Université Saint-Joseph de Beyrouth
Faculté d'ingénierie
École supérieure d'ingénieurs
de Beyrouth

Saint-Joseph University of Beirut

Faculty of Engineering

École Supérieure d'Ingénieurs de Beyrouth

ESIB

Catalog 2020-2021

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Ecole Supérieure d'Ingénieurs de Beyrouth (ESIB)

History

In 1910, the Rector of the "Académie de Lyon (France)", M. Paul JOUBIN, reported to the Council of the University of Lyon the interest of a work of academic expansion in the Middle East. To this end, a commission has been set up and has carried out a number of missions to Lebanon and the Middle East in order to realize this idea.

On November 14, 1913, the French School of Engineering of Beirut was inaugurated, at the same time as the French School of Law, and it was called EFIB. A test of admission to EFIB had taken place on October 17, 1913 and 19 candidates had been admitted. At the end of the first preparatory year, 14 students were considered fit for the second year of study.

Because of the World War I, on November 2, 1914, the diplomatic relations between France and the Ottoman Empire broke off, and on November 14 the school buildings were requisitioned. On October 30, 1918, an armistice was signed on the island of Moudhros, and the opening of the School of Engineering was again scheduled.

Following an agreement signed on January 27, 1919, between the "Lyonnaise Association for the Development Abroad of Higher and Technical Education" and the "Society of Jesus", the opening of the EFIB took place on November 10, 1919. The duration of the studies was extended to three years, then to four from 1936.

The model for the School of Engineering of Beirut was undoubtedly the "Ecole Centrale de Lyon". It is the model of a general training of a polyvalent civil engineer able to allow, if necessary, a later specialization. This program was simply retouched to adapt it to the requirements of Lebanon. Because of this program resemblance, the engineering degree awarded to EFIB students had the same value as that of the "Ecole Centrale de Lyon". EFIB students were able to attend the "Ecole Centrale de Lyon" specialization courses without an entrance exam. The first Engineering Degree (called "Diplôme" according to the French system) was given in 1922 to Mr. Gabriel Rezkallah ARACTINGI.

Initially, the lessons were mainly related to civil engineering, mechanics and electricity. Early on, civil construction, public works and hydraulics took an important place. In 1942, alongside the Civil Engineering program, an Industry program was set up to train engineers capable of ensuring the utilization of local industrial resources during the war. On the same date, the "National Committee of Combatant of France" authorized the School to organize, for the duration of the war, courses in science. In 1945, the Industry Program was replaced by an Architecture Program, which was better suited to the needs of the country.

In 1949, EFIB changed its name and became the "Higher School of Engineering of Beirut" - ESIB.

The EFIB and then ESIB remained for 40 years, the first and only School of Engineering in Lebanon and the Middle East, and trained all the first engineers of our region. During this period, EFIB and ESIB students were Lebanese, Syrian, Egyptian, Palestinian, Iranian, Turkish, etc.

In 1963 the duration of the studies was extended to 5 years, after the Lebanese Baccalaureate (Freshman according to the US System) and it was in October 1971 that the School moved to its current premises in Mar Roukos. New Programs were then planned. It should be noted that in 1968-1969 and 1972-1973 the School trained Geographic Engineers for the Lebanese Ministry of National Defense.

The events of 1975 forced again the School, completely plundered, to close its doors in March 1976. But in December 1976 the courses resumed, and the ESIB was attached to the new Faculty of Engineering of Saint Joseph University of Beirut (USJ). Great efforts were made since 1977 to equip the laboratories with very modern equipment and very high performance. In 1978 the programs were restructured, and the fifth year options adapted to the new needs of the market.

In 1979, the engineering preparatory years (first two years) were restructured, with the creation of the Higher and Special Mathematics classes preparing for the competitions of the French Grandes Ecoles (Ecole Polytechnique, Ecole Centrale, Ecole Supélec, Ecole Nationale des Ponts et Chaussées, Ecole des Mines, Ecole de Télécom ...), the competitions taking place in Lebanon under the responsibility of the French Embassy.
Between 1978 and 1980 ESIB had to move six times because of the Lebanese war, to take over in October 1980 its activities in its premises of Mar Roukos.
Since 1993, the standardization of the situation allows to gradually establish postgraduate Programs (Masters and PhD). The renewed partnership with France, from 1996 to the year 2000, accelerated this process. In 1998, the Faculty of Engineering decided to set up its teaching and testing laboratories as Research Centers. It includes five research centers within the ESIB: The Regional Center for Water and Environment, the Lebanese Center for the Study and Research of Construction, the Center for Electrical and Telecommunications Industries, the Center for Computer Science, Modeling and Information Technology and the Center of Physics and Chemistry.
Starting from October 2001, ESIB adopts a new admission system based on a selection by one of the three methods: study of school records for early admission, entrance exam, or the Mention Very Good and above on Lebanese or French Baccalaureate. The objective of this system is to allow the best students to be admitted to ESIB very early.
In 2003, ESIB, within the framework of the Faculty of Engineering, changed its teaching structure and switched to the "European Credit Transfer System" (ECTS). At the same time, it signed co-graduation agreements with several major Schools of Engineering in France, which are directly implemented. In September 2005 she restructured its Masters Degrees.
In September 2013, and due to the strategic importance of Oil and Gas sector, ESIB opened its first "Master Degree in Oil and Gas: Exploration, Production and Management" in collaboration with the "Institut Français du Pétrole" (IFP School). It is also the first ESIB program that is fully taught in English.
In 2015, ESIB started the process of accreditation of its engineering programs. In parallel, the Electrical and Mechanical Engineering program was divided into two programs: the Electrical Engineering (EE) Program with the options in Electromechanical Engineering and in Industrial Systems, and the Computer and Communications Engineering (CCE) Program with the options in Software Engineering and in Telecommunication Networks.
In 2017, a Chemical and Petrochemical Engineering Program and a Master in Data Sciences were created in collaboration with the faculty of sciences of Saint Joseph University of Beirut.

ESIB Mission

The « Ecole Supérieure d'Ingénieurs de Beyrouth » (ESIB) of Saint Joseph University is a French-speaking engineering institution of higher education and research serving Lebanon and the region. ESIB provides students with a solid education to acquire high-level scientific and technical skills in several areas of the engineering profession, allowing them to become operational both in design and research as well as on site and in industry. The academic experience of the students goes beyond the acquisition of knowledge in the courses to skill-based learning involving creativity, innovation, cooperation, collaboration with peers and tolerance.

ESIB Vision

Within the next six years, the ESIB decides to:

- Provide a high level of education for students from Lebanon and the region and give them a passport for employment.
- Work to become a pole for research and innovation.

- Promote dialogue through biculturalism and multilingualism.
- Remain a place of reflection and integral formation of the person.

Administration

Dean:

Wassim RAPHAEL

Directors of Educational Departments & Research Centers:

Department of Preparatory Classes (DCP): Marwan BROUCHE
Department of Civil and Environmental Engineering (DCE): Muhsen Elie RAHHAL
Department of Electrical and Mechanical Engineering (DEM): Hadi KANAAN
Department of Doctoral Studies (DED): Wassim RAPHAEL
Center of Electrical and Telecommunications Industries (CINET): Elias RACHID
Center of Computer, Modelling and Information Technology (CIMTI): Samer LAHOUD
Lebanese Center for the Study and Research of Construction (CLERC): Fouad KADDAH
The Regional Center for Water and Environment (CREEN): Wajdi NAJEM

Administrative Staff

Dean's Office:

Executive Assistant: Ghada AOUAD, Viviane BOU ABSI ABI HAYLA, Rose DAGHER MRAD
Supervisor: Jihad KHAWAND
Staff: Marie EL KHOURY EL HAGE

Department of Preparatory Classes:

Executive Assistant: Elise SALIBA
Department of Civil and Environmental Engineering:
Executive Assistant: Lina HANY AZAR

Department of Electrical and Mechanical Engineering:

Executive Assistant: Marlène Daoud DAOUD
Department of Doctoral Studies:
Executive Assistant: Rana KHOURY (EL)

The Regional Center for Water and Environment:

Lab Assistant: Elie KHACHO

Center of Electrical and Telecommunications Industries:

Head of the Electromechanical Unit: Michel MOUGHABGHAB

Center of Computer, Modelling and Information Technology:

Programmer: Carine BOUSTANY SAWAYA
Technical support: Georges FAWAZ

Lebanese Center for the Study and Research of Construction:

Executive Assistant: Rana KHOURY (EL)
Lab Technician: Charbel AOUN

Faculty Members

Professors:

Marwan BROUCHE, Maroun CHAMOUN, Fadi GEARA, Ragi GHOSN, William HABRE, Alfred HAYEK, Fouad KADDAH, Hadi KANAAN, Rima KILANY CHAMOUN, Dany MEZHER, Wajdi NAJEM, Elias RACHID, Muhsen Elie RAHHAL, Wassim RAPHAEL, Hadi SAWAYA.

Associate Professors:

Joe BITAR, Rémi Ziad DAOU, Marc IBRAHIM, Flavia KHATOUNIAN, Samer LAHOUD, Chantal MAATOUK, Toni NICOLAS, Rania SASSINE, Tarek SINNO, Sami YOUSSEF.

Assistant Professors:

Alain AJAMI, Nancy CHALHOUB, Jad DAKROUB, Rafic FADDOUL, Nohra HAGE, Melhem HELOU, Farah HOMSI, Fares MAALOUF, Joseph MAALOUF, Rayan MINA, Joanna NSEIR YARED, Jihane RAHBANI, Chantal SAAD HAJJAR, Hiba RAJHA, Katia RAYA, Georges SAKR, Jean SAWMA, Toufic WEHBE, Christiane ZOGHBY.

Invited Professors:

Alain AURIAULT, Said BITAR, Claude BOCQUILLON, Carla CASTILLO, Michel CHACAR, Gilles DARMOIS, Maurice FADEL, Julien GUILLET LHERMITE, Hussein IBRAHIM, Eric MONMASSON, Etienne MOREAU, Isabelle REY FABRET, Assad ZOUGHAIB.

Faculty Members of another institution of USJ:

Maher ABBOUD, Nancy ALLAM CHOUCAIR, Nizar ATRISSI, Hayat AZOURI TANNOUS, Hilda BAIRAMIAN, Joseph BEJJANI, Souraya BECHEALANY, Lara BOUSTANY, Georges FARES, Ursula HAJJ, Roger LTEIF, Jihad RENNO, Alfred RIACHI, Dominique SALAMEH, Nada SLEIMAN, Pascal TUFENKJI.

Lecturers:

Mira ABBOUD, Pascale ABBOUD RIZK, Sara ABDALLAH, Roy ABI ZEID DAOU, Elie ABOU ANTOUN, Adel ABOU JAOUDE, Georges ABOU SLEIMAN, Antoine ALLAM, Angèle AOUAD RIZK, Elie AOUAD, Nathalie AOUAD, Joseph ASMAR (AL), Jean Claude ASSAF, Khattar ASSAF, Ortanse ATARIAN JABRE, Soumaya AYADI MAASRI, Mounia BADRAN SABA, Youssef BAKOUNY, Danielle BEDROSSIAN, Nabil BEJJANI, Rana BEJJANI, Elie BOU CHAKRA, Robert BOU NAHED, Karen BOULOS, Maroun BOULOS, Fadi CHAMMAI, Georges CHAMOUN, Jean CHAMOUN, Said CHEHAB, Jessica CHEMALI, Lucien CHEMALY, Jihad CHERFANE, Samer CHERFANE, André CHKEIBANE, Nadim CHOUEIRY, Marina DACCACHE, Mohammad DAKROUB, Simon DANIEL, Habib DEBS, Gabriel DEEK, Hassan DEGHAILY, Ahmad, Elias DIB, Khalil EDDE, Joe ELIAS, Georges FAHD, Rana FAKHREDDINE, Fadi FARAH, Robert FARHA, Nasr FARHAT, Hassan FAWAZ, Nicolas FAYAD, Antoine FEGHALY, Christelle GEARA, Elie GEDAOUN, Charbel GEMAYEL, Youssef GERGES, Alain GHANEM, Ghassan GHATTAS, Nada GHORRA CHEHADE, Lara GHOSN, Rémi GHOSN, Akram GHOSSOUB, Fouad GORAEIB, Bassam HABRE, Ghassan HACHEM, Joanna HADDAD, Ahmad HAJJ, Ziad HAKIME RAHME, Najib HARB, Hanane HAYEK, Elias HELOU, Nabil HENNAOUI, Josiane HINDI, Elie HLEIHEL, Nelly HOBEIKA, Jihad HOKAYEM, Najate HOKAYEM, Antoine HREICHE, Eliane IBRAHIM, Emile JALKH, Samar KADDAH, Sabine KAHI, Bassam KAHWAGI, André KANAAN, Joy KANAAN, Steve KARAM, J.-M. KAWKABANI, Philippe KECHICHIAN, Joseph KESSERWANI, Dima KHAIRALLAH, Walid KHALIL, Mahmoud KHAZMA, Samar KHOURY, Gabriel KHOURY (EL), Grace KHOURY, Marina KHOURY, Ziad KHOURY, Joseph

KOZEILY, Bachir LAHAD, Chawki LAHOUD, Firas MAATOUK, Hiam MALLAT, Chadi MASSOUD, Rodolphe MATAR, Chadi MATNI, Raya MAZIGI, Joseph MCHAYLEH, Elias MECHREF, Antoine MEOUCHI, Georges MELKI, Rabih MOAWAD, Majed MOUBARAK, Oumar MOURAD, Carine MOUSSAED KEHDI, Manal MOUSSALLEM, Richard MOUZANNAR, Mohamad MROUE, Paul NACOUZI, Candice NAIM, Marwan NAKFOUR, Georges NASHEF (EL), Nassib NASR, Catherine NASR EL-KHOURY, Bassam NASRALLAH, Maha NASRALLAH, Ralph NASRALLAH, Cyrine NEHME, Hiam NEHME, Georges NEHME, Caecilia PIERI, Jalal POSSIK, Abbas RAAD, Elie RAHME, Ziad RAHME, Roger RAKWEH, Eva RAZZOUK ASSAF, Elie RENNO, Alexandre RICHA, Majdi RICHA, Nicolas ROUHANA, Nour ROUMIEH, Kamal SAFA, Rémi SAFI, Mona SAIKALI, Antoine SAWAYA, Antonio SAWAYA, Graziella SEBAALY, Marlène SEIF AOUAD, Sylvain SEIF, Saad SFEIR, Joe SOKHN, Guy TABET, Antoinette TAMER, Gregory TAOUSSON, Naji WAK, Ghada WAKED, Fathi YAFI (EL), Yammine YAMMINE, Sarah-Lily YASSINE, Grace YOUNES MADI, Kamal YOUSSEF, Shawki YOUSSEF, Marie José ZAKKA.

Degrees awarded

- Bachelor of Engineering – Major Chemical and Petrochemical Engineering
- Bachelor of Engineering – Major Civil Engineering. Options:
    - Buildings and Engineering Management
    - Water and Environment
    - Public Works and Transportation
- Bachelor of Engineering – Major Computer and Communications Engineering. Options:
    - Software Engineering
    - Telecommunication Networks
- Bachelor of Engineering – Major Electrical Engineering
- Bachelor of Engineering – Major Mechanical Engineering
- Master in Data Science
- Master in Electrical Engineering
- Master in Oil and Gas: Exploration, Production and Management
- Master in Renewable Energy
- Master in Road Safety Management
- Master in Structures and Soil Mechanics
- Master in Telecommunications, Networks and Security
- Master in Water Sciences

Admission

Admission to « Mathématiques Supérieures » (first year of the Preparatory Engineering Classes)

- The selection is made in three ways: School records in January, School records in June and and mention “Very Good” at the official Lebanese baccalaureate.
- Required level: Lebanese scientific baccalaureate or equivalent.

First year admission to the Major Engineering Classes

- Admission file and possibly an admission exam for the students of USJ, and within the limits of available places, an admission exam for other candidates.
- Required level: BS degree in Mathematics, Physics, Computer Science or Chemistry (bac + 3). or an equivalent scientific degree compatible with the desired program. Or eligibility for the entrance to a “Grande École Française d'Ingénieurs” (A or B).

- Tests: Mathematics, Physical science and Engineering Sciences.

Admission to a Master

Candidates are selected by a committee within the limits of available places.

- Master in Data Sciences
    - Admission to the first year of the Master (M1): Admission file for candidates holding a Bachelor's degree in Computer Science or Mathematics or holding an equivalent degree.
    - Admission to the second year of the Master (M2): Admission files for the graduate CCE engineers. For holders of a 1st year Master's degree in Computer Science or Mathematics. For students of the 5th year of the CCE Program at ESIB or holders of an equivalent recognized degree.
- Master in electrical engineering
    - Admission to the first semester of the Master (MR1): Admission file for holders of a Bachelor's degree in Electrical Engineering, Physics, Electronics, or Automation or for holders of an equivalent degree.
    - Admission in another semester of the Master: Admission files for the graduate engineers, for holders of a 1st year Master's degree in Electrical Engineering, Physics, Electronics, or Automation or holders of an equivalent degree.
- Master Oil and Gas: Exploration, Production and Management
    - Graduate engineers (civil, electrical, mechanical, chemical, petrochemical or equivalent), holders of a Master's degree in Mathematics, Physics, Mechanics, Electricity or Electro techniques or holders of an equivalent recognized degree.
- Master in Renewable Energy
    - Admission in the 3rd semester (MR3) for graduate engineers (civil, electrical, mechanical or equivalent), for holders of a Master's degree in civil, electrical or mechanical engineering or holders of an equivalent recognized degree.
- Master in Road Safety Management
    - Graduate of a BS degree in many fields. This Master is jointly organized with RENAULT France and has its own conditions. Please refer to the official application of this Master.
- Master in Structures and Soil Mechanics
    - Admission to the first semester of the Master (MR1): Admission file for holders of a Bachelor's degree in Civil engineering, Mathematics, Physics, Mechanics or Earth Sciences or holders of an equivalent degrees.
    - Admission in another semester of the Master: Admission files for the graduate engineers, for holders of a 1st year Master's degree in Civil engineering, Mathematics, Physics, Mechanics or Earth sciences. For Students of the 5th year at ESIB or holders of an equivalent degrees.
- Master in Telecommunications, Networks and Security
    - Admission in the 3rd semester (MR3) for graduate engineers (civil, electrical, mechanical or equivalent), for holders of a Master's degree in civil, electrical or mechanical engineering or holders of an equivalent recognized degree.
- Master in water sciences
    - Admission to the first semester of the Master (MR1): Admission file for holders of a Bachelor's degree in Civil engineering, Water sciences, Mathematics, Physics, Chemistry,

Earth sciences, Biology, Geography, Agronomy, Agrofood, Process engineering or Water treatment or holders of an equivalent degree.

- Admission in another semester of the Master: Admission files for the graduate engineers, holders of a 1st year Master's degree in Civil engineering, Water sciences, Mathematics, Physics, Chemistry, Earth sciences, Biology, Geography, Agronomy, Agrofood, Process engineering or Water treatment, for Students of the 5th year at ESIB or holders of an equivalent degree.

Tuition fees

The tuition fees are fixed at the beginning of the academic year and payable in two installments for each semester. For information. For the first semester of the 2019-2020 academic year, the tuition fees are 268 dollars per ECTS credit in the Preparatory Engineering Classes and in the Major Engineering Classes; this is 8040 dollars for 30 ECTS credits. Students in financial difficulty can apply to the USJ Social Service which studies their file and grants them, in the event of a favorable opinion, a scholarship or a loan for tuition fees.

Organization of studies

After two years of studies in the Department of Preparatory Engineering Classes and validation of the corresponding 120 ECTS credits, students integrate the Department of Civil and Environmental Engineering or the Department of Electrical and Mechanical Engineering. The Engineering Programs proposed correspond to 180 ECTS credits distributed over 3 years of study. After completion of studies, a Bachelor of Engineering degree is awarded.

Community life

Upon their entry, students find themselves in a friendly and even family atmosphere, due to the good spirit that reigns in their mutual relations and in their relations with the administration and the teaching staff. In this context, students stand together through student associations, which elect their delegates and committees and deal with common problems and hobbies. A number of activities are undertaken at the initiative of the student associations. At the exit, the alumni of each school or institute ensure the maintenance of friendly and professional ties that contribute to solidarity and mutual aid of the elders in the context of mutual esteem. Each promotion designates a delegate to the alumni who regularly elects its committee. Most promotions keep contacts through annual meetings several decades after they leave the Faculty.

Chaplaincy

The Faculty is open to students of all faiths, of all nationalities: the only admission criteria are academic. It refers to the Christian faith, for whom everyone is loved by God and is called by him to a singular vocation. She therefore wishes to help each student respond to this call by becoming a free person, autonomous, capable of reflection, synthesis, judgment, having the taste of teamwork, the desire to be useful, the passion for justice and fraternity and open to spiritual realities. Students find chaplaincy a place to make this reflection. A chapel is located on the campus, where groups meet regularly.

Department of Preparatory Classes

Head of Department: Marwan BROUCHE

Faculty Members

Professors:

Marwan BROUCHE, William HABRE, Alfred MORCOS HAYEK.

Associate Professors:

Remi-Ziad DAOU, Toni NICOLAS, Sami YOUSSEF.

Assistant Professors:

Alain AJAMI, Nancy CHALHOUB, Jad DAKROUB, Nohra HAGE, Chantal SAAD HAJJAR, Fares MAALOUF, Joseph MAALOUF, Jihane RAHBANI, Hagop TAWIDIAN.

Lecturers:

Mira ABBOUD, Pascale ABBOUD, Charbel AOUAD, Soumaya AYADI, Youssef BAKHOUNY, Maroun BOULOS, Georges CHAMOUN, Lucien CHEMALY, Nada GHORRA, Ghassan HACHEM, Mireille HADDAD, Samar KADDAH, Joseph KESSERWANI, Wael MAHBOUB, Chadi MASSOUD, Remi SAFI.

Objectives

The purpose of the Preparatory Classes Department is to teach students the basic scientific concepts necessary to engage in specialization options.

Outlets

The training of the Department of Preparatory Classes allows, after two years, students to continue their studies in the specialization departments: Department of Civil Engineering and Environment (corresponding to 180 ECTS credits) or Department of Electricity and Mechanics (corresponding to 180 ECTS credits).

Programs and Options

After graduating from the baccalaureate, students enter one of the programs in the preparatory classes department. Courses correspond to 120 ECTS credits. The Department of Preparatory Classes comprises eight programs:

- The Chemical and Petrochemical Engineering Preparatory Program – Regular Class prepares students for the Chemical and Petrochemical Engineering program, managed by the Department of Civil Engineering and Environment.
- The Civil Engineering Preparatory Program – Regular Class prepares students to enter the Department of Civil Engineering and Environment.
- The Computer and Communications Engineering Preparatory Program – Regular Class prepares students to join the Electrical and Mechanical Department.
- The Electrical Engineering Preparatory Program – Regular Class prepares students to join the Electrical and Mechanical Department.
- The Mechanical Engineering Preparatory Program – Regular Class prepares students to join the Electrical and Mechanical Department.

- The Chemical and Petrochemical Engineering Preparatory Program – Honors Class, which prepares students to take entrance exams to the French ‘‘Grandes Ecoles’’ and/or to follow the Chemical and Petrochemical Engineering program, managed by the Department of Civil Engineering and Environment.
- The Civil Engineering Preparatory Program – Honors Class, which prepares students to take entrance exams to the French ‘‘Grandes Ecoles’’ and/or to join the Civil Engineering Environment Department.
- The Computer and Communications Engineering Preparatory Program – Honors Classes prepares students to pass entrance exams at the French ‘‘Grandes Ecoles’’ and/or to join the Electrical and Mechanical Department.
- The Electrical Engineering Preparatory Program – Honors Class, which prepares students to take entrance exams to the French ‘‘Grandes Ecoles’’ and/or to join the Electrical and Mechanical Engineering Department.
- The Mechanical Engineering Preparatory Program – Honors Class, which prepares students to take entrance exams to the French ‘‘Grandes Ecoles’’ and/or to join the Electrical and Mechanical Engineering Department.

Chemical and Petrochemical Engineering Preparatory Program – Regular Class

Coordinator: Marwan BROUCHE

Program Educational Objectives

The objectives of the program are to graduate students able to:

- Work effectively and ethically in their professional environment at local, regional and international levels.
- Advance in their careers to become leaders in their profession, through trilingual skills, life-long learning and creativity.
- Lead in a dynamic professional environment through continuous learning and development of knowledge and skills.

Student Outcomes

The student outcomes are aligned with the ABET requirements:

1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3) An ability to communicate effectively with a range of audiences.
4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Requirements

Required Courses (116 ECTS credits), Restricted Electives (0 ECTS credits), Open Electives (4 ECTS credits).

English (0 Cr.)

Level A on the English language proficiency test is required to integrate the 4-credit English course taught in the specialization departments. In the Preparatory Classes Department, refresher courses (B, C, D, E) are offered to reach this level. To obtain the final engineering degree, students must then pass the Saint Louis English Proficiency Test.

General Education (10 Cr.)

Required Courses (6 Cr.)

Initiation to Engineering Project (2 Cr.)
Citizenship Topic: Engineering at the Service of the Community (2 Cr.)
Philosophy and Religions Topic: Religions in their diversity (2 Cr.)

Open Electives (4 Cr.)

General Education courses that can be pursued in any USJ institution.

Core Mathematics and Sciences (80 Cr.)

Mathematics (46 Cr.)

General Analysis (6 Cr.)
Analysis 1 (4 Cr.)
Analysis 2 (6 Cr.)
Linear Algebra (8 Cr.)
Bilinear Algebra and Geometry (6 Cr.)
Differential Calculus (6 Cr.)
Discrete Mathematics (6 Cr.)
Probability (4 Cr.)

Sciences (34 Cr.)

General Chemistry (4 Cr.)
Mechanics 1 (6 Cr.)
Mechanics 2 (4 Cr.)
Physical Signals (6 Cr.)
Thermodynamics 1 (4 Cr.)
Thermodynamics 2 (4 Cr.)
Chemistry Laboratory (2 Cr.)
Physics Laboratory 1 (2 Cr.)
Physics Laboratory 2 (2 Cr.)

Programming (12 Cr.)

Computer Aided Design (4 Cr.)
Programming 1 (4 Cr.)
Programming 2 (4 Cr.)

Engineering Courses (18 Cr.)

Atomic Structure and Bonding (2 Cr.)
Introduction to Fluid Mechanics (2 Cr.)
Geology (2 Cr.)
Kinetics of Chemical Reactions (2 Cr.)
Organic chemistry (4 Cr.)
Organic Chemistry Laboratory (2 Cr.)
Inorganic chemistry and Laboratory (4 Cr.)

Proposed Schedule

Semester 1

020ANGNI1	General Analysis	6 Cr.
020CHGNI1	General Chemistry	4 Cr.
020MADNI1	Discrete Mathematics	6 Cr.
020GSCNI1	Engineering at the Service of the Community	2 Cr.
020MC1NI1	Mechanics 1	6 Cr.
020SPHNI1	Physical Signals	6 Cr.
	Total	30 Cr.

Semester 2

020ALNNI2	Linear Algebra	8 Cr.
020AA1NI2	Analysis 1	4 Cr.
020ATONI2	Atomic Structure and Bonding	2 Cr.
020IF1NI2	Programming 1	4 Cr.
020TH1NI2	Thermodynamics 1	4 Cr.
020TCGNI2	Chemistry Laboratory	2 Cr.
020PP1NI2	Physics Laboratory 1	2 Cr.
	Open Electives	2 Cr.
	Total	28 Cr.

Semester 3

020ALBNI3	Bilinear Algebra and Geometry	6 Cr.
020AY2NI3	Analysis 2	6 Cr.
020CORNI3	Organic chemistry	4 Cr.
020IF2NI3	Programming 2	4 Cr.
020MC2NI3	Mechanics 2	4 Cr.
020TH2NI3	Thermodynamics 2	4 Cr.
020PP2NI3	Physics Laboratory 2	2 Cr.
018RDLDL1	Religions in their diversity	2 Cr.
	Total	32 Cr.

Semester 4

020CDFNI4	Differential Calculus	6 Cr.
020CIONI4	Inorganic chemistry and Laboratory	4 Cr.
020CIHNI4	Kinetics of Chemical Reactions	2 Cr.
020CADNI4	Computer Aided Design	4 Cr.
020GELNI4	Geology	2 Cr.
020IMFNI4	Introduction to Fluid Mechanics	2 Cr.
020PRBNI4	Probability	4 Cr.
020PIINI4	Initiation to Engineering Project	2 Cr.
020PCONI4	Organic Chemistry Laboratory	2 Cr.
	Open Electives	2 Cr.
	Total	30 Cr.

Civil Engineering Preparatory Program – Regular Class

Coordinator: Marwan BROUCHE

Program Educational Objectives

The objectives of the program are to graduate students able to:

- Work effectively and ethically in their professional environment at local, regional and international levels.
- Advance in their careers to become leaders in their profession, through trilingual skills, life-long learning and creativity.
- Lead in a dynamic professional environment through continuous learning and development of knowledge and skills.

Student Outcomes

The student outcomes are aligned with the ABET requirements:

1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3) An ability to communicate effectively with a range of audiences.
4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Requirements

Required Courses (116 ECTS credits), Restricted Electives (0 ECTS credits), Open Electives (4 ECTS credits).

English (0 Cr.)

Level A on the English language proficiency test is required to integrate the 4-credit English course taught in the specialization departments. In the Preparatory Classes Department, refresher courses (B, C, D, E) are offered to reach this level. To obtain the final engineering degree, students must then pass the Saint Louis English Proficiency Test.

General Education (10 Cr.)

Required Courses (6 Cr.)

Initiation to Engineering Project (2 Cr.)
Citizenship Topic: Engineering at the Service of the Community (2 Cr.)
Philosophy and Religions Topic: Religions in their diversity (2 Cr.)

Open Electives (4 Cr.)

General Education courses that can be pursued in any USJ institution.

Core Mathematics and Sciences (86 Cr.)

Mathematics (46 Cr.)

General Analysis (6 Cr.)

Analysis 1 (4 Cr.)
Analysis 2 (6 Cr.)
Linear Algebra (8 Cr.)
Bilinear Algebra and Geometry (6 Cr.)
Differential Calculus (6 Cr.)
Discrete Mathematics (6 Cr.)
Probability (4 Cr.)

Sciences (40 Cr.)

General Chemistry (4 Cr.)
Mechanics 1 (6 Cr.)
Mechanics 2 (4 Cr.)
Wave Physics (4 Cr.)
Physical Signals (6 Cr.)
Hydrostatics (2 Cr.)
Thermodynamics 1 (4 Cr.)
Thermodynamics 2 (4 Cr.)
Chemistry Laboratory (2 Cr.)
Physics Laboratory 1 (2 Cr.)
Physics Laboratory 2 (2 Cr.)

Programming (14 Cr.)

Computer Assisted Drawing (4 Cr.)
Programming 1 (4 Cr.)
Programming 2 (4 Cr.)
MATLAB (2 Cr.)

Engineering Courses (10 Cr.)

Fluid kinematics (2 Cr.)
Geology (2 Cr.)
Building Information Modeling (2 Cr.)
Statics (2 Cr.)
Topography (2 Cr.)

Proposed Schedule

Semester 1

020ANGNI1	General Analysis	6 Cr.
020CHGNI1	General Chemistry	4 Cr.
020MADNI1	Discrete Mathematics	6 Cr.
020GSCNI1	Engineering at the Service of the Community	2 Cr.
020MC1NI1	Mechanics 1	6 Cr.
020SPHNI1	Physical Signals	6 Cr.
	Total	30 Cr.

Semester 2

020ALNNI2	Linear Algebra	8 Cr.
020AA1NI2	Analysis 1	4 Cr.
020IF1NI2	Programming 1	4 Cr.
020STFNI2	Hydrostatics	2 Cr.
020TH1NI2	Thermodynamics 1	4 Cr.
020TCGNI2	Chemistry Laboratory	2 Cr.

020PP1NI2	Physics Laboratory 1	2 Cr.
	Open Electives	2 Cr.
	Total	28 Cr.

Semester 3

020ALBNI3	Bilinear Algebra and Geometry	6 Cr.
020AY2NI3	Analysis 2	6 Cr.
020IF2NI3	Programming 2	4 Cr.
020MC2NI3	Mechanics 2	4 Cr.
020PHONI3	Wave Physics	4 Cr.
020TH2NI3	Thermodynamics 2	4 Cr.
020PP2NI3	Physics Laboratory 2	2 Cr.
018RDLDL1	Religions in their diversity	2 Cr.
	Total	32 Cr.

Semester 4

020CDFNI4	Differential Calculus	6 Cr.
020CIFNI4	Fluid kinematics	2 Cr.
020DAINI4	Computer Assisted Drawing	4 Cr.
020GELNI4	Geology	2 Cr.
020MATNI4	MATLAB	2 Cr.
020BIMNI4	Building Information Modeling	2 Cr.
020PRBNI4	Probability	4 Cr.
020PIINI4	Initiation to Engineering Project	2 Cr.
020STANI4	Statics	2 Cr.
020TOGNI4	Topography	2 Cr.
	Open Electives	2 Cr.
	Total	30 Cr.

Computer and Communications Engineering Preparatory Program – Regular Class

Coordinator: Marwan BROUCHE

Program Educational Objectives

The objectives of the program are to graduate students able to:

- Advance in their careers in various sectors at local, regional and international levels.
- Successfully pursue higher education in world-class universities.
- Become decision-makers, innovators, and leaders in their profession.

Student Outcomes

The student outcomes are aligned with the ABET requirements:

1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3) An ability to communicate effectively with a range of audiences.
4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Requirements

Required Courses (116 ECTS credits), Restricted Electives (0 ECTS credits), Open Electives (4 ECTS credits).

English (0 Cr.)

Level A on the English language proficiency test is required to integrate the 4-credit English course taught in the specialization departments. In the Preparatory Classes Department, refresher courses (B, C, D, E) are offered to reach this level. To obtain the final engineering degree, students must then pass the Saint Louis English Proficiency Test.

General Education (10 Cr.)

Required Courses (6 Cr.)

Initiation to Engineering Project (2 Cr.)
Citizenship Topic: Engineering at the Service of the Community (2 Cr.)
Philosophy and Religions Topic: Religions in their diversity (2 Cr.)

Open Electives (4 Cr.)

General Education courses that can be pursued in any USJ institution.

Core Mathematics and Sciences (84 Cr.)

Mathematics (46 Cr.)

General Analysis (6 Cr.)
Analysis 1 (4 Cr.)
Analysis 2 (6 Cr.)
Linear Algebra (8 Cr.)
Bilinear Algebra and Geometry (6 Cr.)
Differential Calculus (6 Cr.)
Discrete Mathematics (6 Cr.)
Probability (4 Cr.)

Sciences (38 Cr.)

General Chemistry (4 Cr.)
Electromagnetism (4 Cr.)
Magnetic Induction (2 Cr.)
Mechanics 1 (6 Cr.)
Mechanics 2 (4 Cr.)
Wave Optics (2 Cr.)
Physical Signals (6 Cr.)
Thermodynamics 1 (4 Cr.)

Chemistry Laboratory (2 Cr.)
Physics Laboratory 1 (2 Cr.)
Physics Laboratory 2 (2 Cr.)

Programming (14 Cr.)

Programming 1 (4 Cr.)
Programming 2 (4 Cr.)
Programming 3 (4 Cr.)
MATLAB (2 Cr.)

Engineering Courses (12 Cr.)

Linear Electrical Systems and Networks (6 Cr.)
Digital Systems Design (6 Cr.)

Proposed Schedule

Semester 1

020ANGNI1	General Analysis	6 Cr.
020CHGNI1	General Chemistry	4 Cr.
020MADNI1	Discrete Mathematics	6 Cr.
020GSCNI1	Engineering at the Service of the Community	2 Cr.
020MC1NI1	Mechanics 1	6 Cr.
020SPHNI1	Physical Signals	6 Cr.
	Total	30 Cr.

Semester 2

020ALNNI2	Linear Algebra	8 Cr.
020AA1NI2	Analysis 1	4 Cr.
020IF1NI2	Programming 1	4 Cr.
020INMNI2	Magnetic Induction	2 Cr.
020TH1NI2	Thermodynamics 1	4 Cr.
020TCGNI2	Chemistry Laboratory	2 Cr.
020PP1NI2	Physics Laboratory 1	2 Cr.
	Open Electives	2 Cr.
	Total	28 Cr.

Semester 3

020ALBNI3	Bilinear Algebra and Geometry	6 Cr.
020AY2NI3	Analysis 2	6 Cr.
020EMENI3	Electromagnetism	4 Cr.
020PRBNI4	Probability	4 Cr.
020IF2NI3	Programming 2	4 Cr.
020MC2NI3	Mechanics 2	4 Cr.
020OPTNI3	Wave Optics	2 Cr.
020PP2NI3	Physics Laboratory 2	2 Cr.
	Total	32 Cr.

Semester 4

020CDFNI3	Differential Calculus	6 Cr.
020IF3NI4	Programming 3	4 Cr.

020MATNI4	MATLAB	2 Cr.
020PIINI4	Initiation to Engineering Project	2 Cr.
020SRLNI4	Linear Electrical Systems and Networks	6 Cr.
020TEDNI4	Digital Systems Design	6 Cr.
018RDLDL1	Religions in their diversity	2 Cr.
	Open Electives	2 Cr.
	Total	30 Cr.

Electrical Engineering Preparatory Program – Regular Class

Coordinator: Marwan BROUCHE

Program Educational Objectives

The objectives of the program are to graduate students able to:

- Advance in their careers in various sectors at local, regional and international levels.
- Successfully pursue higher education in world-class universities.
- Become decision-makers, innovators, and leaders in their profession.

Student Outcomes

The student outcomes are aligned with the ABET requirements:

1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3) An ability to communicate effectively with a range of audiences.
4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Requirements

Required Courses (116 ECTS credits), Restricted Electives (0 ECTS credits), Open Electives (4 ECTS credits).

English (0 Cr.)

Level A on the English language proficiency test is required to integrate the 4-credit English course taught in the specialization departments. In the Preparatory Classes Department, refresher courses (B, C, D, E) are offered to reach this level. To obtain the final engineering degree, students must then pass the Saint Louis English Proficiency Test.

General Education (10 Cr.)

Required Courses (6 Cr.)

Initiation to Engineering Project (2 Cr.)
Citizenship Topic: Engineering at the Service of the Community (2 Cr.)
Philosophy and Religions Topic: Religions in their diversity (2 Cr.)

Open Electives (4 Cr.)

General Education courses that can be pursued in any USJ institution.

Core Mathematics and Sciences (84 Cr.)

Mathematics (46 Cr.)

General Analysis (6 Cr.)
Analysis 1 (4 Cr.)
Analysis 2 (6 Cr.)
Linear Algebra (8 Cr.)
Bilinear Algebra and Geometry (6 Cr.)
Differential Calculus (6 Cr.)
Discrete Mathematics (6 Cr.)
Probability (4 Cr.)

Sciences (38 Cr.)

General Chemistry (4 Cr.)
Electromagnetism (4 Cr.)
Magnetic Induction (2 Cr.)
Mechanics 1 (6 Cr.)
Mechanics 2 (4 Cr.)
Physical Signals (6 Cr.)
Thermodynamics 1 (4 Cr.)
Thermodynamics 2 (2 Cr.)
Chemistry Laboratory (2 Cr.)
Physics Laboratory 1 (2 Cr.)
Physics Laboratory 2 (2 Cr.)

Programming (14 Cr.)

Programming 1 (4 Cr.)
Programming 2 (4 Cr.)
Programming 3 (4 Cr.)
MATLAB (2 Cr.)

Engineering Courses (12 Cr.)

Linear Electrical Systems and Networks (6 Cr.)
Digital Systems Design (6 Cr.)

Proposed Schedule

Semester 1

020ANGNI1	General Analysis	6 Cr.
020CHGNI1	General Chemistry	4 Cr.
020MADNI1	Discrete Mathematics	6 Cr.
020GSCNI1	Engineering at the Service of the Community	2 Cr.
020MC1NI1	Mechanics 1	6 Cr.
020SPHNI1	Physical Signals	6 Cr.
	Total	30 Cr.

Semester 2

020ALNNI2	Linear Algebra	8 Cr.
020AA1NI2	Analysis 1	4 Cr.
020TCGNI2	General Chemistry Lab	2 Cr.

020IF1NI2	Programming 1	4 Cr.
020INMNI2	Magnetic Induction	2 Cr.
020TH1NI2	Thermodynamics 1	4 Cr.
020PP1NI2	Physics Laboratory 1	2 Cr.
	Open Electives	2 Cr.
	Total	28 Cr.

Semester 3

020ALBNI3	Bilinear Algebra and Geometry	6 Cr.
020AY2NI3	Analysis 2	6 Cr.
020EMENI3	Electromagnetism	4 Cr.
020PRBNI4	Probability	4 Cr.
020IF2NI3	Programming 2	4 Cr.
020MC2NI3	Mechanics 2	4 Cr.
020THSNI3	Thermodynamics 2	2 Cr.
020PP2NI3	Physics Laboratory 2	2 Cr.
	Total	32 Cr.

Semester 4

020CDFNI4	Differential Calculus	6 Cr.
020IF3NI4	Programming 3	4 Cr.
020MATNI4	MATLAB	2 Cr.
020PIINI4	Initiation to Engineering Project	2 Cr.
020SRLNI4	Linear Electrical Systems and Networks	6 Cr.
020TEDNI4	Digital Systems Design	6 Cr.
018RDLDL1	Religions in their diversity	2 Cr.
	Open Electives	2 Cr.
	Total	30 Cr.

Mechanical Engineering Preparatory Program – Regular Class

Coordinator: Marwan BROUCHE

Program Educational Objectives

The objectives of the program are to graduate students able to:

- Advance in their careers in various sectors at local, regional and international levels.
- Successfully pursue higher education in world-class universities.
- Become decision-makers, innovators, and leaders in their profession.

Student Outcomes

The student outcomes are aligned with the ABET requirements:

1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3) An ability to communicate effectively with a range of audiences.

4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Requirements

Required Courses (116 ECTS credits), Restricted Electives (0 ECTS credits), Open Electives (4 ECTS credits).

English (0 Cr.)

Level A on the English language proficiency test is required to integrate the 4-credit English course taught in the specialization departments. In the Preparatory Classes Department, refresher courses (B, C, D, E) are offered to reach this level. To obtain the final engineering degree, students must then pass the Saint Louis English Proficiency Test.

General Education (10 Cr.)

Required Courses (6 Cr.)

Initiation to Engineering Project (2 Cr.)
Citizenship Topic: Engineering at the Service of the Community (2 Cr.)
Philosophy and Religions Topic: Religions in their diversity (2 Cr.)

Open Electives (4 Cr.)

General Education courses that can be pursued in any USJ institution.

Core Mathematics and Sciences (84 Cr.)

Mathematics (46 Cr.)

General Analysis (6 Cr.)
Analysis 1 (4 Cr.)
Analysis 2 (6 Cr.)
Linear Algebra (8 Cr.)
Bilinear Algebra and Geometry (6 Cr.)
Differential Calculus (6 Cr.)
Discrete Mathematics (6 Cr.)
Probability (4 Cr.)

Sciences (38 Cr.)

General Chemistry (4 Cr.)
Electromagnetism (4 Cr.)
Introduction to Materials Science (2 Cr.)
Mechanics 1 (6 Cr.)
Mechanics 2 (4 Cr.)
Physical Signals (6 Cr.)
Thermodynamics 1 (4 Cr.)
Thermodynamics 2 (2 Cr.)
Chemistry Laboratory (2 Cr.)
Physics Laboratory 1 (2 Cr.)
Physics Laboratory 2 (2 Cr.)

Programming (14 Cr.)

Programming 1 (4 Cr.)
Programming 2 (4 Cr.)
Programming 3 (4 Cr.)
MATLAB (2 Cr.)

Engineering Courses (12 Cr.)

Linear Electrical Systems and Networks (6 Cr.)
Computer Assisted Drawing (DAO) (4 Cr.)
Statics for mechanical engineering (2 Cr.)

Proposed Schedule

Semester 1

020ANGNI1	General Analysis	6 Cr.
020CHGNI1	General Chemistry	4 Cr.
020MADNI1	Discrete Mathematics	6 Cr.
020GSCNI1	Engineering at the Service of the Community	2 Cr.
020MC1NI1	Mechanics 1	6 Cr.
020SPHNI1	Physical Signals	6 Cr.
	Total	30 Cr.

Semester 2

020ALNNI2	Linear Algebra	8 Cr.
020AA1NI2	Analysis 1	4 Cr.
020TCGNI2	General Chemistry Lab	2 Cr.
020IF1NI2	Programming 1	4 Cr.
020ISMNI2	Introduction to Materials Science	2 Cr.
020TH1NI2	Thermodynamics 1	4 Cr.
020PP1NI2	Physics Laboratory 1	2 Cr.
	Open Electives	2 Cr.
	Total	28 Cr.

Semester 3

020ALBNI3	Bilinear Algebra and Geometry	6 Cr.
020AY2NI3	Analysis 2	6 Cr.
020EMENI3	Electromagnetism	4 Cr.
020PRBNI4	Probability	4 Cr.
020IF2NI3	Programming 2	4 Cr.
020MC2NI3	Mechanics 2	4 Cr.
020THSNI3	Thermodynamics 2	2 Cr.
020PP2NI3	Physics Laboratory 2	2 Cr.
	Total	32 Cr.

Semester 4

020CDFNI4	Differential Calculus	6 Cr.
020DAMNI4	Computer Assisted Drawing (DAO)	4 Cr.
020IF3NI4	Programming 3	4 Cr.
020MATNI4	MATLAB	2 Cr.

020PIINI4	Initiation to Engineering Project	2 Cr.
020SRLNI4	Linear Electrical Systems and Networks	6 Cr.
020STMNI4	Statics for mechanical engineering	2 Cr.
018RDLDL1	Religions in their diversity	2 Cr.
	Open Electives	2 Cr.
	Total	30 Cr.

Chemical and Petrochemical Engineering Preparatory Program – Honors Class

Coordinator: Marwan BROUCHE

Program Educational Objectives

The objectives of the program are to graduate students able to:

- Work effectively and ethically in their professional environment at local, regional and international levels.
- Advance in their careers to become leaders in their profession, through trilingual skills, life-long learning and creativity.
- Lead in a dynamic professional environment through continuous learning and development of knowledge and skills.

Student Outcomes

The student outcomes are aligned with the ABET requirements:

1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3) An ability to communicate effectively with a range of audiences.
4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Requirements

Required Courses (120 ECTS credits), Restricted Electives (0 ECTS credits), Open Electives (0 ECTS credits).

English (0 Cr.)

Level A on the English language proficiency test is required to integrate the 4-credit English course taught in the specialization departments. In the Preparatory Classes Department, refresher courses (B, C, D, E) are offered to reach this level. To obtain the final engineering degree, students must then pass the Saint Louis English Proficiency Test.

General Education (8 Cr.)

Initiation to Engineering Project (2 Cr.)
Citizenship Topic: Engineering at the Service of the Community (2 Cr.)
Philosophy and Religions Topic: French and Philosophy 1 and 2 (4 Cr.)

Core Mathematics and Sciences (94 Cr.)

Mathematics (42 Cr.)

General Analysis (6 Cr.)
Analysis 1 (4 Cr.)
Analysis 2 (6 Cr.)
Analysis 3 (4 Cr.)
Algebra 1 (6 Cr.)
Algebra 2 (6 Cr.)
Algebra 3 (4 Cr.)
Discrete Mathematics (6 Cr.)

Sciences (52 Cr.)

General Chemistry (4 Cr.)
Advanced Chemistry (4 Cr.)
Mechanics 1 (6 Cr.)
Mechanics 2 (4 Cr.)
Physical Signals (6 Cr.)
Thermodynamics 1 (6 Cr.)
Thermodynamics 2 (2 Cr.)
Electromagnetism (4 Cr.)
Wave Optics (2 Cr.)
Signal Processing (2 Cr.)
Magnetic Induction (2 Cr.)
Quantum Physics (2 Cr.)
Chemistry Laboratory (2 Cr.)
Physics Laboratory 1 (2 Cr.)
Physics Laboratory 2 (2 Cr.)
Personal Initiative Work (2 Cr.)

Programming (10 Cr.)

Programming 1 (4 Cr.)
Programming 2 (4 Cr.)
Programming 3 (2 Cr.)

Engineering Courses (8 Cr.)

Introduction to Fluid Mechanics (2 Cr.)
Geology (2 Cr.)
Organic Chemistry Laboratory (2 Cr.)
Inorganic chemistry and Laboratory (2 Cr.)

Proposed Schedule

Semester 1

020ANGCI1	General Analysis	6 Cr.
020CHGCI1	General Chemistry	4 Cr.
020MADCI1	Discrete Mathematics	6 Cr.
020GSCCI1	Engineering at the Service of the Community	2 Cr.

020MC1CI1	Mechanics 1	6 Cr.
020SPHCI1	Physical Signals	6 Cr.
	Total	30 Cr.

Semester 2

020AL1CI2	Algebra 1	6 Cr.
020AN1CI2	Analysis 1	4 Cr.
020FR1CI2	French and Philosophy 1	2 Cr.
020INMCI2	Magnetic Induction	2 Cr.
020IF1CI2	Programming 1	4 Cr.
020TH1CI2	Thermodynamics 1	6 Cr.
020TCGCI2	Chemistry Laboratory	2 Cr.
020PP1CI2	Physics Laboratory 1	2 Cr.
	Total	28 Cr.

Semester 3

020AL2CI3	Algebra 2	6 Cr.
020AN2CI3	Analysis 2	6 Cr.
020CHACI3	Advanced Chemistry	4 Cr.
020EMECI3	Electromagnetism	4 Cr.
020FR2CI3	French and Philosophy 2	2 Cr.
020IF2CI3	Programming 2	4 Cr.
020MC2CI3	Mechanics 2	4 Cr.
020OPTCI3	Wave Optics	2 Cr.
020PP2CI3	Physics Laboratory 2	2 Cr.
020TRSCI3	Signal Processing	2 Cr.
	Total	36 Cr.

Semester 4

020AL3CI4	Algebra 3	4 Cr.
020AN3CI4	Analysis 3	4 Cr.
020CIOCI4	Inorganic chemistry and Laboratory	2 Cr.
020GELCI4	Geology	2 Cr.
020IF3CI4	Programming 3	2 Cr.
020IMFCI4	Introduction to Fluid Mechanics	2 Cr.
020PHQCI4	Quantum Physics	2 Cr.
020PIICI4	Initiation to Engineering Project	2 Cr.
020CORCI4	Organic Chemistry and Laboratory	2 Cr.
020TH2CI4	Thermodynamics 2	2 Cr.
020TIPCI4	Personal Initiative Work	2 Cr.
	Total	26 Cr.

Civil Engineering Preparatory Program – Honors Class

Coordinator: Marwan BROUCHE

Program Educational Objectives

The objectives of the program are to graduate students able to:

- Work effectively and ethically in their professional environment at local, regional and international levels.
- Advance in their careers to become leaders in their profession, through trilingual skills, life-long learning and creativity.
- Lead in a dynamic professional environment through continuous learning and development of knowledge and skills.

Student Outcomes

The student outcomes are aligned with the ABET requirements:

1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3) An ability to communicate effectively with a range of audiences.
4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Requirements

Required Courses (120 ECTS credits), Restricted Electives (0 ECTS credits), Open Electives (0 ECTS credits).

English (0 Cr.)

Level A on the English language proficiency test is required to integrate the 4-credit English course taught in the specialization departments. In the Preparatory Classes Department, refresher courses (B, C, D, E) are offered to reach this level. To obtain the final engineering degree, students must then pass the Saint Louis English Proficiency Test.

General Education (8 Cr.)

Initiation to Engineering Project (2 Cr.)
Citizenship Topic: Engineering at the Service of the Community (2 Cr.)
Philosophy and Religions Topic: French and Philosophy 1 and 2 (4 Cr.)

Core Mathematics and Sciences (94 Cr.)

Mathematics (42 Cr.)
General Analysis (6 Cr.)
Analysis 1 (4 Cr.)
Analysis 2 (6 Cr.)
Analysis 3 (4 Cr.)
Algebra 1 (6 Cr.)
Algebra 2 (6 Cr.)
Algebra 3 (4 Cr.)
Discrete Mathematics (6 Cr.)

Sciences (52 Cr.)

General Chemistry (4 Cr.)
Advanced Chemistry (4 Cr.)
Mechanics 1 (6 Cr.)
Mechanics 2 (4 Cr.)
Physical Signals (6 Cr.)
Thermodynamics 1 (6 Cr.)
Thermodynamics 2 (2 Cr.)
Electromagnetism (4 Cr.)
Wave Optics (2 Cr.)
Signal Processing (2 Cr.)
Magnetic Induction (2 Cr.)
Quantum Physics (2 Cr.)
Chemistry Laboratory (2 Cr.)
Physics Laboratory 1 (2 Cr.)
Physics Laboratory 2 (2 Cr.)
Personal Initiative Work (2 Cr.)

Programming (10 Cr.)

Programming 1 (4 Cr.)
Programming 2 (4 Cr.)
Programming 3 (2 Cr.)

Engineering Courses (8 Cr.)

Introduction to Fluid Mechanics (2 Cr.)
Geology (2 Cr.)
Statics (2 Cr.)
Topography (2 Cr.)

Proposed Schedule

Semester 1

020ANGCI1	General Analysis	6 Cr.
020CHGCI1	General Chemistry	4 Cr.
020MADCI1	Discrete Mathematics	6 Cr.
020GSCCI1	Engineering at the Service of the Community	2 Cr.
020MC1CI1	Mechanics 1	6 Cr.
020SPHCI1	Physical Signals	6 Cr.
	Total	30 Cr.

Semester 2

020AL1CI2	Algebra 1	6 Cr.
020AN1CI2	Analysis 1	4 Cr.
020FR1CI2	French and Philosophy 1	2 Cr.
020INMCI2	Magnetic Induction	2 Cr.
020IF1CI2	Programming 1	4 Cr.
020TH1CI2	Thermodynamics 1	6 Cr.
020TCGCI2	Chemistry Laboratory	2 Cr.
020PP1CI2	Physics Laboratory 1	2 Cr.
	Total	28 Cr.

Semester 3

020AL2CI3	Algebra 2	6 Cr.
020AN2CI3	Analysis 2	6 Cr.
020CHACI3	Advanced Chemistry	4 Cr.
020EMECI3	Electromagnetism	4 Cr.
020FR2CI3	French and Philosophy 2	2 Cr.
020IF2CI3	Programming 2	4 Cr.
020MC2CI3	Mechanics 2	4 Cr.
020OPTCI3	Wave Optics	2 Cr.
020PP2CI3	Physics Laboratory 2	2 Cr.
020TRSCI3	Signal Processing	2 Cr.
	Total	36 Cr.

Semester 4

020AL3CI4	Algebra 3	4 Cr.
020AN3CI4	Analysis 3	4 Cr.
020GELCI4	Geology	2 Cr.
020IF3CI4	Programming 3	2 Cr.
020IMFCI4	Introduction to Fluid Mechanics	2 Cr.
020PHQCI4	Quantum Physics	2 Cr.
020PIICI4	Initiation to Engineering Project	2 Cr.
020STACI4	Statics	2 Cr.
020TH2CI4	Thermodynamics 2	2 Cr.
020TOGCI4	Topography	2 Cr.
020TIPCI4	Personal Initiative Work	2 Cr.
	Total	26 Cr.

Computer and Communications Engineering Preparatory Program – Honors Class

Coordinator: Marwan BROUCHE

Program Educational Objectives

The objectives of the program are to graduate students able to:

- Advance in their careers in various sectors at local, regional and international levels.
- Successfully pursue higher education in world-class universities.
- Become decision-makers, innovators, and leaders in their profession.

Student Outcomes

The student outcomes are aligned with the ABET requirements:

1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3) An ability to communicate effectively with a range of audiences.

4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Requirements

Required Courses (120 ECTS credits), Restricted Electives (0 ECTS credits), Open Electives (0 ECTS credits).

English (0 Cr.)

Level A on the English language proficiency test is required to integrate the 4-credit English course taught in the specialization departments. In the Preparatory Classes Department, refresher courses (B, C, D, E) are offered to reach this level. To obtain the final engineering degree, students must then pass the Saint Louis English Proficiency Test.

General Education (8 Cr.)

Initiation to Engineering Project (2 Cr.)
Citizenship Topic: Engineering at the Service of the Community (2 Cr.)
Philosophy and Religions Topic: French and Philosophy 1 and 2 (4 Cr.)

Core Mathematics and Sciences (94 Cr.)

Mathematics (42 Cr.)

General Analysis (6 Cr.)
Analysis 1 (4 Cr.)
Analysis 2 (6 Cr.)
Analysis 3 (4 Cr.)
Algebra 1 (6 Cr.)
Algebra 2 (6 Cr.)
Algebra 3 (4 Cr.)
Discrete Mathematics (6 Cr.)

Sciences (52 Cr.)

General Chemistry (4 Cr.)
Advanced Chemistry (4 Cr.)
Mechanics 1 (6 Cr.)
Mechanics 2 (4 Cr.)
Physical Signals (6 Cr.)
Thermodynamics 1 (6 Cr.)
Thermodynamics 2 (2 Cr.)
Electromagnetism (4 Cr.)
Wave Optics (2 Cr.)
Signal Processing (2 Cr.)
Magnetic Induction (2 Cr.)
Quantum Physics (2 Cr.)
Chemistry Laboratory (2 Cr.)
Physics Laboratory 1 (2 Cr.)
Physics Laboratory 2 (2 Cr.)
Personal Initiative Work (2 Cr.)

Programming (10 Cr.)

Programming 1 (4 Cr.)
Programming 2 (4 Cr.)
Programming 3 (2 Cr.)

Engineering Courses (8 Cr.)

Linear Electrical Systems and Networks (4 Cr.)
Digital Systems Design (4 Cr.)

Proposed Schedule

Semester 1

020ANGCI1	General Analysis	6 Cr.
020CHGCI1	General Chemistry	4 Cr.
020MADCI1	Discrete Mathematics	6 Cr.
020MC1CI1	Mechanics 1	6 Cr.
020SPHCI1	Physical Signals	6 Cr.
	Total	28 Cr.

Semester 2

020AL1CI2	Algebra 1	6 Cr.
020AN1CI2	Analysis 1	4 Cr.
020FR1CI2	French and Philosophy 1	2 Cr.
020INMCI2	Magnetic Induction	2 Cr.
020IF1CI2	Programming 1	4 Cr.
020GSCCI1	Engineering at the Service of the Community	2 Cr.
020TH1CI2	Thermodynamics 1	6 Cr.
020TCGCI2	Chemistry Laboratory	2 Cr.
020PP1CI2	Physics Laboratory 1	2 Cr.
	Total	30 Cr.

Semester 3

020AL2CI3	Algebra 2	6 Cr.
020AN2CI3	Analysis 2	6 Cr.
020CHACI3	Advanced Chemistry	4 Cr.
020EMECI3	Electromagnetism	4 Cr.
020FR2CI3	French and Philosophy 2	2 Cr.
020IF2CI3	Programming 2	4 Cr.
020MC2CI3	Mechanics 2	4 Cr.
020OPTCI3	Wave Optics	2 Cr.
020PP2CI3	Physics Laboratory 2	2 Cr.
020TRSCI3	Signal Processing	2 Cr.
	Total	36 Cr.

Semester 4

020AL3CI4	Algebra 3	4 Cr.
020AN3CI4	Analysis 3	4 Cr.
020IF3CI4	Programming 3	2 Cr.
020PHQCI4	Quantum Physics	2 Cr.

020PIICI4	Initiation to Engineering Project	2 Cr.
020SRLCI4	Linear Electrical Systems and Networks	4 Cr.
020TEDCI4	Digital Systems Design	4 Cr.
020TH2CI4	Thermodynamics 2	2 Cr.
020TIPCI4	Personal Initiative Work	2 Cr.
	Total	26 Cr.

Electrical Engineering Preparatory Program – Honors Class

Coordinator: Marwan BROUCHE

Program Educational Objectives

The objectives of the program are to graduate students able to:

- Advance in their careers in various sectors at local, regional and international levels.
- Successfully pursue higher education in world-class universities.
- Become decision-makers, innovators, and leaders in their profession.

Student Outcomes

The student outcomes are aligned with the ABET requirements:

1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3) An ability to communicate effectively with a range of audiences.
4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Requirements

Required Courses (120 ECTS credits), Restricted Electives (0 ECTS credits), Open Electives (0 ECTS credits).

English (0 Cr.)

Level A on the English language proficiency test is required to integrate the 4-credit English course taught in the specialization departments. In the Preparatory Classes Department, refresher courses (B, C, D, E) are offered to reach this level. To obtain the final engineering degree, students must then pass the Saint Louis English Proficiency Test.

General Education (8 Cr.)

Initiation to Engineering Project (2 Cr.)
Citizenship Topic: Engineering at the Service of the Community (2 Cr.)
Philosophy and Religions Topic: French and Philosophy 1 and 2 (4 Cr.)

Core Mathematics and Sciences (94 Cr.)

Mathematics (42 Cr.)

General Analysis (6 Cr.)
Analysis 1 (4 Cr.)
Analysis 2 (6 Cr.)
Analysis 3 (4 Cr.)
Algebra 1 (6 Cr.)
Algebra 2 (6 Cr.)
Algebra 3 (4 Cr.)
Discrete Mathematics (6 Cr.)

Sciences (52 Cr.)

General Chemistry (4 Cr.)
Advanced Chemistry (4 Cr.)
Mechanics 1 (6 Cr.)
Mechanics 2 (4 Cr.)
Physical Signals (6 Cr.)
Thermodynamics 1 (6 Cr.)
Thermodynamics 2 (2 Cr.)
Electromagnetism (4 Cr.)
Wave Optics (2 Cr.)
Signal Processing (2 Cr.)
Magnetic Induction (2 Cr.)
Quantum Physics (2 Cr.)
Chemistry Laboratory (2 Cr.)
Physics Laboratory 1 (2 Cr.)
Physics Laboratory 2 (2 Cr.)
Personal Initiative Work (2 Cr.)

Programming (10 Cr.)

Programming 1 (4 Cr.)
Programming 2 (4 Cr.)
Programming 3 (2 Cr.)

Engineering Courses (8 Cr.)

Linear Electrical Systems and Networks (4 Cr.)
Digital Systems Design (4 Cr.)

Proposed Schedule

Semester 1

020ANGCI1	General Analysis	6 Cr.
020CHGCI1	General Chemistry	4 Cr.
020MADCI1	Discrete Mathematics	6 Cr.
020GSCCI1	Engineering at the Service of the Community	2 Cr.
020MC1CI1	Mechanics 1	6 Cr.
020SPHCI1	Physical Signals	6 Cr.
	Total	30 Cr.

Semester 2

020AL1CI2	Algebra 1	6 Cr.
020AN1CI2	Analysis 1	4 Cr.

020FR1CI2	French and Philosophy 1	2 Cr.
020INMCI2	Magnetic Induction	2 Cr.
020IF1CI2	Programming 1	4 Cr.
020TH1CI2	Thermodynamics 1	6 Cr.
020TCGCI2	Chemistry Laboratory	2 Cr.
020PP1CI2	Physics Laboratory 1	2 Cr.
	Total	28 Cr.

Semester 3

020AL2CI3	Algebra 2	6 Cr.
020AN2CI3	Analysis 2	6 Cr.
020CHACI3	Advanced Chemistry	4 Cr.
020EMECI3	Electromagnetism	4 Cr.
020FR2CI3	French and Philosophy 2	2 Cr.
020IF2CI3	Programming 2	4 Cr.
020MC2CI3	Mechanics 2	4 Cr.
020OPTCI3	Wave Optics	2 Cr.
020PP2CI3	Physics Laboratory 2	2 Cr.
020TRSCI3	Signal Processing	2 Cr.
	Total	36 Cr.

Semester 4

020AL3CI4	Algebra 3	4 Cr.
020AN3CI4	Analysis 3	4 Cr.
020IF3CI4	Programming 3	2 Cr.
020PHQCI4	Quantum Physics	2 Cr.
020PIICI4	Initiation to Engineering Project	2 Cr.
020SRLCI4	Linear Electrical Systems and Networks	4 Cr.
020TEDCI4	Digital Systems Design	4 Cr.
020TH2CI4	Thermodynamics 2	2 Cr.
020TIPCI4	Personal Initiative Work	2 Cr.
	Total	26 Cr.

Mechanical Engineering Preparatory Program – Honors Class

Coordinator: Marwan BROUCHE

Program Educational Objectives

The objectives of the program are to graduate students able to:

- Advance in their careers in various sectors at local, regional and international levels.
- Successfully pursue higher education in world-class universities.
- Become decision-makers, innovators, and leaders in their profession.

Student Outcomes

The student outcomes are aligned with the ABET requirements:

1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3) An ability to communicate effectively with a range of audiences.
4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Requirements

Required Courses (120 ECTS credits), Restricted Electives (0 ECTS credits), Open Electives (0 ECTS credits).

English (0 Cr.)

Level A on the English language proficiency test is required to integrate the 4-credit English course taught in the specialization departments. In the Preparatory Classes Department, refresher courses (B, C, D, E) are offered to reach this level. To obtain the final engineering degree, students must then pass the Saint Louis English Proficiency Test.

General Education (8 Cr.)

Initiation to Engineering Project (2 Cr.)
Citizenship Topic: Engineering at the Service of the Community (2 Cr.)
Philosophy and Religions Topic: French and Philosophy 1 and 2 (4 Cr.)

Core Mathematics and Sciences (94 Cr.)

Mathematics (42 Cr.)
General Analysis (6 Cr.)
Analysis 1 (4 Cr.)
Analysis 2 (6 Cr.)
Analysis 3 (4 Cr.)
Algebra 1 (6 Cr.)
Algebra 2 (6 Cr.)
Algebra 3 (4 Cr.)
Discrete Mathematics (6 Cr.)

Sciences (52 Cr.)
General Chemistry (4 Cr.)
Advanced Chemistry (4 Cr.)
Mechanics 1 (6 Cr.)
Mechanics 2 (4 Cr.)
Physical Signals (6 Cr.)
Thermodynamics 1 (6 Cr.)
Thermodynamics 2 (2 Cr.)
Electromagnetism (4 Cr.)
Wave Optics (2 Cr.)
Signal Processing (2 Cr.)
Magnetic Induction (2 Cr.)

Quantum Physics (2 Cr.)
Chemistry Laboratory (2 Cr.)
Physics Laboratory 1 (2 Cr.)
Physics Laboratory 2 (2 Cr.)
Personal Initiative Work (2 Cr.)

Programming (10 Cr.)

Programming 1 (4 Cr.)
Programming 2 (4 Cr.)
Programming 3 (2 Cr.)

Engineering Courses (8 Cr.)

Linear Electrical Systems and Networks (4 Cr.)
Computer Assisted Drawing (DAO) (2 Cr.)
Statics for mechanical engineering (2 Cr.)

Proposed Schedule

Semester 1

020ANGCI1	General Analysis	6 Cr.
020CHGCI1	General Chemistry	4 Cr.
020MADCI1	Discrete Mathematics	6 Cr.
020GSCCI1	Engineering at the Service of the Community	2 Cr.
020MC1CI1	Mechanics 1	6 Cr.
020SPHCI1	Physical Signals	6 Cr.
	Total	30 Cr.

Semester 2

020AL1CI2	Algebra 1	6 Cr.
020AN1CI2	Analysis 1	4 Cr.
020FR1CI2	French and Philosophy 1	2 Cr.
020INMCI2	Magnetic Induction	2 Cr.
020IF1CI2	Programming 1	4 Cr.
020TH1CI2	Thermodynamics 1	6 Cr.
020TCGCI2	Chemistry Laboratory	2 Cr.
020PP1CI2	Physics Laboratory 1	2 Cr.
	Total	28 Cr.

Semester 3

020AL2CI3	Algebra 2	6 Cr.
020AN2CI3	Analysis 2	6 Cr.
020CHACI3	Advanced Chemistry	4 Cr.
020EMECI3	Electromagnetism	4 Cr.
020FR2CI3	French and Philosophy 2	2 Cr.
020IF2CI3	Programming 2	4 Cr.
020MC2CI3	Mechanics 2	4 Cr.
020OPTCI3	Wave Optics	2 Cr.
020PP2CI3	Physics Laboratory 2	2 Cr.
020TRSCI3	Signal Processing	2 Cr.
	Total	36 Cr.

Semester 4

020AL3CI4	Algebra 3	4 Cr.
020AN3CI4	Analysis 3	4 Cr.
020DAMCI4	Computer Assisted Drawing (DAO)	2 Cr.
020IF3CI4	Programming 3	2 Cr.
020PHQCI4	Quantum Physics	2 Cr.
020PIICI4	Initiation to Engineering Project	2 Cr.
020SRLCI4	Linear Electrical Systems and Networks	4 Cr.
020STMCI4	Statics for mechanical engineering	2 Cr.
020TH2CI4	Thermodynamics 2	2 Cr.
020TIPCI4	Personal Initiative Work	2 Cr.
	Total	26 Cr.

Courses Content

020AL1CI2 Algebra 1 6 Cr
Vector spaces, vector subspace, affine space, linear map, linear span, basis, sum of vector spaces, linear form and hyperplane, finite dimension spaces , matrices, matrix calculation, rank of a matrix, symmetrical group and determinant, Euclidean space.
Prerequisites: None

020AL2CI3 Algebra 2 6 Cr
Algebraic structures, groups, rings, fields, endomorphism and matrix reduction.
Prerequisites: Algebra 1 (020AL1CI2)

020AL3CI4 Algebra 3 4 Cr
Inner product spaces, inner products, orthogonal vectors, orthonormal bases, orthogonal projections, total sequences, isometries in two and three dimensional Euclidian spaces, symmetric endomorphism, orthogonal matrices, geometry.
Prerequisites: Algebra 2 (020AL2CI3)

020ALBNI3 Bilinear Algebra and Geometry 6 Cr
Diagonalization and trigonalisation of a matrix, Inner product spaces, Inner product, orthogonal vectors, orthogonal projection, Gram-Schmidt orthonormalization, Isometry in Euclidian spaces of dimension 2 and 3, Parametric curves.
Prerequisites: Linear Algebra (020ALNNI2)

020ALBNI3 Linear Algebra 8 Cr
Complex numbers, algebraic structure, vector spaces, vector subspace, linear map, linear span, basis, sum of vector spaces, linear form and hyperplane, finite dimension spaces , matrices, matrix calculation, rank of a matrix, determinant, system of linear equations.
Prerequisites: None

020AA1CI2 Analysis 1 6 Cr
Asymptotic analysis: Taylor series- Integration on a segment: integration and derivation- Riemann's sum- Real and complex series, series with positive terms, convergence and absolute convergence- Combinatory: Cartesian product, arrangements, combinations, finite sets cardinality, probability on a finite space, Bayes formula, independence, finite random variables.
Prerequisites: None

020AA1NI2 Analysis 1 4 Cr
Asymptotic analysis, integration, improper integrals, series.
Prerequisites: None

020AN2CI3 Analysis 2 6 Cr

Normed vector spaces: continuity, uniform continuity and Lipchitz continuity, compactness, linear maps, path connectedness – Generalized integrals: tests of convergence, dominated convergence - Functions of several variables: directional and partial derivatives, differentiability, gradient, extrema of functions of several variables, differential forms, multiple integrals, line integrals.

Prerequisites: Analysis 1 (020AA1CI2)

020AN2NI3 Analysis 2 6 Cr

Sequences and series of functions, power series and differential equations , Fourier series, complex analysis.

Prerequisites: Analysis 1 (020AA1NI2) or Analysis 1 (020AA1CI2)

020AN3CI4 Analysis 3 6 Cr

Series and summable families, sequences and series of functions, integration and derivation of a series of functions, power aeries, probability and discrete random variables, linear differential equation and systems of the form $X'=A(t)X+B(t)$, method of the constant variation, Lagrange's method.

Prerequisites: Analysis 2 (020AN2CI3)

020ANGCI1 General Analysis 6 Cr

Set of real numbers, real functions, trigonometric functions, logarithmic functions, power functions, inverse trigonometric functions, hyperbolic functions, linear first order differential equations, second order differential equations with constant coefficients, real and complex sequences, limits and continuity of real functions, differentiability, Roll's Theorem, applications.

Prerequisites: None

020ANGNI1 General Analysis 6 Cr

Set of real numbers, real functions, trigonometric functions, logarithmic functions, power functions, inverse trigonometric functions, hyperbolic functions, linear first order differential equations, second order differential equations with constant coefficients, real and complex sequences, limits and continuity of real functions, differentiability, Roll's Theorem, applications.

Prerequisites: None

020ATONI2 Atomistic 2 Cr

Emission and absorption spectra. Atom with one electron: hydrogenoids. Polyelectronic atoms. Chemical bonds in isolated molecules - Simple theories (Lewis + VSEPR). Ionic and covalent bonds. Molecular interactions. Periodic classification.

Prerequisites: None

020CDFNI4 Differential Calculus 6 Cr

Normed vector spaces, functions of several variables, line integrals, multiple integrals, parameter dependent integrals.

Prerequisites: General Analysis (020ANGNI1)

020CHACI3 Advanced Chemistry 4 Cr

States of matter: gas, liquid, crystalline solid, amorphous solid and semi-crystalline solid, allotropic varieties, Notion of phase, Physical, chemical, nuclear transformations, Physico-chemical constituents, Pure substances and mixtures, Modeling of a transformation by one or more chemical reactions, Evolution of a system during a chemical transformation modeled by a single chemical reaction, Reaction rate for a transformation modeled by a single chemical reaction. Rate laws: reactions without order, reactions with simple order (0, 1, 2), global order, apparent order, half-reaction time, half-life time of a radioactive nuclide, Arrhenius empirical law, activation energy, Standard reaction enthalpy, Hess's law, Thermal effects for an isobaric transformation, free enthalpy of a system, Chemical potential, Standard free reaction enthalpy, Absolute standard molar entropy, Equilibrium constant, Relationship between ΔrG , K° and Qr, Evolution of a chemical system, VAN'T HOFF relation, Characterization of the intensive state of a system in equilibrium: variance of a system in equilibrium. Optimization of a chemical process, Overvoltage, Allure of current-potential curves (intensity or current density). Spontaneous transformations: notion of mixed potential, Corrosion potential, corrosion current intensity, uniform corrosion in

acidic or neutral oxygenated medium , Differential corrosion by heterogeneity of the support or the environment, Protection against corrosion, Conversion of chemical energy into electrical energy: Thermodynamics approach Kinetic approach, Electrolyser, Recharging of an accumulator.
Prerequisites: General Chemistry (020CHGNI1)

020CHGCI1 General Chemistry 4 Cr
General information on acid-base equilibria, Prevailing reaction method, Final state of equilibrium: acids and bases, Acid-base titrations, Heterogeneous equilibrium in aqueous solution, Common ion effect, influence on solubility, Complexation reactions , Influence of pH on solubility, Titrations by precipitation, General information on redox reactions, Study of batteries, Types of electrodes, Prediction of the reaction direction, Titrations by redox reaction, Pourbaix diagram, Plot of the E-pH diagram of water, E-pH diagrams of iron, zinc and copper, Conventions and boundary equations, Readings of diagrams and interpretations.
Prerequisites: None

020CHGNI1 General Chemistry 4 Cr
General information on acid-base equilibria, Prevailing reaction method, Final state of equilibrium: acids and bases, Acid-base titrations, Heterogeneous equilibrium in aqueous solution, Common ion effect, influence on solubility, Complexation reactions , Influence of pH on solubility, Titrations by precipitation, General information on redox reactions, Study of batteries, Types of electrodes, Prediction of the reaction direction, Titrations by redox reaction, Pourbaix diagram, Plot of the E-pH diagram of water, E-pH diagrams of iron, zinc and copper, Conventions and boundary equations, Readings of diagrams and interpretations.
Prerequisites: None

020CIOCI4 Inorganic chemistry and Laboratory 2 Cr
Crystal structure of metals: compact and pseudo-compact stacking. Interstitial sites: location and dimensions. Metal alloys, metal bonds and model of energy bands. Ionic solids: CsCl, NaCl, ZnS type compounds. Equilibrium diagrams of binary systems: total, partial or null solubility in the solid state. Hydrogen: element, molecule, properties, preparations, industrial uses, derivatives. Oxygen and oxides: element, O3, O2, properties, oxidizing character, degrees of oxidation. Halogens: element, molecules, physical states, preparation, degrees of oxidation. Iron: generalities, different oxides, steel industry, blast furnace, refining of cast iron, Chaudron and Boudouard equilibrium. Sulfur: element, properties, hydrogen sulfide, sulfur dioxide, sulfur trioxide. Practical training: Determination of copper in brass, Preparation of hydrogen peroxide. Determination of water hardness by complexometry. Preparation of double salts, Synthesis and purification of calcium carbonate.
Prerequisites: None

020CIONI4 Inorganic chemistry and Laboratory 4 Cr
Crystal structure of metals: compact and pseudo-compact stacking. Interstitial sites: location and dimensions. Metal alloys, metal bonds and model of energy bands. Ionic solids: CsCl, NaCl, ZnS type compounds. Equilibrium diagrams of binary systems: total, partial or null solubility in the solid state. Hydrogen: element, molecule, properties, preparations, industrial uses, derivatives. Oxygen and oxides: element, O3, O2, properties, oxidizing character, degrees of oxidation. Halogens: element, molecules, physical states, preparation, degrees of oxidation. Iron: generalities, different oxides, steel industry, blast furnace, refining of cast iron, Chaudron and Boudouard equilibrium. Sulfur: element, properties, hydrogen sulfide, sulfur dioxide, sulfur trioxide. Practical training: Determination of copper in brass, Preparation of hydrogen peroxide. Determination of water hardness by complexometry. Preparation of double salts, Synthesis and purification of calcium carbonate.
Prerequisites: None

020CORNI3 Organic chemistry 4 Cr
Nomenclature of organic molecules and their spatial representation. Stereoisomerism. Reactivity of molecules: inductive and mesomeric effects; nucleophilic and electrophilic reagents. The reaction in Organic chemistry. Study of the following organic compounds: halogenated derivatives - alkenes and alkynes - benzene and aromatic compounds - Alcohols: substitution, elimination, oxidation - Carbonyl compounds: substitution on the acyl group, reactions of aldehydes and ketones - Carboxylic acids, esters, amides and amines
Prerequisites: None

020CORCI4 Organic Chemistry and Laboratory 2 Cr

Study of the following organic compounds: halogenated derivatives - alkenes and alkynes - benzene and aromatic compounds - Alcohols: substitution, elimination, oxidation - Carbonyl compounds: substitution on the acyl group, reactions of aldehydes and ketones - Carboxylic acids, esters, amides and amines. Practical Work: Extraction of caffeine from tea. Synthesis of aspirin. Synthesis of dibenzalacetone (aldol condensation). Cannizaro's reaction. Chromic oxidation of menthol. Preparation of the isoamyl ester. Column chromatography.
Prerequisites: None

020CIFNI4 Fluid kinematics 2 Cr
Mathematical operators, trajectory, streamlines, physical interpretations of divergence and rotational of a velocity field, spatial scale, Fluid Particle, Lagrangian and Eulerian Description, Material derivative, rate of fluid flow, continuity equation, Particular flows.
Prerequisites: Hydrostatics (020STFNI2)

020CIHNI4 Kinetics of Chemical Reactions 2 Cr
Material balances, progress of reactions; constituents in aqueous and gas phase. Speed laws. Determination of partial orders. Reactions of 0, 1 and 2 orders, Reactions without order. Degeneration of order. Influence of temperature, Arrhenius law. Catalysis. Transition State Theory, Simple, Complex Reactions. Quasi-stationary states method. Particular reactions: parallel, successive and reversible. Reactions in open and closed sequence.
Prerequisites: None

020CADNI4 Computer Aided Design 4 Cr
The objective of this course is to become familiar with the use of a process simulator, a software used in both design and operation for process optimization and feasibility studies. The course will cover the use of software to accurately represent the behavior of manufacturing processes: Simulate a simple industrial process. Master the design and optimal operation of an industrial unit. Convert a steady-state process model into a dynamic simulation model to study time-dependent "oil and gas" processes.
Prerequisites: None

020DAINI4 Computer Assisted Drawing 4 Cr
Introduction / Create a document (save-layout - work unit). Carry out the drawing (choice of commands - structure approach). Add the necessary complements to the drawing. Use a library of symbols (blocks). Manage layers. Modify dimensioning variables. Modify printing variables (judicious choice of scale). Exercises (Plan - Section - Elevation - Apartment - Electrical circuit - section and metal parts - reinforced concrete section).
Prerequisites: None

020DAMCI4 Computer Assisted Drawing (DAO) 2 Cr
Drawing on Autocad. Classification of drawings. Standardization. Presentation of drawings. Methods of execution of a drawing. Geometrical traces. Connections. Usual curves. Presentation of solids. Dimensioning. Sections. Sections. Surface states. Tolerances and fits. Functional dimensioning. Overall design. Mechanicss connection modes. Mechanicss connection means and technological elements. Symbolic representation.
Prerequisites: None

020DAMNI4 Computer Assisted Drawing (DAO) 2 Cr
Drawing on Autocad. Classification of drawings. Standardization. Presentation of drawings. Methods of execution of a drawing. Geometrical traces. Connections. Usual curves. Presentation of solids. Dimensioning. Sections. Sections. Surface states. Tolerances and fits. Functional dimensioning. Overall design. Mechanicss connection modes. Mechanicss connection means and technological elements. Symbolic representation.
Prerequisites: None

020EMECI3 Electromagnetism 4 Cr
This course starts with a separate study in the stationary case of the electric and the magnetic fields. Geometrical symmetries are used to benefit from the properties of the flux and the circulation of a vector field. Stationary local equations are introduced as a special case of Maxwell equations. After a presentation of the Maxwell equations and the electromagnetic (EM) energy, attention is focused on the propagation of EM waves in vacuum, in conductors, in plasma and far away form an EM oscillating dipole.
Prerequisites: Physical Signals (020SPHNI1), General Analysis (020ANGNI1)

020EMENI3 Electromagnetism 4 Cr

This course starts with a separate study in the stationary case of the electric and the magnetic fields. Geometrical symmetries are used to benefit from the properties of the flux and the circulation of a vector field. Stationary local equations are introduced as a special case of Maxwell equations. After a presentation of the Maxwell equations and the electromagnetic (EM) energy, attention is focused on the propagation of EM waves in vacuum and conductors.
Prerequisites: Physical Signals (020SPHNI1), General Analysis (020ANGNI1)

020FR1CI2 French and Philosophy 1 2 Cr

To learn and perfect the techniques useful for the essay. Each year a theme and three works (mostly two literary and one philosophical) related to it are chosen. The study of this theme through the three works should allow the student to write about the subjects of the competitions that are related to the theme of the year.
Prerequisites: None

020FR2CI3 French and Philosophy 2 2 Cr

To learn and perfect the techniques useful for the essay. Each year a theme and three works (mostly two literary and one philosophical) related to it are chosen. The study of this theme through the three works should allow the student to write about the subjects of the competitions that are related to the theme of the year.
Prerequisites: None

020GELCI4 Geology 2 Cr

Internal structure of planet Earth and seismic waves behavior analysis. Structural geology: rocks competence, deformation and stress; brittle deformation, ductile deformation, tangential tectonics. Stratigraphy, major principles of relative dating and timing of geologic events. Cartography, map reading and graphic representation. Mineralogy, petrogenesis and petrography, arrangement of matter and different types of rocks. Overview of the geology of Lebanon.
Prerequisites: None

020GELNI4 Geology 2 Cr

Internal structure of planet Earth and seismic waves behavior analysis. Structural geology: rocks competence, deformation and stress; brittle deformation, ductile deformation, tangential tectonics. Stratigraphy, major principles of relative dating and timing of geologic events. Cartography, map reading and graphic representation. Mineralogy, petrogenesis and petrography, arrangement of matter and different types of rocks. Overview of the geology of Lebanon.
Prerequisites: None

020INMCI2 Magnetic Induction 2 Cr.

This course is new for students since they only had a descriptive approach to the magnetic field at high school. It is concerned with everyday applications: compass, electric motor, alternator, transformer, speaker, induction plate, radio frequency identification…. Magnetic flux is introduced and magnetic dipole of a current circuit is generalized to magnet.
Prerequisites: None

020INMNI2 Magnetic Induction 2 Cr.

Magnetic field, Actions of a Magnetic field, Induction laws, Fixed circuit in a variable magnetic field, Mobile Circuit in a stationary field.
Prerequisites: None

020IF1NI2 Programming 1 4 Cr.

Computer system (hardware, software), Binary encoding (integers conversion between decimal and binary systems), Python programming language: variables (initialization, types, conversion between types), assignment instruction, data input and output, arithmetic expressions, logical expressions, conditional statements, looping statements, user-defined functions, random numbers generation (“random” module), composite data types (string, list, tuple), introduction to recursion, graphics (“turtle” module).
Prerequisites: None

020IF1CI2 Programming 1 4 Cr.
Computer system (Hardware, Software), Floating numbers and integers representation, Python programming language: data input and output, variables (initialization, types, conversion between types), assignment instruction, data input and output, arithmetic expressions, logical expressions, conditional statements, looping statements, user-defined functions, composite data types (dictionaries, strings, lists, tuples), Iterating and searching algorithms, recursion, text file management, numerical methods and simulations (dichotomy method, Newton method, secant method, Euler method, …).
Prerequisites: None

020IF2NI3 Programming 2 4 Cr.
Dictionaries, Variable scope, Passing parameters by reference and by value, Exception handling, Graphical user interface using "tkinter" module, Object oriented programming: class definition (constructors, attributes, methods), object instantiation, operator overloading, inheritance, and polymorphism.
Prerequisites: None

020IF2CI3 Programming 2 6 Cr.
Algorithm and programming in CAML (Input, Output, Types, Operators, Variables, Expressions, Conditional Statements, Looping Statements, Strings, Functions, Recursive divide and conquer algorithms, Arrays, Sorting algorithms, Data Structures, Stack and Queues, Lists, Recursive Lists, Trees, Binary Search Trees, Complexity, Propositional Logic, Deterministic and non-Deterministic Finite State Automata, Regular Expressions, Recognizable Languages.
Prerequisites: None

020IF3NI4 Programming 3 4 Cr.
Sorting algorithms, Time complexity of sorting algorithms, More in depth with recursion through recursive sorting algorithms, File management, Command line interface, Code testing with the "unittest" framework, Application programming interface for remote hosts data retrieval and submission.
Prerequisites: Programming 1 *(*020IF1NI2*)*

020IF3CI4 Programming 3 2 Cr.
Algorithms in Python- Stacks and Queues- Recursive algorithms- Sorting algorithms (Bubble, selection, insertion, fusion, quick sort)- Complexity- Introduction to Relational Databases- Initiation to the Object Oriented Programming- Graph Searching algorithms.
Prerequisites: Programming 1 (020IF1CI2)

020IMFNI4 Introduction to Fluid Mechanics 2 Cr.
Fluid properties, Hydrostatic Law, Pascal Law, Archimedes Law, Hydrostatic force on plane and curved surfaces. Lines of flow, Types of flow, velocity field and acceleration, continuity equation, Equation of streamline, stream function, velocity potential function, circulation, vorticity, irrotational and rotational flow, compressible and incompressible flows, Lagrangian and Eulerian Description.
Prerequisites: None

020IMFCI4 Introduction to Fluid Mechanics 2 Cr.
Fluid properties, Hydrostatic Law, Pascal Law, Archimedes Law, Hydrostatic force on plane and curved surfaces. Lines of flow, Types of flow, velocity field and acceleration, continuity equation, Equation of streamline, stream function, velocity potential function, circulation, vorticity, irrotational and rotational flow, compressible and incompressible flows, Lagrangian and Eulerian Description.
Prerequisites: None

020ISMNI2 Introduction to Materials Science 2 Cr.
Structure of solid materials, material properties and degradation phenomena, metallic materials, polymer materials, mineral materials. The families of metals, polymers, and minerals are examined with regard to their structures, and the links between structure and properties required in mechanical engineering. Standard designations of material grades as well as examples of common applications are discussed.
Prerequisites: None

020GSCNI1 Engineering at the Service of the Community 2 Cr.
General introduction on the different engineering specializations and the opportunities for each one of them: design offices, construction sites, control offices, research and development, audit and consulting companies, insurance, banks. Organizational framework of relations between engineers. Role of the Order of Engineers.
Prerequisites: None

020GSCCI1 Engineering at the Service of the Community 2 Cr.
General introduction on the different engineering specializations and the opportunities for each one of them: design offices, construction sites, control offices, research and development, audit and consulting companies, insurance, banks. Organizational framework of relations between engineers. Role of the Order of Engineers.
Prerequisites: None

020MADCI1 Discrete Mathematics 6 Cr.
Propositional logic, Mathematical reasoning, Natural numbers, induction, Sets, Applications and relations, Sequences and summations, Binomial coefficient and Pascal triangle, Arithmetic, Polynomials and fractions.
Prerequisites: None

020MADNI1 Discrete Mathematics 6 Cr.
Propositional logic, Mathematical reasoning, Natural numbers, induction, Sets, Applications and relations, Sequences and summations, Binomial coefficient and Pascal triangle, Arithmetic, Polynomials and fractions.
Prerequisites: None

020MATNI4 MATLAB 2 Cr.
MATLAB environment and toolboxes, Basic commands, Arithmetic expressions, Logical expressions, Vector and matrix operations, Integrated mathematical and statistical functions, Symbolic computations, Scripts and user-defined functions, Conditional and looping statements, 2D graphics, Simulink (modelling physics problems).
Prerequisites: Programming 1 (020IF1NI2), General Analysis (020ANGNI1)

020MC1CI1 Mechanics 1 6 Cr.
Coordinate systems, Kinematics of single particles, Concept of force, Principle of inertia, Newton’s second law, Action-reaction law, Free fall, Dry and fluid friction, Power and work, Work-energy theorem, Potential energy, Equilibrium and stability in the presence of external force fields, Mechanical energy, Motion in a conservation force fields, Lorentz force, Motion of charged particles in electric and magnetic fields, Central fields and the motions of planets and satellites.
Prerequisites: None

020MC1NI1 Mechanics 1 6 Cr.
Coordinate systems, Kinematics of single particles, Concept of force, Principle of inertia, Newton’s second law, Action-reaction law, Free fall, Dry and fluid friction, Power and work, Work-energy theorem, Potential energy, Equilibrium and stability in the presence of external force fields, Mechanical energy, Motion in a conservation force fields, Lorentz force, Motion of charged particles in electric and magnetic fields, Central fields and the motions of planets and satellites.
Prerequisites: None

020MC2CI3 Mechanics 2 4 Cr.
Movement of a referential relatively to another in the case of translational and uniform rotational movement about a fixed axis. Vector rotation of a referential with respect to another. Laws of composition of speeds and accelerations in the case of a translation and in the case of a uniform rotation around a fixed axis: drive speed, drive and Coriolis accelerations. Laws of point dynamics in non-Galilean frame of reference in the case where the trained frame of reference is in translation, or in uniform rotation around a fix axis with respect to a Galilean frame of reference. Forces of inertia. Galilean character approached by a few frames of reference: Copernicus frame of reference, geocentric frame of reference, terrestrial frame of reference. Coulomb's laws of sliding friction just in the case of a solid in translation.
Prerequisites: Mechanics 1 (020MC1NI1)

020MC2NI3 Mechanics 2 4 Cr.

Center of mass, Moment of inertia, Torsor, Solid Kinematics, Kinetic quantities, Newtonian dynamics Postulates, General theorems of Newtonian dynamics, Contact actions between solids, Energetic aspects of Newtonian Mechanics, laws of conservation in Mechanics. Non-Galilean referential.
Prerequisites: Mechanics 1 (020MC1NI1)

020BIMNI4 Building Information Modeling 2 Cr.
Introductory course for Building Information Modelling (BIM). Key concepts of BIM are explained and implemented using the BIM software (Revit). Numerous exercises and mini projects guide the student in model development throughout the lifecycle of a building, from planning, to design, to construction, to operations and finally to decommissioning.
Prerequisites: Computer Assisted Drawing (020DAINI4)

020OPTCI3 Wave Optics 2 Cr.
Scalar theory of light, wave equation, notion of optical path and wave surface, spherical and plane waves, illumination, real and complex notation, interference phenomena by division of the wave front and by division of amplitude, Fresnel mirror, Young holes and slits, Michelson interferometer and equivalent systems, interference with enlarged sources, loss of contrast, spatial and temporal coherence, interference in non-monochromatic light: case of a doublet, diffraction phenomenon, Huygens-Fresnel principle, Fraunhofer diffraction.
Prerequisites: Physical Signals (020SPHNI1)

020OPTNI3 Wave Optics 2 Cr.
Scalar theory of light, wave equation, optical path length and wave front, spherical and plane waves, light intensity, complex notation of wave, interference phenomenon by division of the wave front, Fresnel mirror, Young's double-slit experiment, light interference with enlarged sources, loss of coherence, spatial and temporal coherence, diffraction of light, Huygens-Fresnel principle, Fraunhofer diffraction. Application: Fiber optics.
Prerequisites: Physical Signals (020SPHNI1)

020PHONI3 Wave Physics 4 Cr.
Mathematical description of wave propagation. Wave equation. Progressive plane waves and Fourier analysis. electromagnetic waves. Seismic waves.
Prerequisites: Physical Signals (020SPHNI1)

020PHQCI4 Quantum Physics 2 Cr.
this course is concerned with two aspects of modern physics. The first based on the Schrodinger formulation of the wave mechanics and is treat simple but fundamental problems: free particle, particle in a single-step potential, tunnel effect, particle in a box and energy quantification. The second is an introduction to statistical thermodynamics where macroscopic properties of a system are to be related to its microscopic constituents. The Boltzmann factor is introduced for the isothermal atmosphere model then generalized to systems with a discreet spectrum of energy. Equipartition theorem is then used to evaluate heat capacity of gases and solids.
Prerequisites: Electromagnetism (020EMECI3)

020PRBNI4 Probability 4 Cr.
Combinatory, finite and countable probability spaces, discrete and continuous random variables.
Prerequisites: Analysis 1 (020AA1NI2)

020PIINI4 Initiation to Engineering Project 2 Cr.
To bring students to put themselves in situations of responsibility like researchers or engineers. Initiation and training in the scientific research process. Bringing together scientific and technological research work. Elaboration of objects of thought and real objects, which participate in the permanent process of construction - from knowledge to conception, or even realization.
Prerequisites: None

020PIICI4 Initiation to Engineering Project 2 Cr.
To bring students to put themselves in situations of responsibility like researchers or engineers. Initiation and training in the scientific research process. Bringing together scientific and technological research work. Elaboration

of objects of thought and real objects, which participate in the permanent process of construction - from knowledge to conception, or even realization.
Prerequisites: None

020SPHCI1 Physical Signals 6 Cr.
The course is concerned with a wide range of concepts already introduced at high school: periodic signals, spectrums, electrical energy, Ohm's law, Joule's law, lenses, wave length, light spectrum, numerical signal, travelling wave, diffraction, interferences, Doppler effect, Newton's law, mechanical energy, harmonic oscillator. It assures a smooth transition toward a more quantitative physics than the one seen at high school.
Prerequisites: None

020SPHNI1 Physical Signals 6 Cr.
The course is concerned with a wide range of concepts already introduced at high school: periodic signals, spectrums, electrical energy, Ohm's law, Joule's law, Millman's theorem, resonance, geometrical optics, lenses, wave length, diffraction, Descartes law, Gauss approximation, travelling wave, waves superposition and interference, Doppler effect, mechanical energy, harmonic oscillator, linear electric circuits in a quasi-stationary regime, Sine signal and complex notation, damped oscillation, linear electric filter, transfer function, Bode diagram.
Prerequisites: None

020STACI4 Statics 2 Cr.
Definitions and identifications of forces and moment due to a force about a point, and moment due to a couple-Static equivalence and summation of several forces and external couple -Analyze of general equilibrium for bodies in two (2D) and three (3D) dimensions loaded with simple concentrated forces, couples and distributed loads.
Prerequisites: Mechanics 1 (020MC1NI1)

020STANI4 Statics 2 Cr.
Definitions and identifications of forces and moment due to a force about a point, and moment due to a couple-Static equivalence and summation of several forces and external couple -Analyze of general equilibrium for bodies in two (2D) and three (3D) dimensions loaded with simple concentrated forces, couples and distributed loads.
Prerequisites: Mechanics 1 (020MC1NI1)

020STMNI4 Statics for mechanical engineering 2 Cr.
Introduction to internal forces, study of axial load -Study of equilibrium, classification of structures, and introduction to different types of supports-Equilibrium of bodies with engineering connections-Study of equilibrium, classification of structures, and introduction to different types of supports-Study of trusses and identification of internal forces in each bar.
Prerequisites: Mechanics 1 (020MC1NI1)

020STMCI4 Statics for mechanical engineering 2 Cr.
Introduction to internal forces, study of axial load -Study of equilibrium, classification of structures, and introduction to different types of supports-Equilibrium of bodies with engineering connections-Study of equilibrium, classification of structures, and introduction to different types of supports-Study of trusses and identification of internal forces in each bar
Prerequisites: Mechanics 1 (020MC1NI1)

020STFNI2 Hydrostatics 2 Cr.
Fluid properties, Hydrostatic Law, Pascal Law, Archimedes Law, Hydrostatic force on plane and curved surfaces
Prerequisites: None

020SRLNI4 Linear Electrical Systems and Networks 6 Cr.
Signals and systems (definitions and properties). Laplace transformation Linear electrical networks (General topological definitions, dipole, network, dipole associations, energy aspect). General Theorems: Principle of superposition, substitution principle, Thevenin Voltage divider, Kenelly's theorem, Millmann's theorem. Theorems resulting from the principle of duality. Permanent sinusoidal regime (Complex transformation, complex impedance and admittance, energy considerations in sinusoidal regime, complex power, Boucherot's theorem. Diagrams and Abacs (Bode, Black, Nyquist d). Practical work: Impedance measurements. Study and application

of the oscilloscope. RLC circuits. Transitional regime. Representation of transfer functions in permanent sinusoidal regime. Signals and Systems under MATLAB.
Prerequisites: Physical Signals (020SPHNI1)

020SRLCI4 Linear Electrical Systems and Networks 4 Cr.
Signals and systems (definitions and properties). Laplace transformation Linear electrical networks (General topological definitions, dipole, network, dipole associations, energy aspect). General Theorems: Principle of superposition, substitution principle, Thevenin Voltage divider, Kenelly's theorem, Millmann's theorem. Theorems resulting from the principle of duality. Permanent sinusoidal regime (Complex transformation, complex impedance and admittance, energy considerations in sinusoidal regime, complex power, Boucherot's theorem. Diagrams and Abacs (Bode, Black, Nyquist d). Practical work: Impedance measurements. Study and application of the oscilloscope. RLC circuits. Transitional regime. Representation of transfer functions in permanent sinusoidal regime. Signals and Systems under MATLAB.
Prerequisites: Physical Signals (020SPHNI1)

020TEDCI4 Digital Systems Design 4 Cr.
This course introduces the engineering approaches to design and analysis of digital logic circuit. The course covers number systems and codes, Boolean algebra and logic gates, arithmetic operations and circuits, combinational and sequential logic, Morgan's theorem, Karnaugh table, multiplexers, flip-flops, synchronous and asynchronous sequential logic, registers and counters, Huffman's method for synthesizing sequential circuits. Practical work: Introduction to the schematic description (software: Quartus II), introduction to the VHDL language, 4-bit comparator in VHDL, sequential circuits and temporal analysis of signals.
Prerequisites: None

020TEDNI4 Digital Systems Design 6 Cr.
This course introduces the engineering approaches to design and analysis of digital logic circuit. The course covers number systems and codes, Boolean algebra and logic gates, arithmetic operations and circuits, combinational and sequential logic, Morgan's theorem, Karnaugh table, multiplexers, flip-flops, synchronous and asynchronous sequential logic, registers and counters, Huffman's method for synthesizing sequential circuits. Practical work: Introduction to the schematic description (software: Quartus II), introduction to the VHDL language, 4-bit comparator in VHDL, sequential circuits and temporal analysis of signals.
Prerequisites: None

020TH1CI2 Thermodynamics 1 6 Cr.
States of matter, Length scales, State of thermodynamic system, Equation of state, Internal energy, Thermodynamic process, First law of thermodynamics, Work, Heat, Energy balances for gas systems, Irreversibility or time's arrow, Second law and entropy, Applications of second law, Qualitative study of a phase transition, Thermodynamic study of a phase transition, Gas liquefaction, Heat engine, Refrigerator, Heat pump.
Prerequisites: None

020TH1NI2 Thermodynamics 1 4 Cr.
States of matter, Length scales, State of thermodynamic system, Equation of state, Internal energy, Thermodynamic process, First law of thermodynamics, Work, Heat, Energy balances for gas systems, Irreversibility or time's arrow, Second law and entropy, Applications of second law, Qualitative study of a phase transition, Thermodynamic study of a phase transition.
Prerequisites: None

020TH2CI4 Thermodynamics 2 2 Cr.
Formulation of the principles of Thermodynamics for an elementary transformation. First and second principles of Thermodynamics for an open system in a steady state, in the only case of one-dimensional flow in the inlet section and the outlet section. Conduction, convection and radiation. Fourier's law. Thermal diffusion equation. Stationary regime. Thermal resistance. Surface heat transfer coefficient h, Newton's law.
Prerequisites: Thermodynamics 1 (020TH1CI2)

020TH2NI3 Thermodynamics 2 4 Cr.

Internal energy and entropy of a thermodynamic system, Laws of thermodynamics for open systems, Pressure-enthalpy diagram, Heat flux and heat flux density, Fourier's law, Heat equation, Elementary models analysis in steady-state regime, Wall model, Hollow cylinder model, Hollow sphere model, Convective heat transfer, Heat sink.
Prerequisites: Thermodynamics 1 (020TH1NI2)

020THSNI3 Thermodynamics 2 2 Cr.
Conduction and thermal radiation. Fourier's law. Thermal diffusion equation. Stationary regime. Thermal resistance. Surface heat transfer coefficient (h), Newton's law. Stefan-Boltzmann's law, black body, spectral existence and volume energy, Wien's law, Planck's law.
Prerequisites: Thermodynamics 1 (020TH1NI2)

020TOGCI4 Topography 2 Cr.
Introduction to surveying. Geodesy and cartography. Levelling. Measuring instruments. Topographic plans. Profiles and volumes. Setting out techniques. Surveying base plan and official documents folder.
Prerequisites: None

020TOGNI4 Topography 2 Cr.
Introduction to surveying. Geodesy and cartography. Levelling. Measuring instruments. Topographic plans. Profiles and volumes. Setting out techniques. Surveying base plan and official documents folder.
Prerequisites: None

020TRSCI3 Signal Processing 2 Cr.
The first part concerns the action of a linear filter (first and second order) on a periodic signal. The goal is to understand the role of linear system to interpret the form of the output signal. The second part is an introduction of the digital processing of signals through the following points: sampling and aliasing, analogue/digital conversion and digital filtering.
Prerequisites: Physical Signals (020SPHNI1)

020TIPCI4 Personal Initiative Work 2 Cr.
To bring students to put themselves in situations of responsibility like researchers or engineers. Initiation and training in the scientific research process. Bringing together scientific and technological research work. Elaboration of objects of thought and real objects, which participate in the permanent process of construction - from knowledge to conception, or even realization.
Prerequisites: None

020TCGCI2 Chemistry Laboratory 2 Cr.
Introduction to the chemical laboratory, Safety rules and prevention of risks in the laboratory, Safety pictogram for chemicals, Signal words: H and P phrases, Environmental impact, Qualitative mineral chemical analysis, Acid-base titrations, Redox titrations, Titrations by complexation, Titrations by precipitation, pH-metric assay, spectrophotometric assay, conductimetric assay.
Prerequisites: General Chemistry (020CHGNI1)

020TCGNI2 Chemistry Laboratory 2 Cr.
Introduction to the chemical laboratory, Safety rules and prevention of risks in the laboratory, Safety pictogram for chemicals, Signal words: H and P phrases, Environmental impact, Qualitative mineral chemical analysis, Acid-base titrations, Redox titrations, Titrations by complexation, Titrations by precipitation, pH-metric assay, spectrophotometric assay, conductimetric assay.
Prerequisites: General Chemistry (020CHGNI1)

020PCONI4 Organic Chemistry Laboratory 2 Cr.
Caffeine extraction from tea. Aspirin synthesis. Synthesis of dibenzalacetone (aldol condensation). Cannizaro's reaction. Chromic oxidation of menthol. Preparation of isoamyl ester. Column chromatography.
Prerequisites: None

020PP1CI2 Physics Laboratory 1 2 Cr.

Resonance in series and parallel RLC circuits, transfer function and Bode plot, Resistance and impedance measurements, Series RC circuit and Zener diode, Introduction to LabVIEW, Linear filters, measuring electric fields, Measuring magnetic fields, Oscilloscope applications, Single degree of freedom oscillator, Focometry, Prism.
Prerequisites: None

020PP1NI2 Physics Laboratory 1 2 Cr.
Resonance in series and parallel RLC circuits, transfer function and Bode plot, Resistance and impedance measurements, Series RC circuit and Zener diode, Introduction to LabVIEW, Linear filters, measuring electric fields, Measuring magnetic fields, Oscilloscope applications, Single degree of freedom oscillator, Focometry, Prism.
Prerequisites: None

020PP2CI3 Physics Laboratory 2 2 Cr.
Summing/differential amplifiers, Linear filter, Fourier analysis, LabVIEW programming, Frequency domain analysis, Thomson tube, Acoustic waves, heat transfer, Stefan-Boltzmann's law, Two degrees of freedom oscillator, Diffraction and interferences, Light polarization.
Prerequisites: Physics Laboratory 1 (020PP1NI2 or 020PP1CI2)

020PP2NI3 Physics Laboratory 2 2 Cr.
Summing/differential amplifiers, Linear filter, Fourier analysis, LabVIEW programming, Frequency domain analysis, Thomson tube, Acoustic waves, heat transfer, Stefan-Boltzmann's law, Two degrees of freedom oscillator, Diffraction and interferences, Light polarization.
Prerequisites: Physics Laboratory 1 (020PP1NI2 or 020PP1CI2)

Department of Electrical and Mechanical Engineering

Head of Department: Hadi KANAAN

Faculty Members

Professors:

Maroun CHAMOUN, Ragi GHOSN, Hadi KANAAN, Rima KILANY CHAMOUN, Dany MEZHER, Elias RACHID, Hadi SAWAYA.

Associate Professors:

Marc IBRAHIM, Flavia KHATOUNIAN EL RAJJI, Samer LAHOUD, Chantal MAATOUK RIACHI.

Assistant Professors:

Melhem EL HELOU, Rayan MINA, Katia RAYA, Georges SAKR, Jean SAWMA, Toufic WEHBE.

Faculty Members of another institution of USJ:

Jihad RENNO

Lecturers:

Roy ABI ZEID DAOU, Joseph ASMAR (AL), Elie AOUAD, Nathalie AOUAD REHAYEM, Youssef BAKOUNY, Elie BOU CHACRA, Said CHEHAB, Andre CHKAIBANE, Nasr FARHAT, Fouad GORAIEB, Elie HLEIHEL, André KANAAN, Steve KARAM, Gabriel KHOURY (EL), Rabih MOAWAD, Oumar MOURAD, Jalal POSSIK, Eva RAZZOUK HAJJ ASSAF, Elie RENNO, Antoine SAWAYA, Marlène SEIF AOUAD, Joe SOKHN, Fathi YAFI (EL), Georges ZAKKA NASHEF (EL).

Objectives

The Department of Electrical and Mechanical Engineering is a part of the Higher School of Engineers of Beirut. Its main objective is to provide its students with an academic framework that promotes learning. Its activities cover teaching, academic follow-up of students, and academic coordination of studies. It defines the paths and actions aimed at deploying the educational strategy of the Faculty of Engineering.

Job opportunities

Due to a global scientific education and diversified specialties, graduates have high opportunities in the job market. They have access to a stable job in the first few months after graduation, and have good prospects for moving into positions of responsibility. Many students get employment contracts even before graduation. The engineer’s degree gives access to a wide range of jobs, whether in the industrial sector, building, computer, communications, business, public or private sectors.

Specialization and Research

Graduate students who would like to pursue advanced studies to complete their education or specialize in a specific field have several possibilities. In this perspective, the Department of Doctoral Studies of ESIB has set up several programs of Specialized Masters composed of two semesters of 30 credits each.
Graduates who are attracted by research may pursue graduate studies to obtain a PhD with a possibility of co-supervision or co-direction between ESIB and local or international high-level universities.

Programs and Options

After two years of study in the Department of Preparatory Classes and the validation of the corresponding 120 ECTS (European Credit Transfer System) credits, the students integrate one of the programs offered in the Department of Electrical and Mechanical Engineering to continue their studies. Upon validating the remaining 180 credits of their curriculum, an engineer's degree is issued and delivered to the students. The Electricity and Mechanics Department offers three programs:

- The Computer and Communications Engineering (CCE) program with two options:
  - Software Engineering option
  - Telecommunication Networks option
- The Electrical Engineering (EE) program
- The Mechanical Engineering (ME) program

Computer and Communications Engineering (CCE) Program

Coordinator: Melhem EL HELOU

Program Educational Objectives

The objectives of the program are to graduate students able to:

- Advance in their careers in various sectors at local, regional and international levels.
- Successfully pursue higher education in world-class universities.
- Become decision-makers, innovators, and leaders in their profession.

Student Outcomes

The student outcomes are aligned with the ABET requirements:

1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3) An ability to communicate effectively with a range of audiences.
4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Requirements

Required Courses (106 ECTS credits), Option Required Courses (44 ECTS credits), Restricted Electives (26 ECTS credits), Open Electives (4 ECTS credits).

English (4 Cr.)

Level A English Language Proficiency Test is a prerequisite to the 4-ECTS credit English course. Other English courses (B, C, D, E) are offered to reach this level. Prior to graduation, students must submit and validate the Saint Louis English Proficiency test.

General Education (26 Cr.)

Required Courses (20 Cr.)

Accounting (4 Cr.)
Business Ethics (4 Cr.)
Business Law (2 Cr.)
Communication Skills (2 Cr.)
Innovation and Design Thinking (2 Cr.)
Management (2 Cr.)
Project Management (4 Cr.)

Restricted Electives (2 Cr.)

One course to be selected from the following list:
Business Economy (2 Cr.)
Marketing (2 Cr.)
Operational Management (2 Cr.)
Quality Management (2 Cr.)
Strategic Planning (2 Cr.)

Open Electives (4 Cr.)

General Education courses that can be pursued in any USJ institution, with at least two credits of Arab language or Arab culture.

Core Engineering Courses (58 Cr.)

Analog and Digital Communications (6 Cr.)
Analog Electronics (6 Cr.)
Data Structures and Algorithms (4 Cr.)
Digital Electronics (6 Cr.)
Graph Theory and Operational Research (4 Cr.)
Introduction to Data Networks (6 Cr.)
Network Routing and Switching (4 Cr.)
Object-Oriented Programming (6 Cr.)
Statistics (4 Cr.)
Relational Databases (4 Cr.)
Signal Theory (4 Cr.)
Unix System Administration (4 Cr.)

Options (68 Cr.)

Software Engineering Required Courses (44 Cr.)

Analysis and Design of Information Systems (4 Cr.)
Artificial Intelligence (4 Cr.)
Compiler Principles (4 Cr.)
Computer Architecture (4 Cr.)
Parallel Programming (4 Cr.)
Computer Virology (4 Cr.)
Design Patterns in Java (4 Cr.)
Distributed Applications (4 Cr.)
Enterprise Application Integration (4 Cr.)
Operating Systems (4 Cr.)
Software Engineering (4 Cr.)

Telecommunication Networks Required Courses (44 Cr.)

Digital Signal Processing (4 Cr.)

Information Theory and Coding (4 Cr.)
Microprocessor Systems (4 Cr.)
Mobile Networks (4 Cr.)
Network Engineering (4 Cr.)
Optical Systems and Networks (4 Cr.)
Performance of Computer Systems and Networks (4 Cr.)
Quality of Service in Networks (4 Cr.)
Secured Enterprise Networks (4 Cr.)
Waveguides and Antennas (4 Cr.)
Wireless Communications (4 Cr.)

Restricted Electives (24 Cr.)

Six courses to be selected from the following list:
Advanced Networking and WAN Technologies (4 Cr.)
Analysis and Design of Information Systems (4 Cr.)
Artificial Intelligence (4 Cr.)
Big Data (4 Cr.)
Big Data Integration (4 Cr.)
Cloud and Digital Transformation (4 Cr.)
Compiler Principles (4 Cr.)
Computer Architecture (4 Cr.)
Computer Virology (4 Cr.)
Cryptography (4 Cr.)
Design and Integration of Mixed-Signal Systems (4 Cr.)
Design Patterns in Java (4 Cr.)
Digital Signal Processing (4 Cr.)
Distributed Applications (4 Cr.)
Embedded Systems (4 Cr.)
Enterprise Application Integration (4 Cr.)
Ethical Hacking (4 Cr.)
Functional Programming (4 Cr.)
Image Processing (4 Cr.)
Information Security - Standards and Best Practices (4 Cr.)
Information Theory and Coding (4 Cr.)
Interactive 3D Graphics (4 Cr.)
Internet Ecosystem and Evolution (4 Cr.)
Internet of Things Technologies (4 Cr.)
IT Enterprise Architecture (4 Cr.)
Machine Learning (4 Cr.)
Microprocessor Systems (4 Cr.)
Microwave Links and Circuits (4 Cr.)
Mixed-Signal IC Design (4 Cr.)
Mobile Applications Development (4 Cr.)
Mobile Networks (4 Cr.)
Multimedia Engineering (4 Cr.)
Network Engineering (4 Cr.)
Numerical Methods (4 Cr.)
Operating Systems (4 Cr.)
Operator Networks Infrastructure (4 Cr.)

Optical Systems and Networks (4 Cr.)
Parallel Programming (4 Cr.)
Performance of Computer Systems and Networks (4 Cr.)
Quality of Service in Networks (4 Cr.)
Secured Enterprise Networks (4 Cr.)
Software Engineering (4 Cr.)
Space and Micro/Nano Satellite Technologies (4 Cr.)
Value-Added Services Engineering (4 Cr.)
Waveguides and Antennas (4 Cr.)
Web Programming (4 Cr.)
Windows System Administration (4 Cr.)
Wireless Communications (4 Cr.)

Corporate Internships (2 Cr.)

During his studies, each student is required to validate two activities:

- A labor internship of at least 4 weeks at the end of the third year of study (0 Cr.)
- A technical internship of at least 10 weeks at the end of the fourth year of study (2 Cr.)

Multidisciplinary Project (6 Cr.)

This project brings together students from different programs and/or options where each student participates in the execution of a task related to his field. It strengthens their analysis capacity and develops their communication skills and teamwork ability.

Final Year Project (16 Cr.)

The final year project is carried out by groups of 2 to 4 students, aiming to deliver a practical design experience in computer and communications engineering under the supervision and approval of a full-time faculty. Students must define the project, specify its objectives, perform a state of the art of the studies topic, establish the project specifications and select a design method. In this project, students must apply the knowledge acquired throughout their academic years of study, and provide a final product that went through all stages of design, modeling, analysis, testing and evaluation. A final report and two oral presentations are the main deliverables of the project.

Proposed Schedule

Semester 1

020ELAES1	Analog Electronics	6 Cr.
020INRES1	Introduction to Data Networks	6 Cr.
020CPPES1	Object-Oriented Programming	6 Cr.
020GPRES2	Project Management	4 Cr.
020STAES1	Statistics	4 Cr.
020THSES2	Signal Theory	4 Cr.
	General Education Restricted Elective	2 Cr.
	Total	32 Cr.

Semester 2

020CONES3	Analog and Digital Communications	6 Cr.
020TCOES2	Communication Skills	2 Cr.
020ELNES2	Digital Electronics	6 Cr.
020TROES2	Graph Theory and Operational Research	4 Cr.
020RCOES2	Network Routing and Switching	4 Cr.
020BDRES2	Relational Databases	4 Cr.

020ADUES3	Unix System Administration	4 Cr.
	Arabic Open Elective	2 Cr.
	Total	32 Cr.

Semester 3

020ETHES3	Business Ethics	4 Cr.
020SDAES3	Data Structures and Algorithms	4 Cr.
020INDES2	Innovation and Design Thinking	2 Cr.
	UE d'Options (16 Cr.)	
	Software Engineering	
020ADPES2	Analysis and Design of Information Systems	4 Cr.
020IA2ES4	Artificial Intelligence	4 Cr.
020AROES3	Computer Architecture	4 Cr.
020MCJES3	Design Patterns in Java	4 Cr.
	Telecommunication Networks s	
020TNSES3	Digital Signal Processing	4 Cr.
020SMPES3	Microprocessor Systems	4 Cr.
020PGAES3	Waveguides and Antennas	4 Cr.
020CSFES3	Wireless Communications	4 Cr.
	Restricted Electives	8 Cr.
	Total	34 Cr.

Semester 4

020ANGES4	English	4 Cr.
020PRMES4	Multidisciplinary Project	6 Cr.
	UE d'Options (16 Cr.)	
	Software Engineering	
020PCOES4	Compiler Principles	4 Cr.
020APDES4	Distributed Applications	4 Cr.
020SSEES4	Operating Systems	4 Cr.
	Telecommunication Networks	
020REMES4	Mobile Networks	4 Cr.
020SYOES4	Optical Systems and Networks	4 Cr.
020PSRES4	Performance of Computer Systems and Networks	4 Cr.
	Open Elective	2 Cr.
	Restricted Electives	8 Cr.
	Total	32 Cr.

Semester 5

020CMPES5	Accounting	4 Cr.
020DROES5	Business Law	2 Cr.
020STGES5	Corporate Internship	2 Cr.
020MNGES5	Management	2 Cr.
	UE d'Options (16 Cr.)	
	Software Engineering	
020VIRES5	Computer Virology	4 Cr.
020IAEES5	Enterprise Application Integration	4 Cr.
020PPLES5	Parallel Programming	4 Cr.
020GLOES5	Software Engineering	4 Cr.

	Telecommunication Networks s	
020TICES5	Information Theory and Coding	4 Cr.
020IDRES5	Network Engineering	4 Cr.
020QOSES5	Quality of Service in Networks	4 Cr.
020RESES5	Secured Enterprise Networks	4 Cr.
	Restricted Electives	8 Cr.
	Total	34 Cr.

Semester 6

020PFEES6	Final Year Project	16 Cr.
	Total	16 Cr.

Electrical Engineering (EE) Program

Coordinator: Hadi KANAAN

Program Educational Objectives

The objectives of the program are to graduate students able to:

- Advance in their careers in various sectors at local, regional and international levels.
- Successfully pursue higher education in world-class universities.
- Become decision-makers, innovators, and leaders in their profession.

Student Outcomes

The program outcomes are aligned with the ABET requirements:

1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3) An ability to communicate effectively with a range of audiences.
4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Requirements

Required Courses (150 ECTS credits), Restricted Electives (26 ECTS credits), Open Electives (4 ECTS credits).

English (4 Cr.)

Level A English Language Proficiency Test is a prerequisite to the 4-ECTS credit English course. Other English courses (B, C, D, E) are offered to reach this level. Prior to graduation, students must submit and validate the Saint Louis English Proficiency test.

General Education (30 Cr.)

Required Courses (24 Cr.)

Accounting (4 Cr.)

Business Ethics (4 Cr.)

Business Law (2 Cr.)
Communication Skills (2 Cr.)
Entrepreneurship (2 Cr.)
Innovation and design thinking (2 Cr.)
Management (4 Cr.)
Project Management (4 Cr.)

Restricted Electives (2 Cr.)

One course to be selected from the following list:
Business Economy (2 Cr.)
Marketing (2 Cr.)
Operational Management (2 Cr.)
Quality Management (2 Cr.)
Strategic Planning (2 Cr.)

Open Electives (4 Cr.)

General Education courses that can be pursued in any USJ institution, with at least two credits of Arab language or Arab culture.

Core Engineering Courses (122 Cr.)

Required Courses (98 Cr.)

Analog Electronics (6 Cr.)
DC-AC Conversion (4 Cr.)
DC-AC Conversion (4 Cr.)
Digital Electronics (6 Cr.)
Digital Systems and Control (4 Cr.)
Dynamic Systems Modeling (4 Cr.)
Electric Machines 1 (6 Cr.)
Electric Machines 2 (4 Cr.)
Electrification 1 (6 Cr.)
Electrification 2 (4 Cr.)
Electrotechnics (6 Cr.)
Industrial Electronics (6 Cr.)
Linear Control (6 Cr.)
Microprocessor Systems (4 Cr.)
Modern Control (4 Cr.)
Object-Oriented Programming (6 Cr.)
Renewable Energy (4 Cr.)
Signals and Systems (4 Cr.)
Statistics (4 Cr.)
Variable-Speed Drive Systems (6 Cr.)

Restricted Electives (24 Cr.)

Six courses to be selected from the following list:
Artificial Intelligence (4 Cr.)
Automation (4 Cr.)
Design and Integration of Mixt Systems (4 Cr.)
Embedded Systems (4 Cr.)
Energy optimization (4 Cr.)
Fluid Mechanics (4 Cr.)
Fuzzy Logic and Neural Networks (4 Cr.)
Graph Theory and Operational Research (4 Cr.)

HVAC 1 (4 Cr.)
HVAC 2 (4 Cr.)
Industrial Engineering (4 Cr.)
Industrial Process and Control (4 Cr.)
Integrated Circuits Design (4 Cr.)
Nonlinear Systems (4 Cr.)
Numerical Methods (4 Cr.)
Power Generation (4 Cr.)
Power Systems Analysis (4 Cr.)
Robotics 1 (4 Cr.)
Robotics 2 (4 Cr.)
Sensors and Instrumentation (4 Cr.)
Space and Micro/Nano Satellite Technologies (4 Cr.)
System Identification (4 Cr.)
Web Programming (4 Cr.)

Corporate Internships (2 Cr.)

During his studies, each student is required to validate two activities:

- A labor internship of at least 4 weeks at the end of the third year of study (0 Cr.)
- A technical internship of at least 10 weeks at the end of the fourth year of study (2 Cr.)

Multidisciplinary Project (6 Cr.)

This project brings together students from different programs and/or options where each student participates in the execution of a task related to his field. It strengthens their analysis capacity and develops their communication skills and teamwork ability.

Final Year Project (16 Cr.)

The final year project is carried out by groups of 2 to 4 students, aiming to deliver a practical design experience in electrical engineering under the supervision and approval of a full-time faculty. Students must define the project, specify its objectives, perform a state of the art of the studies topic, establish the project specifications and select a design method. In this project, students must apply the knowledge acquired throughout their academic years of study, and provide a final product that went through all stages of design, modeling, analysis, testing and evaluation. A final report and two oral presentations are the main deliverables of the project.

Proposed Schedule

Semester 1

020ELAES1	Analog Electronics	6 Cr.
020MSDES1	Dynamic Systems Modeling	4 Cr.
020ETCES1	Electrotechnics	6 Cr.
020CPPES1	Object-Oriented Programming	6 Cr.
020SYSES1	Signals and Systems	4 Cr.
020STAES1	Statistics	4 Cr.
	General Education Restricted Elective	2 Cr.
	Total	32 Cr.

Semester 2

020TCOES2	Communication Skills	2 Cr.
020ELNES2	Digital Electronics	6 Cr.
020ME1ES2	Electric Machines 1	6 Cr.
020IE1ES2	Electrification 1	6 Cr.

020ELIES2	Industrial Electronics	6 Cr.
020AULES2	Linear Control	6 Cr.
	Arabic Open Elective	2 Cr.
	Total	34 Cr.

Semester 3

020CCCES3	DC-DC Conversion	4 Cr.
020SCNES3	Digital Systems and Control	4 Cr.
020ME2ES3	Electric Machines 2	4 Cr.
020IE2ES3	Electrification 2	6 Cr.
020ANGES4	English	4 Cr.
020INDES2	Innovation and Design Thinking	2 Cr.
020SMPES3	Microprocessor Systems	4 Cr.
020GPRES2	Project Management	4 Cr.
	Restricted Elective	4 Cr.
	Total	34 Cr.

Semester 4

020ETHES3	Business Ethics	4 Cr.
020CCAES4	DC-AC Conversion	4 Cr.
020ENTES1	Entrepreneurship	2 Cr.
020PRMES4	Multidisciplinary Project	6 Cr.
020EVVES4	Variable-Speed Drive Systems	6 Cr.
	Open Elective course	2 Cr.
	Restricted Electives	8 Cr.
	Total	32 Cr.

Semester 5

020CMPES5	Accounting	4 Cr.
020DROES5	Business Law	2 Cr.
020STGES5	Corporate Internship	2 Cr.
020MNGES5	Management	4 Cr.
020CTMES4	Modern Control	4 Cr.
020ERNES5	Renewable Energy	4 Cr.
	Restricted Electives	12 Cr.
	Total	32 Cr.

Semester 6

020PFEES6	Final Year Project	16 Cr.
	Total	16 Cr.

Mechanical Engineering (ME) Program

Coordinator: Chantal MAATOUK

Program Educational Objectives

The objectives of the program are to graduate students able to:

- Advance in their careers in various sectors at local, regional and international levels.
- Successfully pursue higher education in world-class universities.

- Become decision-makers, innovators, and leaders in their profession.

Student Outcomes

The student outcomes are aligned with the ABET requirements:

1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3) An ability to communicate effectively with a range of audiences.
4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Requirements

Required Courses (146 ECTS credits), Restricted Electives (30 ECTS credits), Open Electives (4 ECTS credits).

English (4 Cr.)

Level A English Language Proficiency Test is a prerequisite to the 4-ECTS credit English course. Other English courses (B, C, D, E) are offered to reach this level. Prior to graduation, students must submit and validate the Saint Louis English Proficiency test.

General Education (28 Cr.)

Required Courses (22 Cr.)

Accounting (4 Cr.)
Business Ethics (4 Cr.)
Business Law (2 Cr.)
Communication Skills (2 Cr.)
Entrepreneurship (2 Cr.)
Management (4Cr.)
Project Management (4 Cr.)

Restricted Electives (2 Cr.)

One course to be selected from the following list:
Business Economy (2 Cr.)
Innovation and Design Thinking (2 Cr.)
Marketing (2 Cr.)
Operational Management (2 Cr.)
Quality Management (2 Cr.)
Strategic Planning (2 Cr.)

Open Electives (4 Cr.)

General Education courses that can be pursued in any USJ institution, with at least two credits of Arab language or Arab culture.

Core Engineering Courses (124 Cr.)

Required Courses (96 Cr.)

Automotive (4 Cr.)
Computer aided drawing and design (CADD) (4 Cr.)
Electronics (6 Cr.)
Finite elements applied to mechanical systems (4 Cr.)
Fluid mechanics 1 (4 Cr.)
Heat transfer (6 Cr.)
HVAC 1 (4 Cr.)
Hydraulics (4 Cr.)
Introduction to electrical machines (4 Cr.)
Linear control (6 Cr.)
Mechanical systems (6 Cr.)
Mechanics of machines 1 (4 Cr.)
Numerical methods (4 Cr.)
Plumbing (4 Cr.)
Renewable energy (6 Cr.)
Sensors and Instrumentation (4 Cr.)
Statically typed programming (4 Cr.)
Statistics (4 Cr.)
Strength of materials 1 (4 Cr.)
Thermodynamics: Principles and phase change (6 Cr.)
Vibrations (4 Cr.)

Restricted Electives (28 Cr.)

Six or seven courses to be selected from the following list:
Acoustics and vibrations (4 Cr.)
Advanced science of materials (4 Cr.)
Aerodynamics (4 Cr.)
Artificial intelligence for mechanical engineering (6 Cr.)
Automotive propulsion system (4 Cr.)
Biomaterials and medical equipment (4 Cr.)
Biomechanics (4 Cr.)
Building energy management (4 Cr.)
Design of Mechanisms (4 Cr.)
Design of mechatronic systems (4 Cr.)
Energy optimization (4 Cr.)
Fatigue of materials (4 Cr.)
Fluid mechanics 2 (4 Cr.)
Fluid Power Systems (4 Cr.)
HVAC 2 (4 Cr.)
Hydraulic Servo Systems (4 Cr.)
Image processing (4 Cr.)
Manufacturing Processes 1 (4 Cr.)
Manufacturing Processes 2 (4 Cr.)
Mechanics of composite materials (4 Cr.)
Mechanics of machines 2 (4 Cr.)
Mechatronics and Intelligent Machines (6 Cr.)
Micro-Electro Mechanical Systems (4 Cr.)

Mobile robots (4 Cr.)
Modal Analysis (4 Cr.)
Nonlinear systems (4 Cr.)
Power generation (4 Cr.)
Power Systems Analysis (4 Cr.)
Profitability of energy projects (4 Cr.)
Refrigeration systems (4 Cr.)
Robotics (4 Cr.)
Selection of Properties of Materials (4 Cr.)
Strength of materials 2 (4 Cr.)
Thermal engines (4 Cr.)
Turbomachine (4 Cr.)

Corporate Internships (2 Cr.)

During his studies, each student is required to validate two activities:

- A labor internship of at least 4 weeks at the end of the third year of study (0 Cr.)
- A technical internship of at least 10 weeks at the end of the fourth year of study (2 Cr.)

Multidisciplinary Project (6 Cr.)

This project brings together students from different programs and/or options where each student participates in the execution of a task related to his field. It strengthens their analysis capacity and develops their communication skills and teamwork ability.

Final Year Project (16 Cr.)

The final year project is carried out by groups of 2 to 4 students, aiming to deliver a practical design experience in electrical engineering under the supervision and approval of a full-time faculty. Students must define the project, specify its objectives, perform a state of the art of the studies topic, establish the project specifications and select a design method. In this project, students must apply the knowledge acquired throughout their academic years of study, and provide a final product that went through all stages of design, modeling, analysis, testing and evaluation. A final report and two oral presentations are the main deliverables of the project.

Proposed Schedule

Semester 1

020ELCES1	Electronics	6 Cr.
020IMEES1	Introduction to Electrical Machines	4 Cr.
020MEFES1	Fluid Mechanics 1	4 Cr.
020SMEES1	Mechanical Systems	6 Cr.
020STAES1	Statistics	4 Cr.
020TPPES1	Thermodynamics: Principles and Phase Change	6 Cr.
	General Education Restricted Elective	2 Cr.
	Total	32 Cr.

Semester 2

020CL1ES2	HVAC 1	4 Cr.
020CAOES3	Computer Aided Drawing And Design (CADD)	4 Cr.
020PSTES2	Statically typed programming	4 Cr.
020RM1ES2	Strength of Materials 1	4 Cr.
020MENES2	Numerical Methods	4 Cr.
020TDCES2	Heat Transfer	6 Cr.

020VIBES2	Vibrations	4 Cr.
020TCOES4	Communication Skills	2 Cr.
	Arabic Open Elective	2 Cr.
	Total	34 Cr.

Semester 3

020AULES2	Linear Control	6 Cr.
020AUTES3	Automotive	4 Cr.
020CM1ES3	Mechanics of Machines 1	4 Cr.
020HYDES3	Hydraulics	4 Cr.
020CPIES3	Sensors and Instrumentations	4 Cr.
	Restricted Electives	12 Cr.
	Total	34 Cr.

Semester 4

020ANGES4	English	4 Cr.
020DROES5	Business Law	2 Cr.
020GPRES2	Project Management	4 Cr.
020PLBES4	Plumbing	4 Cr.
020PRMES4	Multidisciplinary Project	6 Cr.
020ENTES1	Entrepreneurship	2 Cr.
	Open Elective	2 Cr.
	Restricted Electives	8 Cr.
	Total	32 Cr.

Semester 5

020CMPES5	Accounting	4 Cr.
020ERNES5	Renewable Energy	6 Cr.
020ETHES3	Business Ethics	4 Cr.
020EFMES5	Finite Elements Applied to Mechanical Systems	4 Cr.
020MNGES5	Management	4 Cr.
020STGES5	Corporate Internship	2 Cr.
	Restricted Electives	8 Cr.
	Total	32 Cr.

Semester 6

020PFEES6	Final Year Project	16 Cr.
	Total	16 Cr.

Course Descriptions

020CMPES5 Accounting 4 Cr.

Definition of accounting, accounting process, accounting concepts, classification of accounts, rules of double entry accounting system, rules of journal, current assets, and current liabilities. Concepts of cost accounting, advantages of cost accounting, classification and elements of cost, preparation of cost Sheet.

Prerequisites: None

020AEVES4 Acoustics and vibrations 4 Cr.

This course covers the fundamental concepts in noise and vibration, passive and active damping strategies, damping materials, control methods; and applications.

Prerequisites: Vibrations (020VIBES2)

020RLIES4 Advanced Networking and WAN Technologies 4 Cr.
This course presents the third and fourth courses of the Cisco CCNA Routing & Switching curriculum. It describes the architecture, components, and operations of routers and switches in larger and more complex networks and presents the configuration of those equipment for advanced functionalities. It also discusses the WAN technologies and network services required by converged applications in a complex network, making it possible to understand the selection criteria of network devices and WAN technologies necessary to meet specific network requirements.
Prerequisites: Network Routing and Switching (020RCOES2)

020SMAES4 Advanced science of materials 4 Cr.
This course deals with metals and polymers. The ferrous and non-ferrous alloys section covers the following aspects; industrial balance diagrams; heat treatment of metals; surface properties of metals; plastic deformation of metals; elements of fracture mechanics; process-structure-property relationships. The polymers part covers their properties, polymerization and synthesis, characterization techniques, physical properties of polymers, viscoelasticity, mechanical properties and applications.
Prerequisites: Science of materials

020ARDES3 Aerodynamics 4 Cr.
A course on theoretical and empirical methods for calculating the loads on airfoils and finite wings by application of classical potential theory, thin airfoil approximations, lifting line theory, and panel methods; wings and airplanes; application of linearized supersonic flow to supersonic airfoils; performance and constraint analysis; longitudinal stability and control.
Prerequisites: Fluid mechanics 1 (020MF1ES1) and Thermodynamics: Principles and phase change (020TPPES1)

020CONES3 Analog and Digital Communications 6 Cr.
Narrow band signals – linear modulations: AM, Double Side Band, Single Side Band – Frequency modulation: Spectrum, Modulator, Demodulator , Phase Locked Loop – Performance in presence of Noise – Digital communications system – Pulse Amplitude Modulation – QAM, PSK, ASK, MSK, GMSK modulations – Coherent Reception of linear modulations – Base band and narrow band models of a digital communication system – Inter Symbol Interference – Eye diagram – Nyquist channel – performance of linear modulations over a Nyquist channel – Reception in presence of ISI – Equalization: Linear, DFE, MSE – Mobile and selective channels – OFDM modulation - performance of digital modulations over a Rayleigh flat fading channel – Diversity – MIMO channels – Alamouti scheme – Carrier and time Synchronization: Differentially coherent reception – Squaring method – Costas Loop.
Prerequisites: Signal Theory (020THSES2)

020ELAES1 Analog Electronics 6 Cr.
This course covers the main low-power electronic components: 1) P-type and N-type semiconductors – P-N junction; 2) diodes: characteristics and application circuits (clipping, rectification…) – Zener diode (regulation) – Light-emitting diode. 3) Bipolar transistor: static operation (polarization, application circuits) – dynamic operation (amplifier circuits) – synthesis of amplifier circuits – Bipolar transistor as switches. 4) FET and MOSFET transistor: characteristics – resistive operation and amplification. 5) Operational amplifier (OA): differential structure and differential amplifier – static and dynamic performances – application circuits (Log amplifier, instrumentation and isolation OA, active filter...). 6) Comparator: characteristics – performances and limitations – application circuits (clock, hysteresis, peak value detector) – digital compatibility.
Prerequisites: Linear Electrical Systems and Networks (020SRLNI4 or 020SRLCI4)

020ADPES3 Analysis and Design of Information Systems 4 Cr.
I.S (information systems) in the company. Data Analysis. Data Modeling - Merise Methodology. Static Model. Dynamic Model. Data Flow Diagram. Data Conceptual Model. Data Logic Model. Passage Rules. Conceptual Model of Treatments. Logic Model of Treatments. MCD, MCT, MLD, MOT, MPD, MoPT. Extension Merise 2.
Prerequisites: None

020IA2ES4 Artificial Intelligence 4 Cr.
Study of intelligent agents, Search problems, DFS, BFS, A*, Greedy … games minimax, expectimax, alfa beta pruning, bayes nets, machine learning, reinforcement learning.

Prerequisites: Data Structures and Algorithms (020SDAES3)

020IA3ES4 Artificial Intelligence for mechanical engineering 6 Cr.
Fundamental concepts of Data structures and algorithms. Study of intelligent agents, Search problems, DFS, BFS, A*, Greedy … games minimax, expectimax, alfa beta pruning, bayes nets, machine learning, reinforcement learning.
Prerequisites: None

020DOMES3 Automation 4 Cr.
Introduction to Home Automation. Communication mode: Dry contact, Serial, Infrared and TCP-IP. Protocol: Wired and Wireless, Dedicated and Universal. Type of control: Lighting, electrical curtains, HVAC and Audio video equipment. Interface with other systems: Building management systems (BMS), Fire Alarm, Intrusion, CCTV and intercom. Internet of things (IOT). User Interface: Binary input, Wired Keypads, Wireless remote control, Touch screen and Mobile / Tablet applications. Concept of electrical installation relative to home automation complete with the relative electrical panel. Load schedule with the number of circuits and type of control. Home Automation devices. KNX Protocol. ETS software. Concept of typical project (requirement and recommendations).
Prerequisites: Digital electronics (020ELNES2)

020AUTES3 Automotive 4 Cr.
Clutch - Manual and automatic gearboxes - Torque converter - 4x4 transfer - CV joints - Transmission - Differential - Suspension - Wheel geometry - Steering box - Braking systems.
Prerequisites: Mechanical systems (020SMEES1) and Thermodynamics: Principles and phase change (020TPPES1)

020SPAES5 Automotive propulsion system 4 Cr.
This course covers the basics of transmission systems and ground propulsion. Energy consumption and environmental impact of modern means of transport. Configuration of conventional vehicle propulsion systems. Principles of operation of conventional propulsion systems. Technologies of propulsion systems for battery electric vehicles. Technologies of propulsion systems of fuel cell vehicles. Hybrid electric powertrain technologies. Stop / start of hybrid, parallel hybrid and series / parallel hybrid drive systems. Fundamental principles of the braking recovery system.
Prerequisites: Automotive (020AUTES3), Thermal engines (020MOTES4)

020BIGES4 Big Data 4 Cr.
Introduction to massive data challenges, High Performance File System and MapReduce, Link Analysis in Graphs, Similar Sets, Similar Item sets, Community detection in graphs, mining data streams, recommender systems, Clustering and classifiers.
Prerequisites: None

020IBDES4 Big Data Integration 4 Cr.
This course covers different approaches to data integration in general: Integration according to a materialized view (Data Warehouse) and integration according to a virtual view (Mediator), as well as more specific approaches to Big Data, such as Data Lakes, Lambda architecture (Streams, Batch processing), integration and processing pipelines, and finally the semantic approach for data description with RDF and OWL. This course also covers the techniques, the tools and the environment to be put in place in order to practically perform this Big Data integration (Talend Big Data Integration Studio, Aoache Nifi, ...), by tackling especially the Variety issue, since the data to be integrated can be structured, semi-structured (XML, JSON), or unstructured (text, etc.), and can be stored in relational databases, or in NoSQL Databases (key-value, Column, Document or Graph Oriented Databases).
Prerequisites: None

020BEMES5 Biomaterials and medical equipment 4 Cr.
A course that examines the structure-property relationships for biomaterials and the medical applications of biomaterials and devices. The first part of the course focuses on the main classes of biomaterials, metal, ceramic, polymeric, and composite implant materials, as well as their interactions with the human body (biocompatibility).

The second part examines the various applications of biomaterials and devices in different tissue and organ systems such as orthopedic, cardiovascular, dermatology, and dental applications.
Prerequisites: Science of materials

020BIMES3 Biomechanics 4 Cr.
A course on study of the biomechanical principles underlying the kinetics and kinematics of normal and abnormal human motion. Emphasis is placed on the interaction between biomechanical and physiologic factors (bone, joint, connective tissue, and muscle physiology and structure) in skeleto-motor function and the application of such in testing and practice in rehabilitation.
Prerequisites: Science of materials, Mechanical systems (020SMEES1)

020ENBES4 Building energy management 4 Cr.
A course that provides an opportunity for students to explore topics in energy management systems and management strategies for new and existing buildings; energy use in buildings; energy systems analysis and methods for evaluating the energy system efficiency; energy audit programs and practices for buildings and facilities; initiating energy management programs; guidelines for methods of reducing energy usage in each area in buildings; conservation of the energy in the planning, design, installation, utilization, maintenance; control and automation of the mechanical systems in existing and new buildings; air conditioning and ventilation systems in buildings; assessment and optimization of energy control strategies; prediction methods of economic and environmental impact of implemented control strategies and indoor settings.
Prerequisites: None

020ETHES3 Business Ethics 4 Cr.
The course is interactive in nature. It includes readings and analysis of basic texts, moments of reflection and debate, awareness of the state-of-the-art in the region, studies of authentic international organizational documents, role plays and projects for a more pragmatic analysis.
Prerequisites: None

020DROES5 Business Law 2 Cr.
Introduction to rights, rules and sanctions - the subjective rights - the trial, first instance, remedies (in civil and commercial matters) - Commercial law: acts of commerce, merchants, commercial properties - Commercial companies - Framework of the legal environment of the company - Main payment and credit tools - Guarantees given and received by the company.
Prerequisites: None

020CLDES5 Cloud and Digital Transformation 4 Cr.
Devops - Continuous Integration - Continuous Deployment - Continuous Delivery - Containers - Docker - Amazon Web Services, AWS, Microsoft Azure - IBM Bluemix - Vmware Cloud Air - Internet of Things - Smart Home - Quantified Self - Connected Car - Digital Health - Watson.
Prerequisites: None

020TCOES2 Communication Skills 2 Cr.
Communication Skills' course is an interactive one. It is built around two main axes. The first consists of theoretical knowledge of certain models and tools of communication. On the other hand, students will be asked to participate in simulations where they would be speakers and communicators. In order to optimize the duration of the course and allow the student to put communication in practice, the class is reversed. Students are asked to prepare presentations on topics briefly discussed in class and based on visuals (PPT, Prezi…). Oral presentations will be corrected/completed by the teacher in charge. They are asked to provide also a text document that briefs the topic and accessible to all through Moodle platform.
Prerequisites: None

020PCOES4 Compiler Principles 4 Cr.
Introduction to compilers – Lexical analysis: A language for specifying lexical analyzers, Finite automata, Design of a lexical analyzer generator, LEX tool. Algebraic grammar and pushdown automata - Syntax analysis: Top-down parsing and LL parsers, Bottom-up parsing and LR parsers, Parser generators and YACC tool – Semantic analysis:

Syntax-directed definitions, Bottom-up evaluation, Top-down translation – Intermediate code generation: Three-address code, code optimization.
Prerequisites: None

020CAOES2 Computer aided drawing and design (CADD) 4 Cr.
The course aims to prepare the mechanical engineering student to communicate through graphics, technical drawings, and design databases via Computer Aided Drawing (CAD) software (such as AutoCAD®) and 3D Computer Aided Design software (such as Creo Parametric). Orthographic projection, auxiliary views, sectional views, dimensioning and tolerancing, drawing formats. Part geometric construction. Assemblies and exploded assemblies. Parts and assemblies working Drawings. Engineering symbols. CADD project.
Prerequisites: None

020AROES3 Computer Architecture 4 Cr.
Computer evolution and performance - Von Neumann model – interconnection structures – memory systems - inputs / outputs - instruction sets – processor structure and function - pipelines - RISC and CISC – ILP and superscalar processors - parallel architectures and organizations.
Prerequisites: Digital Systems Design (020TEDNI4 or 020TEDCI4)

020VIRES5 Computer Virology 4 Cr.
Introduction: The taxonomy of malware and its capabilities, History of malware -Reverse engineering: tools, obfuscation, packers, anti-debug techniques, x86 and x64 Assembly, Binary Code Analysis – Buffer overflows: Memory Corruption Bugs, Stack Overflow, Format String Attack, Integer Overflow, Fuzzing, Exploitation and Mitigation Techniques, Protection Mechanisms - The theory of malware: Turing Machine, The Halting Problem and Decidability, Adleman's proof of the undecidability of the presence of a virus, Cohen's experiments on detectability and self-obfuscation – Self-reproducing Malware: script and macro-virus, executable file virus, system virus and rootkit, Antivirus: Antivirus techniques, Antivirus Relay, Protection techniques, Antivirus Benchmarking and Testing – SPAM: Common techniques of SPAM and SPAM filtering.
Prerequisites: None

020STGES5 Corporate Internship 2 Cr.
The corporate internship is a learning opportunity for students to: apply the knowledge they acquired during earlier coursework in a professional environment - acquire professional skills in addition to the theoretical and practical formation - experiment situations of human relationships that occur in the different environments where engineers may work - acquire experience and knowledge that facilitate future professional integration.
Prerequisites: None

020CRYES4 Cryptography 4 Cr.
Introduction to attacks, Services: authentication, integrity, confidentiality, non-repudiation - Security mechanisms and techniques: algorithms, microcircuits, key management, certificates, firewalls - Security protocols: SSL, S / Mime, Etebac5, PKI, X509, SSH, ISO9735 - Programmatic Interfaces - EDI: definitions, electronic banking, e-commerce, edifact, security - Practical cases.
Prerequisites: None

020SDAES3 Data Structures and Algorithms 4 Cr.
Complexity analysis, Elementary data structures (Arrays, Linked lists, stacks, queues), Search problems (sequential search, bisection), Sorting (elementary sorts, quicksort, merge sort), trees (characteristics, structure, traversal), string search algorithms, priority queues, heap, graphs (characteristics and structure), graph algorithms (shortest path, spanning tree, connectivity…), , scheduling problems, flow problems (maximum flow, minimum cost flow problem,…), coupling, dynamic programming, linear programming (simplex).
Prerequisites: None

020SSMES3 Design and Integration of Mixed-Signal Systems 4 Cr.
This applied course is divided into two distinct parts: Design and Realization of a Printed Circuit Board (PCB) in the frame of a project; Practical use of 32-bit microcontroller boards and Firmware programming. The first part enables the students to acquire the necessary skills to fabricate a PCB by tackling the following concepts: PCB Fabrication process, PCB Schematic and Layout Design on Proteus EDA Software, Fab-ready file generation,

Introduction to Coupling effects, Parasitics, HF signals, delays, Controlled Impedance. The second part provides knowledge of the main Software and Hardware components of a Mixed-System: 32-bit microcontroller board architecture, Peripherals and Input/output interfaces, Link Communication Protocols, Wireless Connectivity, Memory Resources, Computational Power, Power consumption, Introduction to Firmware development.
Prerequisites:

020CPMES3 Design of mechanisms 4 Cr.
A course involving graphical and analytical synthesis of single- and multi-loop linkage mechanisms for motion, path, and function generation through 2-3-4- and 5-precision positions; optimum synthesis of linkage mechanisms; synthesis of cam-follower mechanisms; synthesis of gear trains.
Prerequisites: Mechanical systems (020SMEES1)

020CSMES4 Design of mechatronic systems 4 Cr.
A course that discusses mechatronics; data; numbering systems, architecture of microcontroller, assembly language programming, A/D and D/A conversion; parallel I/O programmable timer operation, interfacing sensors and actuators, applications; a team project on design and implementation of a mechatronic system.
Prerequisites: Electronics (020ELCES1), Sensors and Instrumentation (020CPIES3)

020MCJES3 Design Patterns in Java 4 Cr.
This course exposes the principles of Object Oriented Programming in Java. It describes: java.awt, and javax. swing librairies in order to develop graphical user interfaces, java.io to handle Inputs/Outputs, java.net to be able to develop applications that communicate by using TCP or UDP. The course details the 23 design patterns of the book: Design Patterns: Elements of Reusable Object-Oriented Software (GOF) and shows how and when to use creational/structural/behavioral design patterns in a Java application.
Prerequisites: None

020ELNES2 Digital Electronics 6 Cr.
Digital systems and analog systems: comparison, advantages and disadvantages, analog switches – Application to sample-and-hold circuits, analog to digital converter and digital to analog converter – Terminology of digital integrated circuits, digital integrated circuits using saturated bipolar transistors – TTL characteristics, advantages and disadvantages, digital integrated circuits using unsaturated bipolar transistors – ECL characteristics. advantages and disadvantages, digital integrated circuits using MOS transistors – CMOS characteristics, advantages and disadvantages, interfacing digital integrated circuits, introduction to memories: terminology and architecture.
Prerequisites: Analog Electronics (020ELAES1)

020TNSES3 Digital Signal Processing 4 Cr.
Digital signals and systems, sampling and reconstruction, quantization, SNR, truncation-Digital Filters FIR and IIR, time and frequency response, Z transform, filter stability-Discrete Fourier Transform DFT, Fast Fourier Transform FFT, Windowing and effects on spectrum-Analog filter design (Butterworth, Tchebychev, Bessel)-FIR filter design methods: Windowing, frequency sampling-IIR filter design methods: Impulse invariance, bilinear transformation-Real-time DSP card Implementation: MATLAB and Simulink.
Prerequisites: Signal Theory (020THSES2)

020SCNES3 Digital systems and control 4 Cr.
Introduction to digital control. Z-transform: definition, properties of Z-transform, Calculation of the Z-transform using the Laplace transform, inverse Z-transform: partial fraction decomposition, division by increasing power, Residues method. Continues to discrete transformation, systems simulation. Design of a discrete controller, discretization of classic control laws (PI, PID), Dead-beat control. Introduction to embedded systems. Introduction to the variable formats (Double precision, fixed point formats…), performance evaluation. Simulation of a discrete system in closed-loop using MATLAB Simulink. Introduction to FPGAs. Emulation an electrical system in real-time using FPGA.
Prerequisites: Linear control (020AULES2), Signals and systems (020SYSES2)

020APDES4 Distributed Applications 4 Cr.

This course explains the concept of middleware within the context of object-oriented distributed applications. It covers the following distributed architectures: Java RMI, OMG - CORBA, Enterprise Java Beans distributed components as well as Web Services.
Prerequisites: None

020ME1ES2 Electric machines 1 6 Cr.
Course introduction: Mechanical loads, Mechanical force and emf production. DC Machine: Constructional features, windings, armature voltage, electromagnetic torque, magnetization curve, separately excited and series excited dc machines, motor and generator operations, torque-speed and voltage-current characteristics, nameplate, rated values and per unit values. Manufacturer data-sheet. Problems on dc machines. Electromechanical conversion and rotating magnetic field. Induction Machines: Constructional features, squirrel-cage and wound-rotor inductions machines. Equivalent circuit models, no-load test, blocked-rotor test and equivalent circuit parameters, power flow in motor operation, torque-speed characteristic. Starting torque and current. Maximum torque. Nameplate, rated values and per unit values. Manufacturer data-sheet. Starting and introduction to speed control of an induction machine. Synchronous Machines: Constructional features, non-salient and salient pole rotors. Equivalent circuit models of non-salient pole rotor unsaturated and saturated machine, synchronous reactance, phasor diagrams. Tests and equivalent circuit parameters, power flow in generator operation, motor operation, power and torque characteristics, power factor control. Nameplate, rated values and per unit values. Connection to an infinite bus, stability, independent generators. Manufacturer data-sheet. Lab sessions on dc machine, induction machine and synchronous machine.
Prerequisites: Electrotechnics (020ETCES1)

020ME2ES3 Electric machines 2 6 Cr.
Course introduction. Special transformers: three windings transformers, autotransformers, current and voltage transformers. Transformers in unbalanced mode, transformers in transient mode, parallel operation of transformers. DC machines in transient mode, application in unsaturated transient conditions. Reminder on three-phase induction machine operating in steady-state. Generator and braking operation of a three-phase IM. Special types of IM. Transient models of a three-phase IM (Clarke, Concordia, Park transforms). Determination of the parameters of an IM model using the manufacturer datasheet. Simulation of an induction machine operation in both transient and steady-state using Matlab/Simulink software. Reminder on rotating fields theory and synchronous machines in steady-state. Synchronous machines with salient poles model and synchronous machines characteristics in steady-state. Transient modeling of a generalized synchronous machine. Application on generators under short-circuit operation, transient parameters determination from short-circuit experimental results. Lab experiments.
Prerequisites: Electric machines 1 (020ME1ES2)

020IBTES3 Electrification 6 Cr.
Course introduction. Lighting Theory. Lighting Design. Lighting Fixtures and sources. Dialux software training. Emergency Lighting. Electrical Load Estimation, Substation and Electrical rooms sizing. LV switchgear and switchboards. Sizing and protection of conductors. Ecodial software training. Earthing Schemes. Lighting Protection and Overvoltage protection. Motors starters and motor control centers. Generators, UPS and PFCC brief introduction. Lighting and power circuits layouts.
Prerequisites: Electrotechnics (020ETCES1)

020ELCES1 Electronics 6 Cr.
This course introduces the basics of electronics and electronic circuits to students in the mechanical engineering program. Its objectives are to provide a concise treatment of the basic concepts of electronic components and to introduce students to basic analog and digital circuits. The course covers the basics of diodes, semiconductors, transistors, operational amplifiers and their applications, digital circuits and systems, and basic instrumentation.
Prerequisites: Linear electrical systems and networks (020SRLNI4 or 020SRLCI4)

020ETCES1 Electrotechnics 6 Cr.
Course introduction. Electromagnetism reminder, dielectrics, conductors, magnetic materials used in electrotechnics, operating and modeling of linear and non-linear magnetic circuits without and with flux leakage, effect of the airgap. Ideal transformer, magnetic coupling, flux leakage modeling, equivalent electric circuits, construction of a single-phase transformer, equivalent circuits, phasor diagram, no-load, short-circuit and load operations, voltage regulation, rated values, nameplate, tests, efficiency. Reminder on steady-state sinusoidal

regime, balanced three-phase regime, wye and delta connections, power calculations and measurements, single-phase star equivalent circuit, unbalanced three-phase regime, symmetrical components method, examples. Three-phase transformer: Construction of a three-phase transformer, windings connections, wye, delta, zig-zag, equivalent circuits, vector group, no-load, short-circuit and load operations, voltage regulation, rated values, nameplate. Lab sessions on three-phase power measurements, single-phase transformers, three-phase transformers.
Prerequisites: Electromagnetism (020EMENI3 or 020EMECI3), Linear electrical systems and networks (020SRLNI4 or 020SRLCI4)

020SEMES3 Embedded Systems 4 Cr.
Embedded systems: Introduction, History, Motivation and applications – Definitions of real-time embedded systems – Technology integration and the implementation levels – Recap on logic gates: AND, OR, NOR, XOR, NAND, NOT, NXOR – Recap on combinatorial logic circuits: Multiplexer, Decoder, Encoder, 7-segment display – Recap on sequential logic circuits: D flip-flop, RS flip-flop, JK flip-flop, T Flip-flop, registers – Introduction to co-design: link between the hardware and the software – Alternatives to microcontroller (in particular the FPGA) – FGPA: Introduction, Basic Logic Element (BLE) architecture, Programmable Input/output – Introduction to Lab, Quartus and Altera DE2 – VHDL: Introduction, Basics, Combinatorial and sequential behavior, Process and clocks, Advanced concepts.
Prerequisites: Digital Systems Design (020TEDNI4 or 020TEDCI4), Programming 1 (020IF1NI2 or 020IF1CI2)

020OEPES5 Energy optimization 4 Cr.
Course introduction. Key concept of pinch analysis. Basic concepts of heat exchange; the temperature-enthalpy diagram; composite curves; a targeting procedure; the grand composite curve. The pinch and its signification. The methodology of pinch analysis. Data extraction and energy targeting. Data extraction; heat and mass balance; stream data extraction; calculating heat loads and heat capacities; choosing streams; mixing; heat losses. Case study: Organics distillation plant. Process description; Heat and mass balance; stream data extraction. Utilities, heat and power systems. Concepts: Types of heat and power systems; Basic principles of heat engines and heat pumps; appropriate placement for heat engines and heat pumps. CHP systems: Practical heat engine; Selection of CHP system; Refinement to heat and power systems; economic evaluation; Organic Rankine Cycle. Heat pumps and Refrigeration systems: Heat pump cycles; refrigeration systems; Shaft work analysis; cooling water systems. Case studies and examples. Whisky distillery; CHP with geothermal district heating; Hospital Site. Heat Exchanger Network. Heat exchange equipment: Types of heat exchanger; Shell and tube exchanger; Plate exchanger; Recuperative exchanger; Heat recovery to and from solids; Multi-stream heat exchanger. Stream splitting and cyclic matching: Stream splitting; cyclic matching; design away from the pinch. Network relaxation: Using loops and paths; Network and exchanger temperature difference; Alternative network design and relaxation strategy. Multi-pinches and near pinches. Retrofit design. Network design for organics distillation case study. Economical study of integrated industrial process. Targeting heat exchanger units, area and shells: Targeting for number of units; targeting for minimum number of units; Area targeting; Deviations from pure counter-current flow; Number of shell targeting. Supertargeting: Cost targeting for optimal Pinch; Trade-offs in choosing pinch value; Illustration of two-stream example; Factors affecting the optimal pinch. Case study: Energy targeting; Area targeting; Cost targeting; Zonal targeting; Targeting with utility streams included.
Prerequisites: Thermodynamics of machines (020TDMES3)

020ANGES4 English 4 Cr.
A course designed to develop student's communication skills to facilitate their integration into the professional world; refer to the English section of the program.
Prerequisites: None

020IAEES5 Enterprise Application Integration 4 Cr.
This course details the constraints and challenges of different integration techniques and methodologies. It covers Microsoft integration technology with Microsoft Biztalk Integration Server. It explains the SOA concepts and the implementation of a business process integrating several applications using an Enterprise Service Bus with Glassfish-ESB from Oracle. This course explains the difference between data, interface and process integration, as well as the difference between SOAP extended web services and REST web services in the context of web integration.
Prerequisites: None

020PIRES5 Ethical Hacking 4 Cr.
Introduction to Ethical Hacking: Information Security, Hacking phases, Ethical Hacking Concepts and Scope – Footprinting and Reconnaissance - Scanning: Check for Live Systems, Check for Open Ports, Banner Grabbing, Scan for Vulnerability, Draw Network Diagrams - Enumeration – Cracking Passwords System Hacking: Gaining Access, Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks – Network Hacking: DoS Attack, Sniffing, Spoofing, Session Hijacking – Web hacking: SQL Injection Attacks, Cross-Site Scripting (XSS) Attacks, Cross-Site Request Forgery (CSRF) Attack, Session Fixation Attack - Social Engineering.
Prerequisites: None

020FDMES3 Fatigue of materials 4 Cr.
This course deals with the behavior of materials subjected to static (creep) and dynamic (fatigue) mechanical loads with high and low cyclic variations; endurance tests and factors affecting the experimental endurance limit; Wöhler curves; constraint not completely reversed; variable amplitude constraint; notched limbs; departure of cracks and growth in fatigue; Manson-Coffin curves; damage estimation; creep and damping.
Prerequisites: None

020PFEES6 Final Year Project 16 Cr.
Refer to the paragraph concerning the final year project in the concerned program.
Prerequisites: None

020ELFES4 Finite elements analysis for mechanical applications 4 Cr.
Reminder on strength of materials. Elasticity, strain, stress, boundary conditions, statically indeterminate system, virtual works, potential energy. Stiffness analysis. Meshing types and labelling. Stiffness matrix, boundary conditions, stiffness matrix of a linear spring, stiffness matrix of spring association, system with articulated beams. Finite elements applied on 2D beam. Identification of the problem, displacement function, strain stress relation, relation between efforts and nodal displacement. Triangular elements for plane elasticity. Stiffness matrix of a triangular element, coordinates system, punctual displacement function, relation between punctual displacement and deformation. Model convergence. Rectangular finite elements. Rectangular finite elements for plane elasticity. Bending of beams. Model convergence.
Prerequisites: Numerical methods (020MENES1) , Mechanics of Materials (020RDMES3)

020MEFES2 Fluid mechanics 4 Cr.
Characteristics of fluids - Kinematics - Balance equations - Study of viscous fluids - Dimensional analysis and similarity - Flow regimes - Laminar and turbulent flows in pipes.
Prerequisites: Mechanics 2 (020MC2CI3 or 020MC2NI3)

020MF1ES1 Fluid mechanics 1 4 Cr.
Characteristics of fluids - Kinematics - Balance equations - Study of viscous fluids - Dimensional analysis and similarity - Flow regimes - Laminar and turbulent flows in pipes. Euler and Bernouilli theorem - Navier-Stokes equations Dimensional analysis applying the PI theorem.
Prerequisites: Mechanics 2 (020MC2CI3 or 020MC2NI3)

020MF2ES3 Fluid mechanics 2 4 Cr.
Kinetics of 3D fluid flows - Applications of basic and combined flow fields - Dynamics of compressible and incompressible flows - One-dimensional compressible flow in nozzles and pipes; normal shock waves and channel flow with friction or heat transfer; fluid machines (pumps and hydraulic turbines). Continuity equation - Navier-Stokes equations, dimensional analysis using the PI theorem (Buckingham) - Boundary layers - Lift and drag forces - Lubrication theory - Application of phenomena and case study on CFD software.
Prerequisites: Fluid mechanics 1 (020MF1ES1)

020OFPES4 Fluid power systems 4 Cr.
General aspects: System power transmission, various components, diagram of active components of a fluid system, evaluation factors of an energy transmission system, elements of a control chain, symbols of hydraulic components, hydraulic fluids, classification and physicochemical characteristics, example of hydraulic circuits. Passive components: Reservoirs, filters, connecting elements, quick couplers. Pumps: Volumetric pumps and motors classification, gear units, vane units, piston units, computational operations relating to pumps. Cylinders: General

and decription, cylinders characteristics, mounting schemes, sizing and verification, applications. Valves: pressure limiter, valve pressure reduction, sequence valve, relief valves, balancing valves. Flow restrictors: principle, flow regulators, functions of flow restrictors, flow limiters two-ports, flow limiters three-ports, various adjustment modes. Directional control valves: functions, constituting elements, characteristics, symbolic representation, various centers, Overlapping, by control pilot directional valves, spools centering, electrical control, control timing, grouping of directional valves. Non- return valves: functions, constituting elements, various types of non-return valves, blocks of double non- return valves, fast fill valves. Accumulators: functions, various types, accumulators use, accumulators dimensioning, commissioning and periodical controls. Fundamentals of logic valves: definition, characteristics, functioning principles, basic hydraulic functions (non-return valves, flows reducers, restrictive flow control, pressure valves, directional control valves). Fundamentals of proportional control: technology of proportional components (solenoid with progressive action, torque motor, rotating electric motor, electrohydraulic amplifiers), proportional control characteristics, pressure-flow relationship. Motors: equipment types, operating modes and use, assembly drawing. Design of hydraulic installation: project data analysis, sizing movers, development of hydraulic scheme, consumptions diagram, devices for control and regulation, sizing hydraulics, pumps specifications, identifying filters and stainers, reservoir sizing, annotation of the hydraulic circuit, operating manual.
Prerequisites: Hydraulics (020HYDES3), Industrial graphics (020DNDES3) or Computer aided drawing and design (CADD)

020PFSES3 Functional Programming 4 Cr.
The goal of this course is to introduce the functional programming paradigm using, mainly, the Scala programming language. The course begins with an overview of functional programming followed by a brief explanation of how traditionally imperative languages (such as C ++ and Java) recently incorporated some elements of this paradigm. Then, the course will proceed with the gradual exposition of the evaluation model (used to reason about functional programs) alongside the explanation of the following concepts: recursion and the optimization of recursive functions, the use of functions as values, the partial application of functions, object immutability and its advantages, types and pattern matching, pairs and tuples, lists and functional collections, combinatorial search problem solving using for-expressions, lazy evaluation, functional streams and infinite sequences. These concepts will be illustrated by examples and exercises in Scala. Once done, the Java 8 syntax of a subset of these concepts will also be exposed. Finally, the course will end with an introduction to program proving using structural induction.
Prerequisites: Object-Oriented Programming (020CPPES1)

020LFLES5 Fuzzy logic and neural networks 4 Cr.
Introduction of Fuzzy Logic and Neural Networks as intelligent techniques to manipulate imprecise and approximated data and systems. Industrial applications. Intelligent control of complex systems. Fuzzy sets theory and concepts, membership functions, operations on fuzzy sets, triangular norms. Fuzzy relations and fuzzy quantities, fuzzy intervals, fuzzy numbers, operation on fuzzy quantities. Linguistic variables, linguistic modifiers, fuzzy rules, fuzzy quantifiers. Fuzzy reasoning, fuzzy implications, generalized modus ponens. Fuzzy control, Mamdani and Larsen methods. MATLAB simulations using the Fuzzy Toolbox. Introduction to neural networks, artificial neuron model, activation functions, neural network structures. Learning process, error correction learning algorithm, Hebb learning algorithm, competitive learning. Single-layer neural networks, associative memory, perceptron, Adaline, LMS algorithm. Multi-layer perceptron. Applications. Back-propagation algorithm. Momentum. Adaptive learning rate. Levenberg-Marquardt learning algorithm. Cross validation technique. Generalized back-propagation algorithms. Radial Basis Functions networks. Application of neural networks in the identification and control of complex dynamic systems. Simulations using the Neural Networks Toolbox of Matlab.
Prerequisites: None

020TROES2 Graph Theory and Operational Research 4 Cr.
This course introduces graph theory and operational research as engineering tools for modeling, optimization, and decision making. It covers the basics of graph theory; mathematical and numerical graph representation; connectivity; paths and cycles; graph search algorithms; algorithmic complexity; well-known problems in graph theory: minimum cost spanning tree, shortest path, and max-flow min-cut problems, matching, coloring, etc.; solving engineering and real-world problems using graphs; manipulating graphs using Networkx Python library; Markov chains and applications; complex networks analysis; optimization and linear programming; numerical tools for solving optimization problems.
Prerequisites: None

020TRCES2 Heat transfer 6 Cr.
The course seeks to cover the fundamental concepts and conduction, convection and heat transfer by radiation, as well as their application to the solution of thermal engineering problems. The course covers stationary thermal conduction and transient regime; flat surfaces; numerical simulations of conduction in one-dimensional and two-dimensional problems; external and internal forced convection applied to laminar and turbulent flows; natural convection ; principles of the heat exchanger; and thermal radiation, form factors and radiation exchange between diffuse and gray surfaces.
Prerequisites: Thermodynamics 2 (020TH2NI3 or 020TH2CI4)

020CL1ES3 HVAC 1 4 Cr.
Course introduction. Thermal Comfort: thermal and hydrothermal exchange. Interior Basic conditions. Exterior Basic conditions. Comfort elements: activity, clothes, hygrometry, radiation, temperatures. Psychometric Chart: calculation and dimensioning of Heating, Cooling, Humidifying, Dehumidifying systems for interior ambient. Load Estimation for heating taking in account the impacts of ventilation, wall insulation, glazing treatment, lighting and equipment heating production, etc. Central Heating using Hot Water: Presentation, design and sizing of radiators, fan-coils, floor heating, convectors, pipes, pumps, boilers, burners, domestic hot water, fuel tanks, chimney, etc. Heating with hot air: Production of hot air, Air Handling Unit, Fan coil unit. Presentation, design and sizing using the psychometric chart of heating coils, humidifiers, air filters, fans, mixing box
Prerequisites: Fluid mechanics (020MEFES2), Thermodynamics 2 (020TH2NI3 or 020TH2CI4)

020CL2ES4 HVAC 2 4 Cr.
Heat pump – Mollier diagram – Environmental issues related to cooling fluids (Ozone and global warming) and new fluids – Summer thermal balance sheet - Cold battery and air evolution on cold batteries - Direct and indirect expansion air conditioning modes - Low and high-speed duct systems, single and double flow and variable air flow.
Prerequisites: HVAC 1 (020CL1ES3)

020SSHES5 Hydraulic Servo Systems 4 Cr.
This course covers the fundamentals of modeling and control of hydraulic servo-systems. It provides theoretical background and practical techniques for the modeling, identification and control of hydraulic servo-systems. Classical and advanced control algorithms are discussed. The use of Matlab/Simulink and other programming languages will be an integral part in this course.
Prerequisites: Fluid mechanics 1 (020MF1ES1), Linear control (020AULES2)

020HYDES3 Hydraulics 4 Cr.
Steady-state analysis of hydraulics systems – Transient regime analysis - Pumps - Turbines.
Prerequisites: Fluid mechanics (020MEFES2)

020TIMES4 Image Processing 4 Cr.
The course introduces the basic techniques and concepts of image processing. It covers 3 principal approaches: (i) spatial transformations such as logical, arithmetic and LUT operations, histogram transformations and spatial filtering, (ii) frequency filtering and the use of the Fourier Transform for images and (iii) morphological mathematics and some of its basic operators.
Prerequisites: Signal Theory (020THSES2)

020ELIES2 Industrial electronics 6 Cr.
Course introduction. Characteristics of ideal versus practical power switches. The power diode. Thyristors. Thyristors natural and forced commutation techniques. Fully-controlled power switches: power bipolar transistors, GTO, MOSFET, IGBT. Switch mode and snubber circuits. Single-phase thyristor-based power rectifiers. Three-phase thyristor-based power rectifiers. Power factor improvement: Mixed topologies. Case study: Design of a simple system based on power conversion from ac-dc. Workshops using MATLAB/Simulink. Laboratory experimental validation of the main rectifiers topologies.
Prerequisites: None

020DNDES3 Industrial graphics 4 Cr.

Drafting Instruments and their use. Lettering. Sketching type and line techniques. Multiview drawings. Sectional and auxiliary view. Descriptive geometry, patterns, dimensioning and notation. Computer-aided drafting technology. Geometric dimensioning and tolerancing, Pictorial Drawings, technical representation of mechanical elements (Fasteners, springs, bearings, Gear, etc…), assembly and detail drawings. Manufacturing technique (welding, casting, forging, extruding, stamping, machining), Pipe Drafting and design process.
Prerequisites: None

020PRNES4 Industrial process and control 4 Cr.
Programmable Logic Controllers (PLC) - Distributed Control Systems (DCS) - Supervisory Control And Data Acquisition (SCADA) - Human Machine Interface (HMI) - Remote Terminal Unit (RTU) - Fieldbus (MODBUS, PROFIBUS, PROFINET, HART) - CPU memory (executive, system, data, program) - Memory types (RAM, ROM, EPROM, EEPROM) - Data type (input, output, digital, analog) - SCADA architecture (field level, automation level, management level) - Intelligent Electronic Devices (IED) - Communication (message, sender, receiver, master, slave, serial, parallel) - Transmission (simplex, duplex, point to point, multipoint, guided, unguided) - Topology (mesh, star, bus, ring, hybrid) - Transmission media (twisted pair, coaxial, patch cable, crossover cable, fiber optic) - Data coding - Operational Block (OB) - Function (FC) - Function Block (FB) - DataBlock (DB) - Scan cycle - Interrupt - MODBUS data types (discrete input, coil, input register, holding register).
Prerequisites: None

020ISSES5 Information Security - Standards and Best Practices 4 Cr.
An introductory session on key concepts and risk analysis is delivered before discussing the various IT security standards, best practices, standards and guidelines. This course will discuss the ISO 27001-2 2013 standard, PCI DSS, OWASP, SANS-CIS top 20 cyber security controls. This course covers the following areas: Security policy and procedures, human resources security, physical and logical security of systems and networks, incident management and business continuity management.
Prerequisites: None

020TICES5 Information Theory and Coding 4 Cr.
This course introduces the limits of possible in digital communications systems and the techniques that can be used to approach these limits. The course covers the basics of information theory like the information associated to an event, entropy, mutual information, data processing theorem, source coding, Huffman codes, channel capacity and the channel coding theorem. The course covers also the channel coding technics used to improve the performance of a communications system like block codes, the algebraic structure of cyclic codes, BCH codes, Reed Solomon codes, convolutional codes, LDPC codes, turbo codes and polar codes.
Prerequisites: Analog and Digital Communications (020CONES3)

020INDES2 Innovation and Design Thinking 2 Cr.
In a rapid changing and complicated world with fast evolving products and business models, innovation has become a must for every professional especially in engineering. Innovation and design thinking focuses on the leader's role as an innovator and facilitator of innovation. This course allows students to develop basic skills in innovation and creative problem solving. Innovation can be applied to any discipline, and a special focus would be to search for innovative solutions for daily social problems. Innovation is a practical transformation of ideas to new products, services, processes, systems and social interactions. It creates new added values that satisfy interest groups and drive sustainable growth, improve the quality of living and promote a sustainable society. Innovation isn't only technology; it develops in all the economy and society dimensions. (EFQM framework for Innovation). The term was created in 1980s at Stanford to characterize the approach designers, architects or artists use to solve problems. The approach is user's centered, focusing on their needs. Considering that the approach is based in the design world, it uses tools like look/ask/try and visual thinking to understand and communicate ideas. Even though Innovation and design thinking have been related to product design, they can be applied to all kind of problem solving including business modeling and processes.
Prerequisites: None

020I3DES3 Interactive 3D Graphics 4 Cr.
The course provides basic techniques for generating interactive images from a three-dimensional environment. The underlying mathematics are exposed and the implementation is done in C/C ++ using the OpenGL library which

has established itself as a de-facto standard. Advanced techniques (shading, drop shadows, reflection, ray tracing, stereoscopy) are overviewed.
Prerequisites: Object-Oriented Programming (020CTPES1)

020EEIES4 Internet Ecosystem and Evolution 4 Cr.
Internet governance – Autonomous system interconnection – Transit and peering agreements – Internet exchange points – Concepts of external routing – BGP routing protocol – BGP routing policies – Security of routing in the Internet – Utility and demand models – Pricing models in the Internet.
Prerequisites: Introduction to Data Networks (020INRES1)

020RCTES5 Internet of Things Technologies 4 Cr.
IoT reference model – End-to-end IoT chain – Constraints and challenges of connected devices – Hardware architecture of connected devices – Wireless LAN (IEEE 802.11, IEEE 802.15.4, BLE, ZigBee) – Low power long range networks (LoRa, Sigfox, NB-IoT) – Routing protocols (AODV, OLSR, RPL, LOADng) – IPv6 for IoT – Application layer (MQTT, XMPP, COAP) – Operating systems for connected devices – hands-on and deployment of end-to-end IoT chain.
Prerequisites: Introduction to Data Networks (020INRES1)

020INRES1 Introduction to Data Networks 6 Cr.
This course introduces the basic principles and the various techniques governing the operation of data networks and the Internet, with particular focus on the TCP / IP stack protocols. It covers the architecture of data networks and the Internet; Circuit and packet switching; Protocols and standardization bodies; OSI and TCP / IP layers; Access mechanisms and Ethernet/WIFI technologies in local area networks; The switched architecture of local area networks; IP (IPv4 and IPv6); Routing; Designing IP addressing; Transport protocols (TCP and UDP) and their reliability mechanisms, WEB, mail, DNS and DHCP services; Socket programming, the basic concepts of security. On a more practical level, this teaching unit offers a set of practical exercises that introduces the student to the implementation of a network and configuration of the switching equipment; the use of network simulation tools and protocol analysis; Socket programming. This is a blended course offering the Semester 1 of Cisco CCNA Routing & Switching online material.
Prerequisites: None

020IMEES1 Introduction to electrical machines 4 Cr.
Principles of energy conversion - Magnetic materials and circuits - Balanced and unbalanced three-phase regimes. Constitution, modeling, equation and external characteristics in steady state of the DC machine - Concept of rotating field - Constitution, equivalent diagrams and external characteristics in steady state of the asynchronous machine and the synchronous machine.
Prerequisites: Electromagnetism (020EMENI3 or 020EMECI3)

020AULES2 Linear Control 6 Cr.
Course introduction. Analysis of 1st and 2nd order linear systems: definition, transient and steady-state response, frequency-response using Bode, Nyquist and Nichols diagrams, examples. Introduction to closed-loop versus open-loop control systems: bloc diagrams, transfer functions, feedback signal, reference, etc. Stability analysis based on Routh's stability criterion as well as Hurwitz stability criterion. Precision analysis, types of steady-state error: position, speed, acceleration. Introduction to MATLAB and MATLAB/Simulink. Control of linear systems using different types of PID controllers (P, PI, PD and PID) and lead/lag compensation techniques. Analytical design of PID controllers: Determination of the proportional, integral and derivative parameters of a PID controller for 1st and 2nd order linear systems. Control of special cases of linear systems using zero-pole compensation, derivative feedback, etc. Exercises, problem solving and case studies. Workshops using MATLAB/Simulink. Experimental identification and control of a linear system.
Prerequisites: Analog Electronics (020ELAES1)

020MLRES4 Machine Learning 4 Cr.
Machine learning is a subfield of Artificial intelligence. It is the science of making the machine learn by examples. The ultimate goal of ML is to make a computer that can learn from examples autonomously. The main research topics in ML include: natural language understanding, computer vision, self driving cars and radiogenomics. In this course, we will study the implementation of different machine learning algorithms using python with tensorflow

and keras. We will introduce several state-of-the-art algorithms such as decision trees, random forest, support vector machines, neural networks and many other algorithms and we will discuss implementation details for all algorithms.
Prerequisites: None

020MNGES5 Management 2 Cr.
The course aims at introducing the major functions of business and providing an overview on activities within organizations - The per-organization: Formulation, the legal entity, types of organizational Structures, the Vision and Mission, STEP Analysis, SWOT Analysis, Types of Business Strategies and the strategic Gap model of Ansoff - The Post Organization: The HR function, the accounting & finance function, the operation function, the marketing function - Formulating a business plan.
Prerequisites: None

020PF1ES3 Manufacturing Processes 1 4 Cr.
This course introduces the student to the industrial production of mechanical parts. It covers traditional shaping processes by removing material using a cutting tool, namely machining, via the study of straight cutting (physical phenomena, parameters, Taylor model, forces, power consumed), then sets out the main operations (turning, 3 to 5 axis milling, drilling), associated tools (characteristics, materials and associated angles), traditional machining machines, numerically controlled (CNC) machining centers, machining ranges and code ISO (Gcode), computer-aided manufacturing (CAM) from computer-aided drawing (CAD). The course also covers less non-traditional shaping processes (EDM, thermal cutting, wire cutting, water jet cutting, folding, etc.) as well as assembly processes such as welding, soldering, hooping. The course emphasizes process capabilities and limitations, relative cost and process selection guidelines. The concept of simultaneous design is introduced.
Prerequisites: Computer aided drawing and design (CADD)

020PF2ES4 Manufacturing Processes 2 4 Cr.
This course focuses on heat treatments, deformation, phase change and solidification treatment of metallic particles; manufacturing processing of non-metallic engineering materials such as ceramics, polymers and composites; It focuses on process capabilities and limitations, relative costs and process selection guidelines; the behavior of materials under processing conditions; manufacturing guidelines.
Prerequisites: Manufacturing processes 1 (020PF2ES4)

020SMEES1 Mechanical systems 6 Cr.
This basic course in mechanical engineering allows the student to establish the link between kinematics of solids and mechanical construction. It covers the modeling and the resolution of problems relating to the mechanisms made up of non-deformable solids: normalized mechanical connections and action torsors and associated kinematics, analysis of definition planes, kinematic diagram, configuration, analysis of the operation, determination of the equations of movement (positions, speeds and accelerations), calculation of the forces applied to the parts and the mechanical energies supplied and dissipated. Link chains: serial and parallel links degrees of mobility and the concept of hyper droop. Practical work (disassembly, modeling, reassembly, calculations) on simple mechanisms will allow the student to familiarize himself with the applied mechanics, and strengthen his vision of kinematics in space.
Prerequisites: Industrial drawings, Mechanics 2 (020MC2CI3 or 020MC2NI3).

020FABES5 Mechanical manufacturing 4 Cr.
Introduction to metals. Structure, standardized designations, alloys, cooling curve and phase diagram. Ferrous metals, steel and cast alloys. Non-ferrous metals alloys: aluminum, titanium, copper, etc. Metal molding processes. Permanent and non-permanent processes. Lost wax technique, sand casting, centrifugal casting …. Physical phenomena and precautions (turbulences, solidification and cooling geometrical release cavities and defects, rake angle impact on feasibility), gating system and risers. Exercises. Molding operations, design of gating system and risers. Metal cutting processes. Milling, turning, broaching, gears grinding…, tools and production machines, elementary operations and cutting parameters. Cutting theory: milling efforts and power. Part fixing. Exercises: machining parameters, part-fixing efforts, machining cost. Metal forming processes. Thin web forming and volume shaping: forging, laminating, continuous and impact extruding, bending… tools, machines and parameters. Metal sheet cutting and assembly techniques: sawing, laser cutting, water jet cutting, etc. Assembly techniques: welding, sticking, riveting, shrink fitting, screwing.
Prerequisites: None

020MMCES4 Mechanics of composite materials 4 Cr.
This course focuses on anisotropic elasticity and laminate theory, analysis of various members of composite materials, energy methods, failure theories, and micromechanics. Materials and fabrication processes are introduced.
Prerequisites: Fatigue of materials (020FDMES3), Science of materials

020CMAES4 Mechanics of machines 6 Cr.
Mechanical machines – mechanisms – power transmission – movement transformation – mechanical parts – design drawing - mechanical parts connections – existing standardized kinematic connections in mechanical engineering – modeling with kinematic connections – input output expression- rod and crank - cams – shafts – ball bearings- roller bearings – bearings mounting –belts – braking – disc brakes – aeronautical multidisc brakes - straight toothed gears - gearboxes – synchronizer - planetary gear train – differential.
Prerequisites: Mechanics of Materials (020RDMES3), Thermodynamics 2 (020TH2NI3 or 020TH2CI4)

020CM1ES3 Mechanics of machines 1 4 Cr.
It is a course that is an integral part of mechanical engineering. The student learns to dimension the current elements of machines for the choice of components or their custom manufacturing: assembly elements (springs, solder joints, screws / bolts, rivets), guide (bearings, bearings) and mechanical power transmission (keys and conical sleeves for coupling shafts, chains, synchronous and asynchronous belts). These elements are studied with an emphasis on their behavior under static loads and fatigue.
Prerequisites: Strength of materials 1 (020RM1ES3)- Mechanical systems (020SMEES1)

020CM2ES4 Mechanics of machines 2 4 Cr.
It is a course that is an integral part of mechanical construction and design. The student learns to dimension the key organs of mechanical power transmission in machines: friction (brakes, clutches), direct (shafts) and cogwheels (cylindrical gears with straight and helical teeth, bevel gears). Introduction to planetary gear trains and differential bridges. Applications projects for the calculation of gear trains (automobile gearboxes and wind turbine reducers). These organs are studied with regard to the presence of static, dynamic charges, and vibrational phenomena.
Prerequisites: Mechanics of machines 1 (020CM1ES3)- Vibrations (020VIBES2)

020MMIES5 Mechatronics and Intelligent Machines 6 Cr.
A course on sensors, sensor noise and sensor fusion; actuators; system models and automated computer simulation; information, perception, and cognition; planning and control; architectures, design, and development; a team project is included.
Prerequisites: Linear control (020AULES2)

020MEMES5 Micro-Electro Mechanical Systems 4 Cr.
A course that deals with materials for micro-sensors and micro-actuators, materials for microstructures, microfabrication techniques and processes for micromachining, computer-aided design and development of MEMS, commercial MEMS structures and systems, packaging for MEMS, future trends, and includes a team project.
Prerequisites: Sensors and instrumentation (020CPIES3)

020SMPES3 Microprocessor Systems 4 Cr.
Difference between microprocessors, microcontrollers and DSP – microprocessor architecture; realization of a basic board – Microcontroller architecture (PIC 18F2520) – Implementation of ROM, RAM and DATA EEPROM memory – special registers – addressing modes – inputs/outputs – interrupts – timers – analog to digital converter – asynchronous serial port – read from program memory – comparators – watchdog – sleep mode – Low Voltage Detect – oscillator – configuration words – Design, simulation and realization of microprocessor systems.
Prerequisites: Digital Systems Design (020TEDNI4 or 020TEDCI4)

020PCHES3 Microwave Links and Circuits 4 Cr.
Free space propagation loss – Effects of atmospheric phenomena – Diffraction and diffusion – RF analog and digital links – microwave junctions – microwave filters used microstrip technology – Microwave sources – S-matrix of quadripole (attenuators, phase shifters), hexapole (T in planes H and E, Y), octopole – 3dB, 30dB coupler,

Magic Tee) – anisotropic junctions (insulator, circulator) – Transistors (bipolar and FET) – Diodes (Tunnel, Gunn, IMPATT) – Sources (Triode, pentode, TOP, klystron and magnetron).
Prerequisites: Electromagnetism (020EMENI3 or 020EMECI3)

020CCIES4 Mixed-Signal IC Design 4 Cr.
In this applied course, the students are introduced to the use of an industrial EDA Software tool to acquire Computer-Aided Design skills in the field of Integrated Circuit Design. The course contents are as follows: Multi-stage Amplifiers, Current mirrors and Active Loads, Basic Biasing concepts, Differential signaling, Operational Amplifier Transistor-Level Design, Filters, Sample-&-hold circuits, Analog Comparators, Buffers, Basic Digital Cells, Frequency response of analog feedback circuits, Introduction to stability and Compensation, Simulation and Evaluation of the electrical performance of ICs using EDA Software. Introduction to Noise and Linearity in Electronics. IC Design Flow, Fabrication Technology and Packaging.
Prerequisites:

020DMOES4 Mobile Applications Development 4 Cr.
Mobile applications: Opportunities and challenges – iOS programming: Application structure, Swift programming language, MVC design pattern, application lifecycle, Visual components, protocols and extensions, gesture recognizers, Table Views and Collection Views, Core Services (Core Data, Core Location, Core Motion, MapKit, iCloud) – Android Programming: Application Structure, Activity, lifecycle and callbacks, Instance State, Resources and Assets, visual components, actions and listeners, Fragments and navigation, data persistence, Services, Content Providers, System services.
Prerequisites: Design Patterns in Java (020MCJES3)

020REMES4 Mobile Networks 4 Cr.
This course covers the evolution of mobile networks; link level and system level design aspects of 2G, 3G, and 4G networks: services, radio interface, network and protocol architectures, physical, (transport) and logical channels, signaling procedures, radio resource management, and security management; GSM evolution to GPRS and EDGE; UMTS evolution to HSPA and HSPA+; LTE evolution to LTE-Advanced and LTE-Advanced Pro; recent advances in mobile networks; use of professional tools to evaluate and analyze mobile networks.
Prerequisites: Wireless Communications (020CSFES3)

020CM2ES4 Mobile robots 4 Cr.
A course that provides an in-depth coverage of wheeled mobile robots. The material covers: nonholonomy and integrability of kinematic constraints; modeling: kinematics, dynamics and state-space representation; and nonlinear control strategies (open-loop and closed-loop). Five case studies are covered all-over the course: car-like, cart-like, omni- directional wheeled, mobile wheeled pendulums and bike-like robots.
Prerequisites: None

020ANMES5 Modal Analysis 4 Cr.
A course reviewing MDOF system vibrations, frequency response functions, damping, mobility measurement, curve fitting and modal parameter extraction, derivation of mathematical models, laboratory experiments, and projects are included.
Prerequisites: Vibrations (020VIBES2)

020CTMES4 Modern control 4 Cr.
Modeling a multi-variable system, interpretation and linearization. Response and matrix transfer. Realization in controllability, observability and Jordan forms. Controllability, the gramien and its properties, test of Kalman, partial controllability. Hautus test, observability and its criteria. Minimum implementation, stabilization and detection. Directions of the poles and zeros, simplification. Pole placement control, error integration, and observer. Optimal quadratic control (LQG): introduction, Riccati equation, Kalman filter, validity conditions. Introduction to minimax and H_∞ control. Guided mini-project: modeling, design and simulation.
Prerequisites: Digital systems and control (020SCNES3)

020PRMES4 Multidisciplinary Project 6 Cr.

This project brings together students from different programs and/or options where each student participates in the execution of a task related to his field. It strengthens their analysis capacity and develops their communication skills and teamwork ability.
Prerequisites: None

020VTLES5 Multimedia Engineering 4 Cr.
Video signal, Luminance, Chrominance, Interlaced and progressive scanning. Frame rate, resolution. Horizontal and Vertical Sync. Video bandwidth. TV analog systems: PAL, NTSC. Camera sensors: CCD and CMOS. Flat Screens technology: LCD, Plasma and OLED. CD, DVD and Blu-ray. Digital TV Signal: CCIR601.AES/EBU and embedded Audio. JPEG. Video and Audio Compression: MPEG2 and MPEG4 (H264). DVB: Digital Video Broadcast, DVB2. HDTV. Video and Audio on Networks.
Prerequisites: Signal Theory (020THSES2)

020IDRES5 Network Engineering 4 Cr.
This course covers the fundamental principles of network engineering; 2G, 3G, and 4G radio network planning; deployment considerations for mobile networks; quality of service and mobile network optimization; use of professional network planning and evaluation tools; optical network protection and survivability; WDM network design; network virtualization.
Prerequisites: None

020RCOES2 Network Routing and Switching 4 Cr.
Concepts of network switching – Hardware architecture of routers and switches – Virtual local area networks – Inter-VLAN routing and switching – High availability in local area networks – STP protocol – Dynamic internal routing – RIP protocol – OSPF protocol – IPv4 address depletion – Network address translation – Introduction to BGP routing – Routing and switching platforms – Network simulation and emulation – Semester 2 of CCNA Routing & Switching certification program.
Prerequisites: Introduction to Data Networks (020INRES1)

020SNLES5 Nonlinear systems 4 Cr.
Introduction to nonlinear systems and functions. Type of nonlinearities. Analysis methods. Class of nonlinearity separated systems. Hammerstein and Wiener modeling methods of nonlinear systems. Describing function method: principle and applications. Analysis of auto-oscillatory systems and stability study using Loeb criterion. Frequency response and synchronization. Step response. Series connection of nonlinear blocks. Harmonic oscillators. Tunnel diode. Tuning. Phase plan method. Lyapunov stability analysis. Dead-beat relay control of a servo-motor. Sliding mode control. Sliding surface. Filippov theorem. Chattering problem. Feedback linearization control. Lie derivative. Lie bracket. Frobenius theorem. Input-state feedback linearization control of multivariable systems. Input-output feedback linearization control of single-input-single-output systems. Inner dynamics. Extension to multi-input-multi-output systems.
Prerequisites: None

020MENES1 Numerical Methods 4 Cr.
Introduction to numerical calculation, error analysis and propagation, numerical software, interpolation and approximation, integration and differentiation, numerical solution to differential equations, finite difference method, matrices, resolution of linear systems, matrix decomposition, eigenvalues and eigenvectors, non-linear system of equations.
Prerequisites: Differential Calculus and Integrals (020CDINI3) or Analysis 2 (020AN2CI3), Linear Algebra (020ALNNI2) or Algebra 1 (020AL1CI2)

020CPPES1 Object-Oriented Programming 6 Cr.
Program structure, types, literals and variables, operators, program control instructions (conditions and loops), functions, arrays, structures - Object-Oriented Programming: Objects and classes, attributes and methods, constructor and destructor, encapsulation, inheritance, virtual functions, abstract classes et polymorphism, method and operator overloading, exceptions, Input/Output, streams, generics and templates, Standard Templates Library (STL), Graphical User Interfaces with Qt.
Prerequisites: None

020SSEES4 Operating Systems 4 Cr.
Introduction to operating systems - Operating system structures, computer hardware properties - Process concept in modern operating systems - Multi-processes - Thread concept and multi-threading - Process synchronization - Process synchronization - Deadlocks in multi-processing - Memory management - Virtual memory management - CPU scheduling algorithms - File system - Disk subsystem - Security.
Prerequisites: None

020ROPES5 Operator Networks Infrastructure 4 Cr.
Overview on operator networks architecture - Study of the operator networks architecture in Lebanon: access network, aggregation network, and backbone network - xDSL physical layer - xDSL devices (DSLAM, BRAS) - xDSL network layer (ATM transport, authentication) - Telephone access architecture - Evolutions in the public operator network in Lebanon – Concepts of virtual circuit switching - Evolution towards MPLS architecture - MPLS VPN services - Deployment of ADSL network platforms - Deployment of MPLS network platforms.
Prerequisites: Introduction to Data Networks (020INRES1)

020SYOES4 Optical Systems and Networks 4 Cr.
Fiber optics - index profile - wave propagation in optical fibers - EH Field expressions and modes - attenuations, dispersions, and wavelength windows - LASER and LED diodes - optical sources and detectors - optical passive and active components - optical amplification - optical fiber systems: point-to-point fiber links, amplified links, and WDM links - optical networks: access networks, optical transport networks, and wavelength routing networks
Prerequisites: Electromagnetism (020EMENI3 or 020EMECI3)

020PPLES5 Parallel Programming 4 Cr.
Program development and object code structure - UNIX introduction - UNIX file systems and low-level I/O - Signals and signal handlers - I/O redirection and pipes - Process management - System V IPC (Inter-process communication) and synchronization: semaphores, message queues, shared memory- Networking and Berkeley Socket Programming.
Prerequisites: Object-Oriented Programming (020CPPES1), Operating Systems (020SSEES4)

020PSRES4 Performance of Computer Systems and Networks 4 Cr.
This course proposes the use of mathematical tools such as stochastic processes and optimization for modeling, performance analysis, and dimensioning of computer systems and networks. It introduces the Poisson processes; the processes of birth and death; Basic M/M queues; Discrete and continuous Markov processes; Queuing networks; Priority queueing and scheduling strategies; Traffic patterns in networks; Performance evaluation by simulation. This course focuses on the application of these tools on real problems and the use of digital tools to solve these problems.
Prerequisites: Probability

020PLBES4 Plumbing 4 Cr.
Introduction to the French standards and to the American standards, definitions, types of plumbing pipes, types of valves, calculation of cold water tanks, differences between French and American norms, calculation of the distribution of cold water, calculating the hot water distribution, calculating the return of hot water, calculating the booster pumps, calculating the sewage evacuation, calculating the evacuation of wastewater, calculating the rainwater discharges, calculation of secondary vent pipes, introduction to NFPA 13 for the sprinkler system, introduction to NFPA 14 for the Landing Valves and Fire Cabinets System, introduction to NFPA 20 for the calculation of fire pumps and their different types, estimating solar energy for warming a hot water bottle.
Prerequisites: Hydraulics (020HYDES3)

020PENES4 Power generation 4 Cr.
Course introduction- World energy situation. Energy forecasts and world reserves. Forms of energy and mode of conversion. Power generation by turbo-machinery. Economic and environmental aspects. Electricity sector: load curve, annual monotonous curve. Fundamentals of Energy Conversion and Heat Transfer. Principles of Heat generation and Transfer; How can we produce heat? What are the modes of heat transfer? Fundamentals of thermodynamics; First law, Second law, Carnot cycle. Basic Principles of Fluid Mechanics; mass conservation, Bernoulli equation, Compressible fluids. Steam Power Plants. Introduction of the steam power cycles; Carnot cycle, Role of working fluid, Rankine cycle, superheat cycles, supercritical cycles, cycles efficiency. Hirn's Cycle;

Theoretical and real. Ideal and real Regenerative Cycle. Reheat Cycle. Condensation of steam. Multi-stage Turbines. Impulse turbines. Reaction turbines. Multiple casing turbine. Non - condensable fluid turbines. Pressure-flow characteristics. Regulation of Steam Turbine. Steam turbine steam control device. Power regulation by total rolling; partial injection; sliding pressure. Consumption in partial injection mode. Gas power cycle. Analysis of the ideal and real gas power cycle. Calculation of a gas turbine performance at nominal and partial loads. Improvement; Gas turbines with regeneration, intercooled compression and reheating. Combined gas-vapor power cycles. Principle of operation of a combined cycle. Thermodynamic analysis. Recovery boiler. Performance at partial loads. Internal combustion engines. The sliding crank mechanism. Lenoir Cycle. Otto Cycle. Alternative engine efficiency. Ignition controlled. Ignition by compression or diesel cycle. Comparison between Otto and Diesel cycles. Performance of a diesel engine.
Prerequisites: Fluid mechanics (020MEFES2)

020ANRES4 Power Systems Analysis 4 Cr.
Introduction on power systems: Chronological evolution, components, per unit model. Line resistive effect: basic expression, impact of temperature and frequency. Line inductive effect: GMR, GMD, group of conductors. Line capacitive effect. Line performance study in permanent regime: equivalent model, mathematical equations. Line compensation. Short-circuit faults analysis. Stability analysis. Line behavior in transient regime. Isolation design: statistical and semi-statistical methods. High Voltage DC transmission systems: benefits and drawbacks, components, operation, control. Power flow analysis: Gauss-Seidel and Newton-Raphson algorithms.
Prerequisites: None

020SNLES5 Profitability of energy projects 4 Cr.
The aim of this course is to allow students to understand, using economic tools, the profitability of an energy project: Energy Efficiency Measures, Green Energy versus Gray Energy (Useful, Final, Secondary and Primary). Identification of the energy project and the financial package; Notions of Investment and technical and economic lifetimes; Annual Recipes and Earnings; Calculation of the Simple Return Time and return on investment; The energy return time; Simple cumulative profit in cash flow; Subsidy and financial incentives; Inflation; Cost of Energy Improvement; Cost of kWh in cash flow; Concept of discount and calculation of the discount rate; Present value and acquired value; Updated Return Time; Net Present Value (NPV); Internal Rate of Return (IRR); Annual Gains in Constant Annuity (AGCA); Economized Fuel Cost (EFC); Cost of kWh in cash flow and discounted (LCE); Integration of externalities into energy costs; Case studies.
Prerequisites: None

020GPRES2 Project Management 4 Cr.
Fundamentals of project management: project definition, project management, framework, Operation VS per project. - Project management life cycle: project phases - Type of organizations: functional, Matrix, projectized - PMI, PMBOK, processes groups and Knowledge areas - Important skills and competencies, responsibilities of a Project Manager - Project management processes and knowledge areas - the process structure, inputs, outputs and methods - How to initiate and Plan a Project? - How to executive, monitor and close a project? - Knowledge areas applied and their key inputs, outputs and methods and techniques: scope management, time management, cost management, quality management, human resources management, communication management, risk management, procurement management, stakeholder management, integration management.
Prerequisites: None

020QOSES5 Quality of Service in Networks 4 Cr.
Traffic control in networks – Congestion control – Traffic shaping – Traffic policing – Traffic engineering – Quality of experience – Performance metrics in networks: delay, jitter, and loss probability – IP traffic models and properties – Architectures for quality of service – DiffServ model – Multimedia transport – IP multicast – Quality of service deployment in local networks – Quality of service deployment in wireless local networks – Quality of service deployment in the Internet – Internet regulation – Network neutrality – Passive and active measurements in networks – Collaborative measurement of quality of service.
Prerequisites: Introduction to Data Networks (020INRES1)

020SFRES5 Refrigeration systems 4 Cr.
Industrial refrigeration - The refrigeration cycle - Mollier diagram - Volumetric compression - The components of the refrigeration machine: the compressor - The components of the refrigeration machine: the heat exchangers -

Refrigerant - The design of a cold room - External quantities: thermostat - Internal quantities: regulators - Internal quantities: safety equipment - Defrosting.
Prerequisites: HVAC 1 (020CL1ES3)

020BDRES2 Relational Databases 4 Cr.
Introduction to databases - Relational model - Relational algebra - Functional dependencies - Normal forms - Relational database construction theory - Data dictionary, SQL (DDL, DML), Views, Triggers, PL / SQL, Stored Procedures and Functions.
Prerequisites: None

020ERNES5 Renewable energy 6 Cr.
Course introduction. Hydro-electric: Principle of operation of hydraulic energy into electricity. Main turbine technologies i.e: Pelton, Francis and Kaplan. Component design and performance of hydro-electric power plant. Applications. Wind energy: History on the use of wind energy; Power in the wind; Wind turbine site assessment basics; Basics of wind turbine design; Wind turbine blade design; Wind turbine alternator design; Wind turbine control systems; Balance of system; Wind turbine towers; Wind turbine monitoring; Diagnosis and prognosis of wind turbine failure. Solar energy: Photovoltaic solar cells. The sunlight. Physics of Photovoltaics: Fundamentals of energy conversion in photovoltaic solar cells. Solar spectrum, effect of geometry, atmospheric attenuation. Main photovoltaic technologies. Design of Stand-alone PV Systems; Hybrid Systems. Specific Purpose Photovoltaic Applications. Calculating the Cost of PV Systems. Life cycle analysis. Thermal Solar systems: Development of solar thermal energy uses. Different technologies of solar thermal panels for domestic hot water production: Unglazed collectors, flat plate collectors, evacuated tube collector. Operating conditions and design. Efficiency and performance. Biomass and environment. Resources and characteristics of different types of biomass. Biomass to renewable energy processes: Chemical process (hydrolysis, liquefaction, pyrolysis, and gasification), Thermochemical process (methanation), and Biological process (compost). Sustainability & Resilience. Bioenergy & Environment, Criteria Pollutants, Carbon Footprint. Geothermal Energy: Geothermal resources. Geothermal heating and air conditioning applications. Low-temperature geothermal applications for heat generation. High-temperature geothermal power production: Natural or flash-based geothermal installations. Design and calculation of geothermal processes. Energy storage. Fuel cells, super capacitors, compressed air, flywheels, chemical batteries, hydraulic storage. Principle of operation. Existing technologies. Efficiency and performance.
Prerequisites: None

020ROBES5 Robotics 4 Cr.
This course introduces students to the concepts of Robotics, mechanical aspects (structure, modeling, Lagrange equations) and applied control and adjustment techniques (linear and nonlinear control, sliding mode control, exact linearization control), robust control, backstepping control).
Prerequisites: None

020RESES5 Secured Enterprise Networks 4 Cr.
Understanding security services used when designing a secure enterprise network. Packet and content filtering, Security zones, Intrusion prevention techniques, Public Key Infrastructures, Virtual Private Networks, Network Access control, Data Leak Prevention, Network Management, Security Events and Information Management, SOC tools, Design principles of a secure network. Case studies on designing an enhanced secure network design, dimensioning principles of security controls and appliances.
Prerequisites: Network Routing and Switching (020RCOES2)

020SPMES4 Selection of Properties of Materials 4 Cr.
A course that reviews the mechanical behavior of materials. Topics covered include structure property relationships in materials; continuum mechanics and tensor notation; theorems of elastic, plastic, viscoelastic behavior of materials; elements of creep, fatigue, and fracture mechanics.
Prerequisites: Strength of materials 1 (020RM1ES3)

020CEIES3 Sensors and instrumentation 4 Cr.
Introduction to sensors, measurement process, conditioning circuits, signal processing circuits. Sensors general characteristics: measurement errors, sensitivity, time delay. Optical sensors: photoelectric effect, photoconductivity, photodiode, phototransistor. Temperature sensors: resistive sensors, temperature sensing using

diodes or paired transistors, thermocouple. Tachometers: electromagnetic tachometers, optical tachometers. Position and displacement sensors: resistive, inductive and capacitive sensors, digital sensors, optical sensors. Force, weight and torque sensors: piezoelectric sensors, magnetic sensors. Lab demonstrations and assignments.
Prerequisites: Electrotechnics (020ETCES1), Digital electronics (020ELNES2)

020SYSES2 Signals and systems 4 Cr.
This course covers basic concepts of signal processing and continuous and discrete systems such as the Fourier transform, distributions, Fourier series decomposition of periodic signals, Parseval's theorem, linear and invariant systems, linear filtering of continuous signals, linear and nonlinear distortions, sampling, Z transform, discrete time Fourier transform, truncation windows, discrete Fourier transform (DFT), Fast Fourier (FFT), recursive and non-recursive digital filters, synthesis of recursive and non-recursive filters.
Prerequisites: Mathematics (020MATES1)

020THSES2 Signal Theory 4 Cr.
This course introduces the basic concepts for analyze and treatment of continuous and discrete-time deterministic signals, as well as continuous and discrete-time random processes. The course covers Fourier transform, Perceval theorem, distributions, Fourier series decomposition for periodic signals, linear time-invariant systems, linear filtering of continuous signals, linear and non-linear distortions, sampling, Z-transform, discrete-time Fourier transform, continuous and discrete random signals, 2nd-order stationarity of continuous and discrete-time random processes, representation of narrow band signals.
Prerequisites: Analysis 2 (020AN2NI4), Probability (020PRBNI4) or Analysis 3 (020AN3CI4)

020GLOES5 Software Engineering 4 Cr.
This course describes the problems related to programming in the Large vs programming in the Small, at the level of cost, quality, functionalities and time management. It explains the methodologies related to the project development life cycle according to sturdy approaches, such as CMM, TSP or PSP, as well as according to agile methodologies such as RUP, XP, Scrum, and RAD. It details elicitation techniques and software Requirement Specification writing rules and templates, as well as it describes many specification tools used for analysis. It explains advanced object-oriented design concepts (OCP, LSP, etc…), and covers all the diagrams of UML, which is used as a modeling language. It also explains de CRC Card design method adopted by the eXtreme Programming methodology. It demonstrates the need for continuous refactoring and explains refactoring techniques at a chirurgical, tactical and strategic level. It also describes the process to follow in order to succeed, starting by configuring and using configuration management and versioning tools, as well as testing and bug management software, then, by proceeding to quantitative and qualitative analysis in order to find eligible refactoring candidates and finally by executing and validating the refactoring step. This course also details testing at the unit/integration/functional and non-functional levels. It exposes methods that can be used to estimate the cost of developing a software. It explains UI/UX to-do and not-do basics by studying the different cases of standalone, web and accessible applications.
Prerequisites: None

020SSTES4 Space and Micro/Nano Satellite Technologies 4 Cr.
Micro/nano satellite mission, orbits design and analysis, subsystem scheme, micro/nano satellite configuration design, system performance determination and analysis, reliability and safety analysis technical processes of the satellite development, basic conception and modeling technologies for micro/nano satellite design, some studies of multidisciplinary design optimization (MDO) for the micro/nano satellite, and discusses its characteristics, attitude system determination and control, design of the micro/nano satellite integrated electronic system, architecture of micro/nano satellite integrated electronic and relevant technical specifications, concept of micro/nano satellite testing description, properties of the navigation system, , sun sensor and the star tracker, ground station types and related software's, STK tracker software,design and implement (tabletop) a nano-satellite type Cubesat using commercial components and boards.
Prerequisites: Analog Electronics (020ELAES1), Mechanics 1 (020MC1NI1 or 020MC1CI1

020PSTES2 Statically typed programming 4 Cr.
This course introduces the basic principles of statically typed programming, first using C as a procedural language and then C ++ as an object-oriented imperative language. It introduces the C ++ 11 language as it has been standardized by ISO. In contrast to dynamically typed languages such as JavaScript and Python; statically typed

languages offer verification of programming errors during compilation. This is what prompted, for example, Microsoft to develop TypeScript, a language that adds static typing to JavaScript. We notice on the TypeScript website the following description of this new language: "JavaScript that Scales". It is in the context of code maintainability that a static type system plays an important role. For this we note that such a system is implemented in traditionally imperative and object-oriented languages such as C / C ++, Java and C #. We can also note the presence of this static typing in traditional functional languages such as Haskell, OCaml and SML. New hybrid languages such as Scala, Swift and Kotlin have also had a static type system. This was notably possible thanks to the various research works on type theory. In addition to its static type system, the C / C ++ language allows low-level performance optimizations. In particular, it is distinguished by manual memory management. This sets it apart from other languages, such as Java and C #, which focus more on reducing development time through high-level programming with automatic memory management. Thanks to these low-level functionalities, C / C ++ is often a language of choice for applications with limited resources such as those generally found in embedded systems.
Prerequisites: None

020STAES1 Statistics 4 Cr.
Hypotheses, characteristics of a sample - Sampling - Estimation - Confidence intervals - Statistical control - Principle of hypothesis tests - Tests of conformity to a standard - Tests of comparison of two normal populations - Adjustment tests - Independence tests - Nonparametric tests - Analysis of variance - Study of the influence of two factors - Linear regression: Ordinary Least Square Estimators (OLS), laws of estimators and tests of estimators, correlation and analysis of variance, use of the model of regression in anticipation.
Prerequisites: Probability (020PRBNI4) or Analysis 3 (020AN3CI4)

020RDMES3 Strength of materials 4 Cr.
Reminders of statics and introduction to SOM. Rigid body equilibrium under external loading, standardized mechanical connections and supports reaction calculations. Objectives of the SOM, the hypothesis of the SOM and key definitions. Geometrical properties of areas. Centroid of an area, composite area centroid, moments of inertia for an area, polar moment of inertia, product of inertia for an area, parallel axis theorem / moments of inertia for a composite area. Stresses. Method of sections, internal resultant normal force, average normal stress, internal resultant shear force, average shear stress, shear stress in pins and bolts design, factor of safety. Axially loaded beams. Stress-strain diagram, Hooke's law and Young's Modulus, elastic deformation of an axially loaded members (basic cases), deformation of a member with non-constant section area and a non-constant axial loading, Poisson's ratio, generalized form of Hooke's law. Thermal expansion and associated developed stresses. Principle of superposition for statically indeterminate axially loaded members. Bending of beams. Internal moment diagram (convention, calculus and graphs), the flexure formula (bending normal stress). Boundary and continuity conditions, rotation and displacement by integration, principle of superposition for statically indeterminate beams. Resultant internal torque acting at the cross section, the torsion formula (shear stress), angle of twist, principle of superposition for statically indeterminate torque loaded members.
Prerequisites: None

020RM1ES3 Strength of materials 1 4 Cr.
Reminders of statics and introduction to SOM. Rigid body equilibrium under external loading, standardized mechanical connections and supports reaction calculations. Objectives of the SOM, the hypothesis of the SOM and key definitions. Geometrical properties of areas. Centroid of an area, composite area centroid, moments of inertia for an area, polar moment of inertia, product of inertia for an area, parallel axis theorem / moments of inertia for a composite area. Stresses. Method of sections, internal resultant normal force, average normal stress, internal resultant shear force, average shear stress, shear stress in pins and bolts design, factor of safety. Axially loaded beams. Stress-strain diagram, Hooke's law and Young's Modulus, elastic deformation of an axially loaded members (basic cases), deformation of a member with non-constant section area and a non-constant axial loading, Poisson's ratio, generalized form of Hooke's law. Thermal expansion and associated developed stresses. Principle of superposition for statically indeterminate axially loaded members. Bending of beams. Internal moment diagram (convention, calculus and graphs), the flexure formula (bending normal stress). Boundary and continuity conditions, rotation and displacement by integration, principle of superposition for statically indeterminate beams. Resultant internal torque acting at the cross section, the torsion formula (shear stress), angle of twist, principle of superposition for statically indeterminate torque loaded members.
Prerequisites: Statics, Mechanical systems (020SMEES1)

020RM2ES3 Strength of materials 2 4 Cr.
This course deals with the problems of hyperstatic beams which are most present in reality and impossible to solve thanks to statics alone. He develops different resolution methods (by integration, superposition, Clapeyron) allowing to determine the reactions to the supports of hyperstatic beams in tension, torsion, bending, buckling. It also deals with the theorem of virtual works, energy methods, gantries, cross-linked systems - State of constraints and Mohr's circle - Reservoirs under pressure - Introduction to finite elements.
Prerequisites: Strength of materials 1 (020RM1ES3)

020CA1ES3 Switch-mode power converters 1 6 Cr.
Introduction: Basic functions of power electronics, applications, course outcomes and topics. Choppers: series and parallel structures, operation in case of an ideal or an inductive load, in continuous or discontinuous current mode, two and four-quadrants operation. Thyristor-based choppers. Non-isolated switch-mode power supplies: Classical Buck, Boost and Buck-Boost topologies. Isolated power supplies: principles, review of the transformer operation and basic equations. Forward converter with single or multi outputs: single-switch and asymmetric half-bridge topologies. Push-Pull converters: parallel, series half-bridge and series full-bridge topologies. Fly-back converter with single or multi outputs, single-switch and asymmetric half-bridge topologies. Switch-mode inverters: single-phase basic topologies. Three-phase inverter. Multilevel inverters. Simulations using MATLAB.
Prerequisites: Industrial electronics (020ELIES2)

020CA2ES4 Switch-mode power converters 2 4 Cr.
Introduction to PWM control. Carrier-based PWM for single inverters. Carrier-based PWM for three-phase inverters. Space-vector modulation. Pre-calculated modulation for single and three-phase inverters. Sigma-delta and delta modulations. Modeling techniques applied to switch-mode converters: averaging techniques, state model, small-signal model, transfer functions. Model-based feedback control design. Simulations on MATLAB.
Prerequisites: Switch-mode power converters 1 (020CA1ES3)

020IPRES5 System identification 4 Cr.
Course introduction. Plants and systems models: type of models and representation methods. Identification of nonparametric models in the time and frequency domains: correlation method, Fourier analysis, spectral analysis, closed loop identification. Pseudo ransom binary signal: properties and design for identification purposes. Parametric model’s identification: least squares technique, recursive, weighted, instrumental variables, etc. MATLAB Identification Toolbox. Workshops using MATLAB/Simulink. Experimental identification and control of a linear system.
Prerequisites: Digital systems and control (020SCNES3)

020MOTES4 Thermal engines 4 Cr.
A course that examines the fundamentals of the design and operation of internal combustion engines, focusing on fluid / thermal processes. The subjects covered include the analysis of the phenomena of aspiration, compression, combustion, expansion, expansion and formation of pollutants; heat transfer and friction phenomena; 2- and 4-stroke engines, supercharges and performance characteristics; thermochemistry of air-fuel mixtures; social implications of motorization.
Prerequisites: Chemistry 2, Thermodynamics: Principles and phase change (020TPPES1)

020TDMES3 Thermodynamics of machines 4 Cr.
Course introduction. Basic notions of thermodynamics: Temperature and heat; Work and P(V) diagram; Basic thermodynamic processes. Heat, work and internal energy of fluids. Reversible processes. Ideal Gas. First law of thermodynamics: closed systems. Energy balance; Energy change of a system (ΔE_{system}); Mechanisms of energy transfer; Forms of energy: heat and work; Specific heats; Internal energy, enthalpy and specific heats of ideal gases; Internal energy, enthalpy and specific heats of solids and liquids. First law of thermodynamics: open systems. Control volumes; Conservation of mass principle; Energy balance for a control volume; Energy analysis of steady-flow systems; Some steady state engineering devices (Nozzles and diffusers, Turbines and compressors, Throttling valves, Mixing chambers, Heat exchangers, Pipe and duct flow). Second law of thermodynamics. Kelvin-Planck statement of the second law; The second law of thermodynamics: Kelvin-Planck statement; Clausius statement of the second law; Reversible and irreversible processes; Carnot cycle; Carnot heat engine; Carnot refrigerator and heat pump; Entropy; Isentropic processes; Property diagrams involving entropy; The $T\,ds$ relations; Isentropic processes of ideal gases; Reversible steady flow work; Proof that steady-flow devices deliver the most and consume

the least work when the process is reversible. Gas Power Cycles. Basic considerations in the analysis of power cycles; The Carnot cycle and its value in engineering; Air-standard assumptions; Otto cycle: The ideal cycle for spark-ignition engines; Diesel cycle: The ideal cycle for compression-ignition engines; Stirling and Ericsson cycles; Brayton cycle; Turbojet. Initiation to “Thermoptim” software. Case study. Refrigeration Cycles. Refrigerators And Heat Pumps; The Reversed Carnot Cycle; The Ideal Vapor-Compression Refrigeration Cycle; Actual Vapor-Compression Refrigeration Cycle; Selecting The Right Refrigerant; Heat Pump Systems; Innovative Vapor-Compression Refrigeration Systems.
Prerequisites: Thermodynamics 2 (020TH2NI3 or 020TH2CI4)

020TPPES1 Thermodynamics: Principles and phase change 6 Cr.
This course seeks to provide a methodology by which students consider objects in the physical universe as "systems" and apply to them the fundamental laws of conservation of mass and energy and entropy equilibrium. The course covers the state and thermodynamic properties of a pure substance, energy and mass conservation, entropy and the second law. Applications involve closed configurations and flow devices. Simple applications of steam and gas cycles.
Prerequisites: Thermodynamic 1

020TRBES3 Turbomachine 6 Cr.
Centrifugal and positive displacement pumps - Hydraulic turbines. Fans - Compressors - Gas and steam turbines.
Prerequisites: None

020ADUES3 Unix System Administration 4 Cr.
Shell and commands – File system – Processes – CPU – Users – Backups – Periodic tasks – Network configuration – DNS – DHCP – Configuration of application services: e-mail, directory - Security: Sudo, ACL, ssh, Iptables, logs.
Prerequisites: None

020ISRES5 Value-Added Services Engineering 4 Cr.
Mobile Networks architecture – GSM – E1 – Signaling (SS7) – Mobile Value Added Services – Short Message Service (SMS) – Voice Mail System (VMS) – Intelligent Networks services (IN) – CAMEL – Wireless Application Protocol (WAP) – Multimedia Messaging Service (MMS) – 3G / UMTS – IP Multimedia System (IMS) – SIP Protocol – 4G / LTE.
Prerequisites: Mobile Networks (020REMES4)

020EVVES4 Variable speed drives 6 Cr.
Course introduction. Variable speed DC machine: Four-quadrant operation, Four-quadrant three-phase rectifier with no circulating current, speed control using cascaded loops, current loop and speed loop. Design a speed control of a separately-excited dc machine and predict its performances using MATLAB/Simulink software. Variable speed induction machine: Steady-state equivalent circuit at high frequencies, Torque harmonics, Scalar control of a squirrel-cage induction machine, Vector control of a squirrel-cage induction machine, introduction to DTC control of an induction machine. Design a speed control of a squirrel-cage induction machine and predict its performances using MATLAB/Simulink software. Advantages and drawbacks of synchronous motors connected to the grid. Scalar current control of synchronous motors. Vector current control of synchronous motors. Speed control of synchronous motors. Simulation on MATLAB/Simulink. Lab experiments.
Prerequisites: Linear control (020AULES2), Electric machines 2 (020ME2ES3)

020VIBES2 Vibrations 6 Cr.
This course deals with the vibrations of one-dimensional systems (1 degree of freedom) - Free non-damped oscillations - Forced non-damped oscillations - Free damped oscillations - Forced damped oscillations - Stability - Electrical analogy - Resonance - Non-linear oscillations. Introduction to systems with two degrees of freedom - Examples and applications in mechanics.
Prerequisites: Mechanics 2 (020MC2CI3 or 020MC2NI3)

020PGAES3 Waveguides and Antennas 4 Cr.
Transmission line theory – Lines in sinusoidal and transient regimes – Smith chart – TOS and stub adaptation – Waveguides (parallel plate, rectangular, cylindrical and dielectric) – General solutions for TEM, TE and TM waves

– Fundamental parameters of antennas, gain and power directivity – Dipole antenna and linear wire antennas. Array antennas – Horn and reflector antennas (terrestrial antenna) – Smart antennas – Adaptive and switched-beam antennas.
Prerequisites: Electromagnetism (020EMENI3 or 020EMECI3)

020PWBES3 Web Programming 4 Cr.
This course covers the development of web applications on both the front-end (client-side) and the back-end (server-side). It is, in fact, a hands-on web-programming course where a MongoDB, Express, Angular and Node (MEAN) web application is gradually designed and implemented as the course progresses. The course first introduces the basic languages used for web development, namely HTML, CSS and JavaScript. Several interactive web pages are then implemented using these languages. These first implementations essentially demonstrate how time-consuming web development can be when all components are implemented from scratch. This naturally leads to the introduction of the Twitter Bootstrap web framework and the quick implementation of several web pages using this framework. Afterwards, the Angular framework along with its underlying Model View Controller (MVC) design pattern is explained. An Angular Single Page Application (SPA) is then implemented. At this stage, the front-end has been fully implemented while the back-end is still mocked using a simulated JSON-Server. In the final part of the course, the mocked back-end is replaced by a fully functional REST API implemented using Node.js, the Express framework and the MongoDB database.
Prerequisites: None

020ADWES4 Windows System Administration 4 Cr.
The course aims to acquire the necessary knowledge to define the architecture, configure and administer a Windows/Active Directory infrastructure. It also covers the creation and management of users and access rights to Windows domain resources. The course also introduces LDAP, so that students understand the extension of the Active Directory Schema to integrate new Services and Applications.
Prerequisites: None

020CSFES3 Wireless Communications 4 Cr.
This course covers the fundamentals of wireless communications (with emphasis on wireless channel modeling); digital modulation in wireless channels; channel coding and interleaving in fading channels; equalization; diversity; multiple antenna systems; spread spectrum; multicarrier modulation; multiple access; WIFI networks; cellular basics and concepts; cellular functions in mobile networks.
Prerequisites: None

Department of Civil and Environmental Engineering

Head of Department: Muhsin Elie RAHHAL

Faculty Members

Professors:

Fadi GEARA, Fouad KADDAH, Muhsin Elie RAHHAL, Wassim RAPHAEL, Wajdi NAJEM.

Assistant Professors:

Rafic FADDOUL, Farah HOMSI, Joanna NSEIR, Jihane RAHBANI, Hiba RAJHA, Christiane ZOGHBI.

Faculty Members of another institution of USJ:

Maher ABBOUD, Joseph BEJJANI, Roger LTEIF, Dominique SALAMEH

Lecturers:

Adel ABOU JAOUDE, Pascale ABBOUD RIZK, Georges ABOU SLEIMAN, Ortanse ATTARIAN JABRE, Angèle AOUAD RIZK, Jean Claude ASSAF, Khattar ASSAF, Mounia BEDRAN SABA, Said BITAR, Robert BOU NAHED, Nadim CHOUEIRY, Marina DACCACHE, Mohammad DAKROUB, Hassan DEGHAILY, Elias DIB, Youssef GERGES, Ghassan GHATTAS, Nada GHORRA CHEHADE, Akram GHOSSOUB, Bassam HABRE, Ahmad HAJJ, Ziad HAKIM RAHME, Nabil HENNAOUI, Nelly HOBEIKA, Antoine HREICHE, Samar KADDAH, Walid KHALIL, Mahmoud KHAZMA, Marina KHOURY, Joseph KOZEILY, Hiam MALLAT, Rodolphe MATTAR, Antoine MEOUCHI, Manal MOUSSALLEM, Marwan NAKFOUR, Nassib NASR, Georges NEHME, Hiam NEHME, Roger RAKWEH, Alexandre RICHA, Nour ROUMIEH, Kamal SAFA, Antoine SAWAYA, Antonio SAWAYA, Sylvain SEIF, Saad SFEIR, Guy TABET.

Objectives

The Civil Engineering Program aims to form design and construction engineers of high scientific and technical level, operational in the fields of civil engineering, buildings and engineering structures, public works and transport, water and the environment and having a global and multidisciplinary approach to projects and their management

As for the Chemical and Petrochemical Engineering program, its objective is to train engineers with high technological potential in the fields of Chemical Engineering and Petrochemistry, capable of innovation, critical thinking, mastering complex systems, ready to meet the scientific and technical challenges in a competitive international context and responding to the crucial problems, expectations and demands of the globalized society.

Job Opportunities

The civil and environmental engineering department offers a well-diversified program that allows its graduates to work in all sectors of civil and construction engineering (buildings, public works, engineering structures, geotechnics, structures, maritime works, airports, dams, water and wastewater treatment, etc.) and facilitates their integration into several professions: project management, design and consulting firms, construction companies, research & development, etc.

The Chemical and Petrochemical Engineering program allows its graduates to work in the chemical, biotechnology, pharmaceutical, energy, environmental, petroleum and gas, and material processing (glass, cement, paper, textile, paint, cosmetics, agro-food) industries. It also opens up a large number of

professions such as laboratory services, technical, maintenance; research and development, technical sales engineer or business engineer, chemical or petrochemical engineer; production and control engineer; project manager engineer; quality and regulation engineer; Hygiene-Safety-Environment Engineer; consulting engineer and auditor; teacher.

Programs and Options

Following two years of studies at the Department of Preparatory Classes and the validation of 120 corresponding credits, students join one of the three options of the Civil Engineering Program. The courses correspond to 180 ECTS credits. At the end of the program, an engineering degree will be delivered.
The Civil and Environmental Engineering department offers the following two programs:

- The Civil Engineering Program. Three specialized options are proposed:
  - Buildings and Engineering Management
  - Water and Environment
  - Public Works and Transport
- The Chemical and Petrochemical Engineering Program

Civil Engineering Program

Coordinator: Muhsin Elie RAHHAL

Program Educational Objectives

The objectives of the program are to graduate students able to:

- Work effectively and ethically in their professional environment at local, regional and international levels.
- Advance in their careers to become leaders in their profession, through trilingual skills, life-long learning and creativity.
- Lead in a dynamic professional environment through continuous learning and development of knowledge and skills.

Student Outcomes

The student outcomes are aligned with the ABET requirements:

1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3) An ability to communicate effectively with a range of audiences.
4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Requirements

Credits: Required Courses (132 ECTS credits), Option Courses (42 ECTS credits), Restricted Electives (2 ECTS credits), Open Electives (4 credits).

English (4 Cr.)

The level A in the English language proficiency test is required to integrate the English course of 4 credits. Refresher courses (for levels B, C, D and E) are proposed to achieve this level. For graduation, students must then present the "Saint Louis English Proficiency Test".

General Education (14 Cr.)

Required Courses (10 Cr.)

Engineering Ethics (4 Cr.)
Environment and Sustainable Development (2 Cr.)
General and Analytical Accounting (2 Cr.)
General Economics (2 Cr.)

Open Electives (4 Cr.)

General Education courses that can be pursued in any USJ institution, with at least two credits of Arab language or Arab culture.

Core Engineering Courses (84 Cr.)

Mathematical Techniques for Engineers (2 Cr.)
Building Rules and Regulations (2 Cr.)
Continuum Mechanics (4 Cr.)
Engineering Materials (6 Cr.)
Numerical Analysis (4 Cr.)
Statistics (4 Cr.)
Strength of Materials (6 Cr.)
Fluid Mechanics (6 Cr.)
Soil and Rock Mechanics (6 Cr.)
Structural Load Calculations (4 Cr.)
General Construction Procedures (4 Cr.)
Hydraulics (6 Cr.)
Foundations Engineering (6 Cr.)
Reinforced Concrete (6 Cr.)
Steel and Mixed Structures (6 Cr.)
Structures (6 Cr.)
Buildings and Frames (4 Cr.)
Finite Elements (4 cr.)

Internships (8 Cr.)

During this program, each student is required to undertake three trainings:

- One-week training in surveying at the beginning of the third year (4 Cr.)
- A minimum of 4-week-workman internship at the end of the third year (0 Cr.)
- A minimum of 8-week-scientific and technical internship at the end of the fourth year (4 Cr.)

Projects (26 Cr.)

During this program, each student is required to complete 3 projects:
An Architecture Project (4 Cr.): This project brings together students from different options of the Civil and Environmental Engineering Department. Teams of 2 students are formed. The goal is to prepare a building’s permit and execution drawings according to appropriate standards and building legislation.

A Multidisciplinary Project (6 Cr.): This project brings together students from different options of the Civil Engineering Program. Teams of 2 to 3 students are formed. The goal is to prepare construction drawings of a building according to appropriate standards: structural drawings, foundations design, etc.
A Final Year Project (16 Cr): This project has a duration of 4 months and is done in groups of 3 to 5 students. The purpose of this project is to put students in a real context of a design office and to ask them to establish a concept, analyze and design a civil engineering structure with a number of requirements and constraints

Restricted Elective Civil Engineering Course (2 Cr.)

One course to be selected from the following list:
Urban and Landscape Planning (2 Cr.)
Protection and Aesthetics of Buildings (2 Cr.)
Industrial Construction (2 Cr.)
Engineering Geology (2 Cr.)

Options Courses (42 Cr.)

Courses to be selected from a closed list depending on the option chosen out of the three available: Buildings and Engineering Management, Public Works and Transport, Water and Environment

Option Buildings and Engineering Management (42 Cr.)

American code of reinforced concrete (4 Cr.)
Building Acoustics (2 Cr.)
Building Fire Safety (2 Cr.)
Building Lighting and Sanitary (4 Cr.)
Building Thermal Design (2 Cr.)
Design of Buildings Structures (4 Cr.)
Finance Management (2 Cr.)
Market Globalization (2 Cr.)
Planning and Management of Large-Scale Projects (4 Cr.)
Prestressed Concrete in Buildings (2 Cr.)
Quality Management in Buildings (2 Cr.)
Rehabilitation and Maintenance of Concrete Structures (4 Cr.)
Special Topics in Concrete (2 Cr.)
Structural Dynamics and Earthquake Engineering (4 Cr.)
Structural Software (2 Cr.)

Option Water and Environment (42 Cr.)

Applied hydraulics software (2 Cr.)
Dams (4 Cr.)
Data Measurement and Acquisition (2 Cr.)
Environmental Impact Assessment (2 Cr.)
Environmental Law (2 Cr.)
Geographic Information Systems (2 Cr.)
Groundwater Hydraulics (2 Cr.)
Hydrology and water and environment laboratory (4 Cr.)
Irrigation (2 Cr.)
Karst Hydrogeology (2 Cr.)
Maritime Structures (2 Cr.)
Wastewater Distribution Networks (2 Cr.)
Solid Waste Management (2 Cr.)
Statistical Hydrology (4 Cr.)
Water Distribution Networks (4 Cr.)

Water and Wastewater Treatment (4 Cr.)

Option Public Works and Transport (42 Cr.)

American code of reinforced concrete (4 Cr.)
Dams (4 Cr.)
Pavement Engineering (4 Cr.)
Plates and shells (4 Cr.)
Prestressed Concrete (4 Cr.)
Rehabilitation and Design of Concrete Bridges (4 Cr.)
Road and Structure Plastic Behavior (2 Cr.)
Shear strength and Geo Hazards (4 Cr.)
Special Topics in Concrete (2 Cr.)
Structural Dynamics and Earthquake Engineering (4 Cr.)
Structural Software (2 Cr.)
Traffic Engineering (2 Cr.)
Transport and Airport Engineering (2 Cr.)

Proposed schedule

Semester 1

020PARGS1	Architectural Project	4 Cr.
020LEBGS1	Building Rules and Regulations	2 Cr.
020MMDGS1	Continuum Mechanics	4 Cr.
020ETHGS1	Engineering Ethics	4 Cr.
020MAIGS1	Engineering Materials	6 Cr.
020ENVGS1	Environment and Sustainable Development	2 Cr.
020CGAGS1	General and Analytical Accounting	2 Cr.
020ECGGS1	General Economics	2 Cr.
020ANNGS1	Numerical Analysis	4 Cr.
020STOGS1	Surveying (Summer Training)	4 Cr.
	Total	34 Cr.

Semester 2

020MEFGS2	Fluid Mechanics	6 Cr.
020PGCGS2	General Construction Procedures	4 Cr.
020MESGS2	Soil and Rock Mechanics	6 Cr.
020STAGS2	Statistics	4 Cr.
020RDMGS2	Strength of Materials	6 Cr.
020ACTGS2	Structural Load Calculations	4 Cr.
	Arabic Open Elective	2 Cr.
	Total	32 Cr.

Semester 3

020ANGGS3	English	4 Cr.
020FOSGS3	Foundations Engineering	6 Cr.
020HYDGS3	Hydraulics	6 Cr.
020BEAGS3	Reinforced Concrete	6 Cr.
020CMMGS3	Steel and Mixed Structures	6 Cr.
	Options Required Courses (6 Cr)	

	Option Buildings and Engineering Management	
020ACIGS3	American code of reinforced concrete	4 Cr.
020QUAGS3	Quality Management in Buildings	2 Cr.
	Option Water and Environment	
020DEAGS3	Water Distribution Networks	4 Cr.
020GISGS3	Geographic Information Systems	2 Cr.
	Option Public Works and Transport	
020ACIGS3	American code of reinforced concrete	4 Cr.
020TRAGS3	Traffic Engineering	2 Cr.
	Total	34 Cr.

Semester 4

020OSBGS4	Buildings and Frames	4 Cr.
020EFIGS4	Finite Elements	4 Cr.
020PBAGS4	Multidisciplinary Project: Structures and Foundations	6 Cr.
020STRGS4	Structures	6 Cr.
	Options Required Courses (8 Cr.)	
	Option Buildings and Engineering Management	
020RESGS4	Building Lighting and Sanitary	4 Cr.
020CTHGS4	Building Thermal Design	2 Cr.
020GEFGS4	Finance Management	2 Cr,
	Option Water and Environment	
020IMPGS4	Environmental Impact Assessment	2 Cr.
020DREGS4	Environmental Law	2 Cr.
020IRRGS4	Irrigation	2 Cr.
020ASSGS4	Wastewater Distribution Networks	2 Cr.
	Option Public Works and Transport	
020ROUGS4	Road and Pavement Engineering	4 Cr.
020PLSGS4	Structure Plastic Behavior	2 Cr.
020AERGS4	Transport and Airport Engineering	2 Cr.
	Restricted Civil Engineering Elective	2 Cr.
	Open Elective	2 Cr.
	Total	32 Cr.

Semester 5

020STEGS5	Summer Internship	4 Cr.
	Option Required Courses (28 Cr.)	
	Option Buildings and Engineering Management	
020ACBGS5	Building Acoustics	2 Cr.
020SEIGS5	Building Fire Safety	2 Cr.
020COSGS5	Design of Buildings Structures	4 Cr.
020MOGGS5	Market Globalization	2 Cr.
020PLGGS5	Planning and Management of Large Scale Projects	4 Cr.
020BPRGS5	Prestressed Concrete in Buildings	2 Cr.
020REMGS5	Rehabilitation and Maintenance of Concrete Structures	4 Cr.
020OSPGS5	Special Topics in Concrete	2 Cr.
020DYSGS5	Structural Dynamics and Earthquake Engineering	4 Cr.
020LOCGS5	Structural Software	2 Cr.
020LOGGS5	Option Water and Environment	2 Cr.
020BAGGS5	Applied hydraulics software	4 Cr.
020MEAGS5	Dams	2 Cr.
020HSOGS5	Data Measurement and Acquisition	2 Cr.
020HYDGS5	Groundwater Hydraulics	4 Cr.

020HKAGS5	Hydrology and water and environment laboratory	2 Cr.
020OUMGS5	Karst Hydrogeology	2 Cr.
020DESGS5	Maritime Structures	2 Cr.
020HYSGS5	Solid Waste Management	4 Cr.
020GEPGS5	Statistical Hydrology	4 Cr.
	Water and Wastewater Treatment	
	Option Public Works and Transport	
020BAGGS5	Dams	4 Cr
020PLCGS5	Plates and Shells	4 Cr
020BEPGS5	Prestressed Concrete	4 Cr
020COCGS5	Rehabilitation and Design of Concrete Bridges	4 Cr
020RCGGS5	Shear strength and Geo Hazards	4 Cr
020OSPGS5	Special Topics in Concrete	2 Cr
020DYSGS5	Structural Dynamics and Earthquake Engineering	4 Cr
020LOCGS5	Structural Software	2 Cr.
	Total	32 Cr.

Semester 6

	Final Year Project FYP	16 Cr.
	Total	16 Cr.

Course Descriptions

020ACIGS3 American Code of Reinforced Concrete (ACI) 4 Cr.

A course that is based on the design of reinforced concrete structures according to the American Concrete Institute (ACI) code. Topics include: Introduction to ACI - Comparison between European and American codes - Pure tension - Pure compression - Pure bending - Bending plus compression or tension - Shear and torsion.
Prerequisites: None

020LOGGS5 Applied Hydraulics Software 2 Cr.

This course introduces students to the hydraulic aspects and techniques of designing a hydraulic structure. The student applies theoretical, topographical, hydrological and hydraulic principles in the dimensioning of specific hydraulic structures. Topics include: Basic hydraulic principles - Basic hydrology - Culvert hydraulics – Surface water modeling and flood routing using HEC-RAS.
Prerequisites: None

020ARAGS2 Arabic 2 Cr.

A course in Arabic language.
Prerequisites: None

020PARGS1 Architectural Project 4 Cr.

The objective of this course is to teach students how to conceptualize, design and interpret an architectural project. Topics include: Initiation to architectural language - Design of a plan, organization chart, orientation - Proportion of the various elements in architecture - Fixed and mobile furniture – Staircase study – Project launching - Section plan details – Façades.
Prerequisites: None

020ASTGS4 Astronomy 2 Cr.

This course provides students with basic astronomical knowledge that allows them to better understand the importance of current and future space discoveries. Topics include: Celestial sphere, diurnal movement, planets, ecliptic plane - Tools of modern astronomy - Solar system - The sun - The stars - The interstellar medium - Exo planets - The ultimate states - The galaxy of the Milky Way - Galaxies – Cosmology.
Prerequisites: None

020ACBGS5 Building Acoustics 2 Cr.

The aim of this course is to make students aware of sound transmission problems in buildings in order to ensure a better life quality by respecting the acoustic comfort requirements. The current European standards will be applied

to define the acoustic performance of each building according to its usage and exposure. Topics include: General acoustic concepts - Receiver - Acoustic requirements - Acoustic room correction - Airborne sound insulation - Impact sound insulation - Equipment noise isolation - Acoustic studies.
Prerequisites: None

020OSBGS4 Buildings and Frames 4 Cr.
This course examines the design and dimensioning of the elements of a reinforced concrete building. Topics include: Action on the structures (Basic data allowing the study or the verification of a building - Calculation of loads) - Foundations (Generalities - Shallow and deep foundations) - Floors (Methods of computation - Different types of floors - Calculation of reinforced concrete beams - floor slab) - Stairs (Staircase cast in place - Prefabricated staircases - Various types of cast in place stairs).
Prerequisites: Reinforced Concrete (020BEAGS3)

020SEIGS5 Building Fire Safety 2 Cr.
A course on fire safety in buildings of different types and occupational sizes. Topics include: Fire system installation in buildings - Accessibility of buildings by the emergency service (fire trucks) - Insulation from neighboring buildings and third buildings - Interior design of buildings - Fire resistance of structures - Clearances (traffic, door blocks, stairs, etc.) - Interior fittings - Fire characteristics of materials - Natural or mechanical smoke extraction - Emergency means (Detection, Alarm, etc.).
Prerequisites: None

020RESGS4 Building Lighting and Sanitary 4 Cr.
The purpose of this course is to provide students with a theoretical and practical overview of the different systems and sanitary facilities. Topics include: Project Execution - City water supply - Distribution of cold and hot water in buildings - Water pipes installation - Valves - Wastewater or sewage evacuation - Lighting - Electrical installation.
Prerequisites: None

020LEBGS1 Building Rules and Regulations 2 Cr.
This course aims to teach the students how to develop a building construction project in accordance with building law regulations. Topics include: Introduction - The conditions of the inclined land and fences - The conditions of the building permit and conditions of license - Conditions of the housing permit - The roads of the property and the conditions of purchase of these public goods, the envelope of the buildings on the roads identification properties and classification concepts - The safety and public health and architectural aspects - Building rules of high height> 50m - height of buildings and number of floors of independent buildings - Portions of buildings not included in the surface and total operating coefficients: balconies, basements, floors - Parking and number of compulsory cars and alternatives. Incentive of additional and public car parks - Free height under ceiling - Expropriation Act, Act 324-Act.
Prerequisites: None

020CTHGS4 Building Thermal Design 2 Cr.
Course covers all the necessary elements to achieve thermal building design while ensuring the maximum comfort to the user. Topics include: Concepts of thermal comfort in the building - Energy in the building in Lebanon - Diagram of the humid air - Thermal balance winter - Envelope of the building and thermal insulation in Lebanon - Heating by forced air - Central heating with hot water - Filtering of the air - Solar hot water production - Heat pump - Summer heat balance - Cold batteries - Air conditioning modes - Ventilation and ducting networks - Bioclimatic houses - Building automation.
Prerequisites: Environment and Sustainable Development (020ENVGS1)

020DAFGS4 Business Law 2 Cr.
Introduce engineers to the legal world of business with presentations on budgets.
Prerequisites: None

020ECHGS4 Chess 2 Cr.
Learn Chess - Games - Moves - Strategies - Openings.
Prerequisites: None

020CHCGS4 Climate Change 2 Cr.
Study the climatic changes taking place and their influence on the Earth's environment.
Prerequisites: None

020MMDGS1 Continuum Mechanics 4 Cr.
A course that aims to give students the basic tools to describe and model solid and fluid material environments. This course gives the essential background needed in specialized courses such as mechanics of materials, fluid mechanics, reinforced concrete, soil and rock mechanics and rheology of materials. Topics include: General information on the mechanics of deformable media - Kinematics of deformable media - Dynamics of deformable media - Thermodynamics of deformable media - Calculation methods in linear and isotropic elasticity - Variation principles in solid mechanics.
Prerequisites: Statics (020STANI4)

020CATGS4 Creative art therapy 2 Cr.
Learn to become creative in your analysis of specific situations.
Prerequisites: None

020BAGGS5 Dams 4 Cr.
This course provides an analysis of the elements to be considered for selection and sizing of different types of dams and their appurtenant structures and to compare different solutions technically, economically and environmentally. Topics include: Criteria for site selection – Impact of water pressure on the foundations and structures – Safety and imperviousness of dam foundations and body – Design and stability of embankment – Appurtenant structures – Concrete rigid dams – Mobile dams on water courses.
Prerequisites: None

020MEAGS5 Data Measurement and Acquisition 2 Cr.
This course aims at understanding the operation and use of water-related measurement devices and their environment in associated sensors and electronics. The analysis of the ranges and the conditions of use, as well as the supports necessary for the collection of information. The estimation of the precision of measurements, the processing and the transformation of the data by adequate means to present them in the units relating to the measured quantities. The design of a system and a measurement protocol. The definition of the criteria of choice of measuring equipment. The apparatus studied relates most often to pressurized flows. Topics include: Apparatus – Flow velocity measurements on a laboratory and industrial scales - Drinking water and hot water meters - Equipment for modern network management - Sensor, remote transmission and remote control concepts - Surface hydrological measurements - Climatic stations, evaporation - Limnimetry - Flow measurement - Hydrometric station calibration - Data acquisition and processing - Generalities of measurements - Level and displacement measurements - Distance measurements - Force or constraints - Temperature measurements - Pressure measurements - Fluid velocity measurements - Fluid flow measurements - Flowmeter with gyrometer - Definition of the dimension of a meter - Hydraulic and metering properties of a meter - Permissible flow rates.
Prerequisites: None

020COSGS5 Design of Buildings Structures 4 Cr.
The design of structures is an essential phase prior to any calculation; its aim is to teach students the techniques of design and analysis of real structures. Topics include: Retaining walls - Bearing Walls (Bearings according to DTU-231-1 - Bearings according to Eurocode EC2) - Short consoles (Study of a short console following the BAEL - Study of a short console according to the Eurocode EC2) - Partition beams (Study of partitioned or bended-wall beams, according to the BAEL - Study of a beam according to Eurocode EC2) - Bracing (Introduction - Distribution of forces between the various splits - Design of the braces - Resent with irregularities - Example: mini bracing project) - Reservoirs in the buildings (General - Rectangular tank - Cylindrical tank) - Fire behavior of concrete structures (Area of application - Characteristics of materials as a function of temperature - Distribution of temperature in the concrete - Solicitations and principle of the justifications - Construction rules by categories of works - General method) - Principle of the domes, behavior of slabs of any form (Cupolas - Slabs of some form).
Prerequisites: Buildings and Frames (020OSBGS4)

020EJSGS4 Empowerment Skills for Job Seekers 2 Cr.

Enhance the skills of Job Seekers by learning how to make a good presentation and write a professional report.
Prerequisites: None

020CDAGS4 Engineering Contracts and Laws of Arbitration 2 Cr.
Learn the Principles of Contracts - Study the Law of Arbitration.
Prerequisites: None

020GEIGS4 Engineering Geology 2 Cr.
This course covers an applied geology discipline that involves the collection, analysis, and interpretation of geological data and information required for the safe development of civil works. Engineering geology also includes the assessment and mitigation of geologic hazards such earthquakes, landslides, flooding; the assessment of timber harvesting impacts; and groundwater remediation and resource.
Prerequisites: None

020ETHGS1 Engineering Ethics 4 Cr.
This course aims to teach students the principles of engineering ethics and the relationship of engineers with each other and with the order of engineers. Topics include: ethics - morals, deontology – law - human rights – conscience – freedom - Ethics and spirituality - ethics and religions - Some current issues in the field of ethics of the person in society: bioethics in the 21st century - Some issues in the field of ethics of society at the service of the person: social, political, economic, entrepreneurial ethics - Relations between engineers - Relations with the order of engineers - Relations in the profession and with administration.
Prerequisites: None

020MAIGS1 Engineering Materials 6 Cr.
This course introduces themes that give a general view of the different categories of engineering materials and their behavior; Teach the students the properties and the fields of use of materials in civil engineering. Topics include: Chemical bonds between atoms and molecules and periodic table - Elements of crystallography and defects in crystals - Diagrams of equilibrium and transfer and movement of atoms (diffusion of atoms, Fick's law, etc.) - Mechanical properties and modifications of mechanical properties (softening, hardening, refining, etc.) - Degradation of materials and anti-degradation procedures - Composite materials (wood is one of them) - Ceramics (this theme also includes concrete and glass) - Plastics and polymers. Particular attention will be given to Construction materials: Stony materials - Bonding materials - Artificial cements - Mortars - Concrete - Masonry - Metals - Glass – Wood
Prerequisites: General Chemistry (020CHGNI1)

020ANGGS3 English 4 Cr.
Have sufficient language skills in scientific English
Prerequisites: None

020EFEGS4 Entrepreneurship for Engineers 2 Cr.
Explain the Entrepreneurship field for Engineers.
Prerequisites: None

020ENVGS1 Environment and Sustainable Development 2 Cr.
This course provides a comprehensive presentation on Environment and Sustainable Development to enable the student to assess and analyze the major environmental and development problems as well as challenges facing the humanity and to help him/her suggesting some practical and concrete issues. Topics include: State of the Environment - Demography - Mineral Resources - Energy Resources - Water - Solid Waste Treatment - Air Pollution - The Greenhouse Effects - The Ozone Layer.
Prerequisites: None

020IMPGS4 Environmental Impact Assessment 2 Cr.
A course that introduces environmental impact assessment (EIA) of projects as a main tool for the application of the principle of prevention in the protection of the environment. Topics include: General introduction; Overview of the EIA process - Policy, legal and administrative framework; Introduction to course project - Public participation; Screening; Scoping - Environmental baseline; Impact assessment - Mitigation – Environmental

management plans; Social assessment; Economic valuation of environmental impacts - Reporting; Reviewing; Decision-Making; Monitoring - EIA Challenges; General conclusion; Course evaluation; Presentation of projects.
Prerequisites: None

020DREGS4 Environmental Law 2 Cr.
This course aims to enlighten students on the main environmental, ecological and water scarcity problems as well as the main regulations and laws put in place to face them. Topics include: General - Rights to water usage and consumption: origins, administration and management - Right to water in a Lebanese context - Lebanese waters and Middle Eastern negotiations - Environmental law in Lebanon
Prerequisites: None

020OREGS4 Event Organization 2 Cr.
This course aims to prepare students in a practical way to face the difficulties of the preparation of public events of all kinds. Topics include: Define the concept of event - Define the different types of events - Main questions to discuss - The starting point for any event is its purpose - The nature and form of the event - Decide the schedule (date and time) - The choice of place - The organizers. Planning and logistics. The budget - The site or place of the event - The resources - Decoration - Timing - Program - Animation - Restoration - Preparation of all printed material - Reception and reception – Advertising.
Prerequisites: None

020PBAGS6 Final Year Project 16 Cr.
Allow students to apply their previously acquired knowledge for the study of a real civil engineering work. Complete study of a civil engineering work.
Prerequisites: None

020PEAGS6 Final Year Project 16 Cr.
Allow students to apply their previously acquired knowledge for the study of a real civil engineering work. Complete study of a civil engineering work.
Prerequisites: None

020PTPGS6 Final Year Project 16 Cr.
Allow students to apply their previously acquired knowledge for the study of a real civil engineering work. Complete study of a civil engineering work.
Prerequisites: None

020GEFGS4 Finance Management 2 Cr.
The objective of this course is to show precisely what financial management is, how financial decisions can enable the company to achieve shareholder wealth and how they affect the value of the company. It focuses both on decisions related to the future management of the company and on the acquisition of new assets or new capital. It's about improving the profitability of the company while controlling its risk. Topics include: Financial Diagnosis (Prerequisite for any good financial management decision). Introduction to accounting. Financial Approach - The Different Values of the Company - Working Capital and Working Capital Requirements - Ratio Analysis - Cash Flow Analysis - Cash Flow and Budget. Investment Decision. The criteria of choice (certain future).
Prerequisites: General Economics (020ECGGS1) and General and Analytical Accounting (020CGAGS1)

020EFIGS4 Finite Elements 4 Cr.
This course aims to practice finite element methods through concrete examples of heat transfer, material strength and elasticity theory. This course provides the necessary elements for students to develop their own technical skills and interact appropriately with various software. Topics include: Finite Element Method (FEM) Generalities - Integral or Variational Formulation - Integral Form Discretization Methods - Finite Element Discretization.
Prerequisites: None

020MEFGS2 Fluid Mechanics 6 Cr.
A course that introduces the students to the basic principles of fluid statics and dynamics. Topics include: Fluid statics – Continuity equation – Momentum equation – Energy equation – Differential formulation of the governing

equations - Potential flow theory - Dimensional analysis and similitude – Viscous fluid flow – Introduction to turbulent flow.
Prerequisites: Fluid Kinematics (020CIFNI4) and Calculus 2(020AN2NI4)

020FOSGS3 Foundations Engineering 6 Cr.
A course that introduces the student to the calculation methods and rules of the art in the field of design and construction of foundations and retaining structures. Identify the mechanical and hydraulic properties of soils. Understand the principles of geotechnical investigation as well as the main field tests. Dimension conventional superficial foundations. Understand the principles of thrust and thrust, and apply them to the calculation of retaining walls and different types of walls. Design the piles. Introduction, Geotechnical Design - Reminder Geotechnical Properties - Site Investigation and Exploration - In Situ Testing - Superficial Foundations – Active and Passive Pressures - Retaining Structures - Excavations and Groundwater Control - Deep Foundations.
Prerequisites: Soil and Rock Mechanics (020MESGS2)

020EREGS2 From Engineering to real Estate Development 2 Cr.
Introduction to the Real Estate field. Explain the relation between engineering and real estate.
Prerequisites: None

020CGAGS1 General and Analytical Accounting 2 Cr.
The objective of this course is to familiarize the students with the different accounting documents, to enable them to establish the profit and loss accounts and the balance sheets. Moreover, they will know how to determine the breakeven point as well as the distribution of expenses in fixed and variable. They will be able to draw up projected budgets and analyze the gaps with actual results. Finally, they will have in-depth knowledge of the different external stakeholders in the life of the company. GENERAL ACCOUNTING: Standard documents (invoices, payment method, effect checks, etc.) - Balance sheet accounts - Income statement account - Elisa case (accounts in Te, income statement, balance sheet) - Case Crêperie Bretonne (recipe table, expenses, depreciation) - Case Pierre Berthoin (balance sheet and profit and loss account), profitability compared to turnover and capital - Case Segot Printing (sale of assets, relocation, provision). ANALYTICAL ACCOUNTING: Neutral (fresh fixed and variable allocation) - Motorex case (operating table showing margin on variable expenses and profit) - SAPAG case (estimated budget and gap analysis). EXTERNAL STAKEHOLDERS: The State - The Bank - The Stock Exchange - Special financing (BOT, Concession, Syndic loans, ...).
Prerequisites: None

020PGCGS2 General Construction Procedures 4 Cr.
This course aims to teach engineering students the main problems related to the execution of building construction projects. Topics include: Technical, financial and administrative analysis of the bidding documents - Management of projects in progress - Specifications and implementation techniques for civil engineering works from concrete to finishes - Construction machinery - Concrete components.
Prerequisites: None

020ECGGS1 General Economics 2 Cr.
This course aims to give students the necessary notions of microeconomics with an emphasis on the branch of the economy that analyzes economic behavior at the level of individual entities such as a consumer or a company.
Prerequisites: None

020GISGS3 Geographic Information Systems (GIS) 2 Cr.
The course introduces the possibilities of using GIS in the field of civil engineering, especially in the hydraulic and hydrology fields. It introduces the basic concepts of GIS: it shows how to create, integrate and update geo-referenced data in vector and matrix modes; It introduces the spatial analysis principles applied to GIS, including tabular data querying, spatial queries, and layout and presentation functions.
Prerequisites: None

020GRDGS4 Graphic Design 2 Cr.
Teach students the essentials of graphic design.
Prerequisites: None

020HSOGS5 Groundwater Hydraulics 2 Cr.
This course provides the necessary elements to: quantify the groundwater flow in confined and unconfined aquifers; estimate the rates of seepage under dam structures; design and dimensioning of drills; interpret pumping tests; quantify solute and pollutant transport in simple configurations. Topics include: Introduction - Darcy's law - Groundwater flow - Groundwater flow modeling - Field drilling methods - Pumping well hydraulics - Pollutant transport - Case study.
Prerequisites: None

020HYDGS3 Hydraulics 6 Cr.
This course focuses on steady-state and transient flows that include the design of simple and complex water distribution networks. Extended network analysis is undertaken by studying pumps and turbines. Free-surface flows complement the various flow aspects a civil engineer may encounter in practice. In addition to technical aspects, economic aspects are taken into account through various optimization methods. Topics include: Steady-State and Pressurized Networks – Turbomachines – Free surface flow - Unsteady Network Conditions in Pressurized Pipes - Network Economic Study and Optimization - Laboratory Experiments.
Prerequisites: Fluid Mechanics (020MEFGS2)

020HYDGS5 Hydrology and Water and Environment Lab 4 Cr.
This course is divided into two parts: climatology and hydrology. Climatology deals with the atmospheric mechanisms as well as qualitative and quantitative climate parameters. Hydrology is a fairly large field that covers measurements of a significant number of hydrological variables, as well as the analysis and quantification of terms related to conservation principles. Also, this part deals with extreme events and sheds light on hydrological modeling. Topics include: Introduction to climatology and hydrology - Radiative Exchange between Earth and Atmosphere - Synoptic and local atmospheric movements - Cyclonic Disturbances and Clouds - Climate Change – Transfer Mechanisms in the Inland Water Cycle – Hydrologic Measurements – Rainfall Analysis – Watershed Delineation – Infiltration – Evaporation and Transpiration - Hydrographs – Flood Routing – Short Overview on Modeling – Laboratory Experiments (Hydrological Bench).
Prerequisites: Hydraulics (020HYDGS3)

020INDGS4 Industrial Construction 2 Cr.
The course consists of an interactive platform where the participation of the student is continuous. It is rich in examples supported by recent and less recent photos, in short films and presentations to fix the ideas on the theoretical notions already acquired and to open a new dimension to the student engineer on the way of designing and executing a construction. Topics include: Introduction to the industrialization of concrete construction and prefabrication - Architectural design of a prefabricated construction - Structural design of a prefabricated construction plus annex: how to avoid the behavior in a castle of card during an explosion occurred in a building prefabricated) - Prefabrication methods - Joints between prefabricated components - Transport of prefabricated components - Assembly of prefabricated components - Components of prefabricated facades - Components of prefabricated floors - Examples of prefabrication systems - Example of a handling system - Introduction to prefabrication steel - Example of a component of the building industry: plasterboard is a revolution in the design of partitions.
Prerequisites: None

020AINGS4 Interior Architecture 2 Cr.
This course allows to approach the interior project through the following work methodology: selection of a theme, study the set of architectural movements that are most related to this theme and finally reach a materialization of a concept. Selected topics: Exhibition and discussion of some projects that meet the course objectives - Exhibition of different themes and architectural movements - Choice of a relevant theme by each student and launching of the final project - Projection of some interior and exterior projects where the indoors / outdoors contrast is highlighted – Pin-ups and presentations- Final rendering of an A3 portfolio - Discussion and projection of the class' best projects.
Prerequisites: None

020IMAGS Introduction to Marketing 2 Cr.
This course introduces the students to basic principles of Marketing
Prerequisites: None

020IRRGS4 Irrigation 2 Cr.
This course aims to teach students about the importance of irrigation, plant behavior and irrigation practices. Topics include: Review of water cycle and importance of irrigation systems - Types of irrigation systems and machinery - Evapotranspiration and plants - Sprinkler irrigation - Irrigation and drainage - Irrigation in a Lebanese context.
Prerequisites: None

020HKAGS5 Karst Hydrogeology 2 Cr.
A course about karst nomenclature and definitions, basic concepts for understanding karst development and related groundwater flows. Introduction to methods in karst hydrogeology and geotechnical problems related to karst. Topics include: Introduction to karst geology and geological notions - Introduction to methods in karst hydrogeology including hydrological, hydraulic, hydrochemical and isotopic/tracer methods - Karst hydrogeology of Lebanon - Introduction to groundwater modeling in karst environments.
Prerequisites: None

020MOGGS5 Market Globalization 2 Cr.
This course is divided into two parts and is intended for non-managers. It introduces basics in negotiation, especially through practical case studies and role plays to allow the students to better understand the subtleties and problems they will face in their professional life. Topics include: Business Negotiations. Interpersonal communication - What is meant by negotiation - The method of business negotiations - The strategies for conducting a negotiation. Introduction to globalization. The international environment - The institutional framework of international exchanges - Globalization and new technologies - The international strategy of the company.
Prerequisites: None

020OUMGS5 Maritime Structures 2 Cr.
This course aims to give the students the basic elements in order to assess and analyze the seawater effects on the constituent elements of a port or a maritime structure. Topics include: Wave theory - Physico-chemical properties of seawater - Action of the sea on building materials - Principles of setting up a seaport - External works of the ports - Inner works of the ports - Docking works - Tools of the maritime ports - Clearance of the channels of access of the ports and the water bodies. Dredging-Drills; Bailout wreck.
Prerequisites: None

020PBAGS4 Multidisciplinary Project: Building Design, Foundations and Structures 6 Cr.
A course about the design of foundations and structural elements of reinforced concrete building. Topics include: Calculation of the foundations of a building - Calculation of the structure and dimensioning of the structural elements of a reinforced concrete building.
Prerequisites: Reinforced Concrete (020BEAGS3) and Architecture Project (020PARGS1)

020ANNGS1 Numerical Analysis 4 Cr.
This course aims at providing the students with the numerical tools and computational techniques needed to solve the equations and models encountered in the field of Civil Engineering. Topics include: General introduction to numerical methods - Approximation and interpolation - Numerical integration - Numerical derivation - Numerical resolution of differential equations - Systems of linear equations - Equations and systems of nonlinear equations - Methods of calculating eigenvalues- Partial derivative equations.
Prerequisites: Calculus 2 (020AN2NI4) and Algebra (020ALBNI3)

020PLGGS5 Planning and Management of Large-Scale Projects 2 Cr.
This course aims to introduce the students to the concepts of project management, the content of the contractual management documents, as well as the methodology for preparing a complete set of tender documents. Topics include: General introduction - Administrative management - Quality management - Cost management - Time management - Presentation and discussion of student projects - What is a project - What is planning a project - How to develop a project - Running the schedule - Target and progress - Allocation of resources and costs - Layouts and fitters.
Prerequisites: None

020PLCGS5 Plates and Shells 4 Cr.
A course about the theoretical elements needed to pre-dimension and analyze structural elements such as slabs, walls, roof, tanks and folded structures. Topics include: General introduction on plates and shells - Kirchhoff's theory of plates - Bending theory of rectangular plates - Bending theory of circular plates - Theory of shells - Membrane theory of shells of revolution - Bending theory of shells of revolution - Junction of shells of revolution.
Prerequisites: Structures (020STRGS4)

020BPRGS5 Prestressed Concrete in Buildings 2 Cr.
A course about the basic principles of the behavior of prestressed concrete structures with a focus on building applications. Topics include: Definition - Concept - History - Advantages - Materials (Concrete, Steels) - Processes and systems – Pre-stressing losses - Principles of calculation.
Prerequisites: Reinforced Concrete (020BEAGS3)

020BEPGS5 Prestressed Concrete 4 Cr.
This course provides the necessary elements to understand and design the Prestressed Concrete Structure. Topics include: Historical View of Prestressed Concrete - Different Procedures of Prestressed - Losses Calculation of Prestressed cables - Flexure in Service and Ultimate Design of Prestressed Concrete - Shear Design - Material characteristically and behavior - Composite Beams design - Hyperstatical system: Continuous beams and Post-Tensioning bridges exercises.
Prerequisites: Reinforced Concrete (020BEAGS3)

020PUBGS4 Public Speaking 2 Cr.
This course aims to enhance the knowledge of students in the field of Public Speaking through real cases and examples
Prerequisites: None

020PECGS4 Protection and Aesthetics of Buildings 2 Cr.
This course deals with the protection and aesthetic aspects of constructions, especially paints, sealing problems, etc. Topics include: The elements of mixing water and their influence on buildings - Admixtures - Cemented products - Protective products and applications - Aesthetics (Painting and decorative products) - Plastic products (electrical - heating - expansion joints ...)
Prerequisites: None

020QUAGS3 Quality Management 2 Cr.
An introductory course on quality in management systems and particularly in the field of construction where risk, safety and economic issues are important. Topics include: Introduction - Quality management systems - Quality assurance in construction (ISO, ...) - Codes and standards - European requirements (especially construction products) - Quality chain in the construction industry - Technical inspection - Procedures and quality manual - Economic and technical impact of non-quality - Statistics - Site visit - The necessary improvement of quality in the construction industry - Prevention / correction - Building pathologies - Practical examples - Real cases.
Prerequisites: None

020COCGS5 Rehabilitation and Design of Concrete Bridges 4 Cr.
The course provides the necessary information for the design of the various types of bridges. The course examines the causes of disorders of existing bridges and the techniques used for their repair and reinforcement. Topics include: Generalities -Functional data - Bridge equipment -Traffic load calculations - Distribution of horizontal forces on supports - Piers and abutments - Steel bridges -Reinforced and prestressed concrete bridges - Precast prestressed concrete bridges - Girder bridges - Suspension bridges - Cantilever bridges - Rehabilitation and reinforcement of concrete bridges - Bridge monitoring and maintenance
Prerequisites: Structures (020STRGS4)

020REMGS5 Rehabilitation and Maintenance of Concrete Structures 4 Cr.
This course provides the necessary baggage for the establishment of a rehabilitation operation or transformation of the building structure by the various investigation and consolidation processes with the development of cases of completed projects. Topics include: Introduction: Maintenance - Rehabilitation - Modification-Reinforcement - Choice of policy to follow: cost-Internet - Nature and type of building (Historic building in masonry - Old building:

masonry + concrete - Building in reinforced concrete - Building in steel structure) - Processes and phases to follow (Diagnosis - Rehabilitation Project) - Development of completed projects.
Prerequisites: None

020BEAGS3 Reinforced Concrete 6 Cr.
This course consists of dimensioning reinforced concrete structural elements according to BAEL and Eurocode 2. Topics include: Introduction - General - Bases of semi-probabilistic calculation - Evolution of calculation methods for reinforced concrete - Characteristics of materials - Durability and Coating - Adherence - Constructive provisions - Theory of cracking - Simple traction - Study of columns - Simple compression - Composite bending - Study of beams - Simple bending - Shear force - Study of beams - Torsion - Seismic arrangements - Practical work: Strength of concrete (Mechanical compression - Sclerometer - Pundit) - Test Los Angeles - Determination of concrete - Cleanliness of sand ...
Prerequisites: None

020ROUGS4 Road and Pavement Engineering 4 Cr.
This course aims at learning how to draw a road and the dimension of its roadway. Topics include: Vehicle movement - Plan drawing - Longitudinal profile - Cross section - Road equipment - Safety devices - Signage - Night traffic, lighting - Drainage devices, drainage - City roads - Crossroads - Calculation of cubicles - Initiation to the layout on computer. - Road geotechnics - Surface qualities of pavement - Pavement design, calculation of thicknesses - Basic materials - Aggregates - Binders - Surface layers, asphalt mix - Road construction - Pavements - Superficial coatings - Rigid pavements, cement concrete pavements. - CBR test - Softening test - Penetration test - Ductility test - Accelerated polishing test and friction pendulum.
Prerequisites: None

020RCGGS5 Shear Strength and Geohasards 4 Cr.
This course aims to understand influence factors and plan the measurement of soil shear strength under static and cyclic loading modes; Understand the basis of soil rheology; Introduce the notions of the effect of earthquakes on soils in terms of failure mode; Analyze landslide problems in terms of slope stability, excavations and embankments. Apply geotechnics to environmental problems; Identify the nature of contaminants in the soil with their biological, chemical and physical properties; Understand the modes of transport of contaminants in order to calculate their concentration in time and space; Develop treatment methods for soil decontamination; Design landfills. Recall of stress theory and failure criteria - Evaluation of shear strength - Shear strength of powdery soils - Shear strength of cohesive soils - Resistance to cyclic shear - Effect of earthquakes - Importance of landslide problems - Slope stability: Stability calculation and reinforcement methods - General introduction to geo-environment - Basics of understanding soil behavior in environmental geotechnics - Contaminants and contamination in environmental geotechnics - Transport of contaminants in soils - The recognition and investigation of polluted sites - Design of landfills - Restoration of contaminated sites.
Prerequisites: Foundation Engineering (020FOSGS3)

020MESGS2 Soil and Rock Mechanics 6 Cr.
This course provides the essential basis for understanding the behavior of the soil material. Identify the physical properties, the mineralogical and chemical composition of the porous medium. Understand the theory of soil compaction. Introduce the notions of interstitial pressure and effective stress. Identify the hydraulic properties of soils. Draw the water flow networks. Understand consolidation and calculate soil compaction. Understand the Mohr-Coulomb criterion. Introduce the concepts of shear resistance and geo-environment. General and Geological Recall - Soil Classification Properties and Indexes - Soil Classification - Clay Minerals and Soil Structure - Compaction and Road Geotechnics - Capillarity, Removal, Swelling, Frost Action - Water in Soils: Permeability and Networks flow - Consolidation and settlement - Consolidation velocity - Mohr-Coulomb criterion and Shear resistance - Geo-environmental concepts.
Prerequisites: Geology (020GELNI4)

020DESGS5 Solid Waste Management 2 Cr.
A course dealing with municipal solid waste problems and treatment methods. Topics include: Sources, quantities generated and properties of municipal solid waste - Municipal waste collection techniques - Public road cleaning techniques - Municipal waste disposal techniques: landfilling and incineration - Waste recycling and re-usage

(composting, glass/plastic/paper re-use, etc…) - Waste disposal costs - Industrial and medical waste collection and treatment.
Prerequisites: None

020OSPGS5 Special Topics in Concrete 2 Cr.
This course deals with the design of special concrete structures including: Short consoles - Beams partitions - Mixed structures - Walls of resurfacing - Water tanks - Cap - Industrial chimneys - Silos - Floors - Slabs – Cylindrical shells - Caissons.
Prerequisites: Reinforced Concrete (020BEAGS3)

020SP2GS4 Sporting Activities 2 Cr.
Encourage students to practice one or more types of sport in the presence of qualified instructors. Aikido - Judo - Taekwondo - Ping Pong - Squash - Tennis - Horse riding - Fencing - Bodybuilding - Archery - Aerobics - Ballroom dances - Basketball - Football - Volleyball.
Prerequisites: None

020HYSGS5 Statistical Hydrology 4 Cr.
This course provides the necessary elements to: determine and fit probability distributions and models to univariate and multivariate hydrologic variables, perform statistical tests and frequency analysis, select extreme value distributions and estimate probable maximum or minimum events (precipitation, droughts and floods). Topics include: Statistical analysis of hydrological data - Graphical representation of data - Extreme values of a variable - Correlatory analysis - Simple regression and multiple regression - Statistical tests in hydrology - Statistical study of rainfall - Frequency analysis - Example of statistical model in hydrology.
Prerequisites: Statics (020STAGS2)

020STAGS2 Statistics 4 Cr.
The objective of the course is to give students a notion of basic statistics. Topics include: Central limit theorem - sampling distributions - qualities of the estimators - Estimation by confidence intervals - estimation by the maximum likelihood method - estimation by the moments method - tests of parametric hypotheses - Linear regression (simple and multiple) - tests of non-parametric hypotheses - bootstrap - introduction to Bayesian statistics - Monte Carlo method - Monte-Carlo methods by Markov chains (MCMC) - approximate Bayesian calculation (ABC).
Prerequisites: None

020CMMGS3 Steel and Mixed Structures 6 Cr.
Metallic and mixed construction is one of the most widespread and expanding construction methods in Lebanon. The objective of this course is to design and dimension the structural elements of a building or a metal or mixed structure according to CM66 and Eurocodes 3 and 4 regulations. Topics include: General overview- Components of a metal building structure - Poles - Farms and beams - Floors - Framing walls and partitions - Cover - Connections – Applications. Calculation and sizing. Regulation aspect CM66, EC3 and EC4 - Calculation of solid core and truss posts. Buckling. Calculation of solid core and truss beams – Spill. Calculation of overhead cranes and monorails - Calculation of a roof failure. Calculation of rails - Calculation of joints; bolting, welding - Study of bracing - Study of an industrial building or a residential building.
Prerequisites: Structural Load Calculations (020ACTGS2)

020RDMGS2 Strength of Materials 6 Cr.
A course about understanding the behavioral law of the materials. Calculate and analyze the characteristics of the cross sections, as well as the distribution of the internal efforts and stresses in the different elements of 2D structures and the deformations of these elements. Topics covered: Theory of beams – Characteristics of the cross section - Center of Gravity - Moment of inertia – Normal effort - Bending - Torsion - Shear – Combined loadings - Calculation of the critical load of a structure: Theory of Euler - Energy theorems: Clapeyron, Maxwell-Betti, Bertrand de Fonviolant, virtual works, Castigliano, Menabrea - Force method - Three moments method.
Prerequisites: Statics (020STANI4) and Continuum Mechanics (020MMDGS1)

020DYSGS5 Structural Dynamics and Earthquake Engineering 4 Cr.

Give the necessary elements to understand the dynamics of the structures and size the structures to withstand earthquakes according to the PS92 regulation. Topics include: Earthquakes - Single Oscillator - Multiple Oscillator - Response of a structure to an earthquake - Calculation from an accelerogram - Calculation from a response spectrum - Regulatory aspects - Structural modeling - Seismic design - Rules PS92: Design, calculation and construction - Applications - Study of some works according to PS92.
Prerequisites: Waves Physics (020PHONI3)

020STRGS4 Structures 6 Cr.
A course about structural forms; influence lines; effects of temperature loads on structures, analysis of arches, trusses, continuous beams, 2D frames, grids and 3D frames. Topics include: Calculation of 2D structures (Rotation Method and Hardy-Cross Method) - Study of Arcs - Study of 3D structures - Method of displacements - Study of the stability of structures - Study of influence, use of lines of influence and applications - Beams on elastic supports - Beams on elastic soil - Study of the effect of temperature on structures – Software applications.
Prerequisites: Strength of Materials (020RDMGS2)

020PLSGS4 Structure Plastic Behavior 2 Cr.
This course aims to give students the basic elements of plasticity currently used in the new civil engineering calculation codes. Topics include: General introduction to plastic theory - Plastic traction-compression - Plastic bending - Plastic load capacity of indeterminate structure: Step by step method - Plastic load capacity of indeterminate structure: fundamentals theorems of plasticity - Calculation of reinforced concrete slabs by the yield-line method.
Prerequisites: Strength of Materials (020RDMGS2)

020ACTGS2 Structural Load Calculations 4 Cr.
This course aims to study and analyze the basis of structural design including the evaluation and analysis of vertical loads, snow and wind on structures as well as the appropriate consideration of different combinations of actions. Topics include: Introduction - Verification by the partial factor method - Serviceability and Ultimate limit states - Classification of Actions - Combination of Actions - Snow load - Wind load.
Prerequisites: None

020LOCGS5 Structural Software 4 Cr.
Present the method of displacements in matrix form to facilitate its computer implementation. Topics include: Introduction - ETABS 2016 - CSI bridge 2017 - Safe V12.
Prerequisites: None

020STEGS5 Summer Internship 4 Cr.
Allow students to undertake their first work experience in a professional environment, namely design offices and construction sites. This internship lasts 8 weeks. Internship in a design office or on site.
Prerequisites: None

020STOGS1 Surveying training 4 Cr.
Use of topographic material for field surveys. Use of topographic equipment: tachometer, theodolite, level, prism square, workstation.
Prerequisites: None

020TRAGS3 Traffic Engineering 2 Cr.
This course allows students to study and analyze the road traffic of a region. The different elements and functions of a road or highway. Topics include: Road traffic - Transport demand and supply - Economic and institutional context - Comparison of modes of transport - Priority to public transport in large cities - Environmental impacts.
Prerequisites: None

020AERGS4 Transport and Airport Engineering 2 Cr.
This course provides students with a systematic approach to essential structures in airport design. It addresses all the necessary topics or a civil engineer can intervene for a better exploitation, that it is at the level of the airport platforms or within the airline companies. At the end of this course, students will be able to sizing an aerodrome or undertaking its execution. On the other hand, they will also be familiar with aviation operations. Topics include:

Airport Panorama - Aerodrome Information - Physical Characteristics of the Track and Traffic Tracks - Aeronautical Clearances - Aeronautical Pavements - Freight Stations - Hangars and Specialized Areas - Control Towers and Technical Blocks - Radio and Meteorological Aids - Beaconing of the Day and Lighting Signage - Traffic - Drainage - Maintenance of the Airfield - Visit Beirut International Airport.
Prerequisites: None

020AVTGS4 Urban and Landscape Planning 2 Cr.
Teach urban planning rules to students.
Prerequisites: None

020GEPGS5 Water and Wastewater Treatment 4 Cr.
A course that examines the methods of water and wastewater treatment. Topics include: Water: Characteristics, constituents, impurities - Types of water to be treated and why - Physico-chemical processes for water treatment - Biological processes for water treatment – Sludge - Potable water treatment streams – Typical treatment plants - Waste water treatment streams – Typical treatment plants.
Prerequisites: None

020ASSGS4 Wastewater Distribution Networks 2 Cr.
A course on the design of urban sanitation networks. Topics include: Survey of urban planning (Topographic - Cadastral - Geological - Climatic) - Rainwater (Watershed - Statistical study of precipitation - Impoundment, Storm weirs) - Abacuses and formulas - Wastewater (Analysis - Curve of flow, tips - Evacuation: study of networks - Longitudinal profiles - Drawing in plan - Obstacles - Structures) - Symbols, Written documents.
Prerequisites: None

020DEAGS3 Water Distribution Networks 4 Cr.
This course introduces the water management process, that is, the relationship between natural water and water treatment. It contains essential information for modeling, dimensioning, scenario simulation and the choice of equipment needed to provide citizens with sufficient water and adequate pressure. Topics include: Water transport cycles - Estimation of the populations to be served - Volumes and flows of drinking water - Collection, supply and distribution of water - Flows needed to fight fires - Existing pipes on the market - Accessory organs - Stops and fasteners - Hydraulic characteristics of flows in water distribution pipes - Design and modeling of a drinking water distribution network - Water distribution for irrigation projects.
Prerequisites: None

Chemical and Petrochemical Engineering Program

Coordinator: Jihane Nabil RAHBANI

Program Educational Objectives

The objectives of the program are to graduate students able to:

- Contribute to the sustainable growth and development of the society.
- Sustain intellectual curiosity and further expand their knowledge and skills allowing them to assimilate the advances in the profession in a changing world.
- Adapt to different responsibilities with the ability to assume leadership roles respecting diversity and ethical practices.

Student Outcomes

The student outcomes are aligned with the ABET requirements:

1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

3) An ability to communicate effectively with a range of audiences.
4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program requirements

Credits: Chemistry and physical chemistry (32 credits), English (4 credits), General Education (20 credits), Internships (4 credits), Mathematics and Programming (24 credits), Petrochemical (10 credits.), Projects (22 credits), Reactors and processes (40 credits), Restricted Elective Courses (24 credits).

English (4 Cr.)

Level A on the “English Language Proficiency Test” is required to enter the 4 credits English course. Upgrading courses (B, C, D, E) are offered to reach this level. For graduation, students must then submit the " Saint Louis English Proficiency test ".

General Education (20 Cr.)

Required Courses (14 Cr.)

Communication (2 Cr.)
Ethics and engineering (4 Cr.)
Process Safety and Sustainable Development (2 Cr.)
Production Management (2 Cr.)
Project management (2 Cr.)
Quality Health Safety (2 Cr.)

Restricted Electives (2 Cr.)

One course to be selected from the following list:
Economy (2 Cr.)
Law (2 Cr.)
Marketing (2 Cr.)
Management (2 Cr.)
Entrepreneurship (2 Cr.)

Open Electives (4 Cr.)

General Education courses that can be pursued in any USJ institution, with at least two credits of Arab language or Arab culture.

Chemistry and Physical chemistry (32 Cr)

Theoretical chemistry (4 Cr.)
Transfer phenomena (4 Cr.)
Industrial chemistry (4 Cr.)
Chemistry of polymers (4 Cr.)
Fluid mechanics (4 Cr.)
Thermodynamics 2 (4 Cr.)
Thermal engineering (2 Cr.)
Chemical kinetics/ heterogeneous catalysis (2 Cr.)
Total Synthesis and Activation Methods (+ Laboratory) (4 Cr.)

Reactors and processes (40 Cr.)

Mass/Energy Balances and Ideal reactors (6 Cr.)
Separation techniques (6 Cr.)
Non-ideal reactors (2 Cr.)
Introduction to continuous and discontinuous processes (4 Cr.)
Unit operations: Adsorption, drying, crystallization (4 Cr.)
Contactors: systems G-L, F-S, L-L (2 Cr.)
TP Process engineering (2 Cr.)
Bioreactors and fermentation (4 Cr.)
Mechanical agitation and transfer (2 Cr.)
Formulation processes (2 Cr.)
Colloidal state and its applications (2 Cr.)
Energy management applied to processes and utilities (2 Cr.)
Process Equipment Design (2 Cr.)

Mathematics and Programming (24 Cr.)

Numerical analysis (4 Cr.)
Programming and Databases (4 Cr.)
Modeling and Simulation (2 Cr.)
Dynamics and Process Control (4 Cr.)
Mathematical Techniques in Chemical Engineering (6 Cr.)
Statistics (4 Cr.)

Petrochemical (10 Cr.)

Refining processes, natural gas (4 Cr.)
From crude to clean products (2 Cr.)
Petrochemical processes (4 Cr.)

Restricted Electives (24 Cr.)

Six courses to be selected from the following list:
Biochemical techniques and instrumentation (4 Cr.)
Composite materials (4 Cr.)
Design and construction of wells (4 Cr.)
Drilling technology (4 Cr.)
Process CAD (4 Cr.)
Food manufacturing and packaging (4 Cr.)
Lubricants and tribology (4 Cr.)
Microbiology-enzymatic catalysis (4 Cr.)
Pharmaceutical process design (4 Cr.)
Reservoir engineering (4 Cr.)
Solid and hazardous waste management (4 Cr.)
Statistical analysis and design of pharmaceutical operations (4 Cr.)
Wastewater treatment (4 Cr.)

Internships (4 Cr)

During his training, each engineer is required to perform two internships:

- An internship of 2 to 4 weeks in an industry or in a research laboratory in summer between S2 and S3 (with report)
- An internship from 6 to 8 weeks in the chemical industry in summer between S4 and S5 (with report and defense)

Process design Project (6 Cr.)

The purpose of the Process design project is to provide the students with an opportunity to place their course work knowledge into a process context. Teams of 2 to 3 students work on the creation or modification of a flowsheet capable of manufacturing a desired chemical.

Final year Project (16 Cr)

The final year project is carried out by groups of 2 to 3 students aiming to design a process plant, after a feasibility study and selection between process alternatives. Students are required to develop the process flow sheet, calculate mass- and energy balances, choose and dimension the major equipment components, determine the conditions concerning start-up, shutdown and process control, conduct environmental and safety evaluations as well as an economic evaluation of the design. A final report and two oral presentations are the main deliverables of the project.

Proposed schedule

Semester 1

020ETHCS1	Ethics and engineering	4 Cr.
020CCHCS1	Chemical kinetics/heterogeneous catalysis	2 Cr.
020BRICS1	Mass/energy balances and ideal reactors	6 Cr.
02CANCS1	Numerical analysis	4 Cr.
020IBDCS1	Programming and Databases	4 Cr.
020THCCS1	Chemical Thermodynamics	4 Cr.
020CHTCS1	Theoretical Chemistry	4 Cr.
020PDTCS1	Transport Phenomena	4 Cr.
	Total	32 Cr.

Semester 2

020CHPCS2	Chemistry of polymers	4 Cr.
020COMCS2	Communication	2 Cr.
020ANGCS2	English	4 Cr.
020MEFCS2	Fluid mechanics	4 Cr.
020QHSCS1	Quality Health Safety	2 Cr.
020CHICS2	Industrial Chemistry	4 Cr.
020PROfCS2	Introduction to continuous and discontinuous processes	4 Cr.
020RNICS2	Non-ideal Reactors	2 Cr.
020QHSCS2	Quality Health Safety	2 Cr.
020STACS2	Statistics	4 Cr.
	General Education Restricted Elective	2 Cr.
	Arabic Open Elective	2 Cr.
	Total	34 Cr.

Semester 3

020CONCS3	Contactors: systems G-L, F-S, L-L	2 Cr.
020DCPCS3	Dynamics and Process Control	4 Cr.
020ST1CS3	Internship 1 (S2-S3)	2 Cr.
020MOSCS3	Modeling and Simulation	2 Cr.
020SPDCS3	Process Safety and Sustainable Development	2 Cr.
020GEPCS3	Production management	2 Cr.
020GPRCS3	Project management	2 Cr.

020TESCS3	Separation techniques	6 Cr.
020GTHCS3	Thermal engineering	2 Cr.
020STMCS3	Total synthesis and activation methods	4 Cr.
	Restricted Electives	4 Cr.
	Total	32 Cr.

Semester 4

020BRFCS4	Bioreactors and fermentation lab	4 Cr.
020TMCCS4	Mathematical Techniques in Chemical Engineering	6 Cr.
020AMTCS4	Mechanical agitation and transfer	2 Cr.
020PDPCS4	Process design Project	6 Cr.
020CEPCS4	Process Equipment Design	2 Cr.
020OPUCS4	Unit Operations: adsorption, drying, crystallization	4 Cr.
	Restricted Electives	8 Cr.
	Open Elective	2 Cr.
	Total	34 Cr.

Semester 5

020ECACS5	Colloidal state and its applications: polymers, cosmetics, galenic	2 Cr.
020GEACS5	Energy management applied to processes and utilities	2 Cr.
020PFOCS5	Formulation processes	2 Cr.
020BPPS5	From crude to clean products: Process optimization	2 Cr.
020ST2CS5	Internship 2	2 Cr.
020PPCCS5	Petrochemical processes	4 Cr.
020GEPCS5	Process engineering lab	2 Cr.
020PRPCS5	Refining processes, natural gas	4 Cr.
	Restricted Electives	12 Cr.
	Total	32 Cr.

Semester 6

020PFECS6	Final year project	16 Cr.
	Total	16 Cr.

Course Descriptions

020TBICS5 Biochemical techniques and instrumentation 4 Cr.

General principle of chemical and physical quantification. Comparison of different methods of identification and quantification of biomolecules. Electrochemical principle of quantification and separation of biomolecules. Electrochemical instruments. Spectrophotometric methods and instruments in quantitative analysis. Chromatographic principles of separation, identification and quantitative analysis. Chromatographic instruments.
Prerequisites: None

020BRFCS5 Bioreactors and fermentation lab 4 Cr.

The methods of microbiology. Microbial growth: analysis. Microbial growth: kinetic analysis. Growth and production reactions.
Microbial growth: methods for measuring biomass. The microbial cell: structure and function (diagram). Kinetic analysis of a fermentation. General presentation of metabolism (nutrition; substrates and products). The major metabolic pathways. Microbial processes: Kinetic laws, kinetics of industrial processes. Modeling of fermentation processes: Physiological models, industrial fermentations.
Practical fermentation work

Prerequisites: None

020CCHCS1 Chemical kinetics/heterogeneous catalysis 2 Cr.
Open and closed sequence reactions. Basic concepts of catalysis and heterogeneous kinetics, different stages of the catalytic act (diffusion, adsorption and surface reaction), properties of solid catalysts and their main industrial and environmental applications.
Prerequisites: Kinetics of homogeneous reactions 020CIHNI4

020THCCS1 Chemical Thermodynamics 4 Cr.
Chapter I - Recalls on the concepts, Chapter II - Perfect systems, Chapter III - Principle of the study of equilibria - Variance, Chapter IV - Binary solutions, Chapter V - Thermodynamic Stability Liquid binary system - stability compared to diffusion liquid liquid transition or demixing), Chapter VI - The model of regular solutions MSR Chapter VII - Azeotropic distillation: Azeotropes. Heteroazeotropes.
Prerequisites: Thermodynamics 2 (020TH2NI3)

020CHPCS2 Chemistry of polymers 4 Cr.
Chapter I - Introduction - Definition of polymers, nomenclature and classifications, Chapter II - Notions of macromolecules: chain of units, tacticity and macromolecular masses, Chapter III - Polymerization reactions and techniques: step polymerizations - chain polymerizations, Chapter IV - The polymers and the cohesion of macromolecular systems, Chapter V - Morphology in the condensed state, Chapter VI - Phase transitions, Chapter VII - Special structures, Chapter VIII - Thermomechanical properties of polymers, Chapter XI - Additives and adjuvants in polymers - Polymer transformation processes.
Prerequisites: Organic Chemistry (020CORNI3)

020EFCCS5 Colloidal state and its applications: polymers, cosmetics, galenic 2 Cr.
The purpose of this course is to address basic concepts and concepts that govern various colloidal environments. An interest will be given to the physicochemical factors on which it is possible to play (pH, temperature, salinity, addition of additives, ...) to modulate the properties and behavior of these systems for the applications that are sought. Applications in cosmetics and galenic formulations.
Prerequisites: Chemistry of polymers (020CHPCS2)

020COMCS2 Communication 2 Cr.
Human Resources- Marketing - Enterprise - Billing and Settlement - Corporate Mail - Means of Payment-Exposure.
Prerequisites: None

020MACCS4 Composites materials 4 Cr.
Inorganic matrix composites: general information on inorganic composite materials; review of methods for obtaining inorganic composite systems; surface functionalization of composite oxide materials; physicochemical, dispersion and morphological characteristics of composite oxide systems and their derivatives; oxide composites with defined properties for use in various processes; directions for use of advanced powder substances. Polymer matrix composites: basic information on polymer composites - definition and components as well as precursors used; polymer reinforcement methods; preparation and types of composites and their characteristics; methods of synthesis of polymer composites; nanocomposites; differences in the structure and properties of composites and nanocomposites; physical, chemical and mechanical properties of (nano) composites, their treatment and recycling; application of (nano) polymer composites with particular emphasis on composites in medicine and dentistry; basic information on development trends in the field of composite material synthesis.
Prerequisites: None

020CONCS3 Contactors: G-L, F-S, L-L systems 2 Cr.
Gas-liquid contactor technology: the case of tray and packed columns. Dimensioning of the technologies to implement them in countercurrent liquid gas separation columns: distillation, absorption, etc. Description of industrial contactors (step contactors, differential contactors). Criteria for selection of devices. Generalities: Classification of fluid-solid contactors, applications, advantages and disadvantages. Characterization of divided solids (grain scale, bed of particles): porosity, density, compressibility of a powder, specific surfaces, equivalent diameters and form factors, particle size distribution and average diameter, cohesiveness and flowability of a powder. Flow through fixed beds: radius and hydraulic diameter, Darcy's law, Kozemy-Carman's relation, Ergun's

relation. Fluidized bed contactor: general presentation, different hydrodynamic regimes, powder classification, fluidization limit velocities, fluidized bed expansion, bubbling phenomena, technology (distributor calculation, cyclone calculation, TDH calculation), heat transfer, examples of application.
Prerequisites: None

020CRPCS5 Design and construction of wells 4 Cr.
Path design, Drilling well stability and casing selection, Control of drilling fluids and solids, Housing design, Primary cementing, Drilling chain and BHA design, Bit technology, Hydraulic circulation system and hole cleaning.
Prerequisites: None

020TDFCS4 Drilling technology 4 Cr.
Selection of drilling location and underground aspects, drilling history, well design and safety, drilling equipment, drilling process, drilling hydraulics, drilling fluids, directional drilling, drilling challenges, well control, petroleum geomechanics.
Prerequisites: None

020DCPCS3 Dynamics and Process Control 4 Cr.
Introduction to process control: characteristics and associated problems. Dynamic modeling of chemical processes. Laplace transform and solutions of differential equations. Transfer function and dynamic behavior of first and second order systems. Closed loop control. Basic principles and new techniques relating to the dynamics of continuous, discontinuous and hybrid processes. Development of a modeling methodology (development and structuring of models) and dynamic stimulation of processes based on algebra-differential processing with extensions for the identification of parameters, simulation under constraints and optimization.
Prerequisites: None

020ECOCS2 Economy 2 Cr.
Introduction to economic analysis, The instruments of economic analysis, Demand, supply and market, The effect of prices and income on the quantities demanded, The theory of consumer choice, The product offering by firms, development of the theory of supply, perfect competition and pure monopoly.
Prerequisites: None

020GEACS5 Energy management applied to processes and utilities 2 Cr.
Global energy balances, energy balances on an industrial site, different uses of energy, general presentation of typical utilities and processes, energy efficiency, energy saving deposits; Reminders on the laws of heat exchange, design method of heat exchangers (thermal calculations and calculations of pressure drops), air coolers and condensers technology; Production of cold in industry, components, (theoretical cycle and real cycle, COP and Carnot efficiency); Industrial combustion, technologies and operation of steam boilers (calculation of energy efficiency, economical production of steam, recovery from smoke, air heater, economizer); Recovery of waste heat (recovery by heat pump, by local production of electricity via an ORC), technical and economic aspect (case study).
Prerequisites: Thermal engineering (020GTHCS3)

020ANGCS2 English 4 Cr.
Objective: Have sufficient language skills in scientific English
Prerequisites: None

020ENPCS2 Entrepreneurship 2 Cr.
Should you become an entrepreneur? 2. What skills do entrepreneurs need? 3. Entrepreneurs in a market economy 4. Select a property type 5. Develop a business plan 6. Identify and respond to a market need 7. Finance, protect and insure your business 8. Choose your location and create a business 9. Marketing your business 10. Hiring and managing staff 11. Record keeping and accounting 12. Financial management 13. Using technology 14. Meeting your legal, ethical and social obligations
Prerequisites: None

020ETHCS1 Ethics and engineering 2 Cr.

Part 1: Some benchmarks: ethics, morals, deontology, law, human rights, conscience, freedom. One or more ethics? according to the cultures? according to the values? ethics and spirituality, ethics and religions … Some current issues in the field of ethics of the person in society: bioethics in the 21st century ..., Some topical issues in the field of society ethics at the service of the person: social, political, economic, entrepreneurial ethics ...
Part 2: Relations between engineers, Relations with the order of engineers.
Prerequisites: None

020PFECS6 Final year project 16 Cr.
The final year project is carried out by groups of 2 to 3 students aiming to design a process plant, after a feasibility study and selection between process alternatives. Students are required to develop the process flow sheet, calculate mass- and energy balances, choose and dimension the major equipment components, determine the conditions concerning start-up, shutdown and process control, conduct environmental and safety evaluations as well as an economic evaluation of the design. A final report and two oral presentations are the main deliverables of the project.
Prerequisites: None

020MEFCS2 Fluid Mechanics 4 Cr.
Fluid statics; Conservation of mass, momentum and energy; Ideal fluid dynamics; Potential flow theory; Dimensional analysis and similarity; Viscous fluid flow.
Prerequisites: Introduction to Fluid Mechanics (020IMFNI4)

020FEACS4 Food manufacturing and packaging 4 Cr.
Structure of the ingredients necessary to improve or decrease the properties of the products. Roles of proteins, water, starch and other biopolymers. Microencapsulation. Texturing by extrusion. Theory and application of film formation, foaming, thickening, gelatinization, Classification of packaging, paper as packaging material, its manufacture, types, advantages of corrugated and cardboard boxes, etc. Glass as packaging material, manufacturing, advantages, disadvantages. Metal as a packaging-manufacturing material, advantages, disadvantages Aluminum as a packaging material, its advantages and disadvantages, plastic as a packaging material, classification of polymers, properties of each plastic, uses of each plastic, chemistry of each plastic such as polyethylene, polypropylene, polystyrene, polycarbonate, PVC, PVDC, cellulose acetate, nylon etc. Lamination, coating and aseptic packaging. Benefits, process, comparison of conventional and aseptic packaging. Biodegradable and edible packaging. Machineries used in food packaging. Permeability - theoretical consideration, permeability of gases and vapors. Permeability of multilayer packaging, permeability to products. Packaging of specific foods with its properties such as bread, cookies, coffee powder, milk powder, powdered eggs, soft drinks, snacks, etc., mechanical and functional tests on the packaging, various mechanical functional tests performed in the laboratory on packaging boxes and packaging materials.
Prerequisites: None

020PFOCS5 Formulation processes 2 Cr.
I- Surfactants (TA) : 1) definition, 2) classification of surfactants, examples of industrial application, 3) various structures of TA, 4) surfactant character 5) notion of HLB. II- Aqueous solutions of surfactants: 1) micelles, formation, definition of CMC and Nag (experimental determination, factors influencing CMC), shape and sizes of direct micelles, other aggregates, III- Microemulsions 1) definition, domain of existence and phase diagram, parameters influencing formation and stability, Winsor domains, IV- Emulsions, multiple emulsions 1) formation, stability. Practical work.
Prerequisites: None

020BPPCS5 From crude to clean products: process optimization 2 Cr.
Physico-chemical properties and standardized tests, Relations between product specifications and their use (fuels and other products), Implementation of crude oils, Petroleum logistics, Strategic stocks, Petroleum distribution. Practical work petroleum analysis
Prerequisites: None

020CHICS2 Industrial Chemistry 4 Cr.
Study of some major processes in the mineral and organic chemical industry. Design of a block diagram and the 1st flow sheet of a process based on its description, choice of technology (reactor, separations), positioning of recycling, purges ... Some elements on the safety aspects, environmental impact of the processes.

Prerequisites: None

020ST1CS3 Internship 1 2 Cr.
This internship lasts between 2 and 4 weeks in an industry or in a research laboratory.
Prerequisites: None

020ST2CS5 Internship 2 2 Cr.
This internship lasts between 6 and 8 weeks in the chemical industry.
Prerequisites: None

020PROCS2 Introduction to continuous and discontinuous processes 4 Cr.
Introduction: difference between continuous, discontinuous, multiproduct, multifunctional processes. Transitional assessments. Dynamics of continuous and discontinuous processes. Application to reactors. Gantt chart. Description of the problems of design, planning and scheduling of discontinuous workshops: Presentation of the different criteria. Short-term planning: concept of recipe, representation of recipes (SSN STN), associated mathematical model and optimization. Simulation of discontinuous processes.
Prerequisites: Mass/energy balances and Ideal reactors (020BRICS1)

020DROCS2 Law 2 Cr.
Introduction to law, rules and sanctions - subjective rights - trial, first instance, remedies (in civil and commercial matters) - Commercial law: Commercial acts, traders, business - Commercial companies - Framework of the legal environment of the company - Main payment and credit tools - Guarantees given and received by the company.
Prerequisites: None

020MLTCS3 Lubricants and tribology 4 Cr.
1- Principles of lubrication, lubrication regimes: hydrodynamic lubrication, hydrostatic lubrication, elasto-hydrodynamic lubrication, mixed and limit lubrication 2- Basic classes of lubricants and choice of type of lubricant according to requirements, problems, components and the complexity of the machine 3- Properties of lubricating oils: viscosity, compatibility, corrosion, deterioration, contamination 4- Aqueous lubricants: type, properties, chemistry and applications 5- Greases: types, properties, chemistry and applications 6- Solid and gas: types, properties, chemistry and applications 7- Additives for lubricants: types, properties, chemistry and applications 8- Green and nano-lubricants: type, properties, chemistry and applications 9- Self-lubricating coatings: type, properties, coating techniques and tribological applications 10- Automotive, aeronautical lubricants and marine lubricants 11- Tests and specifications lubricants: bench tests, specification 12-Use, handling, storage, disposal, recycling, and safety of lubricants 13- Definition of the tribology and its multidisciplinary character, structural and technological importance of the tribology 14- Description and classification of the system of tribological problems and processes 15- Analysis of contacts in the tribological system, friction process, wear and deterioration, tribological materials.
Prerequisites: None

020MNGCS2 Management 2 Cr.
The course aims at introducing the major functions of business and providing an overview on activities within organizations - The per-organization: Formulation, The legal entity, types of organizational Structures, the Vision and Mission, STEP Analysis, SWOT Analysis, Types of Business Strategies and the strategic Gap model of Ansoff - The Post Organization: The HR function, the accounting & finance function, the operation function, the marketing function - Formulating a business plan.
Prerequisites: None

020MARCS2 Marketing 2 Cr.
Introduction to the basic principles of marketing, practices and the application of these practices. This course examines our current marketing system from a managerial perspective and includes a news component to help focus on the principles of marketing in today's business world. Topics covered include consumers, market research and target markets, feasibility analysis, products, promotion, distribution channels, prices, international marketing and the use of technology in marketing. Discussion of different solutions to marketing cases by applying marketing principles.
Prerequisites: None

020BRICS1 Mass/energy balances and ideal reactors 6 Cr.
Unit operations and analysis of degrees of freedom; Material balances on unit processes; Calculations on multi-unit processes; Mass balances in processes with reaction; Multiple systems with reaction, recycling and purging; Energy balance in the absence of reaction; Energy balances with reaction; Mass and energy balances under transient conditions; Mass balances for ideal reactors: Closed reactor, open stirred reactor, plug flow reactor. Energy balances for ideal reactors: closed reactor, open reactor in steady state
Prerequisites: None

020TMCCS4 Mathematical Techniques in Chemical Engineering 6 Cr.
Reminder of the fundamental properties used in optimization. Optimization problem (mathematical programming). Derivation. Topology concept. Convexity. Analysis of convexity. Eigenvalues. One-dimensional search. Definitions and general assumptions. Method of direct search for the golden ratio. Quadratic interpolation method (Quasi-Newton). Examples. Conclusion. Theoretical aspects of unconstrained optimization. Formulation of the problem. Fundamental theorem. Conclusion. Numerical methods for unconstrained problems. Fundamental principle of descent methods. Direction of descent. Length of the descent step. Stopping test (s). First-order methods. Second order Newton method. Quasi-Newtonian methods. Generalized reduced gradient, SQP.
Prerequisites: None

020AMTCS4 Mechanical agitation and transfer 2 Cr.
Types of bioreactors - Aerated agitated reactor: hydrodynamic constraints - Modeling and extrapolation of fermentations
Prerequisites: None

020MCECS3 Microbiology - enzymatic catalysis 4 Cr.
Introduction and history, Ultrastructure and morphology, Bacterial systematics. Growth and Physiology, Bacteria/Host Relationship, Bacterial Genetics, Antibiotics/ Antiseptics. Structure of nucleic acids, restriction enzymes. The different types of RNA. transcription in eukaryotes and prokaryotes. Posttranscriptional modifications in eukaryotes and prokaryotes. The regulation of transcription. Ribozymes. The genetic code and translation in eukaryotes and prokaryotes. Post-translational modifications. Replication. Sequencing The different tools of molecular biology. Introduction to Biotechnology. Enzymatic processes: kinetic laws, trend in industrial enzymology, models of starch hydrolysis processes. Enzyme and immobilized cell processes: immobilized enzyme technology, fixed cell technology.
Prerequisites: None

020MOSCS3 Modeling and simulation 2 Cr.
Mono-stage systems (FLASH): Definition of the problem (Biphasic unit of separation liquid-vapor mono-staged, called flash separation), Formulation of the problem (General mathematical mode l-Thermodynamic models - Analysis of the degrees of freedom of the system), Definition of the convergence, Efficiency and Safety of an Algorithm, Incident Matrix of a System, The Different strategies of resolution (Decoupling of Equations-Global Treatment), Initialization of Variables, Case Study. MULTI-STAGE SYSTEMS: Introduction, History- Some Key Dates, Shortcut Design, Simulation (General Mathematical Model-Degrees of Freedom - Sensitivity Analysis - Specifications).
Prerequisites: None

020RNICS3 Non-Ideal Reactors 2 Cr.
Introduction: Limits of the "ideal reactors" approach. Actual flows - Residence time distribution: Experimental determination - Diagnosis of malfunctions; Modeling: cascade of stirred reactors, axial dispersion piston model; Effect on reactor performance; Introduction to micromixing. Catalytic reaction: Diffusion in catalysts. External transfer’s fluid catalyst; Reaction - transfer coupling (Thiele modulus and efficiency factor), influence on productivity and selectivity.
Prerequisites: Mass/energy balance and ideal reactors (020BRICS1)

020CANCS1 Numerical analysis 4 Cr.

General introduction to numerical methods, Approximation and interpolation, Numerical integration, Numerical derivation, Numerical solution of differential equations, Systems of linear equations, Nonlinear equations and systems of equations, Methods of calculating eigenvalues, Partial differential equations
Prerequisites: Analysis 2 (020AN2NI4), Bilinear Algebra and Geometry (020ALBNI3)

020PPCCS5 Petrochemical processes 4 Cr.
Introduction to Chemical Process Industries. Raw material for Organic Chemical Industries. Profile of petrochemical Industry and its structure. Feedstocks: present and emerging. Overview of unit processes with applications, Nitration- nitrobenzene, nitrotoluenes, Halogenation- DCM, MCA, VCM, chlorobenzene. Esterification- C1 to C4 alcohols Production of Olefins and Derivatives, Naphtha and gas cracking for production of olefins. Recovery of chemicals from FCC and steam cracking. Ethylene derivatives: Ethylene Oxide, Ethylene glycol, Vinyl chloride, Propylene and Propylene oxide. Production of Aromatics, Aromatics separation train. Aromatics product Profile-Benzene, Toluene, Xylene, Ethyl benzene &Styrene, Cumene and phenol, Bisphenol, Aniline Unit – V Polymers and Elastomers. Polymers: Polyethylene, Polypropylene, Polystyrene, Polyvinylchloride, polycarbonate, Thermoset resin: phenol formaldehyde, uriaformaldehyde and melamine formaldehyde Elastomers: Styrene Butadiene Rubber (SBR), Poly butadiene, Nitrile rubber Unit – VI Fibers. Polyimides or Nylons (PA), DMT and Terephthalic Acid, Polyester, Acrylic Fiber, Modified Acrylic Fiber, Acrylonitrile, Acrolein, Viscose Rayon and Acetate rayon.
Prerequisites: None

020CPPCS4 Pharmaceutical process design 4 Cr.
Introduction to synthesis, separation and sterile processing and their applications to the design and optimization of pharmaceutical processes. The fundamentals of drug synthesis, Industrial pharmaceutical examples, Introduction to essential operations used in the manufacture of pharmaceutical products. Separation, distillation, crystallization, filtration, lyophilization and drying processes. Life cycle of pharmaceutical products, variability, testing and specification of pharmaceutical ingredients. Unit operations, including mixing, granulation, fluid bed operations, grinding, capsule filling, compacting, tablet coating, scaling, troubleshooting and optimization.
Prerequisites: None

020CAOCS4 Process CAD 4 Cr.
General introduction: The design of a computer-assisted process, from analysis to the conduct of a computer-assisted process. Material and thermal balance, Study of thermodynamics, Sizing of a reactor, a separator and a heat exchanger, Economic evaluation of a device, Control of two devices, Study of the process safety.
Prerequisites: None

020PDPCS4 Process design Project 6 Cr.
The purpose of the Process design project is to provide the students with an opportunity to place their course work knowledge into a process context. Teams of 2 to 3 students work on the creation or modification of a flowsheet capable of manufacturing a desired chemical.
Prerequisites: None

020GEPCS5 Process engineering lab 2 Cr.
The process engineering lab provides an introduction to the chemical processing unit operations : reactors, spray dryer, liquid-liquid exraction, gaz-liquid absorption, crystallization, osmosis
Prerequisites: 020TESCS3 Separation techniques ; 020OPUCS4 Unit operations : adsorption, drying, crystallization

020PEDCS4 Process Equipment Design 2 Cr.
General Design procedure, Design methodology, steps in design activity, process design and mechanical design, mechanical properties of material, factor of safety, material of construction, Selection, Economic considerations in the design process. Design of Basic Machine elements (Shafts, Keys and belt), Design of mechanical components such as protected and unprotected types of flange couplings. A brief overview of process design aspects of pressure vessel (as a reactor for example), design of head (Flat, hemispherical, torrispherical, elliptical & conical), flange joint, nozzle and supports. Design of Storage Tanks. Study of various types of storage vessels and applications. Atmospheric vessels, vessels for storing volatile and non-volatile liquids, storage of gases, Losses in storage vessels, Various types of roofs. Types of Heat Exchangers, Codes and standards for heat exchangers, Design of

heat exchanger (U tube and fixed tube) i.e. shell, head, channel, channel cover, flanged joints, tubes, tube sheet, tie rods & baffles. Design consideration of condensers and evaporators. Fouling in heat exchanger, Fouling types. Safety Measures and over protection devices in equipment design. Hazards Analysis in equipment design, Over pressure protection devices such as blow down, Pressure relief valves, rupture disc, steam trap etc. Environmental considerations in the equipment design.
Prerequisites: None

020SPDCS3 Process safety and sustainable development 2 Cr.
Energy analysis of a process, Energy integration and energy revaluation devices. Heat exchanger networks with specific techniques adapted. Principles of green chemistry. Life cycle analysis.
Prerequisites: None

020GEPCS4 Production management 2 Cr.
Introduction to the main methods of production systems control, Design system (design office, methods, industrialization) and management system, Push/pull systems, business process (workflow) and functions related to the production, project/ production differences, technical data (nomenclature, operating range, load point, deadlines) and production data, production forecasting management (MRP, load/capacity adaptation, inventory management), operational production management (scheduling, purchasing), Production management (control/command, monitoring, launching, monitoring), Software solutions for production (APS, ERP, MES, Supervisor, PLC).
Prerequisites: Project Management (020GPRCS3)

020IBDCS1 Programming and Databases 4 Cr.
Relational database: Design, implement and manipulate databases for beginners; Web databases will be introduced. The MySQL DBMS will be used throughout the course and in practical work using PHP-MySQL (WAMP software, PhpMyAdmin tool). The relational database model and the SQL language will be emphasized. Introduction to object-oriented computer programming: The fundamentals of design, development, implementation, including language syntax, data structures, input / output devices, and databases. The Microsoft Visual Studio Code IDE will be used for program development (Language C #). Practical work: Creation of databases, users, tables, manipulation of data in databases (addition, modification, deletion and recovery of data as needed. Acquire the notions of primary and foreign keys, link between tables and data selection from multiple tables (join). Programming on an object approach, notion of class (attributes / methods), particular members (constructor / destructor), conditional expressions, loops, and derived classes. Manipulation of data in a database from a C # program.
Prerequisites: Programming 2 (020IF2NI3)

020GPRCS3 Project management 2 Cr.
Definition of a project, phasing, organization of the milestones, definition of the different actors (MOA, MOE, realization) roles, clarification of the objectives; project breakdown (products, activities, costs, responsibilities) - planning process - planning methods - resource allocation - joint cost- management allocation costs, deadlines, quality, job evaluation, before, during, after, feedback.
Prerequisites: None

020QHSCS2 Quality, Health, Safety 2 Cr.
Initiation to the control of the industrial risks. I: General information on the French and European regulatory context of industrial and professional risks. II: Presentation of risk analysis methods.
Prerequisites: None

020PRPCS5 Refining processes, natural gas 4 Cr.
Industrial catalysts, Catalytic reforming, Isomerization, HDS, VGO and residues catalytic cracking, VGO and residues hydrocracking, Sulfur chain, FCC gasoline treatment, oligomerization, etherification, alkylation, Residue recovery, visbreaking, coking, Softening, The base oils, waxes, paraffins, bitumens.
Gas: deacidification, dehydration, extraction of liquid in gases and application exercises, Liquefaction of natural gas, Transport by gas pipeline, LNG transport-terminals, Flow assurance, Synthesis gas: H2 production and Fischer Tropsch process, SMDS, Steam cracking , the aromatic loop, selective hydrogenations, Ethylbenzene - Styrene, PEHP.

Prerequisites: None

020IDRCS5 Reservoir engineering 4 Cr.
Darcy's law and applications, concepts of permeability, relative permeability, capillary pressure, wettability, material balance equations for different types of reservoirs and drives, behavior of the aquifer and influx of water, immiscible displacement, Buckley-Leverett theory, stable movement by gravity, coning and cusp, Decay curve analysis, Reservoir and wellbore deliverability.
Prerequisites: None

020TESCS3 Separation Techniques 6 Cr.
Physical aspects of phenomena (Definition, Application).
Balances, solutions and solubility, choice of solvent. Analysis by macroscopic assessments: variance, assessment, operating curve and operating diagram. Countercurrent absorption of a constituent: Cut. Extent of the problem and assumptions. Algebraic resolution. Graphics processing. Distillation of a binary mixture. MacCabe and Thiele method -Ponchon-Savarit Method-Impact of operating conditions. Multi-constituent distillation. Analysis of the Problem-Short Cut Method (Relation of Fensk, Underwood, Gilliland, Kirkbridge). Choice of solvent, characteristics and properties of solvents. Balances between liquid phases. Study of single contactors, with multiple contacts and countercurrents without and with reflux. To know the mechanisms of liquid-solid separation and the fundamental equations allowing to dimension the industrial devices of this separation. Decanting, theoretical study - Falling speed limit. Experimental study. Modeling of continuous settlers with vertical walls. Sizing of continuous decanters with vertical walls. Filtration: Definitions and related techniques. Theory of filtration on support. Application examples. Membrane filtration: Separation membrane techniques. Osmotic pressure. Polarization phenomenon. Clogging mechanisms. Electro dialysis compartments. Centrifugation: Centrifugal effect and centrifugal filtration pressure. Centrifugal spin and flow rates.
Prerequisites: General Chemistry (020CHGNI1)

020GDSCS5 Solid and hazardous waste management 4 Cr.
Definition, production, effects, management options and future trends of waste, principles and design of sanitary landfills, principles and design of material recovery facilities, energy recovery facilities, waste minimization facilities, waste landfills hazardous, hazardous waste storage facilities, heat treatment facilities, Chemical/ physical / biological treatment facilities, Site remediation facilities.
Prerequisites: None

020ASCCS5 Statistical analysis and design of pharmaceutical operations 4 Cr.
The course provides an introduction to statistical analysis and experimental design methods and their applications to the design and optimization of pharmaceutical processes. Conventional statistical concepts and methods will be examined using pharmaceutical examples, including product / process development scenarios, routine in-process and finished product testing, and failure investigations. Regulatory requirements for sample testing, sampling plans, dosage of tablets and capsules, uniformity of content, hardness, friability, dissolution and bioavailability tests will be discussed in detail.
Prerequisites: None

020STACS2 Statistics 4 Cr.
The objective of the course is to give students a notion of basic statistics. Topics include: Central limit theorem - sampling distributions - qualities of the estimators - Estimation by confidence intervals - estimation by the maximum likelihood method - estimation by the moments method - tests of parametric hypotheses - Linear regression (simple and multiple) - tests of non-parametric hypotheses - bootstrap - introduction to Bayesian statistics - Monte Carlo method - Monte-Carlo methods by Markov chains (MCMC) - approximate Bayesian calculation (ABC).
Prerequisites: None

020CHTCS1 Theoretical Chemistry 4 Cr.
Introduction to quantum phenomena, the postulates of the QM: kinetic moment, the hydrogen atom. The main approximation methods: variational principle, perturbation theory. The atom with several electrons; the atomic orbitals approximation. The molecular orbitals approximation and methods of quantum chemistry: Hartree-Fock,

Hückel's method. Application to diatomic and polyatomic molecules; role of spatial symmetry. Introduction to reactivity. Highest occupied and lowest unoccupied molecular orbitals approximation.
Prerequisites: Atomic structure and bonding (020ATONI2)

020GTHCS3 Thermal engineering 2 Cr.
Convection study (Natural convection: empirical relations, forced convection in pipelines, laminar regime - Theoretical relations and empirical relations, Turbulent regime - empirical relations, Extension to non-cylindrical pipes and film flows, Forced convection around solid obstacles, The cylinder and the sphere case, Bundles of tubes case, The shell case of a multitubular exchanger). Theory of heat exchangers (Notion of co-current, countercurrent and multipasses, Definition and expression of the global exchange coefficient, DTML method, Efficiency method, Practical sizing method: this part is mainly treated on the basis of example of multitubular exchangers). Other heat transfer technologies (plate and spiral exchangers, transfer to stirred tanks). Transfer with phase change (Condensation of a pure vapor, Condensation of a mixture of vapors).
Prerequisites: Transport Phenomena (020PDTCS1)

020STMCS4 Total synthesis and activation methods 4 Cr.
Total synthesis, Accessibility of reagents, Optimization of stereoselectivity, Procedures and REACH regulations, Environmental control, Cost analysis, Detailed study of a total synthesis, Study by pair of students of a total synthesis followed by an oral presentation, Electrosynthesis, Ultrasonic technique applied to organic synthesis, Microwave energy in processes.
Practical work.
Prerequisites: Organic Chemistry (020CORNI3)

020PDTCS1 Transport Phenomena 4 Cr.
Laws of conductive transport - Diffusivities, Systems, transfer modes, Particle diffusion, Heat diffusion, Conducto-convective transfer (Newton's law), Global balance sheets, Global mass balance sheet, Total momentum balance, Energy balance, Energy conservation (At variable temperature), Friction factor, Friction factor for flow in rectilinear tubes with circular section, Coefficient of drag for flow around solid obstacles, Transport of fluids - Application to pumps and compressors. Flow regimes, Reynolds experiment, Laminar regime, Flow between two parallel plates (Poiseuille plane flow, Duvet plane flow, Generalized Duvet flow, Hele-Shaw flow), Flow in a cylindrical tube, Turbulent regime, Distribution velocities and boundary layer in a cross section, Concept of boundary layer: Laminar boundary layer, Concept of boundary layer: Turbulent boundary layer. Speed of Falling of a Sphere in a liquid at rest, Conservation equations and local balance sheet, Local equations of momentum, Local equations of energy, Thermal transfer in established flow, Thermal transfer established with constant wall temperature, Heat transfer established with linear wall temperature, Diffusion in a stagnant medium, Initiation to a computational code for Digital Fluid Mechanics.
Prerequisites: None

020OPUCS4 Unit Operations: adsorption, Drying, crystallization 4 Cr.
Sizing of adsorption columns; Mass transfer zone and breakthrough curve in a fixed bed column; Empirical methods: Length of unused bed; The scale-up approach; Mathematical models (Thomas model, Bohart-Adams model (bed depth service time, BDST), Yoon Nelson model); Drying; Efficiency of the dryer; Mass transfer during drying; Psychrometry; Equilibrium relative humidity; Drying rate; Calculation of drying times; Mass and energy balance of a continuous dryer; The different types of dryers; Crystallization, Fundamentals of crystal growth; Measurement of growth rate; Crystal yield; Crystallization technologies; Equipment for solution crystallization; Crystallization from the molten state; Modeling and design of the crystallizer. Practical work: 1- Drying and rehydration: Comparison of the drying and rehydration kinetics of different products. Effect of pretreatment on the kinetics and on the quality of the finished product. 2- Grinding and Granulometry: Effect of the type of grinder and the grinding time on the granulometry of different flours. 3- Pressing and extraction: effects of the various parameters on the extraction yield and the quality of the finished product.
Prerequisites: Separation techniques (020TESCS3)

020TEUCS4 Wastewater treatment 4 Cr.
Classification of wastewater from different points of view. Wastewater pollution assessment.
Equipment for treatment plants. Technological lines for wastewater treatment and sludge removal. Mechanical, chemical and biological stage of wastewater treatment. Pre-treatment and primary stage of wastewater treatment -

mechanical separators, sedimentation and flotation, decanter. The secondary stage of wastewater treatment - activation and secondary decanter, basic activation parameters, types of aerobic bioreactors, nitrification and denitrification, removal of phosphorus. The tertiary stage of wastewater treatment - post-treatment of wastewater. Anaerobic processes - types of anaerobic bioreactors. Treatment of sewage sludge. Industrial wastewater treatment. Physico-chemical and chemical treatment process. Modeling, design and optimization of the activated sludge process. An introduction to the automatic control of wastewater treatment plants.
Prerequisites: None