Unit of Study Information

Code	Unit	Evaluation Method	Mode	Session options
FI72S	Theoretical Physics B	Grade and Attendance	Presencial	Semestral

Workload					
TC	PC	OA	SPA	PACC	Total
4	0	9	0	0	90

- 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 skills and introduction to the physical-mathematical language necessary to quantify collective phenomena, distributed interactions, and hydrodynamic, undulatory and thermodynamic phenomena. Establishment of the bases for General Mechanics, Solid Mechanics, Material Resistance, Transport Phenomena, Fluid Mechanics, Thermodynamics, Electromagnetism and Circuits (Theoretical Physics C). (Note: It has as prerequisites Theoretical Physics 1, Analytical Geometry and Calculus 1).

Syllabus

Mechanical effort and elasticity; Gravitation; Fluid mechanics; Oscillations; Waves; Sound; Temperature, heat and the first law of thermodynamics; Kinetic theory of gases; Entropy and the Second Law of Thermodynamics.

Content

Order	Syllabus	Content
1	Mechanical effort and elasticity	Review of static balance and center of gravity; Mechanical tension, traction, compression, flexion, shear, torsion and buckling; Deformation; Modulus of elasticity (Young and Shear); Hydrostatic stress and modulus of elasticity; Introduction to tensor formulation.
2	Gravitation	Laws of gravitation; Superposition principle; Forces in 3 dimensions; Gravitational acceleration and the equivalence between inertial and gravitational mass; Proximity to the earth's surface; Spherical shells and the interior of the Planet; Gravitational potential energy; Potential energy of a particle system; Escape velocity; Kepler's Laws; Energy of planetary motion; Equivalence principle.
3	Fluid mechanics	Density; Volumetric and surface forces; Force density, energy density and pressure; Hydrostatic; Stevin's Law; Pascal's principle; Communicating vessels; Pressure gauge; Archimedes principle and thrust; Notions of hydrodynamics; Stationary and laminar flow; Equation of continuity; Bernoulli equation (ideal fluid: incompressible, irrotational, and non-viscous); Torricelli's formula; Pitot tube; Viscosity; Notions of turbulence and vortices.
4	Oscillations	Simple harmonic motion (SHM); Frequency and period; Linear oscillator (mass spring system); Energetic balance; Pendulums; Angular oscillator; Relationship between SHM and Circular Uniform Motion (Phasors); Accelerated Harmonic Motion (AHM); Forced oscillations and resonance.
5	Waves	Transverse and longitudinal waves; Sine waves; Wave equation and wave function; Wavelength, frequency, amplitude and phase; Speed of a wave on a taut rope; Power (energy transmitted in a wave); Principle of wave overlap; Phasors and interference; Reflection, standing waves and resonance.
6	Sound	Sound waves; Volumetric modulus of elasticity and the speed of sound; Wave fronts (amplitude of displacement and pressure); Interference (path differences); Power; Intensity and sound levels (decibels); Standing waves in tubes; Beats; Doppler effect; Shock waves (Mach cone).
7	Temperature, heat and the first law of thermodynamics	Macroscopic properties; Temperature and thermometers; Zero law (thermal equilibrium); Relative scales (Celsius and Fahrenheit); Absolute scale (Kelvin); Coefficient of thermal expansion and heat; Thermal capacity and specific heat (Mass and Molar); State transformation (heat of vaporization and fusion); Work due to volumetric expansion; First Law (Conservation of Energy); Applications: adiabatic, isochoric, cyclic and free expansion processes; Heat transfer mechanisms (conduction, convection and radiation).
8	Kinetic theory of gases	Microscopic properties; Avogadro Number; Equation of state and the law of ideal gases; Boltzmann ideal gas constant and constant; Kinetic theory: pressure, temperature and molecular velocity; Middle way free; Maxwell velocity distribution; Molar specific heat; Degrees of freedom, kinetic energy and the equipartition energy theorem; Isothermal and adiabatic process.
9	Entropy and the Second Law of Thermodynamics	Irreversible processes; Entropy variation; Second Law (Axis of Time); Thermal machines and efficiency; Carnot cycle; Stirling machine; Refrigerators and Performance Coefficient; Statistical view of entropy and microstates.

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).

HALLIDAY, David; RESNICK, Robert; WALKER, Jearl. Fundamentos de física. 10. ed. Rio de Janeiro, RJ: LTC, c2016. 4 v. ISBN 9788521630357 (v.1). - vol. 2

HALLIDAY, David; RESNICK, Robert; WALKER, Jearl. Fundamentos de física. 10. ed. Rio de Janeiro, RJ: LTC, c2016. 4 v. ISBN 9788521632078 (v.1). - vol. 2 (E-BOOK)

Aditional Resources

CRAWFORD, Frank S. Waves. New York: Berkeley, 1979. 600 p. (Berkeley physics course -3)

HIBBELER, R. C. Mecânica para engenharia. 12. ed. São Paulo, SP: Pearson Prentice Hall, c2011. 2 v. ISBN 8587918974 (v.1).

FOX, Robert W.; MCDONALD, Alan T.; PRITCHARD, Philip J. Introdução à mecânica dos fluidos. 7. ed. Rio de Janeiro, RJ: LTC, 2010. 710 p. ISBN 9788521617570.

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

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.