BACHELOR IN PHYSICS

Main Language of Instruction:
French ☑ English ○ Arabic ○

Campus Where The Program Is Offered: CST

OBJECTIVES

The Bachelor in Physics offered by the Faculty of Science at USJ provides general training in physics, covering theoretical, experimental, and numerical aspects, both fundamental and applied. By the end of this program, students will be able to:

- Pursue further studies at the Master's level in a coherent physics-related program.
- Advance in their scientific careers at local, regional, and international levels.
- Become decision-makers, innovators, advisors, and leaders in their careers as physicists.

PROGRAM LEARNING OUTCOMES (COMPETENCIES)

- Identify, formulate, and solve complex physics problems by applying fundamental physical principles and using appropriate mathematical and numerical methods.
- Conduct experiments in the fields of physics and electronics, analyze and interpret data, and use scientific judgment to draw conclusions.
- Communicate complex information related to physical sciences.

PROGRAM REQUIREMENTS

180 credits: Required courses (146 credits), Institution's elective courses (28 credits), Open elective courses (6 credits) and USJ General Education Program (32 credits - may be part of the above categories).

Fundamental Courses (174 Cr.)
Required courses (146 Cr.)
Linear Algebra: Matrix Calculations (2 Cr.). Algorithm (6 Cr.). Vector Calculus (6 Cr.). English Level A (4 Cr.). Calculus I (4 Cr.). Biophysics (4 Cr.). Probability Computation (4 Cr.). Numerical Calculus: MATLAB (2 Cr.). General Chemistry I (6 Cr.). Calculus II (2 Cr.). Electromagnetism (4 Cr.). Fundamental Electronics (6 Cr.). Electrostatics and Electrodynamics (4 Cr.). Functions (4 Cr.). Introduction to Electronics (4 Cr.). Physics Instrumentation (4 Cr.). Introduction to Medical Physics (4 Cr.). USJ Values in Daily Life (2 Cr.). Symbolic Computing Software: Maple (2 Cr.). Magnetostatics (4 Cr.). Mathematics for Physicists (6 Cr.). Analytical Mechanics (4 Cr.). Classical Mechanics (4 Cr.). Advanced Classical Mechanics (2 Cr.). Fluid Mechanics (4 Cr.). Quantum Mechanics (4 Cr.). Mathematical Methods for Physicists (6 Cr.). Waves and Wave Optics (6 Cr.). Physics of Matter (6 Cr.). Modern Physics (6 Cr.). Statistical Physics (4 Cr.). Python (4 Cr.). Special Relativity (4 Cr.). Thermodynamics (4 Cr.). Scientific Communication Techniques (4 Cr.).

Institution's Elective Courses (28 Cr.), to be chosen from the list below:
Astronomy (4 Cr.). Advanced Document and Data Management (2 Cr.). Active Citizenship: Strategy and Techniques (2 Cr.). Design and Creation of Mobile Applications (4 Cr.). Designing Business Models (2 Cr.). Entrepreneurship (2 Cr.). Ethics, Energy, and Environment (2 Cr.). Ethics and Technology (2 Cr.). Ethics and Health (2 Cr.). Series (4 Cr.). Artificial Intelligence (4 Cr.). Scientific Journalism (2 Cr.). Law in Everyday Life (2 Cr.). The World, Current Events, and Me (2 Cr.). Nanotechnologies (4 Cr.). Origin of Scientific Concepts (2 Cr.). Physics and Arts (4 Cr.). C++ Programming (4 Cr.). Social Leadership (2 Cr.). Sociology of Emotions (2 Cr.). Successful Job Hunting (2 Cr.). Sustainable Development (2 Cr.). Time and Money Management (2 Cr.). Web Design (2 Cr.). Work Ready Now (2 Cr.).

Open Elective Courses (6 Cr.)

USJ General Education Program (32 Cr.)

Code	Course Name	Credits
	ENGLISH OR OTHER LANGUAGE	**4**
048ANGLL5	English Level A	4
	ARABIC	**4**
	Arabic Language and Culture	**2**
435LALML2 **or** 435LALAL2	Arabic Language and the Media **or** Arabic Language and the Arts	2
	Other Courses Taught in Arabic	**2**
048GESAL4 **or** 048EVMOL1 **or** 048TCSOL2	Basic Pre-Rescue First Aid **or** Self-Expression Through Music **or** Theater and Self-Discovery	2
	HUMANITIES	**8**
064VALEL1	USJ Values in Daily Life	2
	Ethics	**2**
048EEECL1 **or** 048ETTPL1 **or** 048ETSBL1	Ethics, Energy, and Environment **or** Ethics and Technology **or** Ethics and Health	2
	Civic Engagement and Citizenship	**2**
048CITBL1 **or** 048DVQCL1 **or** 048SSDCL1	Active Citizenship: Strategy and Techniques **or** Law in Everyday Life **or** Sustainable Development	2
	Other Humanities Courses	**2**
048JSCPL1 **or** 048MAMPL1 **or** 048OCSCL1	Scientific Journalism **or** The World, Current Events, and Me **or** Origin of Scientific Concepts	2
	SOCIAL SCIENCES	**6**
	Professional Integration and/or Entrepreneurship	**2**
048ENTML6 **or** 048SJHPL2 **or** 048WRNBL2	Entrepreneurship **or** Successful Job Hunting **or** Work Ready Now	2
	Other Social Sciences Courses	**4**

048DBMML6 **or** 048SOLBL2 **or** 048EMIPL2 **or** 048TMMML2	Two courses to be chosen from the list below: Designing Business Models **or** Social Leadership **or** Sociology of Emotions **or** Time and Money Management	2
	QUANTITATIVE TECHNIQUES	**6**
048MPHPL5	Mathematics for Physicists	6
	COMMUNICATION TECHNIQUES	**4**
048TCSPL2	Scientific Communication Techniques	4

SUGGESTED STUDY PLAN

Semester 1

Code	Course Name	Credits
048ALGML1	Algorithm	6
048BANML1	Calculus I	4
048CANML1	Calculus II	2
048CSCCL1	General Chemistry I	6
048MCLPL1	Classical Mechanics	4
048MCAPL1	Advanced Classical Mechanics	2
048THDPL1	Thermodynamics	4
048EEECL1 **or** 048ETTPL1 **or** 048ETSBL1	Institution's Elective Course Ethics, Energy, and Environment **or** Ethics and Technology **or** Ethics and Health	2
	Total	**30**

Semester 2

Code	Course Name	Credits
048ACMPL2	Linear Algebra: Matrix Calculations	2
048EELPL2	Electrostatics and Electrodynamics	4
048FONML2	Functions	4
048MGSPL2	Magnetostatics	4
048PHMPL2	Modern Physics	6
048PYTML2	Python	4
048TCSPL2	Scientific Communication Techniques	4
	Open Elective Course	2
	Total	**30**

Semester 3

Code	Course Name	Credits
048ANVML3	Vector Calculus	6
048CAPML3	Probability Computation	4
048EMGPL3	Electromagnetism	4
048IEPPL3	Physics Instrumentation	4
048MEAPL3	Analytical Mechanics	4
048PHAPL3 **or** 048PGCPL3	Institution's Elective Courses Physics and Arts **or** C++ Programming	4
048CITBL1 **or** 048DVQCL1 **or** 048SSDCL1	Institution's Elective Course Active Citizenship: Strategy and Techniques **or** Law in Everyday Life **or** Sustainable Development	2
	Open Elective Course	2
	Total	**30**

Semester 4

Code	Course Name	Credits
048BPHPL4	Biophysics	4
048IELPL4	Introduction to Electronics	4
048IPMPL4	Introduction to Medical Physics	4
048CNMPL4	Numerical Calculus: MATLAB	2
048LCFPL4	Symbolic Computing Software: Maple	2
048OSLPL4	Waves and Wave Optics	6
064VALEL1	USJ Values in Daily Life	2
048ASTPL4 **or** 048ETSML4	Institution's Elective Courses Astronomy **or** Series	4
048DBMML6 **or** 048SOLBL2 **or** 048EMIPL2 **or** 048TMMML2	Institution's Elective Course Designing Business Models **or** Social Leadership **or** Sociology of Emotions **or** Time and Money Management	2
	Total	**30**

Semester 5

Code	Course Name	Credits
048ANGLL5	English Level A	4
048MPHPL5	Mathematics for Physicists	6
048MFLPL5	Fluid Mechanics	4
048MEQPL5	Quantum Mechanics	4
048RERPL5	Special Relativity	4
048MICCL5 **or** 048NANOL5	Institution's Elective Courses Design and Creation of Mobile Applications **or** Nanotechnologies	4
048JSCPL1 **or** 048MAMPL1 **or** 048OCSCL1	Institution's Elective Course Scientific Journalism **or** The World, Current Events, and Me **or** Origin of Scientific Concepts	2
	Open Elective Course	2
	Total	**30**

Semester 6

Code	Course Name	Credits
048ELFPL6	Fundamental Electronics	6
048MMPPL6	Mathematical Methods for Physicists	6
048PMAPL6	Physics of Matter	6
048PHSPL6	Statistical Physics	4
048ENTML6 **or** 048SJHPL2 **or** 048WRNBL2	Institution's Elective Course Entrepreneurship **or** Successful Job Hunting **or** Work Ready Now	2
	Institution's Elective Courses	6
	Total	**30**

COURSE DESCRIPTION

048ACMPL2 Linear Algebra: Matrix Calculations 2 Cr.

By the end of this course, students will be able to: understand the various properties of vector spaces, manipulate linear applications and matrices, calculate their determinant, and use it to compute the rank and inverse of a matrix when it is invertible. Finally, they will be able to solve linear systems and diagonalize matrices.

048ALGML1 Algorithm 6 Cr.

This course introduces students to programming through algorithms, a generic language that addresses problems with a sequence of basic instructions and forms the foundation of programming languages such as C++ and Python. It teaches students to construct pseudo-codes, including algorithms and flowcharts.

048ANVML3 Vector Calculus 6 Cr.

This course covers differentiation and integration of vector fields, partial differentiation and multiple integration. This branch of mathematics plays an important role in differential geometry and in the study of partial differential equations and is used extensively in physics and engineering. By the end of this course, students will be able to study differentiation of functions involving multiple variables. They will also perform classical calculations of double and triple integrals, line and surface integrals and apply Ostogradsky's and Stokes formulas.

048ANGLL5 English Level A 4 Cr.

This course is designed to develop critical thinking, reading, oral and writing skills. It focuses on synthesizing sources, producing a research paper and defending it in front of an audience. Emphasis is on the analytical reading of different text types required in the disciplines as well as on synthesis from a variety of sources to produce a written text and present it orally.

048ASTPL4 Astronomy 4 Cr.

This course is designed to introduce students to astronomy. It pays particular attention to the latest research and advances in the field. Over the course of the semester, the course follows the same trajectory as that of the Universe: expansion. That said, the aim is to start with an introduction to the celestial sphere and naked-eye astronomy, then broaden the scope to include the solar system, galaxies and their evolution, and continue this expansion until it reaches the zero moment of the Universe, the Big Bang. How was the Universe formed, and how will it end? How will the sun die? Is there life beyond the solar system? If so, how might we find it? What lies at the heart of black holes? This course answers these and other questions. During the course, students will be exposed to research techniques and methodologies, as well as the most advanced results in each of the fields presented. Tutorials enable students to directly apply what they have learned during the sessions, while presenting them with real-life examples of the problems faced by astronomers in their work.

048BANML1 Calculus I 4 Cr.

This course aims to familiarize students with the elementary and basic notations and properties of analysis starting with the real numbers, complex numbers and sequences properties. They will also learn how to study the continuity and derivability of real-valued functions.

048BPHPL4 Biophysics 4 Cr.

This course aims to introduce students to the scientific interface between multiple domains, including physics, biology, and chemistry. Several applications of physics in the realm of living organisms are supported by the concepts acquired during class sessions. Laboratory practical sessions complement the level of application required through experimental manipulations.

048BUICL1 Advanced Document and Data Management 2 Cr.

The course explains how to produce, process, exploit, and disseminate digital documents that combine data of different natures. Students will implement the newly acquired skills using commonly used document production software (text, slideshow, spreadsheet, referencing software, chemistry drawings, online document on various media).

048CAPML3 Probability Computation 4 Cr.

This course equips students with techniques to analyze and explain random phenomena. It starts with enumerative combinatorics as a foundation for probability calculations. The concept of independent events is then discussed, followed by a detailed study of random variables and key probability distributions (Bernoulli, binomial, Poisson, geometric, hypergeometric, uniform, Gaussian, exponential). The course concludes with the weak law of large numbers and the central limit theorem, preparing students for further studies in statistics.

048CNMPL4 Numerical Calculus: MATLAB 2 Cr.

This course introduces MATLAB, a numerical computation software that enables matrix manipulation, data and curve visualization, algorithm implementation, and user interface creation through its interactive programming

language. It highlights MATLAB's applications across engineering, science, and economics in both industrial and research contexts.

048CSCCL1 General Chemistry I 6 Cr.

This course aims to provide an in-depth understanding of the basic concepts of general chemistry in aqueous solutions. By the end of this course, students will be able to grasp the principles of chemical thermodynamics, and chemical equilibria between molecules and ions before studying redox reactions and chemical kinetics.

048CITBL1 Active Citizenship: Strategy and Techniques 2 Cr.

This course is designed for students of the Faculty of Science to enable them to experience citizenship and explore various forms of civic practices in Lebanon and around the world.

048CANML1 Calculus II 2 Cr.

This course allows students to strengthen and deepen their knowledge of basic analysis by providing theoretical tools necessary for its formation.

048MICCL5 Design and Creation of Mobile Applications 4 Cr.

This course introduces students to the fundamental concepts involved in the design, development and deployment of mobile applications. They will learn how to create functional, user-friendly applications adapted to various mobile platforms.

048DBMML6 Designing Business Models 2 Cr.

This course introduces Design Thinking, a framework for solving business problems and creating successful products. It covers the five iterative phases of the process:

- Discovery: gathering information around stakeholders, user pain points, business requirements, etc.
- Definition: re-framing the problem to be broad enough to encourage out-of-the-box thinking, while remaining focused enough to meet business needs.
- Ideation: exploring different ways to address the problem and meeting the user's needs.
- Prototype: producing a low-fidelity version of the product/service/etc. that doesn't require imagination to visualize the solution.
- Testing: gathering feedback from target users on the prototype to understand what works and what needs to be modified.

048EMGPL3 Electromagnetism 4 Cr.

In this course, second-year Bachelor's degree students, capable of using advanced mathematical techniques, delve into an advanced study of concepts related to electric and magnetic fields. After developing the local equations of electrostatics and electromagnetism, students will establish Maxwell's equations in a vacuum. Furthermore, the study of different types of capacitors and their operation, as well as the study of coils and their mutual influences, enable students to undertake a detailed study of RLC circuits in slowly time-varying regimes.

048ELFPL6 Fundamental Electronics 6 Cr.

This course presents the fundamental concepts of analog electronics, focusing on the operation, analysis, and design of analog circuits. It covers amplifiers based on bipolar transistors, field-effect transistors, operational amplifiers, differential amplifiers, oscillators, and more. Laboratory sessions provide hands-on experience to reinforce theoretical concepts and practical applications.

048EELPL2 Electrostatics and Electrodynamics 4 Cr.

This course provides a detailed study of electrostatic and electrodynamics phenomena. While mathematical formalism is used to determine electrostatic field and potential, students will also uncover the physical meaning inherent in this formalism. The study of conductors in electrostatic equilibrium prepares students well to understand the causes of charge transport and to master concepts related to electric current: generators, receivers, resistors, complex circuits, etc.

048ENTML6 Entrepreneurship 2 Cr.

This course introduces the fundamentals of entrepreneurship in a rapidly evolving work environment, where traditional career paths are being reshaped by innovation and technology. It emphasizes the development of an entrepreneurial mindset and provides students with the education and support to explore alternative career paths beyond the traditional trajectory.

048EEECL1 Ethics, Energy, and Environment 2 Cr.

The course aims to introduce students to ethical choices in the context of energy use, energy production, and environmental protection. The course is structured around the following themes: Energy choices and their ethical consequences, Environmental protection and environmental rights, Social responsibility and governance, Climate change: science, ethics, and politics, Ethics of renewable energies: advantages and disadvantages, Ethics of energy consumption: individual choices and social responsibility.

048ETTPL1 Ethics and Technology 2 Cr.

This course focuses on the ethical issues related to the use of technology, such as surveillance, privacy, automation, artificial intelligence, autonomous weapons, and more. Its objective is to help students understand the ethical implications of their work and develop critical thinking about their role as scientists in society. Example topics include: definitions and key concepts in the ethics of technology; the evolution of technology and its impact on society; reflection on the values and ethical principles involved in the technological context; surveillance and privacy; ethical issues in the collection and use of personal data; ethical challenges of artificial intelligence and machine learning; ethics in the design and use of technology; debates on ethical issues related to bioelectronics, virtual reality, genetic modification technology, etc.; and the ethics of emerging disruptive technologies and their societal impact.

048ETSBL1 Ethics and Health 2 Cr.

This course addresses bioethics by broadening its scope to include social and collective issues. The study of clinical cases, situational analysis, and discussions help train students to better analyze and evaluate their daily lives. Research ethics are also an integral part of this course. It encourages a positive attitude of reflection, awareness, and sensitivity to the ethical dilemmas that researchers may encounter in their professional lives.

048ETSML4 Series 4 Cr.

By the end of this course, students will be able, on the one hand, to study the validity of the parameter-dependent integral of functions and calculate those integrals.
On the other hand, they will get acquainted with the notion of infinite sum of terms and will examine the convergence of the series and distinguish between different types of convergence of sequences and series of functions. They will also be capable of developing functions by means of power series, after having examined the necessary conditions.

048FONML2 Functions 4 Cr.

This course allows students to locally compare functions using the limit development. They will be able to integrate functions in any interval and to solve differential equations of first and second order. This course also discusses the basic properties of functions with several variables.

048IELPL4 Introduction to Electronics 4 Cr.

This course familiarizes students with basic electronics by providing them with the necessary elements to understand the fundamentals of digital electronics and the operation of some basic electronic components such as diodes and transistors.

048IEPPL3 Physics Instrumentation 4 Cr.

This course introduces the fundamentals of instrumentation by providing an overview of the concepts necessary for mastering a measurement system for physical quantities. In addition to acquiring new knowledge, students will develop their autonomy when facing a given problem, their analytical skills, and their critical thinking to

analyze, interpret, and present a measurement, control, analysis, or test result in the form of numerical value, unit, uncertainty. These concepts are addressed through the study of examples with a predominant experimental approach, particularly through Computer-Aided Experimentation.

026INARL4 Artificial Intelligence 4 Cr.

This course covers the following themes: study of intelligent agents: problem solving, search algorithms in length and width, game programming: minimax, expectimax, knowledge and reasoning, planning, learning, natural language processing, vision, robotics, inference mechanisms, Bayesian networks, Markov processes, reinforcement learning and its algorithms.

048IPMPL4 Introduction to Medical Physics 4 Cr.

This course aims to introduce students to the applications of physics in a hospital setting. The content focuses on the effects of ionizing radiation given the variety of medical applications. The course gives an overview that starts with the basic principles of particle interactions with matter and covers several application areas such as dosimetry and radiation protection. The second part is more dedicated to medical applications, particularly dosimetry techniques, imaging, and radiotherapy. After the lecture portion given in class (10 sessions), students are accompanied during three visits to the radiotherapy centers of HDF and *Mont-Liban* hospital where they can see the environment and equipment used by physicists at the hospital.

048JSCPL1 Scientific Journalism 2 Cr.

This course is designed to teach students the basic techniques and rules governing journalistic writing. At the end of this course, students will be able to master the basic techniques of journalistic writing, assess the relevance of scientific information likely to be published (choice of information) in the general press and write a journalistic news item as well as a scientific press article.

048DVQCL1 Law in Everyday Life 2 Cr.

This course aims to familiarize students with the basic concepts of law, providing a pedagogical introduction to an essential but seemingly daunting subject, especially for science students. The goal is to enable these students to understand current legal issues, know their basic rights and obligations as citizens, and understand their national legal system in relation to international law. Through examples, this course helps students locate and decipher legal texts, relevant references in legislation, or international conventions. Finally, through examples, this course emphasizes the correct use of words and legal terminology.

048MAMPL1 The World, Current Events, and Me 2 Cr.

This course encourages students to think about the major issues that dominate current events and impact the country and the world. Through an analysis of the news that affects them, widely discussed news, and the news that fuels public debate, students will learn to develop their critical thinking and express their viewpoints, particularly during this period of health, economic, social, and political crises that Lebanon is experiencing.

064VALEL1 USJ Values in Daily Life 2 Cr.

This course aims to raise students' awareness of the core values of the Saint Joseph University of Beirut (USJ) and encourage them to integrate these values into their personal, interpersonal, and professional lives. It engages them in a critical reflection on how the values outlined in the USJ Charter can influence their behaviors, actions, and decisions in addressing contemporary challenges. Students will also become aware of global issues and ethical responsibilities, preparing them to contribute positively to building a better society.

048LCFPL4 Symbolic Computing Software: Maple 2 Cr.

This course is an introduction to Maple for performing symbolic calculations useful for solving physics problems. Students will work with numerical quantities (integers, real numbers, complex numbers), polynomials, functions, or series. They will perform derivations, integrations, solving systems of linear equations, matrix inversions, asymptotic expansions, and solving differential equations in symbolic form, i.e., keeping variables in the solution, using Maple.

048MGSPL2 Magnetostatics 4 Cr.

This course provides a detailed study of magneto-static phenomena. While mathematical formalism is used to determine magnetic fields, students will also uncover the physical meaning inherent in this formalism. Laboratory practical sessions complement the level of application required through experimental manipulations.

048MPHPL5 Mathematics for Physicists 6 Cr.

This course covers complex analysis, Fourier analysis, and integral transformations, highlighting their applications in engineering and physics. It studies analytic functions of a complex variable, harmonic analysis for representing functions or signals as superpositions of basic waves, and integral transformations, including the Laplace transform to convert linear analysis problems into algebraic equations. The course familiarizes undergraduate physics students with these methods to compute definite integrals and solve differential and partial differential equations.

048MEAPL3 Analytical Mechanics 4 Cr.

This course introduces analytical mechanics, a unified and efficient method for modeling solid mechanical systems with high predictive value. It covers Lagrangian and Hamiltonian formalisms for studying systems of rigid bodies connected by perfect constraints and subjected to potential forces.

048MCLPL1 Classical Mechanics 4 Cr.

This course presents classical mechanics as a fundamental component of the science curriculum, developing expertise in solving problems related to point particles and rigid bodies. First-year students in Physics, Mathematics, and Chemistry will study Newtonian mechanics in depth, covering topics from point particle kinematics to accelerated reference frames.

048MCAPL1 Advanced Classical Mechanics 2 Cr.

This course is a continuation of the Classical Mechanics course, designed for first-year physics students. It addresses problems related to central forces, planetary motion, rocket physics, and particle collisions.

048MFLPL5 Fluid Mechanics 4 Cr.

This course introduces fluid mechanics, a branch of continuum mechanics that studies gases and liquids at rest (hydrostatics) and in motion (fluid kinematics and dynamics), as well as their interactions with solid bodies. It covers the behavior of incompressible, viscous, and non-viscous fluids and explores applications ranging from blood flow to petroleum transport.

048MEQPL5 Quantum Mechanics 4 Cr.

This course familiarizes students with the fundamental principles of quantum mechanics. Students will gain a thorough understanding of basic concepts, associated mathematical formalisms, postulates, and practical applications of quantum mechanics.

048MMPPL6 Mathematical Methods for Physicists 6 Cr.

This course aims to train undergraduate physics students in the mathematical methods and tools necessary for solving differential equations and partial differential equations such as orthogonal polynomials, special functions, Bessel functions, and others.

048NANOL5 Nanotechnologies 4 Cr.

This course covers nanotechnologies as they are becoming increasingly present in our daily lives and represent a rapidly growing market. It aims to capitalize on the knowledge accumulated by L3 students during their scientific studies. It covers basic knowledge of nanomaterials and nanotechnologies that have or will have a significant impact in scientific, technological, economic, and even societal domains. After a general introduction to nanoscience, the course provides an overview of the main methods of nanoscale manufacturing. In particular, it demonstrates how nanotechnology tools (e.g., near-field microscopies, lithography) can be used to understand,

and even transform, bio and/or organic systems at the atomic and molecular level on one hand, and to what extent the basic principles (self-assembly) of biology can be exploited to manufacture new materials and devices on the other hand. Additionally, this course discusses the potential contribution of nanomaterials in various fields such as medicine, electronics, space, biotechnology, biomedical, environmental applications, and optics. Current research topics in nanoscience are presented and discussed to understand the new properties sought at a very small scale.

048OSLPL4 Waves and Wave Optics 6 Cr.

The course aims to introduce students to waves and ordinary or generalized linear systems. Thus, regardless of the type of wave encountered in a problem, students will have the tools to solve it. This course also enables students to understand the concepts of light waves (polarization) and optical intensity; calculate the interference pattern produced by plane waves, spherical waves, or a combination of both, and calculate, in some cases, the light intensity after diffraction; understand what an optical grating is and its effect on light.

048OCSCL1 Origin of Scientific Concepts 2 Cr.

This course introduces students to the process of conducting a reflexive analysis on the origins and development of scientific concepts as well as the history of scientific disciplines. The goal is to develop their critical thinking skills in relation to the examination of the current connections among epistemology, science philosophy, and science history. The various epistemological currents and ideas that have influenced the development of scientific knowledge are also covered. Understanding contemporary scientific ideas in the fields of mathematics, physics, chemistry, and life sciences requires these reflective components. Science education and the stance of the scientific researcher are influenced by the epistemological analysis of the development of scientific theories.

048PMAPL6 Physics of Matter 6 Cr.

This course introduces the physics of matter, focusing on the internal structures of atoms and the study of the infinitely small. It covers atomic, solid, molecular, and nuclear structures, presenting essential concepts on atom structure and their interactions with light radiation.

048PHAPL3 Physics and Arts 4 Cr.

This course is an introduction to the physics of sound and light with applications in music and visual arts. It provides an overview of how physics and art are deeply interconnected.

048PHMPL2 Modern Physics 6 Cr.

This course covers the different aspects of physics depending on the context: physics based on quantum mechanics, physics based on the theory of relativity, and 20th century physics in general. It serves as a general introduction to three major branches of physics: quantum physics, special relativity, and nuclear physics.

048PHSPL6 Statistical Physics 4 Cr.

This course explains how statistical physics establishes the relationships between macroscopic variables from the equations governing the behavior of matter at the microscopic scale. The core of statistical physics relies on the probabilistic description of a physical system. This course aims to give students a thorough understanding of the formalism of statistical physics as well as the limitations of classical thermodynamics.

048PGCPL3 C++ Programming 4 Cr.

This course explains the basic data structures in C and C++ languages as well as the syntax of conditional and repetitive structures. They will implement, in C++, the algorithms they have learned in the Algorithmics course. This course also offers students the opportunity to familiarize themselves with the development of small C++ computer projects, the concepts of which are provided during the course. The projects are supervised by the instructor. Following this course, students will be able to write programs in C and C++ to solve problems related to physics, chemistry, or life and earth sciences.

048PYTML2 Python 4 Cr.

This course provides students with a solid understanding of the fundamentals of Python, enabling them to create programs ranging from simple to complex. Students will learn to manipulate variables, control program flow with loops and tests, and use external modules for specific tasks. By the end of the course, students will be capable of developing functional Python applications and solving practical problems using the language.

048RERPL5 Special Relativity 4 Cr.

This course explains the relativity of simultaneity and measurements of time and length. Students will draw Minkowski diagrams to solve problems, use Lorentz transformations for the field, introduce four-dimensional formalism, and solve collision problems in the laboratory frame and in the zero-momentum frame.

048SOLBL2 Social Leadership 2 Cr.

This course explores social leadership, an emotional and empathetic leadership style that emphasizes connection, collaboration, and communication. It covers how leaders cultivate trust, care, and respect within teams to foster an open and positive work environment. Students will learn to leverage emotional intelligence and interpersonal skills to influence others, rather than relying solely on position or title, enhancing effectiveness in today's workplace where employees seek meaning and purpose in their work.

048EMIPL2 Sociology of Emotions 2 Cr.

This course familiarizes students with the sociological theories of emotions, explores the impact of emotions on individual and collective decisions, and analyzes social interactions through the prism of emotions.

048SJHPL2 Successful Job Hunting 2 Cr.

The course introduces students to professional life and its demands in terms of personal development and technical knowledge.
It covers:

1- Responding to a job offer (application e-mail, cover letter, CV)
2- Passing a job interview (dress code; body language; how to present yourself; dos and don'ts; etc.)
3- Searching for a job offer (profile on LinkedIn; search for an offer on LinkedIn, etc.; post your CV on Monster, Bayt and Co, etc.; searching for job offers on the websites of institutions, companies, hospitals, industries, etc.)

048SSDCL1 Sustainable Development 2 Cr.

This course aims to introduce students to the interconnectedness between various sectors of human life, sustainable development, and the Sustainable Development Goals (SDGs) established by the United Nations. It also aims to define the role of public and private entities in implementing these goals.

048THDPL1 Thermodynamics 4 Cr.

This course provides a detailed study of the evolution of thermodynamic systems, enabling students to understand the laws of thermodynamics. It applies these laws to thermodynamic principles, thermal machines, and phase changes in pure substances.

048TMMML2 Time and Money Management 2 Cr.

This course aims to enlighten undergraduates about the choices to be made for extraordinary productivity. Moreover, this course enables students to have a clear understanding of various means of investments in several industries comprising: stock market, life insurance, private banking, and retail banking.

048TCSPL2 Scientific Communication Techniques 4 Cr.

This course is divided into two main parts. The first part focuses on public speaking techniques, where students will learn to effectively present scientific concepts orally. The second part covers written communication techniques through the preparation of a scientific poster, where students will learn to communicate the findings of bibliographic

research visually and persuasively. This course aims to develop the scientific communication skills of students in physics and chemistry, with an emphasis on preparing and presenting scientific projects in different formats. Students will learn to articulate complex scientific concepts effectively, both in writing and orally, and to present their work convincingly. In addition to preparing a scientific poster, students will have the opportunity to refine their communication and public speaking skills through, among other activities, the preparation of a TED Talk.

048MIWDL2 Web Design 2 Cr.

This course aims to introduce students to the fundamental principles of web design. Students will learn the skills necessary to design and create attractive, functional, and responsive websites.

048WRNBL2 Work Ready Now 2 Cr.

The Work Ready Now program provides young students with the essential skills and knowledge needed to find and keep a job. This program, created by Higher Education Capacity Development (HECD), was designed in a participatory and practical manner so that students are actively involved in the learning process, gaining new skills and self-confidence to secure and maintain employment. Additionally, the learning methods allow students to develop digital skills through the use of free online software.

435LALML2 Arabic Language and the Media 2 Cr.

This course allows students to explore the Arabic language and its culture through various forms of media, including visual, audio, and written journalism, as well as visual, audio, and written advertising. It provides linguistic, oral, and written skills that are practical and tangible.

435LALAL2 Arabic Language and the Arts 2 Cr.

This course offers students the chance to explore the Arabic language and culture in an engaging and flexible way. It introduces them to the use of Arabic in various visual arts, such as painting, calligraphy, and arabesque (Arabic ornamentation). Through this, students develop practical linguistic skills, both spoken and written, that are useful in real-life contexts.

048GESAL4 Basic Pre-Rescue First Aid 2 Cr.

This course focuses on recognizing emergencies, identifying appropriate first aid procedures, and providing initial care.

048EVMOL1 Self-Expression Through Music 2 Cr.

This course engages students in selecting songs in Arabic, French, English, and Italian to develop a group project that inspires self-expression through music or original text.

048TCSOL2 Theater and Self-Discovery 2 Cr.

This course is aimed at students who wish to learn acting techniques in a recreational and enjoyable setting. Sessions focus on exercises in dramatic arts such as warm-up, body expression, relaxation, trust-building games, diction exercises, voice and breathing work, mime, improvisation, body and rhythm, physical movements, motor skills, space management, and stage presence. The course aims to help students master and enhance their presence on stage and their interaction with the audience for any type of performance: lectures, seminars, etc. Practice is conducted individually and collectively on stage, combining the enjoyment and discipline of performance. The teaching approach emphasizes the body and voice as the actor's primary tools and encourages creativity in responding to scenarios and delivering text in diverse ways.