STUDY ABROAD

ITBA Escuela de INNOVACIÓN
EVOLUCIÓN CONTINUA

Physics II

LANGUAGE OF INSTRUCTION:

English

TERMS OFFERED:

Summer & Winter terms

PROGRAM OVERVIEW:

Course description:

The program aims to present the main physical foundations, an introduction to Electricity and Magnetism, Geometric and Physical Optics, and how they formulate the various physical models that explain them, their underlying hypotheses and the limits for their application, which serve as a basis for subsequent courses in this discipline, as well as others that relate to them.

LEARNING OUTCOMES:

Program objectives:

The program's structure is designed so that, upon completing the course, students will be able to:

- Understand the concept of an electric field and calculate it for various source configurations. Grasp the concepts of electric potential, conductors, and electric capacitors. Perform calculations using Gauss's and Ampère's Laws.

- Develop skills to solve both DC and AC electrical circuits.
- Understand the concept of a magnetic field, its properties, and the idea of a magnetic dipole. Apply Lenz's and Faraday's Laws and solve problems involving RLC circuits.
- Comprehend the scope of Maxwell's equations and effectively manage the idea of an electromagnetic wave.
- Understand the wave model of light and the phenomena of interference and diffraction. Calculate the basic results of a diffraction grating.
- Master the laws of Geometric Optics, including the laws of lenses and plane and spherical mirrors. Solve systems composed of multiple lenses and understand the fundamental operation of optical instruments.

Training objectives:

Develop:

- Critical analysis, conceptualization, and the production of causal inferences within the context of natural phenomena;
- The ability to employ quantitative and qualitative analysis methods in the study of physical phenomena;
- Manual and planning skills for data collection, and the capacity for synthesis in preparing laboratory reports; and the ability to work in groups.

TEACHING METHODOLOGY:

The course content is presented in a way that recreates the scientific method (observation, description, model formulation, and experimental verification). Theoretical descriptions are reinforced with a suitable selection of demonstrative experimental practices and the laboratory exercises students must perform.

ASSESSMENT METHODOLOGY:

During the course, there will be exams to assess what's been thought during classes, which will be posted into Blackboard, ITBA's educational platform.

CONTENT BY UNITS:

Module 1- Electric charges and fields:

- Electric charges and forces.
- Coulomb's law.
- Electric Fields.
- Electric field of point charges and charge distribution.
- Parallel-plate capacitors.
- Motion of a charged particle and a dipole in an external electric field.
- Symmetries and Gauss's law.
- Conductors in electrostatic equilibrium.

Module 2- Electric potential

- Electric potential energy
- Potential energy of point charges and dipoles
- Potential energy inside a parallel-plate capacitor
- Electric potential of a point charge and charge distributions
- Connecting electric potential and fields
- Conductors in electrostatic equilibrium
- Sources of electric potential
- Capacitance and capacitors
- Energy stored in a capacitor
- Dielectrics

Module 3-Current and resistance - Circuits

- Electron current
- Current density
- Conductivity and resistivity
- Ohm's law
- Kirchhoff's laws
- Energy and power
- Series and parallel resistors
- Real batteries
- Resistor circuits
- RC circuits

Module 4- Magnetic field

- Magnetism
- Magnetic field and its sources
- Magnetic dipoles
- Ampère's law and solenoids
- Magnetic forces on moving charges and current-carrying wires
- Forces and torques on current loops
- Magnetic properties of matter

Module 5 -Electromagnetic induction

- Motional EMF
- Magnetic flux - Lenz's and Faraday's laws
- Induced fields and currents - Inductors
- LC and LR circuits

Module 6- Maxwell's equations

- Displacement current
- Maxwell's equations
- Electromagnetic waves
- Polarization

Module 7- AC circuits

- Ac sources and phasors
- Capacitor circuits and RC filters
- Inductor circuits
- RLC circuits

Module 8-Wave optics

- Models of light
- Interference
- Diffraction gratings
- Single-slit diffraction
- Wave model of light
- Interferometers

Module 9- Ray optics

- Ray model of light
- Reflection and refraction
- This lenses and spherical mirrors
- Lenses in combination
- Vision
- Optical instruments

LEARNING REQUIREMENTS:

It is recommended that the students have the following contents in order to understand the topics taught in the course:

- Systems of linear equations
- First and second order differential equations
- Vector calculus
- Line, surface and volume integral

PROGRAM OUTLINE:

- Modality: In-person
- Amount of instruction contact hours: 60
- Amount of laboratory contact hours: 15
- Duration of classes: 3 hours
- Teaching: Monday to Thursday, 9 a.m. to 12 p.m
- Total amount of hours: 75

Course Schedule:

- **Winter 2026**: January 5 – January 29, 2026

  (Program start: December 2025 with welcome email)

- **Summer 2026:** May 26 – July 16, 2026

  (Program start: Mid- May 2026 with welcome email)

BIBLIOGRAPHY:

Required text

- Knight, Randall. *Physics for scientists and engineers: a strategic approach with modern physics*. 4th ed., Pearson, 2016.

Recommended readings

- Wolfson, Richard. Essential University Physics. 3rd ed., vol. 2, Pearson, 2016.
- Serway, Raymond and Jewett Jr, John. *Physics for scientists and engineers*. 9Th ed., Cengage, 2014.
- Young, Hugh and Freedman, Roger. *University physics with modern physics*. 14Th ed., Pearson, 2016.

COURSE GRADING:

The final course grade will be based on a percentage system founded on the points accumulated during the program, according to the following scale:

A 10

A- 9

B+ 8

B 7

B- 6

C+ 5

C 4

D 2

F 1

U Absent