ESCUELA TÉCNICA
SUPERIOR DE
INGENIERÍA

DIM-GITT-103 Physica Foundations of Communications

SEMESTER: Annual (Fall and Spring)

CREDITS: 12 ECTS (4 hrs. per week)

LANGUAGE: Spanish

DEGREES: GITT

Course overview

This annual course introduces students to classical mechanics, electricity, magnetism, special relativity and quantum physics.

Prerequisites

Basic knowledge of calculus.

Course contents

1. Kinematics of the particle. Motion in one dimension. Motion in the plane. Normal and tangential acceleration. Relative translational kinematics.
2. Particle dynamics in the plane. Inertial systems and principle of inertia. Forces. Principle of action and reaction. Newton's second law. Mass and weight. Linear momentum. Friction.
3. Work and Energy. Kinetic energy. Theorem of living forces. Conservative forces. Potential energy. Theorem of work and energy. Elastic potential energy. Gravitational potential energy. Energy conservation. Harmonic oscillations. Power.
4. Conservation laws. Center of mass. Conservation of linear momentum. Kinetic energy. Linear momentum. Shocks. Introduction to variable mass systems: propulsion rocket. Center of mass system. Angular momentum and central forces.
5. Gravitation, planetary motion and satellites.
6. Electrostatics. Electric charge. Coulomb's law. Electric field. Gauss' law. Electrical potential. Drivers. Electrostatic energy.
7. Electric current. Forces. Current density and intensity. Ohm's law. Joule effect. Electromotive force.
8. Magnetostatics. Magnetic field. Magnetic force on particles and currents. Magnetic moment. Biot and Savart. Ampere's law.

9. Electromagnetic induction. Faraday's law. Lenz's law. Induction coefficients. Magnetic energy.
10. Maxwell equations and electromagnetic waves. Electromagnetic plane waves and light speed. Sinusoidal electromagnetic waves. Energy and momentum of electromagnetic waves. Standing waves.
11. Introduction to optics. Reflection and refraction. Dispersion. Huygens' principle. Reflection and refraction on a flat surface. Refracciuón reflection on a spherical surface. Interference and diffraction.
12. Introduction to special relativity. Relativity of simultaneity. Relativity of time intervals. Relativity length. Lorentz transformations.
13. Introduction to quantum physics. Emission and absorption of light. The photoelectric effect. Atomic line spectra and energy levels. Bohr's model. De Broglie waves.
14. Quantum mechanics. Wave functions and the Schrödinger equation. Particle in a box. Potential wells. Potential barriers and tunneling. Simple applications.

Textbook

- Hugh D. Young, Roger A. Freedman and A. Lewis Ford, University Physics with Modern Physics (13th Edition), Addison-Wesley, 2011.

Grading

The final grade for this course is based on the following criteria:

- Two end of term exams (25% each)
- Two midterm exams (15% each)
- Four short exams (5% each)

The following conditions must be accomplished to pass the course:

- A minimum overall grade of at least 5 over 10.
- A minimum grade of 4 over 10 in the end of term exams.