Unit of Study Information

Code	Unit	Evaluation Method	Mode	Session options
FI71S	Theoretical Physics A	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 skills and introduction to fundamental physical-mathematical language to quantify all physical phenomena observed in nature. Establishment of the necessary bases for the further study of Collective Phenomena (Theoretical Physics B).

Syllabus

Measurement; Rectilinear motion; Vectors; Multidimensional movement; Newton's Laws; Strength and movement; Kinetic Energy and Work; Potential Energy and Conservation of Energy; Particle system; Center of Mass and Conservation of Linear Momentum; Rotation; Rolling, Torque and Angular Momentum Conservation; Conservation Laws; Symmetries and Giant Referential; Static equilibrium.

Content

Order	Syllabus	Content
1	Measurement	Measurement; Significant digits; SI; Change of units; Length; Time; Mass.
2	Rectilinear motion	Rectilinear motion; Position and Displacement; Average speed; Instantaneous velocity; Acceleration; Constant acceleration and free fall; Graphics and graphics integration.
3	Vectors	Vectors and scalars; Geometric sum of vectors; Unit vectors (versors); Addition of vectors through their components; Vector multiplication (scalar product and vector); Introduction to Motion in two and three dimensions; Position and displacement; Average and instantaneous velocity; Average and instantaneous acceleration.
4	Multidimensional movement	Movement in two and three dimensions; Projectile movement (parabolic movement); Uniform Circular Motion (UCM); Relative Motion (one and two dimensions); Graphics and graphics integration.
5	Newton's Laws	Strength and movement; Newton's First Law (Inertia); Force; Mass; Newton's Second Law (Force Effect); Gravitational force, weight, normal force and frictional force; Traction; Newton's Third Law (Action and Reaction); Applications: Inclined plane, pulleys and cables.
6	Strength and movement	Friction properties: kinetic and static; Drag force and terminal velocity; Uniform circular motion; Centripetal acceleration; Centripetal force.
7	Kinetic Energy and Work	Energy; Work theorem and kinetic energy; Work done by gravitational force; Tensile strength; Work done by an elastic force; Work performed by any variable force; Power.
8	Potential Energy and Conservation of Energy	Independence of trajectory for a conservative force; Choice of reference to determine potential energy; Conservation of mechanical energy; Interpretation of the potential energy curve (direction of force); Work performed by an external force on the system; Principle of energy conservation; Work; Power (transmitted by an external force and dissipated by friction); Balance between kinetic and potential energy; Calculation of force from potential energy.
9	Center of Mass and Conservation of Linear Momentum	Center of mass (via sum); Newton's Second Law for a particle system; Linear momentum; Collision and thrust; Internal and external forces; Principle of conservation of linear momentum; Moment and kinetic energy in collisions; Elastic and inelastic collisions in one dimension; Collisions in two dimensions; Variable mass systems (rocket).
10	Rotation	Rotation; Polar coordinates; angular and radial displacement, velocity and acceleration; Kinematic equations for constant angular acceleration; Relationship between linear and angular variables; Kinetic energy of rotation; Moment of inertia (via summing and integration); Parallel axis theorem; Torque; Newton's second law for rotation; Work and kinetic energy of rotation.
11	Rolling, Torque and Angular Momentum Conservation	Rolling, translation and rotation; Rolling kinetic energy; Bearing forces; Yo-yo; Torque, angular momentum and Newton's Second Law; Angular momentum of a particle system (via sum); Angular momentum of a rigid body around an axis (via integral); Conservation Principle of angular momentum and central forces; Gyro precession.
12	Symmetries and Giant Referential	Applications of conservation laws; Collisions: Linear, angular momentum and energy exchanges between two bodies; Description of Ballerina Movement: angular momentum, angular velocity and kinetic energy of rotation; Applications of conservation laws; Precession of Planet Earth; Hollow and solid cylinder bearing; Yo-yo; Applications of conservation laws; Calculation of the moment of inertia of different bodies; Revision of Newton's Laws in three dimensions; Rotating frame: forces of inertia, centrifugal force and Coriolis force.
13	Static equilibrium	Static equilibrium of large bodies; Center of gravity.

Basic Resources

HALLIDAY, David; RESNICK, Robert; WALKER, Jearl. Fundamentos de física. 10. ed. Rio de Janeiro, RJ: LTC, c2016. 4 v. ISBN 9788521632054 (v.1). - vol. 1 (E-BOOK)

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. 1

Aditional Resources

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.

KITTEL, Charles; KNIGHT, Walter D.; RUDERMAN, Malvin A. Mecânica. São Paulo: Edgard Blucher, 1973. 455 p. (Curso de física de Berkeley ; v. 1)

BEER, Ferdinand Pierre et al. Mecânica vetorial para engenheiros. 9. ed. Porto Alegre, RS: AMGH, 2012. 2 v. ISBN 9788580550467(v.1).

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