الجمهورية الجزائرية الديمقراطية الشعبية
وزارة التعليم العالي والبحث العلمي
جامعة سطيف 1 – فرحات عباس
كلية العلوم

Setif 1 University - Ferhat ABBAS

FACULTY OF SCIENCES

Bachelor in Fundamental Physics

Objectives of the License:

- The license in Fundamental Physics allows the student to acquire in-depth knowledge of fundamental physics and skills relating to experimental techniques of study, analysis, and characterization. It also allows the student to master tools in terms of experimental and theoretical research methodology.
- This training aims to master the concepts and foundations of physics, which constitutes the essential link for technology.
- The fundamental Physics path is intended to provide to students solid knowledge in physics to prepare (without this being exclusive) for a Master's degree and doctorate in physics.

Masters degree offered at Faculty of Sciences:

- Master in Energy Physics and Renewable Energies.
- Master in Materials Engineering,
- Master in Theoretical and Fundamental Physics
- Master in Subatomic Physics Engineering.
- Master in Globe Physics

Job Outlook for Physicists

Physicists find employment in various contexts after obtaining their diploma:

- teaching in middle education colleges (CEM) and high schools,
- laboratories and research entities,
- medical physics establishments,
- in manufacturing industries
- just to name a few!

Program Overview:

Semester 3

Teaching Unit: Fundamental (Credits: 20 Coefficients: 10)

Series & Differential Equations (Credits: 6 Coefficients: 3)

Chapter 1: Single and Multiple Integrals
Chapter 2: Improper Integrals
Chapter 3: Differential Equations
Chapter 4: Series
Chapter 5: Laplace Transform
Chapter 6: Fourier Transform

Analytical Mechanics (Credits: 6 Coefficients: 3)

Chapter 1: Classical Mechanics Review
Chapter 2: Lagrangian Formalism
Chapter 3: Hamiltonian Formalism
Chapter 4: Rigid Body Motion
Chapter 5: Lagrangian Mechanics of Continuous Media
Chapter 6: Liouville Theorem. Hamilton–Jacobi Equation

Vibrations & Waves (Credits: 4 Coefficients: 2)

Chapter 1: Introduction to Vibrations
Chapter 2: Linear Systems with One Degree of Freedom
Chapter 3: Linear Systems with Multiple Degrees of Freedom
Chapter 4: Introduction to Mechanical Waves
Chapter 5: Transverse Waves on a String
Chapter 6: Longitudinal Waves in Fluids
Chapter 7: Elastic Waves in Solids

Geometrical & Physical Optics (Credits: 4 Coefficients: 2)

Chapter 1: Geometrical Optics
Chapter 2: Wave Optics
Chapter 3: Diffraction and Applications
Chapter 4: Polarization
Chapter 5: Lasers and Applications

Lab Work – Vibrations & Waves (Credits: 2 Coefficients: 1)

Transverse string oscillations
Electromechanical systems (e.g., dynamic louds-peaker)
Damped oscillations (free and forced RLC circuits)
Coupled oscillations: beat phenomenon
Coupled oscillations: normal modes
Longitudinal wave propagation in fluids
Ripple tank experiments
Kundt's tube
Induction phenomena

Lab Work – Geometrical & Physical Optics (Credits: 2 Coefficients: 1)

Light sources and detectors
Reflection (plane, spherical mirrors) and refraction (air/glass, glass/air)
Prism: deviation and dispersion

Grating: dispersion
Prism and grating spectroscope
Focal length measurement (focometer)
Microscope
Light polarization (linear, circular, elliptical)
Thin film reflection (plane-parallel films)
Spectrophotometry (optical filters)
Interferometry (wavelength, index, velocity)
Diffraction (slits and gratings, Bragg law, monochromator)

Numerical Methods and Programming (Credits: 3 Coefficients: 2)

Chapter 1: Introduction/Review of Programming Languages
Chapter 2: Numerical Integration
Chapter 3: Solving Nonlinear Equations Numerically
Chapter 4: Solving Ordinary Differential Equations Numerically
Chapter 5: Solving Linear Systems Numerically

Physical Crystallography (Credits: 2 Coefficients: 2)

I – GENERALITIES
II – SYMMETRY OF FINITE FIGURES
III – LATTICE SYMMETRY – BRAVAIS LATTICES
IV – EXPERIMENTAL DIFFRACTION METHODS
V – CHEMICAL BONDING

English 3 (Credits: 1 Coefficients: 1)

Semester 4

Thermodynamics (Credits: 6 Coefficients: 3)

Chapter 1: Review of Thermodynamics Principles
Chapter 2: Heat Transfer Modes
Chapter 3: Principle of Maximum Entropy
Chapter 4: Kinetic Theory and Irreversible Phenomena
Chapter 5: Thermodynamic Functions
Chapter 6: Chemical Potential
Chapter 7: Applications

Complex Variable Functions (Credits: 4 Coefficients: 2)

Chapter 1: Holomorphic Functions
Chapter 2: Elementary Functions
Chapter 3: Fundamental Theorems for Holomorphic Functions
Chapter 4: Residue Theorem and Applications to Integral Calculus
Chapter 5: Applications

Quantum Mechanics (Credits: 4 Coefficients: 2)

Chapter 1: Introduction to Quantum Phenomena
Chapter 2: Description of Particles in Quantum Mechanics
Chapter 3: Schrödinger Equation and One-Dimensional Potentials
Chapter 4: Mathematical Formalism of Quantum Mechanics
Chapter 5: Postulates of Quantum Mechanics
Chapter 6: Introduction to the Quantum Harmonic Oscillator

Electromagnetism (Credits: 4 Coefficients: 2)

Chapter 1: Mathematical Tools
Chapter 2: Maxwell's Equations
Chapter 3: Electromagnetic Wave Propagation
Chapter 4: Electromagnetic Radiation

Thermodynamics Lab (Credits: 2 Coefficients: 1)

Ideal Gas Law – Boyle-Mariotte Law Verification
Determination of Gamma (Cp/Cv) – Clément–Desormes Method
Thermal Expansion of Solids
Calorimetry – Measuring Heat Quantities or Thermal Transfers
Latent Heat of Vaporization
Thermocouple Calibration (Thermoelectric Power)
Heat Propagation in a Metal Rod
Heat Transport – Thermal Convection
Thermal Insulation
Kinetic Theory of Gases – Boyle's Law (P-V at Constant T)

Fluid Mechanics (Credits: 3 Coefficients: 2)

Chapter 1: General Concepts
Chapter 2: Fluid Statics
Chapter 3: Fluid Kinematics
Chapter 4: Dynamics of Ideal Fluids
Chapter 5: Dynamics of Viscous Fluids
Chapter 6: Introduction to Gas Dynamics

General Electronics (Credits: 3 Coefficients: 2)

Part I – Electric Networks
Part II – Passive Two-Port Networks
Part III – Diodes

Physico-chemical analysis methods (Credits: 3 Coefficients: 2)

Chapter 1: Introduction to spectroscopy
Chapter 2: UV-Vis Spectroscopy
Chapter 3: IR Spectroscopy

Chapter 4: Mass Spectrometry
Chapter 5: Nuclear Magnetic Resonance (NMR)

Semester 5

Quantum Mechanics II (Credits: 6 Coefficients: 3)
Chapter 1: Review of Quantum Mechanics Postulates
Chapter 2: Angular Momentum
Chapter 3: Central Potential
Chapter 4: Approximation Methods
Chapter 5: Elastic Scattering by a Central Potential

Statistical Physics (Credits: 6 Coefficients: 3)
Chapter 1: Fundamentals
Chapter 2: Microcanonical Ensemble
Chapter 3: Canonical Ensemble
Chapter 4: Grand Canonical Ensemble
Chapter 5: Applications

Special Relativity (Credits: 4 Coefficients: 2)
Chapter 1: Historical Background
Chapter 2: Relativistic Kinematics
Chapter 3: Relativistic Dynamics
Chapter 4: Electromagnetism

Mathematical Methods for Physics (Credits: 4 Coefficients: 2)
Chapter 1: Eulerian Functions – Beta and Gamma
Chapter 2: Bessel Functions
Chapter 3: Error Function and Fresnel Integrals
Chapter 4: Exponential, Sine, and Cosine Integrals
Chapter 5: Orthogonal Polynomials
Chapter 6: Hypergeometric Function

Particle physics (Credits: 1 Coefficients: 1)

Numerical Physics (Credits: 4 Coefficients: 2)

Semiconductor physics (Credits: 4 Coefficients: 2)

Scientific English 1 (Credits: 2 Coefficients: 1)
Grammar review focused mainly on prepositions and definite/indefinite articles
Texts will be provided on: Kinetic theory of gases
Relativity, Waves and particles Optics, Elements of statistical physics

Semester 6

Solid State Physics (Credits: 6 Coefficients: 3)
Chapter 1: Crystallography
Chapter 2: Mechanical Properties – Elasticity
Chapter 3: Lattice Vibrations and Thermal Properties
Chapter 4: Electrons in Solids
Chapter 5: Dielectrics
Chapter 6: Magnetism

Nuclear Physics (Credits: 4 Coefficients: 2)
Chapter 1: The Atomic Nucleus
Chapter 2: Nuclear Reactions
Chapter 3: Radioactivity
Chapter 4: Nuclear Energy

Heat Transfer (Credits: 4 Coefficients: 2)
Chapter 1: Heat Transmission
Chapter 2: Conduction
Chapter 3: Convection
Chapter 4: Radiation – Mechanisms and Properties

Atomic Physics (Credits: 4 Coefficients: 2)
Chapter 1: Hydrogen-Like Atoms
Chapter 2: Multi-Electron Atoms
Chapter 3: Radiative Transitions
Chapter 4: X-Rays

Nuclear Physics Lab (Credits: 4 Coefficients: 2)
Lab 1: Study and efficiency of the Geiger-Müller detector
Lab 2: Nuclear statistics
Lab 3: Attenuation of β and γ radiation in aluminum
Lab 4: Attenuation of β and γ radiation in lead

Plasma Physics (Credits: 1 Coefficients: 1)
Chapter 1: Plasma Medium – Definition and Main Characteristic Quantities
Chapter 2: Motion of a Single Charged Particle in Electric and Magnetic Fields
Chapter 3: Elementary Processes in Plasmas
Chapter 4: Introduction to Kinetic Theory
Chapter 5: Transport Equations
Chapter 6: Introduction to Dusty Plasma Physics

Scientific English 2 (Credits: 1 Coefficients: 1)
Writing a technical report
Writing the report document
Oral presentation and communication