

Course Unit	Physics		Field of study	Physics	
Bachelor in	Electrical and Computers Engineering		School	School of Technology and Management	
Academic Year	2023/2024	Year of study	1	Level	1-1
Type	Semestral	Semester	2	ECTS credits	6.0
			Code	9112-742-1204-00-23	
Workload (hours)	162	Contact hours	T	30	TP
			PL	-	TC
			S	-	E
			OT	-	O

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) João Carlos Almendra Roque

### Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. Know and understand basic physical processes and phenomena of Mechanics.
2. Acquire the necessary knowledge to read physics literature and work with physical quantities, units and tables.
3. Solve physics problems involving vector operations and equations on governing kinematics (rectilinear and curvilinear including circular motions).
4. Know and identify fundamental types of external forces acting to bodies: mass forces (gravitational, inertia forces); interaction forces (normal, tension / compression; tangential, friction; elastic).
5. Solve physics problems applying Newton's Laws, principle of work and energy, conservation of mechanical energy, impulse and momentum theorem, conservation of momentum.
6. Know, understand and solve periodic motion problems (oscillatory and wave).

### Prerequisites

Before the course unit the learner is expected to be able to:  
Solve basic problems of mathematics and physics.

### Course contents

Physical quantities and units. Mathematical operations with vectors. Kinematics. Statics and Dynamics: Newton's Laws. Work and Energy. Impulse and Momentum. Oscillatory and wave motion.

### Course contents (extended version)

1. Physical quantities and units.
  - Physical quantities, units and measures.
  - International System of Units and other systems. Conversion of units.
  - Fundamental units and derived units.
  - Dimensional analysis.
  - Scalar and vector quantities.
  - Applications with vector calculus.
2. Kinematics.
  - Rectilinear, curvilinear and circular motion.
  - Position, displacement, velocity and acceleration vectors.
  - Uniform and non-uniform motion.
  - Motions with constant acceleration: accelerated and retarded motions.
  - Curvilinear motion. Tangential and normal acceleration components
  - Circular motion. Angular velocity and angular acceleration. Period and frequency.
  - Relative motions. Relative displacement, velocity and acceleration.
  - Motion of projectiles
3. Statics / Dynamics.
  - Newton's laws.
  - Types of forces.
  - Free-body diagrams.
  - Static / dynamic equilibrium of a particle. Equations of equilibrium.
  - Static equilibrium of a body. Moment of a force.
  - Friction. Applications in static and dynamic problems.
4. Work and energy.
  - Work a constant force.
  - Work a variable force.
  - Kinetic energy and potential energy.
  - Power and efficiency.
  - Conservative and nonconservative forces.
  - Principle of work and energy.
  - Conservation of mechanical energy.
5. Impulse and momentum.
  - Linear impulse and linear momentum.
  - Linear impulse and momentum theorem.
  - Angular impulse and momentum.
  - Angular impulse and momentum theorem.
  - Conservation of linear and angular momentum.
  - Collisions.
6. Oscillation and waves.
  - Oscillatory and wave motion.
  - Simple harmonic motion.
  - The pendulum.
  - Damped and forced oscillations.
  - Wave equation.
  - Transverse and longitudinal waves.
  - Sound waves.

### Recommended reading

1. Halliday, Resnick, Walker, "Fundamentos de Física 1", 4ª ed, LTC editora, 1996.
2. Halliday, Resnick, Krane, "Física 1", 4ª ed, LTC editora, 1996.
3. Halliday, Resnick; Krane . "Física 2", 4ª ed, LTC editora, 1996
4. Beer, Russel, "Mecânica vectorial para engenheiros : cinemática e dinâmica", 5ª ed, Makron Books , 1994

**Recommended reading**

5. Tipler, Mosca, "Física para cientistas e engenheiros", 5th ed, LTC , cop. 2006

**Teaching and learning methods**

Classroom lectures: Fundamental concepts for understanding the course contents are presented. Students will be assisted by the teacher in deepening their knowledge through discussion and resolution of proposed practical exercises.

**Assessment methods**

1. Alternative 1 - (Regular, Student Worker) (Final)
  - Intermediate Written Test - 50%
  - Final Written Exam - 50%
2. Alternative 2 - (Regular, Student Worker) (Final, Supplementary, Special)
  - Final Written Exam - 100%

**Language of instruction**

Portuguese, with additional English support for foreign students.

**Electronic validation**

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05-03-2024	05-03-2024	06-03-2024	09-03-2024