ITBA Escuela de INNOVACIÓN

EVOLUCIÓN CONTINUA

Syllabus

PROGRAM NAME: Physics II with Laboratory (PHY202CDG) at ITBA

TERMS OFFERED: Summer & Winter terms

LANGUAGE OF INSTRUCTION: English

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 to 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.

PROGRAM OUTLINE:

- Course Length: 8 WEEKS
- HOURS: 75

CONTENT BY UNITS:

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 and 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
- This lenses and spherical mirrors
- Lenses in combination
- Vision
- Optical instruments

RECOMMENDED BACKGROUND KNOWLEDGE:

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 integrals

Lab contents

Activities be performed by students (in groups of 3 or 4 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 tbe 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

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 modernphysics*. 14Th ed., Pearson, 2016.

Amount of instruction contact hours: 60

Amount of laboratory contact hours: 15

Total amount of hours: 75