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. Its objectives are to train students who are capable of:

- Pursuing further studies at the master's level in a coherent physics-related program.
- Advancing in their scientific careers at local, regional, and international levels.
- Becoming 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).
USJ General Education Program (32 credits - may be part of the above categories).

USJ General Education Program (32 Cr.)
English (4 Cr.)
English Level A (4 Cr.)
Arabic (4 Cr.)
Arabic Language and Culture (2 Cr.)
Arabic Language and the Media (2 Cr.)
Arabic Language and the Arts (2 Cr.)
Courses in Arabic (2 Cr.)
Basic Pre-Rescue First Aid (2 Cr.)
Self-Expression Through Music (2 Cr.)
Theater and Self-Discovery (2 Cr.)
Humanities (8 Cr.)
Ethics (2 Cr.)
Ethics, Energy, and Environment (2 Cr.)
Ethics and Technology (2 Cr.)
Ethics and Health (2 Cr.)
Religious Sciences (2 Cr.)
USJ Values in Daily Life (2 Cr.)
Civic and Citizen Engagement (2 Cr.)
Active Citizenship: Strategy and Techniques (2 Cr.)
Law in Everyday Life (2 Cr.)
Sustainable Development (2 Cr.)

Other (2 Cr.)
Scientific Journalism (2 Cr.)
The World, Current Events, and Me (2 Cr.)
Origin of Scientific Concepts (2 Cr.)

Social Sciences (6 Cr.)

Professional Integration and Entrepreneurship (2 Cr.)
Entrepreneurship (2 Cr.)
Successful Job Hunting (2 Cr.)
Work Ready Now (2 Cr.)

Other (4 Cr.)
Designing Business Models (2 Cr.)
Social Leadership (2 Cr.)
Sociology of Emotions (2 Cr.)
Time and Money Management (2 Cr.)

Communication Techniques (4 Cr.)
Scientific Communication Techniques (4 Cr.)

Quantitative Techniques (6 Cr.)
Mathematics for Physicists (6 Cr.)

Fundamental Courses

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 I (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 following list)

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.)

Arabic Language and the Media (2 Cr.). Arabic Language and the Arts (2 Cr.). Basic Pre-Rescue First Aid (2 Cr.). Self-Expression Through Music (2 Cr.). Theater and Self-Discovery (2 Cr.). Simulation of Piloting and Civil Aviation I (2 Cr.).

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
	USJ General Education Program – Humanities *(e.g. Ethics)*	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 Courses / USJ General Education Program – Arabic Language and Culture *(e.g. Arabic Language and Media)*	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
	Institution's Elective Courses	4
	USJ General Education Program - Humanities *(e.g. Civic and Citizen Engagement)*	2
	Open Elective Courses / USJ General Education Program – Arabic *(e.g. Courses in Arabic)*	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
	Institution's Elective Courses	4
	USJ General Education Program – Social sciences *(e.g. Other)*	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
	Institution's Elective Courses	4
	USJ General Education Program - Humanities *(e.g. Religious Sciences)*	2
	Open Elective Courses	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
	Institution's Elective Courses	4
	USJ General Education Program – Social sciences *(e.g. Professional Integration and Entrepreneurship + Other)*	4
	Total	**30**

COURSE DESCRIPTION

048ACMPL2 Linear Algebra: Matrix Calculations 2 Cr.

Students who enroll in this course will understand the various properties of vector spaces, be able to manipulate linear applications and matrices, and will also be able to 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.

Algorithm is a generic language that allows problems to be addressed through a sequence of basic instructions. It is the foundation of all programming languages such as C++, Python, and others.
The aim of this course is to introduce students to programming by constructing pseudo-codes (algorithms, flowcharts).

048ANVML3 Vector Analysis 6 Cr.

This course deals with 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. Students who have completed this course will be able to study differentiation of functions involving multiple variables. They can also perform classical calculations of double and triple integrals, line and surface integrals, and apply Ostogradski'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.

The 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 will follow 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 we reach 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 will answer 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 will 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 provides the way to produce, process, exploit, and disseminate digital documents that combine data of different natures. The attendees will implement the new 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.

The main objective of this course is to equip 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.

MATLAB is numerical computing software. It allows manipulation of matrices, display of curves and data, implementation of algorithms, creation of user interfaces, all through a specific interactive programming language. MATLAB is used in a wide range of fields such as 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.

The Design and Creation of Mobile Applications course aims to introduce students to the fundamental concepts involved in the design, development and deployment of mobile applications. Students will learn how to create functional, user-friendly applications adapted to various mobile platforms.

048DBMML6 Designing Business Models 2 Cr.

A quick google search of the term "Design Thinking" will trigger thousands and thousands of articles, pictures and use cases for you to explore. The reason why this term boomed in the past decade is because, essentially, it is how successful products are made.
Design Thinking is a framework used to solve business problems by going through 5 main iterative phases:

- Discovery: gathering information around stakeholders, user pain points, business requirements, etc.
- Definition: re-framing the problem that is wide enough out-of-the-box thinking, and at the same time 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 are led to 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.

The progress of integration and the rise of microelectronics have favored the development of digital electronics. Most current electronic systems integrate digital and analog systems. While the analog part is decreasing in favor of the digital, analog electronics remains essential in many applications, especially for sensors and transducers. This course aims to present the fundamental concepts underlying the operation, analysis, and design of analog circuits. The topics covered include: Amplifiers based on bipolar transistors, Field-effect transistors, operational amplifiers, differential amplifiers, oscillators, etc. Laboratory practical sessions complement the level of application required through experimental manipulations.

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.

In the fast-evolving world that we are experiencing in our daily life, mostly the work environment, where traditional career paths are being redefined by innovation and technology, it is important for students to be exposed to the fundamentals of entrepreneurship, and include the entrepreneur mindset in today's generation. Therefore, students should receive the right education and support from the institutions. In addition, students have the right to be exposed and to learn that they have other paths than the traditional way.

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 will also be 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.

Upon completion of this course, students will be able on 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 convergences of sequences and series of functions. They will be also 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 also 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.

The objective of this course is to familiarize 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.

The aim of this course is to introduce 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 are encouraged to 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 will be 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 their applications used in medicine. The course covers 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, also through example, this course ensures respect for the etymology 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, the news everyone is talking about, 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 heighten students' awareness of the core values of the Saint Joseph University of Beirut (USJ) with the objective of integrating these values into their personal lives, interpersonal relationships, and professional conduct. Additionally, it encourages critical reflection on how the values outlined in the USJ Charter can influence their behaviors, actions, and decision-making processes in response to the challenges of the modern world. Furthermore, the course assists students in recognizing global issues and ethical responsibilities, while equipping them to make positive contributions towards the advancement of a better society.

048LCFPL4 Symbolic Computation Software: Maple 2 Cr.

This course is an introduction to Maple for performing symbolic calculations useful for solving physics problems. Students learn to work with numerical quantities (integers, real numbers, complex numbers), polynomials, functions, or series. They learn to 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.

Complex analysis, Fourier analysis, and integral transformations have numerous applications in engineering and physics. The course covers: the study of basic methods of the theory of analytic functions of a complex variable, harmonic analysis which studies the representation of functions or signals as a superposition of basic waves by deepening and generalizing the notions of Fourier series and Fourier transform, as well as integral transformations, notably the Laplace transform which allows transforming a problem of linear analysis into a problem of solving an algebraic equation. The course aims to familiarize undergraduate physics students with Fourier analysis and complex analysis to compute definite integrals and solve differential equations and partial differential equations.

048MEAPL3 Analytical Mechanics 4 Cr.

Analytical mechanics is a unified, efficient method for modeling solid mechanical systems with high predictive value. It establishes Lagrangian and Hamiltonian formalisms for the study of systems composed of rigid bodies connected by perfect constraints and subjected to potential forces.

048MCLPL1 Classical Mechanics 4 Cr.

Classical mechanics is one of the cornerstones of a curriculum at the Faculty of Science as it allows for the development of expertise in addressing a variety of problems related to point particles and rigid bodies. First-year students in Physics, Mathematics, and Chemistry engage in an in-depth study of Newtonian mechanics, covering the description of point particle kinematics to that of 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.

Fluid mechanics is a branch of continuum mechanics that encompasses the study of gases and liquids in equilibrium (hydrostatics) and in motion (fluid kinematics and dynamics), as well as the study of their interaction with solid bodies. It is a highly active research field with many unresolved or partially resolved problems. This branch of physics covers a variety of issues ranging from the study of blood flow to petroleum flow. Topics covered include all aspects of the behavior of incompressible, viscous, or non-viscous fluids.

048MEQPL5 Quantum Mechanics 4 Cr.

The Quantum Mechanics course aims to familiarize 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.

Nanotechnologies are becoming increasingly present in our daily lives and represent a rapidly growing market. This course 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 will discuss the potential contribution of nanomaterials in various fields such as medicine, electronics, space, biotechnology, biomedical, environment, and optics. Current research topics in nanoscience will be 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.

The purpose of this course is to introduce 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 intent 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.

Physics of Matter is the science that studies the internal structures of atoms. Physicists in this branch of physics have become increasingly interested in the infinitely small. The topics covered in this course are an introduction to atomic, solid, molecular, and nuclear structure aimed at presenting essential concepts on the structure of atoms and their interaction with light radiation.

048PHAPL3 Physics and Arts 4 Cr.

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

048PHMPL2 Modern Physics 6 Cr.

Modern physics refers to 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. This course is a general introduction to three major branches of physics: quantum physics, special relativity, and nuclear physics.

048PHSPL6 Statistical Physics 4 Cr.

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.

In this course, students learn the basic data structures in C and C++ languages as well as the syntax of conditional and repetitive structures. They implement, in C++, the algorithms they 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.

The main objective of this course is to provide 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, learners will be capable of developing functional Python applications and solving practical problems using the language.

048RERPL5 Special Relativity 4 Cr.

The objectives of special relativity are to understand the relativity of simultaneity and measurements of time and length, to be able to draw Minkowski diagrams to solve problems, to use Lorentz transformations for the field, to introduce four-dimensional formalism, and to solve collision problems in the laboratory frame and in the zero-momentum frame.

048SOLBL2 Social Leadership 2 Cr.

Social leadership is a concept that refers to the emotional and empathetic style of leaders who prioritize connection, collaboration, and communication. These leaders recognize the significance of cultivating strong relationships within their teams and fostering a positive work environment. Being a social leader involves knowing how to nurture trust, care, and respect within the team. Upholding these values enables team members to freely share ideas, fostering an open atmosphere an ever-changing work climate. In contrast to formal leaders, social leaders do not solely rely on position or title to achieve objectives. Instead, they leverage emotional intelligence and interpersonal skills to influence others. This approach enhances the 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 is designed to introduce students to professional life and its demands in terms of personal development and technical knowledge.

1-Responding to a job offer (application e-mail, cover letter, CV)
2-How to pass 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, ...; 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.

In this course, students delve into a detailed study of the evolution of thermodynamic systems. This study enables them to understand the laws of thermodynamics. These laws will be applied to both principles, thermal machines, and changes of state in pure substances.

048TMMML2 Time and Money Management 2 Cr.

The Time and Money Management course aims to enlighten undergraduates about the choices to be made for extraordinary productivity. Moreover, this course will enable 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.

The Web Design 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 was developed to provide 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.

Recognizing emergency situations, identifying first aid procedures, and initiating first aid care.

048EVMOL1 Self-Expression Through Music 2 Cr.

Choosing a selection of songs in various languages: Arabic, French, English, and Italian. The aim is to create a group project that motivates students to express themselves either through music or with their own words.

048TCSOL2 Theater and Self-Discovery 2 Cr.

The theater course is aimed at students interested in learning acting techniques in a fun and engaging environment. The sessions focus on dramatic arts exercises such as warming up, physical expression, relaxation, trust games, voice and breathing exercises, mime, improvisation, body rhythm, physical movements, motor skills, space management, stage presence, character development, and relaxation, concentration, and visualization techniques. The primary objective of this course is to help students develop and strengthen their stage presence (with "stage" referring to any performance space) and enhance their interaction with the audience in various types of performances, including lectures, seminars, and more. Students' stage practice is nurtured both individually and in groups. The teaching method emphasizes both the fun and discipline of play, engaging the body and voice as the actor's primary tools. It encourages students' creativity, prompting them to use their thinking, sensitivity, and imagination to respond to situations and explore different ways of delivering the text.

048SPAOL3 Simulation of Piloting and Civil Aviation I 2 Cr.

The aim of this course is purely instructional and does not claim to be a real pilot training course. However, in the world of digital simulations, we strive to bring our tools as close as possible to the desired reality, sometimes reaching relatively advanced levels of virtuality. In this course, students will be introduced to basic concepts related to the use of a single-engine aircraft with a fixed-pitch propeller. Navigation concepts and standards for various European regions will be introduced in a simple manner to give enthusiasts an idea. The use of airport charts for takeoffs and landings is also introduced. The ultimate goal is to be able to start a training aircraft, perform a proper takeoff, and navigate through the sky in preparation for a landing following Visual Flight Rules.