FUNDAMENTALS OF PHYSICS

Code: 322045

Main Scientific Area: Applied physical sciences

Lecturer: Miguel Ângelo Mendes da Costa Carvalho

Language of Instruction: Portuguese

Regime: S1

Contact Hours: 30h Total Workload: 54h

ECTS: 3,0

Objectives

The aim of the Fundamentals of Physics is to acquire technical knowledge based in the classical physics and analysis of mechanical challenges, through the simplification, logics and applying the correct mathematical tools (trigonometry, algebra, vectors and differential calculus) in order to adress the analysis of real-world problems of Physics and Technology. The aim is to students develop personal skills and professional attitudes that enable them to tackle problems of classical mechanics, both from a theoretical and/or experimental point of view.

Learning Outcomes

The program includes a review of basic concepts of mathematics and geometry that are essential for subsequent topics. In Fundamentals of Physics aims to give students the ability to understand and apply basic concepts of classical physics to problems of dynamics and kinematics, work and energy and communications. Thus, it is intended to equip students with tools and professional attitudes to enable it to address the problems of classical mechanics to a range of everyday situations.

Course Contents

1. PHYSICAL QUANTITIES, UNITS AND DIMENSIONS

1.1 Definition of greatness: quantities fundamental and derived

1.2 Measuring a physical quantity

1.3 Systems of units, SI and CGS system

2. SUPPLEMENTS OF MATHEMATICS

2.1 Trigonometry: trigonometric functions, trigonometric triangle

2.2 Vector calculus

2.3 Differential calculus

3. KINEMATICS OF A MATERIAL POINT

3.1 One-Dimensional Motion

3.1.1 Equation of motion: rectilinear and uniform, and uniformly varied rectilinear

3.1.2 Average speed and instantaneous velocity

3.1.3 Acceleration average and instantaneous acceleration

3.1.4 Free fall of a body

3.1.5 Bidimensional motion

3.1.6 Cartesian coordinates

3.1.7 Motion of a projectile

3.1.8 Circular motion. Angular velocity and angular acceleration

4. DYNAMIC

4.1 Introduction

4.2 Newton`s Laws

4.3 Fundamentals forces (gravity, electroweak and strong) and derivatives (normal reaction, tension in a rope, friction force and elastic)

4.4 Application of the 1st and 2nd and 3rd law of Newton: free body diagram

4.5 Law of attraction gravitational. Satellite Movement. Geostationary satellites

5. WORK AND ENERGY

5.1 Work of a force

5.2 Work and kinetic energy. Kinetic energy theorem

5.3 Potencial energy associated with a conservative force: gravitational potential energy and elastic

5.4 Conservative and non-conservative forces

5.5 Mechanical energy

5.6 Principle of conservation of mechanical energy

5.7 Power and efficiency

6. COMMUNICATION OF INFORMATION

6.1 Propagation of a signal

6.2 Types of waves

6.3 Sound:

6.3.1 Production and Propagation of a Beep

6.3.2 Temporal and spatial frequency of a sound wave

6.3.3 Characteristics of a sound wave

6.3.4 Propagation speed

6.3.5 Sound Attributes: Sound Intensity, Sound Height, and Tone

6.3.6 Sound spectrum

6.4 Applications

Recommended Bibliography

Halliday D., Resnick R., and Walker J., Fundamentals of Physics, 7th Edition, Editora John Wiley.

Frederick J. Bueche/Eugene Hecht, Física (9ª edição), Editora McGraw-Hill, 2001.

Almeida, G. Sistema Internacional de Unidades (SI). Grandezas e Unidades Físicas, 2ª ed., Plátano Editora, 1997.

Halliday, D., Resnick, R. e Krana, K.S., Física 1-4, Livros Técnicos e Científicos Editora S.A, 4ª ed., 1996.

Valadares, J. e Silva, L. Manual de Física, mecânica, 13ª ed., Didática Editora, cap 1-5, 1994.

Learning and Teaching Methods

Contents: PHYSICAL QUANTITIES, UNITS AND DIMENSIONS

Main objectives: To learn the concept of greatness: fundamental and derived quantities. Knowing systems units: SI and CGS system. Learn to correctly represent the value of a quantity in terms of units and scientific notation. Learn to do the dimensional analysis of a physical equation.

Contents: MATH SUPPLEMENTS

Main objectives: Remember basics of trigonometry. Learn represented graphically and analytically a vector in terms of its components in 2 and 3 dimensions. Learn to add vectors graphically and analytically as a function of its components. Know the scalar productand the vector product of vectors. Remember derived functions using derivation rules.

Contents: KINEMATICS OF A MATERIAL POINT

Main objectives: Know and apply the laws of rectilinear and uniform motion, rectilinear and uniformly varied motion in solving exercises. Know calculate average/instantaneous velocity, average/instantaneous acceleration of a body. Learn to study the motion of a projectile. Learn to calculate the tangential acceleration/normal acceleration in circular motion.

Contents: DYNAMICS

Main objectives: To learn the concept of force and momentum. Knowing Newton`s laws and apply them in the interpretation of specific situations. Knowing the fundamental forces (gravitation, electroweak and strong) and derivatives (normal reaction, tension in the rope, friction force and elastic). To apply Newton`s laws in the construction of free body diagram to study the dynamics of a particle material.

Contents: WORK AND ENERGY

Main objectives: Learn to calculate the work done by a force / force system. Knowing the law of work and kinetic energy in solving exercises. Knowing the different forms of mechanical energy: potential energy associated with a conservative force: gravitational and elastic potential energy. Know and give examples of conservative forces and forces non-conservative. To apply the principle of conservation of mechanical energy in solving exercises.

Contents: COMMUNICATION OF INFORMATION Main objectives: Study on the transmission of signals more properly of sound waves with the objective of understanding the phenomenon of wave as the propagation of a perturbation, interpretation and reading of the graphic representation of sound waves (characteristics of a wave) and interpretation/identification of the periodicity of sound waves: temporal and spatial.

Assessment Methods

A written evaluation interim approximately half the length of the semester, and a written evaluation at the final of the semester.

Practical works (mandatory) throughout the semester and during the class - written or oral.

The final grade is weighted between the following classifications:

Practical works during classes (15%)

Test 1 (42.5%)

Test 2 (42.5%)

Global Test (85%)