to reflect on his or her role as a professional in the use of Spanish in the modern world.

**General objective:** Upon completion of the course, the student will have a comprehensive view of the role that the Spanish language currently plays in the new media on a world scale, as well as the main problems it faces.

**Key words:** Spanish and digital media. Spanish language teaching. History of books. Present day spanish.

**Bibliography:** \* Teoría y práctica del contacto : el español de América en el candelero / Julio Calvo Pérez, ed., Frankfurt am Main : Vervuert ; Madrid : Iberoamericana, 2000., [8495107910 (Iberoamericana)],[3893543767 (Vervuert)].

### H3031 Education and New Forms of Knowledge

( 3 - 0 - 8. Prerequisites: None. 8 LCS11 )

**Equivalence:** None

The purpose of this advanced humanities course is for students to study in depth the effect of new technologies on both scholastic and informal educational processes, the appearance of new information vehicles, and the industries linked to them. The course requires previous knowledge of social anthropology, contemporary thought and cultural industries. The learning outcome of this course is for students to prepare a critical essay about how new ways of generating and channeling knowledge can be leveraged to strengthen educational processes.



**General objective:** Upon completion of this course, students will be able to identify the new processes of generation, distribution and exchange of knowledge in both social scientific research and informal cultural processes, and the ways they can be used in formal educational processes.

**Key words:** Constructivism. Education. ICTs. Visual culture. Neurosciences. Communication.

**Bibliography:** \* Gardner, Howard., *La inteligencia reformulada : las inteligencias múltiples en el siglo XXI* / Howard Gardner., Barcelona ; México : Paidós, c2001., spaeng, [8449310296].

### H3032 Seminar in Literary Criticism I

( 3 - 0 - 8. Prerequisites: [ H2044 ]. 7 LLE11 )

Equivalence: H3010

This is an advanced course in the field of literature in which the student will study a specific aspect of Spanish literature in depth. The course requires previous knowledge of Spanish medieval literature, literature of the Golden Age and modern and contemporary Spanish literature. As a learning result the student will carry out an academic research project in which he or she will analyze a Spanish literary work, applying prior knowledge of literary matters and literary theory, as well as literary research tools.

**General objective:** Upon completion of the course, the student will be able to analyze works of Spanish literature in light of the most important present literary criticism trends; also, he or she will be able to involve him or herself in individual and collective literary investigation and criticism projects that have to do with the period and/or topics that are being studied.

**Key words:** Criticism. Postwar. Boom and post-boom. Social reality. Internal world.

**Bibliography:** \* Gómez Redondo, Fernando., *La crítica literaria del siglo XX* / Fernando Gómez Redondo., 2a ed., Madrid : EDAF, c1996., [8441401187].

### H3033 Editing and Text Correction in Spanish

( 3 - 0 - 8. Prerequisites: None. 8 LLE11 )

Equivalence: None

This is an advanced course in the field of the Spanish language that prepares the student to participate in the different processes and moments that are involved in the editing of print and electronic text. That includes style correction, a process that demands perfect command of the language. The course requires previous knowledge of the Spanish linguistic system. As well as abilities in the use of linguistic and grammatical analysis tools. As a learning result the student will interview three recognized authors and/or editors and produce three observation reports on the editing, correction, and printing processes in editorials; an editorial practice and the prototype of an edit in print or electronic format.

**General objective:** Upon completion of the course, the student will be able to systematize the basics of proofreading and edition of texts from a professional perspective; build up a comprehensive view of the work carried out by the proofreader and the editor; and participate in the text editing and proofreading processes.

**Key words:** Style correction. Editorial industry. Textual correction and edition. Print and electronic text.

**Bibliography:** \* Reyes Coria, Bulmaro., *Manual de estilo editorial* / Bulmaro Reyes Coria., México : Editorial Limusa, 1986., [9681821815].

### H3034 Editorial Project and New Technologies

( 3 - 0 - 8. Prerequisites: [ H3033 ]. 9 LLE11 )

Equivalence: None

This is an advanced course in the field of editing that prepares the student to identify opportunities, develop and participate in projects linked to the world of editing, proofreading and new technologies, and provide solutions to 21st century problems. The course requires prior knowledge of the Spanish language, information technologies and the editing and proofreading processes. As a learning result, the



student will propose and carry out an editing project linked to a professional workspace in the community.

**General objective:** Upon completion of the course, students will be able to deal with and manage the main aspects of editorial work, using information technology tools; design and implement editorial and/or proofreading projects and apply their own knowledge to their professional studies.

**Key words:** Writing supports. Digital revolution and bibliodiversity. Orthotypographic and style correction. Writing and editing in and through the web.

**Bibliography:** \* Hurrell, Silvia., *Proyectos con todos : desde el aula y la escuela a la comunidad* / Silvia hurrell, Cecilia Pisos., Buenos Aires : Lugar, c2004., [9508921781].

### **H3035 Seminar in Literary Criticism II** ( 3 - 0 - 8. Prerequisites: [ H3032 , H2045 , H2046 ], 8 LLE11 )

**Equivalence:** H3015

This is an advanced course in the field of literature in which the student will read recent texts in Hispano-American literature. The course requires previous knowledge of Hispano-American literature, from its origins to the 20th and 21st centuries. As a learning result the student will carry out an academic research project in which he or she will analyze a Hispano-American literary work, while applying prior knowledge of literary matter and literary theory, as well as literary research tools.

**General objective:** Upon completion of the course, the student will be able to analyze Hispano-American literature in light of the most important current trends of literary criticism; also, he or she will be able to get involved in individual and group literary investigation and criticism projects related to the period and/or topics that are being studied.

**Key words:** Boom and post-boom. Social reality. Internal world. Magic realism.

**Bibliography:** \* Shaw, Donald Leslie, 1930-, *Nueva narrativa hispanoamericana : boom, posboom, posmodernismo* / Donald L. Shaw., 9a ed., Madrid : C tedra, c2008., [9788437602783].

### **H3036 Integrative Seminar of Humanistic Studies**

( 3 - 0 - 8. Prerequisites: None. 9 LCS11 )

**Equivalence:** EH3001

The purpose of this advanced humanities course is to give students the ability to develop an objective and consistent outline of humanities and social sciences of our time from a multidisciplinary perspective. The course requires previous knowledge of history, philosophy, literature, art, sociology and social anthropology. The learning outcome of this course is for students to prepare policies, mechanisms and actions to correct or improve the channeling of social or cultural organizations.

**General objective:** Upon completion of this course, students will be able to apply the theoretical, methodological and technical knowledge they have acquired to the different areas of their major (literature, history, philosophy, art in conjunction with social science); research, analyze and evaluate the most relevant, topical and significant issues; forecast their evolution and formulate, when necessary, policies, mechanisms and actions to correct them or enhance their direction; develop an objective, congruent outline of the field of humanities and social science in this day and age from a multidisciplinary and interdisciplinary perspective.

**Key words:** Comprehension and action. Transformation, development and responsibility. Symbols and texts. Image, portrayal and transmission. Development and capacity. Liberty and citizenship.

**Bibliography:** \* Rosell  i Cerezuela, David, 1959-, *Dise o y evaluaci n de proyectos culturales* / David Rosell  i Cerezuela., 1a ed., Barcelona : Ariel, 2004., [8434467216].

### H3037 Cultural and Alternative Tourism

( 3 - 0 - 8. Prerequisites: None. 9 LCS11 )  
**Equivalence: None**

This is an advanced course of Humanities oriented toward the development of the student's capabilities of identifying natural and cultural resources and generating strategies in harmony with the social needs of human communities, by proposing programs and projects in order to make the best use of resources in a sustainable way. Prior knowledge of management, economics, social anthropology and Mexican law are required. As a learning outcome the student will propose and design projects and actions for tourist developments that represent business opportunities and satisfy the particular needs of specific communities.

**General objective:** Upon completion of this course, students will be able to implement practical applications of cultural, ecological and alternative tourism in Mexico, taking into account the current rules and regulations, promotional programs and the existing demand.

**Key words:** Cultural heritage. Eco-tourism, alternative tourism and sustainability. Natural protected areas and conservationism.

**Bibliography:** \* Avila Aldapa, Rosa Mayra., Turismo cultural en México : alcances y perspectivas / Rosa Mayra Aldapa., 1a ed., México, D.F. : Trillas, 2007., [9789682478796].

### H3038 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 LCS11 )  
**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to

explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Life and Career Center. Professional development alternatives.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

### H3039 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 LLE11 )  
**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

### **H3040 Seminar in Literary Criticism III**

**( 3 - 0 - 8. Prerequisites: [ H3035 , H2047 , H2048 ]. 9 LLE11 )**

**Equivalence: None**

This is an advanced course in the field of literature in which the students will study a specific aspect of Mexican literature in depth. The course requires previous knowledge of the literature of New Spain and Mexican literature from the 20th and 21st centuries. As a learning result the students will carry out an academic research project in which they will analyze a Mexican literary work, applying prior knowledge of literary matters and literary theory, as well as literary research tools. The course may cover Mexican literature from any period, from the colonial period to present day.

**General objective:** Upon completion of the course, the student will be able to analyze Mexican literature in light of the most important current trends of literary criticism; also, he or she will be able to get involved in individual and group literary investigation and criticism projects related to the period and/or topics that are being studied.

**Key words:** The evolution of Mexican literature in the 20th century. How is México related to its literature. The corpus, the authors and the writing situation in Mexico.

**Bibliography:** \* Brushwood, John Stubbs, 1920-, México en su novela : una nación en busca de su identidad / John S. Brushwood ; tr. Francisco González Aramburo., 1a Ed., México : FCE , 1973., spa.

## HS Humanities and Social Sciences

### HS2000 Humanities and Fine Arts

( 3 - 0 - 8. Prerequisites: None. 2 IA 11, 2 IAB11, 3 IBN11, 3 IBT11, 4 IC 11, 2 IDA11, 3 IDS11, 2 IFI11, 3 IIA11, 4 IID12, 4 IIN12, 2 IIS11, 2 IMA11, 4 IMD11, 2 IME11, 6 IMI11, 2 IMT11, 3 INCQ13, 5 INT11, 2 IQA11, 2 IQP11, 5 ISC11, 2 ISD11, 5 ITC11, 2 ITE11, 5 ITIC11, 3 ITS11, 5 LAE11, 5 LAF11, 5 LCDE11, 6 LCMD11, 5 LCPF11, 6 LCS11, 6 LDF11, 5 LDN11, 5 LDP11, 1 LEC11, 5 LED11, 1 LEF11, 5 LEM11, 5 LIN11, 5 LLE11, 5 LLN11, 5 LMC11, 5 LMI11, 6 LNB11, 5 LP 12, 6 LPL11, 6 LPM12, 4 LPO11, 5 LPS12, 5 LRI11, 5 MC 11, 7 MO 11 )

**Equivalence:** HS2007

**General objective:** Students will select a course that contributes to the development of critical thinking and an ethical sense of responsibility to oneself, to others and to the environment, in order to create a sustainable world through the development of skills and capacities that lead to the construction of knowledge from multiple perspectives.

### HS2005 Citizenship

( 3 - 0 - 8. Prerequisites: None. 8 ARQ11, 7 IA 11, 7 IAB11, 8 IBN11, 7 IBT11, 7 IC 11, 7 IDA11, 8 IDS11, 8 IFI11, 7 IIA11, 7 IID12, 7 IIN12, 7 IIS11, 7 IMA11, 7 IMD11, 7 IME11, 7 IMI11, 8 IMT11, 5 INCQ13, 7 INT11, 7 IQA11, 7 IQP11, 7 ISC11, 8 ISD11, 7 ITC11, 8 ITE11, 7 ITIC11, 7 ITS11, 8 LAD11, 7 LAE11, 8 LAF11, 7 LCDE11, 8 LCMD11, 7 LCPF11, 8 LDF11, 6 LDI11, 8 LDN11, 7 LDP11, 7 LEC11, 8 LED11, 8 LEF11, 7 LEM11, 7 LIN11, 8 LLE11, 7 LLN11, 7 LMC11, 8 LMI11, 7 LNB11, 7 LP 12, 7 LPM12, 7 LPO11, 7 LPS12, 8 MC 11, 8 MO 11 )

**Equivalence:** HS2009

**General objective:** Students will select a course that contributes to their formation as Mexican and global citizens with historical awareness, analytical skills and critical sense, in order to promote their effective participation in the configuration of an equitable, sustainable and democratic society.

### HS2006 Applied Ethics

( 3 - 0 - 8. Prerequisites: None. 10 ARQ11, 9 IA 11, 9 IAB11, 9 IBN11, 9 IBT11, 9 IC 11, 9 IDA11, 9 IDS11, 9 IFI11, 9 IIA11, 9 IID12, 9 IIN12, 9 IIS11, 8 IMA11, 9 IMD11, 9 IME11, 8 IMI11, 9 IMT11, 9 INCQ13, 9 INT11, 9 IQA11, 9 IQP11, 9 ISC11, 9 ISD11, 9 ITC11, 9 ITE11, 9 ITIC11, 9 ITS11, 9 LAD11, 9 LAE11, 9 LAF11, 9 LCDE11, 9 LCMD11, 9 LCPF11, 9 LCS11, 9 LDF11, 9 LDI11, 9 LDN11, 8 LDP11, 8 LEC11, 9 LED11, 9 LEF11, 9 LEM11, 9 LIN11, 9 LLE11, 9 LLN11, 9 LMC11, 9 LMI11, 9 LP 12, 9 LPL11, 9 LPM12, 9 LPO11, 9 LRI11, 10 MO 11 )

**Equivalence:** None

The purpose of this ethics course is to create conditions that help students become aware of the ethical commitments that lead them to assume social responsibility within their professions and understand the interdependency between their work and the political, social and economic spheres of a globally sustainable world.

**General objective:** Students will select a course that is conducive to reflection on the personal and social accountability involved in their profession and on their commitment to contributing to the formation of a fairer, more sustainable society.

**Key words:** Professions as a social phenomenon. Work and society. Professional practice and Ethics.

**Bibliography:** \* Singer, Peter, 1946-, One world : the ethics of globalization / Peter Singer., 2nd ed., New Haven, Conn. : Yale University Press, 2004., [0300103050 (rústica)].

## IB Biologic Engineering

### IB1002 Applied Physiology and Plant Nutrition

( 3 - 0 - 8. Prerequisites: None. 3 IAB11 )

**Equivalence: None**

This is a basic course, which provides students with the necessary knowledge for understanding physiological processes. The course will include activities to develop solutions to problems and broadening concepts of innovation, using biotechnological tools. Previous knowledge is required in basic biology, chemistry and physics. The learning outcome for this course is that the students be able to analyze and interpret information that leads them to propose crop management and fertilization programs.

**General objective:** Upon completion of this course, students will be able to understand and analyze the regulation of plant growth and development, and comprehend crop management and nutrition requirements.

**Key words:** Plant metabolism. Plant nutrition and plant physiology. Abiotic stress.

**Bibliography:** \* Taiz, Lincoln., Plant physiology / Lincoln Taiz, Eduardo Zeiger., 4a ed., Sunderland, Mass. : Sinauer Associates, c2006., [0878938567 (hdbk. : alk. paper)], [9780878938568(hdbk. :alk.paper)].

### IB1003 Introduction to Agrobiotechnology

( 3 - 0 - 4. Prerequisites: None. 1 IAB11 )

**Equivalence: None**

The purpose of this basic-level course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Jensen, Merle H., Protected agriculture : a global review / Merle H. Jensen and Alan J. Malter., Washington, D.C. : World Bank, 1995., [0821329308].

### IB1004 Introduction to Biobusiness Engineering

( 3 - 0 - 4. Prerequisites: None. 1 IBN11 )

**Equivalence: None**

The purpose of this basic course is to introduce students to life as university students and undergraduate program in which they are enrolled. No previous knowledge is required for this course. Students are expected to have a clearer idea of what their major is about and the institution they are studying at. Students will also set up a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduate profile from the undergraduate program in which they are enrolled, its competences, opportunities, and professional development. They will also become familiar with the organizational structure of Tecnológico de Monterrey, its principal rules, and its regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.



## IB2003 Soil-Water-Plant-Atmosphere Relationships

( 3 - 0 - 8. Prerequisites: None. 4 IAB11 )

**Equivalence: None**

This is an intermediate level course, designed to provide students with the bases and specific knowledge of the physiological relationship between plants and the soil, water and atmosphere, which will serve as a foundation for production system management. The course will include the development of a project and concepts of sustainable development that will enable students to use the resources of production systems efficiently. Previous knowledge is required in plant physiology and mathematics. The learning outcome for this course is that the students be able to develop a project that integrates sustainable management in the interaction between soil, water and plants in a given region.

**General objective:** Upon completion of this course, students will be able to analyze the relationship of plants with soil, water and the atmosphere; and evaluate and design an irrigation system in a controlled environment production system.

**Key words:** Bioresources. Soil analysis. Watering calendar. Agroclimatology. Watering design.

**Bibliography:** \* Kirkham, M.B., Principles of Soil and Plant Water Relations, Academic Press, [0124097510].

## IB2004 Plant Protection

( 3 - 0 - 8. Prerequisites: None. 5 IAB11 )

**Equivalence: AG2005**

This is an intermediate course, which provides students with the necessary tools for recognizing the symptoms/signs of the principal agents that cause plant diseases and analyzing the biological cycles of phytopathogens and vectors, so that they can take basic control measures based on this knowledge. Previous knowledge of the general characteristics of microorganisms is required. The learning outcome for this course is that the students be able to recognize the main symptoms/signs of phytopathogens. The students will recognize the primary vectors and propose general control methods, based on their un-

derstanding of the biological cycles of phytopathogens and vectors (insects and mites).

**General objective:** Upon completion of this course, students will be able to interpret the symptoms and signs produced by main plant pathogens and recognize the damage caused by insect infestations in order to propose basic control methods.

**Key words:** Phytosanitary problems; Symptoms plant pathogens. Pest and disease control methods.

**Bibliography:** \* Helyer, Neil., A color handbook of biological control in plant protection / Neil Helyer, Kevin Brown, Nigel D. Cattlin., Portland, Or. : Timber Press, c2003., [0881925993].

## IB2005 Diagnosis and Pest Integrated Management Laboratory

( 0 - 3 - 4. Prerequisites: None. 6 IAB11 )

**Equivalence: None**

This is an intermediate course, which provides students with practical tools for diagnosing phytopathogens. This course includes solutions to practical problems, as well as identification methods using molecular tools. Previous knowledge is required on theoretical concepts and principles of diagnosis of phytopathogenic agents and in basic laboratory techniques. The learning outcome for this course is that the students take phytopathogenically representative samplings and apply the most suitable diagnostic techniques in order to identify the agents that cause diseases and propose control strategies that are compatible with human health and environmental conservation.

**General objective:** Upon completion of this laboratory course, students will be able to apply the relevant diagnostic techniques, ranging from the most basic to the latest, in order to identify the biological agents that cause diseases in plants and be able to propose solutions for infestations or plant diseases that are compatible with the environment and human health.

**Key words:** Diagnosis. Phytopathogen morphology, biology, physiology and habits. Abiotic or non-para-



sitic diseases. Clinical prediction or symptomatology. Diseases evolution. Plant disease control methods.

**Bibliography:** \* Koike, Steven T., Vegetable diseases : a color handbook / Steven T. Koike, Peter Gladders, Albert O. Paulus., Burlington, MA : Academic Press, c2007., [0123736757],[9780123736758].

## **IB2006 Integrated Pest and Disease Management**

**( 3 - 0 - 8. Prerequisites: None. 6 IAB11 )**

**Equivalence: None**

This is an intermediate course, which provides students with the theoretical tools to diagnose phytopathogens and create programs for the integral management of pests and diseases, understand the characteristics of the agents that cause diseases and understand the characteristics of insects and mites. Previous knowledge is required in basic methods of pest and disease prevention and control. The learning outcome for this course is that the students understand the theoretical principles of diagnostic techniques, from the most basic to the most cutting-edge, analyzing the most suitable techniques according to the case under consideration. The students will design basic pest and disease control programs, based on their knowledge of best practices in agriculture.

**General objective:** Upon completion of this course, students will be able to describe plant pathogen diagnosis techniques and formulate integrated infestation and disease management programs.

**Key words:** Description of the phytopathogenic diagnostic techniques. Integrated pest and disease management (IPDM).

**Bibliography:** \* Integrated pest management : concepts, tactics, strategies and case studies / edited by Edward B. Radcliffe, William D. Hutchison, Rafael E. Cancelado., Cambridge, UK ; New York : Cambridge University Press, 2009., [9780521875950 (hardback)], [0521875951 (hardback)], [0521699312 (paperback)], [9780521699310 (paperback)].

## **IB2007 Agri-food Bioengineering**

**( 3 - 0 - 8. Prerequisites: [ BT1003 , BT2003 ]. 5 IBN11 )**

**Equivalence: None**

This is an intermediate course, aimed at examining the use of biotechnology in food production, including both historical and current perspectives, as well as some predictions of what future applications might be. Technologies to be covered include fundamental and historical approaches, such as the use of microbes and yeast for fermentation; the use of mutagenesis to create new plant varieties, such as wheat varieties used for production of most pastas; and the generation of transgenic or genetically engineered plants and animals with new characteristics to address nutritional, storage and processing issues. The course requires prior knowledge of Biology, Biochemistry, Genetics and Molecular Biology, and an understanding of basic biotechnological terms is required in order to permit discussion of the uses of biotechnology in food production. As a learning outcome, the student presents a research report or case study of an agrobiological product or process, including historical aspects, technologies used, key features, market impact and future prospects.

**General objective:** At the end of the course the student will be able to understand how biotechnological tools have been, currently are, and will be used in the development and production of food in the future; understand current biotechnological applications including the use of analytical tools to study and evaluate plants and animals that are used as foods and in the production of foods with certain characteristics; gain an appreciation for the potential of biotechnological applications, as well as an understanding of the uses of biotechnology through agricultural history.

**Key words:** Agrobiotechnology. History of agri-food bioengineering. Food production. Animal biotechnology.

**Bibliography:** \* Phillip G. Purdy, The Future of Food: Biotechnology Markets and Policies in an International Setting.

## **IB2008 Energy and Environmental Bioengineering**

**( 3 - 0 - 8. Prerequisites: [ BT2003 ]. 6 IBN11 )**

**Equivalence: None**

This is an intermediate course intended to help students understand the theoretical fundamentals of the biological processes applied to prevent and put right environmental contamination, as well as generate alternative energy sources. The course requires basic knowledge of biology, microbiology and organic and inorganic chemistry. As a learning outcome, students will be able to solve environmental problems by designing projects to remedy the problems and/or produce energy based on biological systems.

**General objective:** Upon completion of this course, students will be able to design and incorporate the biological component of a remedial and/or bioenergy project. Also, students will be able to think critically with respect to the diagnosis and applicability of these processes in different scenarios and be aware of the ethical, social, and legal implications in the environmental field.

**Key words:** Bioremediation engineering. Environmental biotechnology. Biological transformation and degradation of environmental contaminants. Bioenergy production.

**Bibliography:** \* Rittmann, Bruce E., Environmental biotechnology : principles and applications / Bruce E. Rittmann, Perry L. McCarty., Edición internacional., Nueva York, N.Y. : McGraw-Hill, c2001., [0071181849].

## **IB3001 Production in Controlled Environment I**

**( 3 - 0 - 8. Prerequisites: None. 5 IAB11 )**

**Equivalence: None**

In this advanced course, students will analyze the principal interactions in production systems in controlled environments for both vegetable crops and ornamental plants. Students will complete a final project in which they relate technical elements to sustainable business elements. This course requires prior knowledge of the areas of climate, soil, water and plants. As a learning outcome students will be

able to evaluate and analyze a project proposal for greenhouse production based on the knowledge gained during this course.

**General objective:** Upon completion of this course, students will be able to analyze and evaluate a greenhouse production system in terms of its biological and economic variables in accordance with market requirements; interpret the manner in which production factors affect product quality.

**Key words:** Plant production in greenhouses. Marketing greenhouse products.

**Bibliography:** \* Langhans, Robert W., 1929-, Greenhouse management : a guide to structures, environmental control, materials handling, crop programming, and business analysis / Robert W. Langhans ; line drawings by Virginia Langhans, 3rd ed, Ithaca, N.Y. : Halcyon Press of Ithaca, 1990, New York, 1990, eng, [0960400621].

## **IB3002 Production in Controlled Environment II**

**( 3 - 0 - 8. Prerequisites: None. 6 IAB11 )**

**Equivalence: None**

In this advanced course, students will analyze, establish and modify the principal factors that determine the production of ornamental crops and vegetables or other production systems, and become familiar with the technological requirements and the way in which their control is implemented. This course will include activities and concepts related to innovative technologies that broaden the students' vision of the development of technologies in controlled environments. This course requires a basic knowledge of the interactions in the environment, water, plant and harmful organisms. As a learning outcome students will apply their knowledge and interpretation of the use of environmental-control technologies in order to manage sustainable production operations.

**General objective:** Upon completion of this course, students will be able to analyze and evaluate a production system in ornamental greenhouses in terms of its biological and economic variables in accordance with market requirements; interpret the manner

in which production factors affect ornamental product quality.

**Key words:** Ornamentals.

**Bibliography:** \* Dole, John M., Floriculture : principles and species / John M. Dole, Harold F. Wilkins, 2nd ed., Upper Saddle River, N.J. : Pearson/Prentice Hall, c2005, New Jersey, c2005, eng, [0130462500],[9780130462503].

### **IB3004 Precision Agriculture**

**( 3 - 0 - 8. Prerequisites: None. 5 IA 11, 7 IAB11 )**

**Equivalence: None**

In this advanced course, students will analyze precision agriculture technologies and be capable of making decisions and solving problems on the basis of a solid understanding of this technology. The course includes the analysis of technology within the framework of the management of extensively genetically-modified plants, as well as the criteria for evaluation and sustainable management making efficient use of precision technology. This course requires a basic knowledge of the use of computer tools as well as knowledge of soil, water and climatology. As a learning outcome students will be able to handle and integrate precision technologies into an extensive production system or other production systems.

**General objective:** Upon completion of this course, students will be able to design an agricultural production system based on the use of information management technology (geographic information systems, global positioning systems, and related technologies) with the goal of increasing the sustainability of agricultural systems.

**Key words:** GPS. GIS. Yield maps. Remote sensors.

**Bibliography:** \* Precision agriculture / edited by J. Stafford, A. Werner, Wageningen, The Netherlands : Wageningen Academic, 2003, Netherlands, 2003, eng, [9076998213].

### **IB3007 Strategic Information Systems in Biobusiness**

**( 3 - 0 - 8. Prerequisites: None. 5 IAB11, 5 IBN11 )**

**Equivalence: None**

This is an advanced level course which provides students with the necessary knowledge for compiling, analyzing and interpreting environmental information to support decisions related to a bio-business, from the macro-environment to commercial intelligence, using databases and analyses of the climate and the economic environment. Previous knowledge is required in planning and development of business ideas in the area of agro-biotechnology. The learning outcome for this course is that students be able to use strategic information to take advantage of opportunities in agro-biotechnology and propose innovative projects.

**General objective:** Upon completion of this course, students will be able to use diverse strategic information systems in biobusinesses to identify market opportunities, analyze the conditions of the macro environment and their effect on business models.

**Key words:** Competitiveness. Market intelligence. Value chains. Model innovation.

**Bibliography:** \* Ward, John, 1947-, Strategic planning for information systems / John Ward and Joe Peppard., 3a ed., Chichester ; New York : Wiley, c2002., [0470841478],[9780470841471].

### **IB3008 Design and Engineering in Controlled Environments**

**( 3 - 0 - 8. Prerequisites: None. 7 IAB11 )**

**Equivalence: None**

This is an advanced course designed to develop students' understanding of the principles and processes in the design of climate control systems with emphasis on solution of problems in greenhouse design. Activities include the use of software to simulate factors related to the design. The course requires previous knowledge in the physiology of plants and their interaction with water, soil, and atmosphere, and also in greenhouse production systems. The learning outcome for this course is that students be able to

solve real problems based on an objective analysis, integrate their scientific and technical knowledge, and interpret physical and mathematical information from a controlled environment.

**General objective:** Upon completion of this course, students will be able to integrate engineering elements to determine, implement and/or follow up on the adaptation, design or construction of intensive agriculture production systems.

**Key words:** Heating systems. Climate control. Ventilation and cooling. Insect control. Covers.

**Bibliography:** \* Ball redbook., 17th ed., Batavia, IL. : Ball Pub., c2003., [1883052343 (v. 1 : encuadernado : papel alcalino)], [9781883052348 (v. 1 : encuadernado : papel alcalino)], [1883052351 (v. 2 : encuadernado : papel alcalino)].

### **IB3009 Production in Controlled Environments Laboratory**

**( 0 - 3 - 4. Prerequisites: None. 8 IAB11 )**

**Equivalence: None**

This is an advanced level course, which provides students with the ability to understand and manage the technical aspects of horticultural production in controlled environments. Previous knowledge is required in Vegetal Physiology, Applied Nutrition and Production in controlled environments. The learning outcome for this course is that the students be able to manage the basic operations of a greenhouse, as well as demonstrate the principles of hydroponic production, based on the physical and biological principles of interaction between plants and their environment.

**General objective:** Upon completion of this course, students will be able to operate a production system in greenhouses and evaluate the development of a crop in relation to production quality; analyze the development of a plant by studying its phenology and make decisions regarding its correction; identify nutritional disorders in plants and propose corrective actions.

**Key words:** Fertirrigation. Substratum management. Nutrient management. Harvesting practices. Hydroponics.

**Bibliography:** \* Boodley, James William, 1927-, The commercial greenhouse / James W Boodley, Steven B Newman., 3rd ed., Clifton Park, NY : Delmar Cengage Learning, c2009., [9781418030797].

### **IB3010 Regulatory Framework in Biotechnology**

**( 3 - 0 - 8. Prerequisites: None. 8 IAB11, 6 IBN11 )**

**Equivalence: None**

This is an advanced level course, which provides students with the knowledge and tools to apply national and international legislation related to production systems and focused on innovative business technologies. Previous knowledge is required in Molecular Biology and Genetic Engineering. The learning outcome for this course is that the students become familiar with national and international bio-legislation, with the ability to incorporate this knowledge in their business plans. The student will be able to search for those patents that have an impact on potential bio-businesses, as well as evaluate the feasibility of a bio-business.

**General objective:** Upon completion of this course, students will be able to offer recommendations on the feasibility and convenience of using biotechnological products in productive systems based on their knowledge of legal system and patents.

**Key words:** Patents. Bioregulation. Biobusiness.

**Bibliography:** \* Biotechnology and the law / Hugh B. Wellons . [et al.], Chicago, Ill. : American Bar Association, c2007., [9781590317617],[1590317610].

### **IB3011 Market Development: Bioenergy and the Environment**

**( 3 - 0 - 8. Prerequisites: None. 9 IAB11 )**

**Equivalence: None**

This is an advanced course, which provides students with the knowledge required to enter the bioenergy and environmental market. Included in the course are activities that incorporate creative solutions for developing bioenergy and environmental businesses,

by means of a project that integrates the students' knowledge of biology and engineering in the development and administration of bio-business plans in these sectors. Previous knowledge is required in microbiology, the environment and bioenergetic cultivation. The learning outcome for this course is that the students be able to map out the technical aspects of biological processes in waste management and in the search for alternative energy sources, in order to enter the environmental and energetic biotechnology market within the framework of generating sustainable businesses.

**General objective:** Upon completion of this course, students will know about the theoretical aspects that form the foundation of environmental biotechnology and of businesses that offer creative solutions to the energy problem through biomass, and will be able to apply these principles to solve business-related issues. They will also play an active role in identifying, executing and managing this type of business.

**Key words:** Alternative energy. Bioenergy. Environmental biotechnology. Environmental biobusiness.

**Bibliography:** \* Rittmann, Bruce E., Environmental biotechnology : principles and applications / Bruce E. Rittmann, Perry L. McCarty., Edición internacional., Nueva York, N.Y. : McGraw-Hill, c2001., [0071181849].

### **IB3012 Agrobiotechnology Capstone Project**

**( 3 - 0 - 8. Prerequisites: None. 9 IAB11 )**  
**Equivalence: None**

This is an advanced course that gives students the ability to integrate their knowledge in agro-biotechnology by carrying out an innovative project in the areas of greenhouse agriculture, biotechnology, agro-biotechnology market development, environmental friendliness and biosecurity, etc. Previous knowledge is required in the areas of Agriculture, Strategic Informational Analysis, Agro-biotechnology applications, project evaluation and cost-effective engineering. The learning outcome for this course is that the students be able to defend an opportunity to develop a business plan in any area of agro-biotechnology development with sound technical and economic justification.

**General objective:** Upon completion of this course, students will be able to integrate leading-edge technological tools in a high-value productive system through an original project that promotes innovation and sustainability within a competitive environment.

**Key words:** Integration project. Engineering economics. Agrobiotechnology. Project assessment.

**Bibliography:** \* Kerzner, Harold., Project management : a systems approach to planning, scheduling, and controlling / Harold Kerzner., 9th ed., Hoboken, N.J. : J. Wiley, 2006., [0471741876 (tela)], [9780471741879 (tela)].

### **IB3013 Introduction to Professional Development**

**( 2 - 0 - 2. Prerequisites: None. 9 IAB11 )**  
**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CE-NEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].



### **IB3015 Innovative Project in Biobusiness**

**( 3 - 0 - 8. Prerequisites: None. 9 IBN11 )**  
**Equivalence: None**

This is an advanced course that gives students the ability to integrate their acquired knowledge and skills in a design project for areas or physical spaces dedicated to biotechnological products and processes. Previous knowledge is required in handling biological products, biosecurity and project management. The learning outcome for this course is that the students design a suitable production installation in a biotechnological or pharmaceutical area, taking into consideration the commercialization of the product as well as the financial restrictions and legal implications.

**General objective:** Students will be able to design a laboratory or work area for producing biological or pharmaceutical products, including the financial feasibility analysis, and taking into account the optimization of flows and selection of appropriate technology to meet the desired quality and biosafety requirements.

**Key words:** Laboratory design. Biosecurity levels. Facilities planning.

**Bibliography:** \* Leonard Mayer, Design and planning of research and clinical laboratory facilities, [0-471-30623-1].

### **IB3016 Introduction to Professional Development**

**( 2 - 0 - 2. Prerequisites: None. 9 IBN11 )**  
**Equivalence:None**

This is a university course which is designed to prepare students in their area of specialization for the CE-NEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].



## IM Music Production Engineering

### IM1001 Introduction to Digital Music Production Engineering

( 3 - 0 - 4. Prerequisites: None. 1 IMI11 )

**Equivalence: None**

The purpose of this basic-level course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Thompson, Daniel M., Understanding audio : getting the most out of your project or professional recording studio / by Daniel C. Thompson., Boston, Mass. : Berklee Press, c2005., [0634009591],[9780634009594].

### IM1002 Taller de teoría musical aplicada

( 0 - 3 - 4. Prerequisites: [ H1042 ]. 2 IMI11 )

**Equivalence: None**

This is a basic course in musical instruction intended to convey the gradual and systematized application of the fundamental elements of musical language. Previous knowledge of music theory and solfège is required. At the end of the course, the student

should be able to produce short arrangements and compositions using the grammar of music creatively.

**General objective:** By the end of the course the student will be able to apply the basic elements of musical language to composition and arrangement projects developed collaboratively for different genres and applications (musicalization of videos, jingles, commercials, etc.)and with different durations.

**Key words:** Music theory fundamentals.

**Bibliography:** \* Carnota, Lalo, Teoría Musical Aplicada (vol. I y II), Año 2010, Apmusica, [ISBN: 978-84-96978-65-2].

### IM2004 Ear/Instrumental Training Lab

( 4 - 0 - 8. Prerequisites: [ IM1002 ]. 3 IMI11 )

**Equivalence: None**

The purpose of this intermediate music education course is for students to develop skills in auditory training and instrumental/vocal dexterity using specific interactive software programs. The course introduces the student to the development of sound design, composition, and musical production. It requires previous knowledge of music theory and elementary dexterity on any musical instrument (piano, guitar) and/or voice. The learning outcome of this course is for students to develop a project in the design of sound, composition, and instrumental and vocal execution, applying principles of musical structure, individually and in a group.

**General objective:** Upon completion of this workshop students will be able to identify the auditory mode and using specific software the main components of musical grammar: pitch, intervals, tonality, chords, harmonic progressions, modes, scales, rhythms, timbres, and textures. They will also be able to recognize these components in scores, writing them on the staff and applying them to instrumental and vocal execution.

**Key words:** Modes, scales, rhythms, timbres, textures. Chords, harmonic progressions. Aural training, intervals, tones.

**Bibliography:** \* Martínez, Pedro., Ear Training : Formación y desarrollo del oído musical., s.l., 2009, [9788850716982].

### **IM2005 Audio Programming** ( 3 - 0 - 8. Prerequisites: [ TC1017 ]. 4 IMI11 ) **Equivalence: None**

The audio-programming course is an intermediate level course designed to teach students a number of high-level audio programming languages to generate audio, sound and/or music. The course requires the students to have basic knowledge of high-level programming . As learning outcome the students, working in teams, have to develop an application using the knowledge learnt in this course.

**General objective:** Upon completion of this course, students will be able to develop programs using high-level audio programming tools.

**Key words:** Audio programming. High-level language. Programming libraries.

**Bibliography:** \* Bosi, Marina., Introduction to digital audio coding and standards / Marina Bosi, Richard E. Goldberg., Boston : Kluwer Academic Publishers, c2003., [1402073577 (papel alcalino)], [9781461350224].

### **IM2006 MIDI Systems** ( 3 - 0 - 8. Prerequisites: [ IM1002 ]. 6 IMI11 ) **Equivalence: None**

The purpose of this intermediate music-production course is for students to understand MIDI language and protocol in order to carry out recordings, sequences and live presentations. The course requires previous knowledge of music and programming. The learning outcome of this course is for students to complete projects in which they manipulate controllers or electronic devices for different instruments, mixers or effects using the MIDI protocol in order to produce a recording and/or live presentation.

**General objective:** Upon completion of this course, students will be able to apply the MIDI protocol and the main sound libraries in recordings and live presentations, handling instruments, mixers and peripherals by means of digital controllers.

**Key words:** Musical instruments. Digital interface. General MIDI. System exclusive messages. Device chaining.

**Bibliography:** \* Huber, David Miles., The MIDI manual : a practical guide to MIDI in the project studio / David Miles Huber., 3rd ed., Burlington, MA : Focal Press/Elsevier, c2007., [9780240807980 (rústica : papel alcalino)], [0240807987 (rústica : papel alcalino)].

### **IM2007 Sound Engineering** ( 3 - 0 - 8. Prerequisites: [ AT2006 ]. 7 IMI11 ) **Equivalence: None**

The purpose of this intermediate audio-engineering course is for students to use the principal audio-engineering tools in different subject disciplines, such as recording, studio design and live sound boosting. The course requires previous knowledge of music and programming. The learning outcome of this course is for students to complete a "Home Studio" design project involving digital recording and voice dubbing.

**General objective:** Upon completion of this course, students will be able to apply their knowledge of the field of sound engineering to diverse specializations, such as recording, recording studio design and live sound reinforcement, including the operation, connection, installation and handling of the main components: microphones, cables, mixers, preamplifiers, amplifiers and peripherals.

**Key words:** Home studio. Types of microphones. Digital and analog mixers. Surround monitoring. Recording studio.

**Bibliography:** \* Rumsey, Francis., Sound and recording : an introduction / Francis Rumsey, Tim McCormick., 4th ed., Oxford : Focal, 2002., [024051680X].

## IM3006 Digital Audio Systems for Web and Mobile Devices

( 3 - 0 - 8. Prerequisites: [ IM2005 ]. 7 IMI11 )

**Equivalence: None**

The purpose of this advanced computing course is for students to acquire the necessary knowledge and tools to develop and implement audios, specifically taking into consideration the characteristics and limitations of applications for the web and mobile devices. The course requires previous knowledge of and practice in programming audios in a high-level language. The learning outcome of this course is for students to develop at least one audio application for the web and one for any mobile device, using any programming language and/or specialized software for implementation. These applications should function appropriately with different browsers and on various mobile devices.

**General objective:** Upon completion of this course, students will be familiar with the particular characteristics that differentiate programming for WEB audio systems and for mobile devices.

**Key words:** Audio streaming. Audio programming for mobile devices.

**Bibliography:** \* Yuan, Michael Juntao., Enterprise J2ME : developing mobile Java applications / Michael Juntao Yuan ; [foreword by Jim Colson]., Upper Saddle River, NJ : Prentice Hall PTR, c2004., [0131405306 (rústica)].

## IM3007 Music Composition and Digital Arranging Workshop

( 4 - 0 - 8. Prerequisites: [ IM2006 ]. 7 IMI11 )

**Equivalence: None**

The purpose of this advanced music-education course is for students to acquire the necessary tools to design and carry out composition and musical production projects as well as provide soundtrack and music for film, video, videogames, the web, mobile devices and multimedia. The course requires knowledge of music theory, auditory and instrumental training, music appreciation, humanistic education, sound and acoustics theory and the MIDI system. The learning

outcome of this course is for students to develop soundtrack and musical composition projects for application in musical productions and other media. Students will also be able to develop basic abilities in musical arrangement using specific computer tools (Pro Tools, Sibelius, etc.).

**General objective:** Upon completion of this workshop, students will be able to design creatively and structure ideas, and develop soundtrack and musical composition projects to be applied to music production and diverse media, such as video, film, videogames, advertising, the Internet, mobile devices, etc. They will also have developed the skills needed for multitrack digital arrangement using specific software tools (Pro Tools, Sibelius, etc.).

**Key words:** Introduction to composition and composition techniques. Music editing and notation (Pro Tools, Sibelius, etc.). Digital arrangement.

**Bibliography:** \* Hewitt, Michael., Composition for computer musicians / Michael Hewitt., Boston : Course Technology, c2009., [9781598638615],[1598638610].

## IM3008 Music Production and Digital Mixing Workshop

( 4 - 0 - 8. Prerequisites: [ IM2007 ]. 8 IMI11 )

**Equivalence: None**

The purpose of this advanced audio-engineering course is to help students acquire the theoretical and practical tools for carrying out professional digital mixing using specialized software and hardware as well as peripheral analog devices. The course requires prior knowledge of MIDI systems and audio engineering. The learning outcome of this course is for students to create different types of productions, doing all the management for a studio and/or live music production, from planning the project to the final mix in 7.1 format.

**General objective:** Upon completion of this course, students will be able to carry out a musical production project that involves the distinct phases of pre-production, production and digital mixing, highlighting the entrepreneurship of independent productions. They will also be familiar with the main

digital platforms for musical notation, recording and sound manipulation through participating in sound laboratory, recording studio and live practices.

**Key words:** Time code. Master. Production file. Set of microphones. Monitoring position.

**Bibliography:** \* Owsinski, Bobby., The recording engineer's handbook / Bobby Owsinski., 2nd ed., Boston, MA : Course Technology, c2009., [9781598638677], [159863867X].

### **IM3009 Recording Techniques** ( 3 - 0 - 8. Prerequisites: [ IM2007 ]. 8 IMI11 ) **Equivalence: None**

The purpose of this advanced audio-engineering course is to provide students with the theoretical and practical tools to produce professional digital recordings with digital and analog instruments. The course requires prior knowledge of MIDI systems and audio engineering. The learning outcome of this course for students is to make professional digital recordings of vocal groups and digital and analog instruments in studio and/or live sessions.

**General objective:** Upon completion of this course, students will be able to use the most common recording techniques, and be conversant with the types of microphones and their possible uses; manage an entire recording session, from the planning through to the mastering stages; be familiar with the diverse types of multitrack analogue recorders and external sound processors for recording, manipulation, chaining and mixing.

**Key words:** Peripheral components. Studio recording. Live recording. Synchronization of elements. Mixing.

**Bibliography:** \* Huber, David Miles., Modern recording techniques / David Miles Huber, Robert E. Runstein., 7th ed., Amsterdam ; Boston : Focal Press/Elsevier, c2010., [0240810694 (rústica)], [9780240810690 (rústica)].

### **IM3010 Musical Production Project** ( 3 - 0 - 8. Prerequisites: [ IM3008 ]. 9 IMI11 ) **Equivalence: None**

The purpose of this advanced course in digital music production is to permit students to combine and apply skills developed in the disciplines of music, technology and marketing through carrying out a musical production project. The course requires prior knowledge of music and art, as well as associated technologies for digital musical production (digitization, creation and sound engineering) and fundamentals of project administration and marketing. The learning outcome of this course is for students to develop a musical production project, including sound engineering in all the phases of pre-production, production and post-production, along with the logistical and commercial aspects of the project.

**General objective:** Upon completion of this course, students will be able to conceptualize, define, design, develop and implement a project that integrates the management of music and technology in the areas of digital music production, including a business model that covers logistics, planning, target market identification, sources of financing, administrative issues, follow-up, quality of results and marketing.

**Key words:** Business project creation. Technology development. Music creation. Production.

**Bibliography:** \* Richard James Burgess, The Art of Music Production, Omnibus Press, Inglés.

### **IM3011 Post-production and Digital Mastering Workshop** ( 4 - 0 - 8. Prerequisites: [ IM3008 ]. 9 IMI11 ) **Equivalence: None**

The purpose of this advanced audio-engineering course is to help students acquire theoretical knowledge and practical tools for performing post-production of soundtracks and musicals. The course requires previous knowledge of production and digital mixing. The learning outcome of this course is for students to perform post-production for soundtracks on diverse projects, such as videogames, documentaries or musicals.

**General objective:** Upon completion of this course, students will be able to implement complete post-production and mastering processes using the most common tools for this purpose; know the importance of mastering and the final preparation process for Blue Ray, DVD and CD mobile and physical devices.

**Key words:** Peripheral components. Production file. Aural appreciation of masters. Positioning of stereo monitors, 5.1 and 7.1.

**Bibliography:** \* Bobby Owsinski, The mixing engineer's handbook, Thomson Course Technology, [1598632515].

## IM3012 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 IMI11 )

**Equivalence:** None

This is a university course which is designed to prepare students in their area of specialization for the CE-NEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Life and Career Center. Professional development alternatives.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].



## IN Industrial Engineering

### IN1002 Systems Engineering Laboratory

( 0 - 3 - 4. Prerequisites: [ IN2022 Corequisite , IN2022 ]. 6 IIS11, 6 INT11 )

**Equivalence:** None

This basic course in industrial and systems engineering allows students to understand the basic concepts of systemic thinking and apply techniques for systems modeling and participative decision making. No previous knowledge is required. The learning outcome of this course is, for students, to be able to select and apply systemic thinking tools that will be used in further systemic related courses.

**General objective:** Upon completion of this course, students will be able to design and implement participative intervention processes using a systemic approach, from the conceptualization phase to the final documentation.

**Key words:** Systems thinking. Participative processes. Systemic modeling.

**Bibliography:** \* Anderson and Johnson, System Thinking Basic from Conceptos to causal loops, Pegasus.

### IN1003 Introduction to Industrial Engineering

( 3 - 0 - 4. Prerequisites: None. 1 IIS11 )

**Equivalence:** None

This is a basic level course intended to introduce students to the context of university life and to the career in which they are enrolled. No previous knowledge is required. As a result of learning, it is expected that students have a clearer vision of their career and the institution they have joined. Students will also generate an academic-professional life & career plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the career in which they are enrolled, their competencies and their work & professional de-

velopment fields. They will also get to know the organizational structure of Tecnológico de Monterrey and its main regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Turner, Wayne C., 1942-, Introduction to industrial and systems engineering / Wayne C. Turner, Joe H. Mize, Kenneth E. Case., 2nd ed., Englewood Cliffs, N.J. : Prentice-Hall, c1987., [0134845692].

### IN2004 Statistical Quality Control

( 3 - 0 - 8. Prerequisites: [ IN2002 , MA1006 , MA2011 Corequisite , MA2011 ]. 6 IBT11, 7 IIA11, 6 IIN12, 5 IIS11, 5 IMA11, 5 INT11, 5 IQA11 )

**Equivalence:** IN00852

This is an intermediate level industrial engineering course that provides students with the necessary statistical tools to control, monitor and improve the quality of products and services, as well as to solve problems. This course requires prior knowledge of hypothesis testing, probability distributions and sampling distributions. As a learning outcome, the student is able to propose solutions to quality problems using statistical control methodologies. The student applies quality control tools to control and improve production and service processes.

**General objective:** Upon completion of this course, students will be able to select and apply statistical quality control tools in order to improve production and service processes.

**Key words:** Acceptance sampling. Statistical process control. Process capability. Continuous improvement cycle.

**Bibliography:** \* Mitra, Amitava., Fundamentals of quality control and improvement / Amitava Mitra., 3rd ed., Hoboken, N.J. : Wiley, 2008., [9780470226537 (tela)], [0470226536 (tela)].



## IN2005 System Dynamics

( 3 - 0 - 8. Prerequisites: [ MA2001 , MA1006 , IN1002 , MA2010 ]. 7 IIN12, 7 IIS11, 7 INT11 )

**Equivalence:** IS00853

This is an intermediate industrial engineering course that provides students with the basic and intermediate concepts of systems dynamics, highlighting their applications in industry and society. This course requires prior knowledge of systems thinking. The learning outcome is for students to be able to simulate, validate and sensitize diverse scenarios in the situations being studied, using specific system dynamics software.

**General objective:** Upon completion of this course, students will be able to utilize the basic concepts and tools of systems thinking and system dynamics in order to study an organizational or social process through the development, implementation, validation, and maintenance of a system dynamics model.

**Key words:** Loops (Feedback cycles). Flows and levels. Continuous simulation. Systems thinking. Dynamic systems: structure and behavior.

**Bibliography:** \* Morecroft, John D. W. (John Douglas William), Strategic modelling and business dynamics : a feedback systems approach / John Morecroft., Chichester, England : John Wiley & Sons, c2007., [0470012862 (rústica : papel alcalino)], [9780470012864 (rústica : papel alcalino)].

## IN2017 Facility Design and Materials Management

( 3 - 0 - 8. Prerequisites: [ IN2001 Corequisite , IN2001 , IN2018 Corequisite , IN2018 ]. 5 IIN12, 4 IIS11 )

**Equivalence:** IN2003

The purpose of this intermediate industrial engineering course is to provide students with the necessary tools to solve location, layout and material handling problems in manufacturing, service and/or warehousing facilities. The course requires previous knowledge of work design. The learning outcome of this course is for students to be able to put forward solutions for the optimal distribution of facilities (manufacturing, services, warehouses), and suggest the

most efficient layout, considering a suitable material handling system within the installations.

**General objective:** Upon completion of this course, students will be able to determine the optimal layout of the facilities for a manufacturing, warehouse or service company; design efficient material handling systems, including the selection of the appropriate machinery and equipment.

**Key words:** Layout. Materials management. Selection of machinery and equipment.

**Bibliography:** \* Bedworth, David D., Computer - integrated design and manufacturing / David D. Bedworth, Mark Richard Henderson, Philip M. Wolfe., 1a ed., New York : Mc Graw Hill , 1991., [0071008462].

## IN2018 Work Design

( 3 - 0 - 8. Prerequisites: [ MA1006 Corequisite , MA1006 , MA1020 Corequisite , MA1020 ]. 4 IIN12, 4 IIS11, 5 IMA11 )

**Equivalence:** IN2001

The purpose of this intermediate industrial engineering course is to provide students with the necessary tools to measure, improve, design and redesign work systems (manufacturing and services) taking into consideration the human and/or mechanical factors inherent in the operation. The course requires previous knowledge of probability and statistics. The learning outcome of this course is for students to be able to set out solutions for increasing work-system efficiency (manufacturing and services), using the tools of methods analysis and work measurement.

**General objective:** Upon completion of this course students, will be able to analyze, design and/or redesign efficient work systems (manufacturing and services), considering the principles of work method standardization, occupational ergonomics, occupational safety and hygiene, standard operating times, operating capacity analysis, and personnel and/or machinery requirements.

**Key words:** Work measurement. Productivity. Work method analysis. Operational capacity analysis. Staff and/or machinery requirements in a work system.

**Bibliography:** \* Niebel, Benjamin W., Ingeniería industrial : métodos, tiempos y movimientos / Benjamin W. Niebel ; [versión en español y adaptación técnica Francisco Paniagua Bocanegra], México : Alfaomega, c1996., spaeng, [9701502175].

### **IN2019 Metrology Laboratory** ( 0 - 3 - 4. Prerequisites: [ MA1020 ]. 4 IIS11 ) Equivalence: None

The purpose of this intermediate industrial engineering course is to provide students with concepts and practice related to measurement and the use of measurement instruments in different environments. The course requires previous knowledge of random variables, probability distribution and sample distribution. The learning outcome of this course is for students to identify the appropriate type of measurement instrument for performing measurements that reflect process performance. Students will be able to interpret measurements in different environments and validate whether the measurements are consistent and the instruments suitable for the measurement.

**General objective:** Upon completion of this course, students will be able to distinguish between the diverse measurement instruments, measurement units and their impact on the performance measurements of a process.

**Key words:** Metrology. Sensitivity, stability and linearity of measurements. Measurement patterns and standards.

**Bibliography:** \* Bucher Jay L, The metrology handbook, The measurement Quality Division ASQ.

### **IN2020 Inventory Management** ( 3 - 0 - 8. Prerequisites: [ IN2022 Corequisite , IN2022 ]. 6 IIN12, 5 IIS11, 7 IMA11, 6 INT11 ) Equivalence: IN2010

It is an intermediate level course on industrial engineering that provides strategies to efficiently managing inventories by creating value in the production system of a company. It requires previous knowledge on linear programming. As a result of the learning

process the student will be able to design, evaluate and improve supply schemes and inventory systems. Furthermore, the student will be able to understand the importance of inventory management in the competitiveness of the industries.

**General objective:** Upon completion of this course, students will have gained an understanding of the role of inventory management and control, and its relevance within a company's productive system.

**Key words:** Deterministic and stochastic inventory control. Modern techniques of inventory control. Technologies for the inventory management.

**Bibliography:** \* Nahmias, Steven., Production and operations analysis / Steven Nahmias., 6th ed., New York, NY ; México : McGraw-Hill/Irwin, c2009., [0071263705 (ed. internacional)], [0073377856 (papel alcalino)], [9780071263702 (ed. internacional)], [9780073377858 (papel alcalino)].

### **IN2021 Production Management** ( 3 - 0 - 8. Prerequisites: [ IN2020 Corequisite , IN2020 ]. 8 IIN12, 5 IIS11, 9 IMA11, 7 INT11 ) Equivalence: IN3012

The purpose of this intermediate industrial engineering course is to provide students with useful tools and concepts for controlling, modeling and improving production systems in companies. The course requires previous knowledge of inventory management and control. The learning outcome of this course is for students to be able to use mathematical tools and management concepts to program and control production so that the company obtains the maximum benefit.

**General objective:** Upon completion of this course, students will be able to analyze and improve a production system on the basis of production management and control strategies.

**Key words:** Production Systems. Production control. Aggregate planning. Sequencing.

**Bibliography:** \* Sipper, Daniel., Planeación y control de la producción / Daniel Sipper, Robert L. Bulfin ; traducción de Marcia González Osuna, Silvina Her-

nández García., México : McGraw-Hill, 1998., spaeng, [970101944X].

### IN2022 Optimization Models

( 3 - 0 - 8. Prerequisites: [ M2025 , TC2019 ]. 6 IIN12, 5 IIS11, 6 IMA11, 5 INT11, 6 IQA11 )

**Equivalence:** IN2007

This is an intermediate level course in Industrial Engineering, which provides students with the tools to solve problems that involve optimizing limited resources by means of mathematical models. The course requires previous knowledge of vector and matrix algebra, vector spaces, base and dimension. As a result of learning, the student will be able to mathematically model problems related to the optimization of limited resources, will solve these models and will take decisions based on the information obtained from the solution found.

**General objective:** Upon completion of this course, students will be able to synthesize the relevant information of a problem by means of a mathematical model of optimization that will let him/her to determine the best use of the limited resources of a system, process or organization.

**Key words:** Simplex method. Linear programming. Integer programming. Duality. Sensitivity. Heuristics.

**Bibliography:** \* Taha, Hamdy A., Investigación de operaciones / Hamdy A. Taha, tr. José de la Cera Alonso., 5a ed., Mexico : Alfaomega, 1995., spa, [9701210026].

### IN2023 Design and Analysis of Experiments

( 3 - 0 - 8. Prerequisites: [ MA1006 , MA2011 ]. 6 IA11, 6 IAB11, 6 IBN11, 7 IBT11, 6 IDA11, 5 IDS11, 5 IFI11, 6 IIA11, 6 IIS11, 6 IMA11, 7 INCQ13, 6 INT11, 6 IQA11, 6 IQP11 )

**Equivalence:** IN2002

The purpose of this intermediate industrial engineering course is to provide students with the necessary tools to build and analyze regression models; design and carry out experiments; and analyze and interpret

the information obtained with the aim of improving processes. The course requires previous knowledge of hypothesis testing, probability distribution and sampling. The learning outcome of this course is for students to build process-improvement models, using the tools of regression analysis and experiment design.

**General objective:** Upon completion of this course, students will be able to build regression models, and design, conduct and analyze experiments to prove hypotheses in science- and engineering-related problems.

**Key words:** Regression analysis. Experiment design.

**Bibliography:** \* Montgomery, Douglas C., Introducción al análisis de regresión lineal / Douglas C. Montgomery, Elizabeth A. Peck y G. Geoffrey Vining., 1a ed. en español., México : Patria, 2002., spaeng, [9702403278],[9789702403272].

### IN2024 Decision-making Models

( 3 - 0 - 8. Prerequisites: [ IN2022 ]. 7 IIN12, 6 IIS11 )

**Equivalence:** IN2012

This intermediate industrial engineering course allows students to analyze productive systems, using mathematical decision-making models, in order to best utilize the available resources. It requires previous knowledge of mathematical modeling, and discrete and continuous probability functions. As a result of the learning process, the student will be able to model, analyze and solve practical cases and optimization problems, using operations research tools and software.

**General objective:** Upon completion of this course, students will be able to use analytical decision-making tools to expedite product flow and minimize in-process inventory.

**Key words:** Decision trees. Dynamic programming. Queueing theory. Integer programming. Markov Processes.

**Bibliography:** \* Winston, Wayne L., Investigación de operaciones : aplicaciones y algoritmos / Wayne L. Winston ; traducción María Bruna Anzures y Francis-

co Sánchez Fragoso., 4a ed., México, D. F. : Thomson, c2005., spaeng , [9706863621].

## IN2025 Project Evaluation and Management

( 3 - 0 - 8. Prerequisites: None. 7 IA 11, 7 IAB11, 7 IBN11, 7 IBT11, 9 IDA11, 6 IDS11, 9 IFI11, 8 IIA11, 7 IIS11, 9 IMA11, 7 IMD11, 6 IME11, 8 IMT11, 7 IQA11, 7 IQP11, 7 ISD11, 9 ITE11, 9 ITS11, 8 LDI11 )  
**Equivalence:** IN2006

This intermediate course in industrial engineering allows students to understand the concept of the value of money over time, with its distinct implications for engineering problems and key concepts in project management. It requires no prior knowledge. As a learning outcome, students will be able to apply different economic feasibility analysis schemes to justify their decisions regarding the implementation of a project, and also monitor its development over time.

**General objective:** Upon completion of this course, students will be able to understand the impact of changing the value of money over time and formulate the justification and economic feasibility analysis for engineering projects, as well as the tools for controlling their execution.

**Key words:** Project control. Project management. Project assessment. Economic feasibility.

**Bibliography:** \* Park, Chan S., Contemporary engineering economics / Chan S. Park., 3rd ed., Upper Saddle River, N.J. ; México : Prentice Hall, c2002., [0130893102], [9780130893109].

## IN2026 Statistical Engineering

( 3 - 0 - 8. Prerequisites: None. 6 IIN12, 7 IIS11 )  
**Equivalence:** IN2011

The purpose of this intermediate industrial engineering course is to provide students with advanced statistical tools for analyzing time series and carrying out process performance forecasts as well as process improvement using current statistical methodologies. The course requires previous knowledge on statistical quality control and experiment design. The

learning outcome of this course is for students to be able to apply advanced statistical tools in analyzing production processes and services.

**General objective:** Upon completion of this course, students will be able to select and use the most appropriate and current statistical tools to analyze and enhance processes in service and manufacturing firms.

**Key words:** Response surface. Time series. Experiment design and analysis. Experiments with mixtures.

**Bibliography:** \* Bowerman, Bruce L., Pronósticos, series de tiempo y regresión : un enfoque aplicado / Bruce L. Bowerman, Richard T. O'Connell, Anne B. Koehler., 4a ed., México, D.F. : Thomson, c2007., spaeng, [970686606X], [9789706866066].

## IN2027 Discrete Event Simulation

( 3 - 0 - 8. Prerequisites: [ IN2022 ]. 8 IIN12, 7 IIS11, 7 IQA11 )  
**Equivalence:** IN3014

The purpose of this intermediate industrial engineering course is to allow students to model, analyze and improve complex systems using an integral approach, through simulation models of discrete events. The course requires previous knowledge of optimization. The learning outcome of this course is for students to be able to understand the existing relationships among the relevant decision variables for system improvement as well as analyze proposed improvement scenarios. This is achieved through system modeling, using simulation of discrete events.

**General objective:** Upon completion of this course, students will be able to use discrete event simulation tools to model, analyze and enhance complex systems with an integral approach.

**Key words:** Discrete-event simulation. Pseudo-random numbers. Generation of random variables. Goodness-of-fits test. Comparing alternative scenarios.

**Bibliography:** \* Discrete-event system simulation / Jerry Banks . [et al.], 4th ed., Upper Saddle

River, N.J. ; México : Pearson/Prentice Hall, 2005., [0131446797],[9780131446793].

## IN2028 Knowledge Systems in Organizations

( 3 - 0 - 8. Prerequisites: None. 7 IIS11 )

Equivalence: IN2014

The purpose of this intermediate industrial engineering course is to allow students to design plans for the analysis and presentation of information with the goal of using those plans in the decision-making process and the corporate memory of the enterprise. The course requires previous knowledge of basic computing. The learning outcome of this course is for students to be able to identify the best strategies for analyzing and presenting information so that this becomes a competitive advantage for an organization and reduces the time required to make decisions.

**General objective:** Upon completion of this course, students will be able to organize and handle data to transform this into relevant information for decision making within the company, and generate performance indicator reports that accurately represent the behavior of the company's systems.

**Key words:** Information system. Decision making. Performance indicators. Corporate minutes.

**Bibliography:** \* Laudon, Kenneth C., 1944-, Management information systems: Managing the digital firm/Laudon, Kenneth C, 9a. ed., Upper Saddle River, N. J.: Pearson, 2006, United States, 2006, español, [0131971921].

## IN2030 Manufacturing Models

( 3 - 0 - 8. Prerequisites: None. 8 IBN11, 7 LDI11 )

Equivalence: None

This is an intermediate course.

**General objective:** Students will be able to understand the basics, principles and benefits of diverse contemporary product manufacturing strategies; apply strategies to synchronize operations and expedite product flows to guarantee the greatest number of products manufactured per time unit; balance

operations to share out the work load in the manufacturing processes; identify the main advantages of diverse manufacturing systems, for example, by project, by batch, mass production, continuous production; identify the main advantages of process organization systems, such as type A plants, type V, by functions, by processes, etc.

**Key words:** Line balancing. Production management. Productive systems.

**Bibliography:** \* Chase, Richard B., Administración de operaciones : producción y cadena de suministros [recurso electrónico] / Richard B. Chase, F. Robert Jacobs, Nicholas J. Aquilano ; traducción Pilar Mascaró Sacristán y Martha Elsa Mauri Hernández., 12a ed., México: McGraw-Hill Interamericana Editores, 2010., [9781615024056].

## IN3013 Integrated Manufacturing Systems Laboratory

( 0 - 3 - 4. Prerequisites: [ IN3015 Corequisite , IN3015 ]. 7 IIN12, 6 IIS11 )

Equivalence: IN00984, IN95984

Advanced course in industrial engineering that integrates the knowledge acquired by students in their courses related to manufacturing systems through practical experience prior knowledge of production management and manufacturing systems integration. As a result of learning, students will be able to apply the knowledge acquired during his career in the analysis and improvement of manufacturing systems through a laboratory experience.

**General objective:** After completing the course, students will be able to analyze and improve integrated manufacturing systems from the point of view of operations and technology integration.

**Key words:** Computer-integrated manufacturing.

**Bibliography:** \* Groover, Mikell P., 1939-, Automation, production systems, and computer-integrated manufacturing / Mikell P. Groover., 3rd ed., Upper Saddle River, N.J. : Prentice Hall, 2008., [0132393212 (encuadernado)], [9780132393218 (encuadernado)].



## IN3015 Integrated Manufacturing Systems

( 3 - 0 - 8. Prerequisites: [ M2018 , M2024 ]. 7 IIN12, 6 IIS11 )

**Equivalence:** IN00884, IN90502, IN95884

Advanced industrial engineering course that focuses on the integration of manufacturing systems, their challenges and advantages, and the conditions required for integration through technology to be suitable. This course requires prior knowledge of production management. The learning outcome of this course is for students to be able to identify the elements that can set up an integrated manufacturing system, its integration restrictions and advantages over non-automated systems.

**General objective:** Upon completion of this course, students will be able to recognize different technologies and equipment that can be found in an integrated manufacturing system. This will allow students to select, improve, and integrate them in the most effective manner possible within automated production processes.

**Key words:** Product lifecycle management. Computer-integrated manufacturing. Flexible manufacturing systems. Technology integration.

**Bibliography:** \* Groover, Mikell P., 1939-, Automation, production systems, and computer-integrated manufacturing/Mikell P. Groover, 3rd. Edition, Upper Saddle River, N. J.: Prentice Hall, 2008, [0132393212 (encuadrado)], [9780132393218 (encuadrado)].

## IN3020 Strategic Planning

( 3 - 0 - 8. Prerequisites: None. 9 IIS11 )

**Equivalence:** AD3003, IS00897

Advanced course in which students integrate systemic competencies to analyze and establish growth strategies for an organization. This course requires prior knowledge of problem-solving methodologies. The learning outcome is for students to be able to complete a strategic, operating plan for a competitive strategy for an organization, considering both the external environment and its resources and capabilities.

**General objective:** Upon completion of this course, students will be able to present a strategic and operational plan for a company, utilizing tools of sectorial analysis, prospective analysis, internal analysis, and competitive strategy.

**Key words:** Strategic management. Strategic planning. Interactive management. Systems thinking.

**Bibliography:** \* Grant, Robert M., 1948-, Contemporary strategy analysis / Robert M. Grant., 5th ed., Blackwell Pub., Malden, Mass. , 2005, eng, [1405119985 (encuadrado) : papel alcalino)].

## IN3035 Analysis and Enhancement of Manufacturing Systems

( 3 - 0 - 8. Prerequisites: IN2020 , [ IN2021 , IN2021 Corequisite ], [ IN3036 Corequisite , IN3036 ], [ CD2006 Corequisite, CD2006 ]. 8 IIN12, 6 IIS11, 9 IQA11, 5 LCDE11 )

**Equivalence:** IN3016

The purpose of this advanced industrial engineering course is to provide students with useful tools and concepts for eliminating non-value-added activities, processes and systems for the users of the products or services offered by a company. The course requires previous knowledge of inventory administration and control and production control. The learning outcome of this course is for students to be able to model and analyze processes with the goal of detecting activities that do not add value to the processes and/or services offered by the company.

**General objective:** Upon completion of this course, students will be familiar with and be able to apply the necessary concepts and tools for modeling and analyzing a process in its current state, and develop a plan to eliminate activities that are of no value to customers.

**Key words:** Process mapping. Lean manufacturing. Just in Time. Rapid response manufacturing. Kaizen. Value generation.

**Bibliography:** \* Womack, James P., Lean thinking : banish waste and create wealth in your corporation / James P. Womack and Daniel T. Jones., 1st ed. revised



and updated., New York : Free Press, c2003., [0743249275],[9780743249270],[0743231643].

### IN3036 Value-chain Management

( 3 - 0 - 8. Prerequisites: [ IN2022 ]. 8 IQA11 )

**Equivalence:** None

The purpose of this advanced industrial engineering course is to provide students with the tools to efficiently manage the inventory of useful tools and concepts for controlling, modeling and improving a company's production systems. The course requires previous knowledge of linear problem modeling. The learning outcome of this course is for students to be able to design, evaluate and improve inventory provisioning and control plans as a competitive measure, as well as program and control production in a way that derives maximum benefit for the company.

**General objective:** Upon completion of this course, students will be able to analyze and improve a production system on the basis of inventory control strategies and production management and control, and their relevance within a company's production system.

**Key words:** Production systems. Inventory control. Inventory management. Inventory model. Inventory control technology. Production control. Aggregate planning. Sequencing.

**Bibliography:** \* Sipper, Daniel., Planeación y control de la producción / Daniel Sipper, Robert L. Bulfin ; traducción de Marcia González Osuna, Silvina Hernández García., México : McGraw-Hill, 1998., spaeng, [970101944X].

### IN3037 Design and Improvement of Logistic Systems

( 3 - 0 - 8. Prerequisites: [ IN2021 ]. 9 IIN12, 8 IIS11 )

**Equivalence:** IN3023

Advanced course in industrial engineering that allows students to learn the relevant concepts for design, analysis and improvement of logistic systems. This course requires prior knowledge of management strategies and production control. As a result

of learning, students will be able to identify the key elements for the design, control and improvement of a logistics network from procurement to delivery of a product or service to the end user.

**General objective:** Upon completion of this course, students will be able to model, design and enhance a logistics system, determine the related costs and set up diverse configurations to achieve the integration of the supply chain.

**Key words:** Logistics. Supply chain.

**Bibliography:** \* Ballou, Ronald H., 1937-, Business logistics management / Ronald H. Ballou., 3rd ed., Englewood Cliffs, N.J. : Prentice Hall, 1992., [0131055453 (encuadernado)], [0130934100 (rústica)].

### IN3038 Operational Design and Optimization Laboratory

( 0 - 3 - 4. Prerequisites: None. 8 IIS11 )

**Equivalence:** IN3017

The purpose of this advanced industrial engineering course is to integrate students' knowledge of classic industrial engineering, value creation and optimization models through a hands-on laboratory experience. The course requires previous knowledge of production management, added-value activity concepts, process maps, and process-optimization tools. The learning outcome of this course is for students to be able to apply the knowledge acquired during their course of study to the design, analysis and improvement of production processes by means of a laboratory experience.

**General objective:** Upon completion of this course, students will be able to select the most appropriate set of tools for analyzing and enhancing a production system.

**Key words:** System modeling and analysis. Implementation and analysis of improvements.

**Bibliography:** \* Pendiente, Pendiente.

### IN3039 Problem-Solving Methodologies

( 3 - 0 - 8. Prerequisites: [ IN1002 , CD2007 ]. 8 IIS11, 8 INT11, 8 LCDE11 )

**Equivalence:** IN3018

This is an advanced course in Industrial and Systems Engineering, in which students develop in full a participative diagnosis and design a intervention process in order to produce desirable changes in organizations and/or organizational entities. This course requires previous knowledge in systemic thinking. As a learning outcome, students will be able to carry out participative diagnosis and design intervention proposals to orchestrate change in organizational and/or social problems.

**General objective:** Upon completion of this course, students will be able to propose and consolidate organizational and social change through an intervention process, using a systemic approaches such as: SSM, VSM, IM, Critical System Thinking, Interactive Planning, etc.

**Key words:** Systems thinking. Intervention processes. Organizational diagnostics.

**Bibliography:** \* Jackson, Michael C., 1951-, Systems approaches to management / Michael C. Jackson., New York : Kluwer Academic/Plenum, c2000., [0306465000 (encuadernado)], [030646506X (rústica)], [9780306465062 (rustica)], [9780306465000 (encuadernado)].

### IN3040 Technological Innovation Systems

( 3 - 0 - 8. Prerequisites: None. 8 IIS11 )

**Equivalence:** IN3019

This is an advanced course, which aims to teach students how to compare different methods of technological development in order to recommend the most suitable one. Tools will be provided based on conceptions of intellectual property, technology roadmaps, clusters, knowledge management, think tanks, and the acquisition, transfer and absorption of new technologies. The evaluation criteria are based on the model of sustainable development, consider-

ing the economic, social and environmental aspects. This course requires prior knowledge of systemic thinking and information systems concepts. The learning outcome of this course is for students to be able to recommend programs and/or processes for implementing new technologies; and design innovative potential scenarios that add competitive advantages in the future, selecting the most suitable evaluation tools for this.

**General objective:** Upon completion of this course, students will be able to identify competitive advantages in goods or services by designing potential scenarios for technological innovation.

**Key words:** Intellectual property. Knowledge management. Technological prospective. Technological innovation management.

**Bibliography:** \* Khalil, Tarek M., Management of technology : the key to competitiveness and wealth creation / Tarek M. Khalil., Boston : McGraw-Hill, c2000., [007336149X],[007336149x (papel alcalino)].

### IN3041 Project Feasibility

( 3 - 0 - 8. Prerequisites: [ IN2025 , NN2000 ]. 8 IBN11, 8 IID12, 8 IIN12, 8 IIS11 )

**Equivalence:** None

The purpose of this advanced industrial engineering course is to allow students to decide on the feasibility of an investment project, supporting their decision by pre-investment studies and identification of opportunities; technical, economic and financial market analysis; and studies of the sustainability and social implications of the investment's development. The course requires previous knowledge of project evaluation and management. The learning outcome of this course is for students to be able to develop and present the complete feasibility study for an investment project.

**General objective:** Upon completion of this course, students will be able to detect investment opportunities, obtain financing, use market research methodologies, and apply their knowledge of technical and engineering economics studies to decide on the financial, sustainable and social acceptability of a project.

**Key words:** Project lifecycle. Analysis, assessment and selection of projects. Project Implementation. Project management.

**Bibliography:** \* Park, Chan S., Contemporary engineering economics / Chan S. Park., 3rd ed., Upper Saddle River, N.J. ; México : Prentice Hall, c2002., [0130893102],[9780130893109].

## IN3042 Industrial Agrobiotechnology

( 3 - 0 - 8. Prerequisites: None. 9 IAB11 )

**Equivalence:** None

The purpose of this advanced agrobiotechnology course is to provide students with learning experiences through which they develop knowledge and skills in the use of decision-making tools to bring to fruition a business idea based on an agrobiotechnological product. The course requires previous knowledge of techniques for developing functional products, bioenergy and the environment. The learning outcome for this course is for students to incorporate the idea for a business opportunity in agrobiotechnology with elements of an industrial plant project, supported by computational tools.

**General objective:** Upon completion of this course, students will be able to plan the industrial components of a production plant for a new agrobiotechnological product (bio-pesticide, bio-fertilizers, secondary metabolites, etc.), detailing the elements of an industrial plant, and then defend and justify the project to an external examining committee.

**Key words:** Logistics. Optimization. Supply chains. Industrial agrobiotechnology . Suppliers.

**Bibliography:** \* Nahmias, Steven., Production and operations analysis / Steven Nahmias., 3rd ed., Chicago : Irwin, c1997., [0256195080].

## IN3043 Quality Management Strategies

( 3 - 0 - 8. Prerequisites: [ IN2026 ]. 9 IIS11 )

**Equivalence:** IN3022

The purpose of this advanced course is to give industrial engineering and systems engineering graduates

the capabilities of guaranteeing the quality of products and/or services using concepts and methodologies for quality administration with a holistic focus. This approach is used to optimize productivity and competitiveness in an organization. The course requires previous knowledge of methodologies and tools (basic and advanced) for continuous improvement and participative methodologies for decision making and analysis of problematic situations, as well as systemic thinking skills. The learning outcome of this course is for students to diagnose a quality system (including its management), structure the information gathered and, from this, design/select a proposal for improvement (feasible and desirable) that permits the organization's competitiveness to increase. Students prepare a detailed work plan (objectives, measures of success, execution plan, requirements, tools, participants, responsibilities, contingency plan) that includes the creation or maintenance of conditions to maximize its success.

**General objective:** Upon completion of this course, students will be able to evaluate the performance of an organization's quality management system and design strategies that make it possible to increase the level of customer satisfaction, product quality assurance and increase an organization's level of competitiveness. The appropriate strategies must consider the organization's social system, industrial context, the customers' real needs, knowledge management, collaborative work and the implications of implementing organizational change.

**Key words:** Service quality. Total quality management. Business excellence models. Quality awards.

**Bibliography:** \* Camisón, César., Gestión de la calidad : conceptos, enfoques, modelos y sistemas / César Camisón, Sonia Cruz, Tomás González., Madrid : Pearson Educación ; 2007., [9788420542621],[8420542628].

## IN3044 Industrial and Systems Engineering Project

( 3 - 0 - 8. Prerequisites: [ IN3041 Corequisite , IN3041 ]. 9 IIS11 )

**Equivalence:** IN3021

This is an advanced course intended to integrate the knowledge acquired during the course by means of

carrying out a real project within an organization. It requires previous knowledge of problem solving methodologies, project feasibility and project evaluation and management. As a learning result, students are expected to develop an applied project within an organization by using methods and techniques that are utilized during the professional activities of an industrial engineer. Students will use systemic thinking, analysis and synthesis skills to handle an organizational problem. Due to the nature of the course, one of the main skills for development is oral and written communication, which allows the students to communicate their proposals or solutions related to the projects. Human values, such as honesty, responsibility, work culture and leadership; values that are the characteristic seal of every professional graduate from the ITESM, are also reinforced.

**General objective:** Upon completion of this course, students will be able to apply the knowledge they have acquired throughout their degree program, developing their capacity to identify and solve problems; analysis, synthesis and evaluation; teamwork; capacity for hard work; honesty and responsibility.

**Key words:** Engineering projects. Integration. Implementation. Diagnosis Process.

**Bibliography:** \* The Wiley guide to managing projects / Jeffrey K. Pinto, Peter W.G. Morris [editors], Hoboken, N.J. : John Wiley & Sons, 2004., [0471233021 (tela)], [9780471233022 (tela)].

## IN3045 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 IIS11 )

**Equivalence:** None

This is a university course which is designed to prepare students in their area of specialization for the CE-NEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## IQ Chemical Engineering

### IQ1001 Material Balance

( 3 - 0 - 8. Prerequisites: [ Q1001 , F1002 ]. 4 IAB11, 3 IBT11, 3 IDS11, 3 IIA11, 3 IIS11, 3 IQA11, 3 IQP11 )  
Equivalence: IQ00831

This is a basic course intended to familiarize students with the concept of conservation of mass, and allow them to apply it to the quantification of materials in process analysis. Concepts of sustainable development will be included through the discussion of examples and the analysis of problems related to the efficient use of materials in chemical processes. This course requires prior knowledge of differential and integral calculus, general chemistry and physics. The learning outcome for this course is for students to be able to analyze chemical and biochemical processes using the principle of conservation of mass to quantify flows, compositions, and systems performance with and without chemical reactions in a stationary or transition state. Problem solving skills and critical analysis will be developed, stressing the impact of the adequate use of materials within the context of sustainable development.

**General objective:** Upon completion of this course, students will be able to propose the flow diagram based on the process description; propose mass balances for processes with and without chemical reactions; solve the mass balance for processes with and without chemical reactions; identify areas of opportunity in a process in order to save and efficiently use materials (waste minimization).

**Key words:** Ideal and real gases. Humidity and saturation. Basic concepts: unit operations and process variables. Mass balances without chemical reaction. Mass balances with chemical reaction.

**Bibliography:** \* Richard M. Felder, Ronald W. Rousseau, Principios Elementales de los Procesos Químicos, 3a, Limusa Wiley, Español, [968-18-6169-8].

### IQ1004 Introduction to Chemical Engineering

( 3 - 0 - 4. Prerequisites: None. 1 IQA11, 1 IQP11 )  
Equivalence: None

The purpose of this basic-level course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Legislación académica para los alumnos de carrera profesionales 2001., Monterrey : Instituto Tecnológico y de Estudios superiores de Monterrey, Campus Monterrey, 2001.

### IQ2000 Energy Balance

( 3 - 0 - 8. Prerequisites: [ IQ1001 , IQ1001 , MA1004 , MA2010 Corequisite , MA2010 ]. 4 IBT11, 4 IDS11, 4 IIA11, 4 IQA11, 4 IQP11 )  
Equivalence: IQ00843

This is an intermediate course, intended to enable students to understand and apply basic concepts of energy conservation to process analysis. Cases and examples from chemical processes will be used to stress the concepts of energy saving and efficient energy use within the framework of sustainable development. This course requires prior knowledge of



material balance, differential and integral calculus, general chemistry and physics. The learning outcome of this course is for students to be able to propose and solve material and energy balances for different processes in static and transition states. Students will identify areas of opportunity for energy saving in a determined process.

**General objective:** Upon completion of this course, students will be able to propose and solve energy balances for processes which involve temperature and phase changes; apply the concepts of heat of reaction, heat of mixing, vapor-liquid equilibrium, and humidity and saturation at energy balance; apply simultaneous mass and energy balances to the analysis of complex chemical processes; analyze transient state processes from the point of view of mass and energy balances.

**Key words:** Energy balances in processes with chemical reactions, mixing, vapor-liquid equilibrium, humidification and drying. Simultaneous mass and energy balances. Mass and energy balances in transient state. Energy balances in non-reacting processes.

**Bibliography:** \* Himmelblau, David Mautner, 1923-, Basic principles and calculations in chemical engineering / David M. Himmelblau, James B. Riggs., 7th ed., Upper Saddle River, N.J. : Prentice Hall Professional Technical Reference, 2004, New Jersey, 2004, eng, [0131406345],[9780131406346].

### IQ2001 Thermodynamics

( 3 - 0 - 8. Prerequisites: [ F1003 , MA1004 , MA1017 ]. 5 IAB11, 4 IBN11, 4 IBT11, 5 IDA11, 4 IDS11, 4 IIA11, 4 IMA11, 4 IME11, 5 IMT11, 4 IQA11, 4 IQP11 )

**Equivalence:** IQ00844

This is an intermediate course intended to use mathematical analysis, algorithmic thinking and knowledge of thermodynamics (first and second law) to solve problems involving energy transformation in pure substances. Thermodynamic cycles, and the reasons why the operating efficiency of a process or thermal machine is limited, will be analyzed. Themes and concepts related to sustainable development will be included in the form of examples, problems and case studies. This course requires prior knowl-

edge of differential and integral multivariable calculus, general chemistry and physics. The learning outcome of this course is for students to construct mathematical models explaining energy transformations in industrial processes and thermal machines.

**General objective:** Upon completion of this course, students will be able to analyze energy transformation processes; calculate the thermodynamic properties of pure substances; evaluate process performance, and; define the performance limits of systems.

**Key words:** Second law of Thermodynamics. Thermodynamic cycles. General thermodynamic relations. First law of thermodynamics in closed and open systems. Properties of pure substances and equations of state.

**Bibliography:** \* Yanus A. Cengel, Michael A. Boles, Thermodynamics: An Engineering Approach, 5a, McGraw-Hill, Inglés, [13 9780073107684].

### IQ2003 Equilibrium Thermodynamics

( 3 - 0 - 8. Prerequisites: [ IQ2001 ]. 5 IBT11, 5 IQA11, 5 IQP11 )

**Equivalence:** IQ00852

This is an intermediate course intended to provide the required tools for evaluating if an operation of separation or reaction can occur under certain conditions. The concepts of sustainable development will be exemplified by using the principles of partition between media in equilibrium in predicting the final destination of contaminants in the environment. This course requires prior knowledge of material and energy balance, thermodynamics, numerical methods, and differential and integral calculus. The learning outcome of this course is for students to relate operating conditions to the composition attained by the constituents of a physical and/or chemical process in equilibrium through mathematical models.

**General objective:** Upon completion of this course, students will be able to calculate the temperature and pressure of equilibrium in processes with phase changes for pure and mixed compounds; calculate the partitioning of components between phases in equilibrium; evaluate the composition at equilib-



rium for certain operational conditions in reactional systems; calculate the pressure and/or temperature necessary to obtain the desired compositions in the equilibrium of a reactional system.

**Key words:** Equilibrium in reacting systems. Partial molar properties. Equilibrium criteria and equilibrium between phases for a pure compound. Phase equilibria .

**Bibliography:** \* Smith, J. M. (Joseph Mauck), 1916-, *Introducción a la termodinámica en ingeniería química* / J.M. Smith, H.C. Van Ness, M.M. Abbott ; traducción, Efrén Alatorre Miguel . [et al.], 7a ed., México : McGraw-Hill, 2007., spaeng, [0073104450].

### **IQ2004 Heat Transfer Operations**

( 3 - 0 - 8. Prerequisites: [ IQ2000 ]. 6 IDS11, 5 IQA11, 5 IQP11 )

**Equivalence:** IQ00855

This is an intermediate course intended to give students the necessary tools to analyze and design new and existing heat exchange systems. In this course, emphasis will be placed, through examples and application, on the importance of heat transfer equipment in efficient energy use and recuperation in processes within a sustainable development context. This course requires prior knowledge of energy balances. The learning outcome of the course is for students to develop and apply methodologies for the solution of heat exchange problems, as well as the specification and basic design of heat exchange equipment.

**General objective:** Upon completion of this course, students will be able to propose and solve heat exchange problems; establish the required variables for determining thermal efficiency in an existing heat exchanger; select and carry out the basic specification for heat transfer equipment.

**Key words:** Heat balance and heat transfer. Evaporation and radiation. Convection equipment with phase change. Convection equipment without phase change.

**Bibliography:** \* McCabe, Warren L. (Warren Lee), 1899-, *Operaciones unitarias en ingeniería química* / Warren L. McCabe, Julian C. Smith, Peter Harriott., 7a ed. en español., México, D. F. : McGraw-Hill Interamericana, 2007., Mexico, 2007., spa, [9701061748], [9789701061749].

### **IQ2005 Momentum Transfer Operations**

( 3 - 0 - 8. Prerequisites: [ IQ2000 ]. 5 IDS11, 5 IQA11, 5 IQP11 )

**Equivalence:** IQ00854

This is an intermediate course intended to use mathematical thinking and analysis to solve problems related to fluid and solid transport in industry. Topics related to environmental aspects of sustainable development will be covered. This course requires prior knowledge of basic mathematics, numerical methods and physics. The learning outcome of the course is for students to analyze situations and solve problems involving compressible and incompressible flow and specify agitation systems and handling of solids.

**General objective:** Upon completion of this course, students will be able to design and analyze systems of fluid transport; select and specify the equipment for fluid transport systems; design and analyze fluidized and packed beds; specify liquid agitation systems and determine their power requirements; select systems for the management of solids.

**Key words:** Packed and fluidized beds. Compressible flow and compressors. Solid management. Stirring and mixing. Basic incompressible flow and pumping equipment.

**Bibliography:** \* McCabe, Warren L. (Warren Lee), 1899-, *Operaciones unitarias en ingeniería química* / Warren L. McCabe, Julian C. Smith, Peter Harriott., 7a ed. en español., México, D. F. : McGraw-Hill Interamericana, 2007., Mexico, 2007., spa, [9701061748], [9789701061749].

### **IQ2006 Diffusion Transfer Processes** ( 3 - 0 - 8. Prerequisites: [ IQ2004 , IQ2005 ]. 7 IQA11, 7 IQP11 )

**Equivalence: None**

This is an intermediate course intended to provide the basic knowledge to comprehend and handle process operations that involve fluid transport, heat transfer and the basic concepts related to diffusional transport of mass. The course requires knowledge of physics, energy, mass balances and differential equations. The student will be able to set up problems beginning with a shell balance that leads to differential models of fluid, heat and mass transport. The student will be able to solve these models to obtain velocity, temperature and concentration profiles and calculate pressure drops in conduits, heat and mass flows in different systems. The student will understand the importance of laminar and turbulent flow regimes in transport processes and learn the significance and estimation of transport coefficients through correlations based on dimensionless numbers.

**General objective:** Upon completion of this course, students will be able to propose and solve differential equations that represent the transport of momentum, heat and mass to generate phenomenological models; estimate, analyze and apply the transport coefficients for macroscopic momentum, heat and mass transfer operations; analyze the momentum, heat and mass transfer processes based on their knowledge of the variables that control these phenomena.

**Key words:** Mathematical models. Transport phenomena. Friction coefficient. Momentum. Heat transfer and mass transfer.

**Bibliography:** \* Bird, R. Byron (Robert Byron), 1924-, Transport phenomena / R. Byron Bird, Warren E. Stewart, Edwin N. Lightfoot., Rev. 2nd ed., New York : Wiley, c2007., [0470115394 (papel alcalino)], [9780470115398 (papel alcalino)].

### **IQ3003 Chemical Reaction Engineering**

( 3 - 0 - 8. Prerequisites: [ IQ2004 , IQ2005 ]. 6 IQA11, 6 IQP11 )

**Equivalence: IQ00872**

This is an advanced course intended to use engineering thinking and analysis to solve problems that involve chemical reactors. In this course sustainable development concepts are reinforced through examples and case studies in which the correct selection of the reaction scheme improves yield, decreasing the production of potential waste. Previous knowledge of calculus and differential equations, chemistry, numeric methods, material and energy balance, equilibrium thermodynamics, momentum transfer and heat transfer are required.

**General objective:** Upon completion of this course, students will be able to understand the main types of reactors and their characteristics; analyze and design isothermal reactors with one or more reactions; analyze and design non-isothermal reactors with one or more reactions; propose and analyze experimental data in order to obtain kinetic parameters.

**Key words:** Isothermal reactors. Determination of kinetic models. Non-isothermal reactors. Heterogeneous catalysis reactors. Considering non-idealities in the flow patterns in reactors. Isothermal reactors with multiple reactions.

**Bibliography:** \* Fogler, H. Scott., Elements of chemical reaction engineering / H. Scott Fogler., 4th ed., Prentice Hall.

### **IQ3004 Eco-efficiency and Sustainable Processes**

( 3 - 0 - 8. Prerequisites: [ IQ2000 ]. 7 IDS11, 6 IQP11 )

**Equivalence: IQ3000**

This is an advanced course intended to use eco-efficiency criteria to assess and evaluate chemical processes. In addition the concept of sustainable development is applied in order to analyze manufacturing and chemical production processes, either in operation or during the design phase. The course

requires previous knowledge of material and energy balances, as well as knowledge of basic momentum, heat and mass transfer operations. As a learning outcome, students are expected to assess and design conceptually manufacturing and chemical production processes using eco-efficiency criteria, as well as assessing the manufacturing and chemical production processes using sustainability indicators.

**General objective:** Upon completion of this course, students will be able to generate eco-efficiency indices with the data available from a chemical process and establish which tendencies should improve operations; use GRI criteria and DJ indices to assess and classify the sustainability of a chemical process on the basis of the available process data; generate the conceptual design of a chemical process using eco-efficiency and/or sustainability criteria.

**Key words:** Eco-efficiency. Sustainable products and processes.

**Bibliography:** \* DeSimone, Livio D., *Eco-efficiency : the business link to sustainable development* / Livio D. DeSimone and Frank Popoff with the World Business Council for Sustainable Development., Cambridge, Mass. : MIT Press, 1997., [0262041626 (alk. paper)].

### **IQ3006 Thermo-mechanical Operations Laboratory**

( 0 - 3 - 4. Prerequisites: [ IQ2004 , IQ2005 ]. 6 IQA11, 6 IQP11 )

**Equivalence:** IQ00971

This advanced course provides students with the necessary practical experience in the diverse unit operations of process engineering. This course requires prior knowledge of transfer phenomena, momentum and heat. The learning outcome of this course is for students to be able to apply their knowledge of momentum and heat transfer through experimentation.

**General objective:** Upon completion of this course, students will be able to: design and utilize experimental procedures in order to obtain information required for diagnosing or operating momentum

and heat transfer equipment or processes, and; process and analyze the information obtained in experiments.

**Key words:** Basic measurements of transfer properties (viscosity, thermal conductivity). Fluid transfer systems (pumps and pressure drops). Mechanical separations (filtration, sieving, sedimentation). Heat exchange.

**Bibliography:** \* McCabe, Warren L. (Warren Lee), 1899-, *Unit operations of chemical engineering* / Warren L. McCabe, Julian C. Smith, Peter Harriott., 7th ed. , Boston, Mass. ; Mexico : McGraw-Hill/Higher Education, c2005., [0072848235 (papel no acido)], [9780072848236],[0071247106 (ed. internacional)].

### **IQ3007 Separation Processes**

( 3 - 0 - 8. Prerequisites: [ IQ2003 ]. 6 IQA11, 6 IQP11 )

**Equivalence:** IQ00862, IQ00863

This is an advanced course intended for students to be able to design and specify separation units based on mass transfer and understand the effect that the operation variables have on the process performance. Furthermore, the student will be able to select the most suitable separator unit based on the energy requirements of the process. The course requires knowledge regarding material and energy balances, phase equilibrium, numerical methods and momentum and heat transfer.

**General objective:** Upon completion of this course, students will be able to calculate the number of real stages in a distillation, absorption, or continuous extraction column; evaluate the diameter and height of a column that operates by stages or packing; calculate the quantity of adsorbent or the required mass for the exchange; calculate the transfer area and specify the type of membranes; determine the performance that a separation process will have after a change in its operating conditions.

**Key words:** Membranes. Distillation. Absorption. Liquid extraction. Adsorption.

**Bibliography:** \* Benitez, Jaime, 1948-, Principles and modern applications of mass transfer operations / Jaime Benítez., 2nd ed., Hoboken, N.J. : Wiley, c2009., [9780470181782 (tela)], [0470181788 (tela)].

### **IQ3008 Chemical Process Analysis**

( 3 - 0 - 8. Prerequisites: [ IQ3007 , IQ3003 ]. 7 IQA11, 7 IQP11 )

**Equivalence:** IQ00885

In this advanced course, students will understand, evaluate and decide whether a piece of process equipment or a set of this equipment can operate adequately to increase or decrease a plant's production capacity. The concepts of sustainable development will be reinforced through examples and case studies in which the most favorable condition is sought for operating a chemical process, both from the perspective of efficient use of materials and of energy. This course requires prior knowledge of diffusion transfer processes, momentum and heat transfer, separation processes and reactor engineering. The learning outcome of this course is for students to be able to make decisions on the feasibility of a piece or set of equipment to function properly in the face of changes (scale up or down) in a plant's production capacity.

**General objective:** Upon completion of this course, students will be able to: analyze process flow diagrams; evaluate the operational conditions of each piece of process equipment; analyze the performance of each piece of process equipment under modifications to production capacity; decide whether or not a process equipment can operate properly under a different production capacity; comprehend and use diagrams for chemical processes; understand the structure of process flow diagrams and trace components in these diagrams; comprehend specific conditions for process equipment; use tools for the evaluation of process performance; analyze the performance of isolated and interconnected unit operations, including reactors.

**Key words:** Understanding and using diagrams for chemical processes. Structure of process flow diagrams and tracing of components in the diagrams. Understanding the specific conditions for process equipment. Evaluation tools.

**Bibliography:** \* Richard Turton, Richard C. Bailie, Wallace B. Whiting, Joseph A. Shaeiwitz, Analysis, Synthesis, and Design of Chemical Processes, Tercera edición, Prentice Hall, Inglés, [0-13-512966-4].

### **IQ3009 Chemical Process Design**

( 3 - 0 - 8. Prerequisites: [ IQ3007 , IQ3003 ]. 8 IQA11, 8 IQP11 )

**Equivalence:** IQ00881

This is an advanced course intended for students to learn how to design a chemical process, taking into account principles of eco-efficiency and sustainability, as well as to select the most suitable operating method for the process and its production capacity. Previous knowledge of momentum and heat transfer, separation processes and chemical reactor engineering is required. As a learning outcome the student will be able to generate the concept and basic engineering for a chemical process, as well as its economic feasibility.

**General objective:** Upon completion of this course, students will be able 1. to decide on and select the operating mode of a chemical process, either batch, continuous, or a combination of both; 2. to select the reaction pathway for a chemical product; 3. to generate the conceptual and basic engineering of a process; 4. to estimate the investment of capital and the production cost of the process; 5. to design a chemical process; and 6. to calculate the capital investment and manufacturing costs.

**Key words:** Selection of batch processes, continuous processes or a combination of both. Selection of the reaction route considering eco-efficiency and sustainable development, as well as the use of renewable resources. Conceptual engineering and basic engineering.

**Bibliography:** \* Richard Turton, Richard C. Bailie, Wallace B. Whiting, Joseph A. Shaeiwitz, Analysis, Synthesis, and Design of Chemical Processes, Tercera edición, Prentice Hall, Inglés, [0-13-512966-4].

### **IQ3010 Fundamentals of Engineering Microprocesses**

( 3 - 0 - 8. Prerequisites: [ IQ2006 , IQ3007 , IQ3003 ]. 8 IQA11, 8 IQP11 )

**Equivalence:** None

This is an advanced course that aims to develop the students' abilities to use microtechnology for designing innovative processes and solving conventional Process Engineering problems. The course requires knowledge of momentum and heat transfer, separation processes and reactor engineering. As a learning outcome, students are expected to integrate concepts of unit operations and transport phenomena to analyze and apply microtechnologies to process engineering.

**General objective:** Upon completion of this course, students will be able to develop and resolve mathematical models of microprocesses; select the most suitable operations and devices for the production of a substance or product; develop a conceptual design of processes based on microtechnology.

**Key words:** Process intensification. Microprocesses. Microtechnologies. Conceptual design.

**Bibliography:** \* Volker Hessel, Steffen Hardt, Holger Löwe , Chemical Micro Process Engineering: Fundamentals, Modelling and Reactions, Wiley, 2004, [978-3-527-30741-8].

### **IQ3011 Process Engineering Laboratory**

( 0 - 3 - 4. Prerequisites: [ IQ3007 , IQ3003 ]. 7 IQA11, 7 IQP11 )

**Equivalence:** IQ00972

This is an advanced course intended to enable students to apply theoretical concepts to experimentation related to unit operations and reactor engineering. Prior knowledge of separation processes and chemical reactor engineering is required. As a learning result, students are expected to apply their theoretical knowledge of topics related to separation processes and reaction systems through experimentation.

**General objective:** Upon completion of this course, students will be able to design and utilize experimental procedures in order to obtain the required information for the diagnosis or operation of mass transfer equipment or processes; process and analyze the information obtained in experiments.

**Key words:** Basic measurements of phase equilibria. Basic measurements of mass transfer (diffusion and overall coefficients of transfer). Equilibrium-based separation processes. Reaction equipment.

**Bibliography:** \* Fogler, H. Scott., Elements of chemical reaction engineering / H. Scott Fogler., 3rd ed., Upper Saddle River, NJ : Prentice Hall PTR, 1999., [0135317088 (cloth)].

### **IQ3013 New Products Development Workshop**

( 3 - 1 - 8. Prerequisites: [ Q3001 ]. 6 IQA11 )

**Equivalence:** IQ3001

This is an advanced course designed to provide students with the experience of generating and specifying a raw material and using it to generate and specify a chemical product, including preliminary technical and economic feasibility. This course requires previous knowledge in product chemistry, project engineering, quality systems and control, and material and energy balances. The learning outcome for this course is that students make a presentation of the product, defending its technical and economic feasibility before a committee.

**General objective:** Upon completion of this course, students will be able to understand and apply the basic processes and characteristics of fine chemistry; link laboratory work to the scale-up and design of a chemical plant.

**Key words:** Design and operation criteria. Bases of the development of a chemical industry, products, competitive advantages, cost effects, applications, prices. Batch processes, origin, advantages and disadvantages compared with continuous processes. Industrial safety, formulation, validation and update of specifications. Creation of a product proposal, escalating from lab to industrial level, grounding in investment, profit and cost estimation.



**Bibliography:** \* George, Michael L., Fast innovation : achieving superior differentiation, speed to market and increased profitability / Michael George., New York ; London : McGraw-Hill, 2005., [0071457895 (en-cuadernado)].

### **IQ3016 Microprocesses Laboratory** ( 0 - 3 - 4. Prerequisites: [ IQ3010 , IQ3010 Corequisite ]. 9 IQA11, 9 IQP11 )

**Equivalence: None**

This is an advanced course that aims to give students experience through laboratory practice in order to appreciate the advantages and applications of microprocessor engineering. Previous knowledge of momentum and heat transfer, separation processes and reactor engineering is required. As a learning outcome, students are expected to apply their knowledge of the use of microtechnology by experimentation and compare the performance of conventional against microprocessor operations.

**General objective:** Upon completion of this course, students will be able to design and utilize experimental procedures in order to obtain the required information for the diagnosis or operation of microprocesses, comparing their performance with that of conventional technology; conceptualize and test a microtechnology-based production process experimentally.

**Key words:** Experimentation. Application. Microprocess engineering. Enhanced performance. Microreactors and micromixers.

**Bibliography:** \* ITESM, Manuales del Laboratorio de Ingeniería Química.

### **IQ3017 Processes and Products Innovation Project**

( 3 - 0 - 8. Prerequisites: [ IQ3009 ]. 9 IQA11 )

**Equivalence: IQ00892**

This advanced course integrates the knowledge, skills, attitudes and values developed throughout the degree program, applying them to a real life project for the development of innovative processes or products requested and supervised by a real client.

The course focuses on the project, through which students will also develop social and technical synthesis skills. The “client” setting will give students the opportunity to handle diverse technical, financial, environmental and social topics, and an integral assessment of the solution presented by students will be made of these aspects.

**General objective:** Upon completion of this course, students will be able to analyze a non-structured problem in order to propose innovative alternatives for the development of processes or new products; synthesize ideas and knowledge in the definition of a solution to an engineering problem; communicate their findings effectively in oral and written form.

**Key words:** Integration of consulting work proposals. Capstone project execution and management. Technical and economic evaluation and selection of alternatives.

### **IQ3018 Technology Development Strategies**

( 3 - 0 - 8. Prerequisites: [ IQ3009 , IQ3032 ]. 7 IQP11 )

**Equivalence: None**

This is a final course that teaches the tools required for increasing companies' competitiveness through the management of technology and best practices, and by carrying out appropriate projects and value creating initiatives, focusing on the whole value chain, from the customer to the supplier. As a result of the course, students will be able to assume an integrating role within the organization, thereby satisfying an important need in the process of increasing the competitiveness of organizations in today's competitive marketplace.

**General objective:** Upon completion of this course, students will be able to understand technological change and its effect on new and existing companies; develop strategies to improve the competitiveness of a high-tech company; manage value-creation projects, from the client to the supplier; identify and protect technological and intangible assets.

**Key words:** Creativity and innovation. Concepts of value, analysis and value creation. Management of



the human factor in processes of concurrent engineering. Methodology for the identification of latest technology.

**Bibliography:** \* Escorsa Castells, Pere., Tecnología e innovación en la empresa / Pere Escorsa Castells, Jaume Valls Pasola., 2a ed., México, D.F. : Alfaomega : Universidad Politécnica de Catalunya, c2005., [970150996X].

### **IQ3032 Technologies for the Efficient use of Thermal Energy**

( 3 - 0 - 8. Prerequisites: [ IQ2004 ]. 8 IDS11, 6 IQP11 )

**Equivalence: None**

This is an advanced course, designed to utilize engineering tools in order to analyze technologies for sustainable energy use. The students will understand the benefits and limitations of technologies for sustainable energy use by modeling those systems, considering their sensitivity to fluctuations in the variables of the process. Likewise, the direct and indirect environmental impact will be integrated within the process evaluation. Previous knowledge is required in thermodynamics, heat conduction and basic mathematics. The learning outcome for this course is that the students integrate process engineering concepts in the analysis of thermal technologies for utilizing energy resources.

**General objective:** Upon completion of this course, students will be able to create conceptual models for the efficient use of energy in processes; develop mathematical models for analyzing thermal and energy generation processes; compare technological methods for utilizing energy resources; evaluate the environmental impact of diverse energy technologies.

**Key words:** Combustion process. Gasification and pyrolysis processes. Emission and environmental impact control. Gasification and pyrolysis processes.

### **IQ3036 Process and Energy Engineering Capstone Project**

( 3 - 0 - 8. Prerequisites: [ IQ3009 ]. 9 IQP11 )

**Equivalence: IQ3021**

This final advanced course of the degree program is designed to place students in real situations, either in order to analyze and solve a defined problem, or identify, evaluate, and develop opportunities for improvement. During the course, students will work in teams and apply the knowledge and skills gained throughout their university studies in order to solve a set of industrial problems or situations for an external client. This course requires previous knowledge of process engineering. The learning outcome for this course is that students integrate the chemical engineering topics in the analysis and identification of alternatives to solve a particular situation in industry.

**General objective:** Upon completion of this course, students will be able to integrate and apply their knowledge of this discipline to a real industrial project; evaluate diverse alternatives and select the best option according to a cost-benefit analysis and taking technical feasibility into account; develop communication and behavior skills in consultancy projects for a client from the industry.

**Key words:** Consulting. Integration project. Process enhancement and industrial projects.

### **IQ3037 Process Modeling**

( 3 - 0 - 8. Prerequisites: [ IQ2006 ]. 8 IQP11 )

**Equivalence: None**

This is a final course, which enables students to employ mathematical analysis, algorithmic thinking and engineering knowledge in order to solve problems involving the mathematical modeling of complex problems that include transport equations. The course includes examples, problems and case studies related to topics and concepts of sustainable development involving the relationship between energy use, process efficiency and environmental impact. Previous knowledge is required in numerical methods and the functioning of momentum transfer and heat conduction. The learning outcome for this

course is that the students build complex mathematical models that explain energy and material transformations in industrial processes, using specialized computer programs to solve these models.

**General objective:** Upon completion of this course, students will be able to analyze transformation processes for materials and energy through mathematical models; solve mathematical models for complex systems through specialized computer programs; understand and apply mathematical models used for special cases such as process risk consequence analysis.

**Key words:** Chemical process modeling. Chemical process simulation. Computer fluid dynamics. Chemical process risk modeling.

### **IQ3038 Energy Audit, Diagnosis and Evaluation**

( 3 - 0 - 8. Prerequisites: [ IQ3008 , IN2025 ]. 8 IQP11 )

**Equivalence: None**

This is a final course, which enables students to identify energy-saving opportunities in industrial processes, propose alternatives for capitalizing on those opportunities and analyze the corresponding costs vs. benefits in order to determine the technical and financial viability of those alternatives. In addition to the technical aspects, the course will deal with the applicable regulations, as well as their implications and the restrictions they impose in the execution of energy-saving projects. Previous knowledge is required in engineering, process analysis and the financial evaluation of projects. The learning outcome for this course is that the students be able to perform an energy analysis and diagnosis of an industrial process in order to determine opportunities for savings or energy efficiencies. In turn, the students must propose alternatives for improving the energy efficiency of these processes, determining the techno-economical viability of their proposals, taking all current applicable regulations into account.

**General objective:** Upon completion of this course, students will be able to identify the government agencies involved in the energy sector, as well as the

norms, regulations, incentives, policies and standards for energy use, rates and savings initiatives and energy production in Mexico; propose a plan for energy assessment of a process according to procedures and standards established to determine areas of opportunity for saving energy in a process; propose energy saving alternatives for a given process based on the energy assessment of this process; carry out technical and economic analysis for energy-saving alternatives for a process to select the most convenient alternative.

**Key words:** Energy audit. Energy efficiency. Technical-economical project evaluation.

### **IQ3039 Introduction to Professional Development**

( 2 - 0 - 2. Prerequisites: None. 9 IQA11, 9 IQP11 )

**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## **IQ3040 Process Sustainability Through Optimization**

**( 3 - 0 - 8. Prerequisites: [ IQ3037 , IQ3037 Corequisite ]. 9 IQP11 )**

**Equivalence: None**

This is a final course, which enables students to understand and utilize optimization tools and techniques in order to determine the optimal operational conditions for an industrial process under known restrictions. This course includes examples, problems and case studies related to the application of optimization techniques in situations that require efficient use of material and energy resources, as well as examples of the environmental impact of processes. Previous knowledge is required in numerical methods, process modeling and unitary process modeling. The learning outcome for this course is that the students be able to develop and solve an optimization model, in order to determine the optimal operational conditions for an industrial process under certain pertinent restrictions. To solve these models, students will use specialized tools and software designed for process optimization.

**General objective:** Upon completion of this course, students will be able to propose mathematical models to optimize processes and provide appropriate constraints; identify and apply various optimization techniques; select the most appropriate optimization technique to solve the mathematical models developed.

**Key words:** Process optimization.

**Bibliography:** \* Edgar, Thomas F., Optimization of chemical processes / Thomas F. Edgar, David M. Himmelblau, Leon S. Lasdon., 2nd ed., Boston : McGraw-Hill, c2001., [0071189777 (Ed. International)], [0070393591 (papel alcalino)].

## LN International Logistics

### LN1000 Logistics from a Global Perspective

( 3 - 0 - 8. Prerequisites: None. 4 LLN11 )

Equivalence: None

This is a basic course in the field of supply chain management in which the aim is for students to understand the fundamentals of supply chain and logistics management in modern organizations, both in the areas of manufacturing and service, and acquire an overview of logistics operations in the Americas, Europe and Asia, from the point of view of infrastructure, policies and regulations, operators, logistics nodes, etc. This course is designed as the introductory course upon which students will base the rest of their specialization courses during their degree. It requires a basic knowledge of international business. As a learning outcome the student is expected to generate a project in which he demonstrates a clear understanding of the concepts of logistics and supply chain; knows how to identify and distinguish the various components that make up a supply chain; and understands the logistical contexts of America, Europe and Asia as well as their respective peculiarities.

**General objective:** At the end of this course, students will be able to identify, from a general perspective, the different aspects of logistics within the context of supply chain management, and will know the specific details of logistics operations in America, Europe and Asia. Additionally, the student will be able to identify logistical alternatives for moving goods within the geographic and regulatory context of these regions.

**Key words:** Logistics. Inventory management. Supply chain. Means of transport. Globalization.

**Bibliography:** \* Bloomberg, David J., Logistics / David J. Bloomberg, Stephen LeMay, Joe B. Hanna., Upper Saddle River, N.J. : Prentice Hall, c2002., [013010194X].

### LN1002 Package, Packing and Material Handling

( 3 - 0 - 8. Prerequisites: [ AD2015 , LN1000 , LN1001 ]. 7 LLN11 )

Equivalence: None

This is a basic course, which is designed to help students to understand and apply the principles of package design, identify the materials used in merchandise packaging and identify the equipment used in material handling. The topic of sustainable development will be covered in the selection of the most suitable materials for designing a package. The learning outcome for this course is that the students outline a proposal for the design of new packaging or for improvements to existing packaging, developing their skills in analysis, evaluation of alternatives, and decision making.

**General objective:** At the end of this course, students will know the main principles of and materials used in packing and packaging. The objective also includes providing students with design and decision-making capabilities in essential elements of material handling.

**Key words:** Logistic systems. Packaging. Package. Packaging and baling.

**Bibliography:** \* Griffin, Roger C., Principles of package development / Roger C. Griffin, Jr., Stanley Sacharow, Aaron L. Brody, 2nd ed, Malabar, Fla. : Krieger Pub. Co., 1993, Florida, 1993, eng, [089464811X (papel no ácido)].

### LN1005 Purchasing and Inventory Management

( 3 - 0 - 8. Prerequisites: [ LN1004 , CD1003 ]. 5 LLN11 )

Equivalence: None

This is an intermediate course in the field of supply chains, which enables students to understand the main tools used in supply and purchasing in different areas of material management. Previous knowledge

is required in statistics. The learning outcome for this course is that the students manage a purchasing department efficiently, and know how to apply various models with the goal of optimizing the different types of inventory that the organizations have in hand.

**General objective:** At the end of this course, students will be able to negotiate and supply the correct materials to the company, enabling optimum flow of the production lines. The objective includes the design of inventory management and control systems, and design and location of distribution centers to support minimization of inventory carrying costs.

**Key words:** Logistics. Purchasing and inventories.

**Bibliography:** \* Monczka, Robert., Purchasing and supply chain management / Robert Monczka, Robert Trent, Robert Handfield., 3rd ed., Mason, OH : South-Western / Thomson, 2005, Ohio, 2005, eng, [0324202547],[0324224192].

### LN1006 Distribution Systems

( 3 - 0 - 8. Prerequisites: [ LN1012 , LN3008 ]. 7 LLN11 )

**Equivalence:** None

This is an advanced level course designed to provide students with knowledge of the application of quantitative methods for the optimal design of distribution chains, warehouse and distribution center location and warehouse configuration. Previous knowledge is required in logistics, linear scheduling and transport. The learning outcome for this course is that the students understand the typical operations of a warehouse or distribution center, design optimal distribution chains for specific situations, evaluate alternatives for warehouse and distribution center location, and determine the optimal configuration for a warehouse.

**General objective:** At the end of this course, students will be able to understand the role performed by distribution channels, levels of collaboration and the design of these within a logistics system. The objective includes developing students' ability to design distribution systems that benefit the efficiency of the company's supply chain.

**Key words:** Logistics. Purchasing and inventory management.

**Bibliography:** \* Ballou, Ronald H, Business Logistics Management Planning and Control, Wellington : Prentice-Hall, 1985, Sin información, 1985, spa, [0131048295].

### LN1007 Introduction to International Logistics Academic Program

( 3 - 0 - 4. Prerequisites: None. 1 LLN11 )

**Equivalence:** None

The purpose of this basic-level course is to introduce students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** At the end of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the skills, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its main rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Waters, C. D. J. (C. Donald J.), 1949-, Logistics : an introduction to supply chain management / Donald Waters., New York : Palgrave Macmillan, 2003., [0333963695 (papel alcalino)].

### LN1013 Customer Service Systems

( 3 - 0 - 8. Prerequisites: [ LN1011 , LN1006 ]. 9 LLN11 )

**Equivalence:** None

The customer-service course is given in the eighth semester of the program, in order to provide the



student with different approaches to the ultimate goal of logistics: customer satisfaction. The concepts on this course bring together many of the aspects within the program, given that the end user is the closing point of any logistics system.

**General objective:** At the end of this course, students will be able to understand the main philosophies, activities and performance measures that are involved in the area of customer service. The objective includes the ability to design systems that enable optimal levels of customer service to be maintained in order to strengthen organizational competitiveness.

**Key words:** Logistics. Customer satisfaction.

**Bibliography:** \* Lovelock, Reynoso, D'Andrea & Hueyte, Administración de Servicios, Ed. Pearson Educación.

### **LN2000 Transportation Systems**

( 3 - 0 - 8. Prerequisites: [ AD2015 , LN1000 ]. 6 LLN11 )

**Equivalence: None**

This is an intermediate course in the field of logistics, which aims to introduce students to the main elements of transport systems and establish guidelines for the management of these systems in the context of company efficiency and its role in the supply chain. Previous knowledge of logistics is required. As a result of learning, the student is expected to produce reports evaluating transportation alternatives for particular situations, quotations for transport services, and prepare the documentation needed to transport products by different means and make claims for damage to the cargo being transported.

**General objective:** At the end of this course, students will be able to identify the main responsibilities of a traffic and transportation department, make decisions regarding transportation services, design transportation routes, estimate transportation service costs, and prepare the documents required for local and international freight transportation.

**Key words:** Transport systems. Supply chain.

**Bibliography:** \* Sussman, Joseph., Introduction to transportation systems / Joseph Sussman., Boston : Artech House, 2000., [1580531415 (alk. paper)].

### **LN2001 International Commerce Operations**

( 3 - 0 - 8. Prerequisites: [ AD2015 , LN1000 ]. 7 LLN11 )

**Equivalence: None**

This is an intermediate course in the field of supply chain management that seeks to introduce students to Mexican foreign trade regulations and the stages of an import - export project. Previous knowledge of international business and logistics from a global perspective is required. As a learning outcome the student is expected to carry out various authentic import - export procedures for merchandise, applying current legislation and taking advantage of instruments that support foreign trade.

**General objective:** At the end of this course, students will be able to develop strategies that allow movements of goods into or out of the country to be optimized, apply the different laws and regulations in the context of logistics and international trade operations, identify and manage existing support tools.

**Key words:** Logistics. International treaties. Foreign trade. Customs regulations.

**Bibliography:** \* Witker, Jorge., Régimen jurídico del comercio exterior de México / Jorge Witker, Laura Hernández., 3a ed., México : Instituto de Investigaciones Jurídicas, Universidad Nacional Autónoma de México, 2008., [9789703253524].

### **LN3008 Production Logistics**

( 3 - 0 - 8. Prerequisites: [ CD2007 ]. 6 LLN11 )

**Equivalence: None**

This is an advanced course in the field of the supply chain, in which the student will become familiar with the tools to plan, organize, manage and control production operations in a company. The course requires prior knowledge of statistics. As a learning outcome the student is expected to develop, using a sales forecast and with the help of specialized software, an



aggregate production plan; a master production schedule; MRP tables for inventory control of parts, components, sub-assemblies of a finished product; daily program for machine job sequencing; and control charts to measure the variability in a production process.

**General objective:** At the end of this course, students will be able to identify different production processes and classify them according to their flexibility, volume and variety of products they can handle. Students will also be able to design production plans under different time horizons considering the efficient use of available resources. Finally, students will be able to evaluate and monitor the quality of production processes using statistical quality control tools.

**Key words:** Work sequencing. Aggregate planning. Control charts. MRP.

**Bibliography:** \* Stevenson, William J., Operations management / William J. Stevenson., 10th ed., Boston, Mass. : McGraw-Hill/Irwin, c2009., [9780070091771],[0070091773].

### LN3009 Strategic Supply Chain Management

( 3 - 0 - 8. Prerequisites: [ LN1006 ]. 9 LLN11 )

**Equivalence:** None

This is an advanced course in the field of supply chain management that seeks for students to integrate strategies and create business solutions in the field of supply chain. It requires prior knowledge of logistics management and distribution center management. As a learning outcome the student is expected to develop a comprehensive strategy for a company's supply chain that generates value for the organization and its customers, and responds and innovates in the face of future demand changes.

**General objective:** At the end of this course, students will be able to develop the skills required to direct and control supply chains according to company objectives. To that end, different situations that managers regularly face will be studied: decision making processes, allocation of resources and systems, and the development of strategies to reach these

objectives, with an emphasis on improvement processes.

**Key words:** Supply chain. Strategic management. Performance indicators.

**Bibliography:** \* Harrison, Alan, 1944-, Logistics management and strategy : competing through the supply chain / Alan Harrison, Remko van Hoek., 3rd ed., Harlow, England ; New York : Prentice Hall Financial Times, 2008., [9780273712763 (rustica : papel alcalino)].

### LN3010 Logistics Systems Modeling

( 3 - 0 - 8. Prerequisites: [ LN1006 ]. 9 LLN11 )

**Equivalence:** None

This is an advanced course in the field of supply chain management, in which the student uses quantitative modeling tools in order to make decisions in the field of logistics at strategic, tactical and operational levels. The course requires prior knowledge of operations management of logistics and distribution centers. As a learning outcome, the student is expected to produce analysis reports for results and proposals for solutions and/or improvements to the issues studied, focusing on a problem in the area of logistics. The student will construct mathematical programming models and solve these using simulation models and specialized software.

**General objective:** At the end of this course, students will be able to build quantitative simulation and optimization models, and use specialized software (ARENA, LINDO, etc.) to solve different logistical problems, such as warehouse location, production planning, distribution network design, inventory control, and vehicle routing, among others.

**Key words:** Transportation. Modeling. Simulation. Problem solving. Distribution networks.

**Bibliography:** \* Azarang Esfandiari, Mohammad Reza., Simulación y análisis de modelos estocásticos / Mohammad Reza Azarang Esfandiari, Eduardo García Dunna., México : McGraw-Hill, 2001., [9701011732].

## **LN3011 Introduction to Professional Development**

**( 2 - 0 - 2. Prerequisites: None. 9 LLN11 )**

**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics taught during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional, and find employment.

**General objective:** At the end of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek a job.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## M Mechanical Engineering

### M1003 Statics

( 3 - 0 - 8. Prerequisites: [ F1002 , MA1002 ],[ F1002 , MA1015 ],[ F1002 , MA1017 ],[ F1002 , MA1017 Corequisite ]. 2 IDA11, 4 IDS11, 2 IIN12, 2 IIS11, 2 IMA11, 2 IME11, 2 IMT11 )

**Equivalence:** M 00822

This is a basic course in the engineering area, in which the student applies his knowledge of physics and handling of vectors to solve problems associated with static equilibrium of rigid bodies.

**General objective:** On completing the course the student will have developed the ability to analyze problems related to rigid bodies in static equilibrium in a simple and logical manner, thus achieving a clear vision of the phenomenon of classic mechanics.

**Key words:** Free body diagram. Dry friction. Rigid body equilibrium. Force and momentum. Moment of inertia. Centroids.

**Bibliography:** \* Hibbeler, R. C., Engineering mechanics. Statics / R.C. Hibbeler., 11th ed., Upper Saddle River, NJ : Pearson Prentice Hall, c2007., New Jersey, c2007., eng, [0132215004],[9780132215008].

### M1005 Dynamics

( 3 - 0 - 8. Prerequisites: [ M1003 ]. 3 IDA11, 3 IMA11, 3 IME11, 3 IMT11 )

**Equivalence:** M 00823

In this basic engineering course, students apply their knowledge of statics and calculus to solve problems associated with the plane motion of rigid bodies. This course requires prior knowledge of vectors, free-body diagrams, principles of differential and integral calculus, evaluation of support forces and reactions with or without friction. The learning outcome of this course are: to obtain the kinematic conditions (position, speed and acceleration) in the motion of rigid bodies; assess the required force and momentum to maintain or cause motion in rigid bodies; and select the most appropriate analysis method for a specific application.

**General objective:** On completing the course the student will have developed the ability to analyze problems relating to rigid bodies in movement in a simple and logical manner, establishing their kinematic and kinetic conditions.

**Key words:** Rigid body kinematics. Rigid body kinetics. Work and energy. Impulse and momentum. Vibrations.

**Bibliography:** \* Beer, Ferdinand Pierre, 1915-, *Mécanica vectorial para ingenieros : Dinámica / Ferdinand P. Beer, E Russell Johnston, Phillip J. Cornwell ; revisión técnica Miguel ángel Ríos Sánchez, Felipe de Jesús Hidalgo Cavazos ; traducción, José Elmer Murrieta Murrieta, Gabriel Nagore Cazare, 9a ed., México : McGraw Hill Interamericana, 2010., [9786071502612].*

### M1006 Computer Drawing

( 3 - 0 - 8. Prerequisites: [ M1003 Corequisite , M1003 , F1002 , F1002 Corequisite , F2001 Corequisite , F2001 ]. 3 IDA11, 3 IIN12, 3 IIS11, 3 IMA11, 3 IME11, 4 IMT11, 3 LDI11 )

**Equivalence:** M1002, M1004

This is a basic course in Mechanical Engineering, Mechatronics, Industrial Engineering and Industrial Design, which provides students with the basic and intermediate skills for designing components and interpreting technical drawings at a basic level. This course requires prior knowledge of basic geometry. The learning outcome is for the student to hand in a final project of his own choice, but approved by the professor, using the design techniques learned.

**General objective:** Upon completion of this course, students will be able to design and resolve design problems and interpret 2D drawings.

**Key words:** Basic curves and Sketches. Primitive solids. Assemblies and 2D drawings. Chunky solid.

**Bibliography:** \* French, Thomas Ewing, 1871-1944., *Engineering drawing and graphic technology / Thomas E. French, Charles J. Vierck, Robert J. Foster., 14th ed., New York : McGraw-Hill, c1993., [0070223475].*

## M1007 Introduction to Mechanical Engineering

( 3 - 0 - 4. Prerequisites: None. 1 IDA11, 1 IMA11, 1 IME11 )

**Equivalence: None**

The purpose of this basic-level course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Shigley, Joseph Edward., Mechanical engineering design / Joseph E. Shigley, Charles R. Mischke, Richard G. Budynas., 7th ed., New York, NY ; Mexico : McGraw-Hill, c2004., [0072520361 (papel no a'cido)], [0071232702 (ed. internacional)].

## M2001 Fundamentals of Combustion and Emissions

( 3 - 0 - 8. Prerequisites: None. 5 IDA11 )

**Equivalence: None**

Intermediate course that provides the basic tools needed to understand, model, and control the combustion process of any fuel in any heat engine. This course requires prior knowledge of thermodynamics. The learning outcome is for students to design and construct a device to apply the energy contained in a fuel.

**General objective:** On completing the course the student will understand the physical phenomena involved in the processes of combustion and the relationship to the emission of atmospheric pollutants.

**Key words:** Chemical reactions. Flames. Thermochemistry.

**Bibliography:** \* Turns, S., ? An introduction to combustion. Concepts and applications, McGraww Hill.

## M2003 Energy Generation Systems

( 3 - 0 - 8. Prerequisites: [ IQ2001 , TE2000 ], [ IQ2001 , TE2032 ]. 7 IDS11 )

**Equivalence: None**

This is an intermediate course which presents students the main capabilities of electrical engineering, especially the different ways to generate energy from fossil fuels, nuclear energy, and renewable sources. The course also introduces the principal applications of electrical energy in the industry and transport sector, with the corresponding cost analyses. This course requires prior knowledge of electromagnetism and alternating/direct current circuits. As a learning result, the student will be able to perform economic/environmental analysis of the main electrical energy applications.

**General objective:** Upon completion of this course, students will be able to analyze the primary energy sources: fossil fuels, nuclear fission, and renewable resources; understand the use of secondary energy in transportation, the generation of electricity, production processes, etc; comprehend the technologies which are used to make steam in processing plants; understand the technologies which are utilized in order to generate electricity; obtain the cost of the energy generation by means of efficiency calculations; and describe the environmental impact of the different options of energy use.

**Key words:** Renewable energy. Energy. Energy resources. Electrical and thermal energy. Power system components. Power plants. Electric machines.

**Bibliography:** \* El-Sharkawi, Mohamed A., Electric energy : an introduction / Mohamed A. El-Sharkawi.,

Boca Raton, Fla. : CRC Press, c2005., [0849330785 (papel alcalino)].

## M2007 Mechanism Analysis and Simulation

( 3 - 1 - 8. Prerequisites: [ M1005 ]. 4 IDA11, 4 IMA11, 4 IME11, 6 IMT11 )

Equivalence: M 00832

This is an intermediate course in which students, based on prior knowledge of statics and dynamics, analyze, simulate, and design mechanisms with applications to machines, instruments, and actuators of different types. This course requires prior knowledge of free body diagrams, vector analysis, differential and integral calculus, rigid body kinematics and kinetics. As a learning outcome, students will be able to recognize mechanisms commonly used in machines (Geneva wheel, cam, rack, universal joint, etc.), analyze and simulate systems involving gears, cams and rods, choose the most appropriate components of the mechanism for a specific application, and design mechanisms based on specific needs.

**General objective:** Upon completion of this course, students will be able to understand the different mechanisms utilized in machines, instruments, and actuators; analyze and simulate mechanisms; design a mechanism according to specific requirements.

**Key words:** Degrees of freedom. Computer simulation. Types of mechanisms. Analysis and simulation of mechanisms. Gear kinematics. Cams.

**Bibliography:** \* Arthur G. Erdman, George Sandor and Kota, Mechanisms Design, Fourth Edition, Prentice Hall.

## M2010 Materials Behavior

( 3 - 1 - 8. Prerequisites: [ Q1001 , IQ2001 Corequisite ], [ Q1001 , IQ2001 ]. 5 IMA11 )

Equivalence: M 00861

Intermediate mechanical engineering course that provides the bases for understanding the structure-behavior relationship of materials, as well as the evaluation methods for mechanical properties and their relationship to mechanical design. This course

requires prior knowledge of chemistry, material resistance, and mathematics. The learning outcome of the course is for students to apply their basic knowledge of material science to the design of mechanical components.

**General objective:** On completing the course the student will be able to find and evaluate mechanical properties relevant to mechanical design and interpret and use them in an informed way.

**Key words:** Structure-properties of materials relationship. Evaluation of mechanical properties.

**Bibliography:** \* William D. Callister Jr., Materials science and engineering, 3era. Edición, John Wiley & Sons, inglés.

## M2014 Materials Applications

( 3 - 1 - 8. Prerequisites: [ M2010 ]. 6 IMA11 )

Equivalence: M 00862

Intermediate mechanical engineering course in which students finish studying the behavior-structure relationship of materials by adding the processing of these, focusing on manufacturing methods for mechanical components. This course requires prior knowledge of chemistry, material resistance, mathematics, and material behavior. As a learning outcome, students apply their knowledge of the structure-properties-processing relationship of materials to the manufacture of mechanical components.

**General objective:** After completing the course, students should be able to understand the principles behind the processing of materials and use them appropriately on the manufacturing of mechanical components.

**Key words:** Structure-properties-processing relationships of the materials. Materials processing.

**Bibliography:** \* William D. Callister Jr., Materials science and engineering, 3era. Edición, John Wiley & Sons, inglés.



## M2016 Thermodynamics Engineering

( 3 - 0 - 8. Prerequisites: [ IQ2001 ]. 6 IMA11, 5 IME11 )

Equivalence: M 00003

This is an intermediate course which focuses in the analysis, design and optimization of thermal and mechanical energy conversion systems. In this course non-reactive systems (psychrometrics) are discussed and reduction of greenhouse gases is also considered (Kyoto Protocol). The course requires prior knowledge of the first and second laws of thermodynamics, thermodynamic properties of gases and pure substances and ideal thermodynamic cycles. As a learning outcome, students are expected to analyze and optimize thermal systems and thermal energy conversion processes and analyze thermodynamic processes involving non-reactive gas mixtures.

**General objective:** At the end of this course, students will be able to analyze power cycles and refrigerators, and make proposals in order to improve these types of systems. Students will also be able to analyze air conditioning systems and diagnose combustion systems.

**Key words:** Power cycles. Thermal efficiency. Coefficient of performance. Psychrometric processes. Stoichiometric reaction.

**Bibliography:** \* Yunus A. Cengel, Thermodynamics, Fourth Edition, McGraw Hill.

## M2017 Design Methodologies

( 3 - 0 - 8. Prerequisites: [ M2015 Corequisite , M2015 , M2030 ]. 8 IDA11, 8 IMA11, 8 IME11 )

Equivalence: M 00843

This is an advanced intermediate course in engineering in which students develop and use the knowledge, competencies and attitudes required in order to follow a socially and environmentally responsible process of engineering design in a formal and structured manner; integrate the knowledge acquired on the courses during the second third of the degree course and foster competencies in collaborative engineering. This course requires prior knowledge of

statics, dynamics, the mechanics of materials, materials applications, and computerized drawing. As a learning outcome, students will propose design solutions for developing products, considering not only engineering aspects, but also ethical and environmental perspectives.

**General objective:** On completing the course the student will have acquired the knowledge and developed the skills, competencies and attitudes necessary to follow in a structured and collaborative fashion a set of methods that, from the perspectives of engineering, ethical responsibility and the environment, integrate design, manufacture and marketing functions for the development of innovative and competitive products.

**Key words:** Design methodologies. Product development. Engineering design. Creation of models and prototypes. Environmentally responsible design. Design project planning.

**Bibliography:** \* Ulrich, Karl T., Product design and development/Karl T. Ulrich, Steven D. Eppinger, 4th. Edition, Boston: McGraw-Hill/Irwin, 2008, [0073101427 (papel alcalino)], [9780073101422 (papel alcalino)].

## M2020 Manufacturing Engineering

( 3 - 0 - 8. Prerequisites: [ M2014 , M2012 , M2028 ]. 7 IMA11, 7 IME11 )

Equivalence: M 00881

This is an intermediate level course where manufacturing technologies for world class products are used and evaluated. Sustainability for some selected manufacturing systems will be studied. The course requires prior knowledge about material selection, their mechanical properties, and technical drawing. As a learning outcome, students are expected to identify traditional manufacturing processes, and select operating parameters and tools for a specific application.

**General objective:** At the end of the course, students will be able to recognize different traditional manufacturing processes, select machines according to the characteristics, properties, and functionality of the parts to be manufactured. Students will also



be able to specify tools and operating parameters for the manufacture of simple products, considering economic and environmental impact. Finally, they will also be able to select measuring methods and tools for ensuring the quality of the component.

**Key words:** Welding. Machining. Metrology. Casting. Forming and Shaping.

**Bibliography:** \* Kalpakjian, Serope, 1928-, Manufacturing processes for engineering materials / Serope Kalpakjian, Steven R. Schmid., 5th ed., Upper Saddle River, N.J. : Pearson Education, c2008., New Jersey, c2008. , eng, [0132272717], [9780132272711].

### M2021 Fluid Mechanics

( 3 - 0 - 8. Prerequisites: [ MA2001 , MA2010 ]. 5 IC 11, 6 IDA11, 7 IMA11, 6 IME11 )

**Equivalence:** M 00855

This is an intermediate mechanical engineering course that provides students with the tools to solve complex problems related to fluid flow, external flow, gauging, flow measurement and flow properties using mathematical analysis and thinking. This course requires prior knowledge of differential equations. As a learning outcome, students propose solutions to problems related to fluids, using mathematical and experimental analysis. They evaluate the performance of systems that use fluids as a means of operation and suggest improvements for these systems.

**General objective:** Upon completion of this course, students will be able to design and propose experiments which test hypotheses about problems related to science and engineering.

**Key words:** Conservation equations. Properties of fluids. Internal and external flows. Viscous flows. Fluid machines.

**Bibliography:** \* Frank M. White, Mecánica de fluidos, McGraw Hill.

### M2023 Mechanics of Materials

( 3 - 1 - 8. Prerequisites: [ M1003 ]. 3 IDA11, 3 IMA11, 3 IME11, 5 IMT11 )

**Equivalence:** M2006

This is an intermediate course, designed to help students use mathematical analysis and thinking to study the exertion and flat distortion generated by different types of loads in mechanical components and/or systems and produce simple designs for these components and/or systems. Previous knowledge is required of rigid-body equilibrium, vectors, and distribution of forces. The learning outcome for this course is for the students to solve mechanical engineering problems, applying basic sciences and concepts of material resistance, and carry out experiments to measure one-dimensional deformation through which experimental values of loads in mechanical components and/or systems can be calculated.

**General objective:** Upon completion of this course, students will be able to understand the relationships that exist between the external loads applied and the internal effects they cause in a mechanical component; calculate the stress and deformation conditions of a mechanical element and validate the results through experimental testing; and design simple components and structures, backed by a theoretical and/or experimental analysis and using established fault criteria to support their decisions.

**Key words:** Force-deformation relationship. Material stress analysis. Experimental analysis of force and deformations.

**Bibliography:** \* Hibbeler, R. C., Mechanics of materials / R.C. Hibbeler., 6th ed., Upper Saddle River, NJ : Pearson/Prentice Hall, 2005., [013191345X].

### M2024 Manufacturing Processes

( 3 - 0 - 8. Prerequisites: [ F1002 , F2001 ]. 4 IIN12, 3 IIS11, 4 LDI11 )

**Equivalence:** None

This is an intermediate course, which enables students to understand and apply materials and manufacturing processes to the manufacture of specific

products. This course will include activities and concepts of sustainable development that favor eco-efficiency and prevent pollution. Previous knowledge is required in chemistry, physics and statics. The learning outcome for this course is that the students apply these tools to the development of a product, beginning with the selection of materials and finishing with the specification of the manufacturing process. The students will design a prototype.

**General objective:** Upon completion of this course, students will be able to identify and classify diverse materials: metals, polymers, ceramics, compounds; understand and measure the mechanical properties of materials; choose the appropriate materials for different processes; classify the different manufacturing processes; choose the appropriate manufacturing process for a specific product; know the key concepts of sustainable manufacturing; create a prototype using the most suitable materials and processes.

**Key words:** Mechanical properties of materials. Manufacturing processes classification. Materials applications. Manufacturing processes applications. Materials and manufacturing processes relationship. Classification of materials. (Metals, polymers, ceramics, compounds).

**Bibliography:** \* Kalpakjian, Serope, 1928-, Manufacturing engineering and technology / Serope Kalpakjian, Steven R. Schmid., 6th ed., New York ; México : Prentice Hall, c2010., [0136081681],[9780136081685].

## M2025 Numerical Methods in Engineering

( 3 - 0 - 8. Prerequisites: [ MA2010 Corequisite , MA2010 ]. 4 IBN11, 4 IBT11, 4 IC 11, 4 IDA11, 4 IDS11, 3 IFI11, 4 IIA11, 5 IID12, 5 IIN12, 4 IIS11, 4 IMA11, 4 IMD11, 4 IME11, 4 IMT11, 6 INCQ13, 4 IQA11, 4 IQP11, 4 ISD11, 4 ITE11, 4 ITS11 )  
**Equivalence:** M2009

This is an intermediate level course which will allow students to solve science and engineering problems through the application of numerical approximation methods. It requires previous knowledge of programming. The learning outcome for this course is that students be able to apply a method of numeri-

cal approximation in the design of a solution to an engineering problem.

**General objective:** Upon completion of this course, students will have the capacity to propose a solution to an engineering problem, manually or with a computer, by applying numerical methods.

**Key words:** Interpolation and curve fitting. Matrix algebra. Numerical approximations. Numerical methods and programming. Integration and differential equations. Linear and nonlinear equation systems. Nonlinear equations.

**Bibliography:** \* Chapra, Steven C., Numerical methods for engineers / Steven C. Chapra, Raymond P. Canale., 6th ed., Boston : McGraw-Hill Higher Education, 2010., [9780071267595 (encuadrado : papel alcalino)],[007126759X (encuadrado : papel alcalino)].

## M2026 Advanced Methods for Strength of Materials

( 3 - 1 - 8. Prerequisites: [ M2023 , M2025 ],[ MA1019 , MA1019 Corequisite ]. 5 IDA11, 5 IMA11, 5 IME11)

**Equivalence:** None

This is an intermediate course, which enables students to employ mathematical analysis and thinking in order to: calculate stress and strains in mechanical components in two and three dimensions subject to different loadings; explore the stability of mechanical components subject to compression forces; design mechanical components and systems based on its material strength. The course will include advanced mathematical techniques used to solve problems in 2 and 3 dimension. In particular, the finite element method will be employed. , and the results will be validated through laboratory experiments. The course also includes activities and concepts related to mechanical design in order to contextualize the use of the various tools and techniques that will be introduced. Previous knowledge is required in solid mechanics, calculation of axial, shear and combined stresses, Mohr's circle, numeric methods and differential equations. The learning outcome for this course is that students are able to apply basic sciences, ad-

vanced mechanics, material strength techniques and the finite element method in order to evaluate and analyze stress and strain conditions in mechanical components. Similarly, the students will use these techniques to design mechanical components.

**General objective:** Upon completion of this course, students will be able to analyze the general conditions of stress and strain in mechanical elements subjected to the action of diverse types of loading; resolve statically indeterminate beams; identify the critical loads and deformations existing in different types of materials (fragile and ductile); understand the basics of the Finite Element Method and use it to solve problems in mechanics of materials; check Finite Element Method results with experimental methods, using experimental stress analysis techniques, such as photoelasticity.

**Key words:** Finite Element method. Experimental stress analysis by photoelasticity. Advanced materials mechanics and resistance techniques.

**Bibliography:** \* Hibbeler, R. C., Mechanics of materials / R. C. Hibbeler., 7th ed., Upper Saddle River, N.J. ; México : Pearson/Prentice Hall, c2008., [0132209918 (encuadernado)],[9780132209915 (encuadernado)].

### **M2027 Advanced CAD and Metrology** ( 3 - 1 - 8. Prerequisites: None. 6 IDA11 ) **Equivalence: None**

This is an intermediate course in mechanical design, using CAD software (NX or Catia), considering the fundamentals and methods of industrial metrology. Previous knowledge is required in the use of a Computer Aided Design program including its interface and basic commands, as well as design methodologies in the field of mechanical engineering. The learning outcome for this course is that the students solve problems related to the design of mechanical components with complex geometry, as well as create automated processes for improving efficiency in this phase of product development. Additionally, students will develop their ability to apply metrology technologies.

**General objective:** Upon completion of this course, students will have acquired and be able to apply

knowledge of the existing advanced tools in CAD software (NX or Catia) in the field of mechanical design, and will be able to use industrial metrology appropriately for the modeling methodologies employed in industry.

**Key words:** Automotive. CAD. Metrology. Tolerances. NX. Catia.

**Bibliography:** \* Lee, Kunwoo., Principles of CAD/CAM/CAE systems / Kunwoo Lee., Reading, Mass. : Addison-Wesley, c1999., [0201380366].

### **M2028 Materials Technology** ( 3 - 0 - 8. Prerequisites: [ Q1001 , IQ2001 ]. 6 IDA11, 5 IME11, 6 IMT11 ) **Equivalence: M2012**

This is an intermediate course, in which students study the interrelationship between properties and structure. It does not require previous knowledge. The learning outcome of this course is for students to identify and select the parameters of materials for a specific application.

**General objective:** Upon completion of this course, students will be able to understand the interrelation between the structure, properties and processing of materials; use materials appropriately in specific applications; select materials based on the Ashby method.

**Key words:** Evaluation of mechanical properties. Material selection. Material processing. Material structure - properties - processing relationship.

**Bibliography:** \* donald askeland., The Science and engineering of materials.

### **M2029 Machine Design and Development** ( 3 - 0 - 8. Prerequisites: [ M2023 , M2007 ]. 7 IMT11 ) **Equivalence: None**

This is an intermediate course in engineering that provides students with the necessary tools to help them design the basic elements that make up parts

of machinery. Previous knowledge is required in mechanisms, material mechanics, material selection, manufacturing processes and computerized drafting. The learning outcome for this course is that the students evaluate conditions to determine the workload and exertion that the components are subjected to and compare these against the amount of resistance, in order to establish appropriate safety measures; and use sources of information, computer tools and engineering knowledge to meet specific mechanical needs, considering the engineering, social, ethical and environmental aspects.

**General objective:** Upon completion of this course, students will have acquired and developed the necessary skills and competencies to analyze, select, design and simulate the different components of a machine.

**Key words:** Mechanical design. Machine components. Root-cause mechanisms. Power transmission. Shafts, bearings, gears. Belts, brakes, clutches.

**Bibliography:** \* Budynas, Richard G. (Richard Gordon), Shigley's mechanical engineering design / Richard G. Budynas, J. Keith Nisbett., 8th ed. , New York, N.Y. ; Boston, MA. : McGraw-Hill, c2008., [0073121932 (encuadrado : papel alcalino)], [9780073121932 (encuadrado : papel alcalino)], [0073312606], [9780073312606], [9780071257633].

## M2030 Machine Design and Simulation

( 3 - 0 - 8. Prerequisites: [ M2026 , M2007 ]. 7 IDA11, 7 IMA11, 7 IME11 )

**Equivalence:** None

This is an intermediate course in engineering, which provides students with the necessary tools for designing the basic components and subsystems found in machines. Previous knowledge is required in mechanisms, material mechanics, material selection, manufacturing processes and computerized drafting. The learning outcome for this course is the evaluation of operating conditions to determine the workload and wear that components are subjected to and compare these against component durability and strength, in order to establish appropriate safety measures or factors; and use sources of information,

computer tools and engineering knowledge to meet specific mechanical needs, considering the engineering, social, ethical and environmental aspects.

**General objective:** Upon completion of this course, students will have acquired and developed the necessary skills and competencies to analyze, select, design and simulate the different components of a machine.

**Key words:** Mechanical design. Machine components. Root-cause mechanisms. Power transmission. Shafts, bearings, gears. Belts, chains, pulleys.

**Bibliography:** \* Collins, J. A. (Jack A.), Mechanical design of machine elements and machines : a failure prevention perspective / Jack A. Collins, Henry Busby & George Staab., 2nd ed., Hoboken, N.J. : Wiley ; Chichester : John Wiley [distributor], 2010., [9780470413036 (encuadrado)], [0470413034 (encuadrado)].

## M2031 Manufacturing Technologies

( 3 - 1 - 8. Prerequisites: [ M2028 ]. 7 IDA11, 7 IMT11 )

**Equivalence:** M2019

This is an intermediate course, in which students study manufacturing technologies for world-class products, paying special attention to the sustainability of the chosen manufacturing systems. Previous knowledge is required in material selection, properties and technical drafting. The learning outcome for this course is that the students identify manufacturing processes and select the appropriate operational parameters and tools for a specific application. Additionally, the students will be able to develop a prototype for machinery's part used in the manufacture of a specific product.

**General objective:** Upon completion of this course, students will be able to comprehend the diverse manufacturing processes, select the machinery and specify the ideal tools and operating parameters for manufacturing mechatronic products, considering both the economic and environmental impacts; generate a machine prototype for manufacturing a specific product.

**Key words:** Sustainable manufacturing. Casting processes. Permanent bonding processes. Shaping processes. Material removal processes. Electronic manufacturing.

**Bibliography:** \* Kalpakjian, Serope, 1928-, Manufacturing engineering and technology / Serope Kalpakjian, Steven R. Schmid., 5th ed., Upper Saddle River, NJ : Pearson/Prentice Hall, c2006., New Jersey, c2006., eng, [0131489658],[9780131489653].

## M2032 Materials Technology

( 3 - 0 - 8. Prerequisites: [ M2024 ]. 5 LDI11 )

**Equivalence:** DL3002

This is an intermediate level course, in which students study the interrelationship between properties and structure. It does not require previous knowledge. The learning outcome for this course is that the students identify and select the parameters of materials for a specific application.

**General objective:** Upon completion of this course, students will be able to understand the interrelation between the structure, properties and processing of materials; use materials appropriately in specific applications; select materials based on the Ashby method.

**Key words:** Material selection. Material processing. Material structure - properties - processing relationship. Materials classification. Material properties. Standardized presentation of materials. Material transformation.

**Bibliography:** \* Callister, William D., 1940-, Materials science and engineering : an introduction / William D. Callister, Jr., 7th ed., Hoboken, N.J. : John Wiley & Sons, c2007., [0471736961 (papel alcalino)],[9780471736967 (papel alcalino)].

## M3014 Manufacturing Processes Laboratory

( 0 - 3 - 4. Prerequisites: [ M2020 Corequisite , M2020 , M2028 Corequisite , M2028 ]. 8 IDA11, 7 IMA11, 8 IME11 )

**Equivalence:** PV3004

This advanced course reinforces students' theoretical knowledge of manufacturing processes through laboratory assignments. This course requires prior knowledge of properties and selection of materials, heat treatments, and material shaping, cutting, welding and casting processes. The learning outcome of this course is for students to apply their knowledge of manufacturing processes to the production of simple mechanical components; and verify the dimensional, geometric and surface characteristics of mechanical components in accordance with design specifications.

**General objective:** On completing the course, the student will be able to operate smelting, machining and soldering equipment in order to manufacture mechanical parts and devices; develop and manufacture plastic prototypes and parts; certify the quality of mechanical components through the use of measuring instruments; and incorporate the vision of sustainable development within manufacturing processes.

**Key words:** Rapid prototyping. Welding. Machining. Metrology. Casting. Forming and Shaping. Plastics.

**Bibliography:** \* Tlusty, Jiri., Manufacturing processes and equipment / Jiri Tlusty., Upper Saddle River, NJ : Prentice-Hall, c2000., [0201498650].

## M3015 Thermofluids Laboratory

( 0 - 3 - 4. Prerequisites: [ M3017 Corequisite , M3017 ]. 8 IMA11, 8 IME11 )

**Equivalence:** None

This is an experimental advanced course that reinforces the theoretical knowledge in the thermal and fluid fields through implementation of laboratory practice. This course requires prior knowledge of thermodynamic engineering, fluid mechanics and heat transfer. As a learning outcome students will



propose diagnostic methodologies for thermal and fluid systems. They will develop the ability to plan experiments to measure thermal and hydrodynamic properties of a fluid as well as analyzing thermal systems involved in the flow of a fluid.

**General objective:** On completing the course the student will be familiar with the main techniques used to measure the thermophysical properties of a fluid, as well as the way to measure the performance of the main pieces of equipment used in thermofluids (refrigerators, pumps, compressors, internal combustion engines, turbines, heat interchangers, etc.).

**Key words:** Heat exchangers. Heat transfer by conduction. Transient conduction in solids. Free and forced convection in cooling fins with variable geometry. Drag and lift. Radiation: (Demonstration of the Stefan Boltzmann Law). Centrifugal compressors and compressible flow. Refrigeration cycles. Loss of energy in filters. Measurement of density, specific weight and viscosity. Characteristic curves of fluid machines. Friction factor in piping and pressure drop in accessories. Centrifugal pumps. Flow measurement.

**Bibliography:** \* Fundamentals of heat and mass transfer / Frank P. Incropera . [et al.], 6th ed., Hoboken, NJ : John Wiley, c2007, New Jersey, c2007, eng, [0471457280 (tela)],[9780471457282 (tela)].

### **M3016 Advanced Manufacturing** ( 3 - 0 - 8. Prerequisites: [ M2020 , M3014 ]. 9 IMA11 ) **Equivalence: None**

In this advanced course, students learn about advanced manufacturing processes. This course requires prior knowledge of metrology, traditional and permanent smelting, welding and forming processes, and basic material removal processes. The learning outcome of this course is for students to be able to identify the different advanced and non-conventional processes, and their application in product manufacturing; use new manufacturing technologies; and select the processes for manufacturing advanced and new materials.

**General objective:** On finishing the course, the student will have studied and analyzed advanced ma-

chining and non-conventional machining processes; plastic and composite injection molding processes, and production of prototypes; manufacture of die and matrices for metalworking; production of fast tools and parts for dust metallurgy. The student will have developed, through detailed knowledge of certain manufacturing processes, the theoretical framework to select and integrate product-oriented processes; as well as provide the tools and machines required for their production. The student will also be aware of innovation of future technical processes as well as consideration of present and future ecological aspects of modern manufacturing.

**Key words:** Rapid prototyping. Dust metallurgy. Manufacturing. Polymer processing. Sheet metal forming. Non-traditional machining. Computer aided manufacturing.

**Bibliography:** \* Krar, Stephen F., Exploring Advanced Manufacturing Technologies / Steve F. Krar and Arthur R. Gill., 1st ed., New York : Industrial Press, c2003., [0831131500].

### **M3017 Heat Transfer** ( 3 - 0 - 8. Prerequisites: [ M2016 Corequisite , M2016 , M2021 Corequisite , M2021 ]. 7 IDA11, 8 IMA11, 7 IME11 ) **Equivalence: None**

This is an advanced course in which students analyze and apply heat transfer concepts to optimize the performance of thermal systems by reducing the negative impact on the environment. The course requires prior knowledge of differential equations, numerical methods, thermodynamic engineering and fluid mechanics. As a learning outcome the students must apply mathematical models and computational tools to solve engineering problems in heat transfer. Also, they are expected to be able to analyze and design thermal systems considering their impact on the environment.

**General objective:** At the end of this course, the students will be able to comprehend the heat transfer mechanisms and apply the mathematical models which represent them in order to analyze various thermal systems.



**Key words:** Heat conduction. Heat convection. Heat radiation. Heat exchanger. Numerical methods in heat transfer.

**Bibliography:** \* J.A. Manrique, Transferencia de calor, Editorial Harla.

### M3018 Mechanical Engineering Capstone Project

( 3 - 0 - 8. Prerequisites: [ M3016 Corequisite , M3016 , M2017 Corequisite , M2017 ]. 9 IMA11 )  
**Equivalence: None**

In this advanced course, students will complete industrial, scientific, technological and sustainable development engineering projects using the knowledge acquired in the final third of their major. This course requires prior knowledge of design methodology, manufacturing processes, mechanical design, engineering economics, heat transfer mechanisms, and automatic control systems. As a learning outcome, students will be able to solve real mechanical engineering problems that will benefit the industrial sector and society, and minimize environmental degradation.

**General objective:** Upon completion of this course, students will be able to apply knowledge gained in previous studies to the development of an engineering project with an industrial, scientific, or technological application; develop teamwork, leadership, and innovation skills; evaluate the viability of a project considering the three perspectives of sustainable development.

**Key words:** Preliminary design. Detail design. Art field study. Problem definition. Definition of additional information and knowledge needed for a successful solution. Analysis and testing. Validation. Generation of the final report. Necessary documentation: plans and/or prototypes.

**Bibliography:** \* Ulrich, Karl T., Product design and development/Karl T. Ulrich, Steven D. Eppinger, 4th. Edition, Boston: McGraw-Hill/Irwin, 2008, [0073101427 (papel alcalino)], [9780073101422 (papel alcalino)].

### M3019 Electromechanical Prototype Simulation and Construction

( 3 - 1 - 8. Prerequisites: [ M2017 Corequisite , M2017 ]. 9 IME11 )  
**Equivalence: None**

This advanced course enables students to integrate the basic knowledge acquired throughout their bachelor's degree program to design, construct and test electromechanical products that meet human needs and use energy and the available resources efficiently. As a learning outcome, students will prepare computer models to simulate the behavior of their products under operating conditions. They will also develop skills to construct electromechanical product prototypes and they will evaluate the performance of these prototypes. Finally, students will develop the skills to write the technical documentation that validates the development process of their product and the necessary manuals to guarantee its safe handling and maintenance.

**General objective:** On completing the course the student will have designed electromechanical products; prepared finite elements models and manufacturing blueprints; built prototypes; designed and carried out performance tests.

**Key words:** Development of manufacturing specifications and inspection of electromechanical products. Prototype construction and testing. Concurrent engineering. Prototyping. Simulation. Validation. Simulation using specialized software. Documentation associated with the product and its development process. Preparation of models to simulate electromechanical product performance in heat transfer, force prediction applications.

**Bibliography:** \* Ullman, David G., 1944-, The mechanical design process / David G. Ullman., 4th ed., Dubuque, IA : McGraw-Hill, c2009., [9780072975741 (papel alcalino)], [0072975741 (papel alcalino)].

### M3028 Internal Combustion Engines

( 3 - 0 - 8. Prerequisites: [ IQ2001 ]. 6 IDA11 )  
**Equivalence: M 95893**

This advanced course provides the concepts and tools needed to understand and model the function-

ing of internal combustion engines and the different technologies implemented to prevent and control pollution emissions. This course requires prior knowledge of thermodynamics and basic combustion. As a learning outcome, students will complete a capstone project in which they will model and optimize the performance of internal combustion engines and their different technologies for controlling pollution emissions.

**General objective:** Upon completion of this course, students will be able to model the workings of an internal combustion engine, and the different technologies implemented to prevent and control the emission of pollutants. Students will also be able to describe the new power sources available for automobiles.

**Key words:** Thermodynamic cycles. Environmental legislation. Fuels. Pollutant emissions. Emission control technologies. Engine performance.

**Bibliography:** \* Willard W. Pulkrabek, Engineering Fundamentals of the Internal Combustion Engine, Prentice-Hall, Inc, 1997, ING.

### M3029 Mold and Die Design

(3 - 0 - 8. Prerequisites: [ M2015 , M2030 ]. 8 IDA11)

**Equivalence: None**

This advanced course focuses on the application on manufacturing design and engineering concepts for the production of molds and tools for manufacturing plastic and metal products. This course requires prior knowledge of properties and selection of materials, manufacturing processes, CAD-CAM-CAE. The learning outcome of this course is for students to be able to design, manufacture and fine-tune molds for the manufacture of plastic products and tools for the cutting, embedding, stamping and forging processes for specific metal products.

**General objective:** Upon completion of this course, students will be able to design, create prototypes of, and manufacture dies for processing plastics and sheet metals involved in the manufacture of automotive parts through development of skills in selecting machining materials, geometry, mechanisms, and machining operations in the manufacture of metal dies.

**Key words:** Forging. Stamping. Molds. Toolcraft. Damos. Embedding. Die-casting.

**Bibliography:** \* Fundamentals of tool design / revised by John G. Nee ; reviews David Ardayfio., Dearborn, MI : Society Manufacturing Engineers, 1998., [18007334763].

### M3030 Vehicle Dynamics

(3 - 0 - 8. Prerequisites: [ M3027 , M3035 ]. 8 IDA11)

**Equivalence: None**

This is an advanced course in which students assess and optimize the performance of an automotive vehicle as a unit. The assessment is made from mechanical, energy (fuel consumption) and environmental perspectives. In addition, it allows students to define the minimum requirements of each component of the power train to achieve the desired mechanical, energy and environmental performance. It also allows them to define the minimum requirements for the brake system and steering system to achieve a desired specification. This course requires prior knowledge of dynamics. As a learning outcome, students will be able to complete an integrating project in which they will model, construct and optimize the performance, maneuverability and comfort of one of the components of the power train, suspension or transmission of a vehicle.

**General objective:** Upon completion of this course, students will be able to model the dynamic behavior of each of the parts of a vehicle (with the exception of the engine) and of the vehicle as a whole.

**Key words:** Brakes. Suspension. Acceleration capacity. Performance assessment. Drag loads. Rolling resistance. Steering systems. Powertrain.

**Bibliography:** \* Wong, J. Y. (Jo Yung), Theory of ground vehicles / J.Y. Wong., 3rd ed., New York : John Wiley, c2001., New York, c2001., eng, [0471354619 (tela : papel alcalino)].

### **M3034 Computer-aided Prototyping** ( 3 - 0 - 8. Prerequisites: None. 6 LDI11 )

**Equivalence: None**

This is an advanced level course, designed to provide students with knowledge of the methods and cutting-edge technologies used in the manufacture of prototypes during the development phase of new products. The students will understand the competitive advantages that the application of these technologies represents for the country's industry. Previous knowledge is required in surface modeling, the parameters of digital modeling, materials and processes. The learning outcome for this course is that the students plan and develop three-dimensional prototypes through a combination of various technologies.

**General objective:** On finishing this course, students will be able to apply different rapid prototyping technologies and digitize surfaces and three-dimensional objects; combine technologies to produce top quality prototypes in terms of appearance, materials, mechanisms and design solutions; understand the capacities of machines and of the programs used in the machine languages (numerical control machining centers and computer-aided manufacturing systems CAM); solve design problems using advanced prototype digitizing and manufacturing.

**Key words:** Rapid prototyping. Numerical control. Metal mechanics. Digitalization technologies. CMM Coordinate-Measuring Machines. Stereolithography. 3D printing. Rapid tooling. STL. FDM. SRP.

**Bibliography:** \* Virtual modeling and rapid manufacturing : advanced research in virtual and rapid prototyping / Paulo Jorge Bártolo . [et al.], London : Taylor & Francis, c2005., [0415390621].

### **M3035 Mechanical Vibrations** ( 3 - 0 - 8. Prerequisites: [ M2007 , MA2010 ]. 7

IDA11, 6 IME11 )

**Equivalence: M 00864**

This is an advanced course which enables students to employ mathematical tools and the fundamental concepts of particle and rigid body dynamics in or-

der to formulate movement equations, with the goal of studying and analyzing the dynamic vibration behavior of mechanical components and systems. The course includes activities and concepts related to mechanical design in order to contextualize the use of various techniques and tools involved in diverse areas, such as automotive engineering, aeronautics and manufacturing. Previous knowledge is required in differential equations, linear algebra and numerical methods. The learning outcome for this course is that the students employ the aforementioned tools and concepts to model and mathematically analyze the dynamic vibration behavior of mechanical components and systems. Similarly, students will use laboratory equipment to characterize vibration behavior and obtain essential information from the modal response of the system when subjected to different types of dynamic loads.

**General objective:** Upon completion of this course, students will be able to apply the necessary mathematical tools to model, analyze, design and evaluate mechanical components and/or systems of one or more degrees of freedom that are subjected to vibratory phenomena with or without perturbation; prepare and conduct experiments that allow them to observe and analyze the vibratory phenomena in mechanical systems in specific applications in the areas of automotive engineering, aeronautics, manufacturing operations, etc.

**Key words:** Modal analysis. Dynamic systems. Vibration analysis and control.

**Bibliography:** \* Rao, S. Singiresu., Mechanical vibrations / Singiresu S. Rao., 4th ed., Upper Saddle River, N.J. : Pearson/Prentice Hall, c2004., [0130489875].

### **M3036 Advanced Materials** ( 3 - 0 - 8. Prerequisites: [ M2014 ]. 8 IMA11 )

**Equivalence: None**

This is an advanced course that provides students with the bases for selecting engineering materials according to their electrical, magnetic, optical and thermal properties; analyzing and designing devices based on intelligent materials and analyzing nano-structured materials. The analysis process is carried

out using a green engineering approach and/or incorporating elements of material choice oriented toward green sustainability.

**General objective:** Upon completion of this course, students will be familiar with and be able to analyze smart materials (shape-memory alloys, magneto- and electro-rheological fluids, piezoelectric glass, etc) and advanced materials with non-linear behavior (high-performance elastomers, nanostructured polymers, etc); design and analyze devices based on smart materials.

**Key words:** Optical properties. Biomaterials. Polymers. Nanostructured materials. Green engineering. Thermal properties. Intelligent materials. Material selection. Electrical properties. Magnetic properties.

**Bibliography:** \* Askeland, Donald R., Ciencia e ingeniería de los materiales / Donald R. Askeland, Pradeep P. Phulé ; traducción, Virgilio González y Pozo, Gabriel Figueroa López., 4a ed., México, D. F. : Cengage Learning, c2004., spaeng, [9706863613],[9789706863614].

### M3037 Automotive Engineering Project

( 3 - 1 - 8. Prerequisites: None. 9 IDA11 )

**Equivalence:** None

This is an advanced course in which automotive projects will be carried out in the areas of technology and sustainable development, integrating the knowledge from the final third of the degree program. The course requires previous knowledge in design methodology, manufacturing processes, mechanical design, and engineering economics. The learning outcome for this course is that students solve real problems in the automotive area that will benefit the industrial sector and society and minimize the deterioration of the environment.

**General objective:** Upon completion of this course, students will be able to integrate their knowledge of automotive engineering acquired during the course of their studies, within the specialization of automotive engineering, in order to solve real-life situations through the virtual creation of a competitive product related to the automotive industry, using the avail-

able resources with optimal efficiency; know the procedures that will help them to reach a solution within a reasonable time frame and in which the different design stages are of utmost importance.

**Key words:** Automotive engineering.

**Bibliography:** \* Gillespie, T. D. (Thomas D.), Fundamentals of vehicle dynamics / Thomas D. Gillespie., Warrendale, PA : Society of Automotive Engineers, c1992., [1560911999].

### M3038 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 IDA11, 9 IMA11, 9 IME11 )

**Equivalence:** None

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## MA Mathematics

### MA1001 Introduction to Mathematics

( 6 - 0 - 16. Prerequisites: None. 0 ARQ11, 0 IA 11, 0 IAB11, 0 IBN11, 0 IBT11, 0 IC 11, 0 IDA11, 0 IDS11, 0 IFI11, 0 IIA11, 0 IID12, 0 IIN12, 0 IIS11, 0 IMA11, 0 IMD11, 0 IME11, 0 IMI11, 0 IMT11, 0 INCQ13, 0 INT11, 0 IQA11, 0 IQP11, 0 ISC11, 0 ISD11, 0 ITC11, 0 ITE11, 0 ITIC11, 0 ITS11, 0 LAD11, 0 LAE11, 0 LAF11, 0 LCDE11, 0 LCMD11, 0 LCPF11, 0 LCS11, 0 LDF11, 0 LDI11, 0 LDN11, 0 LDP11, 0 LEC11, 0 LED11, 0 LEF11, 0 LEM11, 0 LIN11, 0 LLE11, 0 LLN11, 0 LMC11, 0 LMI11, 0 LNB11, 0 LP 12, 0 LPL11, 0 LPM12, 0 LPO11, 0 LPS12, 0 LRI11, 0 MO 11 )

**Equivalence:** MA00801

This course helps students to adopt a reflective attitude that allows them to comprehend and appreciate the importance of Pre-University Mathematics for the scientific education they will be receiving on entering the field of Higher Mathematics, in particular, Calculus. The learning outcome of this course is for students to be able to solve problems that involve the concepts of algebra, analytic geometry and trigonometry, and model and solve problems of medium complexity by using the aforementioned disciplines.

**General objective:** Upon completion of this course, students will be able to manage the tools of algebra, analytical geometry, trigonometry, and the concepts of functions and their graphs effectively.

**Key words:** Analytical geometry. Graphing functions. Trigonometry. Functions. Algebra.

**Bibliography:** \* Stewart, James, 1941-, Cálculo de una variable : trascendentes tempranas / James Stewart ; traducción Andrés Sestier Bouclier., 4a ed., México : International Thompson, 2001., spaeng, [970686069X].

### MA1006 Probability and Statistics

( 3 - 0 - 8. Prerequisites: [ MA1004 , MA1017 ]. 3 IA 11, 4 IAB11, 5 IBN11, 5 IBT11, 4 IC 11, 4 IDA11, 3 IDS11, 3 IFI11, 5 IIA11, 4 IMA11, 6 IMD11, 4 IME11, 4 IMI11, 5 IMT11, 5 INCQ13, 3 INT11, 4 IQA11, 4 IQP11, 3 ISC11, 4 ISD11, 3 ITC11, 4 ITE11, 4 ITIC11, 4 ITS11 )

**Equivalence:** MA00835

This basic course develops students' capacity for abstraction and modeling, and ability to solve engineering problems that include uncertainty and the systematic use of the acquisition, ordering, analysis and interpretation of data for decision making using, as support, relevant informatics tools. This course requires prior knowledge of differential and integral calculus. As a learning outcome students will be able to solve problems that involve concepts of probability and statistics using the available informatics tools.

**General objective:** Upon completion of this course, students will understand the basic concepts of probability and problem solving using counting techniques, conditional probability, and discrete and continuous random variables and their distributions. Students will analyze a set of experimental data and make statistical inferences from the data.

**Key words:** Descriptive statistics. Random variables. Inferential statistics. Probability theory.

**Bibliography:** \* Johnson, Robert Russell, 1939-, Estadística elemental: Lo esencial/Robert Johnson y Patricia Kuby; traducción Jorge Humberto Romo Muñoz, 10ma Edición, México; Australia: Cengage Learning, 2008, español, [9789706868350],[9706868356].

### MA1008 Statistics for Research in the Social Sciences

( 3 - 0 - 8. Prerequisites: [ MA1001 ]. 2 LCMD11, 2 LCS11, 1 LDP11, 1 LLE11, 2 LMI11, 4 LP 12, 2 LPL11, 2 LPM12, 4 LPS12, 2 LRI11 )

**Equivalence:** MA00813, MA1000

This basic level course has the objective of developing students' capacity for abstraction and problem



solving in the area of statistics. It makes emphasis in the techniques most commonly used in social research. This course requires prior knowledge of basic algebra and functions. The learning outcome of this course is for students to apply the techniques of descriptive and inferential statistical analysis required to obtain information of interest about a set of data and the relations between them.

**General objective:** On completing the course the student will be able to understand the basic concepts of probability and statistics used to describe and allow for the evaluation of social situations, patterns and tendencies; apply the necessary techniques of descriptive and inferential statistical analysis to obtain information of interest about a set of data and the relations between them, with the help of statistical software (SPSS, SAS, MINITAB, etc.).

**Key words:** Descriptive statistics. Basic concepts of probability. Discrete and continuous random variables and their distributions. Parametric statistics. Non-parametric statistics.

**Bibliography:** \* Bluman, Allan G., Elementary statistics : a brief version / Allan G. Bluman., Boston : McGraw-Hill, c2000.

### MA1009 Mathematics for Design

( 3 - 0 - 8. Prerequisites: [ MA1001 ]. 1 ARQ11, 2 LAD11, 1 LCMD11, 1 LDI11 )

**Equivalence:** MA1011

It is a basic level course which has the purpose that the student acquires the concepts of differential and integral calculus, as well as fractal geometry, through algorithmic processes and the use of technology, in order to solve problems related to the design of objects and spaces that provide functionality and comfort to humans and their environment. It will promote innovation in various activities where real problems of space and form are handled. Previous knowledge of algebra, trigonometry, analytic geometry, Euclidean geometry and basic concepts of functions is required. As a learning outcome, students are expected to solve problems related to geometric modeling of various objects and to calculate quantities related to this, also will be familiar with algorithmic processes

and the use of technology.

**General objective:** Upon completion of this course, students will be able to comprehend the fundamental principles of differential and integral calculus; understand the basic principles of fractal geometry; be familiar with and utilize mathematical packages which permit construction of knowledge and facilitate modeling, performance, and processes in the problems to be solved; implement algorithmic processes as an effective tool for solving specific mathematical problems; value mathematics as a tool that will allow them to take an active part in solving problems in their profession.

**Key words:** Fractal geometry. Functions and their graphs. Integral. Derivate.

### MA1015 Mathematics I

( 3 - 0 - 8. Prerequisites: [ MA1001 ]. 1 IA 11, 1 IAB11, 1 IBN11, 1 IBT11, 1 IC 11, 1 IDA11, 1 IDS11, 1 IFI11, 1 IIA11, 1 IID12, 1 IIN12, 1 IIS11, 1 IMA11, 1 IMD11, 1 IME11, 1 IMI11, 1 IMT11, 1 INCQ13, 1 INT11, 1 IQA11, 1 IQP11, 1 ISC11, 1 ISD11, 1 ITC11, 1 ITE11, 1 ITIC11, 1 ITS11, 1 LAF11, 1 LDF11, 1 LEC11, 1 LEF11 )

**Equivalence:** MA1002, MA1012, MA1016

This is a basic level course that has the following purposes: a) To enable students to solve problems in the areas of business and engineering. These problems are related to the concept of change of a magnitude that depends on one independent variable, and b) to develop their critical thinking to generalize valid solution procedures for an associated application range. The course requires prior knowledge of algebra, analytical geometry, trigonometry and functions. As a result of learning, the student is expected to understand when a specific problem corresponds to Differential Calculus, use its concepts and procedures to solve the problem, and analyze the results, interpreting them in the context in which the problem arises, using computer resources if necessary.

**General objective:** Upon completion of this course, students will be able to recognize, in real situations, the variation of one given variable compared with another, and to represent mathematically and analyze the relationship between both variables, using



derivatives and including, as well, the analysis of the behavior of a function at infinity and the case when the function has infinite discontinuities.

**Key words:** Derivative rules: Chain rule, sum, product and quotient of functions. Polynomial, rational, exponential, logarithmic, trigonometric and hyperbolic functions. Limits and the Derivative as an instantaneous rate of change and as a quotient of differentials. Analysis of functions, infinite limits and limits at infinity and the Continuity of a function. Relative Extrema, inflection points, increasing and decreasing functions and concavity.

## MA1016 Mathematics I

( 3 - 0 - 8. Prerequisites: [ MA1001 ]. 1 LAE11, 1 LCDE11, 1 LCPF11, 1 LCS11, 1 LDN11, 2 LDP11, 3 LED11, 1 LEM11, 1 LIN11, 1 LLN11, 1 LMC11, 1 LMI11, 2 LP 12, 1 LPL11, 1 LPM12, 2 LPO11, 2 LPS12, 1 LRI11 )

**Equivalence:** MA1002, MA1003, MA1007, MA1012, MA1015

This is a basic course in the field of Mathematics, aimed at developing in students the skills of analysis, reflection and abstraction, by means of modeling and problem solving, in the areas of business and social sciences, where the use of single variable Differential Calculus is required, while allowing the student to formulate and provide quantitative back up for strategies that support decision-making processes. The course requires previous knowledge of Arithmetic, Basic Algebra, Analytic Geometry and basic principles of function plotting. As a result of the learning process, students are expected to solve medium-level problems, by using the appropriate mathematical language and the course content. Students should also be able to interpret the results and express them in correct verbal and written form.

**General objective:** Upon completion of this course, the student will be able to recognize, analyze and solve real-life problems by using single variable Differential Calculus; he will be able to use computer based programs to solve problems in the business and social sciences areas by using graphical, numerical and analytical analysis as well as solving optimi-

zation problems through the use of single variable Differential Calculus. To accomplish the above, the topics considered are: functions, limits and continuity, differentiation, related rates, and optimization of single variable functions.

**Key words:** Limits and continuity. Related rates. Optimization of single variable functions. Functions. Derivatives.

**Bibliography:** \* Haeussler, Ernest F., Matemáticas para administración y economía / Ernest F. Haeussler, Richard S. Paul, Richard W. Wood ; traducción, Jesús Elmer Murrieta Murrieta., 12a ed., México, D.F. : Pearson Education, 2008., spaeng, [9702611474], [9789702611479].

## MA1017 Mathematics II

( 3 - 0 - 8. Prerequisites: [ MA1015 ]. 2 IA 11, 2 IAB11, 2 IBN11, 2 IBT11, 2 IC 11, 2 IDA11, 2 IDS11, 2 IFI11, 2 IIA11, 2 IID12, 2 IIN12, 2 IIS11, 2 IMA11, 2 IMD11, 2 IME11, 2 IMI11, 2 IMT11, 2 INCQ13, 2 INT11, 2 IQA11, 2 IQP11, 2 ISC11, 2 ISD11, 2 ITC11, 2 ITE11, 2 ITIC11, 2 ITS11, 2 LAF11, 2 LDF11, 2 LEC11, 2 LEF11 )

**Equivalence:** MA1004

This is a basic level course aimed at developing in students the capacity for abstraction and the ability to solve problems involving the cumulative change of a fluctuating dimension, expressing and explaining this in terms of the Integral. The course requires previous knowledge of single variable differential calculus. As a result of learning, the student is expected to solve problems involving concepts of integral calculus, and to model and solve problems of medium complexity using integral calculus and computer resources for that purpose.

**General objective:** Upon completion of this course, students will be able to understand the concepts of definite integral and the differential; use the integral and its properties to solve problems; solve integrals using the integration techniques; comprehend the concepts of succession and series; and apply Taylor's theorem to solve problems that require approximation.

**Key words:** Integration methods. Indefinite integral

or antiderivatives family. Definite integral: accumulated change in an interval. Applications of integration. Series.

### **MA1018 Mathematics II**

( 3 - 0 - 8. Prerequisites: [ MA1016 ]. 2 LAE11, 2 LCDE11, 2 LCPF11, 2 LDN11, 2 LEM11, 2 LIN11, 2 LLN11, 2 LMC11 )

**Equivalence:** MA1005

This is a basic course in the field of mathematics, aimed at developing in students the skills of analysis, reflection and abstraction, by means of modeling and solving problems, in the areas of business and social sciences, that require the application of single variable integral calculus, multivariable differential calculus and matrix algebra, while allowing the student to formulate and provide quantitative back up for strategies that support decision-making processes. The course requires previous knowledge of arithmetic, basic algebra, graphical behavior of functions and single variable differential calculus. As a result of the learning process, students are expected to solve medium-level problems, by using the appropriate mathematical language and the course content. Students should also be able to interpret the results and express them in correct verbal and written form.

**General objective:** Upon completion of this course, the student will be able to solve basic optimization problems, with or without restrictions, using multivariable differential calculus; solve problems involving separable variable differential equations using basic concepts of single variable integral calculus; obtain accumulated change in a quantity and apply the tools of matrix algebra in order to solve problems that involve systems of linear equations. To accomplish the above, the topics considered are differential calculus, optimization, integrals, matrices, determinants and systems of linear equations.

**Key words:** Optimization. Indefinite Integral. Definite Integral. Multivariable differential calculus. Matrices, determinants and systems of linear equations.

**Bibliography:** \* Haeussler, Ernest F., Matemáticas para administración y economía / Ernest F. Haeussler, Richard S. Paul, Richard W. Wood ; traducción, Jesús Elmer Murrieta Murrieta., 12a ed., México, D.F. : Pearson Education, 2008., spaeng, [9702611474], [9789702611479].

### **MA1019 Linear Algebra**

( 3 - 0 - 8. Prerequisites: [ MA1017 ]. 5 IC 11, 5 IDA11, 4 IFI11, 5 IMA11, 5 IME11, 5 ISC11, 5 ITC11, 5 ITIC11 )

**Equivalence:** MA1010

This is an intermediate course aimed at providing the student with the theory and methodology of linear algebra that will allow him to recognize the processes that can be modeled by means of these fundamental concepts. The student will be able to identify problems, find solutions and apply the concepts of linear algebra to problems in the engineering field. Innovative activities that encourage students to maintain interest in learning and value the acquisition of a mathematical culture will be included. The course requires systems of linear equations, matrices and vectors knowledge. As a result, the student is expected to solve specific engineering problems from his area involving processes that can be solved using linear models.

**General objective:** At the end of the course, students will be able to understand the basics of linear algebra; recognize the processes that are modeled with linear algebra; identify the problems that occur in these models; propose the most suitable solutions; apply these solutions to engineering problems in a creative manner.

**Key words:** Real vector spaces. Linear transformations. Canonical forms. Linear spaces on  $R^n$ . Inner product spaces.

**Bibliography:** \* Nakos, George, 1954-, álgebra lineal con aplicaciones / George Nakos, David Joyner., México D.F. : International Thomson, 1999., spaeng, [9687529865].

## MA1020 Statistics I

( 3 - 0 - 8. Prerequisites: [ MA1017 , MA1017 Corequisite ]. 2 IIN12, 3 IIS11, 3 LAF11, 3 LEC11, 3 LEF11 )

**Equivalence:** MA1000

This basic course is intended to develop in students the ability to perform quantitative analysis in uncertain conditions. The course requires prior knowledge of the basic concepts of algebra of sets, series and differential and integral calculus of one variable. As a result of learning, the student is expected to make statistical inferences in situations of uncertainty in his field of study, using technological tools, as appropriate.

**General objective:** Upon completion of this course, students will be able to appreciate that statistics is a science whose methodology makes it possible to evaluate and judge discrepancies between reality and the mathematical models proposed to explain it; gain competencies in the systematic management of phenomena that involve random variations; develop critical thinking skills to understand the possibilities and limitations of experimental research.

**Key words:** Random variables. Descriptive statistics. Inferential statistics. Probability theory.

**Bibliography:** \* Wackerly, Dennis D., 1945-, Estadística matemática con aplicaciones / Dennis D. Wackerly, William Mendenhall III y Richard L. Scheaffer ; traducción Jorge Humberto Romo Muñoz., 7a ed., México D. F. : Cengage Learning Editores, 2010., spaeng, [9789708300100], [9708300101].

## MA1021 Applied Mathematics

( 3 - 0 - 8. Prerequisites: [ MA1009 ]. 4 LAD11 )

**Equivalence:** MA2005

The purpose of this basic course in design and digital animation is for students to understand and use linear transformations to solve problems related to the generation of dynamic-discrete objects through the use of technology. The course requires previous knowledge of programming, algebra, differential and integral calculus, and fractal geometry. The learning outcome of this course is for students to be able to

use linear transformations to animate previously designed objects using technology.

**General objective:** On completing this course the student will have a good command of algorithmic and logical processes related to animation using linear and similar transformations.

**Key words:** Linear transformations. Matrix algebra. Spatial geometry. Related transformations and applications.

**Bibliography:** \* Poole, David, Álgebra Lineal una Introducción Moderna, Thomson.

## MA2000 Mathematics for Economics I

( 3 - 0 - 8. Prerequisites: [ MA1004 , MA1017 ]. 3 LEC11, 3 LEF11 )

**Equivalence:** None

This is a basic course that is intended to develop the ability in the students for modeling and solving mathematical problems in their own fields of study. This objective will be achieved by solving problems related to mathematical optimization, in order to support the decision-making process. The course requires prior knowledge of single variable differential and integral calculus. As a result of learning, the student is expected to analyze and solve problems related to the field of Economics that involved the concepts of multivariable differential or integral calculus, statistical optimization and linear algebra.

**General objective:** At the end of the course the student will be able to apply concepts related to matrices and vectors and to solve operations involving them; apply concepts of linear algebra on solving linear equation systems, calculate determinants, characteristic values and vectors, and linear transformations; apply concepts of static optimization in order to solve optimization problems; apply calculus to obtain marginal values of economic variables.

**Key words:** Differential calculus of multivariate functions. Integral calculus of multivariable functions. Static optimization. Linear algebra. Lagrange multipliers.

**Bibliography:** \* C. Chiang, Alpha, Métodos fundamentales de economía matemática, Cuarta, McGraw Hill.

### MA2007 Random Processes

( 3 - 0 - 8. Prerequisites: [ MA1006 , TE2004 , MA1010 , MA3013 , MA1006 , TE2035 ]. 6 ITS11 )

**Equivalence:** None

This intermediate mathematics course applied to the field of electronics provides students with the tools required as a foundation for the development of electronic and telecommunication engineering. The students will become competent at conceptualizing and modeling stochastic systems in their own fields. These tools are required in order to analyze random signals, characterize noise, and assess the performance of telecommunication systems, as well as specify traffic issues, reliability and availability in communication networks. This course requires prior knowledge of linear algebra, complex variables, signal and system analysis, probability and statistics. As a learning outcome, students will be able to solve non-deterministic problems, understanding the random nature of electronic and telecommunication signals and systems by using stochastic and random signal and communication system processes and filtering processes.

**General objective:** Upon completion of this course, students will have developed the fundamental theoretical knowledge and the skills required to study signals as sets of random variables dependent on continuous and discrete time. Students will determine their characteristic functions, moments, and higher-order statistics. Students will also be able to evaluate the effect that linear systems have upon random signals. In addition, students, by learning about random processes such as the Poisson and the Gaussian processes, will be able to characterize aspects of systems and networks such as traffic, reliability, and availability, among others. This will provide students with a knowledge base so that they can determine the operation of electronic and telecommunication systems.

**Key words:** Random signal analysis. Spectral density. Traffic analysis. System reliability and availability.

**Bibliography:** \* Alberto Leon-Garcia, Probability, Statistics, and Random Processes for Electrical Engineers, 3rd Edition, Prentice Hall, Español, [9780131471221].

### MA2009 Mathematics III

( 3 - 0 - 8. Prerequisites: [ MA1017 ]. 3 IAB11, 3 IBN11, 3 IBT11, 3 IC 11, 3 IDA11, 3 IDS11, 3 IFI11, 3 IIA11, 3 IID12, 3 IIN12, 3 IIS11, 3 IMA11, 3 IMD11, 3 IME11, 3 IMI11, 3 IMT11, 3 INCQ13, 3 INT11, 3 IQA11, 3 IQP11, 3 ISC11, 3 ISD11, 3 ITC11, 3 ITE11, 3 ITIC11, 3 ITS11 )

**Equivalence:** MA2002

This is an intermediate course intended to facilitate understanding of Engineering situations and phenomena through the development of mathematical thinking related to the ideas of variation and change, and its application to solving engineering problems involving quantities that are related to several variables. The course requires prior knowledge of differential and integral calculus of single-variable functions and elementary vector algebra. As a result of learning, the student values, understands and uses infinitesimal arguments to study concepts and build engineering formulas involving quantities related to several variables, relying on technological resources as required.

**General objective:** Upon completion of this course, students will be able to use the concepts of gradient, rotational and divergence in a critical manner to study the nature of vector fields; use line, surface and volume integrals to solve problems involving vector fields; recognize the extensions of the Fundamental Theorem of Calculus for one variable and multiple variables: Stokes' Theorem, Gauss Theorem and the Fundamental Theorem for Line Integrals.

**Key words:** Interpretation of partial derivatives. Line, surface and volume integral calculus. Meaning of gradient. Rotational and divergence.

## MA2010 Differential Equations

( 3 - 0 - 8. Prerequisites: [ MA1017 ]. 5 IA 11, 4 IAB11, 4 IBN11, 4 IBT11, 3 IC 11, 4 IDA11, 4 IDS11, 3 IFI11, 3 IIA11, 4 IIN12, 4 IIS11, 4 IMA11, 3 IMD11, 4 IME11, 4 IMI11, 3 IMT11, 4 INCQ13, 4 INT11, 3 IQA11, 3 IQP11, 4 ISD11, 3 ITE11, 3 ITS11 )

**Equivalence:** MA2001

This intermediate course is intended to help students develop the ability to model and solve specific problems in the field of Engineering through Differential Equations. The course includes activities and innovative concepts for studying differential equations that increase the ways to solve problems, including using information technology tools that are available today. Students require prior knowledge of the ideas of change and accumulation, studied previously on differential and integral calculus courses. As a result of learning students are expected to understand the basics of differential equations, apply them and solve problems in which a differential equation models a real situation, eventually interpreting solutions in the real context.

**General objective:** Upon completion of this course, students will be able to identify and understand differential equations as a mathematical concept and as a model for studying particular phenomena in the area of engineering; use different methods to solve differential equations and understand the meaning of the solutions in terms of the problem in question.

**Key words:** Laplace transform. Introduction to ordinary differential equations: qualitative, numeric and analytic approach. Ordinary differential equations (first order, second order and higher order). Introduction to partial differential equations. Differential equation systems.

**Bibliography:** \* Zill, Dennis G., 1940-, Ecuaciones diferenciales con aplicaciones de modelado / Dennis G. Zill ; traducción Ana Elizabeth García Hernández., 9a ed., México : Cengage Learning, 2009., spaeng, [9789708300551],[9708300551].

## MA2011 Statistics II

( 3 - 0 - 8. Prerequisites: [ MA1020 ]. 5 IIN12, 4 IIS11, 4 LEC11, 4 LEF11 )

**Equivalence:** MA2004

This is an intermediate course, designed to provide students with the ability to construct statistical procedures as part of the quantitative methods that are useful for decision making in uncertain situations and in formulating critical judgments. The course requires basic knowledge of probability theory and statistical inference, as well as differential and integral calculus for several variables and power series. As a learning result, students are expected to apply the quantitative methods in uncertain situations that involve more than one variable and are related to the specific area of study as a tool for decision making; construct distributions of random variable functions and obtain interval estimators and/or hypothesis tests using technological tools whenever needed; and recognize the scope and limitations of statistical models and methods.

**General objective:** Upon completion of this course, students will be able to appreciate that statistics is a science whose methodology makes it possible to evaluate and judge discrepancies between reality and the mathematical models proposed to explain it; gain competencies in the systematic management of phenomena that involve random variations; develop critical thinking skills to understand the possibilities and limitations of experimental research. **Key words:** Multivariate distributions. Functions of random variables. Theory of point and interval estimation. Hypothesis testing theory.

**Bibliography:** \* Wackerly, Dennis D., 1945-, Estadística matemática con aplicaciones / Dennis D. Wackerly, William Mendenhall III y Richard L. Scheaffer ; traducción Jorge Humberto Romo Muñoz., 7a ed., México D. F. : Cengage Learning Editores, 2010., spaeng, [9789708300100], [9708300101].



**MA3001 Mathematics for Economics II**  
( 3 - 0 - 8. Prerequisites: [ MA2000 ]. 4 LEC11, 4 LEF11 )

**Equivalence:** None

The aim of this intermediate-level course is to model, solve and interpret the solutions to problems in economics that require differential equations, difference equations and, more generally, dynamic analysis. This course requires prior knowledge of single- and multi-variable differential and integral calculus, linear algebra and optimization.

**General objective:** At the end of this course the student will be able to apply mathematical models of differential and difference equations, as well as optimization methods, to several models of economics.

**Key words:** Dynamic optimization. Difference equations. Differential equations. Systems of differential equations.

**Bibliography:** \* Chiang, Alpha C., 1927-, Métodos fundamentales de economía matemática / Alpha C. Chiang, Kevin Wainwright ; traducción Francisco Sánchez Frago, Raúl Arrijo Juárez., 4a ed. en español., México, D.F. : McGraw-Hill Interamericana, c2006., spaeng, [9701056140], [9789701056141].

**MA3002 Advanced Mathematics**  
( 3 - 0 - 8. Prerequisites: [ MA2009 ]. 4 IMD11, 4 IMT11, 5 ISD11, 5 ITE11, 4 ITS11 )

**Equivalence:** MA2003

This is an advanced course aimed to help students to understand the mathematical concepts of complex variable and the methodologies of linear algebra and be able to apply these concepts to engineering problems using the appropriate information technologies to solve them. The course requires prior knowledge of calculus of several variables and vector calculus. As a result of taking this course, students will solve problems involving the use of complex variable functions and systems of linear equations. There will be activities that will be performed individually and in teams, inside and outside the classroom. Such activities will help the student to reinforce the concepts reviewed in class.

**General objective:** Upon completion of this course, students will be able to formulate and solve real engineering problems using their mathematical knowledge; use mathematical methodologies to analyze and solve engineering-related problems; use computer tools to solve engineering problems.

**Key words:** Linear transformations. Real vector spaces and their properties. Complex numbers and complex-valued functions. Derivatives and line integrals of complex-valued functions. Methods for solving linear equation systems.

**Bibliography:** \* O'Neil, Peter., Matemáticas Avanzadas para Ingeniería, 6a Edición, México: CENGAGE Learning 2007.



**MB Medical Sciences****MB2036 Pathophysiology of the Endocrine System**

( 3 - 0 - 8. Prerequisites: [ MB2038 Corequisite , MB2038 , MD1045 ]. 5 MC 11 )

**Equivalence: None**

This is an intermediate course intended to teach students the basic principles of hormone action and regulation, chemical signaling, the chemical classification of hormones and their synthesis mechanisms, the concept of surface and intracellular receptors as well as the etiology, pathogenesis and pathophysiological processes associated with various diseases of the endocrine system in humans, identifying the abnormal conditions affecting the endocrine glands in their various roles and anatomical structure, as well as the changes that occur at different stages of life and in specific diseases. The course requires basic knowledge of the physiology of the endocrine system and its interaction with other body systems. As a result of learning the student is expected to apply the fundamental concepts of the normal endocrine system by solving problems based on actual or hypothetical cases related to the pathogenesis of the main diseases of the endocrine system; identifying the etiology of the most common problems; applying the principles that govern the systemic pathophysiological processes; and using the skills developed in previous courses of Basic Sciences and aimed at applying these skills to the study of Clinical Sciences.

**General objective:** Students will be able to identify the key components of the endocrine system, mechanisms of action and hormone regulation, chemical signaling processes and mechanisms of hormone synthesis, transport systems within the circulatory system, and concepts of membrane and intracellular receptors; describe the etiology, pathogenesis and pathophysiological processes related to various disorders of the endocrine system and their major complications; and acquiring, on their own, essential knowledge of medical practice, by problem solving, reviewing clinical cases and searching systematically for valid and up-to-date medical information on topics related to the pathophysiology of the endocrine system.

**Key words:** Endocrine physiopathology. Hormone. Hypopituitarism. Cushing. Addison. Diabetes Mellitus. Hyperthyroidism. Endocrinology.

**Bibliography:** \* Kronenberg Henry, Williams Textbook of Endocrinology, 11a , Saunders, [9781416029113].

**MB2037 Morphological and Functional Pathology I**

( 2 - 2 - 8. Prerequisites: [ MD1031 , MD1033 ]. 5 MC 11 )

**Equivalence: None**

This is an intermediate course aimed at teaching students about the microscopic and macroscopic morphologic alterations of the main mechanisms of damage, repair and cellular adaptation, as well as the different types of inflammatory processes, neoplastic transformation, and the main pathologies of the endocrine system. The course requires basic knowledge of histology and morphophysiology. As a learning outcome the student is expected to identify and explain contextually the anatomopathological and histopathological changes in the basic pathophysiological processes of general pathology and pathology of the endocrine system, based on actual or hypothetical cases.

**General objective:** Upon completion of this course, students will be able to understand the anatomical and histological changes related to the fundamental pathophysiological processes of general pathology and endocrine system pathology and illustrated by actual or hypothetical cases; identify and describe the macroscopic and microscopic characteristics of general pathology and of anatomical and histological alterations related to the fundamental pathophysiological processes of endocrine disease illustrated by actual or hypothetical cases; interpret the meaning of the most relevant pathological abnormalities of general pathology linking these to the underlying pathophysiological mechanism and of abnormalities in the endocrine system illustrated by actual or hypothetical cases.

**Key words:** Pathophysiology. Cell injury. Oncogenesis. Inflammation. Pathology. Endocrine pathology.

**Bibliography:** \* Robbins and Cotran pathologic basis of disease / Vinay Kumar . [et al.] ; with illustrations by James A. Perkins., 8th ed. , Philadelphia, PA : Saunders/Elsevier, c2010., [9781416031215],[1416031219],[9780808924029 (International ed.)],[ 0808924028 (International ed.)], [9781437707922 (Professional ed.)], [1437707920 (Professional ed.)].

### MB2038 Pathophysiology

( 5 - 0 - 12. Prerequisites: [ MD1035 , MD1045 , MD1043 ]. 5 MC 11 )

**Equivalence:** None

This is an intermediate course intended to teach students the basics of Immunopathology, as well as the pathophysiological mechanisms that cause genetic and hematological disorders. The course requires basic knowledge of Immunology, Cell Biology, Genetics, Hematology and Physiology of the lymphoreticular system. As a result of learning, the student is expected to solve problems based on actual or hypothetical cases, related to immunopathological processes, the pathophysiology of genetic disorders, hematologic and lympho-reticular, applying the principles that govern systemic pathophysiological processes and using the skills developed in the study of Medical Sciences.

**General objective:** Upon completion of this course, students will know the basics of Immunopathology; identify the fundamental production mechanisms for genetic, hematologic and lympho-reticular diseases, describing the major pathophysiological processes and the pathogenesis of these diseases and developing the ability to obtain, on their own, fundamental knowledge of these disciplines based on solving problems, reviewing simulated clinical cases and searching systematically for valid medical information, thus building the ethical and moral foundation for medical practice.

**Key words:** Immunology. Pathophysiological processes. Immunopathology. Hematology. Genetics.

**Bibliography:** \* Inmunología básica y clínica / Tristram G. Parslow . [et al.] ; traducción de Germán Arias

Rebatet., 10a ed. en español., México : Manual Moderno, 2002., spaeng, [9684269978].

### MB2039 History Taking and Clinical Examination II

( 2 - 2 - 8. Prerequisites: [ MD1046 ]. 5 MC 11 )

**Equivalence:** None

This is an intermediate course, which enables students to develop their clinical skills in taking patient histories and performing physical examinations, in order to obtain the relevant clinical information that will form the basis of the diagnosis, as well as the skills required to document the following information in the patient's Clinical History file, in accordance with the OFFICIAL MEXICAN REGULATION NOM 168 SSA1 1998, OF THE CLINICAL RECORDS, for specific groups of patients, according to their life stage: newborn, child, teenager, pregnant woman and adult. Previous knowledge is required in writing, oral and written communication and general history taking. The learning outcome for this course is for students to demonstrate the skills required to establish a doctor-patient relationship, and take the full patient history and perform the general physical examination of patients at various stages of life.

**General objective:** Upon completion of this course, fifth-semester students will be able to apply interview skills and techniques for physical examination of patients at different stages of life: infant, child, adolescent, pregnant woman and elderly adult; and establish an adequate doctor-patient relationship.

**Key words:** Medical questioning. Medical examination techniques.

**Bibliography:** \* McMillan, Oski's Pediatrics: Principles and Practice, 4a. edición, Lippincott Williams & Wilkins, [9780781738941].

### MB2040 Applied Pharmacology

( 3 - 0 - 8. Prerequisites: [ MD1044 ]. 6 MC 11 )

**Equivalence:** None

This is an intermediate course that is intended to teach students about the general principles that govern pharmacological treatment of the most common

clinical entities, as part of clinical practice. The course requires basic knowledge of general Pharmacology, including the general principles of pharmacokinetics, pharmacodynamics, metabolism and elimination of drugs. As a learning outcome, the student is expected to solve problems based on actual or hypothetical cases related to making decisions concerning the most suitable pharmacological treatment, or contraindicated treatment in certain cases, for the most common entities in clinical practice. Students are also expected to know the basic principles that govern decision making in pharmacology, including action mechanism, dose, interactions brought on by medications, side and adverse effects and the therapeutic index of the main drugs used in treating these entities, applying the basic principles learned during basic Pharmacology and focusing on applying the competencies acquired during the clinical clerkships.

**General objective:** On finishing the course, students will be able to describe the most important drugs in everyday use in clinical practice with respect to the treatment of diseases of the central and autonomous nervous system, cardiovascular system, hematopoietic system, neoplasms, endocrine system, digestive tract and nutritional process, as well as entities of the respiratory tract, including the pharmacology of infectious and parasitic processes, identifying the main action mechanisms, therapeutic indices, side effects, adverse effects, and health risks.

**Key words:** Treatment. Applied pharmacology. Therapeutics.

**Bibliography:** \* Goodman & Gilman's the pharmacological basis of therapeutics., 11th ed. /editor, Laurence L. Brunton; associate editors, John S. Lazo, Keith L. Parker., New York : McGraw-Hill, c2006., [0071422803].

### **MB2041 Pathophysiology of the Digestive System and Nutrition**

( 3 - 0 - 8. Prerequisites: [ MB2038 , MD1040 ]. 6 MC 11 )

**Equivalence: None**

This is an intermediate course intended to help students apply knowledge to the field of nutrition and

the digestive system, and also develop critical thinking, self-learning and teamwork skills. The course requires basic knowledge of the structure and physiology of the digestive system and of biochemistry and metabolism. As a learning outcome, students are expected to be able to use their critical thinking skills in discussing and resolving clinical cases, making use of the application of knowledge through evidence-based medicine.

**General objective:** On finishing the course, students will be able to understand the pathophysiological mechanisms of the most common diseases of the gastrointestinal system, including the processes of ingestion, digestion and absorption of nutrients, as well as nutritional processes during the life cycle, assessment of nutritional status and medical nutritional therapy for the most common diseases of different apparatus and systems, through discussion of problems; develop self-management and critical thinking skills through discussion of problems, review of clinical cases and the systematic search for reliable health information; assess the impact of nutritional and gastrointestinal diseases on the health of patients and their families, and the importance of nutritional education; behave ethically and professionally within the classroom and in accordance with the rules of the academic institution.

**Key words:** Gastroenterology. Nutrition. Parasitology. Gastrointestinal pathophysiology. Medical nutritional therapy.

**Bibliography:** \* Krause's food & nutrition therapy / [edited by] L. Kathleen Mahan, Sylvia Escott-Stump., 12th ed., St. Louis, Mo. : Saunders/Elsevier, c2008., [9781416034018].

### **MB2042 Renal Pathophysiology**

( 3 - 0 - 8. Prerequisites: [ MB2038 , MD1040 ]. 6 MC 11 )

**Equivalence: None**

This is an intermediate course intended to allow students to review and update their knowledge of the structure and normal function of the kidneys and electrolyte balance, as well as identify and describe the pathophysiological mechanisms of renal disease and different manifestations of electrolyte

imbalance. The course requires basic knowledge of anatomy, physiology and renal histology, and body homeostasis. As a learning outcome, students are expected to solve problems based on real or hypothetical cases related to the pathogenesis of major renal diseases and electrolyte imbalance in its various manifestations, identifying the etiology of the most frequent alterations, applying the principles governing the pathophysiological systemic processes, using the skills developed in previous pathophysiological process and basic science courses and applying these skills to the study of Clinical Sciences.

**General objective:** On finishing the course, students will be able to identify the etiology, pathogenesis and pathophysiological processes related to various kidney disorders and electrolyte imbalance, understanding the fundamental mechanisms of development of renal disease and body fluids at cellular, tissue, organ and systems level, recognizing the complications and consequences of these entities, and acquiring, on their own, essential knowledge required for practicing medicine, based on problem solving, reviewing clinical cases and systematically searching for up-to-date medical information on topics related to renal pathophysiology and body fluids.

**Key words:** Nephrology. Renal physiology. Renal pathophysiology. Electrolyte imbalance. Alkalosis and metabolic acidosis.

**Bibliography:** \* Eaton Douglas, Fisiología Renal de Vander, 6ª Edición, McGraw-Hill, [9789701056417].

### **MB2043 Community Research** ( 2 - 2 - 8. Prerequisites: [ MB2057 ]. 6 MC 11 ) **Equivalence: None**

This is an intermediate course that is intended to integrate community work set out in the curriculum by carrying out field research in the area of health, basing this on different population groups in the locality. As a learning outcome, students are expected to obtain scientific research assignments that they can publish and promulgate in national and international forums.

**General objective:** On finishing the course, students will be able to implement research protocols in the

fields of Otolaryngology, Ophthalmology, Diabetes and Hypertension, until they obtain a scientific document and publish it at national and international level. Another objective of this course is for students to successfully implement educational and training activities for volunteer health promoters in the locality, providing a copy of the information obtained in each community intervention.

**Key words:** Research protocols. Community interventions. National and international forums. Field research.

**Bibliography:** \* Tapia Conyer, Roberto, El manual de salud pública/Roberto Tapia Conyer, 2ª ed., México: Ed. Intersistemas, 2006., [9789706558619],[9706558616].

### **MB2044 Morphological and Functional Pathology II** ( 2 - 2 - 8. Prerequisites: [ MB2037 ]. 6 MC 11 ) **Equivalence: None**

This is an intermediate course intended to teach students about microscopic and macroscopic morphological alterations of the main pathologies of renal and digestive systems. The course requires basic knowledge of histology, pathology and basic morphophysiology. As a learning outcome, the student is expected to identify and explain contextually the pathological and histopathological alterations of renal and digestive systems, based on actual or hypothetical cases.

**General objective:** On finishing the course, students will be able to understand the anatomopathological and histological changes related to the fundamental pathophysiological processes of the renal and digestive systems illustrated with actual or hypothetical cases; identify and describe the macroscopic and microscopic characteristics of the anatomopathological and histological changes related to the fundamental pathophysiology processes of the pathology of renal and digestive systems illustrated with actual or hypothetical cases; interpret the meaning of the most relevant anatomopathological and histopathological anomalies of the renal and digestive systems illustrated with actual or hypothetical cases.

**Key words:** Pathophysiology. Cell injury. Oncogenesis. Inflammation. Pathology.

**Bibliography:** \* Robbins and Cotran pathologic basis of disease / Vinay Kumar . [et al.] ; with illustrations by James A. Perkins., 8th ed. , Philadelphia, PA : Saunders/Elsevier, c2010., [9781416031215],[1416031219],[9780808924029 (International ed.)],[0808924028 (International ed.)], [9781437707922 (Professional ed.)], [1437707920 (Professional ed.)].

### **MB2045 Health Psychology**

**( 3 - 0 - 8. Prerequisites: None. 6 LNB11, 6 MC 11, 8 MO 11 )**

**Equivalence: None**

This is an intermediate course aimed at helping students integrate the psychological perspective with comprehensive preventive or corrective treatment of the patient, considering the dynamic concept of health and disease that allows for effective use of psychological tools in clinical practice. The course requires basic knowledge of the historical and social context and the scope of their profession. As a result of learning, students are expected to analyze holistically cases related to the integral care of patients in different areas and specialties.

**General objective:** On finishing the course, students will understand the fundamental aspects of the psychology of both normal and abnormal human development; identify and analyze the psychological aspects of the relationship between health professionals, patients and family members; know the tools that psychology provides to attend to patients who seek health care in specific areas of application, such as nutrition, dentistry, medicine, nursing and health management, in an integral manner.

**Key words:** Concept of health and disease. Psychological development. Psychological tools. Relationship between health professional and patient.

**Bibliography:** \* Laín Entralgo, Pedro., La relación médico-enfermo : historia y teoría / Pedro Laín Entralgo., 1a ed., Madrid : Alianza Editorial, 1983., Spain, 1983., spa, [8420623709],[9788420623702].

### **MB2046 Pathophysiology of the Circulatory System**

**( 3 - 0 - 8. Prerequisites: [ MB2038 , MB2042 ]. 7 MC 11 )**

**Equivalence: None**

This is an intermediate course intended to allow students to review and update their knowledge of the structure and normal function of the circulatory system in general and the heart in particular, identifying and describing the pathophysiological mechanisms of cardiovascular disease in its spectrum of manifestations. The course requires basic knowledge of anatomy and physiology of the heart and circulatory system, as well as the regulatory mechanisms involved in the kidney. As a result of learning, the student is expected to solve problems based on real or hypothetical cases related to the pathogenesis of the main diseases of the heart and blood vessels, identifying the etiology of the most frequent alterations, applying the principles that govern systemic pathophysiological processes, using the skills developed in previous courses in pathophysiological processes and Basic Sciences and oriented towards applying these skills to the study of Clinical Sciences.

**General objective:** On finishing the course, students will be able to identify the etiology, pathogenesis and pathophysiological processes related to various disorders of the heart and vascular system, understanding the fundamental mechanisms of cardiovascular disease at cellular, tissue, organ and systemic levels, recognizing the complications and consequences specific to these clinical entities, acquiring, on their own, essential knowledge required for practicing medicine, based on solving problems, reviewing clinical cases, and systematically searching for valid and updated health information on issues related to the pathophysiology of the circulatory system.

**Key words:** Cardiovascular physiology. Cardiovascular pathophysiology. Pathophysiology of the heart. Blood pathophysiology. Venous pathophysiology.

**Bibliography:** \* Libby Peter MD, Bonow Robert, Braunwald's Heart Disease. A Textbook of Cardiovascular Medicine, 8th, Saunders Elsevier, [9781415041078].



## MB2047 Pathophysiology of Respiratory System

( 3 - 0 - 8. Prerequisites: [ MB2038 , MB2042 ]. 7 MC 11 )

**Equivalence: None**

This is an intermediate course intended to allow students to review and update their knowledge of the structure and normal function of the respiratory system, identifying and describing the pathophysiological mechanisms of respiratory tract illness and pulmonology in its various forms. The course requires basic knowledge of anatomy and physiology of the heart and circulatory system, respiratory system and regulatory mechanisms involved in the kidney. As a result of learning, the student is expected to solve problems based on actual or hypothetical cases related to the pathogenesis of the main diseases of the respiratory tract and lungs, identifying the etiology of the most frequent alterations, applying the principles governing systemic pathophysiological processes, using the skills developed in previous courses of pathophysiological processes and Basic Sciences and oriented to applying these skills to the study of Clinical Sciences.

**General objective:** On finishing the course, students will be able to identify the etiology, pathogenesis and pathophysiological processes related to various disorders of the pulmonary system and respiratory tract, understanding how the basic mechanisms of respiratory disease develop at cellular, tissue, organ and systemic levels, recognizing the complications and consequences of these clinical entities, acquiring, on their own, essential knowledge required for practicing medicine, based on solving problems, reviewing clinical cases, and systematically searching for valid and updated health information on issues related to the pathophysiology of the respiratory system.

**Key words:** Physiology of the respiratory system. Pulmonary pathophysiology. Pathophysiology of the airways.

**Bibliography:** \* West, John B. (John Burnard), Pulmonary physiology and pathophysiology : an integrated, case-based approach / John B. West., 2nd ed., Philadelphia : Wolters Kluwer Health/Lippincott Williams & Wilkins, c2007., [0781767016], [9780781767019].

## MB2048 Clinical Pathology Laboratory ( 0 - 3 - 4. Prerequisites: [ MB2038 ]. 7 MC 11 )

**Equivalence: None**

This clinical pathology laboratory is an intermediate course in which students acquire the knowledge, skills, and attitudes required to understand, select, and interpret the laboratory analyses and laboratory tests for various diseases, appreciating the importance of laboratory tests to apply preventive measures for improving individual or community health. Previous knowledge of physiopathology is required. As a learning outcome, students will present a portfolio of evidence, which includes laboratory studies of real or simulated clinical cases.

**General objective:** The student will be able to identify, select and interpret the laboratory analyses and methods used for the most common diseases in medical practice; understand the basic functional mechanisms of the equipment and technology used in the laboratory tests and blood bank; apply critical thinking and clinical reasoning skills in the selection of the diagnostic tests to establish a clinical diagnosis of the most common diseases; value the importance of the application of laboratory methods in the diagnosis of diseases and their impact as preventive measures to improve individual and community health.

**Key words:** Clinical management of blood banks. Diagnosis of immunological diseases. Diagnosis of hematological diseases. Diagnose of infectious diseases using microbiological methods.

**Bibliography:** \* Henry's clinical diagnosis and management by laboratory methods / [edited by] Richard A. McPherson, Matthew R. Pincus., 21st ed. , Philadelphia, PA. : Saunders/Elsevier, c2007., [9781416002871], [1416002871].

## MB2049 Legal and Forensic Medicine

( 3 - 0 - 8. Prerequisites: None. 7 MC 11 )

**Equivalence: None**

This intermediate course is intended to teach students the basic principles and main regulations governing the nation's legal and forensic medicine. The course requires prior knowledge of anatomy, physiology, pathology and pathophysiology. As a result of learning, the student is expected to solve clinical



cases, problems and ethical dilemmas related to the forensic aspects of medicine.

**General objective:** The student will be able to understand the role of forensic medicine in order to help obtain justice in civil, penal and labor problems; analyze the main causes of violent death, determining the mechanism, cause and manner of occurrence, as well as the importance in the diagnosis of legal clinical problems related to delinquency in order to produce medical reports, certificates and verbal assistance; value the physician's moral and ethical roles and professional responsibility.

**Key words:** Legal medicine. Forensic medicine. Professional accountability.

**Bibliography:** \* Gisbert Calabuig, Juan Antonio, *Medicina legal y toxicología*, 6a., Elsevier, [9788445814154].

### **MB2050 Pre-hospitalization Care and Clinical Skills**

( 2 - 2 - 8. Prerequisites: None. 7 MC 11, 6 MO 11 )

**Equivalence: None**

This is an intermediate course intended to help students develop the skills required to care for patients in a prehospital environment, applying first aid and cardiopulmonary resuscitation procedures swiftly and skillfully; interpret accurately the most common electrocardiographic changes in cardiovascular pathophysiology; understand the basic principles of radiological interpretation, being able to identify normal structures common in plain radiographs; and understand the most common protocols for development in a hospital setting. The course requires clinical skills to interview and carry out physical examination of patients at different stages of life in pre-hospital settings, as well as basic knowledge of body structure and function. As a result of learning, the student is expected to solve problems based on real or hypothetical cases, applying skills to care for patients in the prehospital environment, demonstrating skill in the practice of cardiopulmonary resuscitation and the administration of first aid patient care; as well as being able to identify normal elements of an electrocardiogram and its variations, and normal anatomical structures in plain radiographs. Finally students are

expected to know the bases that regulate and promote a healthy hospital life between the health team and the relationship with patients and their families.

**General objective:** On finishing the course, students will be able to practice cardiopulmonary resuscitation, administer basic first aid, interpret ECG changes and the most common normal radiographic images in simulated or real models, in a prehospital or hospital setting, while able to carry out the basic protocols that govern hospital life.

**Key words:** Clinical skills. Medical emergencies. Pre-hospital medicine. Basic electrocardiography. Hospital life.

**Bibliography:** \* Limmer D, O'Keefe M, Grant H, Murray B, Bergeron JD, Dickinson E., *Emergency Care*, 11th, Prentice Hall., [978-0135005231].

### **MB2051 Morphological and Functional Pathology III**

( 2 - 2 - 8. Prerequisites: [ MB2037 , MB2044 ]. 7 MC 11 )

**Equivalence: None**

This is an intermediate course intended to teach students about the microscopic and macroscopic morphologic alterations of the main diseases of the respiratory and cardiovascular systems. The course requires basic knowledge of histology, morphophysiology and basic pathology. As a learning outcome, the student is expected to identify and explain contextually the pathological and histopathological alterations of fundamental pathophysiological processes of the pathology of the respirator and cardiovascular systems, based on actual or hypothetical cases.

**General objective:** On finishing the course, students will be able to understand the anatomopathological and histopathological changes related to the fundamental pathophysiological processes of respiratory and cardiovascular systems illustrated with actual or hypothetical cases; identify and describe the macroscopic and microscopic characteristics of anatomopathological and histopathological alterations related to the fundamental pathophysiology of respiratory and cardiovascular systems illustrated with actual or hypothetical cases; interpret the meaning of the

most important pathological and histopathologic abnormalities of the respiratory and cardiovascular systems illustrated with real or hypothetical cases.

**Key words:** Cell injury. Oncogenesis. Inflammation. Pathology. Physiopathology.

**Bibliography:** \* Robbins and Cotran pathologic basis of disease / Vinay Kumar . [et al.] ; with illustrations by James A. Perkins., 8th ed. , Philadelphia, PA : Saunders/Elsevier, c2010., [9781416031215], [1416031219], [9780808924029 (International ed.)], [0808924028 (International ed.)], [9781437707922 (Professional ed.)], [1437707920 (Professional ed.)].

### **MB2052 Global Health and Preventive Medicine**

( 2 - 0 - 4. Prerequisites: None. 6 LNB11, 8 MC 11, 7 MO 11 )

**Equivalence:** MB2035

This is an intermediate course intended to allow students to familiarize themselves with the concept of global health and recognize its importance in the context of preventive medical attention in a globalized framework, with primordial emphasis on human and social sustainable development. This course requires prior knowledge of the historical bases of health sciences, community, and humanistic and civic formation competencies. The learning outcome of this course is for students to prepare an evaluative report, which also offers proposals, oriented to identifying areas of opportunity and challenges that exist in the field of global health, reflecting their understanding of the determinants of public health; transnational health problems and their economic and social consequences; methods and indicators for measuring a state of health; and their knowledge of health systems and international policies.

**General objective:** On finishing the course, students will be able to define basic global health concepts and recognize the aspects that distinguish these from other healthcare systems; demonstrate an understanding of the determinants of public health and its needs in a global context and with significant differences in the Human Development indicators between the different global players, understanding the specific value of the more common patholo-

gies and their incidence in local, national and global health systems; link health, education, equity, labor productivity and economic and social development and understand the functioning, advantages and disadvantages of the different health systems; identify techniques and methods to carry out an evaluation of individual health status in different countries, the factors that determine health, and how to address health problems in a cost-effective and efficient way; identify areas of opportunity and challenges related to global health.

**Key words:** Global health. Measurement of health status. Ethics and human rights in global health. Improving global health.

**Bibliography:** \* Skolnik, Richard L., Essentials of global health / Richard Skolnik., Sudbury, Mass. : Jones and Bartlett Publishers, c2008., [9780763734213 (paper alcalino)], [0763734217 (paper alcalino)].

### **MB2053 Pathophysiology of Nervous System**

( 3 - 0 - 8. Prerequisites: [ MB2038 , MB2046 , MB2047 ]. 8 MC 11 )

**Equivalence:** None

This intermediate course is aimed at providing students with an understanding of the mechanisms of common pathophysiological processes that give rise to diseases in the nervous, visual and auditory systems as seen in general medical practice. The course requires basic knowledge of the normal structure and function of the nervous, visual and auditory systems. As a result of learning the student is expected to solve problems based on real and designed cases that focus on the fundamental mechanisms of injury and disease in the nervous, visual and auditory systems, using the principles governing the study of pathophysiological processes of the nervous system and applying the skills developed in this course in the study of Clinical Sciences.

**General objective:** On finishing the course, students will be able to understand the fundamental mechanisms of neurological, visual, and auditory pathophysiological processes, including central and peripheral abnormalities; understand the pathogenesis of neurological diseases at upper and lower motor

neuron levels, vascular and degenerative brain diseases; and acquiring, on their own, essential knowledge required for practicing medicine, based on solving problems, reviewing clinical cases, and systematically searching for valid medical information.

**Key words:** Neurology. Pathophysiology of the nervous system.

**Bibliography:** \* Ropper, Allan H., Adams and Victor's principles of neurology / Allan H. Ropper, Martin A. Samuels., 9th ed., New York : McGraw-Hill Medical, c2009., [9780071499927 (encuadernado: papel alcalino)], [007149992X (encuadernado: papel alcalino)].

### **MB2054 Pathophysiology of Reproductive System**

( 3 - 0 - 8. Prerequisites: [ MB2046 , MB2047 ]. 8 MC 11 )

**Equivalence: None**

This intermediate course is intended to teach students about the etiology and pathogenesis, as well as pathophysiological processes associated with various diseases of the reproductive system in humans, identifying the conditions that affect the various functions of the reproductive systems in males and females and their anatomical structure, as well as normal changes during pregnancy and the main complications. The course also aims to teach students about the etiology and pathogenesis, as well as pathophysiological processes associated with growth and prenatal and postnatal development. The course requires basic knowledge of reproductive physiology and growth and development, and the pathophysiology of the endocrine system. As a result of learning, the student is expected to solve problems based on actual or hypothetical cases related to the pathogenesis of the main diseases of the reproductive system, pregnancy and growth and development, identifying the etiology of the most common alterations, applying the principles governing systemic pathophysiological processes, using the skills developed in previous courses of Pathophysiology, Morphological and Functional Pathology and oriented to applying these skills in the study of Clinical Sciences.

**General objective:** On finishing the course, students will be able to identify the etiology, pathogenesis and pathophysiological processes related to various disorders of the male and female reproductive systems, the main normal changes in pregnancy and the more important complications; describe the changes related to growth and development, their causative factors and main pathophysiological processes; understand the classifications of the main diseases of the reproductive and urinary systems both in men and women, and the classification of changes associated with growth and development and its basic manifestations, acquiring, on their own, essential knowledge required for practicing medicine, based on solving problems, reviewing clinical cases, and systematically searching for valid and updated health information on issues related to the pathophysiology of the endocrine system.

**Key words:** Growth and development. Pathophysiology of human reproduction. Normal and complicated pregnancy.

**Bibliography:** \* Schorge John, Ginecología de Williams, 1º, McGraw-Hill Interamericana Editores, [970107257X].

### **MB2055 Family Medicine**

( 2 - 2 - 8. Prerequisites: [ MB2057 , MB2039 , MB2046 , MB2047 ]. 8 MC 11 )

**Equivalence: None**

This is an intermediate course intended to familiarize students with the actions of health promotion, specific protection, early detection and attention to damage, all of which are applied at the first level of care. The course requires basic knowledge of pathophysiology, Medical Propaedeutic, Internal Medicine, Pediatrics, Gynecology and Obstetrics, Preventive Medicine and Medical Psychology. As a result of learning, students are expected to be able to develop and implement an action plan for primary-care-level health care, with a holistic approach, considering patients within their family and social environment.

**General objective:** On finishing the course, students will be able to perform the applicable health care actions at primary care level according to international and Mexican health sector guidelines.

**Key words:** Family medicine. First contact medicine. Family. First contact medicine.

### **MB2056 Morphological and Functional Pathology IV**

**( 2 - 2 - 8. Prerequisites: [ MB2051 ]. 8 MC 11 )**

**Equivalence: None**

This is an intermediate course intended to teach students about the microscopic and macroscopic morphologic alterations of the main pathologies of the central nervous and male and female reproductive systems. The course requires basic knowledge of histology, pathology and basic morphophysiology. As a result of learning, the student is expected to identify and explain contextually the pathological and histopathological alterations of fundamental pathophysiological processes of the pathology of the central nervous and male and female reproductive systems, based on real or hypothetical cases.

**General objective:** On finishing the course, students will be able to understand the anatomopathological and histological changes related to the fundamental pathophysiological processes of the central nervous system and male and female reproductive systems illustrated with actual or hypothetical cases; identify and describe the macroscopic and microscopic characteristics of the anatomopathological and histological changes related to the fundamental pathophysiology processes of the pathology of the central nervous and male and female reproductive systems illustrated with actual or hypothetical cases; interpret the meaning of the most relevant anatomopathological and histopathological anomalies of the central nervous and male and female reproductive system illustrated with actual or hypothetical cases.

**Key words:** Cell injury. Oncogenesis. Inflammation. Pathology. Physiopathology.

**Bibliography:** \* Robbins and Cotran pathologic basis of disease / Vinay Kumar . [et al.] ; with illustrations by James A. Perkins., 8th ed. , Philadelphia, PA : Saunders/ Elsevier, c2010., [9781416031215],[1416031219], [9780808924029 (International ed.)], [0808924028 (International ed.)], [9781437707922 (Professional ed.)], [1437707920 (Professional ed.)].

### **MB2057 Community III**

**( 2 - 2 - 8. Prerequisites: [ MD1048 ]. 5 LNB11, 5 MC 11, 5 MO 11 )**

**Equivalence: None**

This is an intermediate course intended to provide continuity and monitoring to the community work set out in the curriculum by implementing educational and preventive actions in the various fields of health, taking as reference the needs of the community being studied and projects established in previous semesters. The course requires prior knowledge of research methodology, biostatistics and project development. On completion of the course, students are expected to obtain documented evidence of the educational and preventive actions implemented in the maternal and child populations and of the community work carried out at community health centers, and circulate these documents in local and national forums.

**General objective:** Upon completion of the course, students from different health degrees will be able to implement educational and preventive actions in the areas of maternal and child health in the fields of Dentistry, Nutrition, Nursing, and Medicine, promoting citizen participation through volunteer health promoters. Another essential part of the course is that students implement education and prevention activities in local education institutes by integrating official school records in order to carry out health diagnoses in the school population.

**Key words:** Maternal and child health. Prevention activities. Educational activities. Health promotion volunteer. School health records. School health diagnosis.

**Bibliography:** \* Organización Panamericana de la Salud, Atención Integrada de las Enfermedades Prevalentes de la Infancia.

## MC Clinical Sciences

### MC3084 Cardiology and Metabolic Diseases

( 3 - 0 - 8. Prerequisites: None. 9 MC 11 )

**Equivalence: None**

This is an advanced course intended to help students acquire the general theoretical knowledge of internal medicine in the field of chronic degenerative metabolic and cardiovascular diseases, integrating the diagnostic and therapeutic approaches with the pathophysiological processes. The course requires basic knowledge of physiology and pathophysiology of the different parts and systems of the human body, as well as knowledge of nutrition, pathology and pharmacology. As a learning outcome, students are expected to answer exams and clinical cases through which they can demonstrate that they have acquired the necessary knowledge for identifying problems and determining the diagnostic and therapeutic approaches in their clinical activities in the field of metabolic and cardiovascular diseases, with emphasis on the prevention of metabolic diseases, such as diabetes among others.

**General objective:** Upon completion of this course, students will be able to describe and discuss the diagnostic and therapeutic approach to various metabolic and cardiovascular diseases. Similarly they will be able to identify and describe the diagnostic criteria for these, as well as principles for prevention and treatment.

**Key words:** Metabolic syndrome. Diabetes. Dyslipidemia. Ischemic heart disease. Hypertension.

**Bibliography:** \* Fauci AS, et al, Principles of Internal Medicine, 17th edition, McGraw Hill.

### MC3085 Internal Medicine Clinic

( 0 - 60 - 12. Prerequisites: [ MC3087 Corequisite , MC3087 ]. 9 MC 11 )

**Equivalence: None**

This is an advanced course intended to help students develop and apply the necessary clinical skills to obtain information through questioning, physi-

cal examination and the use of diagnostic adjuvants in the context of inpatient and outpatient care. The course requires basic knowledge of the physiology and pathophysiology of human body systems, and knowledge of pathology and pharmacology. As a result of learning, the student is expected to exercise critical thinking and an analytical approach to establish problem lists, diagnostic alternatives, a therapeutic and diagnostic approach, and interpretation of diagnostic aids. It is also expected that students will develop the interpersonal and communication tools to establish an environment of effective communication and trust with patients and their families, as well as with the rest of the health team.

**General objective:** Upon completion of this course, students will be able to conduct effective and thorough case histories, enabling them to draw up lists of problems and diagnostic possibilities, discuss the processes of diagnostic and therapeutic approaches to these, and critically analyze the results of the diagnostic tests or established therapeutic procedures both in the hospital setting and in the outpatient clinic.

**Key words:** Cardiology. Internship. Internal medicine. Clinical skills. Diabetes.

**Bibliography:** \* Textbook of gastroenterology / editor, Tadataka Yamada ; associate editors, David H. Alpers . [et al.], 4th ed., Philadelphia : Lippincott Williams & Wilkins, c2003., [0781728614 (set)].

### MC3086 Complementary Medicine

( 1 - 0 - 2. Prerequisites: None. 9 MC 11 )

**Equivalence: None**

This is an advanced course that is intended to help students acquire a general overview of the main aspects of Complementary and Alternative Medicine and be able to discriminate within the different disciplines to determine which are useful for supporting the therapeutic aspect of conventional medicine and which stray from the scientific model. The course requires basic knowledge of physiology, pathology, pharmacology, biochemistry and cell biology. As a



result of learning, the student is expected to be able to treat a patient and select a complementary and/or alternative therapy to improve the patient's health.

**General objective:** Upon completion of this course, students will be able to understand the theory, scientific basis, if any, and academic preparation behind the more common current Complementary Medicine and Alternative Therapies; discern the type of Complementary and/or Alternative Medicine that may help their patients according to the specialty they choose; discriminate between the Complementary and Alternative Medicine that can actually be a support for conventional medicine and that which cannot; recommend or dissuade patients when discussing different alternative therapies; discriminate between scientifically valid Complementary and Alternative medicines and those that are not.

**Key words:** Alternative medicine. Complementary medicine. Integrative medicine.

**Bibliography:** \* Goldman, Cecil Textbook of Medicine, 22th.

### MC3087 Internal Medicine

( 3 - 0 - 8. Prerequisites: None. 9 MC 11 )

**Equivalence: None**

This is advanced course seeks to train health professionals who can integrate the knowledge, skills and values required to apply the method of quality healthcare with excellence, when solving common problems in patients related to internal medicine, supported by the latest and most relevant scientific evidence in this field; recognize their role as first contact for medical care in adult patients; act responsibly in the process of medical care for internal medicine patients, being receptive to the health needs and rights of adult patients and always willing to provide timely and ongoing medical care; fulfill their role as medical "healers" in the global context that internal medicine patients require; get involved in the health care team attending to patients with internal medicine problems, following the principles of medical professionalism and establishing an appropriate physician-patient relationship based on respect and aligned with ethics; commit to the continued pursuit and implementation of the optimal methods of pre-

vention and early detection of disease, in addition to the education of patients and their families in health habits related to internal medicine. As a result of learning, the student will deliver a portfolio of diagnoses made during the clerkship.

**General objective:** Upon completion of this course, students will be able to describe and discuss the diagnostic approach to and treatment of different gastrointestinal diseases, pulmonary, hematological, infectious and renal diseases; identify and describe the diagnostic criteria for these, and the principles of prevention and treatment.

**Key words:** Oncology. Hematology. Endocrinology. Gastroenterology. Pulmonary medicine. Infectious Diseases. Nephrology.

**Bibliography:** \* Fauci AS, et al, Harrison's. Principles of Internal Medicine, 17th edition, Mc Graw Hill.

### MC3088 Surgery

( 5 - 0 - 12. Prerequisites: None. 10 MC 11 )

**Equivalence: MC3044**

This is an advanced course intended to teach students the knowledge, skills and values required by a primary care physician in the field of General Surgery. The course requires prior knowledge in Propaedeutic. As a result of learning, the student is expected to analyze cases and resolve questions about most common surgical problems in General Surgery.

**General objective:** Upon completion of this course, students will be able to understand and analyze the most common health problems in General Surgery, in the area of prevention, diagnosis, treatment and rehabilitation, with emphasis on the knowledge, skills and values necessary for a general practitioner regarding general surgery.

**Key words:** Care of the surgical patient. Gastrointestinal surgery. Laparoscopic surgery. Transplant surgery.

**Bibliography:** \* Townsend, Courtney M., Sabiston tratado de cirugía : fundamentos biológicos de la práctica quirúrgica moderna / Courtney M. Townsend . [et al.], 17a ed., Madrid : Elsevier, 2005., [84817484x



(obra completa)],[8481748986 (vol.1)],[8481748994 (vol.2)].

### MC3089 Surgery Clinic

( 0 - 60 - 12. Prerequisites: [ MC3088 Corequisite ]. 10 MC 11 )

**Equivalence: None**

This is an advanced course that forms part of the trimester surgery rotation. It seeks to prepare health professionals with the knowledge, abilities, skills and values needed to apply the method of quality healthcare with excellence when solving common problems in patients related to general surgery, supported by the latest and most relevant scientific evidence in this field. Previous knowledge in Family Medicine is required. The course contributes to instilling in students an attitude of responsibility in the medical care process for surgery patients. As a learning outcome, students must prepare a proposed solution to a health problem from the field of surgery, demonstrating the knowledge and skills they have acquired, based on a receptive attitude to patient health needs and rights and an ongoing willingness to provide timely and continuous medical care.

**General objective:** Upon completion of this course, students will be able to acquire the basic knowledge and develop the necessary abilities and skills required by a primary care physician in the area of general surgery, in order to perform diagnoses, surgical indications and contraindications, main techniques in the surgical field and hospital settings, in addition to surgical complications and bioethical and legal implications; apply the method of ambulatory medical attention, with an excellent quality level, in general surgery patients; use scientific and practical knowledge, the ability to obtain and handle information, and effective communication according to the needs and expectations of the community, in order to facilitate efficient service with a philosophy of quality that enhances the attitudes and values of the medical profession for the patients' appropriate surgical attention and the physician's personal success; educate patients and their relatives about health issues and the prevention and opportune detection of diseases that may require surgical intervention.

**Key words:** Medical care in hospitals. Medical care in consultations. Data records.

**Bibliography:** \* Doherty Gerard , The Washington Manual of Surgery, William and Wilkins, Inglés, [0781716403].

### MC3090 Otorhinolaryngology and Ophthalmology Clinic

( 0 - 10 - 2. Prerequisites: [ MC3091 Corequisite ]. 10 MC 11 )

**Equivalence: None**

This is an advanced course through which students will know and carry out the proper examination of the upper airways and optical system. The course requires basic knowledge of eye anatomophysiology and of the different structures of the ear and nose, sinus, oropharynx, and larynx. As a result of learning, students are expected to be able to apply their knowledge to making accurate diagnoses and prescribing appropriate treatments for different ailments within this specialty.

**General objective:** Upon completion of this course, students will be able to acquire skills for the assessment, diagnosis, medical and surgical treatment and rehabilitation of patients with otorhinolaryngology and ophthalmology problems, both in the inpatient and outpatient setting; educate the patient and family on health habits and the early detection of disease; conduct searches for the clinical information of the patients who come for consultations; and take part in or perform the most common otoscopic and ophthalmic procedures in these patients.

**Key words:** Most common causes of otolaryngology consultations. Most common causes of ophthalmology consultations. Outpatient context of otolaryngology. Outpatient context of ophthalmology. Hospital context of otolaryngology. Hospital context of ophthalmology. Emergencies in ORL. Common throat problems. Common nose problems. Common ear problems.

**Bibliography:** \* Frank Newell, Ophthalmology, inglés.

## MC3091 Otorhinolaryngology and Ophthalmology

( 2 - 0 - 4. Prerequisites: None. 10 MC 11 )

Equivalence: MC3062

This advanced course is intended to help students acquire knowledge of anatomy and physiology and learn how to identify the signs and symptoms of the most common eye diseases and upper respiratory tract ailments in both the pediatric and adult population. The course requires prior knowledge of anatomy, physiology and pathophysiology. As a result of learning, students are expected to respond to examinations and clinical cases, demonstrating the knowledge acquired in the areas of Ophthalmology and Otolaryngology, with emphasis on the pathophysiological processes of recurrent diseases, methods of diagnosis and treatment for each of the diseases in question and strategies for prevention and rehabilitation of these diseases in pediatric and adult patients.

**General objective:** Upon completion of this course, students will be able to understand aspects of prevention, diagnosis, and medical, surgical and rehabilitative treatment of common conditions in the area of Otolaryngology and Ophthalmology; provide professional orientation to patients with these diseases and their families; promote health and prevention of disease in patients; communicate appropriately within their environment; search for and manage information that will enable them to always be up-to-date in their field; apply their knowledge using clinical reasoning and ethical bases; be leaders responsible for caring for the health of their patients.

**Key words:** Sinusitis as a cause of headache. Chronic laryngitis voice abuse. Recurrent tonsillar infections. Sports nasal fractures.

**Bibliography:** \* Corvera Bernardelli, Jorge., Otorrinolaringología elemental / Jorge Corvera Bernardelli., 2a ed., México : Méndez Editores, 1997 (reimpresión 2002), [9686596615].

## MC3092 Legal Issues of Medical Practice

( 1 - 0 - 2. Prerequisites: None. 12 MC 11 )

Equivalence: None

This is an advanced course in which the student will obtain knowledge and identify the origin and application of laws, regulations, codes, rules and administrative provisions governing the practice of medicine, as well as legal problems related to the provision of private and institutional health services, with an emphasis on professional responsibility and criminal, civil and conciliatory procedures in which the matters heard are complaints, lawsuits, etc. As a result of learning, the student will develop a project which identifies the main problems of professional responsibility in the medical environment and proposals to solve these.

**General objective:** Upon completion of this course, students will know and be able to identify the source and application of legal and administrative rules regulating medical practice, and legal issues related to the provision of health services in public and private institutions.

**Key words:** Accreditation. Professional responsibility. Liability. Criminal responsibility. Administrative responsibility.

**Bibliography:** \* Lopez Buado, Responsabilidad profesional de los médicos, Bruno, español.

## MC3093 Bioethics

( 2 - 0 - 4. Prerequisites: None. 8 LNB11, 8 LPS12, 11 MC 11 )

Equivalence: None

This is an advanced course in which the student integrates elements for forming ethical and professional competence in medical professionals. The course includes the development of concepts related to health sciences and their relationship to the humanities, moral development and professional ethics in medicine. The course promotes the development of interpersonal and communication skills related to narrative professionalism in medical practice as well as skills related to wellness and self-care. Through the

analysis of everyday medical ethical dilemmas, students promote self-reflection and self-consciousness as the core for the process of ethical decision making. The course requires basic knowledge related to the ethical dimension of human life, fundamentals of ethics, ethics and society, ethical life. As a learning outcome, students are expected to integrate knowledge, skills, attitudes, principles and values that enable the development of ethical and professional skills which promote regular exercise of ethical reflection on real and current everyday clinical cases taking into account their responsibility as health professionals working for the benefit of society.

**General objective:** Upon completion of this course, students will be able to develop advanced skills of medical ethics and professionalism; participate actively and opportunely in resolving ethical dilemmas individually or in groups using a previously established methodology to recognize conflicts and values; use reason and dialog with others to resolve conflicts; think of their responsibility as health professionals, committed to their vocation and their communities by analyzing the main ethical factors required to achieve a fair society.

**Key words:** Bioethics. Social responsibility. Professionalism. Ethical dilemmas. Science and humanities. Ethics and Medicine. Medical ethics.

**Bibliography:** \* Spiegel, J., *The Mindful Medical Student*, Dartmouth College Press - University Press of New England, [978-1-58465-763-7].

### MC3094 Pediatrics Clinic

( 0 - 60 - 12. Prerequisites: [ MC3095 Corequisite , MC3095 ]. 11 MC 11 )

**Equivalence: None**

This is an advanced course that forms part of the quarterly rotation of Pediatrics. It seeks to prepare health professionals capable of integrating previous knowledge of child growth and development, pathophysiology of disease, and the clinical skills required for quality medical care in pediatric patients. As a result of learning, the student will be able to solve common health problems in pediatric patients, supported by the latest and most relevant scientific evidence in this field, apply the best methods of preven-

tion and early detection of disease, as well as education for the patient and family, being receptive to the health needs and rights of children and adolescents and always willing to provide timely and ongoing medical care.

**General objective:** Upon completion of this course, students will be able to participate in the clinical work of the pediatrician in an inpatient and outpatient setting in the second and third levels of care, applying theoretical knowledge of diagnosis, treatment and prevention, while building their clinical skills, use of diagnostic tools, information management, written documentation, therapeutic management and professionalism needed to help sick or healthy pediatric patients and their anxious caregivers, in a setting where the highest values prevail.

**Key words:** Clinical skills. Pediatric medical care. Therapeutic management. Prevention. Diseases and conditions common pediatric population. Prevention and early detection of common pediatric diseases.

**Bibliography:** \* Hay William, *Current pediatric diagnosis and treatment*, 19th, Ed. Lange.

### MC3095 Pediatrics

( 5 - 0 - 12. Prerequisites: None. 11 MC 11 )

**Equivalence: None**

This is an advanced course, which is intended to help students acquire the knowledge required to perform general and clinical medical care for pediatric patients. The course requires basic knowledge of growth and normal child development, nutrition, pathophysiology of disease, and accident prevention. As a result of learning, students are expected to demonstrate habits of self-study and continual medical updating.

**General objective:** Upon completion of this course, students will be able to integrate the range of knowledge required of normal growth and developmental aspects, pathophysiology of common health problems, diagnosis and therapeutic considerations most relevant to the child and adolescent as a basis for making decisions in the context of general medicine.

**Key words:** Clinical skills. Pediatric medical care. Common pediatric diseases and conditions. Prevention and early detection of common pediatric diseases. Therapeutic management. Prevention.

**Bibliography:** \* Primary pediatric care / editor-in-chief, Robert A. Hoekelman, co-editors, Saul Blatman . [et al.], St. Louis : Mosby, 1987., [0801622549].

### MC3096 Clinical Bioethics

( 2 - 0 - 4. Prerequisites: None. 9 LNB11, 9 LPS12, 12 MC 11 )

**Equivalence: None**

This is an advanced course in which the student integrates elements for forming ethical and professional competence in medical professionals. The course includes the development of concepts related to health sciences and their relationship to the humanities, bioethics, professional ethics, and other social aspects of medicine. The course promotes the development of interpersonal and communication skills related to narrative professionalism in medical practice as well as skills related to wellness and self-care through the analysis of everyday medical ethical dilemmas, the application of the professional code of ethics and self-reflection and self-consciousness as the core for the process of ethical decision making. The course requires basic knowledge of the fundamentals of ethics, ethics and society, ethical life, as well as those related to Health Sciences and Humanities; education; socialization and moral development in Health Sciences; Professional Ethics and Narrative Professionalism in Health Sciences; Professionalism; wellness and self-care in the biomedical field; as well as the ability to identify and analyze ethical dilemmas in Health Sciences. As a result of learning, the student is expected to integrate knowledge, skills, attitudes, principles and values that enable the development of ethical and professional skills, which promote regular exercise of ethical reflection on real and current everyday clinical cases, taking into account their responsibility as health professionals working for the benefit of society.

**General objective:** Upon completion of this course, students will be able to express and reflect on the concepts related to the practice of a physician in their

personal, professional and social spheres, reflecting on their responsibilities as professionals in the field of health, committed to the vocation and their communities, by analyzing the main factors that lead to ethical achievement of a fair and sustainable society. For that reason, the course aims to develop the physician's capacity for reflecting on medical ethics that allows him to act with professional and social responsibility.

**Key words:** Bioethics. Social responsibility. Ethical dilemmas. Medical ethics and professionalism. Narrative professionalism. Personal development and professional formation. Humanism in medicine.

**Bibliography:** \* Spiegel, J. , The Mindful Medical Student, Dartmouth College Press - University Press of New England, [978-1-58465-763-7].

### MC3097 Obstetrics and Gynecology Clinic

( 0 - 60 - 12. Prerequisites: [ MC3098 , MC3098 Corequisite ]. 12 MC 11 )

**Equivalence: None**

This is an advanced course intended to teach students about women's healthcare both in hospital and as an outpatient, based on knowledge of the areas of Obstetrics and Gynecology, promotion of women's health, and areas of subspecialty in Gynecology and Obstetrics. The student will observe and participate actively in the care of hospitalized patients and those seeking outpatient care. In the outpatient department, students will acquire the skills of identifying those elements that arise at the onset of a condition before the patient is admitted to hospital, or learn about the initial stages and resolution of problems that do not require hospital admission. For hospitalized cases, patient care includes hospital admission of obstetric and gynecological patients; processing medical records; monitoring and managing labor; both obstetric and gynecological surgical interventions; and monitoring and control of postoperative or postpartum states. The course requires basic knowledge of anatomy, physiology, embryology, biochemistry, pharmacology, propaedeutic, pathological anatomy, clinical pathology and pathophysiology. As a learning outcome, student are expected to successfully integrate the knowledge acquired in

previous semesters and in other areas of the gynecological and obstetrics clerkship. Such integration will give students the ability to treat patients in hospital and as outpatients, either at the doctor's surgery or as hospital emergencies.

**General objective:** Upon completion of this course, students will be able to recognize their role as primary care physicians for health care in women; evaluate and establish the initial treatment of a gynecological patient who enters the area either by admission or through the emergency department, assist in gynecological procedures, keep watch on patients and detect any postoperative complications. Students will also be able to assess and initiate management of obstetric patients who are hospitalized either in labor or programmed for caesarean section, monitor, induce and/or direct labor or miscarriage, assist in caesarean section and uterine curettage, as well as attend a vaginal delivery, and monitor the progress of patients in puerperium.

**Key words:** Integral care for patients in Gynecology and Obstetrics. Development of clinical record. Interpretation of laboratory and imaging studies. Making appropriate timely diagnoses. Implementation of appropriate treatment in obstetric-gynecological problems.

**Bibliography:** \* Jonathan S. Berek, Novak's gynecology, 14th, Baltimore. Williams & Wilkins, [978-0-781768-05-4].

### MC3098 Obstetrics and Gynecology

( 5 - 0 - 12. Prerequisites: None. 12 MC 11 )

Equivalence: MC3076

This is an advanced course aimed at placing the student in the environment of women's healthcare by providing knowledge in the areas of obstetrics, gynecology, promotion of women's health and areas of subspecialty. They will develop and consolidate skills, attitudes and values under the framework of women's healthcare. The course requires basic knowledge of Anatomy, Human Physiology, Embryology, Biochemistry, Pathological Anatomy and Epidemiology. As a learning outcome, students are expected to acquire, recognize and apply the basic knowledge to

accurately diagnose and treat common diseases in the areas of Obstetrics and Gynecology and the clinical skills related to the field of women's health.

**General objective:** Upon completion of this course, students will be able to apply the principles of obstetrics, gynecology and areas of specialty in the sphere of the general physician; apply the concept of evidence-based medicine in the area of Obstetrics and Gynecology; acknowledge their role as primary care physicians in women's health care; apply the clinical reasoning process to real obstetrics and gynecology patients using the problem based learning (PBL) method, with emphasis on medical decision making; understand, document and discuss the clinical skills observed, attended or performed in procedures and pre-established clinical encounters, related to the field of women's health.

**Key words:** Pregnancy complications. Maternal-fetal medicine. Puerperium. Labor. Reproductive medicine and surgery.

**Bibliography:** \* Jonathan S. Berek, Novak's gynecology, 14th, Baltimore. Williams & Wilkins, [978-0-781768-05-4].

### MC3099 Critical Appraisal of Medical Literature

( 1 - 0 - 2. Prerequisites: None. 14 MC 11 )

Equivalence: None

This is a basic course of analysis and critical appraisal of medical literature. It requires basic knowledge of information technologies (internet, databases etc.) and full (100%) English language reading skills. As a learning outcome, students are expected to formulate structured answerable clinical questions based on a clinical problem they are faced with and search efficiently for the information required to solve the problem using literature from different clinical databases (Medline, embassy, Cochrane registry of randomized controlled trials, etc.), finding and appraising the most valid and relevant literature for the critical analysis, using tools created and validated for this purpose in order to be able to make clinical decisions based on the best scientific evidence available and their own critical thinking skills.



**General objective:** Upon completion of this course, students will be able to critically appraise articles from medical literature (randomized control trials, systematic reviews, observational studies, and studies of diagnostic tests) after framing an answerable clinical question and finding the best evidence available on different clinical databases. After this process, the student will be able to apply the evidence to the context of a particular patient problem and make an informed decision using the critical thinking process.

**Key words:** Critical appraisal. Knowledge transfer. Evidence synthesis. Clinical decision making using critical thinking. Health technology information. Evidence-based medicine.

**Bibliography:** \* Sharon E Straus, W Scott Richardson, Paul Glasziou (editors), Evidence Based Medicine, 3th, Elsevier, [0443074445 / ISBN-13: 9780443074448].

### MC3101 Quality Healthcare and Patient Safety

(1 - 0 - 2. Prerequisites: None. 13 LNB11, 11 MC 11)  
Equivalence: None

This is a basic level course related to concepts of clinical quality, clinical risk management and application of the basic tools of quality and safety in ambulatory settings and hospitals. The course requires prior knowledge of Management, Public Health and prior clinical practice. As a result of learning, students are expected to document, analyze and discuss actual cases related to patient safety.

**General objective:** Upon completion of this course, students will be able to define basic concepts of quality and patient safety; identify key components of safety culture in healthcare; apply methods and tools for collecting, analyzing and using quality information to improve patient safety; understand strategies to promote safety culture and clinical management of risks; identify the role of the health professional in patient safety.

**Key words:** Clinical management. Clinical risk management. Patient safety. Dimensions of clinical quality. Clinical practice guidelines.

**Bibliography:** \* JM Aranaz, C Aibar, J Vitaller, Gestión Sanitaria (Calidad y Seguridad de los Pacientes), Ed. Fundación Mapfre & Ed. Diaz de Santos.

### MC3102 Emergency Clinic

(0 - 20 - 4. Prerequisites: [ MC3105 Corequisite , MC3105 ]. 14 MC 11 )

Equivalence: None

This is an advanced course. It is primarily intended to identify and address practical clinical concepts of disease entities that severely threaten the physical and mental integrity of adult and pediatric patients in the emergency room. The course requires prior knowledge of propaedeutic and pathophysiology of the most common emergency conditions. As a result of learning, students participate in the most common emergencies seen during their rotation and demonstrate mastery of the skills most frequently used in the emergency room.

**General objective:** Students will be able to acquire experience in decision making when attending to critical and non-critical patients in the emergency unit; identify life-endangering situations in a timely manner; apply knowledge of pathophysiology, clinical manifestations, diagnosis and treatment of diseases that require care in an emergency unit; develop the capacity to react and commit in unexpected situations; develop the ability to work in a multidisciplinary manner, as part of a team, solving medical and surgical situations; demonstrate a responsible and ethical attitude in clinical decision making and cost containment; manage information provided to patients and families in the Emergency Unit in accordance with established principles and rules; show concern and consideration for the patient and/or family in making decisions; comply with assigned tasks punctually, honestly and efficiently; show respectful and tolerant attitudes when interacting with staff, patients, families, etc.

**Key words:** Emergencies. Triage. Cardiopulmonary resuscitation.

**Bibliography:** \* Medicina de urgencias / Judith E. Tintinalli, Gabor D. Kelen, J. Stephan Stapczynski; tr. Ana María Pérez-Tamayo R. [et al.], 6 ed. en espan~ol,



México : McGraw Hill, 2006., spaeng, [9701049691 (obra completa)], [9701051335 (v.1)], [9701051343 (v.2)].

### MC3103 Radiology Clinic

( 0 - 20 - 4. Prerequisites: [ MC3106 Corequisite , MC3106 ]. 14 MC 11 )

Equivalence: MC3075

This is an advanced course intended to help students identify the use, indications, contraindications and complications of the different radiological and imaging studies available, using high ethical and professional standards in health institutions in various fields. It also seeks to teach students to recognize normal radiological anatomy and basic abnormalities of the most common pathologies and their differential diagnoses whilst also developing their abilities to be agents of change in healthcare within their own social environments. The course requires prior knowledge of internal medicine. As a learning outcome, students are expected to analyze, discuss, and establish possible solutions for real clinical cases presented during the clinical clerkship.

**General objective:** During the clerkship for this course, students will be able to identify the need for the most common studies in radiology and imaging in real patients and apply the knowledge and skills required to recognize and describe what these are, the manner of completion and time required for the study, as well as the preparation required by patients before undergoing it.

**Key words:** Nuclear medicine. General radiology. CT. Ultrasound. Invasive studies. Magnetic resonance imaging.

**Bibliography:** \* Diagnóstico por imagen : tratado de radiología clínica / edición dirigida por Cesar S. Pedrosa y Rafael Casanova Gomez., 2a ed., Madrid : McGraw-Hill, c2004., [8448602978 (Obra completa)], [8448602994 (v. 1)], [8448603052 (v. 2)].

### MC3104 Traumatology, Orthopedics and Rehabilitation Clinic

( 0 - 20 - 4. Prerequisites: [ MC3107 Corequisite , MC3107 ]. 14 MC 11 )

Equivalence: None

This is an advanced course, intended to teach Clinical Science students to identify the main diseases affecting the musculoskeletal system and familiarize themselves with the basic rehabilitation concepts for these injuries; learn the foundations for a good clinical history and physical examination; request and interpret image and paraclinical studies correctly, leading them to compile an accurate diagnosis and institute appropriate treatment. The course requires basic knowledge of Anatomy, Physiology and Introduction to Psychology, which will facilitate both the assessment and management of the main diseases affecting the musculoskeletal system and comprehensive patient rehabilitation. As a result of learning, students are expected to familiarize themselves with the main diseases affecting the musculoskeletal system, be able to perform a medical history review and physical examination, order the appropriate image and laboratory studies, make a diagnosis and institute initial treatment of the main diseases of the musculoskeletal system, including rehabilitation.

**General objective:** Upon completion of this course, students will be able to assess, diagnose, treat and guide the rehabilitation of patients with problems of the musculoskeletal system; perform the clinical history review and physical examination that lead to recognition of the most common orthopedic and traumatological diseases affecting the system, request the appropriate imaging and laboratory studies to make an accurate diagnosis and institute primary-care treatment. Students should also be able to recognize those cases that require urgent attention or warrant the intervention of a specialist in order to refer the patient as soon as possible and reduce the risk of complications. Students should also understand the basic aspects of conservative and surgical treatment, as well as those aspects related to the integral rehabilitation of patients with musculoskeletal pathology; appreciate the impact of problems of the musculoskeletal system on society and the consequences of morbidity and mortality in patients as well as the costs involved; identify risk areas and possible preventive measures in this regard,

establish the importance of related multidisciplinary actions and the institutions involved. The student should also acquire the skills and abilities required to rehabilitate individuals, in an interdisciplinary context with a multifactorial approach to the problem of the patient, acquire the abilities and skills required for primary care rehabilitation, as well as timely referral to a second level of care, knowing the short, medium and long term objectives of the rehabilitation process in the patient, initiate the intrahospital rehabilitation process and plan the follow-up after hospital discharge; understand and value the legal, ethical and moral regulations that apply to medical activity in the area of orthopedics and rehabilitation.

**Key words:** Traumatology and orthopedics. Integral rehabilitation. Accurate clinical diagnostics. Proper handling. Skeletal-muscle system basics skills.

**Bibliography:** \* Hoppenfeld, Stanley , Exploración Física de la Columna Vertebral y las Extremidades, Manual Moderno.

### MC3105 Emergencies

( 2 - 0 - 4. Prerequisites: None. 14 MC 11 )

**Equivalence: None**

This is an advanced course in terms of knowledge and decision making in Emergency Medicine, applying mainly to the critical moments of the patient's admission and stay in the Emergency Department. The course requires prior knowledge of anatomy, physiology, general surgery and internal medicine. As a learning outcome, students are expected to obtain higher levels of knowledge of the most common and life threatening medical and traumatology emergencies; and learn about the specific details of each of the acute critical pathologies in order to make decisions in the ED. Students are also expected to familiarize themselves with the protocols and diagnostic diagrams for the appropriate management of patients in the Emergency Department.

**General objective:** Upon completion of this course, students will be able to understand the theoretical concepts of emergency; analyze problems of patients and make the decisions required to channel them into specialties or definitive treatments; iden-

tify acute/critical medical and/or surgical conditions that need to be evaluated in an emergency department.

**Key words:** Shock trauma. Multiple trauma patient. Cardiorespiratory emergencies. Metabolic emergencies. Neurologic emergencies. Toxicological emergencies and poisoning. Burns. Patient approach in the emergency department. Legal aspects of emergency medicine. Acute abdominal and stomach pain. Theory of invasive procedures and cardiopulmonary resuscitation. History of emergency medicine and the relationship of an emergency department with the rest of the hospital and the community.

**Bibliography:** \* Trauma / editors, David V. Feliciano, Ernest E. Moore, Kenneth L. Mattox., 3rd ed., Stamford, Conn. : Appleton & Lange, c1996., [0838590101 (papel alcalino)].

### MC3106 Radiology

( 2 - 0 - 4. Prerequisites: None. 14 MC 11 )

**Equivalence: None**

The aim of the advanced course in radiology is for students to become familiar with the use, indications, contraindications and complications of the different radiological and imaging studies; their biological, economic, ethical and legal implications; normal radiographic anatomy and the basic radiological alterations of the most common pathologies and their differential diagnosis. Students should act with ethics and professionalism in groups and with an awareness of the social environment in which they are working. The course requires previous knowledge of Internal Medicine. The learning outcome of this course is for students to analyze, discuss and propose solutions to the clinical cases of real patients.

**General objective:** Upon completion of this course, students will be able to understand the theoretical issues related to the use, indications, contraindications and complications of different radiological and imaging studies, and their biological, economic, ethical and legal implications. Students will be able to understand normal radiographic anatomy and the fundamental radiographic changes for the most common diseases and their differential diagnosis.

**Key words:** Fundamentals of radiology and imagery. Nuclear medicine. General radiology. Nuclear magnetic resonance. CT. Ultrasound.

**Bibliography:** \* Ruth Ann Ehrlich, Ellen Doble McCloskey, Joan A. Daly, Patient care in radiography, 6a, Mosby.

### MC3107 Traumatology, Orthopedics and Rehabilitation

( 3 - 0 - 8. Prerequisites: None. 14 MC 11 )

**Equivalence: None**

This is an advanced course intended to teach Clinical Science students to identify the main diseases affecting the musculoskeletal system and familiarize themselves with the basic rehabilitation concepts for these injuries; learn the foundations for a good clinical history and physical examination; request and interpret image and paraclinical studies correctly, leading them to compile an accurate diagnosis and institute appropriate treatment. The course requires basic knowledge of Anatomy, Physiology and Introduction to Psychology, which will facilitate both the assessment and management of the main diseases affecting the musculoskeletal system and comprehensive patient rehabilitation. As a result of learning, students are expected to familiarize themselves with the main diseases affecting the musculoskeletal system, be able to perform a medical history review and physical examination, order the appropriate image and laboratory studies, make a diagnosis and institute initial treatment of the main diseases of the musculoskeletal system, including rehabilitation.

**General objective:** Upon completion of this course, students will be able to reflect on their in-depth knowledge of assessment, diagnosis, treatment and rehabilitation of patients with problems of the musculoskeletal system; assess the impact of the problem of diseases of the musculoskeletal system on society and the consequences of morbidity and mortality in patients as well as the costs involved; identify risk areas and possible preventive measures in this regard; understand the concept of comprehensive rehabilitation of the patient, in an interdisciplinary context; acquire the knowledge required to initiate primary care treatment and rehabilitation

and make timely referrals to a second level of care in these areas; know the short-term, medium-term and long-term objectives of the patient's rehabilitation process; and, finally, understand and value the legal, ethical and moral regulations that apply to medical activities in the field of traumatology, orthopedics and rehabilitation.

**Key words:** Traumatology and orthopedics. Integral rehabilitation. Accurate clinical diagnostics. Proper handling. Skeletal-muscle system basic skills.

**Bibliography:** \* Salter, Robert Bruce., Trastornos y lesiones del sistema musculoesquelético : introducción a la ortopedia, fracturas y lesiones articulares, reumatología, osteopatía metabólica y rehabilitación / Robert Bruce Salter., 3a ed., Barcelona : Masson, 2000 (reimpresión 2003), [8445808419].

### MC3108 Geriatrics Clinic

( 0 - 20 - 4. Prerequisites: [ MC3111 Corequisite , MC3111 ]. 15 MC 11 )

**Equivalence: None**

This is an advanced course intended to teach students to relate to the elderly and assess and treat their ailments using therapeutic principles that emphasize their functionality and quality of life. The course requires basic knowledge of internal medicine, given that senior citizens suffer from multiple chronic diseases that have to be integrated syndromatically and focus is required on the functionality of the individual at the time of initiating therapy. As a result of learning, students are expected to evaluate the acute and chronic diseases of the elderly, integrate geriatric syndromes and establish a treatment plan aimed at improving their quality of life.

**General objective:** Upon completion of this course, students will be able to assess elderly patients in their different environments, such as the outpatient clinic, chronic care (e.g. nursing homes) and the hospital environment. In the area of outpatient care, students will develop the skills to recognize the pathologies of the elderly, integrating diagnostic methods and carrying out appropriate treatment, emphasizing maintenance of prevention and functionality. In the area of hospital care of the elderly, they will evaluate

acute conditions of chronic diseases, developing diagnostic skills as well as therapeutic approaches and reintegration to their daily activities.

**Key words:** Geriatric syndromes. Geriatric conditions. Geriatric patients. Geriatric assessment.

**Bibliography:** \* Ham Richard , Primary Care Geriatrics a case based approach, 5th, Mosby.

### MC3109 Neurology and Neurosurgery Clinic

( 0 - 20 - 4. Prerequisites: [ MC3112 Corequisite , MC3112 ]. 15 MC 11 )

**Equivalence:** None

This is an advanced course aimed at teaching clinical science students to perform the neurological examination under normal and special clinical conditions and providing them with critical knowledge of the major categories of neurological and neurosurgical diseases found in primary contact. The course requires basic knowledge of neurological basic sciences and the pathophysiology of the main categories of common neurological diseases in daily practice. As a learning outcome, students are expected to be able to perform a neurological examination under normal and special medical conditions, interpret the findings in order to explain and confirm the diagnostic hypothesis, and indicate the best medical or surgical treatment for prevention and rehabilitation.

**General objective:** Upon completion of this course, students will be able to perform a neurological examination correctly, as well as recognize and manage the most common neurological and neurosurgical diseases appropriately, according to best clinical practices; communicate effectively with patients and their families; analyze and synthesize the information required to deal with the clinical cases presented to them; actively observe medical, surgical and emergency services carried out in the operating room, on hospital duty, in the emergency room and outpatient ambulatory areas; participate in establishing plans for diagnosis, treatment, rehabilitation and prevention.

**Key words:** Neurological examination. Main categories of neurological diseases. Skills. Critical knowledge.

**Bibliography:** \* Adams Andrea C. M.D, Essential Clinical Neurology, 1st, Mayo Clinic Scientific Press.

### MC3110 Psychiatry Clinic

( 0 - 20 - 4. Prerequisites: [ MC3113 Corequisite , MC3113 ]. 15 MC 11 )

**Equivalence:** None

This is an advanced course in which it is intended that the student develops the ability to conduct the psychiatric interview. The course requires basic knowledge of semiotics, internal medicine, and the development of clinical history. As a result of learning, students are expected to be able to interview a psychiatric patient and then form diagnostic impressions from the information obtained.

**General objective:** Upon completion of this course, students will be able to understand the fundamental aspects of psychopathology and be capable of detecting signs and symptoms of psychiatric patients in hospital consultation and in-patients, and recognize psychotherapeutic and pharmacological intervention procedures.

**Key words:** Mental examination. Psychiatric history. Theoretical knowledge of psychopathology.

**Bibliography:** \* Kaplan y Sadock , Sinopsis de Psiquiatría: Ciencias de la conducta y psiquiatría clínica., 10. Lippincott Williams and Wilkins, [8496921387].

### MC3111 Geriatrics

( 2 - 0 - 4. Prerequisites: None. 15 MC 11 )

**Equivalence:** MC3057

This is an advanced course aimed at understanding the process of aging, the most common diseases and the therapeutic approach to these. The course requires prior knowledge of internal medicine. As a learning outcome, the student uses basic diagnostic tools to address diseases in elderly adults.

**General objective:** Upon completion of this course, students will be able to understand the epidemiology of the elderly, the aging process and the most common diseases, as well as perform a basic and preventive diagnostic/therapeutic approach for the elderly.

**Key words:** The elderly. Geriatrics.

**Bibliography:** \* Ham Richard , Primary Care Geriatrics a case based approach, 5th, Mosby.

### **MC3112 Neurology and Neurosurgery** ( 3 - 0 - 8. Prerequisites: None. 15 MC 11 ) **Equivalence: None**

This is an advanced course, in which students learn and recognize the main common neurological and neurosurgical diseases and emergencies. The course requires basic knowledge of neuroanatomy, neurophysiology and neuropathology. As a result of learning, students are expected to make a timely and differential diagnosis in order to request laboratory tests or initial images, start treatment or refer the patient to a specialist.

**General objective:** Upon completion of this course, students will be able to identify the main signs and symptoms of central and peripheral nervous system diseases in a patient, through anatomic and clinical correlation of the neurological exam to determine the site of the injury and its possible causes; recognize clinical manifestations; indicate the appropriate laboratory and imaging studies and treatment for the most common neurological and neurosurgical diseases in primary care practice; recognize the presence of neurological and neurosurgical emergencies and be able to take the first steps for immediate management.

**Key words:** Neurological syndromes. Nervous system diseases. Headache. Brain tumors. Radiculopathies.

**Bibliography:** \* Neurología de Merritt / editado por Lewis P. Rowland, 1a ed., Madrid : McGraw Hill Interamericana, c2002., spaeng, [8448604407].

### **MC3113 Psychiatry** ( 2 - 0 - 4. Prerequisites: None. 15 MC 11 ) **Equivalence: None**

This is an advanced course, in which students learn and understand the clinical phenomena of psychopathology and the diagnostic and therapeutic tools that exist in psychiatry as a specialty of medicine. The course requires fundamental knowledge of so-called basic science and internal medicine. As a result of learning, students are expected to be able to produce reports with diagnostic impressions.

**General objective:** Upon completion of this course, students will be able to understand the fundamental aspects of psychopathology in order to analyze the signs and symptoms of psychiatric patients in their psychosocial context and then plan a process of psychotherapy and medication.

**Key words:** Psychosis. Psychopathology. Symptoms of anxiety and depression. Mental examination. Psychopharmacology.

**Bibliography:** \* Kaplan y Sadock , Sinopsis de Psiquiatría: Ciencias de la conducta y psiquiatría clínica, 10, Lippincott Williams and Wilkins, [8496921387].

### **MC3114 Dermatology Clinic** ( 0 - 20 - 4. Prerequisites: [ MC3117 Corequisite , MC3117 ]. 16 MC 11 ) **Equivalence: None**

This is a basic course that requires knowledge of basic dermatology. As a result of the learning process the student is expected to learn to recognize the primary lesions on the skin, as well as diagnose and treat the most common diseases affecting the skin.

**General objective:** Upon completion of this course, students will be capable of describing the morphology of skin lesions and their distribution in an orderly fashion in patients seen in the clinic; make use of the acquired clinical techniques to solve practical common dermatological problems in general practice; educate the patients and/or their relatives about the particular problem they have as well as the different kinds of therapy available and forms of prevention; keep records of the evolution of patients following



the traditional SOAP system; participate in some common skin procedures such as skin biopsy, simple surgical excision, sclerotherapy, cryotherapy, electrolaser surgery; demonstrate confidence when presented with dermatological clinical challenges.

**Key words:** Clinical display of skin lesions.

**Bibliography:** \* Fitzpatrick, Atlas de dermatología clínica, 5ta., Rústica, [9788448143725].

### MC3115 Oncology Clinic

( 0 - 20 - 4. Prerequisites: [ MC3119 Corequisite , MC3119 ]. 16 MC 11 )

**Equivalence:** None

The Oncology Clinic is an advanced course that is intended to educate the general practitioner on matters relating to prevention and early detection of cancer. This course requires prior knowledge of internal medicine, gynecology, surgery, pediatrics, genetics, immunology, pathophysiology, clinical and imaging laboratory. As a result of learning, the student is expected to successfully apply theoretical knowledge acquired during clinical activities to the initial management of patients with cancer and learn about the different styles of physician-patient relationship, observing a real model of oncology practice as a specialty and possible choice for postgraduate studies.

**General objective:** Upon completion of this course, students will be able to perform the initial clinical approach to the patient and participate in the multidisciplinary clinical team in the context of medical oncology service.

**Key words:** Cancer / Prevention and early detection. Cancer epidemiology. Clinical guidelines for managing cancer. Palliative treatment of cancer. Integrated cancer treatment.

**Bibliography:** \* Martin D. Abeloff, James O. Armitage, John E. Niederhuber, Michael B. Kastan, W. Gillies McKenna, Abeloff's clinical oncology, 4, ilustrada, Churchill Livingstone/Elsevier, 2008, [0443066957, 9780443066955].

### MC3116 Rheumatology and Allergies Clinic

( 0 - 20 - 4. Prerequisites: [ MC3120 , MC3120 Corequisite ]. 16 MC 11 )

**Equivalence:** MC3078

This is an advanced course in which it is intended that students come into contact with patients with allergic and rheumatological diseases, and reinforce diagnostic skills through repeated practice of anamnesis, physical examination, writing case notes, exposure to laboratory and imaging studies, and case discussion with experts. The course requires prior knowledge of anatomy, immunology and internal medicine. As a result of learning, students are expected to write up case notes and analyze clinical cases, thus demonstrating their ability to recognize the rheumatological and allergic diseases that are most often presented to the general practitioner at the surgery and in the hospital setting with the aim of searching for an integrated management system supported by appropriate specialists.

**General objective:** Upon completion of this course, students will be able to carry out a directed clinical history, including the symptoms and clinical findings of interest, in patients with allergic and rheumatic disease; know the clinical utility of laboratory and imaging tests in the evaluation of patients with allergic and rheumatic diseases; and know the indications and contraindications for the techniques of arthrocentesis and infiltration of soft tissue and eventually perform these procedures.

**Key words:** Patient with hives. Patient with angioedema. Patient with anaphylaxis. Patient with food allergy. Patient with arthritis.

**Bibliography:** \* Rheumatic Disease Clinics of North America., Philadelphia : Saunders., [0889857X].

### MC3117 Dermatology

( 2 - 0 - 4. Prerequisites: None. 16 MC 11 )

**Equivalence:** None

Dermatology is an advanced course in which students will demonstrate their ethical, professional behavior in the application of their knowledge, abilities and skills by conducting a complete physical derma-



tological examination and describing the skin lesions using precise dermatological terminology. Moreover, they will assertively communicate the most common skin diseases found in daily practice. As a learning outcome, students will develop a logical treatment plan in order to reduce the patient's discomfort, disfigurement, anxiety, embarrassment and/or incapacity produced by the skin problem, addressing this in an integral, individual manner. All of this will be carried out considering the context and the community in which the patient lives.

**General objective:** Students will be able to perform a complete dermatological physical examination, describing the skin lesions using appropriate dermatological language. Students will formulate a differential diagnosis based on morphology and distribution of the skin lesions. They will know the most common skin diseases found in the daily practice of a dermatologist and be able to suggest a logical treatment plan, with the aim of lessening the discomfort, disfigurement, anxiety, shame and/or incapacity the skin problem is causing the patient. Students will identify and diagnose urgent dermatosis and will know the therapeutic options that are available. They will be aware of the importance of education in the prevention of skin diseases such as skin cancer.

**Key words:** Erythematic and ichthyosis diseases. Skin infections. Introduction to dermatology. Cutaneous manifestations of systemic diseases. Sebaceous and apocrine glands, hair and pigmentation disorders. Tumors.

**Bibliography:** \* Fitzpatrick, Thomas B. (Thomas Bernard), 1919-, Color atlas and synopsis of clinical dermatology : common and serious diseases / Thomas B. Fitzpatrick, Richard Allen Johnson, Klaus Wolff ; [contributing author], Dick Suurmond., 4th ed., New York : McGraw-Hill, Medical Pub. Division, c2001., [0071360387 (pbk. : alk. paper)].

### **MC3118 Medical Immunology** ( 2 - 0 - 4. Prerequisites: None. 16 MC 11 ) **Equivalence: None**

This is an advanced course designed so that medical students acquire knowledge of the cellular and molecular physiological processes that characterize

the immune system, as well as their clinical application. Previous knowledge is required in microbiology, internal medicine and pediatrics. The learning outcome for this course is that the students apply their knowledge of the pathophysiology of the immune system to resolving problems and clinical cases (real and simulated), involving the correct diagnostic and therapeutical approach to the most common immunological pathologies.

**General objective:** Upon completion of this course, students will be able to identify the physiological processes by which the body defends itself against infection and diagnose and address diseases related to the immune system.

**Key words:** Primary immunodeficiencies. Pathophysiology of the immune system. Basic immunology.

**Bibliography:** \* Kenneth M. Murray, Paul Travers. , Jeneway's Immunology, Ed. Garland Science , [978-0815341239].

### **MC3119 Oncology and Palliative Care** ( 2 - 0 - 4. Prerequisites: None. 16 MC 11 ) **Equivalence: None**

Oncology and Palliative Care is an advanced course that focuses on prevention and early detection of cancer. This course requires prior knowledge of internal medicine, gynecology, surgery, pediatrics, genetics, immunology, pathophysiology, clinical and imaging laboratory. As a result of learning, students will be able to analyze and discuss case studies that demonstrate their knowledge of the foundations for initial management of patients with cancer.

**General objective:** Upon completion of this course, students will be able to describe and discuss the implementation of procedures for prevention and early detection of the most common cancers at national and global levels.

**Key words:** Cancer / Prevention and early detection. Integrated management of cancer patients. Cancer epidemiology. Clinical guidelines for managing cancer. Palliative treatment of cancer.

**Bibliography:** \* , James O. Armitage, John E. Niederhuber, Michael B. Kastan, W. Gillies McKenna, Abeloff's clinical oncology, 4, ilustrada, Churchill Livingstone/Elsevier, 2008, [0443066957, 9780443066955].

## **MC3120 Rheumatology and Allergies**

**( 2 - 0 - 4. Prerequisites: None. 16 MC 11 )**

**Equivalence: None**

This is an advanced course, which is intended to enable students to carry out early diagnosis of different allergic, autoimmune and rheumatological diseases. The course requires basic knowledge of anatomy, immunology and internal medicine. As a learning outcome students are expected to resolve questions and discuss clinical cases through which they can demonstrate their ability to recognize the rheumatological and allergic diseases that are most often presented to general practitioners in their surgeries; understand the basic immune processes that explain these diseases; and differentiate which of these diseases can be handled in a primary care setting and which should be referred to specialists for definitive management.

**General objective:** Upon completion of this course, students will be able to understand the concepts and principles required to diagnose the most common rheumatic diseases such as osteoarthritis, gout, back pain, fibromyalgia, bursitis, tendonitis, and other regional forms of rheumatism; set out appropriate treatment for common diseases such as osteoarthritis, gout, back pain and fibromyalgia; identify patterns of presentation of autoimmune rheumatic diseases so that students can establish early diagnosis; understand the most frequently used drugs in autoimmune rheumatic diseases.

**Key words:** Generalities of rheumatology . General patterns of allergic diseases.

**Bibliography:** \* Harrison's Rheumatology, Anthony Fauci, Carol Langford, Second Edition, McGraw-Hill Professional, [[]].

## MD Basic Science for Medicine

### MD1015 Biostatistics

( 3 - 0 - 8. Prerequisites: None. 2 LNB11, 2 MC 11, 2 MO 11 )

**Equivalence: None**

The Biostatistics course contributes to the student's profile in the biomedical area by providing knowledge of the diverse statistical techniques and their application in biomedicine. The course requires previous knowledge in mathematics and Excel. As a learning outcome, students are expected to analyze and interpret the statistical results expounded in published articles as well as carry out investigations with scientific input to medicine.

**General objective:** Upon completion of this course, students will understand and apply biostatistical methods and concepts used in the research process and in decision making in public health. Topics include descriptive statistics, probability, sampling and sampling distributions, statistical inference, linear regression.

**Key words:** Descriptive statistics. Sample distributions and sample elements. Probability.

**Bibliography:** \* Daniel, Wayne W, Biostatistics: a foundation for analysis in the health sciences. Español;"Bioestadística : base para el análisis de las ciencias de la salud / Wayne W. Daniel colaboración en la traducción Francisco León Hernández revisión Guillermina Yankelevic, 4a ed., México : Limusa, 2002., mx , spa, [9681861647].

### MD1029 Chemical Foundations of Metabolism and Physiology

( 3 - 0 - 8. Prerequisites: None. 1 IMD11, 1 LNB11, 1 LP 12, 1 LPS12, 1 MC 11, 1 MO 11 )

**Equivalence: None**

This is a basic course focusing on the chemical and biological processes involved in human metabolism. The course requires prior general knowledge of chemistry. It is intended that students acquire basic

knowledge of chemistry, bioenergetics and structural biochemistry to enable them to understand the metabolic reactions that occur in organisms. Concepts related to the structure and chemical organization of the molecules involved in reactions within the body and their interactions will be reviewed; the students will relate the physicochemical characteristics of water to its role as a universal solvent, the importance of buffer solutions, the characteristics of the main biomolecules and the main concepts related to bioenergetics and enzymatic catalysis, as well as the fundamental concepts of some techniques used in the identification and analysis of chemical compounds. As a learning outcome, students are expected to apply this knowledge and these skills to solve problems in real or simulated cases of biomedical origin, either in normal or abnormal processes.

**General objective:** Upon completion of this course, students will have acquired knowledge of the chemical bases of metabolism and physiology, enabling them to understand biochemical processes at cellular level and physiological processes in normal and compensation conditions that occur at apparatus and system levels. Students will be able to relate the chemical structure of biomolecules with their physicochemical characteristics and the type of reaction in which they participate; integrate their knowledge to explain the mechanisms that achieve balance in live organisms and the relationship between chemical alterations and the compensation mechanism in the human body.

**Key words:** Basic principles of molecular structure formation. Bioenergetics and thermodynamics. Enzymatic catalysis. Biomolecules.

**Bibliography:** \* McKee, Trudy., Bioquímica: las bases moleculares de la vida / Trudy McKee, James R. McKee; tr. Juan Roberto Palacios Martínez, 4a ed., México: McGraw Hill, 2009., spaeng, [9789701070215].

## MD1030 Metabolism and Functional Biochemistry

( 3 - 0 - 8. Prerequisites: None. 2 IMD11, 2 LNB11, 2 MC 11, 2 MO 11 )

**Equivalence: None**

This is a basic course which will review the biochemical bases that explain metabolic processes and homeostasis in humans. It is intended that students identify the characteristics of anabolic and catabolic reactions, the control mechanisms of metabolic reactions and the interplay between them. In addition, students will compare aerobic metabolism with anaerobic metabolism in terms of obtaining energy and energy efficiency. The course requires knowledge of general chemistry and cell biology. As a result of learning, students will produce conceptual maps in which they link the metabolic pathways related to real or simulated problems.

**General objective:** Upon completion of this course, students will have acquired knowledge about the biochemical processes related to the human metabolism, enabling them to understand how the systems in the human organism work. Students will be able to relate chemical reactions to the generation of energy, biomolecule degradation or synthesis, and waste elimination processes.

**Key words:** Anabolism. Catabolism. Metabolism of biomolecules. Generation of energy. Physiological implications and integration of the metabolism.

**Bibliography:** \* McKee, Trudy., Bioquímica: las bases moleculares de la vida / Trudy McKee, James R. McKee; tr. Juan Roberto Palacios Martínez, 4a ed., México: McGraw Hill, 2009., spaeng, [9789701070215].

## MD1031 Cell Biology

( 3 - 0 - 8. Prerequisites: None. 3 IMD11, 1 LNB11, 1 LP 12, 1 LPS12, 1 MC 11, 1 MO 11 )

**Equivalence: None**

This is a basic course in which students analyze cellular processes, link structure with cell function and integrate their knowledge to explain the compensatory mechanisms that occur when the function or structure of a cell is altered. The course requires general knowledge of biology and chemistry. It is in-

tended that students acquire knowledge of basic cell structure, its morphological and functional characteristics. Cellular processes will be reviewed and cell structure will be linked to tissue function. As a learning outcome, students are expected to apply their knowledge to solve simulated cases or real problems of biomedical origin, either in normal or abnormal processes.

**General objective:** Upon completion of this course, students will be able to recognize the structural and functional characteristics of cell components; establish the mechanisms produced by external or internal stimuli that alter the structure or function of cells; identify the way in which cells communicate and the types of studies that are conducted to analyze them.

**Key words:** Cell structure. Organelles. Active and passive transport. Vesicular trafficking. Cell signaling. Intra and intercellular communication.

**Bibliography:** \* McKee, Trudy., Bioquímica: las bases moleculares de la vida / Trudy McKee, James R. McKee; tr. Juan Roberto Palacios Martínez, 4a ed., México: McGraw Hill, 2009., spaeng, [9789701070215].

## MD1032 Historical Foundations in Health Sciences

( 3 - 0 - 8. Prerequisites: None. 1 LNB11, 3 LP 12, 3 LPS12, 1 MC 11, 1 MO 11 )

**Equivalence: None**

This is a basic course designed to help students fully understand and analyze the historical bases of the health science disciplines upon which the practice of various professions is founded, as well as the trajectory of trends in welfare health education. The course will review the evolution of the concept of health-illness during important historical-social periods and according to various disciplines and applications of health sciences. The subject matter will give students an introduction to the rational, scientific logic applied to the area of healthcare in order to make sense of their personal motives for seeking and understanding the realities that surround them, so that they can apply this critical thinking throughout their training. Previous knowledge is required in basic web navigation. The learning outcome for this course is that the students outline the role of health

professionals in various areas, in order to develop critical evidence-based thinking.

**General objective:** Upon completion of this course, students will be able to understand the historical eras of health science; develop the ability to abstract the paradigm in each historical period and its impact in practice; question the characters and significant events for the training of health professionals; integrate the concept of health and disease to each historical period from the areas of disciplinary application; assess the current role of medical practice; understand the sociocultural, geographical, economic and political processes that impact on the lives of people and give a specific vision of their suffering, their view of disease, and how the health care professional can understand this process to provide the patient with humanistic, ethical and scientific health care.

**Key words:** Critical thinking. History of health professionals. Health-disease concept. Sociocultural history of the profession as an educational strategy.

**Bibliography:** \* Salas-Salvado Jordi, Garcia-Lorda Pilar Sánchez Ripolles José Ma. , La alimentación y la nutrición a través de la historia, 2da., Glosa, [84-7429-257-3].

### MD1033 Histology

( 2 - 2 - 8. Prerequisites: None. 1 MC 11, 1 MO 11 )

**Equivalence: None**

This is a basic course designed to instruct students in the different levels of molecular and cellular organization that form the basis for the formation of organs and body systems. Students will be able to recognize, through a microscope, the various basic tissues found in the human body. Topics studied include preparation of tissues, use of the microscope, and description of epithelial, nervous, muscular, connective, and special tissues. This course requires previous knowledge of general biology. The learning outcome for this course is that students be able to identify the tissues they observe through the microscope, match them to their corresponding organs, and describe the general function of the tissue, so as to develop their capacity for evidence-based learning.

**General objective:** Upon completion of this course, students will be able to identify the different tissues present in the human body and correlate the tissue with the organ from which it belongs; understand the microscopic bases of human general morphology, fundamental in later lessons.

**Key words:** Histology. Tissues. Cellular and molecular organization.

**Bibliography:** \* 1. Ross, M. H.; Pawlina, W., Histología: Texto y Atlas Color, con biología celular y molecular, 5ta., Médica Panamericana, [9789500604353].

### MD1034 Developmental Biology

( 3 - 0 - 8. Prerequisites: [ MD1031 ]. 2 LNB11, 2 LP 12, 2 LPS12, 2 MC 11, 2 MO 11 )

**Equivalence: None**

This is a basic course designed to help students understand and apply the basic concepts of embryologic development, from conception to birth, and the different stages of life, as well as the anatomy and physiology of the male and female reproductive systems, applying learning based on problem solving. The learning outcome for this course is that the students solve problems, applying their knowledge of embryologic development from fertilization to birth, of the various life stages, from infancy to old age, and of the problems related to the male and female reproductive systems; analyze real-life cases related to the processes of embryonic development, different life stages and the male and female reproductive systems; put together a portfolio of evidence of their activities related to these topics; present, through the technique of problem-based learning, cases related to the topics of embryology, life stages and the male and female reproductive systems; and create or consolidate learning-objective situations based on the case studies that have been presented.

**General objective:** Upon completion of this course, students will be able to propose solutions to biomedical problems, based on physiological knowledge; raise and solve problems related to embryology, the male and female reproductive systems; analyze the main anatomical/physiological processes related to embryologic development and male and female re-



productive systems; identify the main characteristics of the different stages of life.

**Key words:** Male and female reproductive system. Embryologic development. Life stages.

**Bibliography:** \* Dvorkin, Mario A., Best & Taylor : Bases fisiológicas de la práctica médica / Mario A. Dvorkin, Daniel P. Cardinali, Roberto H. Iermoli., 14a ed., Buenos Aires : Médica Panamericana, c2010., [9789500602532].

### **MD1035 Genetics for Health Sciences** (3 - 0 - 8. Prerequisites: [MD1029]. 2 MC 11, 2 MO 11) **Equivalence: None**

This is a basic course in which students will study the chronological development of genetics, from classical to molecular genetics including applications to and influence on social development. Students will learn about the associated terminology, the processes involved in the transmission of hereditary information, and the regulation of hereditary information on a molecular, chromosomal, and cellular level. Students will also learn about Mendelian and polygenic inheritance, molecular causes of genetic diseases, and some genetic analysis techniques. This course requires as a prerequisite the knowledge obtained in the courses of Metabolic and Physiological Chemistry, and Cellular Biology. The learning outcome for this course is that students acquire the basic concepts of genetics and describe the transmission processes of hereditary information in real or simulated situations in simple terms.

**General objective:** Upon completion of this course, students will have acquired knowledge about basic concepts of genetics and transmission of hereditary information that in later courses will enable them to understand the importance of preserving the integrity of genetic material, the molecular bases of alterations, and the mechanisms involved in the activation and inhibition of genes during the various stages of an organism's development.

**Key words:** Genetics. Central dogma of cell biology. Cell cycle. Molecular basis of genetic pathologies. Genetic tools and techniques.

**Bibliography:** \* Pierce, Benjamin A., Genética : un enfoque conceptual / Benjamin A. Pierce., 3a ed., Madrid, España : Médica Panamericana, c2009., [9788498352160].

### **MD1036 Basic Morphophysiology** (5 - 0 - 12. Prerequisites: [ MD1031 ]. 4 IMD11, 2 LNB11, 2 LP 12, 2 LPS12, 2 MC 11, 2 MO 11 ) **Equivalence: None**

This is a basic course in which it is intended that the student will know and relate tissue structure to body function at regional level and by apparatus and systems. The course includes concepts of the classification of the apparatus and systems in the human body, the general function of each one, and how these interact. Previous knowledge of cell biology and histology is required. As a result of learning, students will apply their knowledge and skills to solve real or simulated problems in the biomedical area, in normal or pathological situations.

**General objective:** Upon completion of this course, students will be able to analyze how body systems are structured and be able to understand the relationship between them.

**Key words:** General anatomy. General physiology. Morphology.

**Bibliography:** \* Dvorkin, Mario A., Best & Taylor : Bases fisiológicas de la práctica médica / Mario A. Dvorkin, Daniel P. Cardinali, Roberto H. Iermoli., 14a ed., Buenos Aires : Médica Panamericana, c2010., [9789500602532].

### **MD1037 Healthy Environment and Self-care** (2 - 0 - 4. Prerequisites: None. 3 MC 11, 3 MO 11 ) **Equivalence: None**

This is a basic course, which is designed to help students understand and apply concepts of self-care, such as appropriate diet, exercise, personal hygiene, substance abuse, sexual hygiene, stress, emotions and violence, and concepts of aspects related to the environment, such as pollution, accidents, vaccination and personal safety. Previous knowledge is re-



quired in morphophysiology and handling electrical sources. The learning outcome for this course is that the students perform a self-diagnosis of their health status and establish short-term, medium-term and long-term self-care programs; and that they analyze and write down, using critical thinking, their opinions about the environment in which they have developed.

**General objective:** Upon completion of this course, students will be able to propose a scheme related to self-care in different areas and the way these are related; propose and set out forms of self-care; analyze the causes of a healthy environment and identify areas of opportunity to maintain a balance between the person and the environment in which he is located.

**Key words:** Integral wellness. Healthy environment. Violence. Addictions. Accidents.

**Bibliography:** \* Álvarez Alva, Rafael., Educación para la salud / Rafael Álvarez Alva., 2a ed., Mexico : Manual Moderno, c2005., [9707291664],[9789707291669].

### **MD1038 Morphofunctional Laboratory** (2 - 2 - 8. Prerequisites: [MD1036]. 3 MC 11, 3 MO 11) **Equivalence: None**

The purpose of this basic course is to provide and progressively integrate physical, chemical, morphological, and physiological concepts involved in instrumental diagnostic methods and tests used in clinical practice. This course requires basic general knowledge in physiological chemistry, biochemistry, anatomy, and physiology. The learning outcome for this course is that students will be able to explain the foundations, the basic steps in the procedures, methods, and tests for clinical diagnosis, identifying their scope and limitations, as well as the implications of biomedical instrumental diagnosis, while applying their knowledge to the solution of biomedical problems.

**General objective:** Upon completion of this course, students will be able to describe the foundations of instrumental diagnosis, based upon the physical principles involved and the physiological or anatomical function explored; identify possible sources of er-

rors or misinterpretations of instrumental diagnostic methods based on their understanding of its nature; The student will be able to analyze the implications of any variation in the biomedical diagnostic test process.

**Key words:** Morphofunctional laboratory. Physiology laboratory. Bioinstrumentation fundamentals.

**Bibliography:** \* Arthur C. Guyton , Fisiología Médica, 11ª Edición, Elsevier Saunders, [ISBN 07216-0240-1].

### **MD1039 Microbiology and Parasitology**

(3 - 0 - 8. Prerequisites: [MD1036]. 3 LNB11, 3 MC 11, 3 MO 11 )

**Equivalence: None**

This is a basic course which will train students to describe the taxonomy, morphology, size, structure, and reproduction of the various microorganisms and parasites present in the human body that can affect the health of the individual. Students will be able to identify the etiological agents of infectious disease and the foundations of the host-parasite relationship so that they have a better understanding of the pathogenesis, epidemiology, and etiological diagnosis of these diseases. This course requires previous knowledge in basic morphophysiology, biology, and cellular metabolism. The learning outcome for this course is that students schematize the host-parasite relationship and describe the manifestations that can be produced in the human body, applying this knowledge to the solution of problems of an infectious nature that they may later see in their professional activity.

**General objective:** Upon completion of this course, students will be able to describe the taxonomy, morphology, size, structure and reproduction of various microorganisms and parasites; associate the type of microorganism or parasite with the infection; and identify the likely events that may occur in the human body, covering basic aspects of microbiology, mycology, virology and parasitology.

**Key words:** Microbiology. Bacteriology. Mycology. Virology. Parasitology.

**Bibliography:** \* Tortora, Gerard J., *Introducción a la microbiología* / Gerard J. Tortora, Berdell R. Funke, Christine L. Case., 9a ed., Buenos Aires ; México : Editorial Médica Panamericana, c2007., spaeng, [9789500607407].

## MD1040 Musculoskeletal and Digestive Systems

( 3 - 0 - 8. Prerequisites: [ MD1036 ]. 5 IMD11, 3 LNB11, 3 MC 11 )

**Equivalence:** None

This is a basic course in which students will know and apply the fundamental morphophysiological concepts of the musculoskeletal and digestive systems using problem-based learning. The course requires prior knowledge of anatomy and general physiology. As a learning outcome it is expected that the student deal with embryological, morphological and physiological problems of the musculoskeletal and digestive systems in order to compile a portfolio made of evidences of analysis of real biomedical problems.

**General objective:** Upon completion of this course, students will be able to analyze, express and solve biomedical problems based on embryological, morphological and physiological knowledge of musculoskeletal and digestive systems. He will also be able to identify the main characteristics of these systems as well as the correlations and regulation over different corporal systems.

**Key words:** Musculoskeletal system. Digestive system. Problem-based Learning.

**Bibliography:** \* Dvorkin, Mario A., Best & Taylor : *Bases fisiológicas de la práctica médica* / Mario A. Dvorkin, Daniel P. Cardinali, Roberto H. Iermoli., 14a ed., Buenos Aires : Médica Panamericana, c2010., [9789500602532].

## MD1041 Biocontrol Systems

( 5 - 0 - 12. Prerequisites: [ MD1036 ]. 5 IMD11, 3 LNB11, 3 MC 11, 3 MO 11 )

**Equivalence:** None

This is a basic course in which it is intended that students know and apply the fundamental morphophysiological concepts of the nervous and endocrine

systems using problem-based learning. The course requires prior knowledge of anatomy and general physiology of the human body, as well as basic knowledge of developmental biology. As a learning outcome the student is expected to apply the technique of problem-based learning, solve real cases related to the processes of embryological development, anatomical structure and the physiological process of the nervous and endocrine systems and integrate a portfolio of evidence of the activities related to these topics.

**General objective:** Upon completion of this course, students will be able to analyze, express and solve biomedical problems, based on embryological, morphological and physiological knowledge of the endocrinal and nervous systems; identifying the main characteristics of these systems as well as the interrelations and control over the different kinds of body systems.

**Key words:** Nervous system. Problem-based Learning. Endocrine system.

**Bibliography:** \* Dvorkin, Mario A., Best & Taylor : *Bases fisiológicas de la práctica médica* / Mario A. Dvorkin, Daniel P. Cardinali, Roberto H. Iermoli., 14a ed., Buenos Aires : Médica Panamericana, c2010., [9789500602532].

## MD1042 Community I

( 2 - 0 - 4. Prerequisites: None. 3 LNB11, 3 MC 11, 3 MO 11 )

**Equivalence:** MD1026

This is a basic course aimed at contributing to the Tecnológico de Monterrey's 2015 Mission by sensitizing students to the health sciences, specifically to a vocation of service, humanism, and respect for all people. To this end, students will be placed with various population groups within highly marginalized communities so that they can identify the community needs with respect to their health and improvement of their environment. This course requires previous knowledge of computer resources, word processing, and spreadsheets. The learning outcome for this course is that students produce, in writing, a diagnosis of the state of health of their community and

that they propose a short-term and medium-term improvement plan.

**General objective:** Upon completion of this course, students will be able to identify the theoretical and practical foundations to design and justify health projects in communities with high levels of marginalization, taking into account the UN Millennium Goals and using the Service Learning method.

**Key words:** Models of community service. Service-learning. Community tools. Marginality. Study of the community.

**Bibliography:** \* Pendiente, Pendiente.

### **MD1043 Defense and Hemostasis** ( 3 - 0 - 8. Prerequisites: None. 4 MC 11, 5 MO 11 ) **Equivalence: None**

In this basic course students will know and apply fundamental concepts of anatomy and physiology of the coagulation and immunology systems using problem-based learning. The course requires basic knowledge of cell biology, anatomy and general physiology. As a learning outcome it is expected that the student discusses real cases related to embryological and physiological processes of the immune, hematological and coagulation systems; develops or integrates learning objectives based on the cases presented; resolves problems applying basic knowledge of embryology, morphology, and physiology of the immune, hematological and coagulation systems; and integrates a portfolio of evidences composed of activities related to these issues.

**General objective:** Upon completion of this course, students will be able: to propose solutions to biomedical problems based on their knowledge of physiology; to propose and solve problems related to embryology, morphology and physiology of the immune, hematological and coagulation systems; to analyze the main anatomophysiological processes related to the immune, hematological and coagulation systems; and to identify the main features of the immune, hematological and coagulation systems as well as their relationship and regulation over other corporal systems.

**Key words:** Anatomy, embryology and physiology of the immune system; coagulation and blood.

**Bibliography:** \* Regeiro J.R., López Larrea C., González S. , Inmunología Biología y patología del sistema inmune, 3era, Editorial Médica Panamericana., [978-84-7903-0-9].

### **MD1044 General Pharmacology and Toxicology** (3 - 0 - 8. Prerequisites: [MD1041]. 4 MC 11, 6 MO 11) **Equivalence: None**

This is a basic course whose intention is that students know and apply the general principles that govern the absorption, distribution, biotransformation, elimination, and mechanisms of action of drugs; the pharmacokinetics and pharmacodynamics of the main drugs against bacteria, viruses, fungi and parasites, as well as a general knowledge of substances used as antiseptics, disinfectants, and antiinflammatories. The course requires prior knowledge of chemistry, morphology and general physiology of the human body. As a learning outcome students are expected to apply their knowledge to real or simulated clinical cases, to choose the best option in keeping with the pathophysiological process in question, to make a comparison over what is written in the literature and what is applied in practice, and to be responsible for the proper use of medicines.

**General objective:** Upon completion of this course, students will be able to understand general aspects of pharmacokinetics and pharmacodynamics of drugs; their main pharmacological and adverse effects, drug interactions, contraindications and clinical applications; practice calculating dosage according to weight, age and height; differentiate the uses of drugs against different microorganisms and in inflammatory processes; and choose the best option according to the pathophysiological process presented.

**Key words:** Toxicology. Pharmacokinetics and pharmacodynamics. Antimicrobials and antiparasites. Anti-inflammatory drugs. Antiseptics.

**Bibliography:** \* Goodman & Gilman las bases farmacológicas de la terapéutica., 11th ed. /editor, Laurence L. Brunt

### MD1045 Vital Processes

( 5 - 0 - 12. Prerequisites: [ MD1041 ]. 6 IMD11, 4 LNB11, 4 MC 11, 4 MO 11 )

**Equivalence: None**

This is a basic course in which it is intended that students know and apply the basic morphophysiological concepts of the cardiovascular, renal and respiratory systems by implementing problem-based learning. The course requires prior knowledge of the structure and function of the nervous and endocrine systems. As a learning outcome, students are expected to solve problems of embryological, morphological and physiological aspects of the cardiovascular, renal and respiratory systems, integrating a portfolio of evidences concerning the analysis of real biomedical cases.

**General objective:** Upon completion of this course, students will be able: to propose solutions to biomedical problems based on their knowledge of physiology; to propose and solve related problems based on the embryology, morphology and physiology of the cardiovascular, respiratory and renal systems; to analyze the main anatomophysiological processes related to the cardiovascular, respiratory and renal systems; to identify the main features of the cardiovascular, respiratory and renal systems; and to determine the relationships and regulation of different kinds of corporal systems.

**Key words:** Respiratory system. Cardiovascular system. Problem-based Learning. Renal system.

**Bibliography:** \* Arthur C. Guyton, Fisiología Médica, 11, Elsevier Saunders, Español, [07216-0240-1].

### MD1046 History Taking and Clinical Examination I

( 2 - 2 - 8. Prerequisites: [ MD1029 , MD1036 , H2001 , MD1041 ]. 4 MC 11 )

**Equivalence: None**

In this basic course it is intended that students develop the skills for properly obtaining the medical history and performing the physical examination in order to gather relevant clinical information from a patient and as a part of a clinical reasoning process. It is intended that students have the ability, also, to document, in writing, the information obtained in the medical history observing the Mexican regulation NOM-168-SSA1-1998 for medical records. All of the above should be carried out within an ethical and respectful context for the patient. The course requires basic knowledge of writing, verbal expression, anatomy and physiology. As a learning outcome the student is expected to demonstrate the skills required to establish a doctor-patient relationship within a context of ethics and respect, in addition to carrying out the full interview and general physical examination of a patient.

**General objective:** Upon completion of this course, students will be able: to establish an appropriate doctor-patient relationship within the ethical and cultural context of the patient; to conduct a full medical history and physical examination, using suitable techniques and strategies, and; to document correctly the information obtained according to the statutes of NOM 168.

**Key words:** Medical history. Physical examination. Semiology. Medical interview. Propaedeutic, doctor-patient relationship.

**Bibliography:** \* Bates, Barbara, 1928-, A guide to physical examination and history taking / Barbara Bates, Lynn S. Bickley, Robert A. Hoekelman ; with a chapter on the pregnant woman by Joyce E. (Beebe) Thompson ; illustrations by Susan Shapiro Brenman., 6th ed., Philadelphia : Lippincott, c1995., [0397550537 (papel alcalino)].

## MD1047 Research and Technology in Health Sciences

( 3 - 0 - 8. Prerequisites: None. 1 LNB11, 1 MC 11, 1 MO 11 )

**Equivalence: None**

This is a basic course, which provides students with an introduction to the various interpretations of health phenomena from the standpoint of the scientific method. In addition, students will arrive at an objective, critical viewpoint through the development of skills in the use of information and technology related to their area of specialty, within the context of the association between information and knowledge. Previous knowledge is required in basic database management and Internet information searches. The learning outcome for this course is that the students analyze and apply this knowledge to real-life health problems through a research proposal. The results will be presented in a final report modeled on a scientific publication.

**General objective:** On completion of this course, students will be part of a team that will be able to design, plan and implement the various stages of the scientific method in a research project in the field of biomedical sciences. In order to develop the project, they will take into account elements of ethics and social responsibility and technological advances in the process of health care in the context of information and knowledge society.

**Key words:** Evidence based medicine. Research methodology. Information society. Research plan.

**Bibliography:** \* Hernández Sampieri R, Fernández Collado C, Baptista Lucio P, Metodología de la Investigación, MacGrawHill, [00000056MX].

## MD1048 Community II

( 2 - 0 - 4. Prerequisites: [ MD1042 ]. 4 LNB11, 4 MC 11, 4 MO 11 )

**Equivalence: None**

This is basic course intended to facilitate the completion of curricular requirements in the community, through the implementation of community development projects in different fields of health, taking as a point of reference the needs of those communi-

ties determined on previous courses. The mentioned implementation will be based on the pedagogical and supportive components recommended by the Learning-Service Technique in which the student appears as the main character of the joint initiatives and makes a commitment to the Tecnológico de Monterrey School of Medicine's University Social Responsibility body. The course requires basic knowledge of the learning-service strategy and community diagnostics. As a learning outcome students are expected to implement the community development project and develop a portfolio of evidences showing the impact of the project on the community, thus promoting the attitudes of service and civic responsibility.

**General objective:** Students will be able to plan, organize and implement a community development project in the fields of Dentistry, Nutrition, Nursing, Health & Medical Systems, obtaining citizen participation and measuring the impact it has on the population.

**Key words:** Community development projects in the health area. Service-Learning experience.

**Bibliography:** \* Rivera Martínez, Francisco., Administración de proyectos : guía para el aprendizaje / Francisco Rivera Martínez, Gisel Hernández Chávez., 1a ed., México : Prentice-Hall, 2010., [9786074426205].

## MD1049 Introduction to the Medical Doctor Academic Program

( 3 - 0 - 4. Prerequisites: None. 1 MC 11 )

**Equivalence: None**

The purpose of this basic-level course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and profes-



sional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Netter, Frank H. (Frank Henry), 1906-1991., Atlas of human anatomy / by Frank H. Netter ; Sharon Colacino, consulting editor., Summit, N.J. : CIBA-GEIGY Corp., c1989., [0914168185],[0914168193 (rústica)].

### **MD1050 Psychophysiology** ( 5 - 0 - 12. Prerequisites: None. 5 LP 12, 5 LPS12 ) **Equivalence: None**

This is a basic course in which students integrate the physiological perspective of the etiology of various psychological functions, taking into consideration the knowledge of embryology, morphology and physiology of the gastrointestinal, endocrine and nervous systems, as well as the interrelationship and control of different apparatus and systems. The course requires knowledge of general anatomy and physiology of the human body. As a learning outcome, students are expected to solve real or simulated cases involving the relationship between physiological, emotional, cognitive and human behavior processes.

**General objective:** Upon completion of this course, students will be able to analyze the development of psychophysiology as a science; describe the structural and functional relationship of different systems of an organism with the central nervous system and psychological processes; identify the relationship between different physiological responses, cognitive and emotional processes, by determining psychophysiological profiles under normal conditions; distinguish the parameters related to a particular psychophysiological pathology.

**Key words:** Psychophysiology. Endocrine system. Neurological system. Gastrointestinal system. Psychophysiological parameters.

**Bibliography:** \* Best, Charles Herbert, 1899-, Best & Taylor : bases fisiológicas de la práctica médica / directores Mario A. Dvorkin, Daniel P. Cardinali, Roberto H. Iermoli., 14a ed., Buenos Aires : Médica Panamericana, c2010., [9789500602532].

### **MD3000 Introduction to Professional Development**

( 2 - 0 - 2. Prerequisites: None. 13 MC 11 )  
**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].



## MI Media Studies

### MI1002 Fundamentals of Journalism

( 3 - 0 - 8. Prerequisites: None. 4 LMI11 )

Equivalence: MI2001

The purpose of this basic journalism course is for students to visualize a panoramic view of the history of journalism while recognizing the principal theoretical approaches that explain journalism's social function. The course requires basic knowledge of world and contemporary history. The learning outcome of this course is for students to prepare research projects that demonstrate knowledge of how journalism has evolved, using the basic elements of the theories of journalism.

**General objective:** Upon completion of this course, students will understand the relationship of journalism to historical and technological contexts, and recognize the diverse theoretical approaches and apply them to the analysis of the practice of journalism.

**Key words:** Technological development. History of journalism. Journalistic trends.

**Bibliography:** \* Abril, Gonzalo., Teoría general de la información : datos, relatos y ritos / Gonzalo Abril., 2a ed., Madrid : Cátedra, 2005., [8437614953].

### MI1003 Introduction to Journalism and Media Studies Academic Program

( 3 - 0 - 4. Prerequisites: None. 1 LMI11 )

Equivalence: None

This is a basic level course in the field of marketing that requires students' to identify and implement introductory marketing concepts in activities related to projects of the field. As a learning outcome of this course, students are expected to undertake a comprehensive project where they apply the learned concepts to a practical real-world business situation.

**General objective:** At the end of the course, the student must understand the factors that affect the firms and its environment within the marketing field.

Students will understand the evolution of marketing, and know concepts related to creativity, information and market research systems, market segmentation, consumer behavior, business markets, product development strategies, pricing, distribution, and promotional mix. The course objective also analyzes the marketing process for service and international contexts.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* ITESM, Misión, Visión y Objetivos del Tecnológico de Monterrey.

### MI2005 Production for Informative Journalism

( 3 - 0 - 8. Prerequisites: None. 4 LCMD11, 5 LMI11 )

Equivalence: MI2000

The purpose of this intermediate journalism course is to develop planning, research and writing skills in informative journalistic genres, such as raw material for editorial content in a news medium. The course requires knowledge and practice in writing and research methodology in social sciences. The learning outcome of this course is for students to prepare informative journalistic products (press releases, interviews, reports).

**General objective:** Upon completion of this course, students will be able to research newsworthy topics by consulting diverse news sources, and write news reports for the media.

**Key words:** Investigative journalism. Information sources. Informative writing. Informative journalism genres.

**Bibliography:** \* Benavides Ledesma, José Luis., Escribir en prensa / José Luis Benavides Ledesma, Carlos Quintero Herrera., 2a ed., Madrid : Pearson Educación, c2004., [8420542296].

## MI2006 PProduction for Editorial Journalism

( 3 - 0 - 8. Prerequisites: None. 6 LMI11 )  
Equivalence: MI2002

The purpose of this intermediate journalism course is to develop planning and writing skills in journalistic genres of opinion for informative media. The course requires knowledge and practice in writing, research methodology in social sciences, analysis and interpretation. The learning outcome of this course is for students to prepare interpretative journalistic products (reports, reviews, columns, editorials and articles of opinion).

**General objective:** Upon completion of this course, students will developed writing abilities of interpretation of reality through journalistic writing based on analysis and argument.

**Key words:** Editorial writing. Opinion journalism genres. Journalistic analysis and interpretation.

**Bibliography:** \* Abril Vargas, Natividad., Información interpretativa en prensa / Natividad Abril Vargas., Madrid : Editorial Síntesis, [2003]., [8497561252], [9788497561259].

## MI3001 Photojournalism

( 3 - 0 - 8. Prerequisites: None. 6 LMI11 )  
Equivalence: None

This is an advanced course in the field of journalism that seeks for the student to develop practical and conceptual skills for practicing professional photojournalism. The course requires prior knowledge of audiovisual design and production and use of digital photo and audiovisual editing programs, as well as key journalistic concepts such as codes of ethics, fairness and information as a public asset and social service. As a result of learning, the student will carry out a photojournalistic project related to social interest and media issues.

**General objective:** Upon completion of this course, the student will have developed skills in production, analysis and creation of projects in the field of photojournalism, with an international vision that responds to the need to inform, document and reflect on the

contemporary world, with a clear sense of social responsibility and professional ethics.

**Key words:** Photography. Photojournalism. Informative image.

**Bibliography:** \* Fontcuberta, Joan, El beso de Judas: fotografía y verdad , Gustavo Gili S.A, Español.

## MI3004 Digital Journalism

( 3 - 0 - 8. Prerequisites: [ AV1001 , AV3000 , AV3013 ]. 8 LMI11 )

Equivalence: MI00884

This is an advanced course in the field of journalism whose purpose is for students to develop skills for writing and producing informational products for digital outlets. The course requires knowledge of basic communication theories as well as audiovisual narrative and the ability to write news stories, features and opinion pieces. The learning outcome of this course for students is to prepare and produce informational products for digital outlets.

**General objective:** Upon completion of this course, students will be able to cover journalistic information for the web and digital publications, utilize digital language, and recognize informational tendencies across the various digital platforms.

**Key words:** Digital journalism. Radio, TV in digital platforms. Organizational digital journalism. Digital journalism and ethics.

**Bibliography:** \* López, Xosé , Sistemas digitales de información de información, Pearson Educación.

## MI3008 Radio Journalism

( 3 - 0 - 8. Prerequisites: None. 6 LMI11 )  
Equivalence: MI2003

The purpose of this advanced journalism course is for students to develop skills for writing and generating informational products for the radio and its digital outlets. The course requires knowledge of basic communication theories as well as audiovisual narrative and the ability to write news stories, reports and

opinion pieces. The learning outcome of this course for students is to prepare and produce programs and informational products for radio and its mobile and portable digital Internet outlets.

**General objective:** Upon completion of this course, students will be able to cover news for radio, handle radio broadcasting terminology and recognize the news trends in contemporary radio broadcasting.

**Key words:** Radio. Radio language. Electronic and digital journalism. Radio journalism. Newscasts. Podcasts.

**Bibliography:** \* Olivia, Llúcia., *Las noticias en radio y televisión : periodismo audiovisual en el siglo XXI / Llúcia Olivia, Xavier Sitja.*, 5a ed., Barcelona : Ediciones Omega, 2007., [9788428214469],[8428214468].

### MI3009 Television Journalism

( 3 - 0 - 8. Prerequisites: None. 7 LMI11 )

Equivalence: MI3002

The purpose of this advanced journalism course is for students to develop skills for writing and generating informational products for the television and its digital outlets. The course requires knowledge of basic communication theories as well as audiovisual narrative and the ability to write news stories, reports and opinion pieces. The learning outcome of this course for students is to prepare and produce programs and informational products for television and its mobile and portable digital Internet outlets.

**General objective:** Upon completion of this course, students will be able to cover news for television, handle television broadcasting terminology and recognize the news trends in contemporary television broadcasting.

**Key words:** Television. Newscasts. News bulletins. Television language.

**Bibliography:** \* Olivia, Llúcia., *Las noticias en radio y televisión : periodismo audiovisual en el siglo XXI / Llúcia Olivia, Xavier Sitja.*, 5a ed., Barcelona : Ediciones Omega, 2007., [9788428214469],[8428214468].

### MI3010 Production of Multimedia Publications

( 3 - 0 - 8. Prerequisites: None. 8 LMI11 )

Equivalence: None

The purpose of this advanced journalism course is to train students in the use of specialized software for producing information on digital platforms. The course requires basic knowledge of design and informational writing. The learning outcome of this course is for students to prepare journalistic products: web pages, print magazines, blogs, digital magazines and infographs.

**General objective:** Students will develop their creative skills to generate media products for digital platforms, using specialized software.

**Key words:** Multimedia design and production. Multimedia design software. Production components. Multimedia content management.

**Bibliography:** \* McAdams, Mindy., *Flash journalism : how to create multimedia news packages / Mindy McAdams.*, Amsterdam; Boston : Focal Press, c2005., [0240806972 (rústica : papel alcalino)].

### MI3011 Convergent Journalism

( 3 - 0 - 8. Prerequisites: None. 9 LMI11 )

Equivalence: None

The purpose of this advanced journalism course is for students to develop practical and conceptual skills for producing and writing journalistic products for diverse media outlets. The course requires previous knowledge of digital journalism, radio and television as well as design and production of interactive publications. The learning outcome of this course is for students to produce information using audio, photography, video and multimedia programs to feed information to different media outlets: radio, television, print media and Internet as well as multimedia information portals.

**General objective:** Upon completion of this course, students will be able to produce information for diverse news media.

**Key words:** Convergence and journalism industry. Languages and media convergence. Convergent information production. Convergent information project.

**Bibliography:** \* Kolodzy, Janet, 1955-, *Convergence journalism : writing and reporting across the news media* / Janet Kolodzy., Lanham, Md. : Rowman & Littlefield, c2006., [0742538850 (encuadernado : papel alcalino)], [0742538869 (rustica : papel alcalino)], [9780742538856], [9780742538863].

### MI3012 Research and Development Journalism

( 3 - 0 - 8. Prerequisites: None. 9 LMI11 )

**Equivalence: None**

This is an advanced course in the field of journalism that seeks to enhance in students conceptual and methodological tools for journalistic research and be able to understand the importance of information in the processes of sustainable development. The course requires knowledge of research methodology for social sciences, ethics and media regulation. As a learning outcome, students will develop a research project that contributes with an in-depth perspective of journalistic problems related to sustainable development and its possible solutions.

**General objective:** Upon completion of this course, students will be able to complete a journalistic project that requires research and solution scenarios to solve information problems related to sustainable development: environment, healthcare, education and nonprofit organizations.

**Key words:** Sustainable development. Investigative journalism. Social journalism.

**Bibliography:** \* *Desarrollo sustentable : aplicaciones e indicadores* / María Luisa Quintero Soto, Carlos Fonseca Hernández, coordinadores., 1a ed., México, D.F. : Cámara de Diputados, LX Legislatura : Miguel ángel Porrúa, 2008., [9786074010510], [607401051X].

### MI3013 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 LMI11 )

**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* *What next?* / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## MR Mechatronics

### MR1001 Industrial Informatics

( 3 - 0 - 8. Prerequisites: [ TC1001 , TC1017 ]. 2 IMT11 )

**Equivalence:** None

This introductory course is intended to provide students with the fundamentals needed for the representation and interaction with the physical world through hardware and software tools. As prior knowledge it requires flow diagrams theory and initial experience at programming in high-level text-based languages. As a learning outcome, students will be able to design and implement algorithms for problem solving in the C programming language using mechanical and/or electronic interactions with the physical world; it also provides a basic handling of Supervisory Control and Data Acquisition systems (SCADA) and Human Machine Interface (HMI) programming.

**General objective:** Upon completion of this course, students will be able to implement information systems for industrial applications, design interfaces for data acquisition systems and control of mechatronic processes, developing web servers as an effective way of managing industrial information.

**Key words:** Analysis and synthesis of algorithms. Algorithm implementation using C programming language statements. Digital and analog input/output ports, SCADA systems, supervisory control, HMI.

**Bibliography:** \* Howard Austerlitz, Data acquisition Techniques using PCs, 2nd Edition, Academia Press, English, [978-0120683772].

### MR1002 Introduction to Mechatronics Engineering

( 3 - 0 - 4. Prerequisites: None. 1 IMT11 )

**Equivalence:** None

The purpose of this basic-level course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for

students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Romero Hernández, Omar., Introducción a la ingeniería : un enfoque industrial / Omar Romero Hernández, David Muñoz Negrón, Sergio Romero Hernández., México : International Thomson, c2006., [9706865551].

### MR2000 Logic Automatism

( 3 - 0 - 8. Prerequisites: [ TE1000, TE1002, TE1012 ]. 5 IFI11, 4 IMT11 )

**Equivalence:** MR0033

This is an intermediate course intended to provide students with the skills, methodologies and tools required to analyze, design and evaluate logic control systems based on different technologies. The course requires prior knowledge of electrical circuits and analog electronics. The learning outcome of this course is for students to be able to analyze, understand and solve process and product automation problems using logic design.

**General objective:** On completing the course the student will be able to analyze, design and evaluate combinational and sequential logic control systems and build them with integrated circuit technologies, programmable logic devices, pneumatic devices, electrical devices and programmable logic control-



lers complying with operating specifications for process automation.

**Key words:** Programmable logic controllers (PLCs). Modeling and control of discrete event systems (finite automata and Petri networks). Implementation and evaluation of logic design in programmable logic devices. PLC programming based on standards (IEC 1131). Introduction to combinational and sequential logic design.

**Bibliography:** \* Pessen, David W., Industrial automation : circuit design and components / David W. Pessen., John Wiley & Sons, New York , c1989., eng, [471600717].

### **MR2002 Logic Automatism Laboratory** ( 0 - 3 - 4. Prerequisites: [ MR2000 Corequisite , MR2000 ]. 6 IF111, 4 IMT11 )

**Equivalence:** MR00034, PV2000

This is an intermediate course intended to teach students the design, implementation and construction of logic automatism using programmable logic devices. This course requires prior knowledge of logic automatism. The learning outcome of this course is for students to be able to design, implement and evaluate logic control systems in processes and products using the most commonly applied electrical, electronic, pneumatic and programmable (PLC) technologies.

**General objective:** On completing the course the student will be able to apply the theoretical bases of logic systems to the analysis and design of automatism, as well as install them in integrated circuits, programmable logic devices, pneumatic devices, electrical devices and programmable logic controllers (PLCs) in order to carry out combinational and sequential logic automatism projects.

**Key words:** PLC programming: ladder, functions, grafset, SFC, etc. Familiarization with the application devices for logic automatism design. Electronic, electric and pneumatic systems in the design of logic automatism. Implementation of automatism in programmable logic devices. Applications of logic automatism to processes and products.

**Bibliography:** \* Pessen, David W., Industrial automation : circuit design and components / David W. Pessen., John Wiley & Sons, New York , c1989., eng, [471600717].

### **MR2003 Actuators**

( 3 - 0 - 8. Prerequisites: [ TE2000 , TE2032 , TE2001 , TE1005 Corequisite , TE1005 , TE1012 ]. 6 IDA11, 6 IMT11 )

**Equivalence:** None

This is an intermediate course, intended to provide students with the knowledge required to select and operate the different types of actuators that exist. The course requires prior knowledge of instrumentation, electrical circuits and electronic design. The learning outcome of this course is for students to be able to understand and properly apply the theoretical principles on which actuators in mechatronic applications are based, select the actuators required in different applications and integrate them correctly as part of the solution in the structuring of the automatic control system.

**General objective:** On completing the course, the student will be able to understand the theoretical bases of actuators in order to design and improve actuation systems in mechatronic applications.

**Key words:** Principles of actuators. Electric actuators. Pneumatic actuators. Hydraulic actuators. Basic MEMS.

**Bibliography:** \* Alciatore, David G., Introduction to mechatronics and measurement systems / David G. Alciatore, Michael B. Hstand, 3rd ed., McGraw-Hill, Dubuque, IA, c2007, eng, [9780072963052(encuaderno:papel alcalino)].

### **MR2004 Control Engineering**

( 3 - 0 - 8. Prerequisites: [ MA3013 , TE2004 , MA3002 , TE2035 , TE2035 Corequisite , MA2010 , M3035 ]. 6 IMD11, 7 IME11, 6 IMT11, 7 ISD11, 7 ITE11, 8 ITS11 )

**Equivalence:** MR00021

This is an intermediate course intended to provide students with the mathematical foundations of clas-



sical and modern control, as well as the practical and theoretical bases that are applied to industrial automatic control systems to analyze, design, tune and evaluate them. This course requires prior knowledge of differential equations, electrical circuits, Laplace transform, linear algebra and complex variables. The learning outcome of this course is for students to be able to identify the components of an automatic control loop and the function these components perform within it; model dynamical behaviors between process variables; design and/or tune controllers using different methodologies and techniques to satisfy performance indicators, select the type of controller and its design technique; and evaluate the final performance of the control system.

**General objective:** On completion of the course the student will be able to analyze, model, design and evaluate closed-loop continuous control systems for analog processes which achieve the desired performance according to specifications for regulatory control applications for products and processes.

**Key words:** Introduction to control engineering. Stability analysis. Continuous time dynamical systems modelling. Transfer function. State space model. Synthesis of controllers and evaluation of their performance.

**Bibliography:** \* Dorf, Richard C., Modern control systems/Richard C. Dorf, Robert H. Bishop, 9th. Edition, Prentice Hall, Upper Saddle River, NJ, 2001, eng, [130306606].

### MR2005 Mechatronic Instrumentation Laboratory

( 0 - 3 - 4. Prerequisites: [ TE2000 Corequisite , TE2000 , TE2032 , TE1012 , TE1005 Corequisite , TE1005 ]. 5 IDA11, 5 IMT11 )

**Equivalence:** None

This is an intermediate course intended to provide students with the necessary knowledge for the selection, installation, operation, maintenance and design of measuring instruments for different variables. The course requires prior knowledge of electrical circuits, electricity and magnetism. The learning outcome of this course is for students to know the measurement principles for different sensors, use different alterna-

tives for instrumentation and measurement in industrial processes, and design measuring instruments.

**General objective:** On completing the course the student will be able to understand the operation and application of different types of commercially available measuring instruments, as well as design sensors for complex measurements and carry out mechatronic processes in compliance with international standards.

**Key words:** Measurement of electric variables. Measurement of temperature, pressure, flow and level. Virtual instrumentation. Introduction to instrumentation, measurements and recording of variables. Measurement of proximity, speed, acceleration, displacement and force.

**Bibliography:** \* Doebelin, Ernest O., Measurement systems : application and design / Ernest O. Doebelin., 5th ed., McGraw-Hill, Boston , c2004., eng, [007243886X (acid-free paper)].

### MR2007 Computerized Control

( 3 - 0 - 8. Prerequisites: [ MR2004 ]. 7 IMT11, 8 ISD11 )

**Equivalence:** None

This is an intermediate course intended to enable students to understand, analyze and adequately use discrete control theory in order to produce solutions to different problems pertaining to the design of computerized control systems. The course will be based on the concept of transfer function and state space for linear, discrete, uni and multivariable cases. The course requires prior knowledge of control engineering, z-transform and industrial informatics. The learning outcome of this course is for students to analyze based on physical and technical rules for system identification, design based on specifications, implement using software and digital technologies and evaluate the performance of computerized process control systems.

**General objective:** On completing the course the student will be able to analyze, implement and evaluate computerized product and process control systems with a focus on practical application.

**Key words:** Identification of sampled data systems. Introduction to computer process control. Mathematical modeling of time systems. Stability analysis and synthesis of digital controllers. Evaluation of computerized control systems.

**Bibliography:** \* Ogata, Katsuhiko, Discrete-time control systems / Katsuhiko Ogata., 2a ed., Prentice Hall, Englewood Cliffs, N.J., c1995., eng, [130342815].

## MR2009 Industrial Networks

( 3 - 0 - 8. Prerequisites: [ MR2000 ]. 7 IMT11 )

**Equivalence:** None

This is an intermediate course intended to familiarize students with the characteristics, topologies, protocols and configuration of the most commonly used communication networks in industry. The course requires prior knowledge of logic circuits and industrial informatics. The learning outcome of this course is for students to be able to design and implement sensor networks, field networks and Industrial Ethernet for different programmable logic controllers. They will be able to identify and solve device interconnection problems in industrial communication networks and represent processes through human-machine interfaces, as well as implement structured cabling and plant integration solutions, both in commercial and industrial contexts.

**General objective:** On completing the course the student will be able to propose efficient solutions related to the design and installation of industrial networks in process automation; analyze, understand and learn about the most representative models, protocols, topologies, devices and planning systems involved in industrial communication networks, as well as the interaction between them, based on network architectures and automation for the total integration of plants and/or industrial processes from a distance, programmable logic controllers (PLCs) and their transmission methods.

**Key words:** Introduction to data communication networks. Characteristics and configuration of field networks. Characteristics and configuration of control networks. Characteristics and configuration of industrial supervision and management networks. Configuration of human machine interfaces.

**Bibliography:** \* Romera, Pedro J., Automatización : problemas resueltos con autómatas programables / J. Pedro Romera, J. Antonio Lorite, Sebastián Montoro., 4a ed., Madrid : Thomson, 2007, Spain, 2007, spa, [8428320772].

## MR2012 Process Automation

( 3 - 0 - 8. Prerequisites: [ IQ2005 , IQ2004 , IQ3003 , BT3009 ]. 8 IBT11, 7 IQA11, 7 IQP11 )

**Equivalence:** MR2011

This is an intermediate course in which basic logic and regulatory control tools for solving industrial process automation problems will be provided. The student will develop control systems to improve operation safety, environmental control, quality and efficiency of industrial processes. This course requires prior knowledge of homogenous and non-homogenous ordinary linear differential equations; Laplace transform; unsteady state material and energy balances; operation units (such as heat exchangers, absorption towers, distillation towers, tank type reactors, etc.); process regimes (continuous, semi continuous, intermittent or batch). The learning outcome of this course is for students to apply conventional industrial controllers to the problems of industrial process regulation, apply basic and advanced control strategies to solve problems in industrial process automation and solve logic control problems.

**General objective:** On completing the course the student will be able to identify, analyze and solve problems related to the automation of industrial processes by applying logic and continuous control systems based on different strategies and technologies.

**Key words:** Advanced control strategies and multivariable control. Mathematical bases of logic control systems. Dynamic system modeling and system identification. PID controllers and robustness of feedback control systems. Combinatorial and sequential control systems for batch production systems.

**Bibliography:** \* Smith, Carlos A, Principles and practice of automatic process control / Carlos A. Smith, Armando B. Corripio, 2nd Ed, J. Wiley , New York , 1997, [4471575887].

## MR2013 Control Systems

( 3 - 1 - 8. Prerequisites: [ TE1005 Corequisite , TE1005 , MA2010 , TE1013 ]. 7 IDA11, 8 IMA11 )

Equivalence: MR00027, TF95886

This is an intermediate and fundamental course for solving industrial control problems related to the design of logic control and regulatory control systems. The course requires prior knowledge of homogenous and non-homogenous ordinary linear differential equations, Laplace transform, electric circuits, Kirchhoff's law, the sum of voltages in a mesh and mass-spring-damper mechanical systems. The learning outcome of this course is for students to solve combinational and sequential logic control problems, apply conventional industrial controllers to industrial process regulation problems, and apply control strategies to solve industrial control problems.

**General objective:** On completing the course the student will be able to analyze, identify and solve automatic control problems in industrial processes by applying logical control and continuous process systems based on PID controllers.

**Key words:** Introduction to industrial control. Combinational and sequential logic systems design. Instrumentation and control diagrams (P&ID) based on ISA standards. System stability methods. PID-based process control.

**Bibliography:** \* Nise, Norman S., Control systems engineering/Norman S. Nise, 3rd. Edition, John Wiley, New York , 2000, eng, [0471366013 (cloth/CD-ROM)].

## MR2015 Process Automation Laboratory

( 0 - 3 - 4. Prerequisites: [ MR2012 Corequisite , MR2012 ]. 8 IBT11, 9 IQA11, 9 IQP11 )

Equivalence: MR00032, MR2014, PV2002

This is an intermediate course in which students carry out practical exercises to solve industrial automation problems in processes related to the design of logic control and regulatory control systems. The course requires prior knowledge of logic control, on/off control, experimental process modeling, PID controllers, PID tuning methods, stability and control systems performance. The learning outcome of this course is

for students to acquire practical experience applied to solving logic control problems in batch-type systems, and regulatory control of continuous processes.

**General objective:** On completing the course the student will be able to carry out the analysis, design and implementation of automatic control systems for continuous processes and logic control in batch-type processes.

**Key words:** Advanced control strategies and multivariable control. Mathematical bases of logic control systems. Dynamic system modeling and system identification. PID controllers and robustness of feedback control systems. Combinatorial and sequential control systems for batch production systems.

**Bibliography:** \* Smith, Carlos A, Principles and practice of automatic process control / Carlos A. Smith, Armando B. Corripio, 2nd Ed, J. Wiley , New York , 1997, [4471575887].

## MR2018 Sensors and Actuators

( 3 - 0 - 8. Prerequisites: [ TE1002 ]. 6 ISD11 )

Equivalence: None

This is an intermediate level course, in which students learn about the main sensors and sensing methods used in industrial processes and industrial robotics, as well as electro-pneumatic, "smart," mechanical and power electronic actuators. Previous knowledge is required in analog electronics, basic mechanisms and the fundamentals of physics. The learning outcome for this course is that the students design and implement a control system that includes integration of software and hardware tools for the control of servo systems and control links in industrial and robotic processes.

**General objective:** Upon completion of this course, students will be familiar with the characteristics, operation and selection of the sensors and actuators used in diverse areas of application in industrial processes and robotics, as well as their integration with other software and hardware electronic components to form open-loop and closed-loop automatic control systems.

**Key words:** Sensors. Actuators. HMI. Intelligent instrumentation.

**Bibliography:** \* Alciatore, David G., Introduction to mechatronics and measurement systems / David G. Alciatore, Michael B. Hstand., 3th ed., Dubuque, IA : McGraw-Hill, c2007., [9780072963052 (encuadernado: papel alcalino)], [0072963050 (encuadernado: papel alcalino)].

**MR2019 Industrial Networks Project**  
( 0 - 3 - 4. Prerequisites: [ MR2009 Corequisite , MR2009 ]. 7 IMT11 )  
**Equivalence: None**

This is an intermediate course, which is designed to provide students with the necessary bases for evaluating, configuring and installing various types of industrial networks for solving problems related to automation and industrial computing. Previous knowledge is required in industrial networks and logical automatism laboratories. The learning outcome for this course is that the students be able to configure device networks, field networks and Industrial Ethernet networks, using various programmable logic controllers. The students will be able to identify and solve device interconnectivity problems throughout industrial communication networks, illustrate processes through human-machine interfaces and implement broad-application industrial networks.

**General objective:** Upon completion of this course, students will be able to evaluate, configure and apply the different types of industrial communication networks oriented toward solving automation and industrial informatics problems.

**Key words:** Configuration and application of a field network. Configuration and application of a control network. Configuration and application of an industrial supervision and administration network. Configuration and application of human machine interfaces.

**Bibliography:** \* Romera, Pedro J., Automatización : problemas resueltos con autómatas programables / J. Pedro Romera, J. Antonio Lorite, Sebastián Montoro., 4a ed., Madrid : Thomson, 2007., [8428320772].

**MR2020 Computerized Control of Electric Machines Laboratory**  
( 0 - 3 - 4. Prerequisites: None. 9 IME11 )  
**Equivalence: None**

The purpose of this intermediate electrical engineering course is for students to use critical thinking to interpret the results of experiments using the knowledge acquired in the course on transformers, motors and computerized control of electric machines. The course requires previous knowledge of techniques for analyzing electric circuits, electric measurement, principles of transformer operation, induction motors, direct-current and synchronic machines, and control systems. The learning outcome of this course is for students to evaluate through experimentation the performance of electric machines, complying with safety measures and respecting the operational limits of this equipment and the instrumentation used; select and use the appropriate equipment for control of electric motors; communicate the results obtained orally, in writing and graphically in a well-structured report.

**General objective:** Upon completion of this course, students will be able to apply the safety measures recommended in the use of control systems; apply the mathematical models of electric machines to control the machine parameters; select the components to activate a control system; select the most suitable type of control system for a specific sequence; control the most important functions of electric machines.

**Key words:** Laboratory experimentation practice. Theoretical analysis for solving laboratory cases.

**Bibliography:** \* Rexford, Kenneth B., Electrical control for machines / Kenneth B. Rexford., 5th ed., Albany : Delmar Publishers, c1997., [0827376448 (alk. paper)].

**MR3009 Mechatronic Design**  
( 3 - 0 - 8. Prerequisites: [ M2013 , MR2007 , MR2010 , M2029 , MR2007 , TE2023 ]. 8 IMT11 )  
**Equivalence: None**

This advanced course provides students with the best methodologies and tools that are used in the

design and creation of compact, low-cost mechatronic products and processes with added value in terms of the functionality, quality and performance. This course requires prior knowledge of analysis and synthesis of machines, analysis and simulation of mechanisms, electronic design, microcontrollers and computerized control. The learning outcome of this course is for students to be able to design mechatronic products and processes.

**General objective:** On completing the course the student will be able to select and apply mechatronic design methodologies to the design of products and processes based on the identification of a need.

**Key words:** Introduction to mechatronic design methodologies. Concurrent product and process design techniques. Modeling and simulation of mechatronic systems. Control, identification, prognosis and diagnostic techniques. Application of CAD/CAE tools to mechatronic process and product design.

**Bibliography:** \* Shetty, Devdas., Mechatronics system design / Devdas Shetty, Richard Kolk., PWS Pub., Boston , 1997, eng, [0534952852 : HRD \$91.95].

### MR3012 Mechatronics Laboratory

( 0 - 3 - 4. Prerequisites: [ M2019 , TE3026 , M2031 , MR3009 Corequisite , MR3009 ]. 8 IMT11 )

**Equivalence:** PV3003

This advanced course provides students with the mechanical and electronic manufacturing tools required to design and construct mechatronic prototypes. This course requires prior knowledge of analysis and synthesis of machines, analysis and simulation of mechanisms, manufacturing technologies, materials, instrumentation, electronic design, and mechatronic design. The learning outcome of this course is for students to be able to apply the main mechanical and electronic manufacturing processes to construct, design and validate mechatronic prototypes in accordance with previously established specifications.

**General objective:** On completing the course, the student will be able to apply mechanical and electronic manufacturing methodologies, technologies, and tools for the construction of mechatronic prototypes.

**Key words:** Introduction to mechanical and electronic manufacturing. Mechanical manufacturing processes (manual and numerical control). Manufacturing processes and assembly of electronic cards. Construction of mechatronic prototypes.

**Bibliography:** \* Mechatronics in engineering design and product development [electronic resource] / [edited by] Dobrivoje Popovic, Ljubo Vlacic, Marcel Dekker, New York , c1999, eng, [0585370877 (electronic bk.)].

### MR3016 Project of Mechatronics Engineering

( 3 - 0 - 8. Prerequisites: [ MR3009 , IN2006 , IN2025 ]. 9 IMT11 )

**Equivalence:** MR00038, MR00039

In this advanced course, students put their skills on integrating technologies into mechanics, electronics, control and informatics into practice, by completing the construction of a mechatronic system project. This course requires prior knowledge of project engineering, electronic design, mechatronic design, and synthesis of machines. The learning outcome of this course is for students to implement a mechatronic product through all the stages involved in mechatronic design and be able to integrate diverse engineering tools and technologies into the design and implementation of mechatronic systems with a strong practical orientation.

**General objective:** On completing the course the student will be able to identify the design parameters and requirements that best satisfy the restrictions of a multidisciplinary project involving and integrating the areas of mechanics, electronics, control and computing in order to find an optimal solution. For the final result, the construction of a properly documented functional prototype will be required.

**Key words:** Project selection and assignment. Preliminary designs. Project plan (Analysis of requirements and project delimitation). Development of the prototype. Tests, refinement and presentation.

**Bibliography:** \* Shetty, Devdas., Mechatronics system design / Devdas Shetty, Richard Kolk., PWS Pub., Boston , 1997, eng, [0534952852 : HRD \$91.95].



## MR3019 Automated Control of Greenhouses

( 3 - 0 - 8. Prerequisites: [ MA2001 , F1004 , IB3002, MA2010 ]. 8 IAB11 )

**Equivalence: None**

In this advanced course, students will learn about and integrate the tools for monitoring and controlling variables, such as climate, nutrition, irrigation, lighting and hygiene in greenhouses with security systems (alarms), using sensors for data collection, digital systems and software for recording, monitoring and sending information, and utilizing actuators and control systems to achieve optimal production conditions. This course requires prior knowledge of differential equations and basic concepts of electricity. The learning outcome of this course is for students to be able to propose and assess the best automation and control solutions for greenhouses.

**General objective:** Upon completion of this course, students will be able to understand and utilize the basic principles of greenhouse automation which allow for the control and monitoring of production conditions.

**Key words:** Irrigation control. Environmental automation. Ventilation and lighting control.

**Bibliography:** \* Hanan, Joe J., 1931-, Greenhouses : advanced technology for protected horticulture / Joe J. Hanan., Boca Raton, Flo. : CRC Press, 1998., [0849316987].

## MR3020 Greenhouse Automation Laboratory

( 0 - 3 - 4. Prerequisites: [ MR3019 , MR3019 Corequisite ]. 8 IAB11 )

**Equivalence: None**

In this advanced course, students apply concepts and technologies for the automation of greenhouse crop production systems. This course requires prior knowledge of monitoring and control of crop systems in protected environments linked to greenhouse automation technologies. The learning outcome of this course is for students to acquire practical experience in solving greenhouse automation and control problems.

**General objective:** Upon completion of this course, students will be able to understand, operate, and evaluate the instrumentation and control systems involved in the operation of greenhouses.

**Key words:** Monitoring and sensors. Climate models.

**Bibliography:** \* Langhans, Robert W., 1929-, Greenhouse management : a guide to structures, environmental control, materials handling, crop programming, and business analysis / Robert W. Langhans ; line drawings by Virginia Langhans, 3rd ed, Ithaca, N.Y. : Halcyon Press of Ithaca, 1990, New York, 1990, eng, [0960400621].

## MR3025 Electric and Hybrid Vehicles

( 3 - 0 - 8. Prerequisites: None. 9 IDA11 )

**Equivalence: None**

This is an advanced course, intended to provide the rationale and methods for the design of vehicles powered by alternative energy sources. The course requires prior knowledge of actuators, electronics and internal combustion engines. As a result of learning students will deliver a final project design for hybrid and electric vehicles, in which they quantify the energy requirements for the performance of speed, torque and range required for the vehicle.

**General objective:** Upon completion of this course, students will be able to understand and apply concepts and methods for the design of hybrid and electric vehicles, including aspects such as energy sources, batteries, engines, mechanical systems, and transmissions. Students will also be able to evaluate the performance of hybrid and electric vehicles for different configurations in terms of energy consumed, velocity, acceleration, and battery charge.

**Key words:** Fuel cells. Power electronics. Electric vehicles. Hybrid vehicles. Batteries. Energy sources and energy storage. Fuel batteries. Driving cycles. Electric motors.

**Bibliography:** \* Lino Guzzella and Antonio Sciarretta, Vehicle Propulsion Systems, Second Edition, Springer, Inglés, [978-3-540-74691-1].



## MR3026 Automation of Manufacturing Systems

( 3 - 1 - 8. Prerequisites: [ M2019 , MR2019 ]. 8 IMT11 )

**Equivalence: None**

This is an advanced course, designed to help students understand, evaluate, select and appropriately manage the different pieces of equipment and technological tools that enable communication and integration between components for automating a manufacturing system. Previous knowledge is required, such as material properties, layout design, CAD tools, manufacturing processes, computerized control, industrial networks, fabrication processes, planning and production control. The learning outcome for this course is that the students understand the evolution of manufacturing systems; understand and program numerical control equipment; understand, program and analyze the kinematics of industrial robots; understand and analyze the various systems for automated handling of materials; understand and program visual inspection equipment for automating quality control; program PLC's for device control in flexible manufacturing cells; utilize the various communication protocols in an industrial network; find, compare and select technologies for design automation and planning and production control, such as (CAD/CAM/CAE/CAPP/PP&C); apply heuristics in the design and analysis of technological groups and cellular manufacturing; and understand the importance of tools, such as product lifecycle management (PLM) and concurrent engineering (CE), which enable integration of manufacturing systems.

**General objective:** Upon completion of this course, students will be able to automate manufacturing systems by modeling, analyzing, operating and programming them, using industrial and integration automation technologies.

**Key words:** Industrial robots. Automatic inspection systems. Flexible manufacturing cells. Computer numerical control machines (CNC). Automatic systems for transportation and storage.

**Bibliography:** \* Groover, Mikell P., 1939-, Automation, production systems and computer-integrated manufacturing / Mikell P. Groover., 2nd ed., Upper

Saddle River, NJ : Prentice Hall, c2001., [0130889784],[9780130889782],[8120320743 (rústica)].

## MR3027 Automotive Electronics

( 3 - 0 - 8. Prerequisites: None. 8 IDA11 )

**Equivalence: None**

This is an advanced course in which students are introduced to the fundamentals of mechatronic systems with an emphasis on automotive systems. It requires previous knowledge in electronics. The learning outcome for this course is that students gain solid knowledge about the characteristics and interactions of the various subsystems of an automobile, such as the motor, suspension, transmission, powertrain, and actuators.

**General objective:** Upon completion of this course, students will be able to estimate and simulate electrical energy production, regeneration and storage in automobiles; assess the impact of the diverse operational improvements in automobiles, such as safety, comfort, emissions reduction, fuel efficiency, among others; and master the life cycle test procedures involved in automobile production.

**Key words:** Control and instrumentation. Sensors and actuators. Diagnostics.

**Bibliography:** \* Bosch automotive handbook., 7th ed., [rev. and expanded], Plochingen : Robert Bosch GmbH ; Chichester : Distribution, John Wiley & Sons, c2007., engger, [9780470519363 (encuadernado)], [0470519363 (encuadernado)], [9780470519363 (rústica)], [0470519363 (rústica)].

## MR3028 Control Engineering Laboratory

( 0 - 3 - 4. Prerequisites: None. 9 IME11, 8 ISD11, 8 ITE11 )

**Equivalence: None**

This is an advanced course which deals with the design and application of PID controllers and logic controllers utilizing various software and hardware tools, in continuous and discrete systems, and the performance of quantitative evaluations. This course requires previous knowledge in analog and digi-

tal electronics, PID controllers, Laplace and Z transforms, and software tools. The learning outcome for this course is that students be able to quantitatively evaluate control loops that use PID controllers while experiencing reference and perturbation changes, based on their transitory and steady-state responses. Students will also be able to make control diagrams using industrial standards and design industrial-type logic controllers for the execution of basic and advanced control sequences, utilizing various technologies.

**General objective:** Upon completion of this course, students will be able to operate and implement control loops based on PID controllers in servo- and regulation-type systems; design and implement HMIs for monitoring and digital control; and design logic control automatism using diverse industrial software and hardware tools.

**Key words:** Performance evaluation. PID controllers. Logic controllers.

**Bibliography:** \* Ogata, Katsuhiko., Discrete-time control systems / Katsuhiko Ogata., 2nd ed., Upper Saddle River, N.J. : Prentice Hall, 1995., [0130342815].

### MR3029 Integral Automatic Control Laboratory

( 0 - 3 - 4. Prerequisites: [ MR2007 ]. 8 IMT11 )  
Equivalence: None

This is an advanced course, designed to provide students with practical experience in analysis, modeling, design and evaluation of the performance of automated process control systems. The student will acquire the skills to design and implement mechatronic sensors for feedback and different applications of servo controllers for direct and alternating current step motors, as well as regulatory controllers for continuous processes, such as levels, temperature, flow, etc. Previous knowledge is required in computerized control, mechanisms and analog electronics, as well as evidence of studying or having studied embedded systems. The learning outcome for this course is that students be able to quantitatively evaluate the performance of a control link through graphics of its transitory response; apply advanced control strategies; design HMI's for monitoring and control, using

industrial software; design and implement position and velocity control systems for DC and AC motors; and carry out automated control projects through mechatronic integration.

**General objective:** Upon completion of this course, students will be able to apply and integrate tools from the area of mechatronics in an automatic control loop to operate, design, implement and evaluate the performance of PID and non-conventional automatic closed-loop control systems for different control strategies in continuous and servo processes, based on open-loop and closed-loop identification.

**Key words:** Process modeling and identification. Tuning and evaluation of PID controllers. Design, implementation and evaluation of compensators. Design and implementation of digital controllers. Servo control applications in mechatronic systems. Application and evaluation of advanced control strategies (cascade, feedforward and ratio control). Sensing functions for measurement and feedback.

**Bibliography:** \* Ogata, Katsuhiko., Discrete-time control systems / Katsuhiko Ogata., 2nd ed., Upper Saddle River, N.J. : Prentice Hall, 1995., [0130342815].

### MR3030 Manufacturing Systems Integration

( 3 - 1 - 8. Prerequisites: [ M2020 ]. 9 IMA11 )  
Equivalence: None

This is an advanced course in which various technological tools applied to the automation and integration of manufacturing systems are introduced, evaluated and utilized. Previous knowledge is required of material properties, layout design, CAD tools, control systems and manufacturing processes. The learning outcome for this course is that students be able to understand and program numerical control equipment and industrial robots for various industrial applications; evaluate, compare and select systems for managing materials; find, compare and select technologies for automating the design, planning and control phases of production, such as CAD/CAM/CAE/CAPP/PPC; and understand the importance of tools, such as product life cycle management (PLM) and concurrent engineering (CE), which enable integration of manufacturing systems.

**General objective:** Upon completion of this course, students will be able to select, operate and program the equipment that comprises a flexible manufacturing system.

**Key words:** Industrial robots. Automatic inspection systems. Automatic systems for transportation and storage. Flexible manufacturing cells. Computer numerical control machines (CNC).

**Bibliography:** \* Groover, Mikell P., 1939-, Automation, production systems, and computer-integrated manufacturing / Mikell P. Groover., 3rd ed., Upper Saddle River, N.J. : Prentice Hall, c2008., [9780132070737], [0132070731].

### MR3031 Industrial Robotics

( 3 - 1 - 8. Prerequisites: [ M2007 , MR2003 ]. 9 IMT11 )

**Equivalence:** None

This is an advanced level course, designed to provide students with the basic tools needed to identify and solve industrial problems that require the installation of industrial robots in assembly lines. Previous knowledge is required in Machine component design, mechanism analysis and synthesis, Industrial Electronics and Computerized Control. The learning outcome for this course is that the students be able to design, develop and implement industrial automation projects, based on robotic handlers.

**General objective:** Upon completion of this course, students will be able to program, control and install industrial robots on production lines according to optimal task planning; design and implement a process, line or system with industrial robots.

**Key words:** Kinematics and dynamics of robots. Robot control. Task planning. Installation of robots on production lines: programming, calibration and equipment. Morphology of manipulative robots.

**Bibliography:** \* Hodges, Bernard., Industrial robotics / Bernard Hodges., 2nd ed., Oxford ; Boston : Newnes, 1992., [0750607815].

### MR3032 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 IMT11 )

**Equivalence:** None

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

### MR3033 Computerized Control for Electric Machinery

( 3 - 0 - 8. Prerequisites: None. 8 IME11 )

**Equivalence:** None

This is the final course in the field of power electronics and control of machines, designed to utilize mathematical analysis and thinking so that students can analyze and solve electrical engineering problems. Specifically, it is designed so that students may understand the functioning of traditional DC and AC motors, and more modern stepper motors with embedded magnets, used in conjunction with electronic converters and drives. Previous knowledge required includes AC and DC electrical circuits, induction motors, and electronic power converters. The learning outcome of the course is for students

to understand the functioning of DC and AC motors and electronic control circuits; analyze the behavior of electronic converters that supply electric motors which have typical mechanical loads such as lamination grinders, bridge cranes, machine tools, and train and electric car motors; understand the advantages of using electronic converters to supply electric motors in industrial applications, transport vehicles, or distributed electrical generation; and understand protection circuits for electronic converters and their hazards when used in industrial environments.

**General objective:** Upon completion of this course, students will have acquired practical knowledge of the possibilities offered by electronics in general, particularly power electronics, to solve industrial electrical problems using electric motors and electronic converters.

**Key words:** Principle of operation of DC motors in their different designs. Electronic converters for DC and AC motor control. Soft-start and regenerative braking systems. Control of position and velocity. Vectorial control. Protection of electronic converters, devices and circuits.

**Bibliography:** \* Rashid, M.H., *Electrónica de potencia : circuitos, dispositivos y aplicaciones* / Muhammad H. Rashid ; traducción Virgilio González y Pozo., 3a ed., México, D.F. : Pearson Educación, c2004., spaeng, [9702605326], [9789702605324].

## MT Marketing

### MT1003 Marketing and Creativity

( 3 - 0 - 8. Prerequisites: None. 6 IBN11, 5 IMI11, 3 LAE11, 3 LAF11, 3 LCDE11, 3 LCMD11, 3 LCPF11, 3 LDN11, 3 LEM11, 3 LIN11, 3 LLN11, 3 LMC11, 3 LPM12, 3 LPO11, 4 LRI11 )

**Equivalence:** MT1001

This is a basic course in the field of marketing that requires students to identify and implement introductory marketing concepts to activities related to projects in the field. As a learning outcome of this course, students are expected to undertake a comprehensive project in which they apply the learned concepts to a real-world business situation.

**General objective:** At the end of the course, the student will be familiar with the marketing field and understand the factors that affect firms and their environments. Students will understand the evolution of the marketing concept, Creativity, information and market research systems, market segmentation, consumer purchasing behavior, business markets, product development strategies, pricing, distribution, and promotional mix. Students also analyze the marketing of services, international marketing and creativity.

**Key words:** Marketing research. Consumer behavior. Marketing mix. Market segmentation. Marketing.

**Bibliography:** \* Etzel,M; Walker,B; Stanton,W., Marketing, 4ta. edición, McGraw-Hill, Español.

### MT1004 Introduction to the Marketing Academic Program

( 3 - 0 - 4. Prerequisites: None. 1 LEM11 )

**Equivalence:** None

The purpose of this basic-level course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* AMA, Código de Ética de la AMA.

### MT1005 Introduction to Marketing and Communication Academic Program

( 3 - 0 - 4. Prerequisites: None. 1 LMC11 )

**Equivalence:** None

The purpose of this basic course is to introduce the student into the setting of the university life and the major in which it is enrolled. No previous requisites are required. The learning outcome of this course is for the student to have a clear vision of the career and the institution they have joined. Students also generate a life- and an academic-professional plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Armstrong, Gary (Gary M.), Marketing : an introduction / Gary Armstrong, Philip Kotler.,



9th ed., Upper Saddle River, NJ : Pearson Prentice Hall, c2009., [9780135153109],[0135153107].

### **MT1007 Introduction to Advertising and Marketing Communications Academic Program**

**( 3 - 0 - 4. Prerequisites: None. 1 LPM12 )**

**Equivalence: None**

The purpose of this basic course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Advertising.

**Bibliography:** \* Armstrong, Gary (Gary M.), Marketing : an introduction / Gary Armstrong, Philip Kotler., 10th ed., Upper Saddle River, NJ : Pearson Prentice Hall, 2011., [9780136102434],[0136102433].

### **MT2005 Selling and Sales Management**

**( 3 - 0 - 8. Prerequisites: [ MT1001 , MT1003 ]. 7 LPM12 )**

**Equivalence: None**

This intermediate course in the sales area covers sales management and processes. The course integrates the areas of sales management and the sales process in such a way as to allow students to familiarize themselves with the reality of business practice. On completion of the course, the student will be able to understand the administrative function of the sales

area, as well as understand how to perform as a salesperson for products, ideas and concepts.

**General objective:** Upon completion of this course, students will understand how sales administration is carried out, the sales process; sales negotiations; and professionalization of the sales function. Students learn to manage a team of salespeople; study and practice the different sales and negotiation processes, identify sales opportunities through telemarketing; and how to create long term relations with consumers.

**Key words:** Sales management. Sales negotiation. Sales process. Sales professionalism.

**Bibliography:** \* Weitz, Barton A., Ventas : construyendo sociedades / Barton A. Weitz, Stephen B. Castleberry, John F. Tanner, Jr. ; traducción de Virgilio González y Pozo, Leticia Esther Pineda Ayala., 2a ed. en español., México : McGraw-Hill Interamericana, 2005., Mexico, 2005., spa, [9701050886], [9789701050880].

### **MT2006 Consumer Behavior**

**( 3 - 0 - 8. Prerequisites: [ MT1001 , MT1003 ]. 4 LCDE11, 5 LDN11, 5 LEM11, 4 LMC11, 4 LPM12 )**

**Equivalence: DE2000, MT00852**

This intermediate course allows students to understand the purchase decision-making process and the psychological, sociological, and cultural factors related to the behavior of purchasing and consumption. Students are required to apply prior knowledge of exchange processes in a marketplace to the analysis of consumer processes within a conceptual framework that is significant for making Marketing decisions. This course allows students to understand the impact of marketing decisions on the purchasing behaviors of consumers. The learning outcome of this course is for students to understand their roles as consumers and the impact that consumption has on the quality of life of communities within an ethical context.

**General objective:** At the end of this course students should have a clearer perspective of consumer behavior analysis as a foundation for making Marketing decisions. They should be able to analyze the implications that consumer behavior has for areas such



as marketing, public policy and ethics; understand more about their own consumer habits, resulting in personal and professional growth through the enhancement of their abilities to work collaboratively, honestly, responsibly and respectfully within society; improve their critical thinking, creativity and problem-solving abilities, applied to consumer information analysis, organizing the information obtained into a significant conceptual framework, in which concepts and theories from psychology, sociology and anthropology, disciplines on which consumer analysis is based, should be critically assessed.

**Key words:** The consumer as an individual. Marketing strategies. Consumer analysis and link to the results of the study. Consumerism and social responsibility. Different types of consumers. The consumer in his social and cultural context. Decision making process. Post-purchase processes. Feelings, action-reaction, relation and experiential marketing. Consumer sociology, anthropology and psychology.

**Bibliography:** \* Schiffman, Leon G., Consumer behavior / Leon G. Schiffman, Leslie Lazar Kanuk., 8th ed., Upper Saddle River, NJ : Pearson Prentice Hall, c2004., New Jersey, c2004., eng, [0130673358],[0130491756].

### MT2007 Qualitative Marketing Research

( 3 - 0 - 8. Prerequisites: [ MT2006 Corequisite , MT2006 ]. 6 LDN11, 6 LEM11, 6 LMC11, 4 LPM12 )  
**Equivalence:** MT00854

This is an intermediate course in the field of market research that will provide students with a good understanding of consumer analysis. The learning outcome of the course is for students to understand the market research process, and its importance in decision making, from detecting a problem or opportunity to the design and implementation of a qualitative market research.

**General objective:** At the end of this course the student will understand the marketing research process and its use in decision making, focusing on the use of qualitative research techniques, such as focus groups, in depth interviews, anthropological tools, projective techniques and observation, among others, in order to obtain information.

**Key words:** Applying qualitative tools. Qualitative market research process and design.

**Bibliography:** \* Hair, Bush & Ortinau, Investigación de Mercados, Segunda, McGraw Hill, Español.

### MT2009 B2B Marketing

( 3 - 0 - 8. Prerequisites: [ MT1001 , MT1003 ]. 8 LEM11 )

**Equivalence:** MT00871

This is an intermediate course in the field of study of administrative and technological elements involved in the design and implementation of marketing strategies between organizations, whether these be businesses, institutions or the government. As a learning outcome, students are expected to develop an alternate vision to consumer marketing, focused on a B2B context, which allows them to identify areas of opportunities within the organization and put forward strategies to take advantage of these.

**General objective:** At the end of this course the student will be able to formulate product, price, promotion and distribution strategies that maximize the value to the organizational customer from the viewpoint of the extended enterprise, which takes into consideration the virtual organization between suppliers, manufacturers, distributors, and end consumers; industrial analysis; supply chain; organizational buyer behavior; marketing strategies; relational marketing; technological platforms.

**Key words:** Industrial analysis. Value chain. Organizational buyer behavior. Marketing strategies. Relational marketing. Technological platforms.

**Bibliography:** \* Hutt, Michael D., Business marketing management : a strategic view of industrial and organizational markets / Michael D. Hutt, Thomas W. Speh., 8th ed., Mason, Ohio ; México : Thomson/South-Western, c2004, Maryland, c2004, eng, [0324190433],[9780324190434].

## MT2013 Quantitative Marketing Research

( 3 - 0 - 8. Prerequisites: [ CD1000 , MT2007 , CD1003 , MT2007 ]. 7 LDN11, 7 LEM11, 7 LMC11 )  
**Equivalence:** MT00855

This is an intermediate course in the field of marketing research. As the learning outcome, students are expected to handle the analytical and technical tools to design and implement a quantitative market investigation.

**General objective:** Upon completion of this course, students will design a quantitative market research project that includes setting out the objective of the study; selecting the sampling method and a sufficient sample size; designing the questionnaire or measuring tool based on the different types of scales that exist; and subsequently analyzing the data in univariate and bivariate form using the statistics package SPSS to produce a report of the results.

**Key words:** Sampling methods. Univariate and bivariate data analysis. Poll design. Producing a quantitative report of the investigation results. Processing. Sample size.

**Bibliography:** \* Burns & Bush, Marketing Research, Cuarta Edición, Prentice Hall, Inglés.

## MT2019 Advertising and Interactive Media

( 3 - 0 - 8. Prerequisites: [ MT2006 ]. 5 LMC11, 6 LPM12 )  
**Equivalence:** None

This is an intermediate course in the field of marketing that gives students the opportunity to learn the fundamental aspects of persuasive communication, applied to marketing, which is carried out by using mass media communication, such as digital applications that allow interaction between the consumer and the brand. This course requires basic knowledge of marketing and consumer behavior. As a result of the learning process, students will understand the communication needs of a brand to develop an effective advertising strategy. Skills of persuasion applied to businesses will be fostered by using the latest technology in mass communication.

**General objective:** After completing this course, students will be able to plan, design and implement an advertising campaign for a company, product, or service brand. For this, the student will be able to perform a situation analysis that is necessary to understand the communication needs of the brand, to define relevant strategies and creative tactics for persuasion, and to determine the appropriate media to develop contact between the market and its brand.

**Key words:** Perception and persuasive communication. Advertising and new interactive media. Strategy and creative appeals. Creative brief and execution styles. Media plan and vehicle decisions.

**Bibliography:** \* Arens, William F., Contemporary advertising / William F. Arens, Michael F. Weigold, Christian Arens., 12th ed., Boston : McGraw-Hill Irwin, c2009., [9780073381077 (papel alcalino)], [0073381071 (papel alcalino)].

## MT2020 Strategic Services Marketing

( 3 - 0 - 8. Prerequisites: [ MT2006 ]. 6 LEM11 )  
**Equivalence:** MT2008

This is an intermediate course that seeks to provide students with knowledge of intangibles' marketing. This course will help students to understand the relationship between the basic concepts of services marketing and the \*service philosophy\* that seeks to use marketing actions in order to maximize customer satisfaction. The course requires basic knowledge of consumer behavior, marketing, and creativity. It is expected the student designs a comprehensive marketing plan for a service company, as a result of this class learning.

**General objective:** The students will be familiar with intangibles' marketing and they will identify, analyze, and apply the differences in respect of the traditional product-oriented marketing mix theory.

**Key words:** Service philosophy. Services measurement. Marketing mix in services. Intangibles. Tangibles.

**Bibliography:** \* Zeithaml, Services Marketing.

## MT2021 Promotion, Media and Public Relations

( 3 - 0 - 8. Prerequisites: [ MT2006 ]. 8 LDN11, 6 LEM11 )

**Equivalence:** MT2011

In this intermediate course in the field of marketing, students will create, maintain, and improve the relationship between organizations and their stakeholders, both in real and virtual contexts, through effective integrated communication campaigns. As a result of learning, students are expected to create communication and public relations campaigns and promotional programs, and to implement those strategies and tools that contribute to improving the performance of the communication strategy of organizations.

**General objective:** Students will be able to design promotional programs and campaigns that improve the results of the integrated marketing communication strategy of an organization.

**Key words:** Advertising. Sales promotion. Public relations. Communication strategy. Media plan.

**Bibliography:** \* Schultz, Don E., Comunicaciones de marketing integradas / Don E. Schultz, Stanley I. Tannenbaum, Robert F. Lauterborn ; traducción Carlos Gardini., Barcelona : Granica, c1993., spaeng, [9506411948].

## MT2023 Advertising Design

( 3 - 0 - 8. Prerequisites: None. 5 LPM12 )

**Equivalence:** None

This is an intermediate course in the field of marketing communication aimed at helping students master and apply the principles and techniques of visual design in creating messages for advertising campaigns and other communication strategies in businesses. The course requires basic knowledge of marketing and design. As a learning outcome, students will be able to create the graphic elements of a marketing communications campaign.

**General objective:** After completing the course the student will master the techniques and the visual design tools for creating messages in the context of

a persuasive multi-platform communication campaign. The student must understand the nature of the brand that he or she is communicating and the profile of his or her target audience, in order to design evocative and persuasive messages.

**Key words:** Visual design. Advertising campaign and marketing communications.

**Bibliography:** \* Robin Landa, Advertising by Design. Generating and designing creative ideas across media, 2nd, Wiley, inglés.

## MT2024 Persuasive Copywriting

( 3 - 0 - 8. Prerequisites: None. 6 LPM12 )

**Equivalence:** None

This is an intermediate course in the field of marketing communication through which students will master the use of the written word in the field of advertising and similar forms of persuasion used by businesses to interact with their clients and consumers. The course requires knowledge of marketing, narrative structures and consumer behavior. As a learning outcome, the student will be able to write persuasive texts to be used in campaign messages in various media and communication platforms.

**General objective:** After completing the course the student will master the techniques for creating texts used in the context of integrated communications campaigns in various media and formats. The student will understand the profile of the target audience for the messages in order to attain attention and persuasion, and build a conversation and long-term relationship between the brand and its markets.

**Key words:** Publicidad y comunicación integrada de mercadotecnia. Advertising and integrated marketing communications.

**Bibliography:** \* Sugarman, Joseph, 1938-, The Adweek copywriting handbook : the ultimate guide to writing powerful advertising and marketing copy from one of America's top copywriters / Joseph Sugarman., Hoboken, N.J. : Wiley, c2007., [0470051248 (rústica)], [9780470051245 (rústica)].

### **MT3019 Digital Commerce and Sales** ( 3 - 0 - 8. Prerequisites: [ MT1001 , MT1003 ]. 9 LDN11, 7 LEM11, 7 LMC11 )

**Equivalence:** None

This is an advanced course in marketing which is intended to sensitize students to the use of technology in the fields of marketing and sales. Prior knowledge of creativity, innovation, marketing, promotion, media and public relations is required. As a learning result, the student will design, balance, and operate sales systems that will enable the organization to achieve a better performance in its markets.

**General objective:** At the end of the course, students will apply the sales management process to develop and operate effective and efficient selling systems, the usage of sales techniques to become an effective vendor of goods, ideas and concepts, and to develop customer databases, customer-company relations processes, and e-marketing tools to make optimal and profitable use of Customer Relationship Management (CRM) techniques to improve company performance in its markets.

**Key words:** E-marketing. Strategy. CRM. Technology. Sales.

**Bibliography:** \* Joseph F. Hair, Rolph E. Anderson, Rajiv Mehta, and Barry J. Babin, Sales Management: Building Customer Relationships and Partnerships, 1, Cengage, Inglés.

### **MT3020 Distribution Strategies** ( 3 - 0 - 8. Prerequisites: [ MT1003 , CD2007 ]. 8 LEM11 )

**Equivalence:** MT2014

This is an advanced course in the field of marketing that is intended to help students understand the basic concepts of the distribution of goods so that they can design an appropriate distribution channel, based on applying optimization strategies composed of integrated technology solutions used in the industry, such as logistics tools. Prior knowledge of marketing and market intelligence is required. As a learning result, students are expected to develop a project in which they define the channeling strategy for the marketing plan.

**General objective:** On completion of the course, students will be able to design a distribution channel strategy, based on thorough knowledge of user requirements, to position products in the right place, at the right time and in appropriate quantities, using the tools and solutions provided to the marketing industry by information technology and simulation and planning models in the field of logistics.

**Key words:** Logistics. Channel strategies. Distribution channel. Distribution systems. Value chain.

**Bibliography:** \* Ballou Ronald H., Logística. Administración de la Cadena de Suministro.

### **MT3021 Pricing Strategy** ( 3 - 0 - 8. Prerequisites: [ MT1003 , CF1011 ]. 8 LEM11, 8 LMC11 )

**Equivalence:** MT3008

This advanced course in the field of marketing requires previous knowledge of economics, finance, accounting, law and basic marketing in order to understand and apply the pricing process in a strategic manner. This process rests on marketing methodology, based on customer value criteria, which, as well as attracting the customer and selling products, helps to obtain customer satisfaction and loyalty. In this context, the pricing process serves the company as a strategic tool to drive profitable growth. As a learning result, the student is expected to produce a final project on price setting.

**General objective:** At the end of this course, students will be able to structure an allocation and pricing system that integrates financial tools, thus generating a complete view of these elements that are required in the implementation of marketing both domestically and internationally.

**Key words:** Prices. Cost. Finance and marketing. Pricing strategy. Pricing process.

**Bibliography:** \* Restrepo Abad, Nicolás., Estrategia de precios : un enfoque de mercadeo para los negocios / Nicolás Restrepo Abad., 1a ed., Medellín : Fondo Editoria Universidad EAFIT, 2007., [9588281806],[9789588281803].



### **MT3022 Market Intelligence** ( 3 - 0 - 8. Prerequisites: [ MT2013 ]. 8 LEM11 ) **Equivalence: None**

This is an advanced course in the field of marketing through which students will study data analysis in depth by using multivariate statistical techniques to generate information that supports the decision making process. At the end of this course, the student will be able to solve real problems in any company or industry; understand the context that surrounds the problem under study and analyze relevant information using advanced statistical techniques; provide recommendations and a sound analysis of the organization's strengths and weaknesses, as well as its competencies. This course requires basic knowledge of statistical methods for decision making and quantitative market research. The learning outcome of the course is for students to design and carry out a comprehensive market research (qualitative and quantitative) in which they perform an analysis of the information in order to design the marketing strategies.

**General objective:** Upon completing this course, the student will be able to use multivariate statistical techniques to analyze the information in databases coming from marketing research or consultancy projects and obtain results that help in the decision making process. To achieve this, the following course contents will be considered: evaluation of real problems, use of advanced statistical analysis, and preparation of reports with conclusions and suggestions that are relevant to marketing decisions.

**Key words:** Multivariate analysis. Discriminant analysis. Cluster analysis. ANOVA. Conjoint analysis.

**Bibliography:** \* Rolph Anderson, Ronald L. Tatham, and Joseph F. Hair Jr., Análisis multivariante de datos, 5ta. edición, Prentice Hall, Español.

### **MT3023 Global Brands and Product Development** ( 3 - 0 - 8. Prerequisites: None. 9 LDI11, 9 LEM11, 9 LMC11 ) **Equivalence: MT3009**

This is an advanced course in the field of marketing that requires students to develop a viable product

and a marketing plan to manage the brand in national and/or international markets. Previous knowledge is required of creativity, innovation, and marketing mix management (price, promotion and distribution).

**General objective:** Upon completing this course, students will be able to identify business opportunities and develop new products in national and international markets, establish a procedure to manage existing products with a global view, and build, measure and manage brand equity.

**Key words:** International marketing. Product development. Brand equity. Global Environment. Services.

**Bibliography:** \* Crawford, C. Merle (Charles Merle), 1924-, New products management / Merle Crawford, Anthony Di Benedetto., 9th ed., Boston : McGraw-Hill Irwin, 2008., [9780073529882 (papel alcalino)], [0073529885 (papel alcalino)], [9780071263368 (ed. internacional)].

### **MT3024 Strategic Marketing Capstone Seminar** ( 3 - 0 - 8. Prerequisites: None. 9 LEM11 ) **Equivalence: MT3014**

This is an advanced course in the field of marketing that helps students to integrate both the strategic aspects of the environment and the capabilities of the organization with the formulation and implementation of a marketing strategy for each of the company's business units.

**General objective:** At the end of this course, students will be able to develop, analyze, and communicate marketing strategies that help organizations develop a sustainable competitive advantage by creating an increase in value for customers.

**Key words:** Marketing strategies. Competitive advantage. Sustainability. Marketing and communication plan. Planning and evaluation.

**Bibliography:** \* Mercado H., Salvador., Mercadotecnia estratégica : cómo lograr utilidades en la empresa con la reingeniería mercadológica / Salvador Merca-

do H., 3a ed., México : Instituto Mexicano de Contadores Públicos, 2008., [9706653279],[9789706653277].

### **MT3025 Introduction to Professional Development**

**( 2 - 0 - 2. Prerequisites: None. 9 LEM11 )**

**Equivalence: None**

This is a college level course designed to prepare students in their major topics for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need to successfully make the transition from student to a professional and find or create employment.

**General objective:** Upon the completion of this course, students will have reviewed the topics that are most relevant to their major and will have acquired the tools and information needed to seek or create employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

### **MT3026 Introduction to Professional Development**

**( 2 - 0 - 2. Prerequisites: None. 9 LMC11 )**

**Equivalence: None**

This is a college level course designed to prepare students in their major topics for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career

alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need to successfully make the transition from student to a professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and will have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

### **MT3027 Integrated Marketing Communication**

**( 3 - 0 - 8. Prerequisites: None. 9 LMC11 )**

**Equivalence: None**

The aim of this advanced marketing course is to foster the student's creativity in the use of the persuasive communication tools. Which are used by an advertisers to reach their markets. The course requires previous knowledge of advertising, production and post-production of printed, audiovisual, and interactive messages in mass media. As a learning outcome, the students will design a persuasive communication campaign for a brand. This campaign must integrate various forms of marketing persuasion, including advertising, public relations, sales promotion, experiential marketing, customer service and below the line techniques.

**General objective:** At the end of this course, students will be able to plan, design and execute a persuasive communication campaign for a brand. The campaign must effectively and efficiently integrate various communication tools like advertising, public relations, sales promotions, experiential marketing, customer service, and "below the line" techniques. The student will be able to design an integrated communications campaign, efficient in the use of economic resources and effective in achieving the expected effects on target markets while avoiding consumer manipulation in the purchase decision process.



**Key words:** Customer service. Integrated marketing communications. Advertising and public relations. Experiential marketing.

**Bibliography:** \* Clow, Kenneth E., Publicidad, promoción y comunicación integral en marketing / Kenneth E Clow, Donald Baack; traducción de María del Pilar Carril Villarreal., 4a ed., México : Pearson, 2010., spaeng, [9786074426304].

## MT3028 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 LPM12 )

**Equivalence: None**

This is a college level course designed to prepare students in their major topics for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need to successfully make the transition from student to a professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and will have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## MT3029 Digital Marketing

( 3 - 0 - 8. Prerequisites: None. 7 LPM12 )

**Equivalence: None**

This is an advanced course in the field of marketing communications intended for students to understand and apply fundamental knowledge of the dynamics of digital communication platforms and its

application to persuasive contact planned by a brand for its markets. The course requires basic knowledge of marketing, consumer behavior and advertising. As a learning outcome, the student will be able to effectively use digital communication technologies to serve an organization. Persuasion skills applied to businesses through the use of avant-garde technology will be developed.

**General objective:** After completing the course the student will be able to plan and design a marketing communication campaign using the digital platforms most suited to the communication needs of a brand and the profile of its target clients and consumers. To achieve this, the student will understand consumer use of new communications technologies in order to choose the most suitable channels for the campaign.

**Key words:** Digital Marketing. Communication for marketing and persuasion .

**Bibliography:** \* Ryan, D. & Jones, C. , Understanding Digital Marketing.

## MT3030 Internal Marketing

( 3 - 0 - 8. Prerequisites: None. 8 LPM12 )

**Equivalence: None**

This is an advanced course in the field of marketing communication that is intended to help the student master and apply the principles and techniques of internal marketing as an essential part of an integrated marketing communication campaign. The course requires knowledge of persuasion and marketing communication. As a learning outcome, the student will be able to develop and implement marketing strategies targeted at the human capital of an organization.

**General objective:** After completing the course the student will be able to develop and implement marketing strategies aimed at human capital of an organization, applying the techniques of persuasion and using the most suitable communication platforms for the given context. The student will understand the nature of an organization's culture, linked to its competitive context, both locally and globally.

**Key words:** Branding. Organizational communication. Internal marketing.

**Bibliography:** \* Ind, Nicholas., Living the brand : how to transform every member of your organization into a brand champion ; in association with Marketing / Nicholas Ind., 2nd ed., London ; Sterling, VA : Kogan Page, 2004., [0749441291].

### MT3031 Integrated Advertising Project

( 3 - 0 - 8. Prerequisites: None. 9 LPM12 )

**Equivalence: None**

This is an advanced course in the field of advertising in which it is intended that students put into practice all the knowledge they have acquired of the various marketing communication tools used in business. The course requires knowledge of advertising, communications, and public relations, as well as production and postproduction of messages in the media, whether print, audio-visual and interactive. As a result of learning, the student will be able to develop a comprehensive communication campaign for a brand, product or service that integrates various forms of marketing persuasion, such as advertising, public relations, sales promotion, experiential marketing, customer service, and "below the line" techniques.

**General objective:** After completing the course the student will be able to plan, design and implement a comprehensive communication campaign for a brand that effectively and efficiently combines various communication tools such as advertising, public relations, sales promotion, experiential marketing, internet marketing (Web marketing), and "below the line" techniques. The student will be able to design an advertising campaign that is efficient in the use of economic resources and also effective in achieving the expected impact on target audiences.

**Key words:** Integrated marketing communications. Advertising and public relations. Experiential marketing. Web marketing.

**Bibliography:** \* Clow, Kenneth E., Integrated advertising, promotion, and marketing communications / Kenneth E. Clow, Donald Baack., 4th ed., Upper Sad-

dle River, N.J. : Prentice Hall, c2010., [9780136079422 (rústica : papel alcalino)],[0136079423].

### MT3032 Branding

( 3 - 0 - 8. Prerequisites: None. 9 LPM12 )

**Equivalence: None**

This is an advanced course in the field of marketing communication intended to help the student understand and apply concepts related to brands, their creation and management. The course requires prior knowledge of advertising design, culture and society, and market communication. As a learning outcome, the student will develop graphical, cultural and experiential elements of a brand for a real product or service.

**General objective:** After completing the course the student will be able to master the concepts of graphic, cultural and experiential identity for a brand, as a representation of a product, service or organization and in relation to a target market. The student will be able to audit, modify or develop a brand, using the most suitable market communication tools for a particular context.

**Key words:** Brand development and management. Market communication.

**Bibliography:** \* Keller, K. , Strategic brand management, 3rd.

## NC Clinical Nutrition

### NC3000 Multidisciplinary Pediatric Clinic

( 0 - 20 - 4. Prerequisites: [ NC3005 , NC3005 Corequisite ]. 9 LNB11 )

**Equivalence:** MC3071

This is an advanced course focused toward the student applying the knowledge acquired concerning the clinical-pathological entities of pediatrics and pediatric nutrition. The course requires prior knowledge of nutritional assessment and dietary planning. As a learning outcome, the student is expected to carry out the nutritional management of actual pediatric patients in outpatient and inpatient settings.

**General objective:** On completion of this course, students will be able to perform a comprehensive nutritional clinical assessment of pediatric patients; make a diagnosis of their nutritional status and determine their nutritional requirements; develop individual feeding plans for unweaned babies, as well as individuals in infancy, childhood and adolescence, and children and adolescents suffering from malnutrition, obesity and other diseases, based on their current nutritional status and the conditions of the disease, and taking into account the role of their alimentary habits; appreciate the importance of providing an accurate diagnosis of the nutritional condition of individuals at these stages of life cycle and in these pathological conditions, the impact of appropriate nutritional intervention on disease control and patients' state of health, the importance of family nutritional education and the role of the multidisciplinary team in comprehensive management of the individual. Students should behave with professional ethics when caring for patients.

**Key words:** Assessment, diagnosis and intervention in child's nutritional status. Personalized nutritional therapy for the sick or healthy child.

**Bibliography:** \* Modern nutrition in health and disease / senior editor, Maurice E. Shils ; associate editors, Moshe Shike . [et al.], 10th ed., Philadelphia : Lippincott Williams & Wilkins, c2006., [0781741335 (papel alcalino)], [9780781741330 (papel alcalino)].

### NC3001 Clinical-Pathological Entities in Pediatric

( 3 - 0 - 8. Prerequisites: [ NC3005 Corequisite ]. 9 LNB11 )

**Equivalence:** None

This is an advanced course in which the aim is for students to understand the diverse causes and factors that lead to diseases of distinct apparatus and systems in pediatrics, as well as the epidemiology, pathophysiology, neuroendocrine regulation, clinical presentation, consequences, diagnostic evaluation and integral treatment. The course requires prior knowledge of growth and development in addition to nutritional clinical assessment. As a learning outcome, students are expected to assess the clinical and nutritional status of pediatric patients, based on real or simulated clinical cases.

**General objective:** On completion of this course, students will be able to understand the main characteristics of the metabolism of protein, fat and carbohydrates, and the role of the biochemical-metabolic processes of appropriate nutrition in newborns, toddlers, children, and adolescents, as well as the impact of inadequate nutrition on the development of undernourishment, malnutrition, obesity and other diseases and the effects on energetic and nutritional requirements and metabolism; identify the different causes and factors that lead to these pathologies, the epidemiology, pathophysiology, neuroendocrine regulation, clinical presentation, consequences, diagnostic evaluation and integral treatment; appreciate the impact of these diseases on the deterioration of individual health and the role of nutrition and multidisciplinary work in the treatment of patients who suffer from these diseases.

**Key words:** Nutrition. Pediatrics.

**Bibliography:** \* McPhee, Stephen J., Pathophysiology of disease : [recurso electrónico] / an introduction to clinical medicine / Stephen J. McPhee, William F. Ganong., 5th ed., New York : McGraw-Hill Medical Publishing Division, c2006.

## NC3002 Clinical Nutritional Support in Pediatrics

( 2 - 0 - 4. Prerequisites: [ NU2014 , NU2025 ]. 9 LNB11 )

**Equivalence: None**

This is an advanced course intended to prepare students so that they perform excellently in the clinical field of pediatric nutrition, implementing a course that involves the use of nutritional support as the main nutritional treatment at any stage of pediatric life (infant, preschool, school children and adolescents), and make them understand the importance of nutritional support in hypermetabolic stress conditions and/or any disease that impacts on the nutritional status of the patient, and how this correlates with the life expectancy of the patient. The course requires basic knowledge of clinical evaluation and dietary planning. As a learning outcome, students are expected to deal with instructions, calculations, formulas and solutions, access routes and related complications during clinical rotations and in professional practice.

**General objective:** On completion of this course, students will be able to understand the principles, indications, methods and effectiveness of enteral and parenteral nutrition in pediatric patients; carry out nutritional support competently, including the instructions, calculations, formulas and solutions, access routes and complications that may arise; assess the ethical considerations that apply to decisions made concerning the use of nutritional support methods, and the impact of the special contribution of dietitians on the multidisciplinary nutritional support team in clinical settings; know the main and most common complements and nutritional supplements used in sick pediatric patients; evaluate critically the different products offered on the market as complements and food supplements; assess the positive and negative impact of products used as complements and supplements in different circumstances on patient health.

**Key words:** Use of enteral and parenteral route to meet energy requirements of the sick child .

**Bibliography:** \* Modern nutrition in health and disease / senior editor, Maurice E. Shils ; associate editors, Moshe Shike . [et al.], 10th ed., Philadelphia

: Lippincott Williams & Wilkins, c2006., [0781741335 (papel alcalino)], [9780781741330 (papel alcalino)].

## NC3003 Nutrition in Physical Activity and Exercise

( 2 - 0 - 4. Prerequisites: None. 13 LNB11 )

**Equivalence: None**

This is an advanced course designed to apply the basic principles of physiology of exercise and its effects on energy balance and body composition in healthy individuals and those of special nutrition for physically active individuals and athletes. It requires prior knowledge of designing physical activity programs. As a learning outcome, the student is expected to develop meal plans for these individuals during clinical rotations and professional practice.

**General objective:** Students will be able to plan diets considering the needs and individualities of every sport or physical activity to improve the nutritional condition and increase the physical performance of the athlete.

**Key words:** Energy balance and body composition in healthy individuals. Special nutrition for physically active individuals and athletes.

**Bibliography:** \* Melvin H. Williams, Nutrición ara la salud, condición física y deporte, 7ma., Editorial McGrawHill, [978-970-10-5394-2].

## NC3004 Behavioral Modification Therapy

( 2 - 0 - 4. Prerequisites: [ MB2045 ]. 9 LNB11 )

**Equivalence: None**

This is an advanced course. The aim of the course within the curriculum is to provide knowledge and develop skills in the relationship between human behavior, eating habits, and basic psychological disorder of the various diseases directly resulting from these disorders and behaviors. It requires basic knowledge of psychology. As a learning outcome, students design a plan to help change behavior patterns in real or simulated patients.

**General objective:** Students will be able to explain the importance of health psychology in the multidisciplinary treatment of the patient who comes to a nutritional consultation, with a basic knowledge of general psychology and psychopathology for clinical application in the area of health. They will be able to develop a behavioral plan that can help patients meet their goals, to complement the medical and nutrition plan, based on the study of cognitive-behavioral psychotherapy and its various modalities, such as individual, group and family psychotherapy.

**Key words:** Health. Psychology. Disease. Behavior. Nutrition.

**Bibliography:** \* Amparo Belloch, Manual de Psicopatología I y II, Mc Graw Hill.

### NC3005 Medical Nutrition Therapy in Pediatrics

( 3 - 0 - 8. Prerequisites: [ MC3040 , MC3040 Corequisite , NC3001 , NC3001 Corequisite ]. 9 LNB11 )  
**Equivalence: None**

The aim of this advanced course is for students to develop skills to perform a comprehensive clinical nutrition evaluation, make a diagnosis of the current nutritional status and determine the nutritional requirements. It requires prior knowledge in nutritional assessment and diet planning. As a learning outcome, students are expected to develop nutritional care plans in health and in various pathologies of Pediatrics service based on scientific evidence.

**General objective:** Students will be able to perform an integral clinical nutritional assessment; develop the abilities to diagnose accurately the nutritional status and to determine individualized nutrient and diet needs and design diet planning interventions that meet the recommendations and requirements for individuals in the pediatric stages of the life cycle, and in individuals with malnutrition, obesity and other diseases, based on the current nutritional status and disease condition, considering all factors that affect current dietary intake and eating behavior; value the importance of an accurate diagnosis about the nutritional status of patients during these stages of the life span, and in those with these diseases and the impact of nutritional intervention and adequate

weight control on the recovery and health status of these patients, of family nutrition education, as well as the role of a multidisciplinary team in the integral management of these patients; and perform with ethics and professionalism during patient care.

**Key words:** Nutrition in pediatrics.

**Bibliography:** \* Modern nutrition in health and disease / senior editor, Maurice E. Shils ; associate editors, Moshe Shike . [et al.], 10th ed., Philadelphia : Lippincott Williams & Wilkins, c2006., [0781741335 (papel alcalino)], [9780781741330 (papel alcalino)].

### NC3006 Multidisciplinary Internal Medicine Clinic

( 0 - 20 - 4. Prerequisites: [ NC3010 Corequisite , NC3010 ]. 8 LNB11 )  
**Equivalence: None**

The aim of this advanced course is for students to develop clinical skills in the nutritional management of adult ambulatory and hospitalized patients, basing student learning on patient care. It requires basic knowledge of clinical and pathological entities of internal medicine and medical nutrition therapy in internal medicine. As a learning outcome, students will develop diagnostic and nutrition plans based on the current nutritional status of the patient and disease conditions.

**General objective:** Students will be able to diagnose the patient's nutritional status; determine the nutritional requirements and develop meal plans for healthy individuals, with malnutrition, obesity and other diseases, based on the current nutritional status and conditions of the disease, taking into account the role of eating behavior; assess the importance of issuing an accurate diagnosis of the nutritional status of the individual in health and in various pathological conditions, the impact of appropriate nutritional intervention in disease control and health status of patients with family nutrition education and the role of the multidisciplinary team in the comprehensive management of the individual; and conduct themselves with professional ethics in patient care.

**Key words:** Evaluation, diagnosis and intervention in the nutritional status of adult. Individualized nutri-



tion therapy for the healthy adult or with any specific pathology.

### **NC3007 Physical Activity and Disease**

( 2 - 0 - 4. Prerequisites: [ NU2019 ]. 8 LNB11 )

**Equivalence: None**

This advanced course provides knowledge about the physiology of exercise in cardiovascular, respiratory, endocrine, osteoarticular, rheumatic and mental diseases, as well as about the benefits it produces in them and the physiological mechanisms through which the benefits are produced. It requires basic knowledge of exercise program design. As a learning outcome, students are expected to develop customized treatment plans, considering the patients' pathological condition, general health and current physical condition during their clinical rotations and professional practice.

**General objective:** Students will be able to understand the physiology of exercise in cardiovascular, respiratory, endocrine, osteoarticular, rheumatic, mental diseases, as well as the benefits it produces in them and the physiological mechanisms through which the benefits are produced; develop customized treatment plans, taking into account the pathological condition, general health status and current physical condition of patients.

**Key words:** Physical activity and disease.

**Bibliography:** \* Nieman David C. , Exercise training and Prescription with PowerWeb Bind-in Passcard, Mc Graw-Hill, Inglés.

### **NC3008 Clinical-Pathologic Entities in Internal Medicine**

( 3 - 0 - 8. Prerequisites: [ NU2014 ]. 8 LNB11 )

**Equivalence: None**

This advanced course promotes an understanding of the main characteristics of the metabolism of proteins, lipids and carbohydrates and the role of the biochemical metabolic processes of an inadequate nutrition in the development of endocrinal, cardiovascular, respiratory and digestive diseases, and AIDS, and the effects of each disease upon the ca-

loric and nutritional requirements of the individual. It requires basic knowledge in clinical nutrition assessment. Learning outcome: Students are expected to assess the clinical and nutritional status of these patients during their clinical rotations and professional activities.

**General objective:** Students will be able to promote an understanding of the main characteristics of the metabolism of proteins, lipids and carbohydrates and the role of the biochemical metabolic processes of an inadequate nutrition in the appearance and development of acute and chronic endocrine, cardiovascular, respiratory and digestive diseases, and AIDS, and the effects of each disease upon the caloric and nutritional requirements of the individual. To identify the causes and factors that lead to such diseases, their epidemiology, physiopathology, neuroendocrine metabolic regulation, clinical presentation, consequences, diagnostic approach and integral treatment. To value the impact of these diseases on the impairment of the health status of the individual and the role that nutrition therapy plays in his/her wellbeing, as well as the role of the multidisciplinary team in the management of the individuals who suffer from these conditions.

**Key words:** Clinical-pathologic entities in internal medicine.

**Bibliography:** \* Harrison's principles of internal medicine Dennis L. Kasper . [et al.], 16th ed., New York : McGraw-Hill, Medical Pub. Division, c2005., [0071391401 (juego)], [0071402357 (combo)], [9780071391405], [9780071391412], [9780071391429].

### **NC3009 Complementary and Alternative Nutrition**

( 2 - 0 - 4. Prerequisites: None. 8 LNB11 )

**Equivalence: None**

In this advanced course, students will develop scientifically-based, informed critical judgment skills regarding complementary and alternative treatments for patients, as well as the increasingly popular fad diets, since nutritionists need a solid knowledge based on scientific evidence about the use and safety of these modalities. It requires no prior knowledge. As a learning outcome, students are expected to as-



sess alternative treatments, complementary treatments or fad diets.

**General objective:** Students will be able to analyze and interpret scientific information about the use and safety of complementary and alternative treatments. They will evaluate and assess fad diets based on scientific evidence.

**Key words:** Fad diets. Supplementary nutrition. Alternative nutrition. Alternative diets.

**Bibliography:** \* M.J. Marian, P. Williams-Mullen, J.Muir Bowers, Integrating Therapeutic and Complementary Nutrition , 1st edition, Taylor & Francis Group.

### NC3010 Medical Nutrition Therapy in Internal Medicine

( 3 - 0 - 8. Prerequisites: [ NC3008 Corequisite , NC3008 ]. 8 LNB11 )

**Equivalence: None**

This is an advanced course that aims to develop students' skills in clinical nutritional assessment of adult patients. It requires prior knowledge in nutritional assessment and diet planning. As a learning outcome, students will develop a nutritional care plan for the different diseases of internal medicine, based on scientific evidence.

**General objective:** Students will be able: to plan individualized nutritional care plans for patients with different pathologies of internal medicine based on scientific evidence; develop diagnostic skills to deliver the nutritional status in hospitalized patients; assess the importance of nutritional care in hospitalized patients; develop criteria based on scientific evidence to prescribe appropriate nutritional therapies in patients with cardiovascular, pulmonary, endocrine, digestive, infectious, hematologic, renal and oncology diseases; conduct themselves ethically in patient care.

**Key words:** Nutrition in internal medicine.

**Bibliography:** \* Shils M, Shike M, Ross C, Caballero B, Cousins R , Modern nutrition in health and disease, 10th, Lippincott Williams & Wilkins, [0781741335].

### NC3011 Multidisciplinary Surgery Clinic

( 0 - 20 - 4. Prerequisites: [ NC3015 Corequisite , NC3015 ]. 12 LNB11 )

**Equivalence: None**

This is an advanced course in which students will be able to implement the knowledge gained in the surgery core courses. It requires prior knowledge of nutritional assessment and dietary planning. As a learning outcome, the student is expected to present plans and reports of nutritional management of pre-and post-surgical patients.

**General objective:** Perform the nutritional clinical evaluation of a patient (pre-or post-surgical). Diagnose the nutritional status and determine the nutritional requirements. Develop meal plans for healthy individuals, with malnutrition, malnutrition, obesity and other diseases that require surgical intervention, based on the current nutritional status, conditions of the disease and its metabolic stress. Assess the importance of nutrition education for the individual and family, and the role of the multidisciplinary team in the management of the individual. Conduct themselves with professional ethics in the care of patients.

**Key words:** Assessment, diagnosis and intervention in the patient's nutritional status before and after surgery. Nutrition therapy for adults pre- and post-surgery.

**Bibliography:** \* Modern nutrition in health and disease / senior editor, Maurice E. Shils ; associate editors, Moshe Shike . [et al.], 10th ed., Philadelphia : Lippincott Williams & Wilkins, c2006., [0781741335 (papel alcalino)], [9780781741330 (papel alcalino)].

### NC3012 Clinical-Pathological Entities in Surgery

( 3 - 0 - 8. Prerequisites: [ NC3011 Corequisite ]. 12 LNB11 )

**Equivalence: None**

This advanced course seeks to develop competencies in the interpretation of the main characteristics of protein, fat and carbohydrate metabolism, as well as the role of biochemical-metabolic processes of an

inadequate diet in the development of hypermetabolic stress. It requires basic knowledge in clinical nutrition assessment. As a learning outcome, the student is expected to assess the clinical and nutritional status of patients in the surgery area, based on real or simulated clinical cases.

**General objective:** To promote an understanding of the main characteristics of the metabolism of proteins, lipids and carbohydrates and the role of the biochemical metabolic processes of an inadequate nutrition in the appearance and development of hypermetabolic stress caused by trauma, surgery, burns, transplants, and the effects of each disease upon the caloric and nutritional requirements of the individual. To identify the causes and factors that lead to such diseases, their epidemiology, pathophysiology, neuroendocrine metabolic regulation, clinical presentation, consequences, diagnostic approach and integral treatment. To assess the impact of these diseases on the impairment of the health status of the individual and the role that nutrition therapy plays in his/her wellbeing, as well as the role of the multidisciplinary team in the management of the individuals who suffer from these conditions.

**Key words:** Clinical-pathological entities in surgery.

**Bibliography:** \* Essentials of general surgery / senior editor, Peter F. Lawrence ; editors, Richard M. Bell, Merrill T. Dayton, 4th ed., Philadelphia ; Baltimore : Lippincott Williams & Wilkins, 2006., [0781750032].

### **NC3013 Food-Medication Interactions** ( 2 - 0 - 4. Prerequisites: [ NC3008 , NC3008 Corequisite , NC3010 , NC3010 Corequisite ]. 12 LNB11 ) **Equivalence: None**

This is an advanced course in which students will recognize the main groups of drug nutrient interactions prescribed in different pathologies in order to make better nutritional interventions. They also will be able to design better nutritional care plans. This course requires prior knowledge of nutrition in the lifecycle and of nutritional therapy. Students will evaluate drug interactions with food and/or nutrients in order to use or avoid them.

**General objective:** Students will be able to identify the main drug groups and the general principles and factors (pharmacokinetics and pharmacodynamics) which influence their actions. They will also identify the drug action mechanisms and their clinical use. They will distinguish foods which may alter the efficiency, tolerance and/or safety of diverse drugs, as well as the mechanisms implied in pharmacokinetics and pharmacodynamics modification. As a result, students will develop skills related to the identification of bi-directional drug-nutrient interactions, taking into account nutrient absorption, distribution, metabolism and excretion, in order to give recommendations to patients.

**Key words:** Drug-nutrient interaction. Adverse drug effects.

**Bibliography:** \* Pronsky, Zaneta Marlene., Food medication interactions / Zaneta M. Pronsky, MS, RD, LDN, FADA, Sr Jeanne P. Crowe, PharmD, RPh ; [edited by] Dean Elbe, BSc (Pharm), BCPP, Sol Epstein MD, FRCP, FACP., 16th ed., Birchrunville, PA : Waza Inc, 2010., [0971089647 (alk. paper)].

### **NC3014 Clinical Nutrition Support** ( 3 - 0 - 8. Prerequisites: None. 12 LNB11 ) **Equivalence: None**

This advanced course seeks to provide knowledge about the principles, indications, methods and effectiveness of enteral and parenteral nutrition, and develop skills for the competent practice of nutritional support, ranging from the information, calculations, formulas and solutions, access routes and complications for use during clinical rotations and student practice. It requires basic knowledge of nutritional therapy. As a learning outcome, students will develop meal plans and menus for patients with the corresponding clinical entities.

**General objective:** Students will be able to understand the principles, indications, methods, and effectiveness of enteral and parenteral nutrition; provide competent nutrition support, including information, calculations, formulas and solutions, access routes and complications; assess ethical considerations to be applied to decisions on the use of nutritional support methods, and the impact of the special contri-

bution of dietitians to the nutritional support multi-disciplinary team in clinical settings; know the main and most common supplements and nutritional supplements used throughout the life cycle, both in terms of health and disease; critically evaluate the various products offered on the market as supplements and nutritional supplements; assess the positive and negative impact on health of products and supplements used in various circumstances.

**Key words:** Methods of nutritional support. Enteral nutrition. Parenteral nutrition.

**Bibliography:** \* Rolando H. Rolandelli, MD, MBA, Robin Bankhead, CRNP, MS, CNSN, Joseph I. Boullata, PharmD, BCNSP and Charlene W. Compher, Clinical Nutrition , Saunders Co.

### NC3015 Medical Nutrition Therapy in Surgery

( 3 - 0 - 8. Prerequisites: [ NC3011 Corequisite , NC3012 Corequisite ]. 12 LNB11 )

**Equivalence:** None

This is an advanced course. It requires prior knowledge in nutritional assessment and diet planning. As a learning outcome, students will be able to plan nutritional care in surgical patients (pre- and post-surgical) based on scientific evidence.

**General objective:** Students will be able: to create individualized nutritional care plans for surgical patients based on scientific evidence; diagnose the nutritional status of pre- and post-surgical patients; recognize the importance of nutritional care for patients pre- and post-surgery; develop criteria based on scientific evidence to prescribe appropriate nutritional therapies for pre- and post-surgical patients; conduct themselves with professional ethics in patient care.

**Key words:** Nutrition in surgery. Nutrition therapy in surgery.

**Bibliography:** \* Mora R, Soporte nutricional especial, 3era., Panamericana.

### NC3016 Clinical-Pathologic Entities in Gynecology, Obstetrics and Geriatrics

( 3 - 0 - 8. Prerequisites: None. 13 LNB11 )

**Equivalence:** None

This is an advanced course that promotes an understanding of the main characteristics of the metabolism of proteins, lipids and carbohydrates and the role of the biochemical metabolic processes of an adequate nutrition in pregnancy, lactation, menopause and older age, as well as that of an inadequate nutrition in the appearance and development of pregnancy complications, cancer, osteoarticular, immunologic and neurological diseases and others, and the effects of each disease upon the caloric and nutritional requirements of the individual and on the metabolism. It requires basic knowledge in clinical nutrition assessment. As a learning outcome, students are expected to assess the clinical and nutritional status of these patients during their clinical rotations and professional activities.

**General objective:** Students will be able to understand the main characteristics of the metabolism of proteins, lipids and carbohydrates and the role of the biochemical metabolic processes of an adequate nutrition in pregnancy, lactation, menopause and older adult, as well as that of an inadequate nutrition in the appearance and development of pregnancy complications, of cancer, osteoarticular, immunologic and neurologic diseases and others, and the effects of each disease upon the caloric and nutritional requirements of the individual. To identify the causes and factors that lead to such diseases, their epidemiology, physiopathology, neuro endocrine metabolic regulation, clinical presentation, consequences, diagnostic approach and integral treatment. To assess the impact of these diseases on the impairment of the health status of the individual and the role that nutrition therapy plays in his/her wellbeing, as well as the role of the multidisciplinary team in the management of the individuals who suffer from these conditions.

**Key words:** Clinicopathologic entities of gynecology and obstetrics.

**Bibliography:** \* Harrison's principles of internal medicine Dennis L. Kasper . [et al.], 16th ed., New York : McGraw-Hill, Medical Pub. Division, c2005., [0071391401 (juego)], [ 0071402357 (combo)], [9780071391405], [9780071391412], [9780071391429].

### **NC3017 Medical Nutrition Therapy in Gynecology, Obstetrics and Geriatrics**

( 3 - 0 - 8. Prerequisites: [ MC3041 Corequisite, MC3041, NC3016 Corequisite , NC3016 ]. 13 LNB11 )

**Equivalence: None**

The aim of this advanced course is for students to perform a comprehensive nutritional clinical evaluation of the pregnant patient and the geriatric patient. It requires prior knowledge in nutritional assessment and diet planning. As a learning outcome, students are expected to design nutritional care plans during the course of normal pregnancy, lactation, high-risk pregnancies or special climatic conditions and geriatric patients based on scientific evidence.

**General objective:** Students will be able to perform an integral clinical nutritional assessment; develop the abilities to diagnose accurately the nutritional status and to determine individualized nutrient and diet needs and design diet planning interventions that meet the recommendations and requirements for pregnant, breastfeeding, menopausal, and geriatric stages of the life cycle, and in individuals with cancer, osteoarticular, neurologic and immunologic diseases, based on the current nutritional status and disease condition, considering all factors that affect current dietary intake and eating behavior; to value the importance of an accurate diagnosis about the nutritional status of patients during these stages of the life span, and in those with these diseases and the impact of nutritional intervention and adequate weight control on the recovery and health status of these patients, of family nutrition education, as well as the role of a multidisciplinary team in the integral management of these patients; and perform with ethics and professionalism during patient care.

**Key words:** Nutrition in gynecology and obstetrics. Nutrition and geriatrics.

**Bibliography:** \* Modern nutrition in health and disease / senior editor, Maurice E. Shils ; associate editors, Moshe Shike . [et al.], 10th ed., Philadelphia : Lippincott Williams & Wilkins, c2006., [0781741335 (papel alcalino)], [9780781741330 (papel alcalino)].

### **NC3018 Multidisciplinary Gynecology and Obstetrics Clinic**

( 0 - 20 - 4. Prerequisites: [ NU2014 , NU2025 ]. 13 LNB11 )

**Equivalence: None**

This is an advanced course in which students apply the knowledge gained in the clinical-pathological entity courses. It requires prior knowledge of nutritional assessment and dietary planning. As learning outcome, the student is expected to carry out the nutritional management of real patients in ambulatory and hospital settings.

**General objective:** Students will be able to perform a clinical, nutritional assessment; make a diagnosis of nutritional status and determine the nutritional requirements; develop meal plans based on the current nutritional status and disease conditions, taking into consideration the role of feeding behavior; assess the importance of an accurate diagnosis of nutritional condition, the impact of appropriate nutritional intervention in disease control and the health status of patients, family nutrition education and the multidisciplinary team's role in the management of the individual; and conduct themselves with professional ethics in the care of patients.

**Key words:** Common medical office procedures. Data records.

**Bibliography:** \* Nichols D.H., Ambulatory gynecology, Lippincot, inglés.

## NI International Business

### NI1001 Enterprise, Culture and Business in The World

( 3 - 0 - 8. Prerequisites: None. 3 LAE11, 3 LAF11, 3 LCDE11, 2 LCPF11, 4 LDN11, 3 LEM11, 2 LIN11, 3 LLN11, 3 LMC11, 4 LPM12, 4 LPO11 )

**Equivalence:** NI2002

This is a basic course in the field of international business, which allows students to understand the relevant aspects of globalization, culture and internationalization and their impact on doing business internationally. In particular, students will develop an integral vision of business, which will help students to establish relationships (network) between companies and the global economy. Students will evaluate possible or available business models that an enterprise can implement at an international level, considering several variables (some of them mentioned earlier) that affect international business, as well as international organizations. As learning outcomes, students will solve, in work teams, case studies and projects, wherein they will analyze the social, political, economic, financial and cultural environment of the company, as well as how globalization has influenced the way business is conducted internationally.

**General objective:** Students will be able to identify how nations differ based on cultures, levels of economic development and political systems; analyze differences in cultures, political systems, social systems and economic systems influence on businesses; and analyze how the globalization process affects international businesses.

**Key words:** Global economic outlook. Participants in global economy. Enterprises in global economy. Enterprise and market in global economy.

**Bibliography:** \* Ball D., Mc. Culloch W.H., International Business, The Challenge of Global Competition.

### NI1002 Negotiation Techniques and International Trade

( 3 - 0 - 8. Prerequisites: None. 8 IBN11, 4 LAE11, 6 LCDE11, 4 LCPF11, 5 LDN11, 4 LEM11, 5 LIN11, 4 LLN11, 6 LPO11 )

**Equivalence:** None

This basic international business course introduces students to the main elements of negotiation and its relevance in the everyday events of an organization, in particular the international buying and selling processes. A basic knowledge of management and marketing is required. Learning outcome: students will develop research projects, which demonstrate their knowledge of the basic aspects of negotiation applied to international buying and selling processes. They will also resolve business disputes through real case studies and participate in international negotiation dynamics and exercises.

**General objective:** At the end of the course, the student should be able to develop the competencies to analyze conflicts through negotiation, using a conflict resolution model. The student should possess or develop the knowledge of basic aspects when negotiating, for example, negotiation planning and implementation, factors that influence the process and outcome of any negotiation, and negotiation in an international context.

**Key words:** Negotiation basics. Negotiation management. Conflict resolution. Negotiations: sales and purchase.

**Bibliography:** \* Ralph A Johnson, Negotiation Basics: Concepts, Skills, and Exercises.

### NI1003 Introduction to the International Business Academic Program

( 3 - 0 - 4. Prerequisites: None. 1 LIN11 )

**Equivalence:** None

The purpose of this basic course is to introduce stu-



dents into the setting of university life and the undergraduate program in which they are enrolled. No previous knowledge is required. The learning outcome of this course is to have a clearer vision of their courses and the institution they have joined. Students also generate a life plan and an academic-professional plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the program in which they are enrolled, including the competencies, career field, and professional development. They will also be informed about the organizational structure of Tecnológico de Monterrey, and its main rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Armstrong, Gary (Gary M.), *Marketing : an introduction* / Gary Armstrong, Philip Kotler., 9th ed., Upper Saddle River, NJ : Pearson Prentice Hall, c2009., [9780135153109],[0135153107].

## NI2015 Regional Business Development

( 3 - 0 - 8. Prerequisites: [ NI1001 ]. 4 LIN11 )

**Equivalence:** None

In this advanced course, students will acquire an in-depth understanding of the operation of economic blocs among nations in different regions of the world and of the characteristics of the main emerging economies of the world. They will also learn about the differences between the business practices in those regions and countries. A basic knowledge of international commercial treaties and of the influence of culture in business is required. As a learning outcome, the student will be able to analyze the functioning of each of the economic blocs and emerging economies, and design business strategies, taking into account the idiosyncrasies of each of these blocs and countries.

**General objective:** At the end of this course, students will be able to: understand the structure of

economic relationships in different regions of the world; analyze the history behind the main emerging economies of the world; and design appropriate strategies (considering differences in business practices) to do business in different parts of the world.

**Key words:** Emerging economies. Free trade agreements. Regional business practices.

**Bibliography:** \* Ioffe, Grigory, *Global Studies: Russia and the Near Abroad*, 12 ed.

## NI2016 Legal Aspects of International Commerce

( 3 - 0 - 8. Prerequisites: None. 5 LIN11 )

**Equivalence:** NI2003

This intermediate international business course introduces students to the international legal framework that will help them to understand the impact of foreign trade regulations on their operations. It requires prior knowledge of public and private law. Learning outcome: students will be expected to write reports and essays on the significance of the international legal framework components, identifying their implications in foreign trade operations, consistent with the applicable code of ethics.

**General objective:** At the end of this course, students will be able to manage and operate customs and international trade regulations, and understand the most common sectorial development programs to boost the international exchange of goods and services and promote investments.

**Key words:** Customs regulations and operation. Legal aspects of services. Legal aspects of investments.

**Bibliography:** \* Martínez Vera, Rogelio., *Legislación del comercio exterior* / Rogelio Martínez Vera., 3a ed., México, D.F. : McGraw-Hill, c2006., [9701057171],[9789701057179].



## NI2017 Competitive Intelligence and Geo-economics

( 3 - 0 - 8. Prerequisites: [ NI1001 Corequisite , NI1001 ]. 5 LAE11, 7 LCDE11, 4 LDN11, 5 LEM11, 5 LIN11, 7 LLN11, 7 LMC11 )

**Equivalence:** NI3012

This is an intermediate international business course in which students will understand and use international competitiveness theories and models to identify and analyze competition from the personal and organizational perspective, as well as competition between countries in the global economic environment. This includes trading blocs, knowledge cities, clusters and emerging economic regions. The student requires knowledge of general topics such as culture, organization, marketing, socioeconomic and technological development, government policies and sustainability so they can establish the relationship between these aspects, international competitiveness and the impact on individuals and businesses. The aim of the course is for students to learn about national and international settings through the use of secondary information and through contact with foreign students, officials and businesspeople. This information will allow them to gain a broader perspective of business opportunities in national and international contexts. As a learning outcome, the student is expected to develop a project in which they will interact with companies to identify their competitive advantages and determine the competitive advantages of a country or region that make it attractive for doing business.

**General objective:** At the end of this course, students will have the following skills: Apply different theories of competitiveness in order to achieve competitive advantages in real situations. Analyze different groups and blocs of nations based on established criteria. Develop reports of strategies that contribute to creating or building competitiveness at different levels: individual, organizational, national and regional in an international business environment.

**Key words:** Emerging markets. Competitive and comparative advantage. Strategy. Competition. International competitiveness. Commercial blocks. Sustainable economic development. Clusters.

**Bibliography:** \* Porter, M. E. , The Competitive Advantage of Nations.

## NI2018 Analysis and Management of the Value Chain

( 3 - 0 - 8. Prerequisites: [ CD2006 , MA1020 ]. 6 LAE11, 6 LAF11, 6 LCDE11, 7 LDN11, 6 LEM11, 6 LIN11, 6 LLN11, 6 LMC11 )

**Equivalence:** NI3014

This intermediate international business course aims to give students an integrated vision of value-creating processes in companies and how logistics activities and their integration into the supply chain contribute to the effective, efficient delivery of the value created by the company to its customers. It allows students from different majors to understand the value chain concept and strategies, the main management tools and the potential impact of innovation on improving the value proposition of a company. As a learning outcome, the students will be able to understand and map the supply chain of a company by identifying all the logistics activities associated with the flow and storage of goods, services and information from the point of origin to point of consumption, meeting the customer requirements, clearly identifying those that are value creators and can become critical, in order to prevent risks and to take advantage of business opportunities.

**General objective:** At the end of this course, students will be able to understand that the value chain of a company is determined by how its different activities are integrated internally first and then along the supply chain. Also the student will be able to improve the supply chain flow by applying an analysis of value stream using quantitative methods. As well, the student will be able to understand how a supply chain is integrated, how to identify primary and secondary participants and the relationships among them, recognizing the key logistics activities and support activities involved. In addition, the student will differentiate the value-creating activities in a supply chain from other activities that do not add value, in order to propose initiatives to remove them. Finally, the student will understand the importance of logistics activities and their relationship with the effective and efficient delivery of the value proposition of the company to its customers.

**Key words:** Logistics. Value chain. Supply chain.

**Bibliography:** \* Michael Porter, Ventaja competitiva, creación y sostenimiento de un desempeño superior, CECSA, [ISBN 0-02-925090].

### **NI2019 International Logistics**

**( 3 - 0 - 8. Prerequisites: None. 7 LIN11 )**

**Equivalence: NI3015**

The aim of this intermediate international business course is for students to expand their knowledge of logistics and supply chain with a quantitative approach to analyze the key activities of international distribution and the key operating elements of a supply chain. The course will help students to develop skills and attitudes that allow them to unify knowledge areas to form a logical body of thought that can lead to the effective, efficient management of international logistics in the field of supply chains. As a learning outcome, the student is expected to be able to analyze, quantify and propose solutions to improve logistics performance, the level of customer service and competitiveness of an enterprise and the supply chain in which it participates.

**General objective:** At the end of this course, students will be able to analyze, quantify and propose improvements to the logistics activities performed in the context of a global supply chain in order to boost its competitiveness. Also, students will be able to apply quantitative tools to solve problems by seeking optimization. Among other things, students will use simulation models and quantitative tools to support analysis for decision making in areas of: supply, transportation, customer service, warehouse management, and international sales.

**Key words:** Transportation. ERP. Global supply chain management. Inventory. Warehouses.

**Bibliography:** \* Chopra, Sunil y Meindl, Peter, Supply Chain Management, 4ta. Ed. , Prentice Hall, .

### **NI2020 Customs Operations**

**( 3 - 0 - 8. Prerequisites: [ AD2015 , NI2016 ]. 7 LIN11 )**

**Equivalence: NI2004**

This intermediate international business course aims to introduce students to the Mexican customs system as a support in the development of international trade strategies. It requires knowledge of the regulatory framework of global trade, basic concepts of global economic policies and regional development. As a learning outcome, the student is expected to develop an import or export project to integrate a practical way the elements of the Mexican customs system using specialized technological tools.

**General objective:** At the end of this course, students will be able to carry out imports and exports under the different methods allowed by Mexican customs law. Also, students will learn and apply existing rules according to the different means of transportation. Likewise, students will understand the processes and programs that support foreign trade in order to carry out such operations in a more efficient way.

**Key words:** Legal aspects of foreign trade in Mexico. Customs dispatch control. Merchandise and customs control. Customs office and merchandise. Custom operators and agents.

**Bibliography:** \* Ediciones Fiscales ISEF , Ley aduanera y su reglamento 2010, Ediciones Fiscales ISEF .

### **NI3035 Intercultural Negotiation and Communication**

**( 3 - 0 - 8. Prerequisites: [ NI1001 ]. 6 LIN11 )**

**Equivalence: NI20011**

The aim of this advanced international business course is for students to acquire advanced knowledge of negotiation processes and strategies, to negotiate strategic alliances and business ethical issues, the role of technology and intercultural communication. It requires prior knowledge of negotiation techniques, international marketing, international business, world cultures, political systems of the world, international finance and globalization. As a learning outcome, the student is expected to resolve cases and develop research projects which will demon-

strate advanced knowledge of negotiation in different regions including important elements such as the role of ethics and culture.

**General objective:** At the end of the course, students are expected to achieve the following learning objectives: Understand the impacts of differences in cultures on negotiating styles, strategies and behavior. Develop skills to successfully negotiate business contracts across cultures. Be able to manage and resolve business disputes through direct and mediated negotiations. Learn about alternative dispute resolution models. Understand the importance of cross-cultural communication in negotiation. Be able to use information technology in negotiation. Understand ethical issues concerning negotiation. Learn how to conduct a basic business negotiation research.

**Key words:** International negotiation environment. Culture and negotiation. Negotiation strategies. Ethics and negotiation. Technology and negotiation.

**Bibliography:** \* Rody, Raymond Clarence., International business negotiations : strategies, tactics and practices / Raymond C. Rody., Orange, CA: Oceanprises Publication, 2002., [0967672031],[9780967672038].

### NI3036 International Trade Agreements

( 3 - 0 - 8. Prerequisites: None. 7 LIN11, 7 LRI11 )  
Equivalence: NI3007

This advanced international trade law course examines international trade agreements and their impact on the trading of global goods and services. It requires knowledge of the regulatory framework of international trade and international trade theories. As a learning outcome, students will be able to apply, in diverse international business settings, the main provisions of the international treaties and agreements that Mexico has signed with various countries. Also, they will be able to analyze and implement FTAs in the daily operations of a company with foreign trade operations. Similarly, students will be participating in a practical case in which they will conduct in-depth reviews and comparisons of NAFTA and many other treaties in which Mexico is involved. In addition to the understanding of legal aspects, students will

learn about Mexican trade agreements and business opportunities arising from these agreements, based on the tariff preferences offered by Mexico in order to enter into new markets.

**General objective:** The student will be able to explore and know about opportunities and threats presented in free trade agreements for the development of business; compare advantages and disadvantages of different treaties (agreements), business/economic agreements; likewise, apply the main subjects of such agreements in the negotiation context between nations.

**Key words:** Trade agreements. World Trade Organization. Free trade agreements of Mexico. North American Free Trade Agreement.

**Bibliography:** \* Patrick Hearn , International Business Agreements: A Practical Guide to the Negotiation and Formulation of Agency, Distribution, and Intellectual Property Licensing.

### NI3037 International Services Development

( 3 - 0 - 8. Prerequisites: [ EC2026 ]. 8 LIN11 )  
Equivalence: None

In this advanced international trade course, students analyze the global exchange of services, its history, context and future trends, as well as its application in Mexico. It requires prior knowledge of Mexico's trade agreements, marketing and logistics. As a learning outcome, the student is expected to develop a business plan to market an existing business service. The overall objective of the course is to understand the different aspects related to the international trade of services and its application in Mexico.

**General objective:** The objective of this course is to allow a student to build a strategic vision of the service businesses, acquiring the knowledge and skills needed for managing and commercializing services in an international environment, and its application to Mexico. This course, furthermore, will allow the student to identify the participation of services in global economies, identify business opportunities, look for market access mechanisms, and explore

regimes of international markets for service businesses. With this preparation, students will be able to develop a commercialization and management plan of a service business in an international environment.

**Key words:** Management. Foreign investment. Business services. Regulations and politics. Trade agreements.

**Bibliography:** \* Luis Rubalcaba, The New Service Economy, EE.

### NI3038 International Business Intelligenc

( 3 - 0 - 8. Prerequisites: [ NI2017 ]. 8 LIN11 )  
**Equivalence:** NI3009

This is an advanced international business course which allows students to identify, analyze and take advantage of opportunities in the business world, using specialized international trade databases. The student will develop an international marketing plan for a product/service, according or adapted to the context (economic, political, legal and cultural) of the target market.

**General objective:** At the end of this course, students will be able to analyze different economic, political, legal and cultural factors that influence international markets (Marketing). Students will use or apply specialized databases and software to identify and then assess business opportunities in an international environment. Students will develop or formulate an international marketing plan including the four Ps (product, price, place and promotion) for a product or service for an international market.

**Key words:** Business intelligence. Research design. Measurements and measurement scales. Data preparation and description.

**Bibliography:** \* Cooper, Donald R. & Pamela S. Schindler, Business Research Methods.

### NI3039 International Business Management

( 3 - 0 - 8. Prerequisites: [ NI3038 ]. 9 LIN11 )  
**Equivalence:** NI3011

This is an advanced international business capstone course in which students will apply the knowledge gained throughout their studies. Basic knowledge is required of management, marketing and verbal expression, as well as knowledge of logistics, legal foundations of international trade, negotiations and intercultural communication, strategic project management, project evaluation and sources of financing, among others. As a learning outcome, students will formulate an international business plan, which should include the financial evaluation of the project they analyzed and financing possibilities for the project.

**General objective:** Upon completion of this course, students will be able to present and defend an international business plan of a firm. Use their knowledge of Administration, Logistics, Legal Foundations of International Trade, Project Management and Strategic Assessment of projects and funding sources to develop and propose an international business plan, identifying areas of opportunity for the final proposal that would culminate in a feasible project consistent with the objectives of the firm in question.

**Key words:** Business plan. Project evaluation. Competitive advantage. International marketing. Strategic planning.

**Bibliography:** \* Guía básica del exportador / Banco Nacional de Comercio Exterior., 11a ed., México : BANCOMEXT, c2005., [9686168303].

### NI3040 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 LIN11 )  
**Equivalence:** None

This is a graduate level course designed to prepare students in their area of specialization for the CE-NEVAL examination or the institutional examination given at the end of the Undergraduate Degree program. This course will review the most important

topics studied during the program. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available for them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and to find employment.

**General objective:** Upon completion of this course, students will have reviewed the most relevant topics of their major and will have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## NN Innovation and Development

### NN1000 Introduction to Innovation in Engineering

**( 3 - 0 - 4. Prerequisites: None. 1 IID12, 1 IIN12 )**

**Equivalence: None**

In this basic course the students will be introduced to the principles and mission of Tecnológico de Monterrey, as well as all the academic and extra-academic regulations and rules. The students will learn about the main curricular components of their study plan and conduct activities to be able to identify with their major.

**General objective:** By the end of the course the student will understand the engineering profile, the main abilities, and the professional opportunities of a graduate in the field of innovation in engineering. The student will also understand the main features of the study plan as well as the organizational structure of the institution.

**Key words:** Graduate profile. Academic regulation. Mission and vision. Program. Innovation and development.

**Bibliography:** \* ITESM, Legislación académica para los alumnos de carreras profesionales, Español.

### NN1001 Creativity and Innovation Workshop

**( 3 - 0 - 8. Prerequisites: None. 2 IID12, 2 IIN12 )**

**Equivalence: None**

In this course the student will be introduced to the basic creativity techniques and will recognize the principal features of the innovation model. The workshop combines creativity and model-building exercises for solving practical problems. No prior knowledge is required. Learning outcome: Students will analyze and synthesize creative expressions through product, process and service innovation.

**General objective:** By the end of this workshop the student will be able to generate creative solutions for practical problems, taking into consideration two

basic elements of an innovative development: a creative idea for a desirable design, and an attractive prototype to validate its feasibility. The student will consistently apply design thinking and the visualization of ideas and designs.

**Key words:** Perception and aesthetics. Composition and form. Empathic design and creativity. Innovation model. Prototype Development.

### NN1002 Process Innovation and Prototype Design

**( 3 - 0 - 8. Prerequisites: None. 3 IID12, 3 IIN12 )**

**Equivalence: None**

In this basic course, the student learns about tools for design and prototype fabrication. This course is the space where the student develops the ability to visualize ideas and build prototypes as a mechanism to communicate innovative ideas. It requires prior knowledge and experience in creative skills. Learning outcome: Students will complete the basic design of a product and/or processes, and life-size physical models and prototypes.

**General objective:** By the end of this workshop the student will be able to use design software tools, machinery, and laboratory equipment, for transforming a creative idea into a physical model or prototype with a variety of materials and finishes. The student will have the ability to communicate the feasibility and desirability of ideas and designs using basic tools for metrology, manufacturing and programming.

**Key words:** Visualization. Design. Projects.

### NN2000 Feasibility and Viability of Innovation Projects

**( 3 - 0 - 8. Prerequisites: None. 4 IID12, 4 IIN12 )**

**Equivalence: None**

In this intermediate course, the student learns about the basic tools for analyzing and evaluating innovation projects that are required to develop new prod-



uct-, process- and service-based business models. Knowledge and skills in statistics and basic accounting are required. Learning outcome: Students will formulate technical-feasibility and economic-viability studies to validate innovation and development engineering projects with a high degree of uncertainty and that contemplate scenarios on the short, medium and long terms.

**General objective:** By the end of this course the student will be able to analyze and justify the technical feasibility of a proposal for an innovation project, and to understand how the change in the value of money through time impacts the economic viability of proposals.

**Key words:** Projects. Technical validation. Economic validation. Evaluations. Diagnostics.

### **NN2001 Innovation Positioning** ( 3 - 0 - 8. Prerequisites: None. 5 IID12, 5 IIN12 ) **Equivalence: None**

In this intermediate course the student learns several techniques for marketing and positioning brands and products, and develops an ability to seek and obtain resources for high-risk projects. Verbal and written communication skills and elements of creativity are required. Learning outcome: Students will formulate promotional plans for designs and fundraising proposals to support innovation and development projects.

**General objective:** By the end of this course the student will be able to communicate the addition of value from creative ideas, designs and prototypes, and to feedback those ideas and designs for positioning and protection of innovative proposals. The student will be able to analyze and understand the impact of innovation and technology development on market and industry dynamics, as well as the process for identifying market opportunities for innovation

**Key words:** Funding sources. Intellectual property law. Communication of ideas. Investments.

### **NN2002 Methodologies for Innovation** ( 3 - 0 - 8. Prerequisites: None. 5 IID12, 5 IIN12 ) **Equivalence: None**

In this intermediate course the student learns, practices, and develops an ability to conduct engineering projects for innovation and development. Project evaluation knowledge and skills are required. Learning outcome: Students will apply diverse innovation methods and approaches for product, process and service design, and will identify the critical path that would maximize the possibility of success in accomplishing the project's objectives.

**General objective:** By the end of this course the student will be able to recognize market opportunities and apply action planning for developing new and innovative businesses. The student will be able to design a project with a high level of market desirability and feasibility for a sustainable development.

**Key words:** Project manager. Efficient Designs. Empatic Designs. Feasible designs. Sustainable Designs.

### **NN2003 Innovation, Design, and Business Context Workshop** ( 3 - 0 - 8. Prerequisites: None. 6 IID12, 6 IIN12 ) **Equivalence: None**

In this intermediate course the student participates in open discussions about the elements that are necessary for building a successful innovation and development project. Students will identify spaces and opportunities for new, innovative businesses and be able to use models for describing the social and economic impacts of the new business. Knowledge and skills are required in business creation, project evaluation and innovation methodologies. Learning outcome: Students will generate business models based on innovative products, processes and services, incorporating the financial and social impact factors that would increase the viability of innovation and development projects.

**General objective:** By the end of this course the student will be able to understand the context of necessity and desirability where an innovation process takes place, and to identify opportunities for design-

ing and successfully implementing new business models.

**Key words:** Business market. Market behavior.

### **NN3000 Product and Service Engineering**

**( 4 - 0 - 12. Prerequisites: None. 7 IID12, 7 IIN12 )**

**Equivalence: None**

In this advanced course students will participate in a capstone project to learn about and practice engineering tools, techniques and methodologies for designing products, services, and processes according to the specific requirements of a market niche with opportunities for a new business model. Knowledge and skills in engineering design methodologies are required. Learning outcome: Students will design products, processes and/or services based on the appropriate formal and informal engineering tools and ultimately prepare comprehensive innovation proposals.

**General objective:** By the end of this course the student will be able to analyze, synthesize, and evaluate variants for product, process and service designs in an engineering innovation project. The student will be able to create desirable designs with technical feasibility and taking into account the viability conditions of a business model.

**Key words:** Advanced Design. Product. Services. Process. Analysis and validation.

### **NN3001 Engineering Innovation Design Project I**

**( 4 - 0 - 12. Prerequisites: None. 8 IID12, 8 IIN12 )**

**Equivalence: None**

In this advanced course students will complete the first stage of an innovation and development engineering project. They must do research, design, prototyping and diverse engineering analyses to support the project. Prior knowledge of product and service design and engineering is required. Learning outcome: Students will be able to define technically and financially viable creative solutions to the devel-

opment challenges of their process, product or service, working independently, adhering to their own work plan and finishing with the preliminary phase of prototypes.

**General objective:** By the end of this course the student will be able to formulate a proposal based upon a creative, desirable, technically validated idea that has an innovation and business component. The student will be able to show technical abilities and leadership attitudes for collaboration and for obtaining the required resources to conduct a planned project.

**Key words:** Administration. Elaboration of proposals. Resources in a project. Creativity and prototypes. Leadership and collaboration. reactividad y prototipos. Liderazgo y colaboración.

### **NN3002 Engineering Innovation Design Project II**

**( 6 - 0 - 16. Prerequisites: None. 9 IID12, 9 IIN12 )**

**Equivalence: None**

In this advanced course students will complete their innovation project within the context of a real project for a company. Prior knowledge of product and service design and engineering is required. Learning outcome: Students will finish their innovation and development project.

**General objective:** By the end of this course the student will be able to integrate creativity with technical tools and business modeling for ideation, conduction and administration of innovation and development projects.

**Key words:** Collaborative work. Project manager. Integration of knowledge. Project presentations. Profession and ethics.

### **NN3003 Introduction to Professional Development**

**( 2 - 0 - 2. Prerequisites: None. 9 IID12, 9 IIN12 )**

**Equivalence: None**

This is a college level course which is designed to prepare students in their area of specialization for

the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Professional development alternatives.

**Bibliography:** \* Barbara Moses, What next?, 1st American ed, [[0789493551 (papel alcalino)].

## NU Nutrition and Integral Wellness

### NU1000 Bases of Nutrition and Exercise

( 2 - 2 - 8. Prerequisites: None. 1 LNB11 )

Equivalence: PV1036

Students will learn about the system used by Tecnológico de Monterrey and the global perspective of the nutrition and integral health major. This course provides the theoretic bases of elementary nutrition and physical exercise.

**General objective:** To understand the main food sources as well as the basic elements of adequate nutrition and physical exercise that meet individual needs regarding nutrition and physical activity for healthy human growth and development; apply these concepts to the diverse factors that influence dietary intake and physical activity; apply critical thinking skills and value the importance of good nutrition and physical activity in health promotion and disease prevention.

**Key words:** Bases of nutrition and exercise .

**Bibliography:** \* 3. William D. McArdle Frank I. Katch Victor L. Katch., Exercise Physiology: Energy, Nutrition, and Human Performance. , 5, Lippincott Williams & Wilkins, Inglés.

### NU1002 Exercise Physiology

( 2 - 2 - 8. Prerequisites: [ MD1016 , MD1031 ]. 3 LNB11 )

Equivalence: None

Students will learn the theoretic bases of exercise physiology that can be used later on to understand exercise in different states of health and to formulate training plans.

**General objective:** To understand the physiologic changes in the body systems that are produced by physical exercise in the muscles, bones, cardiovascular, respiratory, neurologic, hematologic and endocrine, as well as the benefits that are obtained; to apply critical thinking abilities to the physiologic changes and exercise-related problems; to value

the impact that exercise has on human physiology, as well as the importance of exercise education and practice of physical activity as a means to improve and maintain individual health and that of the population.

**Key words:** Exercise and laboratory physiology.

**Bibliography:** \* 1. Mc Ardle William D., Match Frank I., Katch Victor L. , Physiology: Energy, Nutrition, and Human Performance., Lippincott Williams & Wilkins, Inglés.

### NU1003 Introduction to the Nutrition and Wellness Academic Program

( 3 - 0 - 4. Prerequisites: None. 1 LNB11 )

Equivalence: None

The purpose of this basic-level course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Byrd-Bredbenner, Carol, Perspectiva en nutrición, 8a, Ed. McGraw-Hill, [978-607-15-0348-0].

### **NU2000 Exercise in the Life Cycle** ( 3 - 0 - 8. Prerequisites: [ NU1002 ]. 4 LNB11 ) **Equivalence: None**

This course introduces students to the physiology of exercise in the different stages of the life cycle, from pregnancy, childhood, adolescence and adulthood to old age. Students recognize the physiological changes that occur at each age in relation to exercise and study the theoretical bases to understand exercise in health and in sickness. Students formulate physical training and diet plans for athletes.

**General objective:** To promote an understanding of exercise physiology in the different stages of the life cycle, from pregnancy through infancy, adolescence, adulthood, menopause, and older adulthood, as well the physiologic changes in exercise that take place as age advances. To understand the benefits of constant exercise, as well as its recommendations and advice in each stage of the life cycle. To apply critical thinking and decision-making skills to problems related to the physiologic changes of exercise throughout the life span. To value the importance of constant exercise in order to maintain good health and prevent disease.

**Key words:** Exercise and life cycle.

**Bibliography:** \* 1. Corbin, Charles B., Welk Gregory J, Lindsey Ruth, Corbin William R. , Concepts Of Fitness And Wellness: A Comprehensive Lifestyle Approach with Powerweb/OIC Bind-in Card & Health Quest CD, 5, Mc Graw Hill, Inglés.

### **NU2003 Nutrition in the Life Cycle** ( 3 - 0 - 8. Prerequisites: None. 4 LNB11 ) **Equivalence: None**

This course introduces students to the physiological, biological, biochemical and metabolic bases required to understand the differences in nutritional recommendations throughout the principal stages of the life cycle: pregnancy, lactation, childhood, adolescence, adulthood, menopause and old age, in order to formulate appropriate nutritional plans for each life stage, considering the special needs for each stage.

**General objective:** To analyze and apply the physiological, biological, biochemical and metabolic basis for differences in nutritional requirements through the principal stages of the life cycle: pregnancy, lactation, infancy, childhood, adolescence, adulthood, menopause, older adulthood, and the way in which social, cultural, psychological, economic and environmental factors influence nutritional status at each stage. To apply critical thinking and clinical reasoning skills to issues related to nutrition in the life cycle; to value the impact of adequate nutrition by means of fulfillment of the dietary recommendations on general actual and coming health in each stage of the life cycle.

**Key words:** Nutrition and life cycle.

**Bibliography:** \* 3. Kristy M. Hendricks, Manual of Pediatric Nutrition, 3, Tufts Univ, Inglés.

### **NU2014 Clinical Nutrition Assessment** ( 4 - 2 - 12. Prerequisites: [ NU1000 ]. 5 LNB11 ) **Equivalence: NU2002**

This intermediate course requires a basic knowledge of nutrition and exercise. As a learning outcome, students are expected to perform comprehensive clinical nutrition assessments: clinical, dietary, anthropometric and biochemical evaluations; diagnose correctly the nutritional status of individuals and population groups; and compare the advantages, limitations, validity and reliability of various methodologies used in clinical nutrition assessments.

**General objective:** Students will be able to perform comprehensive nutritional diagnoses including: clinical examination, dietary, anthropometric and biochemical; compare the advantages, limitations, validity and reliability of the various methods used in dietary and anthropometric assessment for individuals and populations; and develop critical thinking skills to interpret information and findings to determine the current nutritional status of individuals and population groups.

**Key words:** Clinical evaluation. Nutrition assessment. Nutrition diagnosis. Anthropometric assessment. Dietary assessment. Biochemical evaluation.

**Bibliography:** \* Lee Robert, Nieman David , Nutritional Assesment, 5th, Mc Graw Hill, [978-0-07-337556-4].

### **NU2015 Food, Diet Assessment and Planning Lab**

( 0 - 3 - 4. Prerequisites: [ NU2025 Corequisite , NU2025 ]. 5 LNB11 )

**Equivalence: None**

Intermediate course develops students' skills in formulating an appropriate dietary plan. It requires prior knowledge of nutrition and nutrition in the life-cycle. As a learning outcome, students are expected to develop and prepare in the kitchen individualized meal plans that meet the requirements and recommendations for individuals in the main stages of life.

**General objective:** Students will be able to understand the components of dietary planning; make individualized meal plans that meet the requirements and recommendations for individuals in the main stages of life: pregnancy, lactation, infancy, childhood, adolescence, adulthood, menopause and old age, and basic considerations for hospitalized patients taking into consideration all the factors affecting the current and recommended dietary intake; assess the importance of the culinary preparation of a meal plan and the impact this has on nutritional intervention in patients' health; learn the principles of consultation and dietary advice for patients; and act with professional ethics in patient care.

**Key words:** Weights and measurements. Diet and menu planning. Diet and menu evaluation. Planning and preparation of diets in different stages of life. Nutritional calculation.

**Bibliography:** \* Modern nutrition in health and disease / senior editor, Maurice E. Shils ; associate editors, Moshe Shike . [et al.], 10th ed., Philadelphia : Lippincott Williams & Wilkins, c2006., [0781741335 (papel alcalino)], [9780781741330 (papel alcalino)].

### **NU2016 Methodology of Physical Activity**

( 2 - 0 - 4. Prerequisites: [ NU2000 ]. 5 LNB11 )

**Equivalence: None**

Intermediate course in which students develop and master skills related to the techniques and methods needed to design physical exercise programs. Students will complete a learning process starting with an understanding of the genesis of corporal movement and the optimal level of motor development in each stage of life, and then apply the different techniques and methods for physical exercise design programs and use this methodology in sports and physical activity. Students will be participating in an inquiry and analysis process of the methodology as an academic subject, and will be immersed in a patient-focused learning process. It requires prior knowledge in exercise throughout the life cycle. As a learning outcome, students are expected to select, based on critical and analytical thinking, a methodology to be used in designing exercise programs suited to each individual patient.

**General objective:** Students will be able to understand and analyze the methodological bases for teaching and prescribing physical exercise, using the means and variety of methods to develop the physical skills that will function as basis for the design of physical exercise programs.

**Key words:** Methodology of physical exercise and sport.

**Bibliography:** \* Serra G. Jose Ricardo, Prescripción del ejercicio físico para la salud, 1era., PAIDOTRIBO, [84-8019-280.1].

### **NU2017 Clinical Propaedeutic**

( 2 - 2 - 8. Prerequisites: None. 5 LNB11 )

**Equivalence: None**

Intermediate course in which students develop skills in interviewing and physical examination with the appropriate use of complementary instrumental methods and laboratory analyses to obtain clinical information relevant to the nutritional assessment of a patient as part of a clinical reasoning process. In addition to developing the ability to document



in writing the information obtained in the health records according to Mexican Official Standard NOM-168-SSA1-1998, MEDICAL RECORDS. All of this should be conducted within a context of ethics and respect for the patient. It requires basic knowledge of writing, verbal expression, anatomy and physiology. As a learning outcome, the students are expected to demonstrate the skills necessary to establish a dietitian-patient relationship within a context of ethics and respect, and also to carry out a full interview and general physical examination of a patient.

**General objective:** Students will be able to establish an adequate dietitian-patient relationship within the ethical and cultural context of the patient, perform an interview and physical examination oriented to nutrition assessment, using appropriate techniques and maneuvers, and properly document the information obtained according to the statutes of NOM 168.

**Key words:** Physical examination. Nutritional propeudeutic. Dietitian-patient relationship. Interview. Semiology.

**Bibliography:** \* 1. Katharine R. Curry, PhD, RD; and Amy Jaffe, MS, RD, LD, Nutrition Counseling and Communication Skills, Saunders, Inglés.

## NU2019 Design of Physical Exercise Programs

( 2 - 2 - 8. Prerequisites: [ NU2016 ]. 6 LNB11 )  
Equivalence: None

Intermediate course in which students develop and master the skills surrounding the design of exercise programs and the implementation thereof through laboratory practice. It requires prior knowledge of methodology and physical activity. As a learning outcome, the student is expected to apply critical thinking and clinical reasoning for decision-making in the design, monitoring and evaluation of the physical program applied.

**General objective:** Students will be able to design and prescribe physical exercise programs for the healthy patient in different stages of life, efficiently using the scientific parameters for physical exercise prescription, applying measurement protocols, and

developing communication and motivation skills in their personal relation with the patient, in the application and implementation of the designed program.

**Key words:** Exercise programs. Assessment of physical fitness. Exercise prescription.

**Bibliography:** \* Serra G. Jose Ricardo, Prescripción del ejercicio físico para la salud, 1era., PAIDOTRIBO, [84-8019-280.1].

## NU2020 Research and Intervention Programs in Nutrition and Physical Exercise

( 2 - 2 - 8. Prerequisites: [ MD1047 ]. 7 LNB11 )  
Equivalence: None

Intermediate course related to epidemiological research, the types of design for research and the fundamentals of writing scientific papers. It requires prior basic knowledge of the types of study designs in health science. As a result, students develop a research protocol in nutrition and/or exercise, and submit reports analyzing scientific papers.

**General objective:** Students will be able to understand the importance of epidemiology in nutrition and wellness; understand Public Health problems and challenges; read critically and interpret scientific papers; and develop a research protocol.

**Key words:** Nutrition research. Exercise research. Study design. Scientific article. Epidemiology.

**Bibliography:** \* Gordis L. , Epidemiology, 4th, Saunders Elsevier, [978-1-4160-4002-6].

## NU2022 Obesity and Metabolic Syndrome

( 3 - 0 - 8. Prerequisites: [ NU2002 , NU2014 , NU2025 , NU2024 Corequisite , NU2024 ]. 7 LNB11 )  
Equivalence: None

The aim of this intermediate course is for students to understand the multifactorial nature of the origin of obesity and particularly the role of nutrition in the development of obesity and metabolic syndrome,

the effects on energy and nutritional requirements and metabolism, and the neuro-endocrine-metabolic regulation of obesity. It requires knowledge of biochemistry, physiology, clinical nutrition evaluation, chemical and food technology, and exercise physiology. As a result of learning, the students are expected to document the analysis, discussion and presentation of possible solutions to real or simulated clinical cases, demonstrating their understanding of the different causes and risk factors that lead to obesity and metabolic syndrome, the consequences of these disorders, epidemiology, pathophysiological mechanisms, clinical presentation, diagnostic evaluation and treatment services, as well as their ability to identify these patients.

**General objective:** Students will be able to understand the features of obesity and the accompanying metabolic syndrome; identify overweight and obese patients and understand the epidemiological development of the same and of metabolic syndrome; assess the impact of these diseases on the deteriorating health of the individual; evaluate the role of nutrition, physical activity and psychological support in a multidisciplinary approach for managing patients with obesity and/or metabolic syndrome, and in the management of patients suffering from malnutrition, anorexia or bulimia; access public policy consultation on obesity and metabolic syndrome and conduct a critical reading of the same.

**Key words:** Metabolic syndrome. Epidemiology of obesity and overweight. Perspectives of obesity. Food industry and obesity. Global strategies against obesity.

### **NU2023 Nutrition Therapy in Eating Disorders**

( 2 - 2 - 8. Prerequisites: [ NU2014 , NU2025 ]. 7 LNB11 )

**Equivalence:** None

This intermediate course addresses nutritional therapy and multidisciplinary intervention (pharmacological, psychological, physical exercise) in people with eating disorders. It requires prior knowledge of clinical nutrition assessment and dietary planning. As a learning outcome, students will be able to produce

individualized food-nutrition plans for patients with eating disorders, based on the patient's assessment.

**General objective:** Students will be able to evaluate, design and monitor scientifically-based food and nutrition interventions to control the most frequent eating disorders, based on individualized assessment and monitoring; recognize the diagnostic criteria for anorexia nervosa, bulimia nervosa, malnutrition and other eating disorders; recognize the multidisciplinary science-based intervention and comprehensive treatment of people with eating disorders (nutritional therapy, pharmacological, psychological, physical exercise and surgery); recognize and apply the diagnostic criteria, nutritional treatment and control of eating disorders based on scientific evidence.

**Key words:** Eating disorders. Anorexia. Bulimia.

**Bibliography:** \* Modern nutrition in health and disease / senior editor, Maurice E. Shils ; associate editors, Moshe Shike . [et al.], 10th ed., Philadelphia : Lippincott Williams & Wilkins, c2006., [0781741335 (papel alcalino)], [9780781741330 (papel alcalino)].

### **NU2024 Nutrition Therapy in Obesity and Metabolic Syndrome**

( 4 - 2 - 12. Prerequisites: [ NU2022 Corequisite , NU2022 , NU2014 , NU2025 ]. 7 LNB11 )

**Equivalence:** NU2007

This intermediate course addresses nutritional therapy and multidisciplinary intervention (pharmacological, psychological, physical exercise) in people with obesity, diabetes, dyslipidemia and hypertension problems. It requires prior knowledge of clinical nutrition assessment and dietary planning. As a learning outcome, students will be able to produce food nutrition plans for each patient with obesity and metabolic syndrome, and monitor the process, making the necessary modifications.

**General objective:** Students will be able to evaluate, design and monitor scientifically-based food and nutrition interventions to control obesity and metabolic syndrome for each patient. They will also be capable of recognizing obesity and metabolic syndrome diagnostic criteria, as well as, designing weight control intervention and treatment at different life stages.

Moreover, based on scientific evidence, students will be able to recognize and apply the diagnostic criteria, nutritional treatment and control of diabetes, hypertension and dyslipidemia.

**Key words:** Nutrition therapy in obesity. Nutrition therapy in diabetes. Nutritional therapy in dyslipidemia. Nutritional therapy in hypertension.

**Bibliography:** \* García-García E, Kaufer-Horwitz M, Pardío J, Arroyo P, La Obesidad: perspectivas para su comprensión y tratamiento., Editorial Médica-Panamericana, [978-607-7743-08-8].

### **NU2025 Diet Assessment and Planning** ( 3 - 0 - 8. Prerequisites: [ NU2003 ]. 5 LNB11 )

**Equivalence: None**

This intermediate course promotes an understanding of the components of diet planning. It requires prior knowledge of the basic concepts of nutrition and nutrition in the cycle of life, and of clinical nutrition assessment. As a learning outcome, students develop the skills to perform a comprehensive clinical nutrition assessment, diagnose a patient's nutritional status and formulate personalized diet plans that meet the dietary requirements and recommendations for individuals in the principal life stages.

**General objective:** Students will be able to promote an understanding of the components of diet assessment and planning; perform an integral clinical nutrition assessment, to diagnose accurately the nutritional status and to perform individualized diet planning that meets the dietary requirements and recommendations for individuals in the principal life stages: pregnancy, lactation, infancy, childhood, adolescence, adulthood, menopause and older adulthood- considering all the factors that affect the actual recommended dietary intake; value the importance of an accurate diagnosis of the nutritional status and adequate nutritional interventions on the health status of patients; perform with ethics and professionalism during patient care.

**Key words:** Diet and menu planning. Diet and menu evaluation. Nutritional calculation. Diets in different stages of life. Meal planner formats.

**Bibliography:** \* Modern nutrition in health and disease / senior editor, Maurice E. Shils ; associate editors, Moshe Shike . [et al.], 10th ed., Philadelphia : Lippincott Williams & Wilkins, c2006., [0781741335 (papel alcalino)], [9780781741330 (papel alcalino)].

### **NU2026 Food Service Administration and Management**

( 2 - 2 - 8. Prerequisites: [ NU2008 , NU2025 ]. 7 LNB11 )

**Equivalence: NU2011**

Intermediate course that aims to provide knowledge on the principal components of operating food services in both the ambulatory and hospital areas; institutional and commercial service food preparation: menu planning, standardization and costs, methods, purchasing standards, procurement, storage and preparation, introduction into the market and personnel supervision. It requires prior knowledge of dietary planning. As a learning outcome, students present a food service project.

**General objective:** To know the main components of food service operation in ambulatory and hospital areas, as well as the preparation and institutional and commercial service of foods. To establish objectives for, plan and organize food service management, controlling food operations, food service marketing, sales and accounting, and personnel management. To value the importance of appropriate food service processes and management to ensure top-quality consumer care.

**Key words:** Food service planning models. Design and affordability of menus. Food handling hygiene. Kitchen planning. Food service staff training.

**Bibliography:** \* Brown Douglas, The food Service Professional Guide to, Series, Atlantic Pub.

## **NU3016 Introduction to Professional Development**

**( 2 - 0 - 2. Prerequisites: None. 13 LNB11 )**

**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Life and Career Center. Professional development alternatives.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## OD Dentistry

### OD1002 Oral Pathology

( 2 - 2 - 8. Prerequisites: [ MD1019 , OD1007 ]. 4 MO 11 )

**Equivalence: None**

A basic level course focused on the recognition of diseases, lesions and conditions of the oral cavity and related organs, tissues or structures. It requires previous knowledge of general and specific anatomy and physiology of oral structures. As a learning outcome, the student will be able to identify common lesions and diseases in the mouth and general conditions that have oral manifestations.

**General objective:** Students will be able to: identify and recognize diseases, lesions and alterations of the hard and soft tissues and related structures of the oral cavity. They will also learn about the etiology and risk factors of each one and they will be able to establish differential, tentative and definitive diagnosis of the most common oral pathologies.

**Key words:** Normal and pathologic tissues. Soft tissue lesions. Hard tissue lesions. Bacterial, viral and micotic diseases. Dental anomalies.

**Bibliography:** \* Sonis, S.T., Fazio, R.C., Fange, L., Principles and Practice of Oral Medicine, Segunda, W.B. Saunders Company, Inglés.

### OD1005 Introduction to the Dentistry Academic Program

( 3 - 0 - 4. Prerequisites: None. 1 MO 11 )

**Equivalence: None**

Basic course in which students learn about the history and trends of dentistry in Mexico and worldwide, as well as basic aspects of the most common oral diseases, their treatment and prevention. It includes basic clinical photography practices, infection control and exploration of the oral cavity and concepts of ethics, professionalism and legal issues in discussions and case studies related to the practice of dentistry. In addition, students learn about cultural differences of the population and their impact on public, pri-

vate and community dental practice. Students have to participate in health promotion activities (e.g. Meditec and COMUNITEC). As a learning outcome, students will understand the context of dentistry in Mexico, as well as the importance of dental health in humans and its relationship with the rest of the body and complete and oral cavity exploration exercise following the basic infection control protocol.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. History of dentistry. Oral-dental diseases. Exploration of the oral cavity. Relationship and interaction with the health team.

**Bibliography:** \* Castaño Seiquer, Antonio, Manual de introducción a la odontología / Antonio Castaño Seiquer, 2007., [9788460955153].

### OD1006 Oral Morphophysiology Laboratory

( 2 - 2 - 8. Prerequisites: None. 3 MO 11 )

**Equivalence: None**

This is a basic laboratory course that has theoretical-practical content about dental anatomy and occlusion, which will provide students with the opportunity to develop their manual skills by using a dental wax model. This course serves as a basis for the rest of the subsequent courses. It requires basic previous knowledge in anatomy and general physiology. As a learning outcome for this course, students will be able to recognize and describe the anatomy of each one of the teeth: both primary and permanent; students will also be able to make a wax model of the most representative teeth, which will be submitted to and evaluated by the professor.



**General objective:** At the end of the course, students will be able to identify any tooth through its anatomical features and create a wax model of it, characterizing its fine details.

**Key words:** Dental occlusion. Wax modeling. Guidance plans.

**Bibliography:** \* Riojas M.T., Anatomía dental, 2ª, Manual Moderno, [9786074480252].

### OD1007 Oral Morphophysiology

( 3 - 0 - 8. Prerequisites: [ MD1033 , MD1034 , MD1036 ]. 3 MO 11 )

**Equivalence:** None

This is a basic course, which provides students with in-depth knowledge of the anatomy, embryology, histology and physiology of the head and neck, using an odontological approach, which will serve as the basis for odontological subjects that will be studied later. Previous knowledge is required in the basics of general anatomy and physiology. The learning outcome for this course is that the students understand the specific characteristics of the tissues and organs that belong to the oral cavity and its relationship with other parts of the human body, by solving a sample case created by the professor.

**General objective:** Students will be able to describe the structure and function of the different elements of the oral cavity, and to understand its influence on the rest of the body.

**Key words:** Dental approach. Integrated structures of the oral cavity. Generation and development of teeth.

**Bibliography:** \* Norton, Neil Scott., Netter : anatomía de cabeza y cuello para odontólogos / Neil S. Norton ; ilustraciones de Frank H. Netter ; ilustradores, Kip Carter . [et al.], Barcelona ; México : Elsevier Masson, c2007., spaeng, [9788445817858].

### OD1008 History Taking and Oral Clinical Examination

( 2 - 2 - 8. Prerequisites: [ OD1007 , OD1009 , OD1009 Corequisite ]. 4 MO 11 )

**Equivalence:** OD1004

This is a basic course which provides students with the necessary knowledge for taking an odontological history and performing an examination, in order to use this information to formulate a diagnostic impression and possible treatment plan. Previous knowledge is required in oral dental structure and function, the related laboratory techniques, propaedeutic and community health. As a learning outcome for this course, students will have acquired the fundamental knowledge necessary for understanding patients' systemic health or illness from an odontological perspective. As proof of this knowledge, the students will submit the clinical histories that they have taken during the course, so that the professor can evaluate them.

**General objective:** Students will be able to approach a patient in an appropriate way to conduct both the interview and intraoral physical examination and integrate their findings into a clinical history, in which they will describe their diagnostic impression and possible treatment plan.

**Key words:** Treatment plan. Dental approach. Diagnostic impression. Medical history.

**Bibliography:** \* Valoración y profilaxis / Dirigido por D. Heidemann ; con la colaboración de W. Bengel . [et al.], Barcelona ; México : Elsevier Masson, c2007., spager, [9788445817674].

### OD1009 Dental Radiology

( 2 - 2 - 8. Prerequisites: [ OD1001 , OD1007 ]. 4 MO 11 )

**Equivalence:** OD1003

In this basic course, students will learn how to execute a dental radiography and about the different intra- and extra-oral radiographic techniques. The advantages, disadvantages and specific applications of traditional and digital dental x-rays are discussed. No prior knowledge is required. Learning outcome: students will be able to execute intra- and extra-oral



(occlusal) dental x-rays and interpret the images obtained and integrate this information into the patient's dental records.

**General objective:** Students will be able to understand the diagnostic value of radiographs, the operation of x-ray machines for dental use, magnetic resonance imaging and computed tomography, analyze the advantages, disadvantages and applications of each of them and their applications in dentistry; take intraoral and extraoral radiographs in simulators and in actual patients with traditional and digital X-ray machines; and develop films manually and automatically, and interpret the images and integrate the radiographic findings into the patient's medical history.

**Key words:** Intraoral radiography. Extraoral radiology. Radiographic interpretation.

**Bibliography:** \* Whaites, Eric., Fundamentos de radiología dental Eric Whaites ; prologo de R.A. Cawson., 4a ed., Barcelona Elsevier Masson 2008., spaeng, [9788445818725].

### OD1010 Preventive Dentistry

( 2 - 0 - 4. Prerequisites: [ OD2004 , OD3016 ]. 7 MO 11 )

**Equivalence:** None

In this basic course, students participate in planning oral health and community outreach promotional campaigns, and design strategies to take basic and preventive dental services to remote communities and zones. This course requires a basic knowledge of community odontology, epidemiology, integral odontology, periodontics, dental operations. Learning outcome: students will be able to perform basic and complex preventive treatments, with a comprehensive approach, on real patients.

**General objective:** Students will be able to design oral disease prevention campaigns and strategies, and involve other health team members in health promotion campaigns; perform dental treatments (basic and complex) with a comprehensive and preventive approach on real patients; participate actively in dental-care brigades.

**Key words:** Risk factors in dentistry. Prevention for periodontal diseases. Prevention and oral health promotion. Group motivation for dental prevention. Treatments for dental caries prevention.

**Bibliography:** \* Odontología preventiva primaria / [editores] Norman O. Harris, Franklin García-Godoy., 2a ed. en español., México, D. F. : Manual Moderno, c2005., [9707291885].

### OD2000 Dental Biomaterials

( 3 - 0 - 8. Prerequisites: [ BI1000 , OD2008 , OD2008 Corequisite ]. 5 MO 11 )

**Equivalence:** None

This intermediate course focuses on the management and knowledge of the properties of dental materials. Its content is intended to familiarize, teach and understand the behavior of materials in an organized and systematic manner, so that students can choose the best material in each of the different situations presented to them clinically. Dentists spend much of their career managing and manipulating dental materials and success or failure very often depends on choosing the best material with the most suitable properties and on its optimal handling. It requires basic knowledge of biomaterials. As a learning outcome, students are expected to improve their knowledge of the variety of materials available in dentistry, as well as the alteration of their properties in the oral cavity, in order to be able to select in a scientific manner the use of each particular material and apply them directly to their patients with a better predictability in the short, medium and long term.

**General objective:** The students will know the composition and specific characteristics of dental materials and be able to select the appropriate one in each case. They will handle different materials effectively and use them to perform preventive, therapeutic, corrective and surgical dental treatments.

**Key words:** Dental materials. Properties and clinical applications. Restorative material handling. Teeth whitening.

**Bibliography:** \* Powers, John M., 1946-, Dental materials : properties and manipulation / John M. Pow-

ers, John C. Wataha., 9th ed., St. Louis, Mo. : Mosby/Elsevier, c2008., [0323049648],[9780323049641].

## OD2008 Dental Biomaterials Laboratory

( 0 - 3 - 4. Prerequisites: [ BI1000 , OD2000 Corequisite , OD2000 ]. 5 MO 11 )

**Equivalence:** OD2001

The aim of this intermediate course is for students to develop skills and abilities for the proper handling of materials commonly used in dentistry practices. It includes laboratory and simulator practices. A basic knowledge of biomaterials in general and dental biomaterials is required. As a learning outcome, students are expected to handle the different types of dental materials used in dentistry in an agile, efficient manner, ensuring both patient and dentist safety.

**General objective:** At the end of this course, students will be able to handle properly, quickly and efficiently different types of commonly used dental materials in dental practice; identify and manage changes in the materials when exposed to various factors such as temperature and humidity; and practice on models, simulators and their classmates to gain real-life experience in the use of materials.

**Key words:** Dental material handling. Special manipulation of dental materials with temperature and humidity changes. Impression material handling. Restorative material handling.

**Bibliography:** \* Phillips ciencia de los materiales dentales / Kenneth J. Anusavice, ed., 11a ed., Madrid : Elsevier, 2004., spaeng, [8481747467].

## OD2009 Oral Surgery and Anesthesia Preclinic

( 2 - 2 - 8. Prerequisites: [ OD1009 , OD1008 ]. 5 MO 11 )

**Equivalence:** OD2005

This is an intermediate level theoretical practical course, in which students learn the various techniques of local oral anesthesia and the basic principles of oral extraction and surgery, including

methods of infection control and pain management, through the acquisition of theoretical knowledge and the use of simulation. Previous knowledge is required in propaedeutic and oral health, radiology and dental imaging. The learning outcome for this course is that the students demonstrate manual skills at a beginning level, in order to carry out local oral anesthetic techniques, which would enable them to perform odontological restoration procedures and surgeries. The students will practice administering local anesthetic to a real patient while being evaluated by a professor.

**General objective:** Students will be able to apply local anesthesia techniques to perform dental treatment with adequate pain control and perform basic oral surgery procedures, such as simple and complicated dental extractions in simulators.

**Key words:** Manual skills. Intraoral local anesthesia techniques. Pain control. Dental extraction techniques. Infection control standards.

**Bibliography:** \* Martínez, Jorge, Cirugía oral y Maxilofacial, Manual Moderno, [9786074480313].

## OD2010 Basic Multidisciplinary Dental Preclinic

( 2 - 2 - 8. Prerequisites: [ OD1008 , OD1008 Corequisite , OD1009 , OD1009 Corequisite ]. 5 MO 11 )

**Equivalence:** OD2002

This intermediate course gives students the knowledge, skills and abilities necessary to perform preventive, restorative or endodontic dental treatments (on a simulator) to prepare them to carry out these treatments later in their career on real patients. It requires knowledge of dental structure and function, and dental structure and function laboratory. As a learning outcome, students will have gained both the theoretical knowledge and the necessary skills to perform preventive, restorative and endodontic treatments on a dental simulator which will be submitted for evaluation by their teachers.

**General objective:** Students will be able to identify the different techniques of preventive, restorative (basic) and endodontic dentistry, and execute them properly in a dental simulator.

**Key words:** Preventive dental treatments. Dental simulators. Endodontic and restorative treatments. Endodontics.

**Bibliography:** \* Fundamentals of operative dentistry : a contemporary approach / edited by James B. Summitt . [et al.] ; illustrations by Jose dos Santos Jr., 3rd ed., Chicago, IL. : Quintessence Pub., c2006., [0867154527].

### OD2011 Multidisciplinary Dentistry

( 3 - 0 - 8. Prerequisites: [ OD2010 ]. 6 MO 11 )

**Equivalence:** None

This is an intermediate course, which enables students to learn the necessary scientific fundamentals for formulating a diagnosis and treatment plan for those patients in need of basic odontological and endodontic restoration procedures, based on in-depth knowledge of cavities and pulp pathology. Previous knowledge is required in propaedeutic and oral health, radiology and dental imaging, and basic pre-clinical comprehensive odontology. The learning outcome for this course is that the students acquire the necessary scientific means for evaluating the restoration needs of patients with various types of cavity-related conditions and for discussing different treatment options.

**General objective:** Students will be able to apply their knowledge in the diagnosis and basic restorative management, of patients with different types of carious lesions, suggesting alternatives for treatment, which are based on reasoning of the findings and critical thinking.

**Key words:** Restorative dental procedures. Caries lesions. Pulp pathology.

**Bibliography:** \* Fundamentals of operative dentistry : a contemporary approach / edited by James B. Summitt . [et al.] ; illustrations by Jose dos Santos Jr., 3rd ed., Chicago, IL. : Quintessence Pub., c2006., [0867154527].

### OD2012 Dental Research Seminar

( 2 - 0 - 4. Prerequisites: None. 6 MO 11 )

**Equivalence:** None

This is an intermediate level course, which enables students to develop a research project in the area of odontology, putting the principles of research methodology into practice. Previous knowledge is required in Research Methodology, Technological Resources and information searches. The learning outcome for this course is that the students develop a project that integrates research methodology in the area of odontology, based on related bioethical considerations.

**General objective:** Students will be able to design a dental research project, with all the methodological elements, and adjusted to the principles of bioethics.

**Key words:** Dental approach. Design and methodology of a research project. Related bioethical aspects.

**Bibliography:** \* Díaz Narváez, Víctor Patricio., Metodología De La Investigación Científica Y Bioestadística: Para Médicos Odontólogos Y Estudiantes De Ciencias De La Salud., : Ril, 2006., [9789562844857].

### OD2013 Oral Surgery Clinic I

( 0 - 6 - 8. Prerequisites: [ OD2005 , OD2009 ]. 7 MO 11 )

**Equivalence:** None

This is an intermediate course of a practical (clinical) nature in which students begin to practice their knowledge, abilities and skills in diagnosis, treatment plans, discussion and procedures with real patients. The type of attention given to patients on this course consists mainly of non-complicated extractions. The course requires prior knowledge of Preclinical Surgery and Oral Anesthesia. Learning outcome: students will gain confidence by treating real patients, with non-complicated extraction needs, principally caused by orthodontic treatments, periodontal disease or advanced dental caries, handing in reports on each of the patients treated.

**General objective:** Students will be able to apply their knowledge in the diagnosis and management

of patients with basic exodontia needs, performing the right local anesthesia techniques and exodontia procedures relevant to each particular case.

**Key words:** Basic exodontia. Orthodontic treatments. Periodontal disease.

**Bibliography:** \* Martínez, Jorge, Cirugía oral y Maxilofacial, Manual Moderno, [9786074480313].

### **OD2014 Pediatric and Orthodontic Dental Preclinic**

( 2 - 2 - 8. Prerequisites: [ OD2002 , OD2005 , OD2010 , OD2009 ]. 7 MO 11 )

**Equivalence: None**

This is an intermediate course that allows students to know and apply basic techniques for the integrated dental treatment of pediatric patients, using models and simulators. Concepts of preventive and interceptive orthodontics and case review seminars will be included. This course requires prior knowledge of oral structure and function, dental radiology and biomaterials. Learning outcome: students will develop the specific skills required for the treatment of young patients and carry out basic dental procedures on simulated pediatric patients.

**General objective:** Students will be able to perform basic dental treatments (including preventive and interceptive orthodontics), in models and simulated child patients.

**Key words:** Pediatric dentistry vs. adult dentistry. Basic techniques for the management of pediatric patients. Preventive dentistry treatments for pediatric patients. Basic orthodontics and maxilar orthopedics in pediatric dentistry.

**Bibliography:** \* Proffit, William R., Contemporary orthodontics / William R. Proffit, Henry W. Fields, Jr., David M. Sarver., 4th ed., St. Louis, Mo. : Mosby Elsevier, c2007., [9780323040464],[0323040462].

### **OD2015 Prosthodontic Dental Preclinic**

( 2 - 2 - 8. Prerequisites: [ OD2003 , OD3017 ]. 8 MO 11 )

**Equivalence: None**

This is an intermediate course (theoretical-practical) in which students will gain the knowledge, abilities and skills necessary to carry out different restorative or prosthetic dental treatments in order to prepare them to solve problems present in patients who have lost a large amount of dental structure or even complete dental organs. This course requires prior knowledge of Integrated Dentistry I and II. Learning outcome: students will possess both theoretical elements and the necessary skill to perform different restorative treatment options on dental simulators, which be assessed by the professor.

**General objective:** Student will be able to identify and discuss the different, most appropriate prosthetic dental treatment options for different circumstances in which dental structure or complete dental organs have been lost, and execute them properly in a dental simulator.

**Key words:** Restorative dental treatments. Dental prosthetic treatments.

**Bibliography:** \* Rosenstiel, Stephen F., Contemporary fixed prosthodontics / Stephen F. Rosenstiel, Martin F. Land, Junhei Fujimoto, 4th ed., St. Louis, Mo. : Mosby/Elsevier, c2006., [0323028748],[9780323028745].

### **OD3004 Introduction to Professional Development**

( 2 - 0 - 2. Prerequisites: None. 10 MO 11 )

**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to

them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

### OD3016 Multidisciplinary Dental Clinic I

( 0 - 6 - 8. Prerequisites: [ OD2011 Corequisite, OD2011 ]. 6 MO 11 )

**Equivalence:** None

This is an advanced course in which students develop skills and abilities to perform, with quality and efficiency, basic dental treatments on real patients. It includes seminars for the presentation and discussion of clinical cases and advanced concepts of ethics and professionalism. It requires basic knowledge of clinical propaedeutic, dental radiology, oral pathology, dental biomaterials, infection control and pre-advanced dentistry, anesthesiology. As a learning outcome, students are expected to perform a minimum number of basic and complex dental treatments, with a comprehensive approach in real patients and document them in their portfolio of evidence (e-Portfolio).

**General objective:** At the end of the course, students will be able to make a proper medical and dental assessment of the patient; generate a complete medical history (including dental X rays, study models and further tests, where applicable), integrate and analyze the medical and dental information available; diagnose problems, oral diseases and conditions present, propose, present and discuss possible dental treatments for each case, control anxiety and pain of the orofacial region; implement the appropriate dental treatment (core and/or complex) for each

particular case in real patients, prescribe the drugs needed to control infection and pain management post treatment (where applicable); act in an ethical and professional manner. Students will be able to communicate effectively with other health team members and with other dentists to determine the best patient care. They will be under the supervision of their teachers, specialists in the following areas: preventive dentistry, periodontics, endodontics and advanced dental rehabilitation.

**Key words:** Periodontitis. Emergency management in the dental office. Complex dental rehabilitation. Multidisciplinary treatment of dental patients. Fixed and removable partial prostheses.

**Bibliography:** \* Esthetic dentistry : a clinical approach to techniques and materials / [edited by] Kenneth W. Aschheim, Barry G. Dale., 2nd ed., St. Louis : Mosby, c2001., [0323001629 (encuadernado)], [9780323001625 (encuadernado)].

### OD3017 Advanced Multidisciplinary Dental Preclinic

( 2 - 2 - 8. Prerequisites: [ OD2010 ]. 6 MO 11 )

**Equivalence:** OD2003

This is a practical, intermediate course, which focuses on the mastery of manual skills by performing complex dental treatments in models and simulators. It requires knowledge of oral structure and function, radiology, oral pathology, dental materials and a prerequisite course of Multidisciplinary Basic Dental Pre-clinic. As a learning outcome, the student will gain the confidence needed to perform complex dental treatments on real patients.

**General objective:** At the end of the course, students will be able to perform and document complex procedures of preventive dentistry, periodontics, endodontics, operative dentistry and oral rehabilitation in models and simulators; incorporate into their practice the infection control protocol suitable for each procedure; integrate medical, dental and clinical and radiographic information of simulated patient cases; develop accurate diagnoses, present and discuss possible treatment options (comprehensive approach), and behave ethically.



**Key words:** Advanced dental restoration. Diagnosis, presentation and discussion of advanced cases. Multidisciplinary treatment plan. Treatment of moderate periodontal cases. Endodontic treatment in unirradicular teeth and premolars.

**Bibliography:** \* Fundamentals of operative dentistry : a contemporary approach / edited by James B. Summitt . [et al.] ; illustrations by Jose dos Santos Jr., 3rd ed., Chicago, IL. : Quintessence Pub., c2006., [0867154527].

### OD3018 Multidisciplinary Dental Clinic II

( 0 - 6 - 8. Prerequisites: [ OD2004 , OD3016 ]. 7 MO 11 )

**Equivalence:** None

In this advanced course, students will develop the abilities and skills required to efficiently perform high quality odontological treatments on real patients. It will include seminars for presenting and discussing clinical cases and advanced concepts of ethics and professionalism. This course requires a basic knowledge of clinical propaedeutic, dental radiology, oral pathology, dental biomaterials, infection control and advanced preclinical odontology and anesthesiology. Learning outcome: students will complete a minimum number of basic and complex odontological treatments, with an integral approach, on real patients, and document them in their evidentiary portfolio (e Portfolio).

**General objective:** At the end of the course, students will be able to make a proper medical and dental assessment of the patient; generate a complete medical history (including dental X rays, study models and further tests, where applicable), integrate and analyze the medical and dental information available; diagnose problems, oral diseases, as well as, propose, present and discuss possible dental treatments for each case; control anxiety and pain of the orofacial region; implement the appropriate dental treatment (core and/or complex) for each particular case in real patients, prescribe the drugs needed to control infection and pain management post treatment (where applicable); act in an ethical and professional manner. Students will be able to communicate effectively with other health team members and with

other dentists to determine the best patient care. They will be under the supervision of their teachers, specialists in the following areas: preventive dentistry, periodontics, endodontics and advanced dental rehabilitation.

**Key words:** Fixed and removable partial prostheses. Complex dental rehabilitation. Multidisciplinary treatment of dental patients. Periodontitis. Emergency management in the dental office.

**Bibliography:** \* Esthetic dentistry : a clinical approach to techniques and materials / [edited by] Kenneth W. Aschheim, Barry G. Dale., 2nd ed., St. Louis : Mosby, c2001., [0323001629 (encuadernado)], [9780323001625 (encuadernado)].

### OD3019 Oral Implantology

( 3 - 0 - 8. Prerequisites: [ OD2003 , OD2005 ], [ OD2009 , OD3017 ]. 7 MO 11 )

**Equivalence:** None

This is an advanced level course in which students are taught dental implantology, its basic principles, philosophy, indications and contraindications. The aim is for students to be able to assess a patient and know if he or she is a candidate for dental implant treatment, both from the surgical and prosthetic point of view. The course requires prior knowledge of Preclinical Oral Surgery and Anesthesiology, Preclinical Advanced Integrated Dentistry, as well as dental biomaterials. Learning outcome: students will possess the necessary elements to identify those conditions indicating the advisability of an oral surgery procedure including the placement of dental implants, as well as learning the theoretical bases for rehabilitation. This will be evaluated through the solution of a hypothetical case which will be handed in to the professor.

**General objective:** Students will be able to diagnose, present and discuss cases in which conducting a surgical procedure for placement of dental implants is indicated, and describe how the implants can be rehabilitated.

**Key words:** Basic surgical techniques. Dental implantology. Principles, philosophy and indications of dental implantology.



**Bibliography:** \* Martínez, Jorge, Cirugía oral y Maxilofacial, Manual Moderno, [9786074480313].

## OD3020 Oral Surgery II

( 0 - 6 - 8. Prerequisites: [ OD2013 ]. 8 MO 11 )

**Equivalence:** None

This is an advanced course of a practical (clinical) nature in which students use their knowledge, abilities and skills previously acquired (in the Oral Surgery Clinic) with the aim of performing complicated extraction procedures in cases requiring them. One of the main aims of this course is for students to acquire greater confidence in performing treatments, as well as solving more complex problems, such as patients with complicated extraction needs, mainly due to dental or dentoalveolar fractures caused by trauma, or fractures of dental organs with endodontal treatment. Learning outcome: students will be able to carry out any intraoral local anesthesia technique, as well as complicated extraction procedures. On each case they will create reports to be handed in to their professor.

**General objective:** Students will be able to carry out an exodontia diagnosis and treatment of fractured teeth resulting from injuries or that have been treated endodontically, using the necessary instruments and equipment properly.

**Key words:** Complicated exodontia. Endodontically treated teeth. Instruments and equipment for complicated exodontia.

**Bibliography:** \* Jorge Martínez, Cirugía oral y maxilofacial, Manual Moderno, [9786074480313].

## OD3021 Pediatric and Orthodontic Dental Clinic

( 0 - 6 - 8. Prerequisites: [ OD2014 ]. 8 MO 11 )

**Equivalence:** None

In this advanced course, students will use specific techniques for integral odontological pediatric patient care and treatment on real patients. It includes concepts of preventive and interceptive orthodontia, basic jaw orthopedics and case-review seminars. This

course requires basic knowledge of oral structure and function, dental radiology, biomaterials. Learning outcome: students will develop the necessary specific skills to treat pediatric patients and perform basic dental treatments on real pediatric patients.

**General objective:** Students will be able to perform basic dental treatments (including preventive and interceptive orthodontics) on actual pediatric patients.

**Key words:** Basic techniques for the management of pediatric patients. Pediatric dentistry. Intercepting orthodontics. Maxillary orthopedics.

**Bibliography:** \* Proffit, William R., Contemporary orthodontics / William R. Proffit, Henry W. Fields, Jr., David M. Sarver., 4th ed., St. Louis, Mo. : Mosby Elsevier, c2007., [9780323040464],[0323040462].

## OD3022 Preventive Dentistry Clinic

( 0 - 6 - 8. Prerequisites: [ OD1010 , OD1010 Corequisite ]. 8 MO 11 )

**Equivalence:** None

In this advanced course, students will become aware of the reality existing in Mexico with regard to oral health. It will include the concepts of community epidemiology and odontology. This course requires basic and intermediate-level knowledge of oral pathology, periodontics, dental operations and endodontic therapy. Learning outcome: students will be able to perform, on real patients, basic and complex odontological treatments that seek to prevent or arrest the progress of oral disease, and also participate in brigades for promoting dental health and odontological services in communities and regions that do not have access to dental services.

**General objective:** Students will be able to work in teams with other professionals in health promotion campaigns and community care, to perform high quality basic and complex preventive dental treatment on real patients, with limited resources, communicate effectively with people of different social strata and be empathetic to their needs.

**Key words:** Detection of risk factors for oral diseases. Preventive dentistry in action. Preventive dentistry .

**Bibliography:** \* Odontología preventiva primaria / [editores] Norman O. Harris, Franklin García-Godoy., 2a ed. en español., México, D. F. : Manual Moderno, c2005., [9707291885].

### **OD3023 Oral Medicine**

**( 2 - 0 - 4. Prerequisites: None. 8 MO 11 )**

**Equivalence: None**

This is an advanced course in which students will integrate their knowledge of medicine, oral pathology and clinical propaedeutic to diagnose real or hypothetical cases presented by the professor. Learning outcome: students will identify those elements which are important to make a differential diagnosis and a possible treatment plan (through solving hypothetical cases devised by, and then handed back with their solution to, the professor) as well as correlate the medical and dental findings as part of their multidisciplinary training.

**General objective:** Students will be able to identify the relevant elements for reaching a presumptive diagnosis, such as asking questions based on reasoning and critical thinking, requesting different diagnostic studies, and integrating their findings into a clinic history describing their diagnostic impression.

**Key words:** Differential diagnosis. Medical and odontological findings. Auxiliary diagnosis methods.

**Bibliography:** \* Crispian Scully, Oral and Maxillofacial Medicine: The Basis of Diagnosis and Treatment, 2, Churchill Livingstone, [0443068186].

### **OD3024 Oral Surgery III**

**( 0 - 6 - 8. Prerequisites: [ OD3020 ]. 10 MO 11 )**

**Equivalence: None**

This is an advanced level course of a practical (clinical) nature in which students put into practice previously acquired knowledge, abilities and skills in order to carry out various oral surgery procedures, such as surgical extraction of third molars, alveoplasties, phrenectomies, taking of biopsies, etc. The main intention of the course is for students to know and practice those surgical procedures which are required for the most frequent oral cavity pathologies.

Learning outcome: students will identify those cases in which it is necessary to perform a surgical procedure for the correction of a pathological process in the oral cavity, handing in a report on each of them to their professor.

**General objective:** Students will be able to identify the pathologies of the oral cavity that require corrective surgery for correction and implement them under the close supervision of the teacher.

**Key words:** Surgical removal of third molars. Alveoplasty. Frenectomy.

**Bibliography:** \* Jorge Martínez, Cirugía oral y maxilofacial, Manual Moderno, [9786074480313].

### **OD3025 Special, High Risk and Emergency Dental Clinic**

**( 0 - 6 - 8. Prerequisites: [ OD3018 , OD3023 ]. 10 MO 11 )**

**Equivalence: None**

In this advanced course, students will consolidate their knowledge of medical emergencies and integral odontology, and apply it to treating high-risk and special-needs odontological patients. This course requires advanced knowledge of integral clinical odontology, patient psychology and management and emergencies. Learning outcome: students will be able to perform odontological treatments with an integral approach on special-needs patients with high-risk medical conditions, and adequately handle medical emergencies in an odontological context.

**General objective:** Students will be able to plan and carry out basic dental treatment in patients with high-risk medical conditions and special needs, adequately address medical emergencies in dental practice and interact with other health professionals.

**Key words:** High-risk dentistry. Dental treatment for special patients.

**Bibliography:** \* Malamed, Stanley F., 1944-, Medical emergencies in the dental office / Stanley F. Malamed., 6th ed., St. Louis, Mo. : Mosby/Elsevier, c2007., [032304235X], [9780323042352].

**OD3026 Prosthodontic Dental Clinic**  
**( 0 - 6 - 8. Prerequisites: [ OD2015 ]. 10 MO 11 )**  
**Equivalence: None**

In this advanced course, students will develop the abilities and skills required to efficiently perform quality basic odontological treatments on real patients, with an integral approach. It will include seminars for presenting and discussing clinical cases and advanced concepts of ethics and professionalism so that students can justify their diagnosis and their therapeutic approach plan following evidence based odontological protocol. This course requires a basic knowledge of clinical propaedeutic, dental radiology, oral pathology, dental biomaterials, infection control and advanced preclinical odontology and anesthesiology. Learning outcome: students will complete a minimum number of basic and complex odontological treatments, with an integral approach, on real patients; demonstrate that they are capable of performing efficient, top quality dental treatments with limited resources and equipment, as well as in high tech contexts; and document them in their evidentiary portfolio (e Portfolio).

**General objective:** At the end of the course, students will be able to make a proper medical and dental assessment of the patient; generate a complete medical history (including dental X rays, study models and further tests, where applicable), integrate and analyze the medical and dental information available; diagnose problems, oral diseases and conditions present, propose, present and discuss possible dental treatments for each case, control anxiety and pain of the orofacial region; implement the appropriate dental treatment (core and/or complex) for each particular case in real patients, prescribe the drugs needed to control infection and pain management post treatment (where applicable); act in an ethical and professional manner. Students will be able to communicate effectively with other health team members and with other dentists to determine the best patient care. They will be under the supervision of their teachers, specialists in the following areas: preventive dentistry, periodontics, endodontics and advanced dental rehabilitation.

**Key words:** Fixed and removable partial prostheses. Emergency management in the dental office. Multi-

disciplinary therapeutic approach. Restorative dentistry. Periodontal diseases.

**Bibliography:** \* Esthetic dentistry : a clinical approach to techniques and materials / [edited by] Kenneth W. Aschheim, Barry G. Dale., 2nd ed., St. Louis : Mosby, c2001., [0323001629 (encuadernado)], [9780323001625 (encuadernado)].

**OD3027 Evidence-based Dentistry**  
**( 2 - 0 - 4. Prerequisites: None. 10 MO 11 )**  
**Equivalence: None**

This is an advanced course aimed at allowing students to integrate their knowledge of medicine, dentistry, research methodology and ethics, and critically analyze the elements that should be included in a scientific publication for it to be considered a trustworthy source in in dentistry activities. Learning outcome of this laboratory: students will possess the criteria to read a scientific paper provided by their professor and discuss its validity and methodological rigor according to the quality of its evidence, and hand in a report on it.

**General objective:** Students will be able to analyze, discuss and conclude, using critical thinking, the scientific validity and reliability of a dental publication, and the quality of its design and methodology.

**Key words:** Research methodology. Evidence-based dentistry. Scientific publication.

**Bibliography:** \* Taking sides. Clashing views on controversial issues in sex and gender / edited, selected, and with introduction by Elizabeth L. Paul., 1st ed., Guilford, CT : Dushkin/McGraw-Hill, c2000., [0072376805].

**OD3028 Multidisciplinary Dental Seminar**  
**( 3 - 0 - 8. Prerequisites: [ OD3018 ]. 10 MO 11 )**  
**Equivalence: None**

This is an advanced level course in which the student will give presentations of clinical cases treated and documented throughout the degree course. During

each presentation, the student will emphasize his/her findings and reasoning for arriving at the diagnosis, as well as the different possibilities for treatment that have been analyzed. The rest of the students, and the professor, will provide feedback on said presentations as well as ethical aspects of the decisions made. The course requires prior knowledge of the different subjects in the discipline, as well as technological resources and information searches. Learning outcome: the student will hand in the presentation to the professor, thus demonstrating a broader vision of the different aspects to take into account during the planning of an integrated dental treatment, from both the technical and ethical points of view.

**General objective:** Students will be able to present dental treatment cases in an organized manner, carrying out an analysis that includes concepts such as critical thinking, self-criticism, and ethics related to decision making. They will also be able to argue and defend their views in front of their peers and teachers.

**Key words:** Treated and documented clinical cases. Findings and rationale for diagnosis. Dental treatment planning.

**Bibliography:** \* Valoración y profilaxis / Dirigido por D. Heidemann ; con la colaboración de W. Bengel . [et al.], Barcelona ; México : Elsevier Masson, c2007., spager, [9788445817674].

## P Political Science

### P1000 Sociology

( 3 - 0 - 8. Prerequisites: None. 2 LCMD11, 3 LCS11, 1 LED11, 2 LLE11, 3 LMI11, 3 LPL11, 3 LPM12, 3 LRI11 )

Equivalence: P 00812, P 99822, RH95822, RH99822, SO00811, SO99811

Basic social science course focusing on helping students to comprehend the importance of sociology for analyzing the complex nature of contemporary societies. In this course, students will present and discuss a certain number of classical and contemporary theories, organizing them around paradigms or visions of society. No prior knowledge is required. Learning outcome: students will complete, in teams, a research project in which they will apply the classical and contemporary theories to paradigms and/or visions of society.

**General objective:** Upon completion of this course, students will be able to comprehend the fundamental theories of epistemology, the principal theoretical currents, and methods of sociological research. Students will also be able to identify the socio-historical context in which social philosophy is developed, and will identify various social languages as well as their historical and cultural origins.

**Key words:** Sociology. Social science. Society.

**Bibliography:** \* Ritzer, George., Teoría sociológica clásica / George Ritzer ; traducción María Teresa Casado Rodríguez., 3a ed., México : McGraw-Hill, 2001, Spain, 2001, spa, [9701054717],[9789701054710].

### P1002 Fundamentals of Political Science

( 3 - 0 - 8. Prerequisites: None. 1 LCS11, 1 LDP11, 1 LEC11, 1 LEF11, 1 LMI11, 1 LPL11, 1 LRI11 )

Equivalence: P 00811, P 99811

Basic political science course focusing on developing in students an attitude of thinking scientifically about politics. No prior knowledge is required. Learning outcome: students will solve cases, write reports

or conduct research in which they analyze the phenomenon of politics applying basic concepts.

**General objective:** Upon completion of this course, students will be able to apply the principal concepts of political science such as: the state, political parties, civil society, ideology, and power; students will also analyze the phenomenon of politics as a process in order to understand its manifestation in contemporary reality.

**Key words:** Power. State. Political parties. Democracy. Introduction to political science.

**Bibliography:** \* Shively, W. Phillips, 1942-, Power & choice : an introduction to political science / W. Phillips Shively., 9a ed., Boston : McGraw-Hill, 2005., [0072868961 (rústica : papel alcalino)].

### P1004 Introduction to the Political Science Academic Program

( 3 - 0 - 4. Prerequisites: None. 1 LPL11 )

Equivalence: None

The purpose of this basic political science course is for students to understand what political science is, beginning with a review of its history, the latest advances and its projected future as a field of study. Students will also experience the most representative areas of political work through activities inside and outside the classroom. No previous knowledge is required. Learning outcome: students will prepare a document explaining in which area of specialization of political science they would like to work after graduating, and also describe their strategies for achieving this goal. This document will include the selection of course electives, academic development areas, internships, international exchange, cultural activities, sports and social service.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including competencies, career field and professional development. They will also know the organiza-



tional structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Savater, Fernando., Política para Amador / Fernando Savater., 4a ed., México : Ariel, 2006., Spain, 2006., spa, [8434444674],[9788434444676].

### **P2001 State and Economy** ( 3 - 0 - 8. Prerequisites: None. 5 LPL11, 5 LRI11 ) **Equivalence: None**

Intermediate political science course focusing on the analysis of the function of the State in the economy, as well as the role of the different economic actors in the creation of public agendas. This course requires prior knowledge of microeconomics and macroeconomics. Learning outcome: students will demonstrate an understanding of the role of the State in the economy.

**General objective:** Upon completion of this course, students will be able to comprehend the interaction between the state and the market by analyzing concepts, theories, and cases in class.

**Key words:** Political economics. State and market. Economics of the public sector.

### **P2003 Contemporary Political Theory** ( 3 - 0 - 8. Prerequisites: [ P1003 , P2009 ]. 5 LDP11, 5 LPL11 ) **Equivalence: P 00831, P 99831**

An intermediate political science course that provides students with the fundamental contemporary political theories and the historical origins of the current categories of political analysis, in order to understand and appreciate the political basis of Liberalism, Marxism, and other contemporary approaches to political theory. This course requires prior knowledge of classical political thought. Learning outcome: stu-

dents will demonstrate their knowledge of contemporary political theory approaches.

**General objective:** Upon completion of this course, students will be able to apply some current categories in political analysis in order to make a critical analysis of the basic political theories of Liberalism, Marxism, elitist philosophy, and other contemporary perspectives in political theory.

**Key words:** Liberalism. Marxism. Elitist thinking.

### **P2005 Principles of Public Policy** ( 3 - 0 - 8. Prerequisites: [ P1002 , P2003 Corequisite , P2003 ],[ P1002 , H2039 ]. 6 LCS11, 6 LDP11, 6 LPL11 ) **Equivalence: P 00864**

Intermediate political science course in which students will come to understand public administration by studying its structures, functions, actors, processes, historical development and capacities in order to comprehend its role as an executive element of the government. This course requires prior, basic knowledge of the role of the State and of the diverse political perspectives. Learning outcome: students will demonstrate an understanding of the public policy construction cycle.

**General objective:** Upon completion of this course, students will be able to comprehend basic concepts of public policy by means of the study of the political cycle, in order to establish the relevance of public policy in the construction of public decisions, intervention in the public and private sectors, and solutions to public problems.

**Key words:** Government agenda. Political cycle. Public policies.

**Bibliography:** \* Aguilar, Luis F, Estudios introductorios y antologías de Política Pública (4 volúmenes): ?El estudio de las políticas públicas?, ?La hechura de las políticas?, ?Problemas públicos y agenda de gobierno?, ?La implementación de las políticas?, Miguel Ángel Porrúa, México.



**P2009 Classical Political Thinking**  
( 3 - 0 - 8. Prerequisites: [ P1002 ]. 2 LDP11, 3 LPL11, 4 LRI11 )  
**Equivalence: P1003**

The purpose of this intermediate political science course is for students to understand the origins of political systems and models of thought and thus recognize their influence on contemporary political systems. It requires previous knowledge of the fundamentals of political science. Learning outcome: students will demonstrate an understanding of classical political science theories.

**General objective:** Upon completion of this course, students will be able to identify the fundamentals of Western politics by reading the works of the major thinkers from Classical Greece to the French Revolution.

**Key words:** Humanism. Sophism. Aristotle and the harmonious city. Plato and the ideal city. Political liberalism. Roman jurists. Christian thinking. Totalitarianism. Absolutism. Origin of the concepts of sovereignty, democracy and citizenship.

**Bibliography:** \* Sabine, George H., Historia de la teoría política / George H. Sabine ; rev. Thomas Landon Thorson., Nueva ed., México : Fondo de Cultura Económica, 2000., spa, [9681641993].

**P2010 Politics, Media and Public Opinion**  
( 3 - 0 - 8. Prerequisites: None. 6 LDP11, 5 LMI11, 5 LPL11 )  
**Equivalence: P2000**

The purpose of this intermediate political science course is to provide students with analytical tools for understanding the relationship between political class, communications media and public opinion. It requires previous knowledge of political actors and political communication. Learning outcome: students will prepare reports or resolve cases in which they demonstrate their understanding of the dynamics of political communication.

**General objective:** Upon completion of this course, students will be able to identify the postmodern dynamics of the interrelation between public opinion, political class and media firms.

**Key words:** Public opinion. Political communication. Government communication. Mass media.

**Bibliography:** \* Dalton, Russell J., Citizen politics : public opinion and political parties in advanced industrial democracies / Russell J. Dalton., 4th ed., Washington, DC : CQ Press, c2006., [1568029993 (papel alcalino)].

**P2011 Mexican Political System**  
( 3 - 0 - 8. Prerequisites: None. 8 LDP11, 6 LPL11 )  
**Equivalence: P2006**

The purpose of this intermediate political science course is to introduce students to Mexico's political system so that they can understand the decision-making process for national policy and the structures, actors and interests involved in this process. It requires previous knowledge of Mexican history. Learning outcome: students will understand the structure and functioning of the political system in Mexico and the forces and actors involved in making decisions.

**General objective:** Upon completion of this course, students will be able to explain the origins, development and characteristics of Mexico's political system, identifying its structures, workings, processes and actors, before and after democratization, in order to understand contemporary politics and decision making.

**Key words:** Democratic transition. Governability. Presidentialism. Corporativism. State party. Electoral system. Party system. Congress.

**Bibliography:** \* Aguilar Camín, Héctor, 1946-, A la sombra de la Revolución Mexicana / Héctor Aguilar Camín, Lorenzo Meyer., 35a ed., México. : Cal y arena, 2005., Mexico, 2005., spa, [9687711310].

**P3000 Comparative Politics**  
**( 3 - 0 - 8. Prerequisites: None. 7 LPL11 )**  
**Equivalence: P 00872, P 99872**

Advanced political science course that focuses on the definition and recognition of comparative political methodologies in order to apply their models and concepts to the comprehension of contemporary political phenomena. This course requires prior knowledge of classical political theories. Learning outcome: students will analyze case studies using the comparative political methodology.

**General objective:** Upon completion of this course, students will be able to define and identify the methodology of comparative politics, through an analysis of the techniques developed since its adoption into political science, in order to apply its most important concepts and models in the explanation of political phenomena in modern society.

**Key words:** Society's political phenomena. Government systems. Comparative politics. Comparative government.

**Bibliography:** \* Comparative politics: rationality, culture, and structure / [edited by] Mark Irving Lichbach, Alan S. Zuckerman., Cambridge, U.K. ; New York, NY : Cambridge University Press, 1997., [9780521583695 (encuadernado)], [0521583691 (encuaderna)].

**P3005 Political Analysis**  
**( 3 - 0 - 8. Prerequisites: None. 7 LDP11, 7 LPL11 )**  
**Equivalence: P 00865**

Advanced political science course that focuses on reinforcing students' ability to make inferences and prospective studies of situations according to approaches and techniques that explain the behavior of political actors. The course requires significant theoretical knowledge in the field of political science, as well as a superior critical and analytical level. Learning outcome: students will complete political analysis projects that enable them to identify the role of the diverse major actors and analyze their behavior.

**General objective:** Upon completion of this course, students will be able to apply the various theoretical

perspectives and techniques of political analysis in order to create input for decision making.

**Key words:** Decision making. Social actors. Political issues. Political analysis methodologies.

**Bibliography:** \* Dahl, Robert Alan, 1915-, Modern political analysis / Robert A. Dahl, Bruce Stinebrickner, 6th ed., Upper Saddle River, NJ : Prentice Hall, c2003, New Jersey, c2003, eng, [0130497029 (rústica)].

**P3006 Political Marketing**  
**( 3 - 0 - 8. Prerequisites: None. 8 LPL11 )**  
**Equivalence: MT99884, P 00881**

Advanced political science course that focuses on the use of political marketing techniques to analyze, design and implement plans, programs and strategic actions for political campaigns, and to operate work plans for political parties and political marketing consulting firms. This course requires prior knowledge of political actors, such as political parties and/or public institutions. Learning outcome: students will complete electoral campaign and government marketing projects.

**General objective:** Upon completion of this course, students will be able to apply marketing techniques in order to analyze the design and implementation of strategic plans, programs and actions for carrying out political campaigns. Additionally, students will be able to operate the work programs of political parties and political marketing consulting companies.

**Key words:** Political campaigns. Political communication techniques. Political marketing. Electoral campaign management.

**Bibliography:** \* Maarek, Philippe J., Marketing político y comunicación : claves para una buena información política / Philippe J. Maarek ; prólogo de Pere-Oriol Costa ; traducción de Orlando Carreño y Elisa Sanz., Barcelona : Paidós, 1997., Spain, 1997., spa, [8449304512].

**P3008 Political Science Seminar****( 3 - 0 - 8. Prerequisites: None. 9 LPL11 )****Equivalence: P 00891, P 99891**

Advanced political science course that focuses on introducing students to epistemological issues related to political science and to specific knowledge of the research methodology for this topic. This course requires prior knowledge of specific political science methodology and theory. Learning outcome: students will conduct research projects related to political science.

**General objective:** Upon completion of this course, students will be able to approach epistemological questions in political science and specific knowledge about research methodology in that field.

**Key words:** Epistemology. Political science. Public policies. Political studies methodology.

**P3010 Political Parties****( 3 - 0 - 8. Prerequisites: None. 9 LDP11, 7 LPL11 )****Equivalence: P3003**

The purpose of this advanced political science course is to strengthen students' understanding of basic theory and develop skills for the comparative analysis of relevant issues linked to the performance of parties, party systems and electoral systems. It requires previous knowledge of theories of classical political thought. Learning outcome: students will apply the knowledge they acquire to theoretical analysis and case studies related to political parties.

**General objective:** Upon completion of this course, students will be able to analyze the fundamental theoretical debates referred to in contemporary political party theory, comparing the strengths and weaknesses of the models applied to Latin American politics.

**Key words:** Political parties. Party systems. Electoral systems.

**Bibliography:** \* Partidos políticos y procesos electorales en México / Carlos Sirvent, coordinador., 1a ed., México : UNAM. Facultad de Ciencias Políticas y Sociales : Miguel Angel Porrúa, 2002., [970701184X].

**P3011 Civil Society and Citizen Participation****( 3 - 0 - 8. Prerequisites: None. 8 LCS11, 7 LPL11, 7 LRI11 )****Equivalence: P2012**

The purpose of this advanced political science course is for students to analyze the origin and development of civil society with the goal of understanding its importance in the transformation of a political system through citizen participation. It requires previous knowledge of the concept of citizenship and policy development. Learning outcome: students will identify the different ways in which civil society is organized and, in turn, the different possible mechanisms for citizen participation.

**General objective:** Upon completion of this course, students will be able to recognize the importance of civil society, how it is organized and how to participate, in order to open channels from the public sector or raise awareness about promoting citizen participation in the public life of a society.

**Key words:** Public politics. Social mobilization. Citizenship. Social organizations.

**Bibliography:** \* Civil society : theory, history, comparison / edited by John A. Hall., Cambridge, UK : Polity Press, 1995., [0745610617 (hardback : alk. paper)], [0745614566 (paperback : alk. paper)].

**P3012 Design of Public Policies****( 3 - 0 - 8. Prerequisites: [ P2005 ]. 9 LDP11, 8 LPL11 )****Equivalence: None**

The purpose of this advanced political science course is to strengthen students' knowledge of public administration and develop their capacity for analysis in order to recognize, understand and integrate substantive political and organizational aspects of a public problem, leading to a professionally designed public policy. It requires previous knowledge of the fundamentals of public policy. Learning outcome: students will complete projects that include planning, development, implementation and evaluation of a public policy.

**General objective:** Upon completion of this course, students will be able to identify the causes and consequences of a public issue in order to construct an integral solution using the necessary knowledge of both the public and private sector actors, while being aware of the influence of internal and external factors throughout the process.

**Key words:** Public administration. Government. Political actors. Interest groups.

**Bibliography:** \* Ayala Espino, José., Mercado, elección pública e instituciones : una revisión de las teorías modernas del estado / José Ayala Espino., 2a ed., México : UNAM, Facultad de Economía : Miguel Angel Porrúa, 2000., [9707010339],[9789707010338].

### **P3013 Electoral Systems and Institutions**

**( 3 - 0 - 8. Prerequisites: None. 8 LPL11 )**

**Equivalence: None**

The purpose of this advanced political science course is for students to obtain knowledge and skills related to the study of electoral systems and their operation as well as to federal and local administrative and judicial electoral authorities. It requires previous knowledge of political party theory. Learning outcome: students will perform a comparative study of electoral systems in Mexico and the world.

**General objective:** Upon completion of this course, students will be able to distinguish between the different types of electoral systems, the outcome of their implementation on the distribution of public power, and the operational logic of the administrative and juridical authorities that regulate the electoral system.

**Key words:** Electoral systems. Electoral laws and electoral reforms. Electoral authorities.

**Bibliography:** \* Josep M. Colomer, Como Votamos. Los Sistemas Electorales en el Mundo. Pasado, Presente y Futuro, Gedisa.

### **P3014 Managing of Social Projects**

**( 3 - 0 - 8. Prerequisites: None. 9 LCS11, 9 LPL11, 8 LRI11 )**

**Equivalence: None**

The purpose of this advanced social science course is to provide students with the fundamental concepts, methodology and tools to identify, formulate, implement and evaluate a social development project. It requires previous knowledge of administration and research methodology. Learning outcome: students will complete a social development project concerning its design, implementation and evaluation phases.

**General objective:** Upon completion of this course, students will be able to complete a social development project with the aim of solving a specific problem.

**Key words:** Methodology. Social change. Social project. Assessment. Social issues. Social impact. Social actors. Policy design.

**Bibliography:** \* Roche, Chris (Chris J. R.), Impact assessment for development agencies : learning to value change / Chris Roche., Oxford : Oxfam : Novib, 1999., [0855984244],[9780855984243],[085598418X (rústica)],[9780855984182 (rústica)].

### **P3015 Introduction to Professional Development**

**( 2 - 0 - 2. Prerequisites: None. 9 LPL11 )**

**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization in order to fulfill their graduation requirements. Students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them, defining their options for employment, post-graduate study, and professional certifications. The learning outcome for this course is that students acquire all the necessary tools for a successful transition from student to professional.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## Q

## Chemistry

**Q1001 Chemistry**

( 3 - 0 - 8. Prerequisites: None. 1 IA 11, 1 IAB11, 1 IBN11, 1 IBT11, 1 IC 11, 1 IDA11, 1 IDS11, 1 IFI11, 1 IIA11, 2 IIN12, 1 IIS11, 1 IMA11, 1 IME11, 1 IMT11, 1 INCQ13, 1 IQA11, 1 IQP11, 1 ISD11, 1 ITE11, 1 ITS11 )

**Equivalence:** Q 00811

Basic course in which students will come to understand the fundamental laws and principles that govern the transformations of matter in order to analyze the structures, properties and the energy changes involved. This course requires prior knowledge of the physical states of matter; the physical and chemical properties of matter; classification of substances (pure, mixed, alloys, dissolutions); basic understanding of the periodic table; writing chemical equations; basic concepts of stoichiometry. Learning outcome: students will acquire a general academic grounding in chemical science through the analysis of the transformations of matter, energy changes, structure, properties and some applications.

**General objective:** Upon completion of this course, students will be able to integrate the properties, structures, and behavior of materials and transformations of matter, using the governing principles and laws as their basis and applying this to situational problems.

**Key words:** Chemical bonds. Entropy. Molecular geometry. Polarity of molecules. Interactions. Real gases. Liquids. Solids and crystalline structures. Raoult's law. Ebullioscopy. Cryoscopy. Osmotic pressure. Enthalpy. Law of velocities. Gibbs free energy. Chemical equilibrium constants. Galvanic cell. Electrolytic cell.

**Bibliography:** \* T.L. Brown y H.E. Lemay Jr., Química: la ciencia central, Quinta edición Hispanoamericana, Prentice Hall, México, D.F., 1991.

**Q1004 Chemistry Laboratory**

( 0 - 3 - 4. Prerequisites: [ Q1001 , Q1001 Corequisite ]. 2 IAB11, 2 IC 11, 3 IDA11, 2 IDS11, 2 IFI11, 2 IIN12, 2 IIS11, 3 IMA11, 2 IME11, 2 IMT11, 2 ISD11, 2 ITE11, 2 ITS11 )

**Equivalence:** None

In this basic course, through observation and adequate data collection during experiments, students will be able to reach conclusions, test the concepts learned in the classroom and acquire relevant knowledge that will allow them to generate new knowledge and protect the environment by handling substances properly. This course requires prior knowledge of stoichiometry, dissolving, chemical equilibrium, pH, redox balancing, voltaic cells, reaction rate, reaction order, polarity, molecular interactions. Learning outcome: students will be able to handle laboratory equipment and materials skillfully, collect the data obtained from observing experiments, analyze and synthesize the findings of the experiment.

**General objective:** Ending this course, students will be able to: demonstrate and apply the laws and principles which govern matter transformation, through laboratory experimentation with materials, equipment, and chemical substances; observe and interpret experimental facts and their impact on society, the economy, and ecosystems; assume individual and team responsibility, in the analysis and interpretation of observations and findings obtained in experiments; demonstrate an ethical culture of care for the environment and responsibility in the use, handling, and disposal of all substances utilized in the experiments.

**Key words:** Filtration, distillation, sublimation, and flame tests. Solubility, hardness, electrical conductivity, diffusion. Molarity, colligative properties. Factors that affect equilibrium, equilibrium displacement. Factors that affect reaction rates. Corrosion, electrochemical cells, electrolysis.

**Bibliography:** \* Mirna Carrillo Chávez et al., Microescala-Química General ?Manual de Laboratorio, Prentice Hall- Pearson Education, [970-26-0260-6].



### Q1005 Chemistry of Materials ( 3 - 0 - 8. Prerequisites: [ Q1001 ]. 2 IFI11 ) Equivalence: None

This basic course introduces students to the analysis of the structural properties of materials based on the description of the type of bonds they contain, their energy, the crystal arrangement of their atoms, as well as the microstructure of the phases after preparation, as a basis for the selection of a material according to the desired application. This course requires prior knowledge of electronic configuration and periodic properties of elements, identification of types of bonds and Lewis structures, basic concepts of thermochemistry and reaction rates. Learning outcome: students will be able to describe the crystal structure of each of the phases present in a material; identify the type of bonds; and describe the spatial arrangement of its atoms in a crystal structure.

**General objective:** Upon completion of this course, students will be able to relate the thermal, mechanical, electrical, and optical properties of a material with the crystalline structure of each of its phases. Students will also be able to understand the principles for selection of a material according to its applications, and identify the most common techniques for the characterization of materials.

**Key words:** Electronic structure of elements. Chemical reactivity and chemical bonding. Crystalline structure of materials. Phase diagrams and microstructure of solid materials. Properties of materials.

**Bibliography:** \* Callister, William D., 1940-, Materials science and engineering : an introduction / William D. Callister, Jr., 7th ed., Hoboken, N.J. : John Wiley & Sons, c2007, New Jersey, c2007, eng, [0471736961 (papel alcalino)], [9780471736967 (papel alcalino)].

### Q1007 Structural Organic Chemistry ( 3 - 0 - 8. Prerequisites: [ Q1001 ]. 2 IA 11, 2 IAB11, 2 IBN11, 2 IBT11, 2 IIA11, 2 INCQ13, 4 IQA11, 4 IQP11 ) Equivalence: Q 00832

This basic course aims to provide students with the basic concepts related to organic molecules; nomenclature of functional groups and organic molecules,

three-dimensional structure (stereochemistry); chemical transformations and their intermediaries. This course requires prior knowledge of electronic configurations, Lewis structures, links and interactions, VSEPR geometry, as well as concepts of enthalpy, entropy and Gibbs free energy. Learning outcome: students will be able to describe the principal physical properties of organic molecules in relation to their structure, the most important reactions of the organic compounds and their industrial applications; understand the effect of the conditions under which they occur and explain the reactivity of its functional groups and their three-dimensional representation in space.

**General objective:** Upon completion of this course, students will be able to: Use their knowledge of functional groups and structure representation in organic chemistry in order to understand the benefits and risk factors associated with organic compounds handling; comprehend the importance of stereochemistry and its relationship to the molecular properties, especially in the area of biology, emphasizing its importance to living matter; learn about organic reactions and their most common mechanisms in the transformations of organic compounds (analysis and synthesis).

**Key words:** Nomenclature. Concatenation. Hybridization. Covalent bond. Polarity. Functional group. Lewis acids and bases. Stereochemistry. Reaction energy and reaction mechanism profile. Heterolytic and homolytic reactions. Reaction intermediaries. Substitution reactions. Addition reactions. Elimination reactions. Redox reactions. Multistep synthesis.

**Bibliography:** \* Bruice, Paula Yurkanis, 1941-, Fundamentos de química orgánica / Paula Yurkakis Bruice ; traducción Víctor Campos Olguín, Sergio Durán Reyes., México : Pearson/Educación, 2007., spaeng, [9702610222], [9789702610229].

### Q1009 General Organic Chemistry Laboratory ( 0 - 6 - 8. Prerequisites: [ Q1007 ]. 4 INCQ13 ) Equivalence: Q 00931

This is a basic course intended to allow students to better understand the scope and applications of ex-

perimental organic chemistry and apply in practice the physicochemical properties and methods of synthesis of the main families of organic compounds. The course aims to allow students to work in a collaborative environment. Separation and purification techniques and organic reactions will be applied to research activities and to the solution of industrial problems and those related to green chemistry. This course requires prior knowledge of concepts relating to structural theory, properties and methods of synthesis of the different families of organic compounds, experimental techniques for the separation of chemical substances, and safety rules for handling chemical substances. Learning outcome: students will adequately handle reagents, as well as the material and equipment necessary for carrying out the techniques of synthesis, separation and purification. They will develop awareness of the sustainable use of natural resources and respect for the environment, through the best selection of raw materials and the treatment of waste generated during a chemical process. They will also strengthen their logical reasoning, interpretation of experimental data, analysis and synthesis of information, ability to make decisions and assume the responsibility they will have to exercise in their professional life.

**General objective:** Upon completion of this course, students will be able to comprehend the relationship between reaction conditions and the time in which reactions take place. Students will also classify chemical reactions according to their order and apply this classification to predict behavior.

**Key words:** Electrophilic and nucleophilic substitution reactions. Isolation and purification of an organic compound. Reactions that involve the carbonyl group, including the aldol reaction. Reactions of carboxylic acid derivatives. Oxidation reactions. Separation, synthesis and characterization techniques of organic compounds. Microscale. Waste treatment. Green chemistry.

**Bibliography:** \* Lehman, John W., *Microscale operational organic chemistry : a problem-solving approach to the laboratory course* / John W. Lehman., Upper Saddle River, N.J. : Pearson Prentice Hall, c2004., [0130335185 (alk. paper)].

## Q1010 Analytical Chemistry

( 3 - 0 - 8. Prerequisites: [ Q1001 ]. 5 IBT11, 4 IIA11, 3 INCQ13, 3 IQA11, 3 IQP11 )

**Equivalence:** Q 00822

In this basic course, students will understand the fundamental concepts of qualitative and quantitative chemical and instrumental analysis, and will be able to analyze, differentiate and interpret the information obtained from a chemical analysis. It includes concepts associated with sustainable development and activities that reinforce students' environmental awareness. This course requires prior knowledge of stoichiometry, dissolving, chemical equilibrium, pH, redox balancing, voltaic cells, reaction rate, reaction order, polarity, molecular interactions. As a learning outcome: students express the steps involved in the chemical analysis of a substance, including sampling, analytical technique selection, and calculate the equilibrium conditions, pH, ionic strength during a gravimetric, volumetric or instrumental chemical analysis. They should be able to describe the general elements of instrumental analysis in the context of potentiometry, spectroscopy and chromatography analyses, among others.

**General objective:** Upon completion of this course, students will be able to indicate which are the indispensable phases in the sampling, analysis and evaluation of the results of a chemical analysis; interpret the guidelines and protocol for chemical analysis recommended from a legal and regulatory standpoint; recognize the analytical techniques which generate the most appropriate information for the prevention, control, and resolution of industrial problems; recognize the need for the presentation of precise and exact results; value the importance of chemical analysis as a tool for the modern world which contributes to the resolution of problems that affect our society.

**Key words:** Instrumental analysis. Chemical equilibrium sampling. Gravimetric analysis. Volumetric analysis.

**Bibliography:** \* Harris, Daniel C., 1948-, *Quantitative chemical analysis* / Daniel C. Harris., 6th ed., New York : W.H. Freeman and Co., c2003., New York, c2003., eng, [0716744643].

## Q1011 Mechanistic Organic Chemistry

( 3 - 0 - 8. Prerequisites: [ Q1007 ]. 3 INCQ13 )  
Equivalence: None

The aim of this course is to enhance students' understanding of organic reactions, their mechanisms and their use in organic synthesis with emphasis on medicine and the industry. It also introduces the basic concepts of asymmetric synthesis for the production of compounds with specific biological activity. This course requires prior knowledge of nomenclature of organic compounds, functional groups and substitution and addition organic reactions. Learning outcome: Students will be able to anticipate the most likely products of an organic reaction in accordance with the reaction conditions and the analysis of the reaction mechanism, based on their knowledge of chemical reactivity and spectroscopic data.

**General objective:** Upon completion of this course, students will be able to comprehend the concept of organic synthesis applied to compounds relevant to medicine and the industry, analyzing the mechanisms that rule the reactions involved. Students will utilize basic concepts in spectroscopy to analyze the products of the syntheses.

**Key words:** Organic reaction mechanisms. Organic synthesis. Asymmetric synthesis. Spectroscopy.

**Bibliography:** \* Bruice, Paula Yurkanis, 1941-, Química orgánica / Paula Yurkanis Bruice ; traducción, Virgilio González y Pozo., 5a ed., México : Pearson/Educación, 2008., spaeng, [9702607914],[9789702607915].

## Q1013 Organic Synthesis Laboratory

( 0 - 6 - 8. Prerequisites: [ Q1009 , Q1011 Corequisite , Q1011 ]. 5 INCQ13 )  
Equivalence: Q 00952

This is an intermediate level course, it aims to develop in the students the skills required to research, select, organize and use information to design, adapt, carry out and document experimental processes in which they apply the techniques for synthesis, separation and analysis of organic compounds to solve real, current problems in the industry and the health areas. This course requires prior knowledge of the

concepts of the physical and chemical properties of functional groups, reaction mechanisms, basic organic compound separation and purification techniques, residue optimization, and safety regulations. Learning outcome: Students will be able to select, design, adapt, carry out and modify organic synthesis and modern qualitative organic analysis operations, develop a sense of respect for the environment by treating the residues produced during a chemical process, and strengthen their logical reasoning. They will also be able to document, analyze, synthesize and present their findings.

**General objective:** Upon completion of this course, students will be able to select, design, adapt, and execute the operations of sequential organic synthesis, separations, and organic qualitative analysis. They will develop a culture of respect for the environment, performing treatment of the residues generated during a chemical process. Students' logical reasoning skills will be reinforced. Students will also be able to document, analyze, synthesize and present their findings in written form.

**Key words:** Nuclear magnetic resonance. Modern qualitative organic analysis. Organic synthesis. Infrared spectroscopy.

**Bibliography:** \* Lehman, John W., Multiscale operational organic chemistry : a problem-solving approach to the laboratory course / John W. Lehman., 2nd ed., Upper Saddle River, N.J. : Pearson/Prentice Hall, c2009., [0132413752],[9780132413756].

## Q1014 Experimental Chemistry

( 0 - 6 - 8. Prerequisites: [ Q1001 ]. 3 IA 11, 2 IBN11, 2 IBT11, 2 IIA11, 2 INCQ13, 2 IQA11, 2 IQP11 )  
Equivalence: None

This is a basic level course, designed to help students apply basic chemical laboratory techniques and demonstrate observation, analysis and synthesis skills, encouraging the logical reasoning they will need in order to perform and design chemical experiments that comply with safety regulations. Previous knowledge is required in stoichiometry, solutions, chemical equilibrium, pH, redox balancing, voltaic cells, reaction speed, reaction order, polarity and molecular interaction. The learning outcome for

this course is that the students, through chemistry experiments, be able to consolidate their knowledge of the structure, properties and transformation of matter, through analysis of the physiochemical properties and principles that dictate its transformation.

**General objective:** Upon completion of this course, students will be able to integrate their theoretical knowledge of the classification, properties and transformation of matter by conducting chemical experiments in a safe, orderly, collaborative manner; apply the processes and standards and handle materials and equipment properly in the context of the chemistry laboratory; use their observation, analysis and synthesis skills to solve experimental problems; apply logical reasoning to design and conduct experiments, as well as to report the results of the same.

**Key words:** Sampling. Stoichiometry. Chromatography. Laboratory safety standards. Chemicals, materials and basic equipment handling. Distillation, extraction, determination of physical properties. Calibration curves. Preparation of standard solutions.

**Bibliography:** \* Szafran, Zvi., *Microscale inorganic chemistry : a comprehensive laboratory experience* / Zvi Szafran, Ronald M. Pike, Mono M. Singh., New York : J. Wiley, c1991., [0471619965].

### Q1015 Modern Methods in Analytical Chemistry

( 0 - 6 - 8. Prerequisites: [ Q1014 , Q1010 Corequisite ]. 3 INCQ13 )

**Equivalence: None**

This is basic level laboratory course, which enables students to apply their knowledge of chemistry in the qualitative and quantitative characterization of chemical substances, using gravimetric, volumetric and instrumental laboratory analysis techniques, taking their advantages and limitations into consideration. Emphasis will be placed on the criteria and skills that are necessary for selecting representative samplings, choosing methods and reliably validating the results that the students will use to solve problems during their professional careers, considering their responsibility for conserving the environment and their integrity when publicizing analytical results. Previous knowledge is required in laboratory

chemistry, stoichiometry, concentration calculations and concepts of equilibrium in aqueous solutions. The learning outcome for this course is that the students be able to identify and quantify substances, such as: raw materials, finished products, process control aids, contaminants, etc. within an industrial or environmental context.

**General objective:** Students will be able to identify and quantify a sample existing in a specific matrix; design a sampling plan; select and execute an analysis method using volumetric, gravimetric and instrumental methods; perform calibrations and assess the reliability of an analytical result.

**Key words:** Accuracy, precision and validation of results. Instrumental analytical techniques. Analytical techniques for volumetric and gravimetric methods.

**Bibliography:** \* Guiteras, Jacinto., *Curso experimental en química analítica* / Jacinto Guiteras, Roser Rubio, Gemma Fonrodona., Madrid : Síntesis, [2003], [8497560728].

### Q1017 Introduction to Chemical Sciences, Nanotechnology and their Applications

( 3 - 0 - 4. Prerequisites: None. 1 INCQ13 )

**Equivalence: None**

This is an introductory course for the Bachelor of Science in Chemistry and Nanotechnology Engineering in which the fundamental concepts of chemistry, nanotechnology and the process of scientific and applied research are presented. We discuss, using specific cases, the historical development of the chemical sciences and philosophical and ethical issues of this science. This course is for the student know the fields of professional performance, the most representative areas of work of an expert in chemistry and future prospects of the profession in the area of application of nanotechnology. Also known academic legislation and policies of the Institute and achieve an overview of academic and extracurricular opportunities from which students may profit. No previous knowledge is required. As a result of learning the student is expected to reflect on the area of chemistry in which he/she would like to professionally develop. Based on the opportunities presented in the course,



students make a planning of activities to participate in during his career both in areas of academic, professional internships, international exchanges, types of education, sports, cultural and profit for society.

**General objective:** After completing the course the student will learn the characteristics of a Bachelor's degree in which he/she is enrolled, his/her skills, the field of work and professional development. He/She will understand the relationship between the chemical sciences and nanotechnology and the importance of its applications. Also, he/she will get to know the organizational structure of the Tecnológico de Monterrey and its main regulations.

**Key words:** Tecnológico de Monterrey System. ITESM Regulations and Code of Ethics. Professional development Area chemical and Nanotecnología. Career profile and curriculum. Science, Technology and History of Chemical and perspectives of scientific research.

## Q1018 Chemistry of Materials and Nanomaterials

( 3 - 0 - 8. Prerequisites: [ Q1001 ]. 2 INCQ13 )

**Equivalence: None**

It is a basic level course designed to introduce students to the analysis of the structural properties of materials and nanomaterials based on the description of electron behavior, the type of bonds that comprise them, their energy, crystalline arrangement of their atoms as well as the microstructure of their phases as a basis for the selection of a material according to the desired application. Requires prior knowledge on the electronic configuration and periodic properties of the elements. Identification of types of bonds and Lewis structures as well as basic concepts on thermochemical and reaction rates. As a learning outcome the student will be able to describe the crystal structure of each phase present in a material, identify the type of bonds that comprise them and describe the spatial arrangement of their atoms in a crystalline structure and a nanomaterial.

**General objective:** After completing the course, students will be able to relate the thermal, mechanical, electrical and optical properties of a material with the crystal structure of each of its phases, understand

the principles of selecting a material based on their applications and the most common techniques for materials and nanomaterials characterization. He/She will acquire a basic knowledge of the special properties that a nanomaterial presents as a result of the phenomenon of electronic confinement and its area/volume ratio. He/She will be able to describe the main applications of advanced materials and nanomaterials.

**Key words:** Electronic structure of the elements. Chemical reactivity and bonding. Crystal structure of the materials and their properties. Phase diagrams and solid materials microstructure. Properties of nanomaterials.

**Bibliography:** \* Tilley, R. J. D., Understanding solids : the science of materials / Richard J.D. Tilley., Chichester, West Sussex, England ; Hoboken, NJ, USA J. Wiley, c2004., [0470852755 (tela)], [0470852763 (papel)].

## Q2000 Biochemistry

( 3 - 0 - 8. Prerequisites: [ Q1007 ]. 3 IA 11, 3 IAB11, 3 IBN11, 3 IBT11, 3 IIA11, 4 INCQ13 )

**Equivalence: Q 00821**

This is an intermediate course allowing students to recognize biological compounds and understand the basic concepts related to biomolecules, such as: structural characteristics, associations and interrelations, chemical and biochemical modifications. They will also understand the basic aspects of metabolism and metabolic pathways taking as an example the TCA Cycle and Oxidative Phosphorylation. This course requires prior knowledge of molecular geometry, functional groups and their reactivity, stereochemistry, equilibrium and chemical kinetics, the description of the concentration of dissolutions, colligative properties and pH. Learning outcome: students will be able to describe the properties and function of each of the different types of biomolecules based on their structural characteristics and their participation and impact on metabolic pathways within biological systems.

**General objective:** Upon completion of this course, students will be able to: Identify biomolecules; understand their transformations in complex biological

cal processes; identify the function of biomolecules in metabolic processes: Metabolic pathways and their regulation, examples of pathologies which result from their modification; perform calculations of bioenergetics and enzyme kinetics with and without inhibition.

**Key words:** PH buffer solutions. Structure and properties of biomolecules: carbohydrates, lipids, proteins and nucleic bases. Enzymatic kinetics and inhibition. Cell membranes, structure and properties. Metabolic pathways. Bioenergetics.

**Bibliography:** \* Mathews, Christopher K., 1937-, *Bioquímica* / Christopher K. Mathews, K.E. van Holde, Kevin G. Ahern ; traducción José Manuel González de Buitrago., 1a ed. en español., Madrid : Addison Wesley, 2002, Spain, 2002, spa, [8478290532], [9788478290536].

### Q2001 Food Chemistry

( 3 - 0 - 8. Prerequisites: [ Q2000 Corequisite , Q2000 ],[ MD1030 Corequisite , MD1030 ]. 4 IIA11, 4 LNB11 )

**Equivalence:** TA00845

Intermediate course that provides key knowledge of the chemistry of foods to solve problems related to different areas of food technology. This course requires prior knowledge of biochemical organic chemistry. Learning outcome: students will be able to propose solutions to food technology problems by analyzing the components of food and the treatments and conditions to which the food is subjected.

**General objective:** Upon completion of this course, students will be able to utilize chemical concepts and principles in order to predict and control sensory, nutritional, and toxicological changes in foods.

**Key words:** Macronutrients of foods. Micronutrients of foods.

**Bibliography:** \* Badui Dergal, S. , *Química de los Alimentos*, IV, Pearson Educación.

### Q2002 Molecular Thermodynamics

( 3 - 0 - 8. Prerequisites: [ Q1010 , Q1005 ]. 4 IFI11, 4 INCQ13 )

**Equivalence:** Q 00841

This is an intermediate course with the purpose of developing in students the ability to apply mathematical models based on the Laws of Thermodynamics and Statistical Mechanics to explain and predict phenomena associated with organic, inorganic or biological systems, reacting or non-reacting, on a microscopic or macroscopic level. Concepts associated with sustainable development and activities which reinforce awareness of the responsible and efficient use of energy sources are included. This course requires prior knowledge of algebra and differential calculus, materials chemistry and physics. Learning outcome: students will be able to solve industrial and environmental problems related to the thermodynamic properties of materials of organic, inorganic or biological origin.

**General objective:** Upon completion of this course, students will be able to: describe and select materials according to their thermodynamic properties; recognize not only the molecular interactions which define the behavior of materials and substances in their three states of matter but also their characteristics and models which explain those characteristics; calculate chemical potential in order to predict chemical equilibrium; explain the phenomena of denaturation of proteins and of oligomers of RNA or DNA nucleotides using the thermodynamic functions  $(\Delta)H$ ,  $(\Delta)S$  y  $(\Delta)G$ ; relate the macroscopic properties of a material with its microscopic properties through the concepts of statistical mechanics.

**Key words:** Chemical equilibrium. Energy, heat and work. Laws of Thermodynamics. Chemical potential. Phase equilibria. Statistical mechanics.

**Bibliography:** \* Levine, Ira N., 1937-, *Fisicoquímica* / Ira N. Levine., 5a ed., Madrid ; México, D.F. : McGraw-Hill, c2004., spaeng, [8448140052 (Obra completa)], [8448137868 (v.1)], [84481378].



### Q2003 Metabolic Biochemistry ( 3 - 0 - 8. Prerequisites: [ Q2000 ]. 6 INCQ13 ) Equivalence: Q 00851

This is an intermediate level course intended to permit students to acquire an integrated vision of metabolism and its regulation and control strategies. This course requires prior knowledge of: biomolecules, their structure and chemical reactions; catalysis and control of biological reactions, and bioenergetics; membranes and cellular transport; general principles of metabolism. Learning outcome: students will understand general aspects of the regulation and integration of metabolism, as well as molecular aspects of transport and their potential medical and technological applications.

**General objective:** Upon completion of this course, students will be able to apply biological principles in order to solve industrial, environmental, or biomedical science problems.

**Key words:** Metabolism in its different phases. Biological membranes and thermodynamics. Metabolic routes. Hormones and their role in regulating the metabolism. Kinetics and transport mechanisms.

**Bibliography:** \* Campbell, Mary K., Bioquímica / Mary K. Campbell, Shawn O. Farrell., 4a ed., México : Thomson, 2004, Mexico, 2004, spa, [9706863354], [9789706863355].

### Q2012 Industrial Chemistry ( 3 - 0 - 8. Prerequisites: [ Q1010 ]. 4 IQA11, 4 IQP11 ) Equivalence: None

This is an intermediate level course, which enables students to employ the fundamentals of Chemistry, in order to relate the properties of technologically-important substances to their structure. The course will also focus on the analysis of industrial chemical processes used in the production sector, highlighting their environmental impact and identifying the need to replace them with emerging clean technologies. Previous knowledge is required in basic chemistry, reactors and economics. The learning outcome for this course is that the students be able to propose alternatives for integrating new production methods in existing chains and to evaluate the

economic, social and environmental impact of a production chain in any area of chemistry.

**General objective:** Upon completion of this course, students will be able to understand the relationship between the structure and properties of materials, and the chemical foundation of the current technologies that have the greatest industrial and biochemical impact in order to prepare them for the problems they will face during their professional practice, including environmental impact.

**Key words:** Chemistry of inorganic and explosive macromolecules. Corrosion. Solid state chemistry. Water treatment. Crystalline structure and its defects, chemical implications: catalysis, semi-conductivity, interstitial compounds. Sources of atmospheric pollution emissions and control techniques. Manufacturing processes of commonly used industrial products. Chemistry applied to mineral concentration and metal procurement. Electrochemical theory and industrial applications.

**Bibliography:** \* Swaddle, T. W. (Thomas Wilson), 1937-, Applied inorganic chemistry / T. W. Swaddle., Calgary : University of Calgary Press, 1992., [0919813585].

### Q2013 Molecular Kinetics and Dynamics ( 3 - 0 - 8. Prerequisites: [ MA2010 , Q2002 ]. 5 INCQ13 ) Equivalence: None

This is an intermediate level course, which enables students to determine and interpret the kinetic parameters of reactions at the microscopic and macroscopic levels, in order to predict the reaction's course, optimize performance, adjust the experiment conditions, select catalysts and generate information for the design of reactors. Students will be able to apply the fundamental concepts of quantum chemistry in the interpretation of the behavior of substances at the molecular level. Previous knowledge is required in unit management and transformation, integral and differential calculus, differential equations and molecular thermodynamics: enthalpy, free energy and reaction entropy. The learning outcome for this course is that the students be able to analyze data

from experiments on the kinetics of a reaction and discover the kinetic parameters to describe the speed of a chemical reaction. Students will identify the necessary elements for proposing methods of performance optimization, adjustment to experiment conditions, catalyst selection and use of the information that serves as the basis for the design of reactors.

**General objective:** Upon completion of this course, students will be able to develop mathematical models that describe the course of a chemical reaction in an industrial or biological process; use the kinetic parameters of a reaction to adjust the reaction conditions, optimize performance, design and use reaction catalysts or inhibitors. Students will also have gained a basic knowledge of the description of quantum-mechanical systems.

**Key words:** Reaction mechanisms. Kinetic theory of gases. Transport properties. Kinetic parameters of reactions. Analysis of reaction rates. Transition state theory. Physical and chemical adsorption. Catalysis. Postulates of mechanics.

**Bibliography:** \* Levine, Ira N., 1937-, Physical chemistry / Ira N. Levine., 5th ed., Boston ; México : McGraw-Hill, c2002., [0072318082 (papel alcalino)].

### Q2014 Physical Chemistry Laboratory

**(0 - 6 - 8. Prerequisites: [ Q1015 , Q2002 ]. 5 INCQ13)  
Equivalence: None**

This is an intermediate course, where students experimentally determine physicochemical properties of materials applying principles of molecular thermodynamics, phase equilibrium, chemical equilibrium and surface chemistry in multi-component and multiphase systems. These experiment-based determinations will allow students to study and predict behavior of materials, in order to understand and propose their application in industry and in research projects. As learning outcome for this course students learn to apply physicochemical principles in a collaborative and project-oriented work environment. The course will address topics related to the social aspect of sustainable development. Previous knowledge is required in analytical chemistry, ana-

lytical and organic laboratory techniques (such as solution preparation, distillation, titration and statistical data analysis), thermodynamic properties of substances, energy, laws of thermodynamics, chemical potential and phase equilibrium.

**General objective:** After completing the course, students will be able to select and properly operate the equipment necessary for physicochemical determinations, strengthen their logical reasoning and decision-making that they will need to apply in their professional lives.

**Key words:** Heat capacities. Binary and ternary systems. Determination of the molecular weights of gases. Adiabatic and isothermal changes. Heat of reaction and physical changes.

**Bibliography:** \* Daniels, Farrington, 1889-1972., Curso de fisicoquímica experimental / Farrington Daniels [et al.] ; traducción y adaptación [por] Dr. Xorge A. Domínguez [y] Q.Z. Ariosto Aguilar Mandujano., Mexico ; New York : McGraw-Hill, 1972., spaeng.

### Q2015 Physical Chemistry Measurements Laboratory

**( 0 - 3 - 4. Prerequisites: [ IQ2003 , IQ2003 Corequisite ]. 5 IQA11, 5 IQP11 )**

**Equivalence: Q 00951**

This is an intermediate level course, which is designed to help students, through keen observation and compilation of the information obtained during the performance of experiments, examine the nature and structure of matter; determine the properties of gases, liquids, solids and solutions; apply the laws and theoretical fundamentals of physicochemistry; and determine the relationships of energy in physical and chemical transformations. Previous knowledge is required in experimental chemistry, thermochemistry and thermodynamics. The learning outcome for this course is that the students be able to skillfully operate the appropriate equipment for determining physicochemical properties, compile information obtained from observing experiments and analyze and summarize the information obtained from the experiments.

**General objective:** Upon completion of this course, students will be familiar with the laws of gases and apply them to determine calorific capacities; determine the changes in heat that occur with reactions, such as heat from the combustion, neutralization and vaporization of diverse compounds; determine liquid vapor pressures using the static and dynamic methods; differentiate between immiscible liquid systems and recognize the effect of temperature and pressure when separating them by distillation; know the molar partial properties and colligative properties of solutions, and the chemical equilibriums of reactions.

**Key words:** Thermochemistry. Vapor pressure of liquids. Immiscible liquids. Partial molar volume. Colligative properties. Heterogeneous equilibrium. Azeotropes.

**Bibliography:** \* Urquiza, Manuel., Experimentos de fisicoquímica / Manuel Urquiza., Monterrey, N.L. : ITESM. Depto. de Química, 1989.

## Q2016 Advanced Materials and Nanomaterials Laboratory

( 0 - 6 - 8. Prerequisites: [ Q2002 , Q2013 , F1003 ]. 9 IF111 )

**Equivalence: None**

This is an intermediate course, which enables students to realize experimental measurements in order to characterize materials and study chemical processes, leading to a better understanding of the physicochemical properties of multi-component, multiphase or nano-structured systems, and to put physicochemical laws into practice in a project-oriented work environment. The course will deal with topics related to the preparation, characterization and application of advanced materials, biomaterials and nano-materials. Previous knowledge is required in the theories of materials chemistry and chemical kinetics. As expected learning outcome for this course the students will be able to select and appropriately use the necessary equipment for characterizing the physicochemical nature of materials, that they enforce their logical thinking and decision making skills and gain the sense of professional responsibility they will need during the course of their professional life.

**General objective:** Upon completion of this course, students will be able to carry out the physicochemical characterization of the properties of a material and conduct research based on their knowledge of the laws of physical chemistry; analyze and report the results of their experiments in accordance with international regulations and conventions.

**Key words:** Surface phenomena. Binary and ternary systems. Nanomaterials. Physicochemical characterization of materials.

**Bibliography:** \* Garland, Carl W., Experiments in physical chemistry., 7th ed. /Carl W. Garland, Joseph W. Nibler, David P. Shoemaker., Boston ; México : McGraw-Hill, c2003., [007231821X (acid-free paper)], [0071199543],[9780072318210 (acid-free paper)].

## Q2018 Instrumental Analytical Chemistry and Nanoscopy

( 3 - 0 - 8. Prerequisites: [ Q1010 ]. 5 INCQ13 )

**Equivalence: None**

It is an intermediate course, which is intended to provide students with the conceptual tools and skills to apply principles and instrumental analysis methods in solving problems in their professional field. This course will address issues related to sustainable development in environmental and social aspects. Requires prior knowledge of analytical chemistry. As learning outcome of the course the students are expected to apply the basic concepts and nanoscopy instrumental analysis to select the optimal methods for the qualitative and quantitative analysis of all types of substances.

**General objective:** After completing the course, students will be able to offer solutions to analytical problems of chemistry. Recognize the importance of instrumental analytical chemistry and nanoscopy in technological development and its impact on the advancement of other sciences.

**Key words:** Optical spectroscopy instrumentation. Methods of separation. Molecular absorption spectroscopy ultraviolet and visible. Thermal Methods of Analysis. Nanoscopy, using electron microscopy.

**Bibliography:** \* Skoog, Douglas A., Principios de análisis instrumental [recurso electrónico] / Douglas A. Skoog, F. James Holler, Stanley R. Crouch ; traductor, María Bruna Josefina Anzures., 6a ed., México : Cengage Learning, 2008., spaeng, [9786074813906 (ebook)], [9789706868299].

## Q2019 Characterization of Materials and Nanomaterials

( 0 - 6 - 8. Prerequisites: [ Q2013 ],[ Q2002 , F3020 ]. 6 INCQ13 )

**Equivalence: None**

It is an intermediate course in which the student will perform experimental measurements to characterize materials and nanomaterials and to study chemical processes which allow the student to understand the physicochemical properties of multicomponent systems, multiphase or nanostructured, and put into practice physical chemistry laws in a project-oriented work. This course will address topics related to the preparation, characterization and application of advanced materials, biomaterials and nanomaterials. This course requires prior knowledge of materials chemistry and theoretical knowledge of chemical kinetics. Learning outcome is expected that students will be able to select and properly handle the technological tools necessary to perform the physicochemical characterization of materials and nanomaterials that strengthen logical reasoning, decision making, and to acquire a sense of professional responsibility.

**General objective:** After completing the course, students will be able to perform the physicochemical characterization of properties of a material or nanomaterial and conduct research based on their knowledge of physical chemistry laws; also students will be able to analyze and report results of their experiments in accordance to international conventions.

**Key words:** Kinetics. Spectroscopy (Raman, IR). Characterization of Nanomaterials. Thermal Analysis (DSC, DTA). Electrochemistry.

**Bibliography:** \* Garland, Carl W., Experiments in physical chemistry / Carl W. Garland, Joseph W. Nibler, David P. Shoemaker., 8th ed., Boston : McGraw-Hill Higher Education, c2009., [9780072828429 (encuad-

ernado : papel no ácido)],[0072828420 (encuadernado : papel no ácido)].

## Q3001 Product Chemistry

( 3 - 0 - 8. Prerequisites: [ Q1007 ]. 5 IQA11 )

**Equivalence: Q 00872**

In this advanced course, students will understand the specifications and compositions of the chemicals, and the organic and inorganic materials that participate in the same and affect their reproducibility, as well as the effect on their quality by variations in processes, conditions and storage times, and interactions with other products and substances during their use. This course requires prior knowledge of organic chemistry. Learning outcome: students will be able to increase the capacity to specify materials and products, as well as the effects of diverse environments and conditions on the same; learn to integrate these parameters into purchasing decisions, process selection, market expansion and/increase in competitiveness through better quality.

**General objective:** Upon completion of this course, students will be able to: connect the different areas of applied chemistry with production and its results; explain the role of extractive activities in the formation of commercial products; explore the various areas and applications of industrial chemistry.

**Key words:** Storage and exposure to the environment. Products, formulae and specifications. Impurities, processes, and prevention. Specification of materials, process, storage, transport, and safety.

**Bibliography:** \* Harold A. Wittcoff. y Bryan G. Reuben, Productos Químicos Orgánicos Industriales vol. 2, Tecnología, Formulaciones y Usos, Editorial Limusa SA de CV.

## Q3002 Instrumental Analytical Chemistry Laboratory

( 0 - 6 - 8. Prerequisites: [ Q3003 , Q2006 , Q2014 ]. 6 INCQ13 )

**Equivalence: Q 00961**

In this advanced course, students will gain the necessary skills to develop and implement instrumental

analysis methods based upon the concept of quality assurance and quality control of the results. It addresses topics related to environmental and economical aspects of sustainable development. This course requires prior knowledge of analytical chemistry and experimental techniques for chemical analysis. Learning outcome: students will be able to operate measuring instruments and process the information provided by the instrument to obtain reliable quantitative results.

**General objective:** Upon completion of this course, students will be able to implement instrumental analytical methods which will allow them to obtain statistically reliable quantitative measurements.

**Key words:** Spectroscopy. Gas chromatography coupled with mass detector, electron capture detector and flame ionization detector. Liquid chromatography coupled with fluorescence, visible-ultraviolet and refractive index detectors. UV VIS and FTIR Spectroscopy.

**Bibliography:** \* A. Alvarez, Experimentos de análisis químico instrumental, ITESM, ESP.

### Q3005 Spectroscopic Analysis (3 - 0 - 8. Prerequisites: [ Q3003 , Q2018 ]. 6 INCQ13) Equivalence: Q 00873

In this advanced course, students acquire the skills to interpret spectroscopic analyses of organic compounds using the combination of mass spectroscopy, nuclear magnetic resonance, infrared spectroscopy, visible ultraviolet spectroscopy techniques. The course addresses topics related to sustainable development in environmental and social contexts. This course requires prior knowledge of analytical and organic chemistry, physical chemistry and quantum chemistry. Learning outcome: Students will be able to identify the structure of organic compounds based on the interpretation of the mass spectroscopy, nuclear magnetic resonance, infrared spectroscopy, visible ultraviolet spectroscopy and the integration of the information provided by these spectral analysis techniques.

**General objective:** Upon completion of this course, students will be able to identify the chemical struc-

ture of unknown organic compounds, and recognize the importance of spectroscopic interpretation for the development of new products.

**Key words:** Nuclear and multinuclear magnetic resonance spectroscopy. Visible infrared and ultraviolet spectroscopy. Interpretation of mass spectrograms. Mass spectroscopy. Interpretation of NMR, IR and UV/VIS spectrums.

**Bibliography:** \* R.M. Silverstein, Spectrometric Identification of Organic Compounds, 7a edición, Wiley International.

### Q3016 Macromolecule Design and Synthesis

( 3 - 0 - 8. Prerequisites: [ Q2013 , IQ2003 ]. 7 INCQ13 )

Equivalence: Q3013

This is an advanced chemistry course in which students will come to know the various modes of synthesis and the characteristics of polymeric materials and understand the structural particularities of the macromolecules that allow for the chemical and physiochemical properties which are critical in the design of important materials in modern technology. This course requires previous knowledge about the relationship between structure and properties, materials' thermal properties, properties of solutions, organic functional groups, and the basic mechanisms of organic reactions. The learning outcome for this course is that students develop syntheses adequate for new macromolecular materials, or that they redesign materials in order to make them more appropriate for a specific purpose.

**General objective:** Upon completion of this course, students will be able to select a synthesis method for a polymer that has the desired properties; choose the necessary monomers and polymerization route; select the required analysis for its characterization, interpret the results and propose chemical or formulation modifications to improve a commercial polymeric material.

**Key words:** Polymer synthesis. Macromolecules. Biopolymers. Polymer design. Characterization of polymers.



**Bibliography:** \* Seymour, Raymond Benedict, 1912-, *Introducción a la química de los polímeros* / Raimond B. Seymour, Charles E. Carraher, Jr., Barcelona : Reverté, c1998., spaeng, [8429179267].

### **Q3017 Molecular Structure and Computer-aided Design** ( 3 - 0 - 8. Prerequisites: [ Q2013 ]. 7 INCQ13 ) **Equivalence: Q3004**

This is an advanced level course, designed to employ advanced concepts of molecular symmetry and orbits and the use of computer tools to visualize, evaluate and predict the properties of inorganic compounds and coordinating and organometallic complexes. Previous knowledge is required in molecular geometry, the concept of acids and bases and the fundamentals of quantum mechanics. The learning outcome for this course is that the students be able to identify the elements and symmetry groups of a molecule and use this information to describe its molecular orbits and to make computerized calculations regarding its structure and electron levels.

**General objective:** Upon completion of this course, students will be able to use computer tools to visualize molecules, optimize their structure and calculate their electronic properties, taking into account the combinations of their atomic orbitals according to their molecular symmetry.

**Key words:** Molecular mechanics. Molecular visualization. Multielectronic atoms. Elements and groups of symmetry. Linear combination of atomic orbitals based on symmetry. Semi-empirical and ab initio methods.

**Bibliography:** \* Leach, Andrew R., *Molecular modeling : principles and applications* / Andrew R. Leach., 2nd ed., Harlow ; Mexico : Pearson/Prentice Hall, 2001., [0582382106],[9780582382107].

### **Q3018 Analytical Biochemistry Laboratory** ( 0 - 6 - 8. Prerequisites: [ Q3002 ]. 7 INCQ13 ) **Equivalence: None**

This is an advanced level course, which enables students to master the methods of physics and the instrumental techniques used in quantitative analysis as it applies to the analysis of molecules of biochemical interest, correctly performing the separation and purification of bio-molecules. Previous knowledge is required in the physicochemical principles of separation, structure and biochemical activity of bio-molecules and in the development of an instrumental analysis technique. The learning outcome for this course is that the students be able to obtain, separate and purify bio-molecules, and apply the appropriate techniques for analyzing bio-molecules, such as sugars, lipids, proteins and nucleic acids.

**General objective:** Upon completion of this course, students will be able to obtain, separate and purify biomolecules from biological materials; separate biomolecules using centrifugation and chromatography; and analyze proteins, molecular complexes, recombinant DNA and enzymatic reactions using spectroscopy and electrophoresis.

**Key words:** Electrophoresis. Physical separation techniques. Chromatographic separation and analysis. Spectroscopic techniques. Enzymatic reactions. Recombinant DNA.

**Bibliography:** \* Boyer, Rodney F., *Biochemistry laboratory : modern theories and techniques* / Rodney Boyer., San Francisco ; México : Benjamin Cummings, c2006., [0805346139],[9780805346138].

### **Q3021 Introduction to Professional Development** ( 2 - 0 - 2. Prerequisites: None. 9 INCQ13 ) **Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied



during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students will acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

### Q3024 Synthesis of Materials and Nanomaterials Laboratory

( 0 - 6 - 8. Prerequisites: [ Q2019 ]. 7 INQC13 )

**Equivalence: None**

It is an advanced level course, which has as intention the development the intellectual and technical skills that enable students to: make the preparation of compounds of interest in inorganic chemistry (ceramics, nanomaterials, metal complexes, organometallic and bioinorganic compounds); determine their properties chemical and structural; evaluate the synthetic methods used and establish the determinants factors of the quality of the products. Requires previous knowledge of the basics of material properties, chemical reactivity and materials characterization methods and nanomaterials. As learning outcomes it is expected that the student is able to synthesize and characterize nanostructured inorganic materials and macro ; understand the importance of inorganic chemical substances whose production have an impact on society, in terms of production, application and added value and; the development of new technologies and nanotechnological applications. He/she will acquire the necessary knowledge to preserve the environment, handle chemical reagents properly and manage and developing new production processes that meet current regulations.

**General objective:** After completing the course, students will be able to synthesize, isolate, purify and characterize advanced materials and nanomaterials applying different chemical synthesis techniques. He/She will be able to perform experimental procedures following closely health and safety rules. He/She will able to work in a collaborative environment.

**Key words:** Synthetic techniques of molecular materials. Property-oriented and application oriented synthesis of materials and nanomaterials. Synthetic techniques of materials. Synthetic techniques of nanomaterials.

### Q3025 Nanotechnological Formulation for Industry

( 3 - 0 - 8. Prerequisites: [ Q2019 ]. 8 INQC13 )

**Equivalence: None**

It is an advanced level course where students learn the importance of nanomaterials and their applications in the design of consumer products. He/She will have an insight on the current situation of nanotechnology engineering in Mexico and in the world, considering various factors such as the overall status of nanotechnology applications, its projection in the future and its risks in business and emerging markets; the competitiveness of nanotechnology products, as a niche market and source of employment, development and feasibility of nanotechnology projects. Requires basic materials and nanomaterials chemistry, physical chemistry, synthesis and characterization of nanomaterials and be able to develop methods of analytical chemistry. As learning outcomes it is expected that the student: knows the basic principles for the development of formulated products, from conception to manufacture and acquires an overall formative base on the development of a nanotechnological product and its processes , the critical control points in manufacturing of materials or products with nanotechnological components, as well as a knowledge base in the areas of nanotechnology formulations forefront, risks, regulations and ethical implications.

**General objective:** After completing the course the student will know the basic principles for the development of formulated products, from conception to manufacturing and will acquired knowledge on the

overall development of a nanotechnological product and its manufacturing process, the critical points manufacturing and physicochemical controls on the manufactured materials or products with nano components, as well as a base of knowledge in the areas of nanotechnology formulations forefront, risks, regulations and ethical implications.

**Key words:** Development of nanoformulations. Nanotechnology projects. Applications of nanomaterials and nanointermediates in product development.

### **Q3026 Research Project in Chemistry and Nanotechnology**

**(3 - 0 - 8. Prerequisites: [ Q2019 , Q3002 ]. 8 INCQ13 )**  
**Equivalence: None**

It is an advanced level course, whose intention is to develop in students the skills of research, analysis and synthesis of information for the preparation of a research proposal. This course will address topics that represent an innovation to sustainable development and the application of chemistry and nanotechnology to make a contribution in the scientific, economic and social. Requires the previous knowledge acquired during his/her undergraduate studies. As learning outcome the student prepares and presents a research proposal from a critical analysis of bibliographic information relevant and current, also considering the time and resources available to you.

**General objective:** After completing the course, students will be able to apply the strategies followed in the process of scientific and applied research in chemistry and nanotechnology, dominate their field of research and application, based on self-learning, write and present a research proposal based on the literature review to establish the experimental methodology for the implementation of its research and development project.

**Key words:** Research methodology. Writing projects, scientific texts or popular science. Effective use of information sources. Flexible document management. Preparation and presentation of a research proposal.

### **Q3027 Macromolecular Engineering Laboratory**

**( 0 - 6 - 8. Prerequisites: [ Q3016 Corequisite , Q3016 ]. 8 INCQ13 )**

**Equivalence: None**

It is an advanced level course that is intended to teach students how to design, prepare, characterize and apply the macromolecular materials through experiences with an emphasis on collaborative learning and the problem base learning (PBL) and project oriented learning (POL) techniques. The course covers topics related to sustainable development in environmental and economic aspects. Requires prior knowledge of organic synthesis, physical chemistry and analytical chemistry, fundamental management of synthesis laboratory equipment, analytical techniques, basic statistics and experimental design, safety, bibliography search and management of databases. As a result of the learning process, the student develops an innovation project where she designs polymer synthesis under conditions of varying restrictions based on previous information search, including patents. Furthermore, the student acknowledge and explains the versatility macromolecular materials have in their applications.

**General objective:** After completing the course, students can describe and interpret the principles involved in the macromolecular design engineering. Identify, use and interpret different alternatives for design, synthesis and characterization of polymers. Understanding the extent of use of polymer materials. Recognize and explain the versatility that polymeric materials have in their applications mainly those related with nanotechnology. Explain, through effective communication, oral and written, the developmental stages of an innovation project of a polymeric material from its conception to its end use.

**Key words:** Polymers. Polymer synthesis. Solution polymerization. Emulsion polymerization. Condensation polymerization. Suspension polymerization.

**Bibliography:** \* E. Sanchez, R. Peña, Química de Polímeros. Prácticas.

### Q3028 Medicinal Chemistry and Nanomedicine

( 3 - 0 - 8. Prerequisites: [ Q3017 ]. 8 INCQ13 )

Equivalence: None

It is an advanced course that directs the student to the integration his/her knowledge of organic chemistry, physical chemistry, biochemistry, biology and nanotechnology as tools for the development and synthesis of drugs and leads to advanced studies addressing aspects of medicinal chemistry and nanomedicine including: The discovery of active ingredients, the chemical structure related to biological activity, pharmacokinetic models, synthesis strategies and the laws governing the distribution and consumption. Requires prior knowledge of organic synthesis, reaction mechanisms, chemical kinetics, molecular biology, biochemistry, metabolic pathways, visualization and computational design, principles of nanotechnology, nanomaterials mainly. As learning outcome the student is able to apply his/her knowledge of synthesis, biochemistry and molecular biology to the design and synthesis and formulation of molecules that are active or drug delivery vehicles as well as to carry out the evaluation of the manufacturing processes, formulation and validation of new drugs.

**General objective:** The aim of the course is that students will be able to assess the process of drug discovery and understand the importance of interactions between the active principle and the cell structure on which it has its therapeutic action. She/He will be able to apply her/his knowledge of molecular engineering, synthesis, biochemistry and computational design to evaluate the feasibility of a synthesis process of a new drug through proposed new structures for improving the activity of an active ingredient. Additionally, basic knowledge will be acquired on current strategies on Nanomedicine such as controlled drug delivery dependent on the physicochemical properties of nanomaterials used for this purpose.

**Key words:** Drug Delivery Systems. Structure Activity Relationship. Receptors and ligands. Principles of pharmacology and pharmacokinetics. Applications of nanomaterials in medicinal chemistry.

**Bibliography:** \* Textbook of drug design and discovery / [edited by] Povl Krogsgaard-Larsen, Tommy Liljefors, and Ulf Madsen., 3rd ed., London ; New York : Taylor & Francis, 2002., [041528287X (HB)], [0415282888 (PB)].

### Q3029 Integration Project in Chemistry and Nanotechnology

( 9 - 0 - 24. Prerequisites: [ Q3026 ]. 9 INCQ13 )

Equivalence: None

It is an advanced level course in which it is intended for students to develop the experimental part of a research project in the area of chemistry (whose proposal was presented and approved during Research Project in Chemistry and Nanotechnology course). In this project the student is encouraged to apply the knowledge acquired during their undergraduate studies, document his/her project by preparing a written document (thesis) and report his/her results through the development of a scientific research poster. As learning outcome the student will: successfully lead a research project; analyze experimental data and report the results in written and oral, before an audience both general and specialized committee.

**General objective:** After completing the course, students will be able to perform the experimental part of a research project or development in the area of chemistry or nanotechnology, document their project by developing a brief and poster. Be subjected to the defense of his/her results in front of an evaluating committee and the general public to the scientific contributions and achievements of the project. Publish and present the project in at least one research conference.

**Key words:** Experimental development of a scientific or technological project. Written presentation, oral and poster as results of research project. Disclosure and publication of results of research projects.

## RH Human Resources

### RH1000 Organizational Behavior and Human Talent Development

( 3 - 0 - 8. Prerequisites: None. 5 IDS11, 2 INT11, 4 LAE11, 4 LCDE11, 3 LCPF11, 5 LCS11, 3 LDN11, 3 LEM11, 3 LIN11, 5 LLN11, 6 LP 12, 6 LPS12 )

**Equivalence:** None

This is a course to introduce students to the organizational behavior field to study human behavior at work by using traditional and competency-based models. Expected learning outcomes of this course are core competencies reports related to organizational behavior as well as written proposals to enhance organizational competitiveness based on human talent in diverse business areas.

**General objective:** At the end of the course students will be able to identify key elements of work behavior by developing personal skills to incorporate human factor issues into organizational decision making.

**Key words:** Organizational behavior. Effective teamwork. Organizational change and culture. Talent attraction, retention and development.

**Bibliography:** \* Griffin, Ricky W., Organizational behavior : managing people and organizations / Ricky W. Griffin, Gregory Moorhead., 8th ed., Boston : Houghton Mifflin Co., c2007., [0618611584 (student text : encuadernado)], [9780618611584 (student text : encuadernado)], [9780618732128 (instructor's exam ed.)], [0618732128 (instructor's exam ed.)].

### RH3006 Strategic Training Management

( 3 - 0 - 8. Prerequisites: [ CC2007 Corequisite , CC2007 ]. 7 LP 12, 7 LPS12 )

**Equivalence:** RH00883, RH95883

Advanced course oriented to training process consultancy based on an understanding of the relations existing between training and results with human capital retention and potentialization strategies in business. It requires knowledge in the different teaching-learning methods and evaluation and observation methods.

**General objective:** Upon completion of this course, students will be able to advise on the implementation of training processes with innovative strategies according to the organization's needs and within a legal framework. Furthermore, they will be able to evaluate these training processes.

**Key words:** Training processes. Training indicators. Strategic planning for training. Learning facilitation. Legal framework of training.

**Bibliography:** \* Pinto Villatoro, Roberto, Proceso de capacitación / Roberto Pinto Villatoro, 2a ed., México : Diana , c1992, Mexico, c1992, spa, [9681322711].

### RH3012 Human Capital Attraction and Retention

( 3 - 0 - 8. Prerequisites: [ CC2014 ]. 8 LP 12, 6 LPO11 )

**Equivalence:** RH3003

Advanced course about the functions of the human resources area that comprise the employment process and the other functions related to the work environment where employees perform their work within the organization. It includes concepts such as personnel forecasts, job profiles, person, employee motivation and evaluation of the human talent of the people within organizations. Learning outcome: students will be able to make predictions of human resources requirements in terms of company strategy; design job profiles and employee profiles, in order to scan the appropriate channels and filters for achieving the recruitment of the most suitable staff for the organization; and design employee motivation schemes that achieve retention within the organization.

**General objective:** Students will be able to: Understand the impact that each function in the human resources area has on the employment process as well as the process of designing attractive schemes for keeping employees in organizations, providing them with decent working conditions and development.

**Key words:** Strategic human capital planning. Talent attraction. Human resource selection and re-

cruitment. Talent retention. Human talent potential assessment and performance analysis.

**Bibliography:** \* La gestión estratégica de los recursos humanos / Antonio Aragón Sánchez. [et al.] ; coord. Ramón J. Valle Cabrera., 2a ed., Madrid : Prentice-Hall, 2003., [8420536733].

### RH3013 Performance Evaluation

( 3 - 0 - 8. Prerequisites: [ CC2014 ]. 8 LP 12, 7 LPO11 )

**Equivalence:** RH3004

Advanced course in human resources management oriented to the knowledge and application of the different techniques used for performance evaluation in the work area. The course covers topics related to sustainable development, such as employment and unemployment and equity. As a learning outcome, students will be able to develop a complete evaluation manual for performance within the organization.

**General objective:** Upon completion of this course, students will be able to apply the diverse work performance evaluation techniques, and to generate a performance manual with all its components.

**Key words:** Job analysis. Job design and job evaluation. Objectives of performance evaluation.

**Bibliography:** \* Werther, William B., Administración de recursos humanos : el capital humano de las empresas / William B. Werther, Jr., Keith Davis ; traducción y adaptación de Joaquín Mejía Gómez., 6a ed., en español., México, D. F. : Mc Graw Hill, 2008., spaeng, [9701059131],[9789701059135].

### RH3014 Industrial Security and Labor Relations

( 3 - 0 - 8. Prerequisites: [ D1002 ]. 8 LPO11 )

**Equivalence:** RH3009

Advanced course that provides students with the knowledge and tools for analyzing the labor relations process, the applicable regulatory framework, safeguarding employees' wellbeing. As a learning outcome, students will diagnose management-employee-union labor relations, and plan occupational

health and safety strategies and actions that will contribute significantly to companies' competitiveness.

**General objective:** Upon completion of the course, students will be familiar with and able to apply rules and laws relating to hygiene and safety in the organization. They will be able to build labor relations which will allow them to carry out collective bargaining negotiations, identifying and solving disputes arising from the employer-employee relationship.

**Key words:** Security and hygiene. Labor relations. Trade unions and collective bargaining. Safety and hygiene regulatory framework.

**Bibliography:** \* Muñer de la Lama, Enrique., Dirección de relaciones laborales / Enrique Muñer de la Lama., 4a ed., México : Trillas, 1998., [9682456460].

### RH3015 Management Compensations

( 3 - 0 - 8. Prerequisites: [ D1002 , CF1008 ]. 9 LP 12, 8 LPO11 )

**Equivalence:** None

Advanced course in the area of human resource management where students will develop a comprehensive strategic vision of compensation in organizations to apply the most appropriate model according to the needs of the organization. It includes concepts of individual employee perspectives, aspects of the job, individual performance and organizational results. It requires prior knowledge of employment law. As a learning outcome, the students are expected to design a strategic compensation management model that favors the attraction and retention of employees and their contribution to achieving organizational results.

**General objective:** Students will be able to develop and evaluate an effective system of compensation management aligned to the company's strategy to help attain and maintain internal impartiality and external competitiveness in the payment of salaries and fringe benefits so that the organization is able to attract, retain and keep employees motivated, thus contributing to the achievement of the organization's objectives.

**Key words:** Compensation. Wages. Design tab.



**Bibliography:** \* Varela Juárez, Ricardo Alfredo., Administración de la compensación : sueldos, salarios y prestaciones / Ricardo A. Varela Juárez., 1a ed., México : Pearson Educación, 2006., [9702607000], [9789702607007].

### **RH3016 Organizational Development I** ( 3 - 0 - 8. Prerequisites: None. 8 LP 12, 8 LPO11 ) Equivalence: RH3007

Advanced course in the area of human resource management teaching the basics, origins, processes, diagnostic and organizational development tools as a form of planned change in institutions. It includes terms and concepts related to the subject through study, research and case analysis. It requires knowledge of organizational behavior, operations and general management of institutions (organizations). As a learning outcome, students will perform an organizational diagnosis at an institution or organization using the tools for obtaining appropriate information and propose the best intervention practices according to the inquiry.

**General objective:** Students will be able to understand the bases and evolution of organizational development, its methodology and organizational applications in institutions. They will also analyze the disciplines that foster organizational development and the various processes involved, the learning methods, the establishment and evaluation of organizational culture, the different tools for gathering information and building diagnostic models, as well as the various strategies for change in a specific scenario.

**Key words:** Organizational culture. Organizational development. Intervention processes. Consulting principles.

**Bibliography:** \* Gardner, Howard., Mentas flexibles : el arte y la ciencia de saber cambiar nuestra opinión y la de los demás / Howard Gardner., 1a ed., México : Paidós, 2005., spaeng, [9688535842].

### **RH3017 Organizational Development II**

( 3 - 0 - 8. Prerequisites: [ RH3016 ]. 9 LP 12, 9 LPO11 )

Equivalence: RH3008

In this advanced course, students carry out a real intervention in organizational development, incorporating into their learning the analysis of the components required for a successful intervention in the different organizational ambits. It is therefore offered in the modality Development Support Course (DSC), thus allowing them to come into contact with the entrepreneurial reality of our country.

**General objective:** Students will be able to apply to different scenarios the processes, technology, and strategies of organizational development interventions, generating a strategic and systematic way of approaching problems and solutions related to the process of change.

**Key words:** Consulting activities. Technology and process of D.O. D.O. interventions. Human process interventions. Strategic interventions.

**Bibliography:** \* Cummings, Thomas G., Essentials of Organization development and change / Thomas G. Cummings, Christopher G. Worley., Cincinnati, Ohio : South-Western College Pub., 2001., [0324023995 : PAP],[53.95].

### **RH3018 Strategic Management of Human Resources**

( 3 - 0 - 8. Prerequisites: None. 9 LPO11 )

Equivalence: RH3010

Capstone and advanced course. The main intention of the course is to provide students with a space to integrate the knowledge gained throughout their studies, by reflecting on their work as an organizational psychologist in Mexican and international organizations, resolving human resource strategy cases, exploring the different variants for approaching personnel management issues and analyzing trends in human resources.



**General objective:** Students will be able to: Understand the concept of human capital strategic planning and its relationship with strategic business planning. Develop a human capital strategic plan aligned to the company's strategic planning, including elements of talent attraction, development, replacement and succession.

**Key words:** Human capital planning. Competency management in a strategic human resources plan. Succession plan. Strategic planning of human resources in family businesses. Strategic planning.

**Bibliography:** \* Bohlander, George W., Administración de recursos humanos / George Bohlander, Scott Snell., 14a ed., México : International Thomson, c2008., spaeng, [9706867120],[9789706867124].

## RI International Relations

### RI1004 International Politics

( 3 - 0 - 8. Prerequisites: None. 2 LCS11, 2 LDF11, 1 LED11, 3 LIN11, 2 LMI11, 2 LPL11, 3 LPO11, 2 LRI11 )

**Equivalence:** RI00812, RI95812, RI99812

The purpose of this introductory course of international relations is to contribute to the creation of a historical perspective, present students to the analysis of the most important historical processes of the 19th century that contributed to the modern age. No previous knowledge required. The learning outcome of the course is for students to prepare research and/or critical essays which demonstrate a clear understanding and a well-grounded and documented analysis of a historical process. The historical methodology tools used are: bibliographic research, analysis and evaluation of sources, critical reflection and the ability to synthesize.

**General objective:** Upon completion of this course, students will be able to diagnose and analyze international policies: the various participants, the causes of war and peace, proposals for national and collective security, as well as the themes of new international policies such as the economy, the environment, migration and technological changes.

**Key words:** International security. Multiculturalism. Cooperation. International politics. Hegemony. International actors. War and peace. Multipolarity. Globalization. Human Rights.

**Bibliography:** \* Karen Mingst, Essentials of International Relations, 3a, Norton.

### RI1008 World History of the 19th Century

( 3 - 0 - 8. Prerequisites: None. 1 LCS11, 3 LLE11, 1 LPL11, 1 LRI11 )

**Equivalence:** None

The purpose of this basic social science course is to contribute to the creation of a historical perspective, introducing students to the analysis of the most important historical processes of the 19th century that

created the Modern Age. No previous knowledge required. The learning outcome of the course is for students to prepare research and/or critical essays which demonstrate a clear understanding, a well-grounded and documented analysis of a historical process. The tools of historical methodology are used: bibliographic research, analysis and evaluation of sources, critical reflection and the ability to synthesize.

**General objective:** Upon completion of this course, students will be able to use historical analysis to identify and evaluate the processes of political evolution and transformation of the socioeconomic structure that characterized the 19th century and contributed to the construction of modern societies.

**Key words:** Colonialism. Nationalisms. First World War. Liberal revolutions. Imperialism. Socialism and marxism. Social conflicts. Industrialisation and industrial society. Liberalism and democracy.

**Bibliography:** \* Hobsbawm, E. J. (Eric J.), 1917-, La era del imperio, 1875-1914 / Eric Hobsbawm., Buenos Aires : Crítica, Grijalbo Mondadori 1998., [9879317025].

### RI1009 Introduction to International Relations Academic Program

( 3 - 0 - 4. Prerequisites: None. 1 LRI11 )

**Equivalence:** None

The purpose of this basic course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is that students achieve a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of a graduate from the major in which they are enrolled, including competencies, career field and professional development. They will also know the organizational structure of the Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* ITESM, Legislación académica para los alumnos de carreras profesionales, Español.

### **RI2007 Legal Aspects of International Relations**

**( 3 - 0 - 8. Prerequisites: None. 5 LRI11 )**

**Equivalence: D 00878, D2016**

Intermediate international relations course that teaches students the legal system that regulates relations between diverse international community actors (States, NGOs, Multinationals, etc.) and the process of formulating and applying treaties, the regulation of diplomatic and consular relations, and of land and maritime space, the environment, the settling controversies mechanisms and the observance of human rights in an international context. This course requires prior knowledge of international relations theory and a grasp on the leading actors in the world scenario. Learning outcome: students will assess the application of legal instruments in a concrete international relations' case.

**General objective:** Upon completion of this course, students will be able to comprehend the legal ordinances which govern relations among diverse international entities. They will also analyze the wide range of topics covered by this branch of law and its importance to international relations.

**Key words:** International treaties. Diplomacy. International law. International controversies.

**Bibliography:** \* Castro Villalobos, José Humberto., Derecho internacional público / José Humberto Castro Villalobos, Claudia Verónica Agramón Gurrola., Oxford University Press, México , 2002, spa, [9706134328].

### **RI2008 North American Regional Scenario**

**( 3 - 0 - 8. Prerequisites: None. 6 LMI11, 5 LPL11, 6 LRI11 )**

**Equivalence: RI00881, RI95881, RI99881**

Intermediate international relations course that provides students with the knowledge required to analyze the consequences of North America's economic, political and social models in the 20th and 21st centuries, and also to understand the concept of a North American zone that includes the United States, Canada and Mexico. This course requires prior knowledge of 20th century world history. Learning outcome: students will perform simulations, role-play, and generate country profiles and/or research projects that demonstrate their understanding of the political, economic, social and cultural logic of the region and the way in which this is introduced into the global dynamic, and subsequently generate analyses of the same.

**General objective:** Upon completion of this course, students will be able to investigate, analyze, and critically evaluate political, economic, social and foreign policy aspects of the North American region.

**Key words:** Multiculturalism. Migration. Regional integration. Regional security. Political and economic society in North America. Borders.

### **RI2012 Latin American and Caribbean Regional Scenario**

**( 3 - 0 - 8. Prerequisites: None. 7 LLE11, 5 LMI11, 6 LPL11, 5 LRI11 )**

**Equivalence: RI00871, RI95871, RI99871**

Intermediate international relations course that provides students with the knowledge required to analyze contemporary Latin-American social, economic and political reality in the Latin-American and Caribbean region. This course requires prior knowledge of 19th- and 20th-century world history. Learning outcome: students will be able to understand the complexity of the region and identify the leading processes and trends in the area's economy, society, politics and international relations. Learning outcome: students will complete research work on a process,

issue or country in Latin America and the Caribbean, placing particular emphasis on situations of interest today.

**General objective:** Upon completion of this course, students will be able to investigate, analyze, and critically evaluate political, economic, social and foreign policy aspects of the Latin American region.

**Key words:** Democratic transition. Development and dependency. Import-substituting industrialization. Economic liberalization. Regionalism. Uneven modernization. Poverty and marginalization. Regional security. Change, revolution and crisis. Relations with the United States.

**Bibliography:** \* Bulmer-Thomas, V., La historia económica de América Latina desde la independencia / Víctor Bulmer-Thomas; traductor Mónica Utrilla de Neira., México : FCE, 1998., Mexico, 1998., spa, [9681651316].

### **RI2013 Europe Regional Scenario** ( 3 - 0 - 8. Prerequisites: None. 7 LMI11, 6 LRI11 ) **Equivalence: RI00852, RI95852, RI99852**

In this intermediate international relations course, students will gain the capacity to analyze the reality of the European scenario. This course requires prior knowledge of contemporary world history. Learning outcome: students will perform simulations and role-playing, and generate country profiles and/or research projects that demonstrate their capacity to diagnose, analyze and compare the diverse, complex processes that exist in the European regional scenario.

**General objective:** Upon completion of this course, students will be able to investigate, analyze, and critically evaluate political, economic, social and foreign policy aspects of the European region.

**Key words:** European Union. Nationalisms. Migration. International politics. Eastern Europe. Political social issues. Unemployment. Security and the international role of the European Union.

**Bibliography:** \* Ochman, Marta, El occidente dividido: las relaciones bilaterales entre Estados Unidos y Europa, Porrúa, Tecnológico de Monterrey, español.

### **RI2014 International Organizations and Institutions**

( 3 - 0 - 8. Prerequisites: None. 6 LCS11, 7 LRI11 )  
**Equivalence: RI00821, RI95821, RI99821**

Intermediate international relations course in which students will understand the constitution and activities of international organizations and their associated subjects and actors. The latter will be done in order to analyze their influence on the international system and on the creation of international standards. This course requires prior knowledge of the legal aspects of international relations. Learning outcome: students will write an essay or a case study of the constitution and activities of an international organization, using the concepts learnt within the course.

**General objective:** Upon completion of this course, students will be able to understand and analyze the role international entities, coordinating mechanisms, and non-governmental organizations play on the international scene. They will also evaluate their influence and participation in global politics and the generation of norms and legislation which regulate international relations.

**Key words:** United Nations system. International organizations. Non-governmental organizations. Regional organizations. International civil society. Pressure groups.

**Bibliography:** \* Yoder, Amos, The evolution of the United Nations system / Amos Yoder, 3rd ed, Washington, DC : Taylor & Francis, c1997, District of Columbia, c1997, eng, [1560325453 (case : acid-free paper)], [1560325461 (paper : acid-free paper)].

### **RI2015 Foreign Policy Analysis** ( 3 - 0 - 8. Prerequisites: [ RI2010 , RI3016 ]. 8 LRI11 ) **Equivalence: RI00842**

In this intermediate international relations course, students will gain knowledge of the internal and external factors that affect the formulation and implementation of the foreign policy of the diverse actors in the international community, applying the tools developed by doctrine for the comparative analysis of the same. This course requires prior knowledge of international relations theories. Learning outcome: students will complete a case study in which they compare the foreign policies of at least two States, using the theoretical-methodological instruments acquired during the course.

**General objective:** Upon completion of this course, students will know the general guidelines that each country has produced for the analysis of foreign policies, and apply them to the study of different international entities' specific policies, emphasizing their coincidences and divergences and, particularly, the way in which their design and execution are influenced by geopolitics, economics, and various permanent and temporary factors.

**Key words:** National security. Foreign policy. Diplomacy.

**Bibliography:** \* Almond, Gabriel A. (Gabriel Abraham), 1911-2002., Comparative politics : system, process, and policy / Gabriel A. Almond, G. Bingham Powell, Jr., 2nd ed., Boston : Little, Brown, 1978., [0316034983].

### **RI2016 Asia Pacific Regional Scenario** ( 3 - 0 - 8. Prerequisites: None. 8 LMI11, 7 LRI11 ) **Equivalence: RI00851, RI95851, RI99851**

Intermediate international relations course that provides students with an overview of the region of Asia, and enables them to know, analyze and evaluate its historical, political, social and cultural processes. This course requires prior knowledge of 19th- and 20th-century world history and of the contemporary dynamics of the global scenario. Learning outcome:

students will be able to appreciate and evaluate the complexity and diversity of the issues currently existing in Asia and its role in the contemporary international scenario in order to present research projects and analyses of this region and its countries.

**General objective:** Upon completion of this course, students will be able to recognize the main philosophical and religious debates which occurred in Asia from the sixth century B.C. to the sixth century A.D. Students will also be able to analyze the conformation of the most important periods and dynasties in China, Japan, Korea, India, and Southeast Asia. Finally, students will analyze the most important political and economic processes in Asia from the arrival of the European powers to the present.

**Key words:** History. Regionalization. Political science. Social sciences. Globalization. Philosophies. Religions. Economy.

### **RI2017 Middle East Regional Scenario** ( 3 - 0 - 8. Prerequisites: None. 9 LRI11 ) **Equivalence: RI00861, RI95861, RI99861**

In this intermediate international relations course, students will gain a vision of one of the planet's strategic regions. This course requires prior knowledge of world history and geopolitics. Learning outcome: students will write essays and produce research projects in which they will evaluate Middle-Eastern political, social and cultural processes.

**General objective:** Upon completion of this course, students will be able to investigate, analyze, and critically evaluate the political, economic, and social aspects of international politics in the Middle East.

**Key words:** Arabism, Islamism, Fundamentalism. Pan-Arabism, Zionism, Judaism. Oil and global energy trading. Middle East and cultural diversity.

**Bibliography:** \* Zéraoui, Zidane., Islam y política : los procesos políticos árabes contemporáneos / Zidane Zeraoui., 4a ed., México, D.F. : Trillas ; Monterrey, N.L. : ITESM, Universidad Virtual, 2008., [9789682480867].

## RI2028 History of Independent Mexico

( 3 - 0 - 8. Prerequisites: None. 1 LCS11, 1 LLE11, 1 LMI11, 1 LPL11, 1 LRI11 )

**Equivalence:** RI00841

The purpose of this intermediate social science course is to provide students with an overview of the institutions and principal historical, political, economic and social processes in 19th-century Mexico, with special emphasis on the consolidation of modern Mexico. No previous knowledge required. The learning outcome of this course is for students to prepare reports on readings from bibliographic resources in which they demonstrate their ability to distinguish various historical approaches to Mexico's political, social and economic evolution in the 19th century and develop their own criteria with regard to the process of constructing the national State, identifying reformist and liberal approaches for establishing a modern nation.

**General objective:** Upon completion of this course, students will be able to: recognize the main economic, political and social events and processes that occurred from the beginnings of the struggle for independence to the Revolution in Mexico; identify and assess the nature and scope of the national projects of the liberals and conservatives in Mexico; consider the international implications of the policies adopted during the 19th century; evaluate the ideological and economic modernity of Porfirio Diaz's regime and the factors that motivated the Mexican Revolution, thus developing their research, analysis and source criticism capacities.

**Key words:** Political history of Mexico. Social history of Mexico. International interventions. Construction of the modern state. Revolution.

**Bibliography:** \* Bazant, Jan., Breve historia de Mexico de Hidalgo a Cárdenas, (1805-1940) / Jan Bazant., 4a ed., México, D.F. : Ediciones Coyoacán, 2000., [9706330577].

## RI2029 History of Contemporary Mexico

( 3 - 0 - 8. Prerequisites: None. 2 LCS11, 2 LEC11, 2 LEF11, 2 LLE11, 2 LMI11, 2 LPL11, 2 LRI11 )

**Equivalence:** RI2004

The purpose of this intermediate-level social science course is to provide students with a general overview of the economic, political and social development of Mexico in the 20th century. No previous knowledge required. The learning outcome of this course is for students to prepare short essays, debates about concrete problems or research work on change processes in Mexico, starting with the Revolution of 1910.

**General objective:** Upon completion of this course, students will be able to understand and evaluate the political, economic and social processes of contemporary Mexico.

**Key words:** Democratic transition. Political parties. Cultural identity. Constitution of 1917. Revolutionary nationalism. Role of the church. Urbanization, marginalization, poverty, indigenous issues. Protectionism and stabilizing development. Social liberalism. Economic liberalization. Alternation and citizen participation.

**Bibliography:** \* Historia general de México / obra preparada por el Centro de Estudios Históricos ; Ignacio Bernal . [et al.], 1a ed., versio´n 2000., México : El Colegio de México, Centro de Estudios Históricos, 2000., [9681209699],[9681200861].

## RI2030 World History of the 20th and 21st Centuries

( 3 - 0 - 8. Prerequisites: None. 2 LCS11, 4 LLE11, 4 LMI11, 2 LPL11, 2 LRI11 )

**Equivalence:** None

The purpose of this intermediate social science course is to introduce students to critical analysis of the principal historical processes that make up the contemporary world and contribute to the understanding of the diversity and complexity of 21st-century societies. No previous knowledge is required. The learning outcome of this course is for students to prepare research work and/or short critical essays an-



alyzing the meaning and relevance of historical processes that contributed to the shaping of the current world. In order to achieve this, students use specific historical methodology tools: bibliographic research, analysis and evaluation of sources, critical reflection and the ability to synthesize.

**General objective:** Upon completion of this course, students will be able to identify and analyze, from a historical and critical perspective, the main evolutionary processes, actors and the central themes that characterized the 20th century, in order to gain a better understanding of the society in which they live and reflect on the relevance of the major challenges of the world today.

**Key words:** The World Wars. Totalitarianisms. Communisms. Socialisms. Bipolar order. Space and arms race. Decolonization and revolutions in the third world. Non-aligned nations. European construction. International institutions/Supranational. Disintegration of the USSR. Multipolar order.

**Bibliography:** \* Hobsbawm, E. J. (Eric J.), 1917-, *Historia del siglo XX : 1914-1991* / Eric Hobsbawm ; traducción castellana de Juan Faci, Jordi Ainaud y Carme Castells., 5a ed., Barcelona : Crítica, 2003., spaeng, [8484320421 (rústica)], [8474237122].

## RI2031 Geopolitics and Global Changes

( 3 - 0 - 8. Prerequisites: [ RI1004 ]. 4 LIN11, 3 LRI11 )  
Equivalence: RI1005

The purpose of this intermediate international relations course is to provide students with the necessary knowledge for identifying regional scenarios within the global order. Its central purpose lies in the application of a categorical apparatus, provided by political science, for the phenomena that currently define the political players, beginning with their geographic location and strategic importance. It requires previous knowledge of political science. The learning outcome of this course is for students to complete written analyses of the principle geopolitical problems in order to understand the structure and functioning of international order, starting with the factors the discipline affords. Students also make prognoses regarding future scenarios on the world map.

**General objective:** Upon completion of this course, students will be able to perceive, analyze and interpret events, processes and phenomena in the global political scenario from a specific geopolitical and geostrategic perspective. The course focuses in particular on the causes of international conflicts, their development and possible solution. Students will also obtain clear, precise information on the distribution and exploitation of natural resources and their relationship with the use of force to take control of the areas that possess them.

**Key words:** Environment. Space and geopolitics. Geopolitical order. Natural resources. Biodiversity. Globalization. Hegemony. Geoeconomics.

**Bibliography:** \* Flint, Colin (Colin Robert), Introduction to geopolitics / Colin Flint., London : Routledge, 2006., [0415344948 (encuadernado : papel alcalino)], [041534493X (rústica : papel alcalino)], [9780415344944 (encuadernado : papel alcalino)], [9780415344937 (rústica : papel alcalino)].

## RI2032 International Relations Theory I

( 3 - 0 - 8. Prerequisites: [ H1026 Corequisite , RI2031 ]. 5 LRI11 )  
Equivalence: RI2006

The purpose of this intermediate international relations course is to introduce students to an understanding of the theoretical-methodological concepts of the discipline which support political and social action. It requires previous knowledge of political theories. The learning outcome of this course is for students to develop a critical essay analyzing distinct currents of thought that have influenced international foreign policy formulation and governmental response.

**General objective:** Upon completion of this course, students will be able to analyze the main critical thinking schools of thought, paradigms and theories that have influenced international events and apply them, based on a critical assessment, to diverse regional scenarios.

**Key words:** Liberalism. Debates. Schools of thought. Paradigms. Realism. State-centrism.

**Bibliography:** \* Arenal, Celestino del., *Introducción a las relaciones internacionales* / Celestino del Arenal, 4a. ed., Madrid : Tecnos, 2007., [9788430945894].

**RI2033 Mexican Foreign Policy**  
( 3 - 0 - 8. Prerequisites: None. 8 LPL11, 7 LRI11 )  
**Equivalence: RI2011**

The purpose of this intermediate international relations course is for students to analyze the process of formulation and execution of Mexico's foreign policy throughout the history of the country's international relations. It requires previous knowledge on Mexico's independence and contemporary historical processes. The learning outcome of this course is for students to develop a research essay that demonstrates their ability to evaluate Mexico's foreign policy from an analytical perspective.

**General objective:** Upon completion of this course, students will be familiar and will be able to analyze Mexico's foreign policy throughout its history, identifying the actors and factors that have influenced its formulation and implementation, while evaluating the country's standpoint on topics included in the world agenda.

**Key words:** National interest. Mexico's foreign relations. Multilateral Mexican relations. Bilateral Mexican relations. International negotiations.

**Bibliography:** \* México frente a las grandes regiones del mundo / Víctor López Villafaña, Carlos Uscanga, coordinadores., 1a ed., México : Siglo Veintiuno, 2000., [9682322871].

**RI2034 Negotiation and Conflict Management**  
( 3 - 0 - 8. Prerequisites: None. 6 IDS11, 6 LP 12, 9 LPL11, 6 LPS12, 9 LRI11 )  
**Equivalence: RI3004**

The purpose of this intermediate course in international relations is to familiarize students with the theories and concepts of negotiation and conflict resolution as well as to develop practical abilities for preparing and executing these processes. The emphasis will be on theoretical negotiation tools

and practices for resolving political and social conflicts in both public and private, national and international contexts. It requires previous knowledge of the contemporary international system. The learning outcome of this course is for students to perform simulations, role plays and/or research in which they demonstrate their ability to diagnose political, economic, social and cultural problems as well as carry out negotiation processes with integrating strategies that consider multiculturalism and innovation.

**General objective:** Upon completion of this course, students will be able to apply the leading negotiation and conflict resolution theories; diagnose political, economic, social and cultural issues; implement an integral negotiation strategy; and implement a conflict resolution strategy.

**Key words:** Negotiation process. Mediation. Negotiation theories. Typology of conflicts. Controversy resolution mechanisms.

**Bibliography:** \* Raiffa, Howard, 1924-, *The art and science of negotiation* / Howard Raiffa., Cambridge, Mass. : Belknap Press of Harvard University Press, 1982., [0674048121].

**RI3002 Africa Regional Scenario**  
( 3 - 0 - 8. Prerequisites: None. 8 LRI11 )  
**Equivalence: RI00883, RI99883**

Advanced international relations course in which students acquire a multicultural, interdisciplinary vision. Students will be able to locate the African continent in a geographical sense (countries, zones climates, vegetation) and demographical sense (for example, population growth statistics and their link to poverty). Students will know about its historical evolution from pre-colonial to the present times and analyze the current major problems of the continent, such as foreign debt, AIDS and conflicts, among others. This course requires prior knowledge of contemporary history and research methods for social science. Learning outcome: students will be able to know and assess the complexity and diversity of the current issues in the African continent and its role in the contemporary international scenario in order to present research and analysis projects about the region and its countries. Role playing and simulations are pro-

posed to bring students closer to these problems.

**General objective:** Upon completion of this course, students will be able to understand the geopolitics of Africa in the contemporary international scene, through an analysis of the development of the African continent from the pre-colonial period to the present, taking into account the processes of colonization and independence, ethnic and religious dynamics, as well as the political and economic influences of external international actors.

**Key words:** Colonialism and decolonization. Underdevelopment. Africa.

### RI3005 Strategic Prospective

( 3 - 0 - 8. Prerequisites: [ RI2015 , RI2015 Corequisite ]. 8 LRI11 )

**Equivalence:** None

Advanced course focusing on the generation of forecasting and strategic models based on theoretical and methodological tools for analysis and decision making in the context of international relations. This course requires prior knowledge of theoretical and methodological aspects of international relations. Learning outcome: students will be able to apply methodological forecasting tools to current problems that will allow them to analyze, consider and decide on diverse possible futures in their area of responsibility.

**General objective:** On finishing the course the student will be able to apply prospective and strategic analysis tools (Marc Giget's Competence Trees, SWOT Matrix, Delphi Technique, Mactor, IGO, Morphological Analysis, Structural Analysis, Cross Impact Analysis and Scenario Design), understanding their implications, their advantages and disadvantages and identifying the importance of prospective methods for professional use, as well as their possible applications.

**Key words:** Future. Strategic planning. Strategic vision.

**Bibliography:** \* Godet, Michel., De la anticipación a la acción : manual de prospectiva y estrategia / Michel Godet ; traducción de Emilia Pagés i Buisán y

Jaime Gavaldá Posiello., México : Alfaomega, 1995., Mexico, 1995., spa, [9701500288].

### RI3006 International Relations Seminar

( 3 - 0 - 8. Prerequisites: None. 9 LRI11 )

**Equivalence:** RI00893, RI95882, RI95892, RI998

Advanced international relations course focused on the application and integration of the theoretical and methodological knowledge acquired during the bachelor degree program. This course requires prior knowledge of world history, international relations and geopolitical theory. Learning outcome: students will apply the theoretical and methodological instruments acquired throughout their studies to conduct scientific research that will be a major part of their final evaluation.

**General objective:** Upon completion of this course, students will be able to select, analyze, compare, and evaluate topics relevant to contemporary international relations in diverse regional scenarios.

**Key words:** Multiculturalism. International security. Climate change. Borders. International agenda. Organized crime.

**Bibliography:** \* Dannreuther, Roland., International security : the contemporary agenda / Roland Dannreuther., Cambridge, UK : Polity, 2007., [0745635407],[9780745635408],[0745635415 (rústica)],[9780745635415 (rústica)].

### RI3016 International Relations Theory II

( 3 - 0 - 8. Prerequisites: [ RI2032 ]. 6 LRI11 )

**Equivalence:** RI2010

The purpose of this advanced international relations course is for students to analyze the most recently proposed theoretical methodologies that study the international arena. It emphasizes the influence of different theories in forming the contemporary world order and reflects on the ontological and epistemological basis of international relations. It requires previous knowledge of the state-centered

paradigm, the historical materialistic paradigm and the systemic or scientific paradigm in the study of international relations. The learning outcome of this course is for students to develop a research project that sustains a theoretical vision and an argumentation line in analyzing a concrete situation in the current international scene.

**General objective:** Upon completion of this course, students will be able to evaluate, plan and formulate strategies for studying global reality issues, using critical, constructivist and postpositivist approaches.

**Key words:** Modernity vs. Post-modernity. Intersubjective meanings. Gender (genre se utiliza para géneros literarios y éste se refiere a género en cuanto a lo masculino y lo femenino). Post-positivism.

**Bibliography:** \* Brown, Chris, 1945-, Understanding international relations / Chris Brown., 2nd ed., rev. and updated., New York : Palgrave, 2001., [0333948491].

## RI3019 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 LRI11 )  
**Equivalence: None**

This is a university course which is designed to train students to think about this new stage of their lives and to explore the career alternatives that are available to them, defining their options for employment, postgraduate study and professional certifications. The learning outcome for this course is that students will acquire all the necessary tools for a successful transition to the labor market or to postgraduate study.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].w York: DK Pub., 2003., [0789493551 (papel alcalino)].

**SU Health Systems****SU1003 Principles of Health Management**

( 2 - 0 - 4. Prerequisites: None. 2 LNB11, 8 MC 11, 10 MO 11 )

**Equivalence: None**

Basic course that provides the health professional with the knowledge and skills for planning and operating clinics and other organizations related to health services. No prior knowledge is required. Students design a plan of action related to managing an office or health-sector business.

**General objective:** Students will understand the main administrative, financial, legal, fiscal and marketing aspects involved in the operation of an organization or business in the health sector.

**Key words:** Health organizations management. Value in health sector organizations. Business model in the health sector.

**Bibliography:** \* Ley general de salud y disposiciones complementarias / revisión y actualización de Miguel Carbonell., 2a ed. actualizada., México : Porrúa, 2007., [9700772373].

## TA Food Technology

### TA1002 Introduction to Food Engineering

( 3 - 0 - 4. Prerequisites: None. 1 IIA11 )

Equivalence: None

The purpose of this basic-level course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Ibarz, Albert., Operaciones unitarias en la ingeniería de alimentos / Albert Ibarz, Gustavo V. Barbosa-Cánovas., Madrid : Mundi Prensa, c2005., [8484761630],[9788484761631].

### TA2000 Food Analysis

( 3 - 0 - 8. Prerequisites: [ Q2000 ]. 5 IIA11 )

Equivalence: TA00852

Intermediate food engineering course that provides students with the necessary analytical tools to apply food quality assurance throughout the production chain, and to analyze and interpret the information obtained to solve design and investigation problems regarding food additives and contaminants. The course includes sustainable development, innovation and entrepreneurship, and ethics activities and

concepts to reinforce, complement and expand its overall aim. This course requires prior knowledge of de biochemistry, food chemistry and molecular biology. Learning outcome: students will complete a final project in which they analyze each and every one of the instrumental analysis methods and decide which method is the most sensitive, the fastest according to the plant and marketing of the food. Students plan experiments using analysis methods and techniques.

**General objective:** Upon completion of this course, students will be able to: Select the correct method of analysis for the evaluation of each and every one of the components of food products. Comparatively determine which of them is the most appropriate from the legal (official) point of view, from a quality standpoint, and for exportation.

**Key words:** Food analysis. Instrumental analysis (GC, HPLC, Infrared, E. Masses, Atomic absorption).

**Bibliography:** \* Food analysis / edited by S. Suzanne Nielsen., 3rd ed., New York, N.Y. : Kluwer Academic/ Plenum Publishers, c2003., New York, c2003., eng, [0306474956].

### TA2008 Food Chemistry Laboratory

( 0 - 3 - 4. Prerequisites: [ Q2001 Corequisite , Q2001 , Q2000 , MD1030 ]. 4 IIA11, 4 LNB11 )

Equivalence: TA2001

It is an intermediate level course, aimed at the application of Food Chemistry concepts and principles in experiments. This course will include Sustainable Development, Innovation and Entrepreneurship topics. Previous knowledge in biochemistry is required. By the end of this course students will be able to solve problems related to nutritional chemistry and test the impact of various factors on the functional properties of food by means of experimentation.

**General objective:** Upon completion of this course, students will be able to: 1) Conduct experiments using food chemistry concepts, 2) Generate results stemming from experimentation and research, 3) Evaluate, by means of experiments, the effects of



diverse factors on the functional properties of food components.

**Key words:** Analysis of factores involved in food preservation. Analysis of food component properties.

**Bibliography:** \* Weaver, Connie, 1950-, The food chemistry laboratory : a manual for experimental foods, dietetics, and food scientists / Connie Weaver, James Daniel., 2nd ed., Boca Raton : CRC Press, 2003., [0849312930 (alk. paper)].

### TA2009 Nutrition and Nutrigenomics

( 3 - 0 - 8. Prerequisites: [ Q2000 , MD1030 , Q2001 ]. 5 IIA11, 6 LNB11 )

**Equivalence:** None

This is an intermediate level course which will allow students to analyze basic concepts of nutritional genomics and to visualize the role of nutrition in the prevention of polygenic diseases. In this course, students will evaluate the effects of food processing and storage on the composition, stability, and bio-availability of nutrients, and will be able to propose food engineering strategies in order to increase the nutritional value of foods for the benefit of human health. Included in the course are activities related to such concepts as innovation and entrepreneurship, information technology, and ethics, which reinforce, complement, and expand the general intention of this course. Previous knowledge is required in biochemistry, food science, and molecular biology. The learning outcome for this course is that students, applying current scientific knowledge about nutriomics and nutrigenomics, be able to propose formulas for foods and industrialization processes for the production of foods, which, upon introduction into the human diet, will contribute to the prevention and treatment of chronic degenerative diseases.

**General objective:** Upon completion of this course, students will be able to: Understand the interaction between nutrients and bioactive molecules in diets and the expression of genes related to the most common contemporary diseases. Design food formulations and industrialization processes to produce foods that, on being introduced into the human diet, will contribute to the prevention and treatment of chronic degenerative diseases.

**Key words:** Metabolic pathways. Digestion, absorption and transport of nutrients. Nutrigenomics and proteomics and their relationship with health and disease. Nutriomics of processed foods. Gene nutrient interactions in diseases. Polymorphisms in genes involved in the metabolism of lipids and homocysteines. Genetic influence on metabolic syndrome therapy. Genetic influence on cancer prevention.

**Bibliography:** \* Nutritional genomics : impact on health and disease / edited by Regina Brigelius-Flohé and Hans-Georg Joost., Weinheim : Wiley-VCH, c2006., [3527312943 (caja)], [9783527312948 (caja)].

### TA2010 Sensory Evaluation

( 3 - 0 - 8. Prerequisites: [ Q2001 , TA2000 , IN2023 Corequisite ]. 6 IIA11 )

**Equivalence:** None

This is an intermediate level course which will provide students with the necessary theoretical and practical knowledge so that they may be able to identify, apply, and analyze sensory analysis tests for processes in the industrialization of food products. Included in the course are activities related to such concepts as innovation and entrepreneurship, and ethics, which reinforce, complement, and expand the general intention of this course. Previous knowledge is required in food science, statistics and probability, and analysis of foods. The learning outcome for this course is that students be able to design sensory analysis tests for food products, selecting the appropriate techniques for the testing of their experimental hypotheses. Students will be able to effectively apply discriminative, descriptive, and affective tests and analyze the results in order to prove their experimental hypotheses. Students will be able to interpret the information generated by means of the sensory analysis tests they will study, and to make decisions based on the results. Students will also be able to plan and perform sensory analysis tests which will allow them to determine the sensory shelf life of food products.

**General objective:** Upon completion of this course, students will be able to: Design, apply and analyze discriminative, descriptive and affective sensorial evaluation tests. Put into practice their professional ethics values when designing and conducting sen-

social evaluation tests, taking into consideration the international codes of ethics for carrying out experiments on human subjects.

**Key words:** Introduction to sensorial analysis. Sensory discrimination testing. Selection and training of the members of a sensory panel. Descriptive sensory testing. Acceptability sensory testing. Determination of the sensory service life of foods. Applications of sensory evaluation in quality control of foods.

**Bibliography:** \* Meilgaard, Morten., Sensory evaluation techniques / Morten C. Meilgaard, Gail Vance Civille, B. Thomas Carr., 4th ed., Boca Raton : Taylor & Francis, 2006., [9780849338397],[0849338395].

### **TA2011 Basic Food Processing** ( 3 - 0 - 8. Prerequisites: [ Q2001 , IQ2001 , BT2003 ]. 6 IIA11 )

**Equivalence:None**

This is an intermediate course in which students acquire the necessary skills for integrating nutritional science concepts and engineering concepts, in order to analyze, evaluate and apply the scientific principles that support nutritional technology. This course will include activities and concepts of Innovation and Entrepreneurship that reinforce, complement and broaden the general scope of the course. Previous knowledge is required in Nutritional Analysis, Nutritional Chemistry, Nutritional Microbiology, Matter and Energy Balance, Thermodynamics and Statistics and Probability. The learning outcome for this course is that the students be able to define and select the type and level of one or more preservatives to be applied in an integrated project and to describe the active mechanisms of the selected preservation methods.

**General objective:** Upon completion of this course, students will be able to: Integrate the concepts of chemistry, food analysis, microbiology and thermodynamics in food preservation and processing. Explain the mechanisms of action of the diverse factors in food preservation. Describe and classify the diverse food preservation and processing methods. Apply these principles to the analysis and evaluation of the different fruit and vegetable preservation and processing methods.

**Key words:** Principles of food preservation. Mechanisms of action of food preservation factors. Fruit and vegetable preservation.

**Bibliography:** \* Fellows., Food processing technology : principles and practice / P. Fellows., Cambridge : Woodhead , 1997., eng, [1855732718].

### **TA2012 Food Analysis Laboratory** ( 0 - 3 - 4. Prerequisites: [ TA2000 , TA2000 Corequisite ]. 6 IIA11 )

**Equivalence: None**

This is an intermediate level course, which enables students to apply the concepts and principles of chemical and instrumental analysis of foods in experiments to verify their composition, quality and shelf-life. Students will apply sampling criteria and quick analysis methods to use in plant control processes and verify the nutritional value of foods. The course will include activities and concepts of Sustainable Development and Innovation and Entrepreneurship that reinforce, complement and broaden the general scope of the course. Previous knowledge is required in Nutritional Chemistry, Nutritional Analysis and Probability and Statistics. The learning outcome for this course is that the students test the applicability of instrumental methods of nutritional analysis, through laboratory experiments.

**General objective:** Upon completion of this course, students will be able to: Generate results stemming from experimentation and research, and evaluate food by means of experimental analysis using standard methods. Validate reference methods.

**Key words:** Food nutritional quality and toxicological analysis. Instrumental analysis methods.

**Bibliography:** \* Nielsen, S. Suzanne., Análisis de los alimentos : manual de laboratorio / S. Suzanne Nielsen ; traducción de Ana Cristina Ferrando Navarro., 1a ed., Zaragoza, España : Acribia, c2003., [9788420010595].

## TA2013 Basic Food Processing Laboratory

( 0 - 3 - 4. Prerequisites: [ Q2001 , BT2003 , TA2008 , BT1007 , TA2011 Corequisite , TA2011 ]. 6 IIA11 )

**Equivalence: None**

This is an intermediate level course, which enables students to acquire the necessary skills for experimental evaluation of the application of scientific principles in support of nutritional technology and for designing and developing an innovative project. This course will include activities and concepts of sustainable, innovative development and entrepreneurship, which will reinforce, complement and broaden the general scope of the course. Previous knowledge is required in Nutritional Analysis, Nutritional Chemistry, Nutritional Microbiology, Matter and Energy Balance, Thermodynamics and Statistics and Probability. The learning outcome for this course is that the students be able to define and select the type and level of one or more preservatives to be applied in an innovative project for the preservation of fruit and vegetables, and to describe the active mechanisms of the selected preservation methods.

**General objective:** Upon completion of this course, students will be able: Evaluate by means of experiments the diverse factors that affect food preservation. Experiment with the design and generation of fruit and vegetable products. Handle equipment and machinery at pilot level for both conventional and state-of-the-art processes. Design and develop innovation projects with a sustainability approach.

**Key words:** Emerging technologies. Food preservation factors. Fruit and vegetable preservation and processing. Food development and innovation.

**Bibliography:** \* Springer US, Experiments in Unit Operations and Processing of Foods, [1441941363].

## TA2014 Integral Quality Assurance Laboratory

( 0 - 3 - 4. Prerequisites: [ TA2000 , TA2012 , TA2000 , TA2012 Corequisite ]. 6 IIA11 )

**Equivalence: None**

This is an intermediate level course which will provide students with the necessary theoretical and practical

knowledge so that they may be able to identify, apply, and analyze quality assurance tests for processes in the industrialization of food products. Included in the course are activities related to such concepts as sustainable development and innovation and entrepreneurship, which reinforce, complement, and expand the general intention of this course. Previous knowledge is required in food science, statistics and probability, and analysis of foods. The learning outcome for this course is that students be able to design quality assurance tests for food products, selecting the appropriate techniques for the testing of their experimental hypotheses. Students will be able to effectively apply physical, thermal, and physicochemical tests and analyze the results in order to prove their experimental hypotheses. Students will also be able to interpret the information generated by means of the quality assurance tests they will study, and to make decisions based on the results.

**General objective:** Upon completion of this course, students will be able to: Design, conduct and analyze food quality assurance tests. Understand and apply the main contemporary physicochemical and instrumental principles of food quality evaluation. Complete a project related to innovation and entrepreneurship.

**Key words:** Instrumental color analysis. Instrumental food texture analysis. Food thermal analysis testing. Isotherm determination.

**Bibliography:** \* Handbook of food analysis instruments / edited by Semih O'tles., Boca Raton, FL : CRC Press, c2009., [9781420045666 (alk. paper)], [1420045660 (alk. paper)].

## TA2015 Food Sciences

( 3 - 0 - 8. Prerequisites: [ Q2001 ]. 6 LNB11 )

**Equivalence: None**

Intermediate course focused on the study of the various food groups from their molecular structure to the transformations undergone in processing and preparation. It requires prior knowledge of chemistry and basic nutrition. Learning outcome: students are expected to present analysis and evaluation reports of menus and meals for individuals at different stages of life, based on standards.

**General objective:** Students will be able to identify the characteristics, nutritional value, types, classification and management of the various food groups, identify and monitor changes in sensory attributes, nutritional and toxicological aspects of the different food groups, through analysis of their components and the physical and chemical changes suffered by them during storage, processing and /or preparation.

**Key words:** Food groups. Chemical composition of foods. Nutritional value.

**Bibliography:** \* Salinas, Rolando D., Alimentos y nutrición : introducción a la bromatología / Rolando D. Salinas., 3a ed., Buenos Aires : El Ateneo, 2000., [9500203790].

### TA2016 Food Sciences Lab

( 0 3 4. **Requisitos:** [ **Estar cursando TA2015 o Haber cursado TA2015** ]. 6 LNB11 )

**Equivalencias:** No tiene

Intermediate course in which students implement the scientific basis of food science in the selection and preparation of food of high nutritional value. It requires prior knowledge and skills in assessment and dietary planning. As a learning outcome, students are expected to develop menus and meals that meet the personal, medical and nutritional needs of healthy and sick people in various stages of life, complying with the norms and standards in force.

**General objective:** Students will be able to:- Understand the criteria for an adequate selection of food.- Apply scientific techniques of food preparation to maintain nutritional value and prevent the synthesis of compounds that might imply a health risk.- Design menus taking into account the nutritional requirements of individuals as well as various aspects related to food availability, cost, personnel and equipment available.

**Key words:** Food science.

**Bibliography:** \* Badui Dergal, Salvador., Química de los alimentos / Salvador Badui Dergal ; con la colaboración de Salvador Badui Dergal . [et al.], 4a ed.,

México : Pearson Educación, 2006., Mexico, 2006., spa, [9702606705],[9789702606703].

### TA3004 Food Packaging

( 3 - 0 - 8. **Prerequisites:** [ Q2000 , Q2001 , TA2000 , TA2005 , IQ1001 ]. 9 IIA11 )

**Equivalence:** None

Advanced course that develops students' decision-making skills regarding the selection of a container for a food or biotechnological product and of the preservation and marketing process specific to each product. This course addresses topics related to materials and their characteristics, their conversion processes, quality testing and legal aspects for their integral design and ultimate application. It will include activities and concepts related to sustainable development and innovation and entrepreneurship that reinforce, complement and broaden the course's general objective. This course requires prior knowledge of food chemistry, microbiology, experiment design and analysis, mass transfer and heat transfer. Learning outcome: students will complete a capstone project in which they propose at least a pair of solutions to an assigned problem about specific problems generated by a poorly designed container. Students will have to defend the advantages and disadvantages of each decision put forward to solve the problem using experiment analysis and design methods and techniques.

**General objective:** Upon completion of this course, students will be able to: Select and design a container according to the particular needs of the food product, its process of industrialization and conservation, and its expected shelf life during commercialization.

**Key words:** Sustainability. Food Packaging. Toxicological and sanitary aspects of packaging. Packaging and the environment. Active and intelligent packaging.

**Bibliography:** \* Robertson, Gordon L., Food packaging : principles and practice , M. Dekker, New York, 1993, [824787498].

## TA3006 Postharvest Technology and Physiology

( 3 - 0 - 8. Prerequisites: None. 9 IA 11, 7 IAB11 )  
Equivalence: TA00884

The aim of this advanced course is to obtain an overview of fresh fruit and vegetable preservation processes, develop the capacity to make assertive decisions regarding their management and adequate storage, as well as the capacity to design and evaluate semi-industrial and industrial conversion processes. This course requires prior knowledge of biochemistry. Learning outcome: students will be able to discover and apply the physiological and technological principles for fresh fruit and vegetable preservation.

**General objective:** The learning objective for this course is that students: describe and apply physiological principles and technology to the conservation of freshness in fruits and vegetables; explain the fundamental concepts of the industrialization methods for fruits and vegetables and describe the processes, detailing the operations and equipment for each operation, identifying the critical factors for each process and the parameters for finished products which define their quality; and solve technical problems related to the course content.

**Key words:** Handling of fresh fruit and vegetables. Preservation methods. Byproduct formulation technologies.

**Bibliography:** \* Adel A. Kader, Postharvest thecnology of horticultural crops.

## TA3018 Science and Technology of Meat Products

( 3 - 0 - 8. Prerequisites: [ TA2011 ]. 7 IIA11 )  
Equivalence: None

The purpose of this advanced food-engineering course is to provide students with the skills necessary to evaluate by experimentation the scientific principles and technologies for the preservation and processing of meats, fish and seafood as well as to design and develop innovative meat, fish and seafood products. It includes activities and concepts of sustainable development, innovation and busi-

ness development which reinforce, complement and broaden the general focus of the course and requires previous knowledge of food microbiology, food chemistry, food analysis and design of experiments. The learning outcome of this course is for students to design, evaluate and practice the preservation and preparation of meat, fish and seafood products using both conventional and advanced technologies. They also design and develop an innovative project.

**General objective:** Upon completion of this course, students will be able to: Explain the changes that occur during meat, fish and seafood handling and processing. Apply their scientific and technological knowledge to solve problems related to meat, fish and seafood handling and processing. Analyze innovative, leading-edge technologies in meat, fish and seafood preservation and transformation. Complete an innovation and entrepreneurship project in relation to cold preservation or processing of meat, fish and seafood.

**Key words:** Meat, fish and seafood procurement and preservation. Meat, fish and seafood processing.

**Bibliography:** \* Handbook of meat processing / edited by Fidel Toldra', Ames, Iowa : Wiley-Blackwell, 2010., [9780813821825 (hardback : alk. paper)].

## TA3019 Science and Technology of Meat Products Laboratory

( 0 - 3 - 4. Prerequisites: [ TA3018 Corequisite , TA3018 ]. 7 IIA11 )  
Equivalence: None

The purpose of this advanced food-engineering course is to provide students with the skills necessary to evaluate by experimentation the scientific principles and technologies for the preservation and processing of meats, fish and seafood as well as to design and develop innovative meat, fish and seafood products. It includes activities and concepts of sustainable development, innovation and business development which reinforce, complement and broaden the general focus of the course and requires previous knowledge of food microbiology, food chemistry, food analysis and design of experiments. The learning outcome of this course is for students to design, evaluate and practice the preservation and



preparation of meat, fish and seafood products using both conventional and advanced technologies. They also design and develop an innovative project.

**General objective:** Upon completion of this course, students will be able to: Apply scientific and technological principles to meat, fish and seafood preservation and processing, using both conventional and state-of-the-art technologies. Evaluate the use of additives and the process conditions to improve product quality. Handle equipment and machinery at pilot level. Design and develop innovation projects, focusing on sustainability.

**Key words:** Meat, fish and seafood preservation. Meat, fish and seafood processing. Innovation and emerging technologies.

**Bibliography:** \* Handbook of meat processing / edited by Fidel Toldra´., Ames, Iowa : Wiley-Blackwell, 2010., [9780813821825 (hardback : alk. paper)].

### TA3020 Science and Technology of Cereals and Oil Crops

( 3 - 0 - 8. Prerequisites: [ TA2011 ]. 8 IIA11 )

**Equivalence: None**

This is an advanced level course, designed to develop the students' ability to identify and solve problems related to the transformation of grain and oils into food products and problems related to quality control systems in the industry that processes these products. The course will include activities and concepts related to Sustainable and Innovative Development and Entrepreneurship, which reinforce, complement and broaden the general scope of the course. Previous knowledge is required in Nutritional Analysis, Nutritional Chemistry and Nutritional Microbiology. The learning outcome for this course is that the students be able to increase their knowledge in the fundamentals of chemistry, physical properties, structure and nutritional value of grain and oils, and of the role of grain in the problem of worldwide and national malnutrition; and to design production plants and quality control systems for grain and oils. Emphasis will be placed on the storage and milling processes for obtaining wheat flour and pre-cooked cornmeal, decorticated grain and starch, and the conversion of these raw materials into bakery goods, cookies and

crackers, pasta/soups, breakfast cereals, snacks and alcoholic drinks, such as beer and whisky, as well as on the industries that manufacture vegetable oils and high-protein pasta. The students will appreciate the importance of the search for innovative, modern industrial processes for grain and oils.

**General objective:** Understand the chemical, physical, nutritional and anatomic properties of cereals, legumes and oilseed products. Understand and evaluate grain storage systems. Analyze and evaluate cereal and oilseed-product manufacturing processes, including the new biotechnological processes of biocatalysis and fermentation. Integrate quality assurance programs into grain transformation industrial processes.

**Key words:** Grain storage. Oil extraction and refinement. Introduction to chemistry, structure and physical properties of cereals, leguminous plants and oleaginous plants. Dry and wet milling processes. Bread, cookie and pasta making industries.

**Bibliography:** \* Serna Saldívar, Sergio Román Othón., Química, almacenamiento e industrialización de los cereales / Sergio R. Othón Serna Saldívar., 1a ed., México, D. F. : AGT Editor, c1996., [9684630840].

### TA3021 Science and Technology of Dairy Products

( 3 - 0 - 8. Prerequisites: [ TA2011 ]. 8 IIA11 )

**Equivalence: None**

This is an advanced level course, designed to develop the students' skills in identifying and solving problems related to the transformation of milk into dairy products, as well as in the development and implementation of both conventional and modern manufacturing processes, with regard to quality control systems. The course will include activities and concepts related to Sustainable and Innovative Development and Entrepreneurship, which reinforce, complement and broaden the general scope of the course. Previous knowledge is required in Nutritional Microbiology, Nutritional Chemistry and Nutritional Analysis. The learning outcome for this course is that the students analyze and evaluate the principles of milk preservation and the technologies for producing and preserving dairy products.



**General objective:** Students will be able to: Analyze the chemical, physical and nutritional properties of milk. Understand and assess the systems for obtaining and handling milk. Analyze and evaluate the formulations, unitary operations, milk and dairy product manufacturing processes, considering the relevant regulations. Apply the use of biotechnology to dairy product fermentation processes. Recognize the latest technologies and product and process development trends, and propose alternative solutions for the industry's problems, considering the sustainable, market and nutritional factors. Integrate the concepts of quality assurance and effluent management programs in industrial transformation processes. Design processing lines for dairy production plants.

**Key words:** Innovation. Milk procurement and preservation. Dairy product processing. Plant design.

**Bibliography:** \* Dairy processing & quality assurance / editor, Ramesh C. Chandan ; associate editors, Arun Kilara, Nagendra P. Shah., 1st ed., Ames, Iowa : Blackwell Pub., c2008., [9780813827568 (papel alcalino)], [0813827566 (papel alcalino)].

### TA3022 Science and Technology of Cereals and Oil Crops Laboratory

( 0 - 3 - 4. Prerequisites: [ TA3020 , TA3020 Corequisite ]. 8 IIA11 )

**Equivalence: None**

The purpose of this advanced food-engineering course is to offer students the necessary skills to design and implement products as well as to analyze and interpret information obtained from using ingredients and process modifications from the cereal industry. It includes activities and concepts of sustainable development, innovation and business development to reinforce, complement and broaden the general focus of the course and requires previous knowledge of food chemistry, food analysis, microbiology and experiment design and analysis. The learning outcome of this course is for students to propose solutions to problems involving quality and process conditions, implement them and standardize production systems. Students complete an innovative project.

**General objective:** Upon completion of this course, students will be able to design and propound experiments to prove hypotheses in problems related to the industrialization of cereals.

**Key words:** Cereal processing. Experiment design and interpretation. Food development and innovation.

**Bibliography:** \* Serna Saldívar, Sergio Román Othón., Manufactura y control de calidad de productos basados en cereales / Sergio R. Othón Serna Saldívar, 1a ed., México : AGT Editor, 2003., [9684631014],[9789684631014].

### TA3023 Science and Technology of Dairy Products Laboratory

( 0 - 3 - 4. Prerequisites: [ TA3021 , TA3021 Corequisite ]. 8 IIA11 )

**Equivalence: None**

This is an advanced level course, designed to provide students with the necessary skills for solving problems in the formulation, processing and packaging of dairy products, as well as for proposing alternatives for new products and technologies. This course will include activities and concepts related to Sustainable and Innovative Development and Entrepreneurship, which reinforce, complement and broaden the general scope of the course. Previous knowledge is required in Nutritional Chemistry, Nutritional Analysis and Experiment Design and Analysis. The learning outcome for this course is that the students integrate theoretical and practical concepts in the development of their ability to evaluate the scientific and technological principles of dairy product production, and in operating the related equipment and machinery. The students will propose and develop innovative alternatives for products or technologies, considering their social and quality control aspects.

**General objective:** Upon completion of this course, students will be able to: Analyze the conditions of a stable and diverse processing plants, comparing them with theoretical concepts. Interpret the results of physicochemical and microbiological analyses of raw milk and dairy products. Apply the concepts of unitary formulations and operations in the laboratory. Analyze results and write scientific reports. Design

an innovative product, considering trends, social environment and market acceptance, conducting pilot tests.

**Key words:** Evaluation of the quality of milk and by-products. Milk processing.

**Bibliography:** \* Milk processing and quality management / edited by Adnan Tamime., Chichester, West Sussex ; Ames, Iowa : Blackwell Pub., 2008., [9781405145305 (hardback : alk. paper)].

### TA3024 Food Safety

( 3 - 0 - 8. Prerequisites: [ BT2003 ], 8 IAB11, 9 IIA11 )

**Equivalence:** None

The purpose of this advanced food-engineering course is to give students the necessary tools to be able to design and implement food safety control programs based on the Hazard Analysis and Critical Control Points (HACCP) system and its prerequisite programs. It includes activities and concepts related to innovation and business development, information technologies and ethics which strengthen, complement and broaden the general focus of the course. It requires previous knowledge of food microbiology, food chemistry, food analysis and food processing. The learning outcome of this course is for students to be able to analyze food-industry processes and identify hazards associated with raw materials and unitary operations. Students are able to design standard operational procedures for the necessary prerequisite programs for implementing an HACCP plan. They design hazard control plans for a food-industry process based on the seven principles of the HACCP system in compliance with international law regarding food safety.

**General objective:** Upon completion of this course, students will be able to: Design, implement and evaluate food safety assurance programs based on the Hazard Analysis and Critical Control Point (HACCP) system and its prerequisite programs. Put into practice their professional ethics values when designing and setting up reliable, effective safety programs to guarantee consumer health and wellbeing.

**Key words:** HACCP system prerequisite programs. Food safety and legislation. Food Hazards. Unit oper-

ations for food hazard control. Application of the seven principles of the HACCP system. Implementation and maintenance of a HACCP plan and its prerequisite program. International food safety legislation.

**Bibliography:** \* Stevenson, K.E. and Bernard D.T, HACCP: A Systematic Approach to Food Safety, 4th Edition, The Food Processors Institute.

### TA3025 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 IIA11 )

**Equivalence:** None

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

## TC

## Computer Technologies

**TC1001 Introduction to Computer Science**

( 3 - 0 - 8. Prerequisites: None. 0 ARQ11, 0 IA 11, 0 IAB11, 0 IBN11, 0 IBT11, 0 IC 11, 0 IDA11, 0 IDS11, 0 IFI11, 0 IIA11, 0 IID12, 0 IIN12, 0 IIS11, 0 IMA11, 0 IMD11, 0 IME11, 0 IMI11, 0 IMT11, 0 INCQ13, 0 INT11, 0 IQA11, 0 IQP11, 0 ISC11, 0 ISD11, 0 ITC11, 0 ITE11, 0 ITIC11, 0 ITS11, 0 LAD11, 0 LAE11, 0 LAF11, 0 LCDE11, 0 LCMD11, 0 LCPF11, 0 LCS11, 0 LDF11, 0 LDI11, 0 LDN11, 0 LDP11, 0 LEC11, 0 LED11, 0 LEF11, 0 LEM11, 0 LIN11, 0 LLE11, 0 LLN11, 0 LMC11, 0 LMI11, 0 LNB11, 0 LP 12, 0 LPL11, 0 LPM12, 0 LPO11, 0 LPS12, 0 LRI11, 0 MC 11, 0 MO 11 )  
**Equivalence:** CB00801, CB99801

This is an introductory course in the area of computer language programming which requires prior knowledge on the basic sciences at high school level. Learning outcome: students will develop algorithmic reasoning and will be able to use it to analyze basic problems, propose computer solutions specifying them in flow diagrams or pseudocode, as well as encode the specification on an Excel sheet or using basic rules from a high-level programming language.

**General objective:** Upon completion of this course, students will be able to analyze and solve a problem, applying logical thinking and designing algorithmic solutions utilizing computational tools. Students will also be able to correctly utilize computational productivity tools in their daily activities.

**Key words:** Programming. Hardware. Software. Internet. Applications.

**Bibliography:** \* Cairó Battistutti, Osvaldo., Metodología de la programación : algoritmos, diagramas de flujo y programas / Osvaldo Cairó Battistutti., 3a ed., México, D. F. : Alfaomega, 2005., [970151100x].

**TC1003 Discrete Mathematics**

( 3 - 0 - 8. Prerequisites: [ MA1001 Corequisite , MA1001 ]. 1 ISC11, 1 ITC11, 1 ITIC11, 1 LAD11 )  
**Equivalence:** CB00842

Basic computer course in which students will use mathematical tools to model real-life situations, such as sets, relations and functions, propositional calculus, predicate calculus and graph theory. This course requires prior knowledge of basic, high-school level mathematics. Learning outcomes: formal, rigorous presentation of computer and electronics problems and their possible solutions, using formal reasoning.

**General objective:** Upon completion of this course, students will be able to reason in a rigorous and formal manner using the tools of formal logic, use induction as a method of reasoning and proof, and use graphs as a way to model data structures.

**Key words:** Sets, relations and functions. Induction. Propositional calculus. Truth tables. Natural deduction. Predicate calculus. Semantics (models).

**Bibliography:** \* Johnsonbaugh, R, Discrete Mathematics, 6, Pearson Prentice Hall.

**TC1014 Programming Fundamentals**

( 3 - 0 - 8. Prerequisites: [ TC1001 ]. 1 INT11, 1 ISC11, 1 ISD11, 1 ITC11, 1 ITE11, 1 ITIC11, 1 ITS11, 1 LAD11, 2 LCMD11 )  
**Equivalence:** TC1002

Basic computing course whose objective is to develop in students the logic of structured programming that permits them to solve engineering problems using the computer. It Requires of previous knowledge in computer handling and basic algorithmic. As learning outcome of this course the student can design and develop algorithms for solve different kind of problems (for example, science, engineering or multimedia problems).

**General objective:** After completion of this course, students will be able to apply the logic to generate

algorithms whose can obtain solutions to difficult engineering problems.

**Key words:** Algorithms. Structured programming. Control structures.

**Bibliography:** \* Deitel, Paul J., C++ how to program / P.J. Deitel, H.M. Deitel., 7th ed., Pearson International ed., Upper Saddle River, N.J. : Pearson Prentice Hall, 2010., [9780132465403],[013246540X].

### TC1015 Introduction to Interactive Design

( 3 - 0 - 8. Prerequisites: [ TC1014, TC1017 ]. 5 IMI11, 2 ISC11, 2 ITC11, 2 ITIC11, 4 LAD11, 4 LCMD11 )

**Equivalence: None**

The purpose of this basic computing course on human-computer interaction is to introduce students to the user-centered design process, with emphasis on tools and techniques for enriching interactive application design. It requires basic knowledge of information technology (programming fundamentals). The learning outcome of this course is for students to work on a team to develop an interactive application using tools and techniques for human-computer interaction, including: understanding the user, defining requirements, designing high- and low-level prototypes while taking visual organization into consideration, content and navigation as well as evaluating the design and applying empirical and analytical methods.

**General objective:** Upon completion of this course, students will be able to apply the user-centered design process to develop interactive applications, considering knowledge of the user and his/her context; design low- and high-level prototypes; design digital media; evaluate the prototypes using empirical and analytical methods; identify collaboration skills in the development of a technology project.

**Key words:** Perception. Usability. Cognition. Human factors. Interactive design process. Human - computer interaction.

**Bibliography:** \* Lazar, Jonathan., Web usability : a user-centered design approach / Jonathan Lazar.,

Boston, Mass. : Pearson/Addison Wesley, c2006., [0321321359],[9780321321350].

### TC1016 Computer Organization

( 3 - 1 - 8. Prerequisites: [ TC1014 ]. 3 INT11, 2 ISC11, 2 ITC11, 2 ITIC11 )

**Equivalence: None**

Entry level computing science course. Its purpose is that students understand the fundamentals of computer architecture, organization and operation. No previous knowledge is required. As learning outcome, students will be able to: analyze and develop basic programs in assembly language based on computer organization and architecture; describe the operation of the most significant peripheral equipment and communication protocols between internal components and peripherals; describe basic memory systems; describe the components of a CPU; and describe software system operation as well as the various software types for application generation.

**General objective:** Upon course completion, students will be able to understand the internal structure of a computer, how it works and how its components interact.

**Key words:** Compilers. Assembly language. Computer components. Memory (main, cache, secondary). Microprocessor instruction set and its micro-operations.

**Bibliography:** \* Stallings, William., Computer organization and architecture : designing for performance / William Stallings., 7th ed., Upper Saddle River, N.J. : Pearson Education / Prentice Hall, c2006., [0131856448],[9780131856448].

### TC1017 Problem Solving with Programming

( 3 - 0 - 8. Prerequisites: [ TC1001 ]. 2 IA 11, 2 IAB11, 2 IBN11, 2 IBT11, 1 IC 11, 2 IDA11, 2 IDS11, 2 IFI11, 2 IIA11, 1 IIN12, 2 IIS11, 2 IMA11, 1 IMD11, 2 IME11, 3 IMI11, 1 IMT11, 2 INCQ13, 2 IQA11, 2 IQP11 )

**Equivalence: None**

The purpose of this basic computing course is to develop in students the programming logic that per-

mits them to solve engineering problems using the computer language. Requires prior knowledge of computer management and basic algorithmic. The learning outcome of this course is for students to design and develop algorithms to solve engineering problems.

**General objective:** Upon completion of this course, students will be able to apply logic to generate algorithms that provide the solution to engineering problems.

**Key words:** Algorithms. Structured programming. Control structures.

### TC1018 Data Structures

( 3 - 0 - 8. Prerequisites: [ TC2016 ]. 3 ISC11, 3 ISD11, 3 ITC11, 5 ITE11, 3 ITIC11, 3 LAD11 )

**Equivalence:** TC1000

The purpose of this basic computing course is to offer students the necessary tools to design and implement software solutions for managing computer problems, using abstraction and data structures. It requires previous knowledge of object-oriented programming. The learning outcome of this course is for students to design and implement software applications that focus mainly on searching and processing information in an efficient manner.

**General objective:** Upon completion of this course, students will be able to design programs that provide the solution to specific problems, using data structures in a specific programming language.

**Key words:** Algorithms. Data structures. Programming.

**Bibliography:** \* Koffman, Elliot B., Objects, abstraction, data structures, and design : using C++ / Elliot B. Koffman y Paul A.T. Wolfgang., Hoboken, NJ : John Wiley & Sons, Inc., c2006., [9780471467557 (rústica)],[0471467553 (encuadernado)].

### TC1019 Introduction to Software Engineering

( 3 - 0 - 8. Prerequisites: [ TC1014 ]. 3 INT11, 3 ISC11, 3 ITC11, 3 ITIC11 )

**Equivalence:** None

The purpose of this basic information-technology course, focused on software engineering, is to develop in students the skills of analysis and design for information systems. It requires previous knowledge of programming. The learning outcome of this course is for students to apply methodologies and tools for software analysis and design, demonstrating an understanding of the fundamentals of software engineering.

**General objective:** Upon completion of this course, students will be able to understand the fundamentals of software engineering and use object-oriented modeling tools and methodologies.

**Key words:** Software engineering. System analysis and design methods. Object-oriented modeling.

**Bibliography:** \* Sommerville, Ian, 1951-, Software engineering / Ian Sommerville., 9th ed., Boston ; Mexico City : Pearson, 2011., [9780137035151],[0137035152].

### TC1020 Databases

( 3 - 0 - 8. Prerequisites: [ TC1019 ]. 4 INT11, 4 ISC11, 4 ITC11, 4 ITIC11 )

**Equivalence:** None

The purpose of this basic computing course is to provide students with the necessary tools to design and develop information systems that use databases, as well as to analyze and interpret the information obtained in order to solve problems. It requires previous knowledge of discrete mathematics and programming. The learning outcome of this course is for students to build an effective, efficient information system that meets the organization's information requirements, using databases. In addition, students create the necessary documentation for each stage of system analysis and conceptual design of a database, both logical and physical.

**General objective:** Upon completion of this course, students will be able to design and build an effective,



efficient information system that meets the information requirements of an organization using relational databases, producing the appropriate documentation for the analysis and design phases, and ensuring the consistency of the data given the multi-user access.

**Key words:** SQL. Information system. UML model: Use cases, class diagram. Extended entity relationship model. Relational model. Relational algebra. JDBC. Indexing. Transaction. Locks and time stamps. Logs. Fragmentation and replication.

**Bibliography:** \* Elmasri, Ramez., Fundamentals of database systems / Ramez Elmasri, Shamkant B. Navathe., 5th ed., Boston ; Mexico : Pearson/Addison Wesley, c2007., [0321369572 (encuadernado)],[9780321369574 (encuadernado)].

### TC1021 Videogame Development Project

( 3 - 0 - 8. Prerequisites: [ TC1018 ]. 4 ISC11, 4 ITC11, 4 ITIC11, 5 LAD11 )

**Equivalence: None**

The purpose of this basic computing course is to integrate fundamental programming skills, acquired during the first third of the curriculum, through development of a videogame application, sensitizing students to the need for a systematic software-development process as well as to the multidisciplinary nature of this type of application. It requires previous knowledge of basic programming concepts, data structure, the object-oriented paradigm, analytical geometry and basic physics. The learning outcome of this course is for students to work on a team to develop a 2D videogame, from concept to implementation, generating documents for product conceptualization, requirements, design, test and user manual.

**General objective:** Upon completion of this course, students will be able to develop, in teams, basic software projects that meet specific interaction requirements, using a systematic software development process.

**Key words:** Animation. 2D videogame. Videogame development. Systems development. Graphical user interface.

**Bibliography:** \* Davison, Andrew., Killer game programming in Java / Andrew Davison., 1st ed., Sebastopol, CA : O'Reilly Media, 2005., [0596007302], [9780596007300].

### TC1022 Introduction to Computer Science and Technology

( 3 - 0 - 4. Prerequisites: None. 1 ITC11 )

**Equivalence: None**

The purpose of this basic course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Haag, Stephen., Information technology : tomorrow's advantage today / Stephen Haag, Peter Keen., New York : McGraw-Hill, c1996., [0070254478 (text)],[0078442958 (text and IT tutor CD-ROM)].

### TC1023 Introduction to Computer Systems Engineering

( 3 - 0 - 4. Prerequisites: None. 1 ISC11 )

**Equivalence: None**

The purpose of this basic course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is



required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Haag, Stephen., Information technology : tomorrow's advantage today / Stephen Haag, Peter Keen., New York : McGraw-Hill, c1996., [0070254478 (text)], [0078442958 (text and IT tutor CD-ROM)].

### TC1024 Introduction to Information and Communication Technologies

( 3 - 0 - 4. Prerequisites: None. 1 ITIC11 )  
Equivalence: None

The purpose of this basic course is to induct students into the setting of university life and the major in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clear vision of their major and the institution they have joined. Students will also generate a life plan and an academic-professional plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Haag, Stephen., Information technology : tomorrow's advantage today / Stephen Haag, Peter Keen., New York : McGraw-Hill, c1996., [0070254478 (text)], [0078442958 (text and IT tutor CD-ROM)].

### TC1025 Information Technologies and Edition

( 3 - 0 - 8. Prerequisites: None. 5 LLE11 )  
Equivalence: None

Basic course in the information technologies area which introduces students to the main and most recent technological resources used when working with text editing and publication. No previous knowledge is required. Learning outcome: students will formulate projects where they will put into practice the knowledge acquired in text editing and publication technologies.

**General objective:** Upon completion of the course the student will have a general view of the main technological tools used in editing and their practical application in said practice.

**Key words:** Digital edition. New formats. Electronic publications. Edition suites.

**Bibliography:** \* Lazar, Jonathan., Web usability : a user-centered design approach / Jonathan Lazar., Boston, Mass. : Pearson/Addison Wesley, c2006., [0321321359], [9780321321350].

### TC2004 Analysis and Modeling of Software Systems

( 3 - 0 - 8. Prerequisites: [ TC1009 , TC1020 ]. 5 ISC11, 5 ITC11 )  
Equivalence: SI00854

Intermediate computer science course that provides students with the necessary tools to analyze and

design software systems, using the object-oriented methodology. This course requires prior knowledge of object-oriented programming and databases. Learning outcome: students will generate the analysis, design and prototype of a computer project, using object-oriented models, techniques and tools.

**General objective:** At the end of the course, the student will be able to apply object-oriented models, techniques and tools for the analysis, design and implementation of a computer system.

**Key words:** Unified process. Unified Modeling Language (UML). CASE tools for OO Analysis and Design. Object-oriented paradigm. Object-oriented analysis and design.

**Bibliography:** \* Satzinger, John W. , Object-oriented analysis and design with unified process, Thomson, [061921643].

### TC2006 Programming Languages

( 3 - 0 - 8. Prerequisites: [ TC2003 , TC2001 ],[ TC2020 , TC2017 ]. 7 ISC11, 7 ITC11 )

**Equivalence:** CB00853

Intermediate computer course that provides students with the opportunity to know and apply the different programming styles that they have been using while studying their degree program. This is of utmost importance since in their professional lives they will be faced with a huge diversity of programming languages and styles. Knowing the advantages and disadvantages of the different programming languages and paradigms facilitates learning and mastering new languages. This course requires prior knowledge of object-oriented and/or imperative programming, data structures, regular expressions, context-free grammar. Learning outcome: students will develop programs that implement the solution to medium-complexity programming problems, using functional, concurrent/parallel and rule-based reasoning programming styles adequately.

**General objective:** Upon completion of this course, students will be able to: identify the essential elements which constitute a programming language in order to develop the ability to learn new languages on their own; have a general perspective of different

styles of programming, through the knowledge and application of some programming languages which are representative of the styles.

**Key words:** Programming languages. Functional programming. Concurrent/parallel programming.

**Bibliography:** \* Scott, Michael Lee, 1959-, Programming language pragmatics / Michael L. Scott., San Francisco : Morgan Kaufmann, c2000., California, c2000., eng, [1558604421 (encaudernado)], [1558605789 (rústica)].

### TC2007 Quantitative Methods and Simulation

( 3 - 0 - 8. Prerequisites: [MA1006 , TC1018 , TC1005 , IN2022 ]. 7 INT11, 8 ISC11, 8 ITC11, 7 ITIC11 )

**Equivalence:** None

Intermediate computer course that provides students with the necessary knowledge and tools to model computer and telecommunication systems. This course requires prior knowledge of the basic concepts of probability and calculus. Learning outcome: students will be able to create models that capture the performance characteristics of computer systems and telecommunication networks, and study the behavior of these systems by creating simulation programs.

**General objective:** Upon completion of this course, students will be able to comprehend the characteristics of a stochastic process and identify different types of queuing models and the performance of various data link layer protocols. Students will be able to establish system and performance parameters in order to study the behavior of computer systems and telecommunication networks using simulations.

**Key words:** Simulation. Stochastic processes. Computer systems modeling. Communication networks modeling.

**Bibliography:** \* Queueing networks and Markov chains : modeling and performance evaluation with computer science applications / Gunter Bolch . [et al.], New York : Wiley, c1998., [0471193666 : HRD\$98.95].

## TC2008 Operating Systems

( 3 - 1 - 8. Prerequisites: [ TE1001 , TE1007 , TC1005 , TC1012 , TC1016 , TE2023 ]. 5 ISC11, 6 ISD11, 5 ITC11, 7 ITE11, 5 ITIC11 )

**Equivalence:** CB00856

Intermediate computer course that provides students with knowledge of the functioning and interaction of the components of operating systems. Students will use a programming language that is compatible with open-source OS in order to apply the basic concepts of operating systems. This will allow students to understand an open-source operating system and give them the bases for managing and evaluating operating systems, as well as the opportunity to apply the operating-system concepts and techniques in other environments. Students will complete programming exercises related to these topics. This course requires prior knowledge of programming and data structures. Learning outcome: students will solve problems related to the basic algorithms used in diverse components of an operating system. They will demonstrate their competent handling of commands, system calls and device management for specific Unix-type operating systems in the laboratory. Programming using calls to systems such as fork, system and basic concurrent programming for managing processes and threads (POSIX). Development of programs to add functionality to the Operative System nucleus applying the concepts learned in the classroom.

**General objective:** By the end of this course, students will understand the components of an operating system and the basic concepts and principles under which these components were designed. Students will learn about the external and internal structure and functionality of an operating system, the resources that the operating system manages, the techniques used to manage these resources, the interaction between the components of the operating system, and the most important factors that affect the different components of an operating system.

**Key words:** Operating systems. Processes, Concurrency. Computer resource management, Linux.

**Bibliography:** \* Silberschatz, Abraham., Operating systems concepts. Español. "Fundamentos de sistemas operativos / Abraham Silberschatz, Peter

Baer Galvin, Greg Gagne., 7a ed., Madrid ; México : McGraw Hill, 2006., Spain, 2006., spa, [8448146417], [9788448146412].

## TC2009 Use and Management of Operating Systems

( 3 - 0 - 8. Prerequisites: [ TC1004 , TC1016 ]. 5 INT11 )

**Equivalence:** CB00871

This is an intermediate IT engineering course providing students with the technical bases necessary to make the Operating System a tool for company productivity. It allows students to acquire knowledge of the functioning and interaction of Operating Systems components. The course requires prior knowledge of computer organization. Learning outcome: students will demonstrate competent handling of commands, system calls and devices for at least two commonly used operating systems.

**General objective:** At the end of the course, the student will be able to administer and evaluate operating systems, as well as manage services.

**Key words:** Operating Systems. Linux, Windows, MAC. Administración de recursos computacionales. Processes.

**Bibliography:** \* Deitel, Harvey M., 1945-, Operating systems / Harvey M. Deitel, Paul J. Deitel, David R. Choffnes., 3rd ed., Upper Saddle River, NJ : Pearson/Prentice Hall, c2004, Massachusetts, c2004, eng, [0131828274 0131246968].

## TC2011 Intelligent Systems

( 3 - 0 - 8. Prerequisites: [ TC2006 ]. 9 ISC11, 9 ITC11 )

**Equivalence:** CB00884

This is an intermediate course in the field of computer studies and fundamental for Intelligent Systems and Visual Computing Concentration. The course requires students to have basic knowledge of mathematical logic and be able to program at an intermediate using the different programming paradigms. Learning outcome: students will develop applications using the basic techniques of Intelligent Systems.

**General objective:** Upon completion of this course, students will be able to formulate, design and develop simple intelligent systems, analyze and distinguish diverse intelligent systems and select an intelligent system to apply it to specific real-life situations. Therefore, the main course content includes: Formulation of intelligent agents, agents that solve problems, knowledge-based agents and agents that learn.

**Key words:** Intelligent agents, general search algorithms. Uncertainty management systems. Intelligent agents.

**Bibliography:** \* Russell, Stuart J. (Stuart Jonathan), *Inteligencia artificial : un enfoque moderno* / Stuart J. Russell y Peter Norvig ; traducción, Juan Manuel Corchado Rodríguez . [et al.], 2a ed., Madrid : Pearson Educación ; Prentice Hall, c2004., spaeng, [842054003x].

## TC2016 Object-Oriented Programming

( 3 - 0 - 8. Prerequisites: [ TC1014 ]. 2 INT11, 2 ISC11, 2 ISD11, 2 ITC11, 2 ITE11, 2 ITIC11, 2 ITS11, 2 LAD11 )

**Equivalence:** None

The purpose of this intermediate computing course is for students to solve problems using the object-oriented paradigm. It requires prior knowledge of algorithms and control structures in a high-level language. The learning outcome of this course is for students to design and implement solving-problem programs using the object-oriented paradigm.

**General objective:** Upon completion of this course, students will be able to apply the object-oriented paradigm to solve problems.

**Key words:** Object-oriented programming language. Object-oriented programming. Object-oriented design.

**Bibliography:** \* Deitel, Paul J., *C++ how to program* / P.J. Deitel, H.M. Deitel., 7th ed., Pearson International ed., Upper Saddle River, N.J. : Pearson Prentice Hall, 2010., [9780132465403],[013246540X].

## TC2017 Analysis and Design of Algorithms

( 3 - 0 - 8. Prerequisites: [ TC1018 ]. 4 ISC11, 4 ITC11 )  
**Equivalence:** None

This is an intermediate level course in computing, which enables students to learn techniques for designing and analyzing algorithms. Previous knowledge is required in discrete mathematics, high-level programming language and data structure. The learning outcome for this course is that the students analyze and compare algorithms, employ algorithm design techniques to create algorithms that efficiently solve specific problems and understand the algorithm classification system and the P vs. NP problem.

**General objective:** Upon completion of this course, students will be able to analyze algorithms in order to demonstrate temporal correction and complexity; understand, compare and apply the diverse algorithm design strategies and techniques.

**Key words:** Parallel computing. Search algorithms. Graph algorithms. Computational geometry. Classification of algorithms. Computational complexity. Algorithm design.

**Bibliography:** \* Baase, Sara., *Algoritmos computacionales : introducción al análisis y diseño* / Sara Baase, Allen Van Gelder ; traducción de Roberto L. Escalona García., 3a ed., México, D. F. : Pearson/Educación, c2002., spaeng, [9702601428].

## TC2018 Introduction to Networks

( 3 - 1 - 8. Prerequisites: [ TC1016 , TE1010 ]. 4 INT11, 4 ISC11, 5 ISD11, 4 ITC11, 5 ITE11, 4 ITIC11, 4 ITS11 )

**Equivalence:** None

This is an intermediate information technology course in the networking area, which provides students with basic theory regarding the functioning of local area networks (LAN), interconnecting computers in a LAN, and designing local coverage networks for small businesses. This course requires basic previous knowledge in computers, hardware, and software. The learning outcome for this course is that students will plan the design and installation of a local area network and the basic configuration of the rout-



ing equipment. Students will design an IP addressing schemes according to the connectivity restrictions of the business. Students will analyze and study several communication protocols used widely in local area networks.

**General objective:** Upon completion of this course, students will be able to design and implement local area networks; determine appropriate IP addressing schemes; recognize different communications protocols, identify several communications media and the signaling techniques used on them.

**Key words:** Local area networks. LAN design. IP addressing schemes. Communication protocols. Data communication models. Ethernet Technology. Network interconnection. Data transmission media. Signal transmission.

**Bibliography:** \* Tanenbaum, Andrew S., 1944-, Computer networks / Andrew S. Tanenbaum., 4th ed., Upper Saddle River, NJ : Prentice Hall, 2003., [0130661023].

### TC2019 Numerical Methods in Engineering

( 3 - 0 - 8. Prerequisites: [ TC1014 , MA1017 ]. 4 INT11, 4 ISC11, 4 ITC11, 5 ITIC11 )

**Equivalence:** TC1013

This intermediate-level course in engineering and computing science will provide the student with the tools to model and solve real-life problems, whenever the problem at hand needs numerical methods for its solution. It is recommended the use of a widely-used software, such as Matlab, for the implementation of the relevant algorithms. This course requires basic- to intermediate-level mathematics.

**General objective:** Upon completion of this course, the student will be able to propose and implement a numerical solution to an engineering problem.

**Key words:** Integration. Matrix algebra. Numerical approximations. Non-linear and differential equations. Interpolation. Adjustment of curves.

**Bibliography:** \* Nieves Hurtado, Antonio., Métodos numéricos aplicados a la ingeniería / Antonio Nieves

Hurtado, Federico C. Domínguez Sánchez., México : CECSA, 1995., [9682612608].

### TC2020 Computational Mathematics

( 3 - 0 - 8. Prerequisites: [ TC1003 , TC1018 ]. 5 ISC11, 5 ITC11, 7 ITIC11 )

**Equivalence:** None

The purpose of this intermediate computing course is to extend the learning acquired in the discrete-mathematics course and to let students reach a higher level of formal reasoning through themes of great importance in the development of certain areas of computing. It requires previous knowledge of discrete mathematics: propositional calculus, groups, relationships and functions, induction and graphs. The learning outcome of this course is for students to: make a formal, rigorous presentation of computing and electronics problems and their possible solutions; use formal reasoning in approaches and solutions for computing problems (design and analysis of algorithms); and understand modular arithmetic for application to cryptography.

**General objective:** Upon completion of this course, students will be able to model computational situations using finite automata; know the principles of modular arithmetic and understand its application in cryptography.

**Key words:** Groups. Formal languages. Automates and regular languages. Theory of numbers. Integer numbers. Prime numbers. Modular arithmetic. Algebraic structures. Context-free languages. Turing machines.

**Bibliography:** \* Sudkamp, Thomas A., Languages and machines : an introduction to the theory of computer science / Thomas A. Sudkamp., 2nd ed., Reading, Mass. : Addison-Wesley Pub., 1997., [0201821362].

### TC2022 Network Interconnection

( 3 - 1 - 8. Prerequisites: [ TC2018 ]. 5 ISC11, 6 ISD11, 5 ITC11, 6 ITE11, 5 ITIC11, 7 ITS11 )

**Equivalence:** TC2002

The purpose of this intermediate computing course is to provide students with the basics regarding com-

munication protocols and standards, particularly in levels 3 and 4 of the OSI model, for the design and implementation of basic corporate networks which include access controls and basic security mechanisms. In addition, students diagnose and resolve communication problems. It requires previous knowledge of network fundamentals and computing organization. The learning outcome of this course is for students to be able to design and operate a basic corporate network, diagnose and resolve router failures, develop client-server applications and control access to services on a local network.

**General objective:** Upon completion of this course, students will have acquired sufficient knowledge to analyze and understand the different protocols, methods and standards of the network, transport, session and presentation layers of the OSI model and the TCP/IP model, as well as a basic knowledge of network security. They will have developed the skills to configure and manage the main equipment that forms part of networks (hubs, switches, routers and servers), and to solve network problems.

**Key words:** WAN2 network interconnection. Static and dynamic routing. Routing protocols. TCP. Client-server model. Network security.

**Bibliography:** \* Stallings, William., Data and computer communications / William Stallings., 7th ed., Upper Saddle River, N.J. : Pearson Prentice Hall, c2004., [0131006819].

### TC2023 Automation and Domotics Project

( 3 - 0 - 8. Prerequisites: [ TE1002 , TC1020 ]. 6 ITIC11 )

**Equivalence:** TI2006

Intermediate computer course in which students develop problem-solving and project-planning skills, in the area of automation and domotics, integrating and applying their engineering knowledge to develop a system based on electronic devices and computer applications with graphical user interface.

**General objective:** Upon completion of this course, students will be able to evaluate a solution for a real problem that involves the integration of electronics,

computing and information systems, practicing and developing project management, teamwork and written and verbal communication skills.

**Key words:** Technology integration. System specification. Data communication. Electronics and sensors. Specific application software.

**Bibliography:** \* Margolis, Michael, Arduino Cookbook, 1a. Ed, O'Reilly Media.

### TC2024 Mobile Application Development Projects

( 3 - 0 - 8. Prerequisites: [ TC2004 ]. 6 ISC11, 6 ITC11 )

**Equivalence:** None

The purpose of this intermediate computing course is to allow students to understand problems related to the design and implementation of mobile applications as well as the platforms and tools used in addressing these problems. The course requires prior knowledge of software development, databases, operating systems and software modeling of systems. The learning outcome of this course is to design and implement an efficient solution to a specific problem using mobile technologies. This project should be developed with strict adherence to methodologies, processes and best practices in software development and verification.

**General objective:** Upon completion of this course, students will be able to design and implement mobile computer applications. Students study the particular aspects of mobile applications, such as: mobile application architectures, mobile application development platforms, interface design for mobile devices and related hardware components.

**Key words:** Mobile computing. Development of mobile applications. Mobile device programming. Mobile application architecture.

**Bibliography:** \* Knudsen, Jonathan., Kicking butt with MIDP and MSA : creating great mobile applications / Jonathan Knudsen., Upper Saddle River, NJ : Addison-Wesley, c2008., [0321463420 (rústica : papel alcalino)].



## TC2025 Advanced Programming

( 3 - 0 - 8. Prerequisites: [ TC2017 , TC2008 ]. 6 ISC11, 6 ITC11 )

**Equivalence:** None

This is an intermediate level computer science course in which programming concepts and techniques will be studied in order to construct computer applications which have an interface to the operating system. This class requires previous knowledge in programming, TOS structures, and operating systems. The learning outcome for this course is for students to develop programs in which the concepts of concurrent and multi-core programming are put into practice.

**General objective:** Upon completion of this course, students will have acquired an advanced knowledge of the development of programs in C, their debugging and implementation for the design and development of computer applications that optimize the utilization of the operating system nucleus resources; fully understand operating system process management and the synchronization and communication techniques between the processes, as well as the advantages of developing concurrent and multithreaded algorithms simultaneously in order to implement them using tools that guarantee their efficiency.

**Key words:** Threads. Processes, Concurrency. C Language. Multithreads.

**Bibliography:** \* Hoover, Adam., System programming with C and Unix / Adam Hoover., Boston : Addison-Wesley, c2010., [9780136067122 (papel alcalino)], [0136067123].

## TC2026 Web Applications Development

( 3 - 1 - 8. Prerequisites: [ TC1020 , TC2022 ]. 7 ISC11, 9 ISD11, 7 ITC11, 7 ITIC11 )

**Equivalence:** TC2005

The purpose of this intermediate-level computing course is for students to understand aspects of and necessary techniques for developing client/server applications at the web level. Requires previous knowledge of operating systems and basic network concepts. The learning outcome of this course is for

students to understand the most relevant technologies for development of web applications. Students implement simple web applications that use technologies applicable to industry. They select the best technological option for solving problems that require interaction with a web server.

**General objective:** Upon completion of this course, students will be able to evaluate, design and develop web applications using the industry's current protocols, models and architectures.

**Key words:** Web servers. Mobile applications. Client-server system.

**Bibliography:** \* Zakas, Nicholas C., Professional Ajax / Nicholas C. Zakas, Jeremy McPeak, Joe Fawcett., Indianapolis, IN : Wiley Pub., c2006., [0471777781 (papel/sitio web)], [9780471777786 (papel/sitio web)].

## TC2027 Computer and Information Security

(3 - 1 - 8. Prerequisites: [ TC2008 , TC2002 , TC2018 ]. 7 ISC11, 7 ITC11, 8 ITIC11 )

**Equivalence:** None

The purpose of this intermediate computing course is for students to understand the necessary aspects of and techniques for guaranteeing the security of active information in an organization. It requires previous knowledge of operating systems and basic network concepts. The learning outcome of this course is for students to acquire the necessary competencies to be able to securely perform activities in their discipline and to guarantee the confidentiality, integrity and availability of the information.

**General objective:** Upon completion of this course, students will have gained an overview of the area of computer security and the basic knowledge needed to understand the risks, threats and vulnerabilities of computer systems in today's world, as well as the controls and protection methods against possible attacks, which are indispensable for these systems to work properly in contemporary companies. They will also be familiar with the existing national and international laws related to computer system security.

**Key words:** Cryptography. Information security. Malware. Information legislation.

**Bibliography:** \* Ferguson, Niels., Practical cryptography / Niels Ferguson, Bruce Schneier., New York: Wiley, 2003., [047122894X (papel no ácido)], [0471223573 (rústica : papel no ácido)].

## TC2028 Languages and Translators

( 3 - 0 - 8. Prerequisites: [ TC1018 ]. 7 ISD11 )

**Equivalence:** None

This is an intermediate-level computing course which requires previous knowledge of programming and data structures as well as operating systems. The learning outcome of this course is for students to consolidate their programming competence for computer systems that complement the programmatic part of a digital electronic system.

**General objective:** Upon completion of this course, students will be able to create a small programming language for a specific purpose, and program its translator; develop the necessary skills to organize a large-scale efficient programming project, thus consolidating their capacity for planning and meeting goals.

**Key words:** Compilers. Programming languages. Automatic translators.

**Bibliography:** \* Aho, Alfred V., Compilers, principles, techniques, and tools / Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman., Reading, Mass. : Addison-Wesley Pub. Co., c1986., [0201100886], [0201101947].

## TC3002 Management of Software Engineering Projects

(3 - 0 - 8. Prerequisites: [TI2003, TC2004, SI00875], [TI2011, TC2004]. 7 ISC11, 7 ITC11)

**Equivalence:** None

This is an advanced computer science course in the area of software engineering project management, designed to train students in the planning and control of a successful project which resolves a need or a problem that can be resolved by means of a system. Previous knowledge is required in programming lan-

guages, project development, and the fundamentals of project administration. The learning outcome for this course is that students be able to: develop and execute a software project development plan in accordance with international standards, applying effort estimation and team management methods, while considering risk management and mitigation throughout the life cycle of the project.

**General objective:** Upon completion of this course, students will be able to: Know and apply the techniques, methods and processes for planning, implementing, controlling and concluding software engineering projects within organizations. Apply effort estimation and teamwork management methods, considering risk control and mitigation throughout the project's life cycle. Use the concepts of configuration and quality management applied to a software engineering project.

**Key words:** Software engineering. Effort estimation. Risk and configuration management. Software quality.

**Bibliography:** \* Pandian, C. Ravindranath, Software metrics : a guide to planning, analysis, and application / C. Ravindranath Pandian, Boca Raton, FL : Auerbach Publications, 2003., flu, eng, [0849316618 (papel alcalino)].

## TC3011 Management of IT Services

( 3 - 0 - 8. Prerequisites: [ TC2008 , TC2009 ]. 9 INT11, 8 ITIC11 )

**Equivalence:** None

Advanced computer course in which students will learn about the concept of systems management and computer center management processes. Learning outcome: students will work with measurement mechanisms for IT service management processes and the leading frames of reference for adopting competitive practices in planning and operating computer centers. This course requires prior knowledge of operating systems, computer networks and programming.

**General objective:** Upon completion of this course, students will understand the concept of systems management and the processes of data center

management, the measurement mechanisms for IT services management processes, and the leading frames of reference for the adoption of competitive practices in the planning and operation of data centers.

**Key words:** ITIL. Systems management. Computer centers. Service levels. Outsourcing.

**Bibliography:** \* Introduction to ITIL, 1st ed., London : TSO, 2005, England, 2005, eng, [0113309732 (rústica)], [9780113309733 (rústica)].

### TC3022 Computer Graphics

(3 - 0 - 8. Prerequisites: [TC3037, TC2001 , MA2002],[ TC2017, MA2009, AR1014 ]. 8 ISC11, 8 ITC11, 6 LAD11)

**Equivalence:** None

Advanced computer course that offers the necessary bases for understanding and implementing the digital image creation process on the basis of mathematical models and the simulation of light and material interaction. The course requires prior knowledge of C, linear algebra, concepts of physics (kinematic and dynamic). Learning outcome: students will deliver the implementation of Computational Geometry and Computer Graphics geometry, as well as interactive graphic applications, using the OpenGL library and a high-level programming language such as C++.

**General objective:** Upon completion of this course, students will be able to understand and explain the process of creating digital images, making use of this knowledge by programming interactive graphic applications.

**Key words:** Image synthesis (illumination and shading, shadows, ray tracing, radiosity, photon mapping). Animation (keyframe, reverse kinematics, motion capture, particle systems, physics-based simulation, I.A.). The classical "graphic pipeline" (transformations, projections, clipping, rasterization, textures), el actual (vertex shaders, geometry shaders, fragment shaders) and the future (tessellation process, compute shader). Modeling (Polygonal, Parametric surfaces, Implicit surfaces, Subdivision surfaces).

**Bibliography:** \* Hearn, Donald., Computer graphics with OpenGL / Donald Hearn, M. Pauline Baker., 3rd ed., Upper Saddle River, NJ : Pearson Education, Inc. 2004., New Jersey, 2004., eng, [0130153907].

### TC3028 Physical Interfaces

(3 - 0 - 8. Prerequisites: [ TC1010 , TE1002 , TC2016]. 8 LAD11)

**Equivalence:** None

Intermediate course in the area of interactive systems. Designed to explore the use of sensing technologies for systems in interactive environments for art, music and acting. Through the use of microprocessors and sensors will enable user interaction through unconventional interfaces in various applications such as medicine, art, entertainment, engineering, design, education, among others. Requires prior knowledge of interactive design and programming. As a result of learning the student will use existing physical interfaces and design new useful interfaces to interact with different media.

**General objective:** Upon completion of this course, students will be able to identify the characteristics of a physical user interface and the limitations of a graphical user interface. Students will learn how to integrate everyday objects and those from the environment (light, sound, and air or water flow) in order to achieve a multimodal human-computer interaction. They will also design, develop, and evaluate, with users, a prototype which uses physical interfaces to interact with users.

**Key words:** Sensors. Interaction. Augmented reality. Ergonomics. Physical interfaces. User interface paradigms. Ubiquitous computing. Tangible interfaces.

**Bibliography:** \* Egan, Janet I., 1951-, Writing a UNIX device driver / Janet I. Egan, Thomas J. Teixeira, 2nd ed, Wiley, nyu, 1992, eng, [0471535745 (paper : acid-free paper)].

### **TC3041 Advanced Database Systems** ( 3 - 0 - 8. Prerequisites: [ TC1009 , TC1020 ]. 6 ISC11, 6 ITC11 )

**Equivalence:** CB00862

This is an advanced database systems course. In the course, students know, learn and apply advanced techniques with respect to database modeling, database query processing and database management. This course requires prior knowledge of systems analysis and modeling; data structures and fundamentals of database systems. As a learning outcome, students will have acquired the skills and competencies to apply software development methodologies, tools and standards for the efficient, reliable management of information.

**General objective:** The objective of this course is to provide students with a solid base for the exploitation of the resources that a database manager administers, and to strengthen their knowledge of basic concepts in order to develop advanced applications in databases using emerging technologies. Students will also explore relevant modern database problems from the point of view of applied research. Topics to be covered will include: advanced database modeling, advanced SQL, data warehousing, introduction to data mining, XML databases, optimization of queries and performance, transaction processing, database tuning, information integration, mobile database applications, and management of information in digital libraries.

**Key words:** Database optimization. Advanced databases applications. Database tuning. Database system. Advanced SQL.

**Bibliography:** \* Lightstone, Sam., Physical database design : the database professional's guide to exploiting indexes, views, storage, and more / Sam Lightstone, Toby Teorey, Tom Nadeau., Amsterdam ; Boston : Morgan Kaufmann/Elsevier, c2007., [9780123693891 (papel alcalino)], [0123693896 (papel alcalino)].

### **TC3045 Software Quality and Testing** ( 3 - 3 - 12. Prerequisites: [ TC2004 ]. 6 ISC11, 6 ITC11 )

**Equivalence:** None

The purpose of this advanced-level computing course in quality assurance and software test is to prepare students to apply concepts of software process improvement, reference models for process improvement and international software quality standards in order to implement a software improvement program to help a company obtain an international-level quality certificate and adopt effective software engineering practices. Students are also prepared to perform planning, execution, management and measurement functions for verification and validation activities during the software development process and to use the basic tools that support these activities in an organization. Requires previous knowledge of the fundamentals of software engineering and computer science. The learning outcome of this course is for students to develop a quality assurance plan, applying standards and reference models. They apply techniques and tools for software verification and validation, design a sequence of suitable activities for software review and apply suitable test techniques and strategies to the product.

**General objective:** Upon completion of this course, students will be able to apply software quality concepts, using international quality improvement benchmarks; adopt effective software engineering practices that are the most appropriate for each activity in the software development life cycle; diagnose and evaluate the pertinence of adopting improvement processes in software development companies; and plan, design, implement and assess software tests during all the activities in the development process, thus contributing to continuous quality improvement.

**Key words:** Software quality assurance. Software quality.

**Bibliography:** \* Lewis, William E., Software testing and continuous quality improvement / William E. Lewis., Boca Raton : Auerbach, c2000., [0849398339 (alk. paper)].

### **TC3046 Advanced Networks** ( 3 - 3 - 12. Prerequisites: [ TC2022 ]. 6 ITIC11 ) **Equivalence: None**

This is an advanced computing course in the area of internetworking technologies, in which students will learn to solve and document case studies dealing with switched LAN network and WAN network scenarios. This course requires previous knowledge about internetworking. The learning outcome for this course is that students design a scalable network infrastructure appropriate for small and medium-sized businesses, configure services, interfaces, and protocols for a business data network, and efficiently administrate switched networks and connection links to remote sites, through a telecommunications service provider.

**General objective:** Upon completion of this course, students will be able to evaluate and select the most suitable routing protocols during the design of scalable corporate networks; design and operate a corporate switch LAN efficiently; set up basic WAN links to connect remote sites through an Internet service supplier.

**Key words:** Network switches. Network switch architecture. Lock switch.

**Bibliography:** \* Hui, Joseph yu Ngai., Switching and traffic theory for integrated broadband networks / by Joseph Y. Hui ; foreword by Robert G. Gallager., Boston : Kluwer Academic Publishers, c1990, (printing 1992), [079239061X].

### **TC3047 System Server Administration** ( 3 - 0 - 8. Prerequisites: [ TC2022 ]. 7 ITIC11 ) **Equivalence: None**

The purpose of this advanced computing course in information-technology architecture is for students to learn to manage the resources and services of an information/computing system. As a minimum, students must master and acquire a deep understanding of a server operating system. Students also learn the fundamentals of server-related maintenance, availability, restoration, security, migration and capacity planning. Besides managing an operating system, students must implement some services, such

as web servers, mail servers, remote access, private virtual networks, database servers, file servers and printing servers.

**General objective:** Upon completion of this course, students will have a basic knowledge of computer server management, as well as of the related services, and will be competent in the basic maintenance, availability, security and capacity planning techniques for servers.

**Key words:** Computer systems management. Networking services management. Web systems management.

**Bibliography:** \* Frisch, AEleen., Essential system administration / AEleen Frisch., 3rd ed., Beijing : Cambridge, Mass. : O'Reilly, c2002., [0596003439], [9780596003432].

### **TC3048 Compiler Design** ( 3 - 0 - 8. Prerequisites: [ TC2006 ]. 8 ISC11, 8 ITC11 ) **Equivalence: None**

The purpose of this advanced-level computing course is to provide students with the necessary tools to design new programming languages. Requires previous knowledge of computing mathematics, algorithm analysis and programming languages. The learning outcome of this course is for students to implement a new programming language; a basic specific-purpose language. The particular application may vary depending on the needs and available technologies.

**General objective:** Upon completion of this course, students will be able to design and implement a new programming language.

**Key words:** Lexical analysis. Compilation process. Syntax and semantic analysis. Intermediate code generation. Virtual machines.

**Bibliography:** \* Compilers : principles, techniques, and tools / Alfred V. Aho . [et al.], 2nd ed., Boston : Pearson Addison-Wesley, 2007., [0321486811 (paper alcalino)].



## TC3049 Software Design and Architecture

(3 - 0 - 8. Prerequisites: [ TC2004 ]. 8 ISC11, 8 ITC11)  
Equivalence: None

The purpose of this advanced-level course in software design and architecture is for students to apply concepts of design and architecture in the successful construction of a project, beginning with an identified need or problem to be solved by means of a system. Requires previous knowledge of software development methodologies, unified modeling language (UML) and object-oriented programming. The learning outcome of this course is for students to identify and solve problems, make decisions, analyze problems and define objects for a project, taking restrictions into consideration. They also analyze and synthesize information and analyze ethical, social, legal and economic implications in the solution of the problem.

**General objective:** Upon completion of this course, students will be familiar with and be able to use the techniques, methods and processes for designing the basic software architecture of a system and apply object-oriented techniques and design patterns for building quality software.

**Key words:** System design. Software architecture. Software patterns. Refactoring.

**Bibliography:** \* Jazayeri, Mehdi., Software architecture for product families : principles and practice / Mehdi Jazayeri, Alexander Ran, Frank van der Linden., Boston : Addison-Wesley, c2000., [0201699672].

## TC3050 Robot Vision

(3 - 0 - 8. Prerequisites: [ TE2041 ]. 8 ISD11 )  
Equivalence: None

The purpose of this advanced computing course, focused on robotics, is to provide students with image-processing methods to create computer vision systems for pattern-recognition applications, industrial inspection and trajectory planning for mobile robots. It requires previous knowledge of control engineering and programming. The learning outcome of this course is for students to develop a computer

vision system for a robotic system, especially for a mobile robot.

**General objective:** Upon completion of this course, students will be able to define the components and program the methods for processing images in order to construct a computer vision system specifically for a mobile robot system.

**Key words:** Mobile robots. Image processing. Computer vision. Acquisition of images. Trajectory planning.

**Bibliography:** \* Niku, Saeed B., Introduction to robotics analysis, systems, applications / Saeed B. Niku., Upper Saddle River, N.J. : Prentice Hall, c2001., [0130613096].

## TC3051 IT Business Architectures

(3 - 0 - 8. Prerequisites: [ TI3015, TI3032 ]. 8 ITIC11)  
Equivalence: None

This is an advanced IT course which requires previous knowledge about information systems for organizations. The learning outcome for this course is that students be able to define the components of the technology architecture (architecture of applications and software, computing architecture, communications architecture, and security architecture) required for the implantation and operation of the institutional information systems that support business strategies. Students will also study the process of strategic planning applied to the function of information technology.

**General objective:** Upon completion of this course, students will be familiar with the IT components required for processing, storage, communication networks, security, technological infrastructure management, in relation to both hardware and software, in order to implement and operate information systems and services, such as email and Internet access, in an organization, and to design a robust, reliable, modern integral architecture. They will also be familiar with the standards and regulations applicable to IT business architecture management.



**Key words:** Corporate technological architecture. IT planning. Computer architecture. Security architecture. Communication architecture.

**Bibliography:** \* Ross, Jeanne W., Enterprise architecture as strategy : creating a foundation for business execution / Jeanne W. Ross, Peter Weill, David C. Robertson., Boston, Mass. : Harvard Business School Press, c2006., [1591398398].

### TC3052 Web Application Development Laboratory

( 0 - 3 - 4. Prerequisites: [ TC2026 ]. 8 ISC11, 8 ITC11, 8 ITIC11 )

**Equivalence:** None

This is an advanced computing course which requires previous knowledge of programming, computer networks, distributed systems and Internet technologies programming. The learning outcome of this course is to develop a project in which the main technological tools used for developing web applications are used in practice.

**General objective:** Upon completion of this course, students will have applied diverse Internet systems development tools, thus enabling them to select and use the best tool for solving a specific problem.

**Key words:** .NET. JSF. JSP. AJAX & PHP. Java & J2EE.

**Bibliography:** \* Zakas, Nicholas C., Professional Ajax / Nicholas C. Zakas, Jeremy McPeak, Joe Fawcett., 2nd ed., Indianapolis, IN : Wiley, 2007., [0470109491], [9780470109496].

### TC3053 IT Architecture Capstone Project

( 3 - 0 - 8. Prerequisites: [ TC3047 , TC3051 ]. 9 ITIC11 )

**Equivalence:** None

Advanced course in which students will be able to integrate the competencies developed throughout their degree program in the definition, planning and execution of a project that solves a real industrial, business or scientific problem, incorporating into

the solution the definition of an IT architecture, and of integrating components of electronic, software and information systems into this solution. In doing so, students must adhere to the applicable industrial standards and be capable of managing the project in terms of time, resources and scope to establish and fulfill commitments with those interested in the solution.

**General objective:** Upon completion of this course, students will provide evidence of their capacity to integrate an effective, efficient solution to solve a specific problem that involves the definition of an IT architecture and/or the integration of electronics, software and information systems, within the time and cost restrictions imposed by the problem and the duration of the project.

**Key words:** Electronics. IT architecture. Networks and security. Information Systems and Programming 5. Project planning and management. Programming and information systems.

**Bibliography:** \* Ross, Jeanne W., Enterprise architecture as strategy : creating a foundation for business execution / Jeanne W. Ross, Peter Weill, David C. Robertson., Boston, Mass. : Harvard Business School Press, c2006., [1591398398].

### TC3054 Business Solution Development Capstone Project

(3 - 0 - 8. Prerequisites: [ TC2024 ]. 9 ISC11, 9 ITC11)

**Equivalence:** None

This is an advanced level course in the area of computing, designed to develop students' creative skills, based on a formal research method. This process will allow students to integrate their knowledge in the development of viable, new technology-based products. Previous knowledge is required in the fundamentals of Software Engineering and Computer Science. The learning outcome for this course is that students be able to identify the problems or needs of individuals and organizations and develop ICT projects to meet those needs, in a context of applied research that integrates the knowledge obtained during their careers. The products that are expected to be developed, in addition to the deliverables of a software

project, are: formal theoretical reviews, technical reports, free distribution tools, development of prototypes, development of patents or intellectual property, and disclosure materials, among others.

**General objective:** Upon completion of this course, students will be able to recognize the importance of a problem in a specific context and solve it by developing an information and communications technology project, following a formal, relevant, rigorous research process that results in the creation of innovative technology-based products and services that could feasibly be promoted through business creation.

**Key words:** Development of software projects. Technological innovation projects. Technology-based entrepreneurship.

**Bibliography:** \* Harvard business essentials : managing creativity and innovation., Boston, Mass. : Harvard Business School Press, c2003., [1591391121 (alk. paper)].

## TC3055 Advanced Computer and Information Security

( 3 - 1 - 8. Prerequisites: [ TC2027 ]. 9 ITIC11 )

**Equivalence:** None

This is an advanced computing course in the area of information security technology, in which students will be able to: implement a security system in a company, taking the physical infrastructure into account; implement security control systems in order to analyze vulnerabilities and detect intrusions; make a basic business continuity and disaster recovery plan; and provide support in the design of security policies and procedures. This course requires previous knowledge in information security. The learning outcome for this course is that students implement a security system in a company; design a services management system for the organization and control of user access; design and implement business continuity and disaster recovery plans; and design and implement security policies and procedures.

**General objective:** Upon completion of this course, students will have the necessary knowledge to implement a basic security system in a company, tak-

ing into account the physical infrastructure and the available resources; adequately manage computers used in the organization; control user access by means of the tools peculiar to a mid-level operating system; implement security control systems, such as vulnerability analysis and intruder detection; create a disaster recovery and basic business continuity plan; and help to design security procedures and policies.

**Key words:** Security tools. Vulnerability. Risk management. Policies and best practices.

**Bibliography:** \* Shon Harris, CISSP All-in-One Exam Guide, 5th edition , McGraw-Hill Osborne Media, Inglés, [978-0071602174].

## TE

## Electronic Technologies

**TE1002 Electrical Circuits I**

( 3 - 0 - 8. Prerequisites: [ MA1004 , MA1004 Corequisite , MA1017 , MA1017 Corequisite , MA1002, MA1015 ]. 4 IDS11, 2 IMD11, 4 IME11, 3 IMT11, 3 ISD11, 3 ITE11, 2 ITS11 )

**Equivalence:** E 00831, TE1000

This introductory electronics course is intended to provide students with the fundamentals needed to analyze the response of electrical elements (resistors, capacitors, inductors and power supplies) and their interaction among them. As prior knowledge it requires basic differential and integral calculus. As a learning outcome, students will be able to analyze the transient response in time of all the elements subject to an electronic driving force.

**General objective:** Upon completion of this course, students will be able to analyze basic electrical circuits formed by resistors, capacitors, inductors and direct current power supplies, interpreting the resulting interactions among them.

**Key words:** Direct current circuits. RLC circuits.

**Bibliography:** \* Hayt, W.H.; Kemmerly, J.E.; Durbin, S.M, Engineering Circuit Analysis, 6, Mc Graw-Hill , [0-07-112227-3].

**TE1003 Electronics**

( 3 - 0 - 8. Prerequisites: [ TE1002, TE1012, TE1005]. 5 IDA11, 6 IFI11, 3 IMD11, 6 IMI11, 5 IMT11, 4 ISD11, 5 ITE11, 5 ITIC11, 4 ITS11 )

**Equivalence:** E 00854, E 00855, TE2008

This course provides students with the basic electronics concepts and the necessary competencies to analyze, design and implement electronic circuits based on discrete semiconductor devices. This course requires prior knowledge of DC electrical circuit solution; definitions of power and impedance. Learning outcome: students will propose solutions to practical problems in electronic circuit applications, using the electrical circuit analysis techniques.

**General objective:** On finishing the course the student will be able to analyze, design and implement electronic circuit applications using discrete semiconductor devices like diodes, transistors and thyristors.

**Key words:** Field-effect transistors. Bipolar transistors. Diodes. Electronic circuits. Thyristors.

**Bibliography:** \* Boylestad, Robert L., Electrónica : teoría de circuitos y dispositivos electrónicos / Robert Boylestad, Louis Nashelsky ; traducción, Carlos Mendoza Barraza, 8a ed., México : Pearson Educación, 2003, Mexico, 2003, spa, [9702604362],[9789702604365].

**TE1010 Digital Systems**

( 3 - 1 - 8. Prerequisites: None. 6 IMD11, 5 IMI11, 2 ISD11, 2 ITE11, 3 ITIC11, 2 ITS11 )

**Equivalence:** None

The purpose of this basic electronics course, focused on digital systems, is for students to learn the basics of digital circuit design. No previous knowledge is required. Learning outcome: students will design, simulate and build sequential and combinational digital circuits using small and medium-scale integration devices.

**General objective:** Upon completion of this course, students will be able to design, simulate and implement combinational and sequential digital circuits.

**Key words:** Digital systems. Numeric systems. Combinatory circuits. Bistable cells. Records and counters.

**Bibliography:** \* Floyd, Thomas L., Digital fundamentals / Thomas L. Floyd., 7th ed., Upper Saddle River, N.J. : Prentice Hall, c2000., [0130808504 : HRD],[93.00].

### TE1011 Digital Systems Laboratory ( 0 - 3 - 4. Prerequisites: [ TE1010 ]. 3 ISD11, 3 ITE11, 4 ITS11 )

**Equivalence: None**

This is a basic practical course in electronics focused on digital systems in which students build up combinational and sequential circuits using hardware description language and programmable logic devices. It requires previous knowledge in sequential circuits and HDL which is covered in the theoretical course. The learning outcome of this course is that students develop digital circuits on programmable logic devices, specified through hardware description language.

**General objective:** Upon completion of this course, students will be able to design and build up combinational and sequential circuits using a hardware description language.

**Key words:** Sequential circuits. FPGAs. Hardware description languages. Programmable logic. HDL.

**Bibliography:** \* ITESM, Manual de Prácticas del Laboratorio de Sistemas Digitales, primera, ITESM, español.

### TE1012 Electric Circuits

( 3 - 0 - 8. Prerequisites: None. 4 IDA11, 4 IFI11, 4 IMI11, 4 ITIC11 )

**Equivalence: None**

The purpose of this basic electronics course is to give students the basic tools for analysis and modeling of electric circuits and systems. It requires previous knowledge of integral and differential calculus. The learning outcome of this course is for students to be able to select and apply a variety of techniques for circuit analysis as an essential prerequisite for more advanced courses in analog electronics, microelectronics, etc.

**General objective:** Upon completion of this course, students will be able to: Know, define and relate basic electric variables (current, voltage, electric power). Know and define the basic components of circuits (sources, resistors, inductors, capacitors). Understand the laws that govern the behavior of electric circuits

(Kirchhoff's Laws). Apply general circuit analysis techniques (node analysis, mesh analysis, superposition, etc.) in DC (direct current). Analyze RL, RC and RLC circuits in transient processes. Understand the phase relations between R, L and C. Apply general circuit analysis techniques (node analysis, mesh analysis, superposition, etc.) in AC (alternating current). Calculate the average values and effective values of current and voltage, as well as apparent power, complex power and power factor.

**Key words:** Electric variables and basic components. Additional electric circuit techniques. RL, RC and RLC circuits. Kirchhoff's laws. Nodal analysis and mesh analysis. Sinusoidal steady state. Average power, complex power and effective values.

**Bibliography:** \* Rizzoni, Giorgio., Principles and applications of electrical engineering / Giorgio Rizzoni., 5th ed., Boston : McGraw-Hill Higher Education, c2007., Massachusetts, c2007., eng, [0071254447],[072962984],[0073220337],[9780072962987],[9780073220338].

### TE1013 Electrical and Electronic Engineering

( 3 - 1 - 8. Prerequisites: [ F1005 ]. 4 IMA11 )

**Equivalence: None**

A basic course that shows the potential of the electric and electronic engineering field to be applied to industrial problems, transportation and renewable energies. It's necessary to have a good knowledge of electricity (CD and CA, power and energy) Learning Outcome: Understand the generation, transportation and distribution of energy. Understand the purpose of transformers, fuses and electrical protections. Understand the basic principles and types of electric machines, advantages and disadvantages. Understand the basic principles of installations for lighting and power generation. Understand the basic principles of electronic devices and their main application in analog and digital circuits. Understand the basic principles of power electronics and its application to motor control and renewable energies.

**General objective:** Upon completion of this course, students will be able to: Know, define and relate basic electric variables (current, voltage, electric power).

Know and define the basic components of electric circuits (sources, resistors, inductors, capacitors). Understand the laws that dictate the behavior of electric circuits (Kirchhoff's Laws). Apply general circuit analysis techniques (node analysis, mesh analysis, superposition, etc.) in DC (direct current). Analyze RL, RC and RLC circuits in transient behavior. Understand the phasor notation of R, L and C. Apply general circuit analysis techniques (node analysis, mesh analysis, superposition, etc.) in AC (alternating current). Calculate the average values and effective values of current and voltage, as well as apparent power, complex power and power factor.

**Key words:** Fundamentals of electrical engineering. Electric machines and transformers. Fundamentals of analog and digital electronic design. Analysis of electrical circuits. Power electronics and converters: applications. Generation, transmission and distribution of electric power. Motors machines and transformers. Basic principles of electronics.

**Bibliography:** \* El-Sharkawi, Mohamed A., Electric energy : an introduction / Mohamed A. El-Sharkawi., Boca Raton, Fla. : CRC Press, c2005., [0849330785 (papel alcalino)].

### TE1014 Electric Circuits and Measurements Laboratory

( 0 - 3 - 4. Prerequisites: [ MA1017 , TE1002 ]. 5 IDS11, 5 IFI11, 4 IMD11, 5 IME11, 4 ISD11, 4 ITE11, 3 ITS11 )

**Equivalence:** None

This basic electronics course introduces the student to the operation of instruments in the electrical measurements laboratory and to experimental verification of DC and AC circuit behavior. It requires previous knowledge of DC circuits analysis. Learning outcome: students will learn the fundamental operation of electrical measurement instruments. They will also be able to analyze and experimentally verify the behavior of DC- and AC-fed circuits.

**General objective:** Upon completion of this course, students will be able to use basic electrical measurement instruments, and build an electric circuit fed by direct and alternative current, and analyze and verify its behavior.

**Key words:** Instrumentation for electrical measurements. Direct current circuits. Alternating current circuits.

**Bibliography:** \* Hayt, William Hart, 1920-, Engineering circuit analysis / William H. Hayt, Jr., Jack E. Kemmerly, Steven M. Durbin., 7th ed., New York, N.Y. : McGraw-Hill/Higher Education, 2006., [007286611X (encuadernado : papel alcalino)], [9780072866117 (encuadernado : papel alcalino)], [0071106693 (international ed.)], [9780071106696 (international ed.)], [0073263184], [9780073263182], [9780071109376].

### TE1015 Introduction to Digital Systems and Robotics Engineering

( 3 - 0 - 4. Prerequisites: None. 1 ISD11 )  
**Equivalence:** None

The purpose of this basic-level course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Niku, Saeed B., Introduction to robotics analysis, systems, applications / Saeed B. Niku., Upper Saddle River, N.J. : Prentice Hall, c2001., [0130613096].



## TE1016 Introduction to Telecommunications Engineering

( 3 - 0 - 4. Prerequisites: None. 1 ITS11 )  
Equivalence: None

The purpose of this basic level course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Romero Hernández, Omar., Introducción a la ingeniería : un enfoque industrial / Omar Romero Hernández, David Muñoz Negrón, Sergio Romero Hernández., México : International Thomson, c2006., [9706865551].

## TE1017 Introduction to Electronic and Computer Engineering

( 3 - 0 - 4. Prerequisites: None. 1 ITE11 )  
Equivalence: None

The purpose of this basic course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of the major and institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Haag, Stephen., Information technology : tomorrow's advantage today / Stephen Haag, Peter Keen., New York : McGraw-Hill, c1996., [0070254478 (text)], [0078442958 (text and IT tutor CD-ROM)].

## TE2005 Electromagnetic Fields

( 3 - 0 - 8. Prerequisites: [ MA2001 , MA2002 ], [ MA2010 , MA2009 ]. 4 ITE11, 5 ITS11 )  
Equivalence: E 00853

Intermediate electronics course in which students acquire the knowledge and skills corresponding to an initial abstraction to describe and analyze electromagnetic phenomena. Through this class, students will acquire the basic engineering analytical tools they will need for subsequent more advanced courses in electrical engineering. This course requires prior knowledge of multivariable differential calculus, multivariable integral calculus, vector functions in two and three dimensions, line integrals, surface integrals, differential equations, linear equation systems. Learning outcome: students will know and apply the techniques and concepts of electromagnetic theory to model some simple situations of interest in diverse fields of electrical engineering (electronics, telecommunications, and electromechanical energy conversion, among others).

**General objective:** Upon completion of this course, students will be able to represent electromagnetic phenomena with a rigorous mathematic language (vector analysis), distinguishing between electrostatic, magnetostatic, and dynamic field cases.

**Key words:** Electric field. Magnetic field. Maxwell's laws.

**Bibliography:** \* Cheng, David K. (David Keun), 1917-, Fundamentals of engineering electromagnetics / David K. Cheng., Reading, Mass. : Addison-Wesley Pub. Co., c1993., [0201566117].

## TE2019 Digital Signal Processing Laboratory

( 0 - 3 - 4. Prerequisites: [ TE3002 Corequisite , TE2040 , TE2040 Corequisite ]. 7 ITE11, 6 ITS11 )  
**Equivalence: None**

This is a practical electronics course at the intermediate level that focuses on digital signal processing and provides students with the necessary tools to solve real problems, conduct experiments and complete projects using digital signal processing theory. The course requires prior knowledge of Fourier series and transform, discrete signals, linear systems, Z-transform, active filters. Learning outcome: students will use analysis and mathematical thinking to understand the necessary theoretical aspects to achieve the implementation of signal processing systems that solve real problems. They will also design the hardware and software needed for a real-time digital signal processing system, applying mathematical concepts of signals and discrete systems in real situations. In order to achieve this, students will implement algorithms in digital signal processors, after analyzing and simulating the system with system modeling computer tools. Students will understand the importance of digital signal processors as a fundamental component for the efficient (low cost, low energy consumption, greater processing speed) implementation of modern signal processing systems by completing a practical project.

**General objective:** Upon completion of this course, students will be able to apply the fundamental principles of discrete signals in order to design, model, and implement digital signal processing systems. The approach that these systems will use is oriented to frequency-selective digital filters for audio and video applications.

**Key words:** Digital signal processors. Codec. Fast Fourier Transform. FIR and IIR digital filters.

**Bibliography:** \* Ziemer, Rodger E, Signals and systems : continuous and discrete / Rodger E. Ziemer, William H. Tranter, D. Ronald Fannin, 3rd ed, New York : Macmillan ; London : Collier Macmillan Publishers, 1993, New York, 1993, eng, [0024316415].

## TE2023 Microcontrollers

( 3 - 0 - 8. Prerequisites: [ TE1008 , TE2024 Corequisite ], [ TE1010 , MR2000 ]. 7 IMD11, 7 IMT11, 5 ISD11, 6 ITE11, 6 ITIC11, 5 ITS11 )

**Equivalence: None**

Intermediate theoretical course in electronics, focusing on digital systems, that provides students with the necessary theoretical bases to design and construct microcontroller-based devices and to develop the software needed for their operation. This course requires prior knowledge of number systems, data representation, arithmetic operations, combinatorial and sequential digital systems. Learning outcome: Students will construct devices based on microcontrollers to solve specific problems and will also design the programs needed for their operation. **General objective:** Upon completion of this course, students will be able to design devices based on microcontrollers in order to solve specific problems and also design the necessary programs for their operation.

**Key words:** Microcontrollers.

**Bibliography:** \* Ramesh S. Gaonkar, Fundamentals of Microcontrollers and Applications in Embedded Systems , Ed 1, THOMSON Delmar learning , [978-1-4018-7914-3 / 1-4018-7914-4].

## TE2024 Microcontroller Laboratory

( 0 - 3 - 4. Prerequisites: [ TE2023 Corequisite ]. 7 IMD11, 5 ISD11, 6 ITE11, 5 ITS11 )

**Equivalence: None**

Intermediate electronics laboratory course focusing on digital systems in which students gain the necessary skills to design and construct devices based on microcontrollers and to develop the necessary software for their operation. The course requires prior knowledge of number systems, data representation, arithmetic operations, combinatorial and sequential

digital systems. Learning outcome: students will construct microcontroller based devices to solve specific problems and also design the programs needed for their operation.

**General objective:** After completing the course, the student will be able to build devices based on microcontrollers to solve specific problems as well as design the programs necessary for their operation.

**Key words:** Microcontrollers.

**Bibliography:** \* I. Scott Mackenzie, The 8051 Microcontroller, forth edition, Prentice Hall.

### **TE2029 Energy Management and Monitoring Laboratory** ( 0 - 3 - 4. Prerequisites: None. 8 IDS11 ) **Equivalence: None**

This is an intermediate capstone laboratory course in the area of electronics, in which strategies for efficiently administering energy resources are reviewed and different energy information systems, including hardware and software, used for the administration of energy resources, are evaluated. The course requires prior knowledge of the way in which energy distribution systems operate. Learning outcome: students will be able to operate the most common equipment used for this purpose.

**General objective:** 1. Know the basic concepts of electrical measurement including the characteristics of measurement equipment. 2. Use statistical tools employed in energy diagnoses based on the information generated by measuring equipment, using data bases such as Excel, Access and SQL Server. 3. Use data measurement and registering equipment which store information on energy consumption and variables affecting said consumption, such as temperature and humidity. The way to connect and configure measuring equipment is studied in detail in order to measure and store the parameters involved in invoicing (energy, demand and power factor). 4. Integrate measuring systems employed to optimize the performance of equipment using energy for their operation.

**Key words:** Energy. Energy monitoring.

**Bibliography:** \* Thumann and W.J Younger, Handbook of Energy Audits , Fairmont Press, [ISBN: 0-88173-577-9].

### **TE2030 Advanced Digital Systems** ( 3 - 0 - 8. Prerequisites: [ TE1010 ]. 3 ISD11, 3 ITE11, 3 ITS11 ) **Equivalence: None**

The purpose of this intermediate electronics course, focused on digital systems, is for students to acquire knowledge and skills for the design of complex digital circuits, using a hardware description language. It requires background knowledge in numerical systems, combinatorial circuits and sequential circuits. The learning outcome of this course is to have students design, simulate and build digital circuits based on programmable logic devices using hardware description languages.

**General objective:** Upon completion of this course, students will be familiar with the concepts of memory devices, programmable logic devices, HDLs for modeling and synthesis, combinatorial and sequential circuit design using HDLs, arithmetic circuit design with HDLs and design of the input/output subsystem. Students will be able to generate designs and effect the simulation and implementation of complex digital circuits, using hardware description languages.

**Key words:** Sequential circuits. Memory systems. Arithmetic circuits. Hardware description languages. Configurable logic.

**Bibliography:** \* Roth, Charles H., Digital systems design using VHDL / Charles H. Roth., Boston : PWS, c1998., [053495099X].

### **TE2031 Computer Architecture** (3 - 1 - 8. Prerequisites: [ TE2030 ]. 6 ISD11, 4 ITE11) **Equivalence: None**

The purpose of this intermediate-level electronics course is for students to learn to use a hardware-description language to design and implement digital circuits using reconfigurable logic, such as FPGAs. Requires previous knowledge of Boolean algebra, combinatorial circuits, sequential circuits, automaton

design, and physical construction of combinational and sequential circuits. The learning outcome of this course is for students to build digital devices based on the configuration of a circuit in a configurable circuit, such as an FPGA.

**General objective:** Upon completion of this course, students will be able to design the components of a processor, including concepts such as CISC, RISC, pipeline, performance metrics, memory subsystem design and input/output subsystem design.

**Key words:** Hardware description languages. Design and modeling of processors. Processor architectures. Implementation and simulation of processors. Memory hierarchy. Interfaces with input and output devices. Improving performance through Pipelining.

**Bibliography:** \* Patterson D. A., Hennessey J.L., Computer Organization & Design, Morgan Kaufmann, Inglés.

## TE2032 Electrical Circuits II

( 3 - 0 - 8. Prerequisites: [ TE1002 ]. 5 IDS11, 3 IMD11, 5 IME11, 4 IMT11, 4 ISD11, 4 ITE11, 3 ITS11)

**Equivalence:** TE2001

The purpose of this intermediate-level electronics course is for students to study the behavior of an electric circuit composed of resistors, capacitors, inductors and sources of sinusoidal supply. At the same time, the impact of an electric circuit on energy savings is analyzed through the analysis of electric power. Requires previous knowledge of analysis of electric circuits supplied by direct current. The learning outcome of this course is for students to be able to analyze an electric circuit, supplied by sources of sinusoidal current and voltage, as well as the effect of power on the circuit's energy consumption. Students also analyze the effect of frequency variation on the behavior of an electric circuit.

**General objective:** Upon completion of this course, students will be able to analyze electric circuits fed by a sine-type source.

**Key words:** Frequency response. Alternating current circuits. Electrical power.

**Bibliography:** \* Hayt, William Hart, 1920-, Engineering circuit analysis / William H. Hayt, Jr., Jack E. Kemmerly, Steven M. Durbin., 7th ed., New York, N.Y. : McGraw-Hill/Higher Education, 2006., [007286611X (encuadrado : papel alcalino)], [9780072866117 (encuadrado : papel alcalino)], [0071106693 (international ed.)], [9780071106696 (international ed.)], [0073263184], [9780073263182], [9780071109376].

## TE2033 Applied Electronics

( 3 - 0 - 8. Prerequisites: [ TE1003 ]. 5 IMD11, 6 IMT11, 5 ISD11, 6 ITE11, 5 ITS11 )

**Equivalence:** None

The purpose of this intermediate-level electronics course is to provide students with the necessary tools to design solutions for practical problems in analog electronics that use specific integrated analog circuits and linear and non-linear operational amplifiers. Requires previous knowledge of semiconductor materials, diode circuits, bipolar transistors and field-effect transistors. The learning outcome of this course is for students to understand analog circuits that use linear amplification elements. Students analyze and design circuits with advanced operational amplifier applications in linear and non-linear configurations. They also identify the functioning of analog-digital and digital-analog converters.

**General objective:** Upon completion of this course students, will be able to analyze and design circuits with advanced operational amplifier applications and specific analog integrated circuits.

**Key words:** Operational amplifiers. Instrumentation amplifiers. A/D converters. Analog integrated circuits. Active filters. Comparators. D/A Converters.

**Bibliography:** \* Franco, Sergio., Design with operational amplifiers and analog integrated circuits / Sergio Franco., 3rd ed., New York : McGraw-Hill, c2002., [0072320842 (papel alcalino)], [0071121730 (ISE)].

## TE2034 Integral Electronics Laboratory

( 0 - 3 - 4. Prerequisites: [ TE2006 Corequisite , TE2006 , TE2033 Corequisite , TE2033 ]. 6 IMD11, 7 IMT11, 5 ISD11, 6 ITE11, 5 ITS11 )

**Equivalence:** None

The purpose of this intermediate electrical engineering course is to provide students with the necessary tools to test and implement solutions for practical analog electronics problems that use specific integrated analog circuits, operational amplifiers and semiconductor power devices. It requires previous knowledge of circuits with diodes, transistors, thyristors, operational amplifiers and integrated analog circuits. The learning outcome of this course is for students to design and implement solutions to practical analog electronic problems that use specific integrated analog circuits and circuits with advanced, linear and non-linear operational amplifier applications. Students also design and implement solutions to practical analog electronic problems involving discrete, low-signal, low-power semiconductor devices, specific integrated analog circuits, and linear and non-linear operational amplifier applications.

**General objective:** Upon completion of this course, students will be able to implement operational amplifier circuits and specific analog integrated circuits.

**Key words:** Operational amplifiers. Active filters. A/D and D/A Converters.

**Bibliography:** \* Neamen, Donald A., Microelectronics : circuit analysis and design / Donald A. Neamen., 3rd ed., New York, N.Y. : McGraw-Hill, 2007., New York, 2007., eng, [007252362X],[0071254439 (ed. international)],[9780072523621],[9780071254434 (ed. international)].

## TE2035 Analysis of Signals and Systems

( 3 - 0 - 8. Prerequisites: [ MA2010 , MA2009 ]. 6 IMD11, 5 IMT11, 6 ISD11, 6 ITE11, 5 ITS11 )

**Equivalence:** None

The purpose of this intermediate electronics course is to provide students with the necessary tools to

analyze and characterize continuous time signals as well as to design and perform signal treatment to improve system communication. It requires previous knowledge of differential equations, complex variables and the Laplace transform. The learning outcome of this course is for students design and apply different continuous time filters for signal treatment, depending on their frequency and amplitude response. Students study the signals with Fourier's mathematical tools, characterizing them in the frequency domain and identifying the modulation type of a communication system.

**General objective:** Upon completion of this course, students will be able to apply the concepts of convolution, Fourier transform, trigonometric and Fourier exponential series to analyze and design continuous time systems; be familiar with the concepts from the area of deterministic and random signals, linear time invariant systems, filtering, and the frequency response and transfer function; have a basic knowledge of spectral analysis of signals.

**Key words:** Fourier analysis. Filters in Continuous Time. AM, FM modulation.

**Bibliography:** \* Oppenheim, Alan V., 1937-, Signals & systems / Alan V. Oppenheim, Alan S. Willsky, with S. Hamid Nawab., 2nd ed., Upper Saddle River, N.J. : Prentice Hall, c1997., [0138147574].

## TE2036 Electromechanical Energy Conversion

( 3 - 0 - 8. Prerequisites: [ TE2032 ]. 6 IME11 )

**Equivalence:** None

The purpose of this intermediate-level electronics course is for students to use critical thinking to analyze problems in the conversion of electromagnetic and electromechanical energy. Requires previous knowledge of differential and integral calculus, basic knowledge of electricity and magnetism, and techniques for analyzing electric circuits. The learning outcome of this course is for students to evaluate the behavior of transformers and induction motors for different load conditions, select transformers and induction motors for a specific application and confirm by experimentation the knowledge acquired in class.



**General objective:** Upon completion of this course, students will be able to use mathematical models to explain and analyze the operation of induction machines and transformers.

**Key words:** Practical laboratory experiments. Theoretical analysis for solving laboratory cases.

**Bibliography:** \* Chapman, Stephen J., Electric machinery and power system fundamentals / Stephen J. Chapman., Boston : McGraw-Hill, c2002., [0072291354], [007112179X (International ed.)].

### TE2037 Semiconductors

( 3 - 0 - 8. Prerequisites: [ TE1003 ]. 6 ITS11 )

**Equivalence:** None

This is an intermediate level electronics course in which students will acquire knowledge about solid state electronic devices at equilibrium. A learning objective for this course is that students analyze, model, and simulate the behavior of semiconductor devices such as PN junctions, tunneling effect diodes, and LED's. Requires previous knowledge in classical mechanics, electromagnetic fields, basic modern physics, optics, and quantum mechanics. The learning outcome for this course is that students apply mathematical models (Bloch, Kronig Penney) in order to understand the behavior of intrinsic and extrinsic semiconductors under equilibrium conditions.

**General objective:** Upon completion of this course, students will be able to use their basic knowledge of statistical physics and quantum mechanics to analyze and characterize the properties of solid-state devices based on semiconductors, such as transistors, diodes, optoelectronic components and microelectromechanical systems.

**Key words:** Quantum mechanics. Solid state. Optoelectronics. Statistical physics.

**Bibliography:** \* Neamen, Donald A., Semiconductor physics and devices : basic principles / Donald A. Neamen., 3rd ed. , Boston : McGraw-Hill, c2003., [0072321075 (papel no a'cido)], [0071231129], [0071198628 (ed. internacional)].

### TE2038 Computer Equipment Interfaces

( 3 - 1 - 8. Prerequisites: [ TC2008 , TE2023 ]. 7 ISD11, 7 ITE11 )

**Equivalence:** None

The purpose of this intermediate electronics course, focused on digital systems and computer programming, is to provide students with knowledge about the operation of different computer-expansion interfaces and to develop basic skills for programming device drivers and application programs for those interfaces. It requires previous knowledge of programming and design of basic digital systems in addition of structured programming. The learning outcome of this course is for students to use and program development prototypes for computer-expansion equipment, understanding the operation of their components and designing device-driver programs and programs for their application.

**General objective:** Upon completion of this course, students will be able to understand the operation of a computer's expansion interface, connect diverse peripherals to them and program device controllers and applications to conduct data input and output operations between the computer and the external peripheral components.

**Key words:** Interruptions. PCI. PCI Express. Express Card. USB. WDM.

**Bibliography:** \* Buchanan, William., Advanced PC architecture / William Buchanan and Austin Wilson., Harlow, England ; New York : Addison-Wesley, 2001., [0201398583],[9780201398588].

### TE2039 Electromechanical Energy Conversion Laboratory

( 0 - 3 - 4. Prerequisites: TE1014 , [ TE2036 Corequisite , TE2036 ]. 6 IME11 )

**Equivalence:** None

Intermediate electrical engineering laboratory course in which students use critical thinking to interpret the results obtained from experiments, based on the knowledge acquired in the courses on transformers and engines and machines and controllers.

Prior knowledge is required of electrical circuit analysis techniques, electrical measurements, operational principles of transformers, induction motors, direct current and synchronous machines, and control systems. Learning outcome: students will be able to: 1. Evaluate experimentally the performance of electrical machines, complying with safety measures and adhering to the operating limits of this equipment and the instrumentation used. 2. Select and use the appropriate electrical motor control equipment. 3. Communicate orally, in writing and in graphics the results obtained in a well-structured technical report.

**General objective:** Upon completion of this course, students will be able to plan and conduct experiments to evaluate the performance of electric machines and the associated control equipment.

**Key words:** Practical laboratory experiments. Theoretical analysis for solving laboratory cases.

**Bibliography:** \* Chapman, Stephen J., Electric machinery and power system fundamentals / Stephen J. Chapman., Boston : McGraw-Hill, c2002., [0072291354], [007112179X (International ed.)].

### **TE2040 Digital Signal Processing** ( 3 - 0 - 8. Prerequisites: [ TE2035 ]. 7 ITE11, 6 ITS11 ) **Equivalence: None**

The purpose of this intermediate electronics course, focused on signals, is to provide students with Fourier's discrete, rapid analytical transformation tools, which are necessary to analyze discrete signals and thus design and develop applications for digital signal processing. The course puts special emphasis on the design of discrete filters. Requires previous knowledge of Fourier's series and transform, discrete signals, linear systems, Z-transform and active filters. The learning outcome of this course is for students to approach solutions to problems using system-design methodologies for processing digital signals. Students apply mathematical concepts related to signals and systems in order to analyze and design discrete systems, filtered structures and other key algorithms for digital signal processing. To achieve this, students implement these algorithms in software tools. They understand the importance of digital signal process-

ing as fundamental for the implementation of modern signal-processing systems through development of a practice project.

**General objective:** Upon completion of this course, students will be able to use the fundamental principles of discrete signals to analyze, depict and design digital processing signals from the perspectives of time and frequency domains. The focus of these systems will be orientated toward frequency selective digital filters.

**Key words:** Digital signal processing. Discrete systems. Digital filters.

**Bibliography:** \* Oppenheim, Alan V., 1937-, Discrete-time signal processing / Alan V. Oppenheim, Ronald W. Schaffer., 3rd ed., Upper Saddle River [N.J.] : Prentice Hall : imprint of Pearson, c2010., [9780131988422], [0131988425].

### **TE2041 Applied Robotic** ( 3 - 0 - 8. Prerequisites: [ MR2018 ]. 7 ISD11 ) **Equivalence: None**

The purpose of this intermediate electronics course, focused on robotics, is to provide students with the fundamentals of robotics for designing, building and programming robots for all types of applications. It requires previous knowledge of sensors and actuators. The learning outcome of this course is for students to design, build and program a robot for a specific application.

**General objective:** Upon completion of this course, students will be able to select and/or construct the most appropriate components for designing and building a robot for a specific application; apply the kinematic and dynamic analysis and trajectory planning methods to program the robot's controlled movements so that it can perform the specific task for which it was designed.

**Key words:** Robot simulation. Robotic manipulators. Industrial robot. Lagrangian method. Dynamic analysis. Kinematic analysis. Trajectory planning.

**Bibliography:** \* Niku, Saeed B., Introduction to robotics analysis, systems, applications / Saeed B.

Niku., Upper Saddle River, N.J. : Prentice Hall, c2001., [0130613096].

## TE2042 Technologies for the Efficient use of Electricity

( 3 - 0 - 8. Prerequisites: [ TE2032 ]. 9 IDS11 )

**Equivalence: None**

This is an intermediate level course, which enables students to understand the processes of electromechanical energy conversion. This course will apply basic concepts of electricity, including power electronics, for various types of electrical machines. Previous knowledge is required in the basic concepts of electrical circuits. The learning outcome for this course is that the students understand how electricity is used to produce efficient electromechanical energy.

**General objective:** Students will be able to: Understand how electricity generators work. Apply power electronics to electromechanical energy transformation. Understand how different types of electric machines work. Apply the concepts of energy efficiency.

**Key words:** Combustion processes. Gasification and pyrolysis processes, combined cycles and cogeneration processes, emission and environmental impact control. Basic principles of electronics. Transport and distribution of electrical energy. Motors machines and transformers.

**Bibliography:** \* El-Sharkawi, Mohamed A., Electric energy : an introduction / Mohamed A. El-Sharkawi., Boca Raton, Fla. : CRC Press, c2005., [0849330785 (papel alcalino)].

## TE2043 Power Electronics

( 3 - 1 - 8. Prerequisites: [ TE1002 ]. 6 IME11 )

**Equivalence: None**

The purpose of this intermediate electronics course is to make students to use analysis and mathematical thinking to analyze and resolve electrical engineering problems using semiconductor devices. It requires previous knowledge of electrical circuits' use, both AC and DC. The learning outcome of this course is for students to: understand the functioning of diodes and transistors (BJTs, MOS, IGBTs, thyristors

and TRIACs); analyze electronic circuits containing semiconductors; understand why electronic components are used only in power mode for switching operations; analyze monophasic and triphasic rectifying circuits; understand the functioning principle for DC-to-DC and DC-to-AC converters (monophasic and triphasic).

**General objective:** Upon completion of this course, students will have gained practical knowledge of the possibilities offered by electronics in general, in particular of power electronics, to solve industrial electric problems using electronic converters.

**Key words:** Working principle of electronic components. High-power electronic controllers and FACTS. Electronic converters for industrial applications and renewable energy. Quality of electric power and harmonic distortion.

**Bibliography:** \* Ned Mohan, First Course on Power Electronics, 2009, MNPERE, Inglés, [978-0-9715292-8-1].

## TE3007 Transmission Media

( 3 - 0 - 8. Prerequisites: [ TE2005 , E 00853 ]. 6 ITS11 )

**Equivalence: None**

Advanced electronics course that provides students with the necessary tools to analyze and characterize the propagation of electromagnetic waves in free space and different media, and to calculate impedance coupling between different media. The course requires prior knowledge of integral and differential calculus, concepts of electric and magnetic fields, differential equations, Laplace transforms and basic electromagnetic theory. As a result, students will be able to apply the analysis of electromagnetic wave propagation to determine the losses of power in decibels as a function of distance. They will also be able to specify the parameters that characterize antennas and their radiation patterns, and use the Smith chart to analyze networks and impedance coupling.

**General objective:** On finishing the course the student will be able to analyze the parameters affecting the propagation of electromagnetic waves in free space, apply decibels to propagation analysis,

analyze electromagnetic wave propagation characteristics in free space, analyze their interaction on passing from one medium to a different one, analyze propagation characteristics through different media, and calculate impedance coupling between different media or transmission devices.

**Key words:** Transmission Lines. Electromagnetic waves. RF Propagation in continuous media. Waveguides. RF antennas.

**Bibliography:** \* W. Tomasi, *Sistemas de Comunicaciones Electrónicas*, 3er., Prentice Hall.

**TE3027 Industrial Power Systems**  
( 3 - 1 - 8. Prerequisites: [ TE2014 , TE2036 ]. 8 IME11 )  
**Equivalence: E 00888**

This capstone course is designed to help students to understand how the technologies used to distribute electricity to commercial and industrial users work. The course emphasizes the mathematical models used to study the behavior of electrical systems in a stable operating state or with short circuit faults. The courses Electrical Circuits II and Electrical-mechanical Energy Conversion are prerequisites for this course. Learning outcome: students will be able to integrate the components of an electrical system in order to study its performance using equivalent circuits. Moreover, they will be able to calculate short-circuit currents and select switches and fuses.

**General objective:** Upon completion of this course, students will understand the fundamentals of transmission lines, power flows, calculation of fault currents, and coordination of protections as well as selection of components such as: switches, wires, transformers, and electric machines.

**Key words:** Transmission lines. Symmetrical faults. Power flows. Representation of power systems. Asymmetrical faults. Coordination of power system protection.

**Bibliography:** \* Glover, J. Duncan., *Sistemas de potencia : análisis y diseño* / J. Duncan Glover, Mulukutla S. Sarma ; tr. Francisco Sánchez Fragoso y Hernán

Pérez Castellanos., 3a ed., México : International Thomson, 2004., [9706862919].

**TE3028 Efficient Use of Energy**  
( 3 - 0 - 8. Prerequisites: [ TE3027 Corequisite , TE3027 ]. 9 IME11 )  
**Equivalence: E 00887**

Advanced electronics course that develops students' capacities to use energy efficiently, provides tools to develop the capacity to perform multidisciplinary work and integrates knowledge from diverse disciplines. The course requires prior knowledge of engineering economics, electrical system analysis techniques, principles of operation and control of electrical machines, principles of fluid mechanics and heat transfer. Learning outcome: students will be able to evaluate alternatives for reducing operating costs in industrial plants and commercial facilities.

**General objective:** Upon completion of this course, students will be able to: Understand the pricing system for electricity and gas in Mexico. Comprehend the importance of the correct selection of electric machines, especially those which are high-efficiency. Utilize electronic equipment for energy efficiency of pumping, ventilation, and air-conditioning systems. Perform diagnostic energy efficiency tests. Perform economic studies of life-cycles. Design efficient lighting, air-conditioning, and thermal insulation systems.

**Key words:** Evaluation and implementation of energy saving projects. Energy auditing.

**Bibliography:** \* Thumann, Albert, *Plant engineers and managers guide to energy conservation* / Albert Thumann, 8th ed., Lilburn, GA : Fairmont Press ; Upper Saddle River, NJ : Distributed by Prentice Hall PTR, c2002, Georgia, c2002, eng, [0881733601],[0130676195].

**TE3032 Digital Communications**  
( 3 - 0 - 8. Prerequisites: [ TE2004 , MA2007 ], [ TE2035 ]. 8 ITE11, 7 ITS11 )  
**Equivalence: E 00873**

Advanced electronics course that focuses on telecommunications and provides students with the theory, methods and parameters used in evaluating

and comparing the performance of digital communication systems. The course requires prior knowledge of electromagnetic fields, transmission media, analogue modulation, digital signal processing, random signal analysis, Fourier analysis. Learning outcome: students will apply the conceptual framework of information theory to analyze, evaluate, compare and design digital communications system receivers. They will also develop models with specific computer tools related to this area to conduct the analyses and evaluations of said systems.

**General objective:** Upon completion of this course, students will be able to evaluate digital communication systems, determining, analyzing, and comparing their capacity, their rate of errors (BER), bandwidth, and transmission efficiency, considering different techniques of digital modulation and source and channel coding, utilizing the concepts of digital modulation, information theory, and optimal receiver design.

**Key words:** Information theory. Digital modulation systems. Channel and source coding. Optimal receivers.

**Bibliography:** \* Haykin, Simon S., 1931-, Communication systems / Simon Haykin., 4th ed., New York : Wiley, c2001., New York, c2001., eng, [0471178691 (cloth : alk. paper)].

### TE3034 Microelectronics

**(3 - 0 - 8. Prerequisites: [ TE1003 , TE2010 ]. 7 ITS11 )**  
**Equivalence: None**

Advanced course in the area of electronics that provides students with basic competencies for the analysis, modeling, simulation and design of analogue microelectronic circuits. Students must have completed at least two analogue electronics courses. Learning outcome: students will be able to analyze, design and simulate analogue microelectronic circuits using both long- and short-channel high integration transistors.

**General objective:** Upon completion of this course, students will be able to perform analysis, design, and simulation, in preparation for the generation of manufacturing plans for analog integrated circuits.

**Key words:** CMOS technology. CMOS Microelectronics. Analog integrated circuits. Microelectronic design.

**Bibliography:** \* Allen, P. E. (Phillip E.), CMOS analog circuit design/Phillip E. Allen, Douglas R. Holberg, 2nd. Edition, New York; México: Oxford University Press, c2002, New York, 2002, eng, [0195116445],[9780195116445].

### TE3036 Wireless Communications

**(3 - 0 - 8. Prerequisites: [ TE3032 ]. 8 ITS11 )**

**Equivalence: None**

Advanced electronics course that focuses on telecommunications by means of electromagnetic waves, in which students identify the characteristics and limitations of propagation mechanisms of wireless links, in both diverse radiofrequency bands and different scopes and settings. The course requires prior knowledge of electromagnetic fields, transmission media, principles of propagation, analogue and digital modulation, principles of information theory, digital signal processing, and random signal analysis. Learning outcome: At the end of this course the students will be able to model wireless systems and determine the effects in wireless communication links due to channel limitations and also to design optimized communication systems to counteract said effects.

**General objective:** Upon completion of this course, students will be able to identify the most important functions of the physical layer of a wireless communication system, applying knowledge of electromagnetic propagation inherent to the various radio frequency bands. Students will also develop empirical and statistical models of the wireless channel in order to characterize its effects on signals, thus designing systems which counteract said effects, utilizing advanced modulation schemes. Students will be able to apply this knowledge in the design of equalizers and antenna distribution systems.

**Key words:** Digital modulation systems. Propagation in wireless channels. Wireless channel modeling. Equalization and antenna arrays.



**Bibliography:** \* Goldsmith, Andrea, 1964-, Wireless communications / Andrea Goldsmith., Cambridge ; New York : Cambridge University Press, 2005., [0521837162],[9780521837163].

### TE3038 Communications Systems Laboratory

( 0 - 3 - 4. Prerequisites: [ TE3032 ]. 9 ITE11, 8 ITS11)

**Equivalence: None**

Advanced electronics laboratory course that focuses on telecommunications, in which students will reinforce, by means of computer simulations and experimentation, the knowledge acquired in the area of digital signal processing. The course requires prior knowledge of signal and system analysis, analogue and digital modulations, principles of information theory, digital signal processing, random signal analysis. Learning outcome: students will reaffirm the concepts of signals and systems, analogue modulations (AM, FM and PM) and digital modulations (ASK, FSK, PSK, QAM, etc.) by conducting simulations and experiments appropriate to these topics; know and carry out the characterization of a transmission system by means of a spectrum analyzer, using diverse measurement techniques.

**General objective:** On finishing the course the student will be able to apply the concepts of signs, systems, communication systems, transmission systems, and spectral analysis and measurement through simulations and experiment development. Finally the student will possess the skills to carry out measurements with high-level instrumentation in areas such as: frequency measurement, spectral analysis, analogical modulations (AM, FM, PM), digital modulations (ASK, PSK, FSK, etc.), the characterization of a system's spectral behavior and the coexistence of transmission systems through the analysis and use of modulation and transmission equipment.

**Key words:** Continuous and random signals. Analog and discrete systems. Spectral measurements. Analog modulations: AM, FM, PM. Digital modulations: ASK, FSK, PSK. Characterization of transmission systems.

**Bibliography:** \* Tomasi, Wayne, Electronic communications systems : fundamentals through advanced

/ Wayne Tomasi, 5th ed., Upper Saddle River, N.J. : Pearson/Prentice Hall, c2004, New Jersey, c2004, eng, [0130494925],[9780130494924].

### TE3045 Robotics Project

( 3 - 0 - 8. Prerequisites: [ TC3032 , TC3050 ]. 9 ISD11 )

**Equivalence: None**

Advanced electronics course focused on robotics, which offers students a project development methodology, in order to select a current or future real-life need, design, construct and program a robot that solves the selected issue. This course requires prior knowledge of kinematic and dynamic analysis, image processing and trajectory planning. Learning outcome: students design, construct and program a robot for an application that meets the selected real-life need, integrating advanced knowledge of robotics, sensors, actuators, vision systems and programming.

**General objective:** Upon completion of this course, students will be able to integrate knowledge acquired during their studies by means of the design, construction, and testing of a robotic system to solve a real problem.

**Key words:** Sensors. Actuators. Robot design. Robot programming. Robot vision. Trajectory planning. Vision.

**Bibliography:** \* Niku, Saeed B., Introduction to robotics analysis, systems, applications / Saeed B. Niku., Upper Saddle River, N.J. : Prentice Hall, c2001., New Jersey, c2001., eng, [0130613096].

### TE3052 Energy Project Management

( 3 - 0 - 8. Prerequisites: None. 9 IDS11 )

**Equivalence: None**

This advanced course reviews the official provisions issued by the regulating bodies for energy-sector companies, focusing on the prevailing legal provisions in Mexico, including the official provisions issued by the Energy Regulatory Commission. This course requires prior knowledge of the operation of energy distribution systems. Learning outcome: stu-

dents will evaluate proposals for completing energy projects using the operating rules for energy systems, including systems that run on renewable resources.

**General objective:** At the end of the course, the student will be able to: Understand legal schemes used to generate, transmit and distribute energy, including tariff systems. Understand current regulations for operating auto-supply schemes, including energy transport. Understand current regulations for transmitting, distributing and selling natural gas. Analyze coverage schemes used in the energy sector.

**Key words:** Energy projects. Energy regulating commission.

**Bibliography:** \* Compendio de reformas energéticas., 1a ed., México : Ediciones Fiscales ISEF, [2008], [9783687264897].

### TE3053 Energy Distribution Systems

( 3 - 0 - 8. Prerequisites: None. 8 IDS11 )

**Equivalence:** None

Advanced electronics course designed so that students will review the technologies used to distribute energy, highlighting electric energy and natural gas. This course focuses on the mathematical models used to quantify the power and energy transmitted in both electrical grids and duct systems. No prior knowledge is required. Learning outcome: students will evaluate the transmission of energy.

**General objective:** At the end of the course, the student will be able to: Make one-line diagrams of electrical networks using the per-unit system. Calculate the power flows in an electrical system with the support of software tools. Make diagrams of gas distribution systems. Analyze gas transport and distribution systems for energy use.

**Key words:** Energy distribution. Electric Energy.

**Bibliography:** \* Thumann, Albert., Plant engineers and managers guide to energy conservation / Albert Thumann., 8th ed., Lilburn, GA : Fairmont Press, c2002., [082470925X].

### TE3054 Engineering Project Laboratory I

( 0 - 3 - 4. Prerequisites: None. 7 ITS11 )

**Equivalence:** None

The purpose of this advanced-level electronics course is for students to apply the knowledge acquired in previous semesters to develop multidisciplinary projects that help solve real problems by proposing solutions that incorporate the development, adaptation or transfer of technology. Requires previous knowledge of electronics, digital systems, communication, digital signal processing and transmission media. The learning outcome of this course is for students to develop a project proposal that solves a real problem, culminating in innovative products, processes or services.

**General objective:** Students will be introduced to project methodologies. They will identify problems and areas of opportunity in electronic design, propose solutions and analyze their feasibility, and establish evaluation criteria for the solution. At the end of the course, students will be able to conceptualize an electronic or telecommunications product with a particular application in one of the areas of electronics; identify problems and areas of opportunity in digital systems, telecommunications or microelectronics; present their ideas in a document as a project proposal detailing the duration and equipment needed to solve the problem in question.

**Key words:** Quality assurance and standards for certification of products. Patents and copyrights. Project proposal. Bibliographical research. Conceptual model. Project boundaries. Projects development.

**Bibliography:** \* Ronald A. Reis, Electronic project design and fabrication, 6, Prentice Hall.

## TE3055 Embedded Systems for Telecommunications Laboratory

( 0 - 3 - 4. Prerequisites: [ TE3056 Corequisite ]. 7 ITS11 )

**Equivalence: None**

The purpose of this advanced-level electronics course is to help students focus on digital systems for the design of embedded-system applications for telecommunications and related areas. Requires previous knowledge of combinational and sequential circuits, programming and microcontrollers. The learning outcome of this course is for students to understand from the practical point of view a development platform for embedded systems and to carry out practice activities that let them develop applications for telecommunications and related areas.

**General objective:** Upon completion of this course, students will have integrated all the hardware and software components of an embedded system development platform to design applications in telecommunications or related areas.

**Key words:** Embedded systems. Microcontrollers. Real-time systems. Configurable logic. ASIC circuits.

**Bibliography:** \* Wolf, Wayne Hendrix., Computers as components : principles of embedded computing system design / Wayne Wolf., 2nd ed., Amsterdam ; Boston : Elsevier/Morgan Kaufmann, c2008., [0123743974 (rústica : papel alcalino)], [9780123743978 (rústica : papel alcalino)].

## TE3056 Embedded Systems for Telecommunications

( 3 - 0 - 8. Prerequisites: [ TE2023 , TE2024 ]. 7 ITS11 )

**Equivalence: None**

The purpose of this advanced-level electronics course, focused on digital systems, is for students to design embedded-systems applications oriented toward telecommunications and related areas. Requires previous knowledge of combinational and sequential circuits, programming and microcontrollers. The learning outcome of this course is for students to design applications in the field of telecommunica-

tions and related areas, using an embedded-system development platform.

**General objective:** Upon completion of this course, students will be familiar with basic embedded system design from the point of view of hardware and software and will design telecommunications-oriented applications based on this platform.

**Key words:** Embedded systems. Microcontrollers. Configurable logic. ASIC circuits.

**Bibliography:** \* Wolf, Wayne Hendrix., Computers as components : principles of embedded computing system design / Wayne Wolf., 2nd ed., Amsterdam ; Boston : Elsevier/Morgan Kaufmann, c2008., [0123743974 (rústica : papel alcalino)], [9780123743978 (rústica : papel alcalino)].

## TE3057 Wireless Communications Laboratory

( 0 - 3 - 4. Prerequisites: [ TE3036 Corequisite , TE3036 ]. 8 ITS11 )

**Equivalence: None**

The purpose of this advanced-level electronics laboratory course focused on telecommunications is for students, through computer simulations and experimentation, to reinforce knowledge acquired in the areas of electromagnetic propagation, antennas and radiation, characterization of wireless channels and networks. Requires previous knowledge of electromagnetic fields, transmission media, propagation principles, analog and digital modulation, principles of information theory, digital signal processing and analysis of random signals. The learning outcome of this laboratory is for students to reaffirm basic concepts of propagation, radiation and wireless communications, explore the functioning and limitations of diverse wireless technologies, develop network applications using wireless devices, and understand advanced measurement techniques using equipment, such as vector network analyzers and cellular base station emulators.

**General objective:** Upon completion of this course, students will be able to apply the concepts of communications to analyze, by means of simulations and experiments, the limitations produced by the

communications channel in diverse wireless technologies; have the skills to perform measurements with high-level instrumentation in areas such as: transmission line propagation, measurement of the characteristics of diverse antennae, antenna arrangement design, measurement of radiofrequency device parameters such as filters and amplifiers, and statistical characterization of wireless channels, performance of modulation systems in the presence of noise, multiple trajectories and Doppler deviation, expanded spectrum modulation systems, multiple carrier and MIMO systems, multiple access systems such as CDMA, coexistence analysis and generation of network applications using wireless devices.

**Key words:** Digital modulation systems. Propagation in wireless channels. Antennas and propagation. Radiofrequency instrumentation.

**Bibliography:** \* Goldsmith, Andrea, 1964-, Wireless communications / Andrea Goldsmith., Cambridge ; New York : Cambridge University Press, 2005., [0521837162],[9780521837163].

### TE3058 Engineering Project Laboratory II

( 0 - 3 - 4. Prerequisites: [ TE3054 ]. 8 ITS11 )

**Equivalence: None**

The purpose of this advanced-level electronics course is for students to apply knowledge acquired during their course of study to the development of multidisciplinary projects that help solve real problems through problem identification and the proposal of solutions with different perspectives on developing, adapting or transferring technology. Requires previous knowledge of electronics, digital systems, communications, digital signal processing and transmission media. The learning outcome of this course is for students to develop and administer integrated projects for the solution of real problems, culminating in the generation of innovative products, processes or services.

**General objective:** Students will be introduced to project methodologies. They will identify problems and areas of opportunity in electronic design,

propose solutions and analyze their feasibility, and establish evaluation criteria for the solution. At the end of the course, they will be able to develop and validate the functioning of an electronic or telecommunications product, with a particular application in one of the areas of electronics. They will use collaborative methodologies and technological platforms adequate for the established purpose. They will decide on the best solution from among those proposed, using technological feasibility criteria.

**Key words:** Product development. Project development and management.

**Bibliography:** \* Ronald A, Reis, Electronic Project Design and Fabrication, 6, Prentice Hall.

### TE3059 Embedded Systems

( 3 - 0 - 8. Prerequisites: [ TC2008 , TE2023 ]. 8 ISD11, 8 ITE11 )

**Equivalence: Non**

The purpose of this advanced-level electronics course is to offer students a learning platform focused on development environments for projects and applications involving embedded-system design techniques. Requires previous knowledge of sequential and combinational circuits, microcontrollers, operating systems and data structures. The learning outcome of this course is for students to be able to implement a custom electronic design based on configurable (FPGAs) or programmable (microcontrollers) devices. Students carry out formal planning, from electronic design specification to implementation.

**General objective:** Upon completion of this course, students will understand the fundamental principles, specification process and formal methodology in the design, implementation and testing of embedded systems.

**Key words:** Embedded systems. Formal specification methodology. Real-time operating systems.

## TE3060 Embedded Systems Laboratory

( 0 - 3 - 4. Prerequisites: [ TE2023 , TE2024 , TE3059 Corequisite ]. 8 ISD11, 8 ITE11 )

**Equivalence: None**

The purpose of this advanced-level electronics course is to offer students laboratory practice focused on the development environment and application of techniques used in the implementation of embedded systems. Requires previous knowledge of sequential and combinational circuits, microcontrollers, operating systems and data structures. The learning outcome of the laboratory is for students to implement electronic designs in configurable digital devices (FPGAs) or programmable devices (microcontrollers). They perform measurements and tests verifying the correct functioning of the design.

**General objective:** Upon completion of this course, students will understand the fundamental principles of operating, implementing and testing embedded systems.

**Key words:** Embedded systems. Real-time operating systems.

## TE3061 Multiprocessors

( 3 - 0 - 8. Prerequisites: [ TE3059 ]. 9 ISD11 )

**Equivalence: None**

This is an advanced theoretical course in computer equipment programming which provides students with knowledge about the functioning of computer systems based on multi-core microprocessors and architectures of multiple interconnected microprocessors. It requires previous knowledge in operating systems and computer equipment interfaces. Learning outcome: students will design and program algorithms using the paradigm of task fragmentation in order to solve problems using multi-core computer systems and/or systems with multiple processors.

**General objective:** Upon completion of this course, students will be able to understand how a microprocessor works, its internal architecture and programming techniques for codifying parallel algorithms, analyzing the efficiency of its implementations using performance evaluation tools.

**Key words:** Threads. Microprocessor. Parallelizable algorithms.

**Bibliography:** \* Herlihy, Maurice., The art of multiprocessor programming / Maurice Herlihy, Nir Shavit., Burlington, MA : Elsevier : Morgan Kaufmann, 2008., [0123705916],[9780123705914].

## TE3062 Integral Electronic Technologies Project

( 3 - 0 - 8. Prerequisites: [ TE2023 ]. 9 ITE11, 9 ITS11 )

**Equivalence: None**

The purpose of this advanced electronics course is for students to put into practice the concepts covered in the course of study through planning and development of an integrated project involving electronic technologies. It requires previous knowledge of microcontrollers, digital system design, applied electronics, digital signal processing, communications and transmission media. Learning outcome: students will simulate the designs generated and analyze the results; document in a report the results of the simulations; develop and implement the project model or prototype; perform tests and verify that the implemented prototype functions correctly. Students report the results of the tests performed, defend their electronic technology projects, and develop a user manual, a technical manual and a process report. Finally, they generate a project poster.

**General objective:** During this course, students will develop project planning, implementation, technical documentation and formulation skills in both individual and collaborative work contexts, integrating the concepts of exact science and knowledge from the area of electronics to propose engineering solutions supported by knowledge of electronics.

**Key words:** Technological feasibility. Performance evaluation. Prototype development. Integration of hardware with software. Testing prototypes inclusive. SPICE Simulation. Consolidation and testing of prototype.

**Bibliography:** \* Reis, Ronald A., Electronic project design and fabrication / Ronald A. Reis., 6a ed., Upper Saddle River, NJ : Pearson, c2005., [0131130544].



### TE3063 Telecommunication Networks ( 3 - 0 - 8. Prerequisites: [ TE3032 , TC2022 ]. 9 ITS11 )

**Equivalence: None**

The purpose of this advanced electronics course, focused on telecommunications, is for students to develop integrated knowledge of telecommunications networks as well as the heterogeneous services environment, including voice, audio, imaging, video and data, transported over telecommunications networks with packet- and frame-switching. It requires previous knowledge of the OSI reference model, local area networks (LANs) and wide area networks (WANs), random and stochastic processes, signal and system analysis, and transmission media. Learning outcome: students will know and apply traditional techniques and concepts used in telephony and the digital techniques required for their operation. They also analyze network traffic patterns and the functioning of signaling systems to control and administer the service. Students are able to understand the operational characteristics and principles of new digital transport services to help in the planning, implementation and operation of this type of network, both cabled and wireless.

**General objective:** Upon completion of this course, students will be able to use the fundamental principles of network traffic analysis and telephony and package services that transport voice, video and data with the main communication protocols in order to analyze their performance and evaluate the quality of their service.

**Key words:** Transport modes. Digital telephony. Signaling. Telecommunications systems. Communications network model. **Bibliography:** \* Leon-Garcia, Alberto., Communication networks : fundamental concepts and key architectures / Alberto Leon-Garcia, Indra Wadjaja., 2nd ed., Dubuque, Iowa : McGraw-Hill, c2004., [007246352X],[0071198482 (ISE)].

### TE3064 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 ITE11, 9 ITS11 )

**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

### TE3065 Introduction to Professional Development

( 2 - 0 - 2. Prerequisites: None. 9 ISD11 )

**Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to suc-

cessfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].

### **TE3066 Intelligent Electrical Networks** ( 3 - 0 - 8. Prerequisites: [ TE2032 ]. 9 IME11 )

**Equivalence: None**

This is a final course, which is designed to help students understand the logical workings of an electric power grid with distributed generation, based on control and safety systems. The course will include activities that enable students to acquire the knowledge used in the operation of stable power grid systems. It also includes information on the factors that cause transitory phenomena, such as atmospheric discharges and short-circuits, in system operations.

As a prerequisite for this course, the student has to have completed the Industrial Electrical Systems course with a passing grade. Learning outcome: students will be able to analyze the behavior of electric power grids in order to define the safety and automation systems that ensure optimal and reliable performance.

**General objective:** Upon completion of this course, students will be able to: Integrate circuits that are equivalent to power networks. Conduct flow simulations in power networks using commercial products, such as Powerworld and Aspen Power Flow. Coordinate electrical network protection in order to provide the intelligence required by distributed generation systems. Select the protection required by power systems that are exposed to transitory phenomena, such as atmospheric discharges. Understand the optimal operation of reliable electrical systems.

**Key words:** Steady state operation of transmission lines. Power flows. Protection systems. Power control systems. Transients in power lines. Transient stability.

**Bibliography:**\* Glover, J. Duncan., Powersystem analysis and design / J. Duncan Glover, Mulukutla S. Sarma, Thomas J. Overbye., 5th ed., Stamford, CT : Cengage Learning, c2012., [9781111425777],[1111425779].

## TI Information Technologies

### TI1010 Creativity and Innovation for Problem Solving

( 3 - 0 - 8. Prerequisites: None. 3 INT11 )

**Equivalence:** None

Basic information systems course in which students learn about and apply methods and tools for analyzing problems and become capable of identifying the causes and effects of the same, providing effective, efficient solutions. This course does not require any prior knowledge. Learning outcome: students will apply creative thinking and innovation processes to concrete cases and develop skills to solve problems effectively and make sound decisions in order to achieve their objectives in the face of this field's increasingly complex and changing processes.

**General objective:** Upon completion of this course, students will be able to: comprehend the methods and tools for problem analysis, identifying their causes and effects; apply said methods and tools in an effective and efficient solution proposal using creative thinking and innovation processes in increasingly complex cases whose environments will be changing as well.

**Key words:** Problem solving. Innovation methods. Development of creativity and innovation.

**Bibliography:** \* Andrés Fernández Romero, Creatividad e innovación en empresas y organizaciones: técnicas para la resolución de problemas, Ediciones Díaz de Santos.

### TI1011 Selling Chain Management

( 3 - 0 - 8. Prerequisites: [ CF1007 , CF1010 ]. 4 INT11 )

**Equivalence:** None

Basic information technologies course that focuses on commercial process integration and information systems in an enterprise. The aim is for students to understand the commercial processes of an organization, identifying their components (procedures, policies and people) and the flows of objects, people, money and information, and identify the information

technology that could support said processes. This course requires prior knowledge of accounting and cost management. Learning outcome: students will portray a marketing process and the way in which technology should support it.

**General objective:** Upon completion of this course, students will be able to comprehend the commercial process for the various types of organizations from the management and prospecting of sales to the customer relationship and service, identifying the information systems which support these processes in an organization. Students will evaluate the commercial process in each one of its phases, identifying the value that each one adds to the organization's product.

**Key words:** Sales management. Marketing. CRM. Distribution. Customer service.

**Bibliography:** \* Paul Greenberg, McGraw-Hill Osborne Media, CRM at the Speed of Light, Tercera edición.

### TI1012 Business Information Technology

( 3 - 0 - 8. Prerequisites: [ TC1001 ]. 1 LAE11, 1 LAF11, 1 LCPF11, 1 LDN11, 1 LEM11, 1 LIN11, 1 LLN11, 1 LMC11, 3 LP 12, 1 LPM12, 1 LPO11, 3 LPS12 )

**Equivalence:** TI1000

Basic course in the area of information technologies in which students use computational tools to streamline the data analysis and interpretation process, and to support the decision-making process. Learning outcome: students are expected to generate, analyze, synthesize and provide information for making decisions that enable them to solve specific business problems and generate practical solutions.

**General objective:** Students will recognize the impact of information technology as a support tool for decision making in organizations. They will be able to organize data using a database manager. They will also simulate different scenarios, build comparative

tables and graphs and learn how to forecast using a spreadsheet and data analysis tools on Internet to detect opportunities within the company. They will be able to handle an advanced tool to give dynamic information presentations. They will be familiar with the ethical dilemmas existing in the process of obtaining, compiling and sharing information through technology.

**Key words:** Information systems. Competitive intelligence. Information technology. Advanced Excel and Power Point. Data-access tools on Internet.

**Bibliography:** \* M. González, A. Almaguer, M. Dieck, B. García, M. Garza, D. Lankenau, L. Lankenau e I. Valdez., *Tecnologías de Información ? Solución efectiva de problemas*, 2010, Mc. Graw Hill, Español.

### **TI1013 Introduction to Business Informatics**

**( 3 - 0 - 4. Prerequisites: None. 1 INT11 )**  
**Equivalence: None**

The purpose of this basic course is to induct students into the setting of university life and the majors in which they are enrolled. No previous knowledge is required. The learning outcome of this course is for students to have a clearer vision of their majors and the institution they have joined. Students also generate a life plan and an academic-professional major plan.

**General objective:** Upon completion of this course, students will be familiar with the characteristics of graduates from the major in which they are enrolled, including the competencies, career field and professional development. They will also know the organizational structure of Tecnológico de Monterrey and its principal rules and regulations.

**Key words:** Tecnológico de Monterrey. Undergraduate programs: importance and function of the graduate in society. Tecnológico de Monterrey Academic Regulations. Undergraduate programs: career fields and areas of professional development.

**Bibliography:** \* Haag, Stephen., *Information technology : tomorrow's advantage today* / Stephen

Haag, Peter Keen., New York : McGraw-Hill, c1996., [0070254478 (text)], [0078442958 (text and IT tutor CD-ROM)].

### **TI2002 Business Process Management**

**( 3 - 0 - 8. Prerequisites: [ TI1009 , AD1005 , CF1010, CF1007 , AD1000 , OR1003 ]. 5 INT11, 6 ITIC11 )**  
**Equivalence: None**

Intermediate level course in information systems, whose intention is develop in students analysis, modeling, design and business process optimization. Requires previous knowledge in management and information systems. As result of this knowledge, students will present an optimized business process model of an organization using a BPA (Business Process Analysis) tool.

**General objective:** Upon completion of this course, students will be able to apply a model for optimization of business processes which increases the efficiency and profitability of a company, through an analysis and modeling of the processes.

**Key words:** Process optimization. Process modeling. Business process management (BPM). Business Process Analysis (BPA). Porter's value chain.

**Bibliography:** \* Ould, Martyn A., 1948-, *Business process management : a rigorous approach* / Martyn A. Ould., Tampa, FL : Meghan-Kiffer Press, c2005, Florida, c2005, eng, [0929652274],[1902505603],[9780929652276].

### **TI2010 Capstone Project I**

**( 3 - 0 - 8. Prerequisites: [ TI2002 ]. 6 INT11 )**  
**Equivalence: None**

This is an intermediate level course in the information technology area, where students are exposed to real life situations applying knowledge related to information systems, data bases and business processes. It requires previous knowledge in the development of information systems, data bases and business process modeling. As a result of the learning experience, the student will provide a diagnostic of business

process improvements and information technology within the context of a small and/or medium sized enterprise.

**General objective:** Upon completion of this course, students will be able to evaluate the solution to a problem within a real small or medium-sized company, applying knowledge related to the design of business processes and information technology.

**Key words:** Information systems. Business processes. Data bases. Project management. Innovation. Informatics ethics.

**Bibliography:** \* Wing Lam y Venky Shankararaman, Enterprise Architecture and Integration: Methods, Implementation and Technologies, IGI Publishing.

## TI2011 Project Evaluation and Management

( 3 - 0 - 8. Prerequisites: None. 6 INT11, 6 ISC11, 6 ITC11, 6 ITIC11 )

**Equivalence:** TI2003

This is an intermediate IT course in which students will learn the basic concepts of the project management process, in order to apply them in business management in accordance with the Project Management Institute. Previous knowledge is not a requirement. Learning outcome: students will manage a project and evaluate its feasibility.

**General objective:** Upon completion of this course, students will be able to exercise leadership and handle human resources in project management within the context of information technologies, and communicate in interpersonal and group settings to coordinate efforts to complete a project successfully.

**Key words:** Project control. Project management. Project assessment. Economic feasibility.

**Bibliography:** \* Larson, Erik W., 1952-, Project management : the managerial process / Erik W. Larson, Clifford F. Gray., 5th ed., New York, McGraw Hill, 2011 + 2 CD-ROMS (4 3/4 plg.), [9780077426927].

## TI3028 Change Management

( 3 - 0 - 8. Prerequisites: [ TI2010 ]. 8 INT11 )

**Equivalence:** None

Advanced information systems course focusing on the development of the students' ability to generate a change management strategy stemming from working on a project for implementing and/or adopting a new technology. Learning outcome: students will identify the potential problems of resistance to change in process improvement and systematization projects, and will present a proposal with a strategy to mitigate the impact of the resistance and to make it easier for people to adopt those changes.

**General objective:** Upon completion of this course, students will be able to: apply methods in order to implement change management in organizations; design strategies for the adoption of technologies and mitigation of the resistance to change in organizations.

**Key words:** Risk analysis. Resistance to change. Innovation adoption. Conflict management.

**Bibliography:** \* Harvard business essentials. Managing change and transition., Boston, Mass. : Harvard Business School Press, c2003., [1578518741 (alk. paper)].

## TI3029 Capstone Project II

( 3 - 0 - 8. Prerequisites: [ TI2010 ]. 9 INT11 )

**Equivalence:** None

An advanced information technologies course that seeks to expose students to real-world problems where they can apply information systems, databases, and business processes knowledge. This course requires prior knowledge of information systems, databases and business processes. The learning outcome is for students to propose an integral strategy for improving and innovating processes that is compatible to an organization's strategies and vision, which can give the organization a competitive advantage with the use of leading-edge information technologies.

**General objective:** Upon completion of this course, students will be able to apply to a real-world project



concepts and structures which integrate information technology tools for generating and maintaining competitive advantages through the effective use of information and a strategy supported by robust architectures of information technology, communications, and other complementary and support architectures, so that they are later aligned to the business strategy and the opportunities offered by a company's environment.

**Key words:** Competitive advantage. Diagnosis. FODA. Strategic alignment.

**Bibliography:** \* Jeanne W. Ross, Peter Weill, David C. Robertson, *Enterprise Architecture as Strategy: Creating a Foundation for Business Execution*, HBS Press Book.

### **TI3030 Data Management** ( 3 - 0 - 8. Prerequisites: [ TC1020 ]. 6 INT11 ) **Equivalence: TI2009**

The purpose of this advanced information systems lecture is to develop in the students the skills to apply methodologies for database design and techniques for collection, storage and recovery of information using a database manager. It requires previous knowledge about databases and information systems. As a learning outcome, the students will be able to apply data mining methodologies in making real-life decisions.

**General objective:** Upon completion of this lecture, students will be able to use database design methodologies to support an organization's business intelligence process.

**Key words:** Data mining. Visualization. Decision making. OLAP. Data warehousing.

**Bibliography:** \* Han, Jiawei., *Data mining : concepts and techniques* / Jiawei Han, Micheline Kamber., 2nd ed., San Francisco, Calif. : Morgan Kaufmann ; Oxford : Elsevier Science [distribuidor], 2006., United States, 2006., eng, [1558609016],[9781558609013].

### **TI3031 Strategic IT management** ( 3 - 0 - 8. Prerequisites: [ TI2002 ]. 7 INT11 ) **Equivalence: None**

The purpose of this advanced-level information-systems course is to establish necessary connections between business strategy and information-technology strategy, thus permitting the creation of competitive advantages for the company. Requires knowledge of administration and information systems. The learning outcome for this course is for students to prepare a strategic-planning development project for a medium-sized business.

**General objective:** Upon completion of this course, students will be able to: assess the need to incorporate IT into business strategy, as one of the leading drivers of companies' competitiveness; and analyze, design and plan the implementation of information systems in organizations.

**Key words:** Strategic management. Decision making. Information technologies for competitiveness, investment and growth. Strategic planning.

**Bibliography:** \* Goetsch, David L., *Effective strategic planning for competitive advantage : ten steps for technical professions* / David L. Goetsch., Upper Saddle River, N. J. : Pearson Prentice Hall, 2006., [013048525X].

### **TI3032 Enterprise Information Systems** ( 3 - 1 - 8. Prerequisites: [ TI2002 ]. 7 INT11, 7 ITIC11 ) **Equivalence: None**

The purpose of this advanced-level information-systems course is to analyze the different types of information systems used in organizations. Requires previous knowledge of administration and information systems. The learning outcome of this course is for students, after executing a process of evaluation and selection of applications, to propose solutions supported by business information systems and suitable for the specific needs of the organization, keeping in mind budget and operational restrictions, and, finally, defining the system implementation plan.

**General objective:** Upon completion of this course, students will be able to understand the architecture of business systems and select the best integrated and/or extended information system in a specific situation; analyze the structures, scope and implementation of the main information system tools in companies, recognizing the impact of information systems on technology, finance and operations.

**Key words:** CRM. ERP. Benchmarking. Business Information Systems. Implementation of systems. Data migration.

**Bibliography:** \* Hamilton, Scott, 1950-, Maximizing your ERP system : a practical guide for managers / Scott Hamilton., New York : McGraw-Hill, c2003., [0071406115 (hardcover : alk. paper)].

### **TI3033 IT Governability** ( 3 - 0 - 8. Prerequisites: [ TI3031 ]. 8 INT11 ) **Equivalence: None**

The purpose of this advanced-level information-systems course is to prepare students to understand the methodologies that define the operation of an information-technology department: policies, procedures, standards and industry norms. Requires knowledge of information systems. The learning outcome for this course is for the student to study information technology in an organization and relate course concepts to the way the organization operates.

**General objective:** Upon completion of this course, students will be able to understand the regulations and policies that govern the operation of a firm's IT department.

**Key words:** IT strategic planning. IT Governability. CIO role. IT organizational architecture. IT performance, corporate governance.

**Bibliography:** \* Weill, Peter., IT governance : how top performers manage IT decision rights for superior results / Peter Weill and Jeanne W. Ross., Boston, MA. : Harvard Business School Press, c2004., [1591392535].

### **TI3034 Business Intelligence** ( 3 - 1 - 8. Prerequisites: [ TI3030 ]. 9 INT11 ) **Equivalence: TI3022**

The purpose of this advanced-level information-systems course is to consolidate skills in information analysis, database management and visualization of information, applying information models for organizations. Requires previous knowledge of statistical methods for analysis of data, databases, business processes and information systems. The learning outcome of this course is for students to develop a business intelligence proposal for an organization.

**General objective:** Upon completion of this course, students will be able to analyze the organization's external and internal sources of information and the relevant data to propose an organizational indicator system that generates values, employing their database management and result visualization skills.

**Key words:** Data analysis. Decision support systems. Decision process. Competitive advantage. Organizational strategy.

**Bibliography:** \* Mallach, Efrem, 1942-, Decision support and data warehouse systems / Efrem G. Mallach., Boston : Irwin/McGraw-Hill, c2000., [0072899816 (paper no a'cido)].

### **TI3035 Introduction to Professional Development** ( 2 - 0 - 2. Prerequisites: None. 9 INT11, 9 ISC11, 9 ITC11, 9 ITIC11 ) **Equivalence: None**

This is a university course which is designed to prepare students in their area of specialization for the CENEVAL examination or the institutional examination given at the end of the degree program. This course will review the most important topics studied during the students' degree programs. The students, as soon-to-be professionals, will have the opportunity to reflect on this new stage of their lives and to explore the career alternatives that are available to them. The learning outcome for this course is that students acquire the tools they need in order to successfully make the transition from student to professional and find employment.

**General objective:** Upon completion of this course, students will have reviewed the topics that are most relevant to their major and have acquired the tools and information needed to seek employment.

**Key words:** Job-seeking tools. Professional development alternatives. Life and Career Center.

**Bibliography:** \* What next? / Barbara Moses., 1st American ed., New York : DK Pub., 2003., [0789493551 (papel alcalino)].



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