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Course Unit	Physics			Field of study	Physics	
Bachelor in	Mechanical Engineering			School	School of Technology and Management	
Academic Year	2023/2024	Year of study	1	Level	1-1	ECTS credits 6.0
Type	Semestral	Semester	1	Code	9123-759-1104-00-23	

Workload (hours)	162	Contact hours	T	-	TP	60	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)	Sérgio Manuel de Sousa Rosa

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.
2. Understand and to use physical laws governing real process and to describe them mathematically.
3. Acquire knowledge need to read physics literature and to work with physical quantities, units and tables.
4. Solve physics problems by applying vectors operations and equations governing kinematics (rectilinear, curvilinear and circular motion).
5. Know basic forces (weight, normal reaction, tension, elastic force, frictional force and others) and draw a free-body diagram of an object or system.
6. Solve physics problems by applying Newton's Laws, principle of work and energy, conservation of mechanical energy, impulse and momentum (linear and angular) theorem, conservation of momentum.

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. Statics. Kinematics. Dynamics: Newton's Laws. Work and Energy. Impulse and Momentum.

Course contents (extended version)

1. Physical quantities and units.
    - Physical quantities, units and measurements.
    - The International System of Units and other systems. Conversion of units.
    - Base units and derived units.
    - Dimensional analysis.
    - Scalar and vector quantities.
    - Mathematical operations with vectors.
2. Kinematics.
    - Rectilinear, curvilinear and circular motion.
    - Position and displacement vectors, velocity and acceleration vectors.
    - Uniform, accelerated and retarded motions.
    - Motion with constant acceleration.
    - Motion of a projectiles.
    - Tangential and normal components of acceleration.
    - Uniform and nonuniform circular motion.
    - Angular velocity and angular acceleration.
    - Relative velocity and acceleration.
3. Dynamics.
    - Forces, mass and acceleration.
    - Basic forces: weight, normal reaction, tension, frictional force. Other forces.
    - Newton's laws.
    - Equation of motion.
    - Free-body diagrams and solution of problems.
4. Statics.
    - Static and dynamic equilibrium.
    - Moment of a force.
    - Equations of equilibrium.
5. 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.
6. 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.

Recommended reading

1. Halliday, Resnick, Walker, "Fundamentos de Física 1", 4ª ed, LTC editora.
2. Halliday, Resnick, Krane, "Física 1", 4ª ed, LTC editora.
3. Halliday, Resnick; Krane . "Física 2", 4ª ed, LTC editora.
4. Beer, Russel, "Vector Mechanics for Engineers", Dynamics. McGraw-Hill Company.
5. Tipler, "Physics for Scientists and Engineers, Mechanics, Oscillations and Waves", 6th ed, John Wiley and Sons.

Teaching and learning methods

In the lecture classes, the fundamental concepts are presented for understanding the course contents. The students, helped by the professor, will enhance their

Teaching and learning methods

knowledge by solving a group of practical exercises. These, and some other exercises, will be discussed and solved in the practice classes.

Assessment methods

- Alternative 1 - (Regular, Student Worker) (Final, Supplementary, Special)
    - Final Written Exam - 100%

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation

Sérgio Manuel de Sousa Rosa	Debora Rodrigues de Sousa Macanjo Ferreira	João da Rocha e Silva	José Carlos Rufino Amaro
04-10-2023	04-10-2023	04-10-2023	10-10-2023