Unit of Study Information

Code	Unit	Evaluation Method	Mode	Session options
FI73S	Theoretical Physics C	Grade and Attendance	Presencial	Semestral

Workload					
TC	PC	OA	SPA	PACC	Total
4	0	9	0	0	60

- TC: Theorethic Classes (per week);
- PC: Practical Classes (per week);
- OA: Out-of-class Activities (hours per session);
- SPA: Supervised Practical Activities (classes per session);
- PACC: Practical Activities as Curricular Components (classes per session, included in OA and SPA);
- Total: total workload in hours.

Learning Outcomes

Development of problem solving capacity and physical-mathematical language necessary to quantify the electromagnetic phenomena observed in nature. Establishment of the bases for Electrical Circuits, Electrotechnics, Classical Electrodynamics and Modern Physics, and for the understanding of modern scientific and technological advances. (Prerequisites are Theoretical Physics B, Experimental Physics 1 and Calculus 2)

Syllabus

Electric charge; Electric field; Gauss's Law; Electric potential; Capacitance; Current and Resistance; Electric circuits (direct current); Magnetic field; Ampere Law; Law of Induction and Inductance; Electromagnetic Oscillations and Alternating Current; Magnetism in Matter; Maxwell's equations.

Content

Order	Syllabus	Content
1	Electric charge	Electric charges; Conductors and Insulators; Coulomb's Law; Superposition Principle; Quantization and Conservation of Cargo.
2	Electric field	Electric field; Field Lines; Fields produced by a single Charge, Electric Dipole, Continuous Distributions: Line and Disc; Electric charge and dipole in the presence of an external field.
3	Gauss's Law	Field flow; Gauss's Law; Coulomb's Law Deduction; Charged conductor; Gaussian Law Applications: Planar, cylindrical and spherical symmetries.
4	Electric potential	Electric potential energy; Electric potential; Equipotential surfaces; Calculation of potential from the field; Charge potential and electric dipole; Potential of a load distribution; Calculation of the field from the electric potential; Energy stored in a charge system; Potential in conductors.
5	Capacitance	Capacitance and capacitor; Capacitance calculation: planar, cylindrical and spherical symmetries; Capacitors in parallel and in series; Energy stored in the electric field (energy density); Dielectrics and Polarization.
6	Current and Resistance	Electric current (charge flow); Current density (velocity field); Drift velocity; Ohm's Law; Resistivity resistance; Resistivity dependence on temperature; Power in circuits; Semiconductors; Superconductors.
7	Electric circuits (direct current)	Electromotive force; Work and energy; Mesh Circuits; Potential difference (ddp); Mesh law; Resistance in series; Actual source and grounding; Resistance in parallel; Node Law; Ammeter and Voltmeter; RC circuits.
8	Magnetic field	Origin and definition of the magnetic field; Crossed electric and magnetic fields; Hall effect; Charged particle in circular motion; Cyclotrons and Synchrotrons; Magnetic force on a wire with electric current; Torque in a coil; Magnetic dipole momentum.
9	Ampere Law	Magnetic field produced by a current; Ampere Law and Biot-Savart Law; Field produced by the current a straight wire and a circumference arc; Force between two currents; Magnetic field inside the wire; Solenoids and Toroids; Coil interpreted as a magnetic dipole.
10	Law of Induction and Inductance	Current and induced electromotive force; Faraday's induction law; Lenz's Law; Energy conservation; Parasitic currents; Induced electric fields; Inductors and inductance; Self induction and mutual inductance; RL circuits; Energy stored in the magnetic field and energy density; Mutual induction
11	Electromagnetic Oscillations and Alternating Current	Oscillations (LC circuit); Electromechanical analogy (spring-mass system); Damped oscillations (RLC circuit); Alternating current and forced oscillations; Resistance, reactance and impedance; Phasors; RLC circuit in series; Power and mean square value (RMS); Transformers
12	Magnetism in Matter	Permanent magnets; Dipolar momentum of spin and orbital; Diamagnetism, paramagnetism and ferromagnetism; Curie's Law; Magnetic domains; Hysteresis.
13	Maxwell's equations	Maxwell's equations in integral and differential form; Gauss's Law (electric and magnetic); Law of induction (electric and magnetic); Displacement current; Ampère-Maxwell Law; Demonstration of the electromagnetic wave equation and the speed of light.

Basic Resources

TIPLER, Paul Allen; MOSCA, Gene. Física: para cientistas e engenheiros. 6. ed. Rio de Janeiro, RJ: LTC, c2009. 3 v. ISBN 9788521617105 (v.1). - vol. 2

HALLIDAY, David; RESNICK, Robert; WALKER, Jearl. Fundamentos de física. 10. ed. Rio de Janeiro, RJ: LTC, c2016. 4 v. ISBN 9788521630357 (v.1). - vol. 3

HALLIDAY, David; RESNICK, Robert; WALKER, Jearl. Fundamentos de física. 10. ed. Rio de Janeiro, RJ: LTC, c2016. 4 v. ISBN 9788521632092 (v.1). - vol. 3 (E-BOOK)

Aditional Resources

FEYNMAN, Richard Phillips; LEIGHTON, Robert B.; SANDS, Matthew L. The Feynman lectures on physics. 5. ed. the new mullennium edition. New York: Basic Books, 2011. 3 v. ISBN 9780465024162.

SERWAY, Raymond A.; JEWETT, John W. Princípios de física. São Paulo, SP: Pioneira Thomson Learning, c2004-c2005. 4 v. ISBN 8522113828 (v.1).

NUSSENZVEIG, H. Moysés. Curso de física básica. 4. ed. São Paulo, SP: E. Blücher, 2002. 4 v. ISBN 9788521202981 (v.1).

ALONSO, Marcelo; FINN, Edward J. Física: um curso universitário. 2. ed. rev. São Paulo, SP: E. Blücher, c1972. 2 v. ISBN 9788521200390.

PURCELL, Edward Mills. Eletricidade e magnetismo. São Paulo: Edgard Blücher, 1970. 424 p. (Curso de física de Berkeley ;v. 2)