BACHELOR OF ENGINEERING IN CIVIL ENGINEERING

Concentrations

- Buildings and Engineering Management
- Public Works and Transportation
- Water and Environment

Main Language of Instruction:
French ☑ English ○ Arabic ○

Campuses Where The Program Is Offered: Regular Preparatory: CST, CLN, CLS, CZB – Honors Preparatory and Bachelor of Engineering: CST

OBJECTIVES

Objectives – Honors Preparatory Civil Engineering
The Civil Engineering program aims to enable students 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.

Objectives – Regular Preparatory Civil Engineering
The Civil Engineering program aims to enable students 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 life-long learning and development of knowledge and skills.

Objectives – Bachelor of Engineering in Civil Engineering
The Civil Engineering Program aims to train engineers with high scientific and technical expertise in design and construction, equipped to work in civil engineering, building and engineering structures, public works and transportation, water, and environmental sectors. Graduates will have a global and multidisciplinary approach to projects and their management.
This program enables graduates 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, continuous learning, and creativity.
- Lead in a dynamic professional environment through continuous education and the development of knowledge and skills.

PROGRAM LEARNING OUTCOMES (COMPETENCIES)

Competencies – Honors Preparatory Civil Engineering
- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- An ability to apply engineering design to produce solutions that meet specific needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- An ability to effectively communicate with a range of audiences.
- 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.
- An ability to effectively function on a team whose members provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Competencies – Regular Preparatory Civil Engineering

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- An ability to apply engineering design to produce solutions that meet specific needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- An ability to effectively communicate with a range of audiences.
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- An ability to effectively function on a team whose members provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Competencies – Bachelor of Engineering in Civil Engineering

The student outcomes are aligned with the ABET requirements:

- The ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- The 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.
- The ability to communicate effectively with a range of audiences.
- The ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, considering the impact of engineering solutions in global, economic, environmental, and societal contexts.
- The ability to function effectively on a team, where members provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- The ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- The ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

PROGRAM REQUIREMENTS

Students are required to choose either the Honors Preparatory track or the Regular Preparatory track. Once the two years of the chosen track are completed, they join the three-year Bachelor of Engineering program.

Honors Preparatory Civil Engineering

120 credits: Required courses (120 credits including 10 credits for USJ General Education Program)

Required Courses (120 Cr.)

Algebra 1 (6 Cr.). Algebra 2 (6 Cr.). Algebra 3 (4 Cr.). Analysis 1 (4 Cr.). Analysis 2 (6 Cr.). Analysis 3 (4 Cr.). Discrete Mathematics (6 Cr.). General Analysis (6 Cr.). Advanced General Chemistry (4 Cr.). Electromagnetism (4 Cr.). General Chemistry (4 Cr.). General Chemistry Laboratory (2 Cr.). Introduction to Fluid Mechanics (2 Cr.). Magnetic Induction (2 Cr.). Mechanics 1 (6 Cr.). Mechanics 2 (4 Cr.). Physical Signals (6 Cr.). Physics Laboratory 1 (2 Cr.). Physics Laboratory 2 (2 Cr.). Quantum Physics (2 Cr.). Signal Processing (2 Cr.). Thermodynamics 1 (6 Cr.). Thermodynamics 2 (2 Cr.). Wave Optics (2 Cr.). Programming 1 (4 Cr.). Programming 2 (4 Cr.). Programming 3 (2 Cr.). Geology (2 Cr.). Statics (2 Cr.). Supervised Personal Initiative Work (2 Cr.). Topography (2 Cr.). Engineering at the Service of the Community (2 Cr.). French and Philosophy 1 (2 Cr.). French and Philosophy 2 (2 Cr.). USJ Values in Daily Life (2 Cr.).

Regular Preparatory Civil Engineering

120 credits: Required courses (116 credits), Open elective courses (4 credits), USJ General Education Program (10 credits - may be part of the above categories).

Required Courses (116 Cr.)

Analysis 1 (4 Cr.). Analysis 2 (6 Cr.). Bilinear Algebra and Geometry (6 Cr.). Differential Calculus (6 Cr.). Discrete Mathematics (6 Cr.). General Analysis (6 Cr.). Linear Algebra (8 Cr.). Probability (4 Cr.). Supplemental Mathematics (2 Cr.). Fluid Kinematics (2 Cr.). General Chemistry (4 Cr.). Hydrostatics (2 Cr.). Mechanics 1 (6 Cr.). Mechanics 2 (4

Cr.). Physical Signals (6 Cr.). Physics Laboratory 1 (2 Cr.). Physics Laboratory 2 (2 Cr.). Thermodynamics 1 (4 Cr.). Thermodynamics 2 (4 Cr.). Wave Physics (4 Cr.). Programming 1 (4 Cr.). Programming 2 (4 Cr.). Building Information Modeling (2 Cr.). Computer Assisted Drawing (4 Cr.). Introduction to Engineering Projects (2 Cr.). Geology (2 Cr.). MATLAB (2 Cr.). Statics (2 Cr.). Topography (2 Cr.). Engineering at the Service of the Community (2 Cr.). USJ Values in Daily Life (2 Cr.).

Open Elective Courses (4 Cr.)

Bachelor of Engineering in Civil Engineering
180 credits: Required courses common core (132 credits), Required courses per concentration (42 credits), Institution's elective courses (2 credits), Open elective courses (4 credits) and USJ General Education Program (26 credits - may be part of the above categories).

Fundamental Courses (176 Cr.)
Required Courses – Common Core (132 Cr.)
Ethics and Engineering (4 Cr.). General and Analytical Accounting (2 Cr.). General Economics (2 Cr.). Environment and Sustainable Development (2 Cr.). Communication and Work Ready Now (2 Cr.). English (4 Cr.). Building Rules and Regulations (2 Cr.). Continuum Mechanics (4 Cr.). Construction Materials (6 Cr.). Numerical Analysis (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.). Statistics (4 Cr.). Hydraulics (6 Cr.). Foundation Engineering (6 Cr.). Reinforced Concrete (6 Cr.). Steel Structures (6 Cr.). Structures (6 Cr.). Buildings and Frames (4 Cr.). Finite Elements (4 Cr.). Surveying (2 Cr.). Summer Internship (4 Cr.). Final Year Project (16 Cr.). Multidisciplinary Project: Building Design, Foundations and Structures (6 Cr.). Architectural Project (4 Cr.).

Required Courses - Concentration: 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.). Buildings 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.).

Required Courses - Concentration: 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 (4 Cr.). Irrigation (2 Cr.). Karst Hydrogeology (2 Cr.). Maritime Structures (2 Cr.). Solid Waste Management (2 Cr.). Statistical Hydrology (4 Cr.). Urban Drainage (2 Cr.). Water Distribution Networks (4 Cr.). Water and Wastewater Treatment (4 Cr.).

Required Courses - Concentration: Public Works and Transportation (42 Cr.)
American Code of Reinforced Concrete (4 Cr.). Dams (4 Cr.). Road and Pavement Engineering (4 Cr.). Plates and Shells (4 Cr.). Prestressed Concrete (4 Cr.). Rehabilitation and Design of Concrete Bridges (4 Cr.). Structures Plastic Behavior (2 Cr.). Shear Strength and Geohazards (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.).

Institution's Elective Courses (2 Cr.). to be chosen from the list below:
Urban and Landscape Planning (2 Cr.). Protection and Aesthetics of Buildings (2 Cr.). Industrial Construction (2 Cr.). Engineering Geology (2 Cr.). Artificial Intelligence in Civil Engineering (2 Cr.).

Open Elective Courses (4 Cr.)

USJ General Education Program (10 out of 36 Cr.) - Honors Preparatory Civil Engineering, Regular Preparatory Civil Engineering

26 additional credits are validated in the Department of Civil Engineering and Environment

Code	Course Name	Credits
	HUMANITIES	**4**
064VALEL1	USJ Values in Daily Life	2
	Civic Engagement and Citizenship	**2**
020GSCCI1	Engineering at the Service of the Community	2
	QUANTITATIVE TECHNIQUES	**6**
020MADCI1	Discrete Mathematics	6

USJ General Education Program (26 out of 36 Cr.) - Bachelor of Engineering in Civil Engineering

10 additional credits are validated in the Department of Preparatory Classes

Code	Course Name	Credits
	ENGLISH OR OTHER LANGUAGE	**4**
020ANGGS4	English	4
	ARABIC	**4**
	Arabic Language and Culture	**2**
435LALML2 435LALAL2 435LRCTL2	One Arabic Culture and Language course to be selected among: Arabic Language and Media Arabic Language and Arts Arabic Language: Contemporary Novel, Cinema, and Theater	2
	Other Course Taught in Arabic	**2**
020LEBGS1	Building Rules and Regulations	2
	HUMANITIES	**4**
	Ethics	**4**
020ETHGS1	Ethics and Engineering	4
	SOCIAL SCIENCES	**6**
	Professional Integration and/or Entrepreneurship	**2**
020LEBGS1	Building Rules and Regulations	2
	Other Social Sciences Courses	**4**
020ECGGS1	General Economics	2
020CGAGS1	General and Analytical Accounting	2
	COMMUNICATION TECHNIQUES	**8**
020WRNGS1	Communication and Work Ready Now	2
020PBAGS4	Multidisciplinary Project: Building Design, Foundations and Structures	2 out of 6
020PBAGS6 020PEAGS6 020PTPGS6	Final Year Project	4 out of 16

SUGGESTED STUDY PLAN

Students are required to choose either the Honors Preparatory track or the Regular Preparatory track. Once the two years of the chosen track are completed, they join the three-year Bachelor of Engineering program.

Semester 1

Code	Course Name	Credits
	Required Courses - Honors Preparatory Civil Engineering	
020MADCI1	Discrete Mathematics	6
020GSCCI1	Engineering at the Service of the Community	2
020ANGCI1	General Analysis	6
020CHGCI1	General Chemistry	4
020MC1CI1	Mechanics 1	6
020SPHCI1	Physical Signals	6
	Total	**30**
	Required Courses - Regular Preparatory Civil Engineering	
020MADNI1	Discrete Mathematics	6
020GSCNI1	Engineering at the Service of the Community	2
020ANGNI1	General Analysis	6
020CHGNI1	General Chemistry	4
020MC1NI1	Mechanics 1	6
020SPHNI1	Physical Signals	6
020CMTNI1	Supplemental Mathematics	2
	Total	**32**

Semester 2

Code	Course Name	Credits
	Required Courses - Honors Preparatory Civil Engineering	
020AL1CI2	Algebra 1	6
020AA1CI2	Analysis 1	4
020FR1CI2	French and Philosophy 1	2
020TCGCI2	General Chemistry Laboratory	2
020INMCI2	Magnetic Induction	2
020PP1CI2	Physics Laboratory 1	2
020IF1CI2	Programming 1	4
020TH1CI2	Thermodynamics 1	6
	Total	**28**
	Required Courses - Regular Preparatory Civil Engineering	
020AA1NI2	Analysis 1	4
020STFNI2	Hydrostatics	2
020ALNNI2	Linear Algebra	8
020PP1NI2	Physics Laboratory 1	2
020IF1NI2	Programming 1	4
020TH1NI2	Thermodynamics 1	4
	Open Elective Course	2
	Total	**26**

Semester 3

Code	Course Name	Credits
	Required Courses - Honors Preparatory Civil Engineering	
020CHACI3	Advanced General Chemistry	4
020AL2CI3	Algebra 2	6
020AN2CI3	Analysis 2	6
020EMECI3	Electromagnetism	4
020FR2CI3	French and Philosophy 2	2
020MC2CI3	Mechanics 2	4
020PP2CI3	Physics Laboratory 2	2
020IF2CI3	Programming 2	4
020TRSCI3	Signal Processing	2
020OPTCI3	Wave Optics	2
	Total	**36**
	Required Courses - Regular Preparatory Civil Engineering	
020AN2NI4	Analysis 2	6
020ALBNI3	Bilinear Algebra and Geometry	6
020MC2NI3	Mechanics 2	4
020PP2NI3	Physics Laboratory 2	2
020IF2NI3	Programming 2	4
020TH2NI3	Thermodynamics 2	4
064VALEL1	USJ Values in Daily Life	2
020PHONI3	Wave Physics	4
	Total	**32**

Semester 4

Code	Course Name	Credits
	Required Courses - Honors Preparatory Civil Engineering	
020AL3CI4	Algebra 3	4
020AN3CI4	Analysis 3	4
020IMFCI4	Introduction to Fluid Mechanics	2
020STACI4	Statics	2
020IF3CI4	Programming 3	2
020PHQCI4	Quantum Physics	2
020TIPCI4	Supervised Personal Initiative Work	2
020TOGCI4	Topography	2
020GELCI4	Geology	2
020TH2CI4	Thermodynamics 2	2
064VALEL1	USJ Values in Daily Life	2
	Total	**26**
	Required Courses - Regular Preparatory Civil Engineering	
020BIMNI4	Building Information Modeling	2
020DAINI4	Computer Assisted Drawing	4
020CDFNI4	Differential Calculus	6

020CIFNI4	Fluid Kinematics	2
020GELNI4	Geology	2
020PIINI4	Introduction to Engineering Projects	2
020MATNI4	MATLAB	2
020PRBNI4	Probability	4
020STANI4	Statics	2
020TOGNI4	Topography	2
	Open Elective Course	2
	Total	**30**

Semester 5

Code	Course Name	Credits
	Required Courses - Bachelor of Engineering in Civil Engineering – Common Core	
020PARGS1	Architectural Project	4
020LEBGS1	Building Rules and Regulations	2
020MMDGS1	Continuum Mechanics	4
020ETHGS1	Ethics and Engineering	4
020MACGS1	Construction Materials	6
020ENVGS1	Environment and Sustainable Development	2
020CGAGS1	General and Analytical Accounting	2
020ECGGS1	General Economics	2
020ANNGS1	Numerical Analysis	4
020STOGS1	Surveying	2
020WRNGS1	Communication and Work Ready Now	2
	Total	**34**

Semester 6

Code	Course Name	Credits
	Required Courses - Bachelor of Engineering in Civil Engineering – Common Core	
020MEFGS2	Fluid Mechanics	6
020PGCGS2	General Construction Procedures	4
020MESGS2	Soil and Rock Mechanics	6
020STAGS2	Statistics	4
020RDMGS2	Strength of Materials	6
020ACTGS2	Structural Load Calculations	4
	Open Elective Course	2
	Total	**32**

Semester 7

Code	Course Name	Credits
	Required Courses - Bachelor of Engineering in Civil Engineering – Common Core	
020FOSGS3	Foundation Engineering	6
020HYDGS3	Hydraulics	6

020BEAGS3	Reinforced Concrete	6
020CMMGS3	Steel Structures	6
	Required Courses – Concentration: Buildings and Engineering Management	
020ACIGS3	American Code of Reinforced Concrete	4
020QUAGS3	Quality Management in Buildings	2
020GEFGS3	Buildings Finance Management	2
	Required Courses - Concentration: Water and Environment	
020DEAGS3	Water Distribution Networks	4
020GISGS3	Geographic Information Systems	2
020DREGS3	Environmental Law	2
	Required Courses - Concentration: Public Works and Transportation	
020ACIGS3	American Code of Reinforced Concrete	4
020TRAGS3	Traffic Engineering	2
020AERGS3	Transport and Airport Engineering	2
	Total	**32**

Semester 8

Code	Course Name	Credits
	Required Courses - Bachelor of Engineering in Civil Engineering – Common Core	
020ANGGS4	English	4
020OSBGS4	Buildings and Frames	4
020EFIGS4	Finite Elements	4
020PBAGS4	Multidisciplinary Project: Building Design, Foundations and Structures	6
020STRGS4	Structures	6
	Institution's Elective Course	2
	Open Elective Course	2
	Required Courses - Concentration: Buildings and Engineering Management	
020RESGS4	Building Lighting and Sanitary	4
020CTHGS4	Building Thermal Design	2
	Required Courses - Concentration: Water and Environment	
020IMPGS4	Environmental Impact Assessment	2
020IRRGS4	Irrigation	2
020ASSGS4	Urban Drainage	2
	Required Courses - Concentration: Public Works and Transportation	
020ROUGS4	Road and Pavement Engineering	4
020PLSGS4	Structures Plastic Behavior	2
	Total	**34**

Semester 9

Code	Course Name	Credits
	Required Courses - Bachelor of Engineering in Civil Engineering – Common Core	
020STEGS5	Summer Internship	4
	Required Courses - Concentration: Buildings and Engineering Management	
020ACBGS5	Building Acoustics	2
020SEIGS5	Building Fire Safety	2
020COSGS5	Design of Buildings Structures	4
020MOGGS5	Market Globalization	2
020PLGGS5	Planning and Management of Large-Scale Projects	4
020BPRGS5	Prestressed Concrete in Buildings	2
020REMGS5	Rehabilitation and Maintenance of Concrete Structures	4
020OSPGS5	Special Topics in Concrete	2
020DYSGS5	Structural Dynamics and Earthquake Engineering	4
020LOCGS5	Structural Software	2
	Required Courses - Concentration: Water and Environment	
020LOGGS5	Applied Hydraulics Software	2
020BAGGS5	Dams	4
020MEAGS5	Data Measurement and Acquisition	2
020HSOGS5	Groundwater Hydraulics	2
020HYDGS5	Hydrology	4
020HKAGS5	Karst Hydrogeology	2
020OUMGS5	Maritime Structures	2
020DESGS5	Solid Waste Management	2
020HYSGS5	Statistical Hydrology	4
020GEPGS5	Water and Wastewater Treatment	4
	Required Courses - Concentration: Public Works and Transportation	
020BAGGS5	Dams	4
020PLCGS5	Plates and Shells	4
020BEPGS5	Prestressed Concrete	4
020COCGS5	Rehabilitation and Design of Concrete Bridges	4
020RCGGS5	Shear Strength and Geohazards	4
020OSPGS5	Special Topics in Concrete	2
020DYSGS5	Structural Dynamics and Earthquake Engineering	4
020LOCGS5	Structural Software	2
	Total	**32**

Semester 10

Code	Course Name	Credits
	Required Courses - Bachelor of Engineering in Civil Engineering – Common Core	
020PBAGS6 020PEAGS6 020PTPGS6	Final Year Project	16
	Total	**16**

COURSE DESCRIPTION

Honors Preparatory Civil Engineering

020CHACI3 Advanced General Chemistry 4 Cr.

This course provides students with the basic principles of chemical thermodynamics as well as electrochemistry including the laws of thermodynamics; enthalpy, entropy, internal energy, free energy, chemical potential, phase equilibria; equilibrium constant; characterization of the intensive state of a system in equilibrium: variance of a system in equilibrium. optimization of a chemical process; overvoltage: current-potential curves; spontaneous transformations; batteries and electrolyzers; 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.
Prerequisite: General Chemistry (020CHGCI1).

020AL1CI2 Algebra 1 6 Cr.

This course covers the following: Algebraic structures, vector spaces, linear mappings, matrices, determinants, linear systems, Euclidean spaces.

020AL2CI3 Algebra 2 6 Cr.

This course explores the advanced study of algebraic structures such as groups, rings, and fields. It includes a detailed examination of endomorphisms, matrix reduction, and special substructures of algebraic structures like ideals. Topics explored include classification of matrices, the computation of eigenvalues and matrix equivalence. With a mix of theoretical understanding and practical applications, students will gain a comprehensive understanding of these mathematical concepts.
Prerequisite: Algebra 1 (020AL1CI2).

020AL3CI4 Algebra 3 4 Cr.

This advanced course is divided into two main parts. The first part focuses on inner product spaces, exploring concepts such as inner products, orthogonal vectors, orthonormal bases, and isometry in 2 and 3-dimensional Euclidean spaces. This section also delves into the study of symmetric endomorphisms and orthogonal matrices. The second part of the course introduces probability theory, including probability spaces, discrete random variables, probability distributions, and the law of large numbers. Building on the foundations of Algebra 2, this course provides students with a comprehensive understanding of these mathematical disciplines.
Prerequisites: Algebra 2 (020AL2CI3) - Analysis 1 (020AA1CI2).

020AA1CI2 Analysis 1 4 Cr.

This course covers the following: 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- Combinatorics: Cartesian product, arrangements, combinations, finite sets cardinality, probability on a finite space, Bayes formula, independence, and finite random variables.

020AN2CI3 Analysis 2 6 Cr.

This course covers the following: 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, and line integrals.
Prerequisite: Analysis 1 (020AA1CI2).

020AN3CI4 Analysis 3 4 Cr.

This course covers the series and summable families, sequences and series of functions, integration and derivation of a series of functions, power series, probability and discrete random variables, linear differential equations and systems of the form X'=A(t)X+B(t), the method of constant variation, and Lagrange's method.
Prerequisite: Analysis 2 (020AN2CI3).

020MADCI1 Discrete Mathematics 6 Cr.

This course covers the following: Logic and reasoning, Set theory, Applications, Binary relations, Algebraic calculations, Complex numbers, Integer arithmetic, and Polynomials.

020EMECI3 Electromagnetism 4 Cr.

This course starts with a separate study of 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's 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 from an EM oscillating dipole.
Prerequisites: Physical Signals (020SPHCI1) - General Analysis (020ANGCI1).

020GSCCI1 Engineering at the Service of the Community 2 Cr.

This course aims to explore the role of engineers in modern society, with a particular focus on innovation, renewable energies, green buildings, design, food security, recycling, and other areas relevant to our daily lives. Students will learn how engineers can leverage their technical skills, knowledge, and tools to address and solve social and environmental challenges through engineering.

020FR1CI2 French and Philosophy 1 2 Cr.

This course is offered to students in Higher Mathematics - Competition Section (*Mathématiques supérieures - section Concours*) to prepare them for the written French test in the admission competition for polytechnic schools (*Filière Universitaire Internationale-Formation Francophone FUI-FF*). Its objective is to provide students with the academic and didactic tools necessary for success in the admission test.

020FR2CI3 French and Philosophy 2 2 Cr.

This subject is offered to students in Advanced Mathematics - Competition Section (*Mathématiques spéciales - section Concours*) to prepare them for the written French test in the admission competition for polytechnic schools (*Filière Universitaire Internationale-Formation Francophone FUI-FF*). Its objective is to provide students with the academic and didactic tools necessary for success in the admission test.

020ANGCI1 General Analysis 6 Cr.

This course covers a 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, Rolle's Theorem, and applications.

020CHGCI1 General Chemistry 4 Cr.

This course allows students to master acid-base balances, the preponderant reaction method, and the calculation of pH in the final state of chemical equilibrium as well as pH-metric and conductometric titrations. In addition, notions about oxidants and reductants, the electrochemical cell, the type of electrodes, the calculation of the electromotive force and the capacity of the cell, the potential of the electrode through the Nernst equation as well as titration by oxidation-reduction reaction are covered. Students will also learn the concept of heterogeneous equilibrium in aqueous solution, the effect of the common ion and of complexation on solubility, complexation reactions and the influence of pH on solubility. Finally, this course allows analyzing potential-pH diagrams through examples along vertical and horizontal lines.

020TCGCI2 General Chemistry Laboratory 2 Cr.

This course focuses on the comprehension of hazards and risks, as well as the identification of relevant safety guidelines. It aims to enhance students' knowledge regarding laboratory procedures, techniques, and safety protocols. Additionally, the course aims to develop students' skills in qualitative chemical analysis and titration of various mineral solutions, including acids, alkaline solutions, and precipitation reactions. Furthermore, students will learn to verify theoretical information through the determination of concentrations using electrochemical analysis methods such as spectrophotometric analysis. This course also familiarizes students with the equipment used in each laboratory session and establishes a strong foundation for data interpretation.
Prerequisite: General Chemistry (020CHGCI1).

020GELCI4 Geology 2 Cr.

This course aims to introduce fundamental concepts of geology. It focuses on structural geology, stratigraphy, and petrography. It covers the brittle and ductile deformation and explains the behavior of material in front of different kinds of stress, extensive and compressional. It also presents the different types of rocks, their genesis contexts, their physical properties and their organoleptic classification.

020IMFCI4 Introduction to Fluid Mechanics 2 Cr.

This course covers the following: 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, Lagrange and Euler description.

020INMCI2 Magnetic Induction 2 Cr.

This course introduces students to the magnetic field beyond the descriptive approach studied in high school. It covers practical applications such as compasses, electric motors, alternators, transformers, speakers, induction plates, and radio-frequency identification. The course also presents the concept of magnetic flux and generalizes the magnetic dipole of a current circuit to magnets.

020MC1CI1 Mechanics 1 6 Cr.

This course enables students to master the principles and fundamental concepts of classical physics (inertia principle, fundamental principle of dynamics, principle of reciprocal actions, work-energy theorem). This course reinforces understanding of these principles through a wide range of concrete applications or real-life situations with all their richness, particularly in the field of engineering.

020MC2CI3 Mechanics 2 4 Cr.

This course focuses on the study of specific topics within the field of classical mechanics. Its primary objective is to provide students with a deeper understanding of non-inertial reference frames, friction phenomena, and solid rotation around a fixed axis. In the realm of non-inertial reference frames, students explore the principles and equations necessary to analyze and solve problems involving accelerated systems. They will learn to account for the effects of fictitious forces, such as centrifugal and Coriolis forces, which arise in non-inertial frames. The course also delves into the intricate nature of friction, examining its various types and the factors affecting its magnitude. Students will acquire the skills to analyze the behavior of objects subject to both static and kinetic friction. Lastly, the study of solid rotation around a fixed axis enables students to comprehend the kinematics and dynamics of rotating bodies, including concepts like angular velocity, angular acceleration, and moments of inertia. Overall, this course equips students with the fundamental knowledge and problem-solving abilities necessary to tackle complex mechanical systems involving non-inertial reference frames, frictional forces, and solid rotation.
Prerequisite: Mechanics 1 (020MC1CI1)

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, wavelength, 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.

020PP1CI2 Physics Laboratory 1 2 Cr.

This practical work course is designed to bridge the gap between theoretical knowledge and practical application in the field of electrical engineering and physics. Throughout the course, students will engage in hands-on activities to gain a deeper understanding of various concepts. The key topics covered include resonance in RLC circuits, system analysis, circuit measurements, mechanics and motion, LabVIEW software, fields and characteristics, oscilloscope applications, single-degree-of-freedom oscillator, focal measurement, and optical systems. Overall, this practical work course is designed to equip students with the necessary skills to apply theoretical knowledge in real-world scenarios, fostering a comprehensive understanding of electrical engineering and physics concepts.

020PP2CI3 Physics Laboratory 2 2 Cr.

This course allows students to solidify their theoretical knowledge by putting it into practice through a variety of topics. They will have the opportunity to explore areas such as electrical circuits, linear filters, Fourier analysis, frequency analysis, the Thomson tube, thermal conduction, the Stefan-Boltzmann law, the oscillator with two degrees of freedom, diffraction and interference, as well as polarization.
Prerequisite: Physics Laboratory 1 (020PP1CI2).

020IF1CI2 Programming 1 4 Cr.

This course covers the hardware components of a computer and the basic concepts of high-level programming using Python. The topics addressed include the computer's hardware components, algorithms, programming languages, Python and the IDLE environment, variables, arithmetic expressions and operators, primitive data types, input and output of data, built-in composite data types, simple statements, control statements, logical expressions, relational and logical operators, function definition and call, functions from external modules.

020IF2CI3 Programming 2 4 Cr.

This course covers LIFO and FIFO structures - Topics include a systematic study of existing sorting algorithms and how to calculate their time complexity. It also covers the basic concepts of object-oriented programming and their application to data abstraction by introducing the concepts of object instantiation, attributes, and methods. It also covers an introduction to relational databases.
Prerequisite: Programming 1 (020IF1CI2).

020IF3CI4 Programming 3 2 Cr.

This course covers the following: Ce Programming and algorithms with Categorical Abstract Machine Language (CAML) – variables, arithmetic expressions and operators, primitive data types, data input and output, built-in composite data types, simple statements, control statements, logical expressions, relational and logical operators, function definition and call, functions from external modules – array – dynamic programming – recursive structures (lists, trees) – LIFO – FIFO – complexity – graph – propositional logic – deterministic and non-deterministic finite state automata – regular expressions.
Prerequisite: Programming 1 (020IF1CI2).

020PHQCI4 Quantum Physics 2 Cr.

This course is concerned with two aspects of modern physics. The first is based on the Schrodinger formulation of the wave mechanics and treats simple but fundamental problems: free particle, particle in a single-step potential, tunnel effect, particle in a box and energy quantization. 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 discrete spectrum of energy. Equipartition theorem is then used to evaluate heat capacity of gases and solids.
Prerequisite: Electromagnetism (020EMECI3).

020TRSCI3 Signal Processing 2 Cr.

This course aims to provide students with a thorough understanding of key concepts related to filtering of periodic signals and sampling. Students will have the opportunity to deepen their knowledge of linear filters, understanding their operation and exploring the effects of first and second-order filters on a periodic signal. Special attention is given to the sampling process, with a detailed study of the Nyquist-Shannon theorem, which establishes the necessary conditions to avoid spectrum folding. Additionally, students will have the opportunity to become familiar with digital filtering.
Prerequisite: Physical Signals (020SPHCI1).

020STACI4 Statics 2 Cr.

This course introduces the principles and methods used to solve engineering problems, building on prior knowledge in mathematics and physics. It focuses on the modeling and analysis of static equilibrium problems, with an emphasis on real-world engineering applications and problem-solving. The course examines methods for quantifying forces between bodies and defining conditions of equilibrium. It also explores how forces maintain balance, induce motion, or cause deformation, all of which are critical to the functionality of structures and mechanical systems. Statics serves as a foundational prerequisite for several engineering disciplines, particularly civil and mechanical engineering, which study the effects and consequences of forces.
Prerequisite: Mechanics 1 (020MC1CI1).

020TIPCI4 Supervised Personal Initiative Work 2 Cr.

This course enables students to undertake a personal project focused on the scientific and technological research process. Emphasis is placed on the necessity of asking preliminary questions, mirroring the common practice of scientists. The research process leads to the creation of conceptual and real-world objects, promoting knowledge construction. Students will conduct research, analyze reality, and identify an issue related to the theme. Explanations are obtained through investigation using traditional tools and methods of scientific research. The objective is to encourage students to make discoveries on their own, leveraging their inventive and initiative-taking abilities, without undue ambition.

020TH1CI2 Thermodynamics 1 6 Cr.

This course focuses on the laws governing the macroscopic properties of a pure substance by covering fundamental concepts such as work, heat, and temperature. It is in this course that the student understands, describes, and quantifies the operation of thermodynamic machines such as engines, refrigerators, and heat pumps.

020TH2CI4 Thermodynamics 2 2 Cr.

This course enables students to master and apply the concepts and fundamental principles of thermodynamics. It aims to develop the ability to solve practical problems using energy, mass, and entropy balances. Indeed, energy in all its forms is studied in various machines, such as internal combustion engines, turbojets for aerospace and naval propulsion, gas or steam turbines, thermal power plants, and refrigeration systems. Special attention is then given to heat transfer problems, which require a command of powerful tools (Laplacian, divergence) in concrete situations. Students will become familiar with partial differential equations and learn to manipulate the famous heat diffusion equation with or without a source term in Cartesian, cylindrical, or spherical geometry.
Prerequisite: Thermodynamics 1 (020TH1CI2).

020TOGCI4 Topography 2 Cr.

This course introduces surveying, covering topics such as geodesy and cartography, levelling, the use of measuring instruments, creation of topographic plans, profiles, and volume calculations, setting out techniques, and preparation of surveying base plans and official document folders.

064VALEL1 USJ Values in Daily Life 2 Cr.

This course aims to raise students' awareness of the fundamental values of the Saint Joseph University of Beirut (USJ) in order to apply them in their personal, interpersonal, and professional lives. It engages them in critical reflection on how the values outlined in the USJ Charter can influence their behaviors, actions, and decisions to meet the challenges of the contemporary world. They will also be aware of global issues and ethical responsibilities,

ready to contribute positively to the construction of a better society.

020OPTCI3 Wave Optics 2 Cr.

This course covers the key concepts of the wave theory of light. It begins with the definition of spherical and plane waves, accompanied by a comprehensive exploration of key principles associated with them, such as optical path length, wave intensity, wavefront, wave trains, and coherence length. Special attention is given to light interference through wavefront division (Young's double-slit experiment) and through amplitude division (Michelson interferometer). The impact of extended and narrow-spectrum light sources is also examined. Furthermore, an analysis of the Fraunhofer diffraction phenomenon is presented, followed by a study of interference generated by multiple coherent waves and the use of a diffraction grating.
Prerequisite: Physical Signals (020SPHCI1).

Regular Preparatory Civil Engineering

020AA1NI2 Analysis 1 4 Cr.

This course aims to develop a deep understanding of fundamental concepts in mathematical analysis and equip students with the ability to apply these tools to solve more advanced mathematical problems. It covers topics such as Taylor series expansions for approximating functions and studying their local behavior around a point. Students will also learn about anti-derivatives and improper integrals, gaining the skills to manipulate them effectively. Additionally, the course delves into the convergence or divergence of numerical series, teaching students how to determine convergence using specific criteria. Overall, these topics prepare students to tackle complex mathematical problem-solving tasks.

020AN2NI4 Analysis 2 6 Cr.

This course aims to deepen the understanding of advanced concepts in mathematical analysis. It covers various areas, such as the pointwise and uniform convergence of sequences and series of functions. Additionally, it provides a detailed exploration of power series, studying their radii of convergence, properties, and their relation to analytic functions. Complex analysis is also introduced, offering a study of functions of a complex variable, which holds great importance in various applications of engineering. Finally, the course addresses Fourier series, which are used to represent periodic functions through linear combinations of sine and cosine functions. This in-depth knowledge prepares students to engage with more advanced concepts in applied mathematics, physics, engineering, and other related disciplines.
Prerequisite: Analysis 1 (020AA1NI2).

020ALBNI3 Bilinear Algebra and Geometry 6 Cr.

This course provides students with a solid understanding of fundamental concepts, including the reduction of endomorphisms, pre-Hilbert spaces and endomorphisms of Euclidean spaces. Throughout this course, students will develop proficiency in techniques for reducing matrices and endomorphisms, along with their practical applications such as calculating matrix powers, solving linear recurrent sequence systems and utilizing linear recurrent sequences to compute the matrix exponential. Additionally, the course examines pre-Hilbert spaces, placing emphasis on key notions such as the inner product, orthogonality and orthogonal projections. Students will learn how to apply these concepts in solving problems related to orthonormalization. Furthermore, the course covers the study of planar isometries, encompassing translations, rotations and reflections, as well as isometries in space. By engaging with these topics, students will acquire a strong foundation in bilinear algebra and the necessary skills to apply these concepts effectively in practical situations.
Prerequisite: Linear Algebra (020ALNNI2).

020BIMNI4 Building Information Modeling 2 Cr.

This course familiarizes students with the concept and principles of BIM, as well as its impact on the construction industry through the use of Revit Structure (Autodesk) software. It introduces them to the modeling of reinforced concrete or steel buildings through exercises and practical examples, guiding them toward creating a complete 3D model of a building. The course content is divided into several sections, including an introduction to Revit (graphical interface, family concepts, types, instances, construction levels and axes, views), a practical application

of Revit (covering columns, foundations, walls, collaboration in Revit, slabs, beams, stairs, ramps, and developing a BIM model from a DWG drawing), as well as specific aspects such as reinforced concrete reinforcement and quantity takeoffs.

020DAINI4 Computer Assisted Drawing 4 Cr.

This course equips students with the skills to proficiently utilize Autodesk's AutoCAD software. Throughout the course, students will actively engage in hands-on exercises focused on civil drawings, structural elements, rebar placement, and the layout of apartments and building sections. The course structure is designed to progressively guide students through key concepts, beginning with an introduction to Computer-Aided Design (CAD), covering the graphical interface, and essential commands such as Line, Erase, Copy, Move, and Rotate. The aim of this course is to provide students with a solid foundation in using AutoCAD, a widely adopted software within the civil engineering community. This knowledge empowers them to effectively contribute to the field by producing accurate and professional engineering drawings.

020CDFNI4 Differential Calculus 6 Cr.

This course is an in-depth exploration of differential equations and systems of ODEs. Fundamental concepts such as vector norms, subspaces, bases, and open and closed balls are thoroughly detailed. Then, students will explore the notions of convergence and equivalence between norms. The course also covers Topology by introducing fundamental concepts such as open and closed sets, adherent points, interior and boundary points. Then, a significant portion of the course is devoted to studying functions of several variables to explore concepts such as extrema and implicit functions. Finally, students will learn how to calculate double and triple integrals using various methods such as Cartesian, polar, and cylindrical coordinates. The concepts and techniques studied in this course are essential for developing advanced analytical skills and solving complex mathematical problems.
Prerequisite: General Analysis (020ANGNI1).

020MADNI1 Discrete Mathematics 6 Cr.

This course covers the following: Propositional logic - Mathematical reasoning - Sets - Relations - Natural numbers, induction - Applications - Algebraic calculation - Binomial coefficient and Pascal triangle - Polynomials – Arithmetic.

020GSCNI1 Engineering at the Service of the Community 2 Cr.

This course aims to explore the role of engineers in modern society, with a particular focus on innovation, renewable energies, green buildings, design, food security, recycling, and other areas relevant to our daily lives. Students will learn how engineers can leverage their technical skills, knowledge, and tools to address and solve social and environmental challenges through engineering.

020CIFNI4 Fluid Kinematics 2 Cr.

This course introduces the fundamental principles of fluid kinematics. It explores the motion and deformation of fluids without focusing on the forces that produce them. Topics covered include mathematical descriptions of fluid motion, streamlines, particle trajectories, velocity fields, deformation, and potential flows. The course emphasizes the understanding of kinematic concepts and their application in the analysis of fluid flows.
Prerequisite: Hydrostatics (020STFNI2).

020ANGNI1 General Analysis 6 Cr.

This course covers the fundamental concepts of analysis, including limits, continuity, differentiation, sequences, sets of numbers, and differential equations. Its objective is to equip students with the necessary skills to effectively calculate limits, perform differentiation and solve linear differential equations of both first and second order. In addition, this course allows the development of mathematical reasoning skills. Students will learn to formulate coherent arguments, justify calculation steps and prove mathematical results. By the end of this course, students will have gained a solid foundation in analysis enabling them to pursue more advanced courses in mathematics, physics, and engineering.

020GELNI4 Geology 2 Cr.

This course aims to introduce fundamental concepts of geology. It focuses on structural geology, stratigraphy, and petrography. It covers brittle and ductile deformation and explains the behavior of material under different kinds of stress, whether extensive or compressional. It also presents the different types of rocks, their genesis contexts, their physical properties and their organoleptic classification.

020CHGNI1 General Chemistry 4 Cr.

This course allows students to master acid-base balances, the preponderant reaction method, and the calculation of pH in the final state of chemical equilibrium as well as pH-metric titrations. In addition, notions about oxidants and reductants, the electrochemical cell, the type of electrodes, the calculation of the electromotive force and the capacity of the cell, the potential of the electrode through the Nernst equation as well as titration by oxidation-reduction reaction are covered. Students will also learn the concept of heterogeneous equilibrium in an aqueous solution, the effect of the common ion and of complexation on solubility, complexation reactions and the influence of pH on solubility. Finally, this course allows students to analyze potential-pH diagrams through examples along vertical and horizontal lines.

020STFNI2 Hydrostatics 2 Cr.

This course introduces the fundamental principles and concepts of fluid statics. It explores the behavior of fluids at rest and focuses on the study of forces and pressures exerted by fluids on immersed surfaces. Topics covered include hydrostatic pressure, buoyancy, hydrostatic forces on submerged surfaces, stability of floating and submerged bodies, and fluid statics applications. The course emphasizes problem-solving techniques, practical applications, and the development of critical thinking skills in the context of fluid statics.

020PIINI4 Introduction to Engineering Projects 2 Cr.

This course aims to instill a sense of responsibility in students, akin to that of researchers and engineers, by introducing and cultivating their skills in the scientific research process. It also seeks to integrate scientific and technological research endeavors and facilitate the development of conceptual and tangible components that actively contribute to the continuous process of knowledge creation, spanning from ideation to design and, in some cases, realization.

020ALNNI2 Linear Algebra 8 Cr.

This course enables students to manipulate complex numbers and explore their properties to perform calculations and solve equations. They will develop an understanding of geometric transformations such as translations, rotations and homothety. This course introduces students to vector spaces and helps them understand concepts like linear independence, basis, and dimension. Linear transformations and matrices play a central role in this course. Students will examine the properties of linear transformations by learning how to find the kernel and image of these transformations and identify endomorphisms, automorphisms and isomorphisms. They will also learn to represent these transformations using matrices. Additionally, students will master the computation of determinants, which play a key role in the study of linear systems and their solutions. By acquiring this knowledge and these skills, students will be able to solve real-world problems and apply their knowledge in fields such as science, engineering, and computer science.

020MATNI4 MATLAB 2 Cr.

This course covers various key aspects of MATLAB and Simulink, with a particular focus on symbolic computation in calculus and algebra, matrix calculations, programming, and an introduction to Simulink. Students will have the opportunity to explore the advanced features of MATLAB in depth, with an emphasis on its application in different engineering fields. Symbolic calculus and algebra enable students to manipulate complex mathematical expressions, simplify equations, compute derivatives and integrals, and solve systems of symbolic equations. Students will learn to manipulate matrices and vectors and perform essential matrix operations. Additionally, the course covers practical aspects of MATLAB programming, teaching students how to write custom scripts and functions. Furthermore, the course provides an introduction to Simulink, MATLAB's graphical environment dedicated to modeling and simulating dynamic systems. In summary, this course provides students with a comprehensive understanding of MATLAB and Simulink, emphasizing their application in engineering. Topics include symbolic algebra, matrix calculations, essential programming skills in MATLAB, and an introduction to Simulink for modeling and simulating dynamic systems.

Prerequisites: General Analysis (020ANGNI1) - Programming 1 (020IF1NI2).

020MC1NI1 Mechanics 1 6 Cr.

This course studies particle mechanics, a branch of physics that analyzes the motion of objects as dimensionless mass points. This course simplifies physical systems by ignoring object dimensions and internal structure, focusing only on mass and position in space. This course applies Newton's laws to describe the relationship between applied forces, mass, and motion. This course enables students to analyze particle motion based on forces, mass, and initial conditions, providing a foundation for advanced concepts in classical mechanics, including kinematics, dynamics, laws of motion, and energy.

020MC2NI3 Mechanics 2 4 Cr.

This course studies solid mechanics, a branch of mechanics that examines the motion and equilibrium of objects considered as rigid bodies. This course covers the laws of mechanics for systems, focusing on solids, and shows how to determine the center of mass and study translational and rotational motion around a fixed axis. This course provides the definition of force systems and derived laws, allowing students to apply static, dynamic, and energetic principles to solve complex mechanical problems.
Prerequisite: Mechanics 1 (020MC1NI1).

020SPHNI1 Physical Signals 6 Cr.

This course enables students to understand the core principles pertaining to linear circuits and signal propagation. Throughout the course, students will delve into key concepts such as harmonic oscillators, progressive waves, interference, the fundamental laws of electrokinetics, complex notations, impedances and admittances, as well as linear filters. By the end of the course, students will possess the essential knowledge and skills required to effectively analyze and resolve challenges within these domains.

020PP1NI2 Physics Laboratory 1 2 Cr.

This practical work course is designed to bridge the gap between theoretical knowledge and practical application in the field of electrical engineering and physics. Throughout the course, students will engage in hands-on activities to gain a deeper understanding of various concepts. The key topics covered include resonance in RLC circuits, system analysis, circuit measurements, mechanics and motion, LabVIEW software, fields and characteristics, oscilloscope applications, single-degree-of-freedom oscillator, focal measurement, and optical systems. Overall, this practical work course is designed to equip students with the necessary skills to apply theoretical knowledge in real-world scenarios, fostering a comprehensive understanding of electrical engineering and physics concepts.

020PP2NI3 Physics Laboratory 2 2 Cr.

This course allows students to reinforce their theoretical knowledge through practical applications across a variety of topics. They will have the opportunity to explore areas such as electrical circuits, linear filters, Fourier analysis, frequency analysis, the Thomson tube, thermal conduction, the Stefan-Boltzmann law, the oscillator with two degrees of freedom, diffraction and interference, as well as polarization.
Prerequisite: Physics Laboratory 1 (020PP1NI2).

020PRBNI4 Probability 4 Cr.

This course enables students to develop an understanding of the probability theory. It is designed to equip students with the necessary skills to effectively calculate probabilities. Throughout this course, students are introduced to various aspects of probability, beginning with combinatorics. They will learn techniques such as combinations, permutations and arrangements. Furthermore, they will explore concepts that enhance the understanding and manipulation of probabilities on a countable set. This includes the monotone convergence theorem, Boole's inequality, conditioning, compound probabilities, total probabilities and Bayes' formula. Additionally, the course emphasizes the study of discrete random variables, enabling students to model and analyze random phenomena using probability distributions. Finally, students will explore continuous random variables, with a focus on an extensive examination of cumulative distribution functions, expectation and variance.
Prerequisite: Analysis 1 (020AA1NI2).

020IF1NI2 **Programming 1** **4 Cr.**

This course introduces the universal computer and the basic concepts of high-level programming using Python. Topics include: computer hardware components, algorithms, programming languages, Python and the IDLE environment, variables, arithmetic expressions and operators, primitive data types, data input and output, built-in composite data types, simple statements, control statements, logical expressions, relational and logical operators, function definition and call, functions from external modules.

020IF2NI3 **Programming 2** **4 Cr.**

This course allows the students to acquire advanced concepts of structured programming in Python. It also covers the basic concepts of object-oriented programming and their application to data abstraction and encapsulation by introducing the concepts of object instantiation, member visibility, inheritance, and polymorphism. Students will also learn how to create an ergonomic standalone graphical user interface using the standard tkinter library.
Prerequisite: Programming 1 (020IF1NI2).

020STANI4 **Statics** **2 Cr.**

This course introduces the principles and methods used to solve engineering problems, building on prior knowledge in mathematics and physics. It focuses on the modeling and analysis of static equilibrium problems, with an emphasis on real-world engineering applications and problem-solving. The course examines methods for quantifying forces between bodies and defining conditions of equilibrium. It also explores how forces maintain balance, induce motion, or cause deformation, all of which are critical to the functionality of structures and mechanical systems. Statics serves as a foundational prerequisite for several engineering disciplines, particularly civil and mechanical engineering, which study the effects and consequences of forces.
Prerequisite: Mechanics 1 (020MC1NI1).

020CMTNI1 **Supplemental Mathematics** **2 Cr.**

This course equips students with the necessary skills to solve elementary mathematical problems. They will learn key concepts such as composite and inverse functions, numerical sequences, circular functions, as well as definite and indefinite integrals. By studying composite and inverse functions, students will comprehend the relationships between different functions and learn to decompose and reconstruct more complex functions. Additionally, this course introduces numerical sequences, particularly arithmetic and geometric sequences. Another essential component of this course is the study of basic trigonometric functions: sine, cosine, and tangent. Finally, this course covers definite and indefinite integrals by exploring their properties, the technique of integration by parts, the substitution method, and a fundamental application: calculating areas.

020TH1NI2 **Thermodynamics 1** **4 Cr.**

This course enables students to master the key concepts of thermodynamics. It begins with an introduction to the different states of matter and scales of study. It then explores the state of a thermodynamic system, equations of state, and internal energy. Transformations of a thermodynamic system and the first law of thermodynamics are also studied, with a focus on pressure forces and heat transfers. The second law of thermodynamics and the concept of entropy are introduced, along with their applications. The course also covers the thermodynamic study of phase transitions.

020TH2NI3 **Thermodynamics 2** **4 Cr.**

This course enables students to master and apply the concepts and fundamental principles of thermodynamics. Indeed, energy in all its forms is studied in various machines, such as turbojets for aerospace and naval propulsion, gas or steam turbines, thermal power plants, and refrigeration systems. Special attention is then given to heat transfer problems. Students will become familiar with partial differential equations and learn to manipulate the famous heat diffusion equation with or without a source term in Cartesian or cylindrical geometry.
Prerequisite: Thermodynamics 1 (020TH1NI2).

020TOGNI4 **Topography** **2 Cr.**

This course introduces surveying, covering topics such as geodesy and cartography, levelling, the use of measuring instruments, creation of topographic plans, profiles, and volume calculations, setting out techniques, and preparation of surveying base plans and official document folders.

064VALEL1 USJ Values in Daily Life 2 Cr.

This course aims to raise students' awareness of the fundamental values of the Saint Joseph University of Beirut (USJ) in order to apply them in their personal, interpersonal, and professional lives. It engages them in critical reflection on how the values outlined in the USJ Charter can influence their behaviors, actions, and decisions to meet the challenges of the contemporary world. They will also be aware of global issues and ethical responsibilities, ready to contribute positively to the construction of a better society.

020PHONI3 Wave Physics 4 Cr.

This course explains the fundamental principles of sinusoidal waves, their propagation, and their significance in various applications. It covers essential concepts related to transverse mechanical waves through the study of progressive and standing waves on a string. The course further explores longitudinal mechanical waves, specifically focusing on sound waves in a tube and their behavior at points of discontinuity. Additionally, students will engage in a comprehensive study of electromagnetic waves, including an examination of Maxwell's equations, with a particular emphasis on progressive plane waves in a vacuum. Furthermore, the course introduces students to seismic waves and their various types.
Prerequisite: Physical Signals (020SPHNI1).

Bachelor of Engineering in Civil Engineering

020ACIGS3 American Code of Reinforced Concrete 4 Cr.

This course focuses on the design of reinforced concrete structures according to the American Concrete Institute (ACI) code. Topics covered include: Introduction to ACI - Comparison between European and American codes - Pure tension - Pure compression - Pure bending - Bending plus compression or tension - Shear and torsion.

020LOGGS5 Applied Hydraulics Software 2 Cr.

This course introduces students to the hydraulic aspects and techniques of designing a hydraulic structure. Students will apply theoretical, topographical, hydrological and hydraulic principles in the dimensioning of specific hydraulic structures. Topics covered include: Basic hydraulic principles - Basic hydrology - Culvert hydraulics – Surface water modeling and flood routing using HEC-RAS.

435LALAL2 Arabic Language and Arts 2 Cr.

This course offers a gradual immersion into the Arabic language and culture, enabling students to develop essential language skills while exploring a range of cultural topics.
Specific objectives:
- Explore diverse forms of Arabic artistic expression.
- Understand the significance of art within Arab culture and identity.

435LALML2 Arabic Language and Media 2 Cr.

This course offers a gradual immersion into the Arabic language and culture, enabling students to develop essential language skills while exploring a range of cultural topics.
Specific objectives:
- Understand the Arab media landscape and analyze its role in contemporary society.
- Develop critical media analysis skills in Arabic.

435LRCTL2 Arabic Language: Contemporary Novel, Cinema, and Theater 2 Cr.

This course offers a gradual immersion into the Arabic language and culture, enabling students to develop essential language skills while exploring a range of cultural topics.
Specific objectives:
- Deepen knowledge of major Arabic literary and cinematic works.

- Develop critical analysis and debating skills in Arabic.

020PARGS1 Architectural Project 4 Cr.

This course explains how to conceptualize, design and interpret an architectural project. Topics covered 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.
Prerequisite: Computer Assisted Drawing (020DAINI4).

020IAGGS4 Artificial Intelligence in Civil Engineering 2 Cr.

This course introduces students to machine learning and artificial intelligence, with a focus on deep learning techniques. Topics covered include: Decision Trees - Multilayer Dense Deep Neural Networks - Convolutional Networks - Transformers - Automatic Natural Language Processing - AI Threats - Pytorch.

020ACBGS5 Building Acoustics 2 Cr.

This course covers sound transmission problems in buildings to enhance quality of life by meeting acoustic comfort standards. Current European regulations are applied to assess and define the acoustic performance of buildings based on their purpose and environmental exposure. Topics covered include: General acoustic concepts - Receiver - Acoustic requirements - Acoustic room correction - Airborne sound insulation - Impact sound insulation - Equipment noise isolation - Acoustic studies.

020OSBGS4 Buildings and Frames 4 Cr.

This course examines the design and dimensioning of the elements of a reinforced concrete building. Topics covered 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).
Prerequisite: Reinforced Concrete (020BEAGS3).

020GEFGS3 Buildings Finance Management 2 Cr.

This course shows 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 is about improving the profitability of the company while controlling its risk. Topics covered 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).

020SEIGS5 Building Fire Safety 2 Cr.

This course covers fire safety in buildings of different types and occupational sizes. Topics covered 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.).

020RESGS4 Building Lighting and Sanitary 4 Cr.

This course provides students with a theoretical and practical overview of the different systems and sanitary facilities. Topics covered 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.

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 covered 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.

020CTHGS4 Building Thermal Design 2 Cr.

This course covers all the necessary elements to achieve thermal building design while ensuring the maximum comfort to the user. Topics covered 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.
Prerequisite: Environment and Sustainable Development (020ENVGS1).

020WRNGS1 Communication and Work Ready Now 2 Cr.

This course provides students with the foundational "soft skills", communication skills, and work-based learning experiences to prepare them for success in the workplace. It is designed to facilitate participatory, hands-on teaching and learning. Students will be actively engaged in the learning process and provided opportunities to practice and enhance new skills and gain the self-confidence necessary to secure and maintain work related to their professional goals. Work-based learning activities are woven into the course and will require students to go to real workplaces in the community outside of class time. Students will be guided to use free online digital tools to demonstrate their learning. Throughout the course, students will create a career portfolio that will help them on their experiential Work Ready Now journey from student to employee.

020MACGS1 Construction Materials 6 Cr.

This course introduces themes that provide a general view of the different categories of engineering materials, their behavior, and teaches students the properties and fields of use of materials in civil engineering. Topics covered 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.
Prerequisite: General Chemistry (020CHGNI1 or 020CHGCI1).

020MMDGS1 Continuum Mechanics 4 Cr.

This course equips students with the basic tools to describe and model solid and fluid material environments. It provides the essential background needed for specialized courses such as mechanics of materials, fluid mechanics, reinforced concrete, soil and rock mechanics and rheology of materials. Topics covered 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.
Prerequisite: Statics (020STANI4 or 020STACI4).

020BAGGS5 Dams 4 Cr.

This course provides an analysis of the elements to be considered for the selection and sizing of different types of dams and their appurtenant structures, and compares different solutions technically, economically and environmentally. Topics covered 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.

020MEAGS5 Data Measurement and Acquisition 2 Cr.

This course aims to provide an understanding of the operation and use of water-related measurement devices and their associated sensors and electronics. It covers the analysis of the measurement ranges and conditions of use, as well as the supports necessary for data collection. The course also addresses the estimation of measurement precision, data processing, and transformation to present results in units relevant to the measured quantities. Students will learn to design a system and measurement protocol, define criteria for selecting measuring equipment, and explore apparatus typically used for pressurized flows. Topics covered 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.

020COSGS5 Design of Buildings Structures 4 Cr.

This course focuses on the design of structures, an essential phase prior to any calculation. It aims to teach students the techniques of design and analysis of real structures. Topics covered 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). **Prerequisite:** Buildings and Frames (020OSBGS4).

020GEIGS4 Engineering Geology 2 Cr.

This course covers an applied geology discipline involving the collection, analysis, and interpretation of geological data necessary for the safe development of civil works. Engineering geology also includes the assessment and mitigation of geologic hazards such as earthquakes, landslides, and flooding; the assessment of timber harvesting impacts; and groundwater remediation and resources.

020ANGGS4 English 4 Cr.

This course is designed to develop critical thinking, reading, oral and written expression. It focuses on synthesizing sources to produce a research paper and defending it before an audience. Emphasis is placed on analytical reading of different types of texts required in disciplines as well as on synthesizing from various sources to produce a written text and present it orally.

020ENVGS1 Environment and Sustainable Development 2 Cr.

This course provides a comprehensive overview of environment and sustainable development, enabling students to assess and analyze major environmental and development challenges facing humanity, and to suggest practical and concrete solutions. Topics covered include: State of the Environment - Demography - Mineral Resources - Energy Resources - Water - Solid Waste Treatment - Air Pollution - The Greenhouse Effects - The Ozone Layer.

020IMPGS4 Environmental Impact Assessment 2 Cr.

This course introduces environmental impact assessment (EIA) of projects as a main tool for applying the principle of prevention in the protection of the environment. Topics covered include: General introduction; Overview of the EIA process - Policy, legal and administrative framework; Introduction to course project.

020DREGS3 Environmental Law 2 Cr.

This course familiarizes students with the main environmental, ecological and water scarcity problems as well as the main regulations and laws established to address them. Topics covered 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.

020ETHGS1 Ethics and Engineering 4 Cr.

This course aims to teach students the principles of engineering ethics and the relationship between engineers, as well as their relationship with the order of engineers. Topics covered 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.

020PBAGS6 Final Year Project 16 Cr.

This course enables students enrolled in the Buildings and Engineering Management concentration to apply their previously acquired knowledge for the study of a real civil engineering project, providing a complete study of a civil engineering work.

020PEAGS6 Final Year Project 16 Cr.

This course enables students enrolled in the Water and Environment concentration to apply their previously acquired knowledge for the study of a real civil engineering project, providing a complete study of a civil engineering work.

020PTPGS6 Final Year Project 16 Cr.

This course enables students enrolled in the Public Works and Transportation concentration to apply their previously acquired knowledge for the study of a real civil engineering project, providing a complete study of a civil engineering work.

020EFIGS4 Finite Elements 4 Cr.

This course aims to practice finite element methods through concrete examples of heat transfer, material strength, and elasticity theory. It provides the necessary elements for students to develop their technical skills and interact effectively with various software. Topics covered include: General information on the finite element method (FEM) - Strong formulation in structural mechanics and heat transfer - Integral or variational formulation - Methods of discretization of the integral form - Discretization by finite elements - Rod element in tension or compression – Bernouilli beam element - Bar elements in thermal transfer - Isoparametric formulation and numerical integration - Two-dimensional finite elements in plane elasticity and thermal transfer - Reference elements and isoparametric formulation - Numerical integration in two dimensions.
Prerequisite: Numerical Analysis (020ANNGS1).

020MEFGS2 Fluid Mechanics 6 Cr.

This course introduces students to the basic principles of fluid statics and dynamics. Topics covered 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) or Introduction to Fluid Mechanics (020IMFCI4) and Analysis 2

(020AN2NI4 or 020AN2CI3).

020FOSGS3 Foundation Engineering 6 Cr.

This course introduces students to the calculation methods and rules of the art in the field of design and construction of foundations and retaining structures. Topics covered include: 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 active and passive pressures, and apply them to the calculation of retaining walls and different types of walls. Excavations and Groundwater Control. Deep Foundations. Design the piles. Geotechnical Design.
Prerequisite: Soil and Rock Mechanics (020MESGS2).

020CGAGS1 General and Analytical Accounting 2 Cr.

This course familiarizes students with the different accounting documents, enabling them to establish the profit and loss accounts and the balance sheets. Moreover, they will determine the breakeven point as well as the distribution of expenses into fixed and variable categories. They will be able to draw up projected budgets and analyze the gaps with actual results. Finally, students will have in-depth knowledge of the different external stakeholders in the life of the company. Topics covered include: 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, ...).

020PGCGS2 General Construction Procedures 4 Cr.

This course covers the main problems related to the execution of building construction projects. Topics covered 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.

020ECGGS1 General Economics 2 Cr.

This course aims to provide students with the necessary notions of microeconomics, focusing on the branch of the economy that analyzes economic behavior at the level of individual entities such as a consumer or a company.

020GISGS3 Geographic Information Systems 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: 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.

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 covered include: Introduction - Darcy's law - Groundwater flow - Groundwater flow modeling - Field drilling methods - Pumping well hydraulics - Pollutant transport - Case study.

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 considered through various optimization methods. Topics covered include: Steady-State and Pressurized Networks – Turbomachines – Free surface flow - Unsteady Network Conditions in Pressurized Pipes - Network protection from water hammer effects - Network Economic Study and Optimization - Laboratory Experiments.
Prerequisite: Fluid Mechanics (020MEFGS2).

020HYDGS5 Hydrology 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 covered include: Introduction to climatology and hydrology - Principles of Meteorology – Hydrologic Measurements – Rainfall Analysis – Watershed Delineation – Infiltration – Evaporation and Transpiration - Hydrographs – Flood Routing – Short Overview on Modeling.
Prerequisite: Hydraulics (020HYDGS3).

020INDGS4 Industrial Construction 2 Cr.

The course consists of an interactive platform where the participation of students is continuous. It is enriched with examples supported by recent and less recent photos, short films and presentations, which reinforce theoretical notions already acquired. It also introduces a new dimension to the student engineer's approach to designing and executing a construction. Topics covered 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 prevent collapse during an explosion in a prefabricated building - 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 building industry component: plasterboard, which revolutionized partition design.

020IRRGS4 Irrigation 2 Cr.

This course aims to teach students about the importance of irrigation, plant behavior and irrigation practices. Topics covered 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.

020HKAGS5 Karst Hydrogeology 2 Cr.

This course is about karst nomenclature and definitions, basic concepts for understanding karst development and related groundwater flows. Topics covered include: Introduction to methods in karst hydrogeology and geotechnical problems related to karst - 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.

020MOGGS5 Market Globalization 2 Cr.

This course is divided into two parts and is intended for non-managers. It introduces basics of negotiation, especially through practical case studies and role plays to allow students to better understand the subtleties and problems they will face in their professional lives. Topics covered 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.

020OUMGS5 Maritime Structures 2 Cr.

This course equips students with the basic elements to assess and analyze the seawater effects on the constituent elements of a port or a maritime structure. Topics covered 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; Wreck removal.
Prerequisite: Foundation Engineering (020FOSGS3).

020PBAGS4 Multidisciplinary Project: Building Design, Foundations and Structures 6 Cr.

This course covers the design of foundations and structural elements of reinforced concrete building. Topics covered include: Calculation of the foundations of a building - Calculation of the structure and dimensioning of the structural elements of reinforced concrete buildings.
Prerequisites: Reinforced Concrete (020BEAGS3) and Architecture Project (020PARGS1).

020ANNGS1 Numerical Analysis 4 Cr.

This course aims at providing students with the numerical tools and computational techniques to solve the equations and models encountered in the field of Civil Engineering. Topics covered 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: Analysis 2 (020AN2NI4 or 020AN2CI3), and Bilinear Algebra and Geometry (020ALBNI3) or Algebra 2 (020AL2CI3).

020PLGGS5 Planning and Management of Large-Scale Projects 4 Cr.

This course aims to introduce students to the concepts of project management, the contents of the contractual management documents, as well as the methodology for preparing a complete set of tender documents. Topics covered 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.

020PLCGS5 Plates and Shells 4 Cr.

This course covers the theoretical elements needed to pre-dimension and analyze structural elements such as slabs, walls, roof, tanks and folded structures. Topics covered 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.
Prerequisite: Structures (020STRGS4).

020BPRGS5 Prestressed Concrete in Buildings 2 Cr.

This course covers the basic principles of the behavior of prestressed concrete structures with a focus on building applications. Topics covered include: Definition - Concept - History - Advantages - Materials (Concrete, Steels) - Processes and systems – Pre-stressing losses - Principles of calculation.
Prerequisite: Reinforced Concrete (020BEAGS3).

020BEPGS5 Prestressed Concrete 4 Cr.

This course provides the necessary elements to understand and design the prestressed concrete structure. Topics covered 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 characteristics and behavior - Composite beams design - Hyperstatical system: Continuous beams and post-tensioning bridges exercises.
Prerequisite: Reinforced Concrete (020BEAGS3).

020PECGS4 Protection and Aesthetics of Buildings 2 Cr.

This course addresses the protection and aesthetic aspects of constructions, especially paints, sealing problems, and more. Topics covered 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 ...).

020QUAGS3 Quality Management in Buildings 2 Cr.

This course introduces students to quality in management systems and particularly in the field of construction where risk, safety and economic issues are important. Topics covered 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 quality improvements in the construction industry - Prevention and correction - Building pathologies - Practical examples - Real cases.

020COCGS5 Rehabilitation and Design of Concrete Bridges 4 Cr.

The course provides the necessary information for designing the various types of bridges. It examines the causes of disorders of existing bridges and the techniques used for their repair and reinforcement. Topics covered 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.
Prerequisite: Structures (020STRGS4).

020REMGS5 Rehabilitation and Maintenance of Concrete Structures 4 Cr.

This course provides the necessary knowledge for the establishment of a rehabilitation operation or transformation of the building structure through various investigation and consolidation processes with the development of cases of completed projects. Topics covered 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.

020BEAGS3 Reinforced Concrete 6 Cr.

This course consists of dimensioning reinforced concrete structural elements according to BAEL and Eurocode 2. Topics covered 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.
Prerequisite: Strength of Materials (020RDMGS2).

020ROUGS4 Road and Pavement Engineering 4 Cr.

This course explains how to design a road and its roadways. Topics covered include: Vehicle movement - Plan drawing - Longitudinal profile - Cross section - Road equipment - Safety devices - Signing - Night traffic, lighting - Drainage devices, drainage - City roads - Crossroads - Calculation of curvatures - 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.

020RCGGS5 Shear Strength and Geohazards 4 Cr.

This course enables students to: Understand influencing 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.
Prerequisite: Foundation Engineering (020FOSGS3).

020MESGS2 Soil and Rock Mechanics 6 Cr.

This course enables students to: Understand the behavior of the soil material. Identify the physical, mineralogical, and chemical properties of the porous medium. Understand the theory of soil compaction. Introduce the notions of pore 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.
Prerequisite: Geology (020GELNI4 or 020GELCI4).

020DESGS5 Solid Waste Management 2 Cr.

This course addresses municipal solid waste problems and treatment methods. Topics covered 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.

020OSPGS5 Special Topics in Concrete 2 Cr.

This course covers 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.
Prerequisite: Reinforced Concrete (020BEAGS3).

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 covered include: Statistical analysis of hydrological data - Graphical representation of data - Extreme values of a variable -Correlation analysis - Simple regression and multiple regression - Statistical tests in hydrology - Statistical study of rainfall - Frequency analysis - Example of statistical model in hydrology.
Prerequisite: Statistics (020STAGS2).

020STAGS2 Statistics 4 Cr.

This course introduces students to basic statistics. Topics covered include: Central limit theorem - sampling distributions - properties 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: Probability (020PRBNI4) or Algebra 3 (020AL3CI4).

020CMMGS3 Steel Structures 6 Cr.

This course explains how metallic and mixed construction are among 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 covered include: General overview- Components of a metal building structure - Poles - Frames 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 roof failure. Calculation of rails - Calculation of joints; bolting, welding - Study of bracing - Study of an industrial building or a residential building.
Prerequisite: Strength of Materials (020RDMGS2).

020RDMGS2 Strength of Materials 6 Cr.

This course enables students to understand the behavioral law of the materials, calculate and analyze the characteristics of the cross sections, as well as distribute internal forces 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.
Prerequisite: Continuum Mechanics (020MMDGS1).

020DYSGS5 Structural Dynamics and Earthquake Engineering 4 Cr.

This course equips students with the necessary elements to understand the dynamics of the structures and size them to withstand earthquakes according to the PS92 regulation. Topics covered 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.
Prerequisite: Waves Physics (020PHONI3).

020STRGS4 Structures 6 Cr.

This course covers structural forms; influence lines; effects of temperature loads on structures, analysis of arches, trusses, continuous beams, 2D frames, grids and 3D frames. Topics covered 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.
Prerequisite: Strength of Materials (020RDMGS2).

020PLSGS4 Structures Plastic Behavior 2 Cr.

This course equips students with the basic elements of plasticity, currently used in the new calculation codes in civil engineering. Topics covered include: Generalities on plasticity calculation and plasticity criteria, Plastic traction and Compression, Plane plastic bending and notion of plastic hinge, Plastic resistance of sections in the presence of interaction between the internal forces - Calculation of the collapse load of statically indeterminate structures: Using the step-by-step method, Using theorems of limit analysis.
Prerequisite: 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 covered include: Introduction - Verification by the partial factor method - Serviceability and Ultimate limit states - Classification of Actions - Combination of Actions - Snow load - Wind load.

020LOCGS5 Structural Software 2 Cr.

This course presents the modeling and calculation of structures by finite elements using software: Robot Autodesk, ETABS, SAFE, CSI bridge. Topics covered include: Study of plane and spatial portal frames, Study of plates and shells, Study of a bridge, Seismic analysis of a building founded on a general raft.

020STEGS5 Summer Internship 4 Cr.

This internship enables students to undertake their first work experience in a professional environment, namely design offices and construction sites. This internship lasts 8 weeks.

020STOGS1 Surveying 2 Cr.

This course covers the use of topographic material for field surveys, and the operation of topographic equipment: tachometer, theodolite, level, prism square, workstation.
Prerequisite: Topography (020TOGNI4).

020TRAGS3 Traffic Engineering 2 Cr.

This course enables students to study and analyze the road traffic of a region, and the different elements and functions of a road or highway. Topics covered include: The different elements and functions of a road or highway - Road traffic - Transport demand and supply - Economic and institutional context - Comparison of modes of transport - Priority to public transport in large cities - Environmental impacts.

020AERGS3 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 where a civil engineer can intervene for better operations, either at the level of airport platforms or within airline companies. By the end of this course, students will be able to size an aerodrome or undertaking its execution. On the other hand, they will also be familiar with aviation operations. Topics covered 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.

020AVTGS4 Urban and Landscape Planning 2 Cr.

This course covers urban planning rules.

020ASSGS4 Urban Drainage 2 Cr.

This course covers the design of urban sanitation networks. Topics covered include: Survey of urban planning (Topographic - Cadastral - Geological - Climatic) - Rainwater (Watershed - Statistical study of precipitation - Impoundment, Storm weirs) - Charts and formulas - Wastewater (Analysis - Curve of flow, tips - Evacuation: study of networks - Longitudinal profiles - Drawing in plan - Obstacles - Structures) - Symbols, Written documents.
Prerequisite: Hydraulics (020HYDGS3).

020GEPGS5 Water and Wastewater Treatment 4 Cr.

This course examines the methods of water and wastewater treatment. Topics covered 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 - Wastewater treatment streams – Typical treatment plants.

020DEAGS3 Water Distribution Networks 4 Cr.

This course introduces the water management process, focusing on the relationship between natural water and water treatment. It provides essential information for modeling, dimensioning, scenario simulation and the choice of equipment needed to provide citizens with sufficient water and adequate pressure. Topics covered 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