2020 ITBA SUMMER PROGRAMS

Physics II

About ITBA

ITBA (www.itba.edu.ar) is the first and leading private University specialized in teaching and research in Engineering, Technology and Management in Argentina. Renowned for its academic excellence and for its commitment to generating and transferring innovative knowledge to society, ITBA´s programs have achieved the highest national and regional accreditation. In spite of its small size (+4000 students), ITBA's faculty and students have been recognized with several national and international awards. The university´s rigorous admissions criteria and low student to faculty ratio results in the highest student retention rates in Engineering in the country. ITBA graduates have one of the top employment rates and entry salaries in Argentina and occupy leading positions around the globe.

The University is well known for its small classes and personalized attention. It educates its Bachelor´s, Master´s, Ph.D. and Executive Education students to be responsible and pro-active global citizens. ITBA offers regional engineer and management courses, both in Spanish and English, at different levels.

Among ITBA´s, unique traits are the strong linkages to 50 of the world´s best ranked universities, the private and public sector (500 + agreements with industry) and leading international research bodies. ITBA offers a cosmopolitan academic experience in a multicultural community.

Living Buenos Aires – Living South America:

- Best student city in Latin America (QS Best Student Cities Ranking 2018)
- Top city in Latin America in the Global Talent Competitiveness Index (INSEAD, Adecco, Human Capital Leadership Institute)
- Spanish: the second most spoken language in the world.
- Most Global City in Latin America (AT Kearney Global Cities Ranking 2017)

Called the Paris of South America, Buenos Aires never sleeps. Charming its visitors with abundant cultural experiences of all types, it has stunning architecture, vibrant energy, and wonderful weather.

Buenos Aires has increasingly become a preferred destination for students from all over the world. Its European influence and Latin feel, its sophisticated boutiques, world-class gourmet eateries, frenzied nightlife and rich culture, are just some of the traits that make the city a place that enchants most visitors.

Buenos Aires, has easy connections with Chile, Brazil and Uruguay allowing the students to easily have a Latin American experience

Physics II

Program Overview

The course aims to present a course that vigorously underlines 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. It is designed for students with basic knowledge of an initial course of calculus and vector algebra, so the topics are presented based on these mathematical requirements, such as the calculation of derivatives and elementary integrals, operations with vectors, scalar and vector product.

Content

Electric charges and fields

- Electric charges and forces
- Coulomb's law
- Electric fields
- Electric field of point charges and charge distributions
- 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

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

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

Magnetic field

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

Electromagnetic induction

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

Maxwell’s equations

Displacement current
Maxwell’s equations
Electromagnetic waves
Polarization

AC circuits

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

Wave optics

Models of light
Interference
Diffraction gratings

Single-slit diffraction
Wave model of light
Interferometers

Ray optics

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

Lab Contents

Activities to be performed by students (in groups of 2 or 3 students each)

- Charge and discharge of capacitors
- Characteristic I-V curves of electrical devices
- CC circuits, verification of Kirchoff's laws
- Internal resistance of sources and maximum power transfer
- AC circuits, determination of power factor
- RLC circuit with AC source, resonance frequency
- Malus's law verification
- Diffraction gratings, chromatic spectra of light

Activities to be performed by the instructor

- Forces of charged bodies over neutral ones
- Charge distributions and electric fields in conductors
- Electric dipole within electric field
- Ohm's law – use of electrical measurements devices
- Parallel plate capacitor with and without dielectric
- Magnetic fields
- Magnetic force between two parallel conductors
- Faraday's law – interaction between magnets and coils
- Paramagnetic, diamagnetic and ferromagnetic materials
- Effect of temperature and vibrations on magnetized materials
- Microwave polarization
- Reflection and refraction of light
- Real and virtual images with individual and combination of lenses

Teaching Methodology

The teaching of the subject is developed through three training activities:

Theoretical classes.

Practical problem classes.

Laboratory classes in which theoretical knowledge is applied to specific situations and basic skills of data acquisition and presentation of results are developed, and in which students are introduced in the use of various measuring instruments.

Assessment Methodology

Individual final exam.

Course Length: 75 hours (including 15 laboratory hours)

Bibliography:

Key:

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

Recommended:

Wolfson, Richard. Essential University Physics. 3rd ed., vol. 2, Pearson, 2016.

Serway, Raymond and Jewett Jr, John. Physics for scientist 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 of the points accumulated during the semester, 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