

Academic Year: ( 2019 / 2020 )

Review date: 08-12-2019

Department assigned to the subject: Department of Physics

Coordinating teacher: SAVOINI CARDIEL, BEGOÑA

Type: Basic Core ECTS Credits : 6.0

Year : 1 Semester : 1

Branch of knowledge: Engineering and Architecture

**COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.**

Upon successful completion of this subject, the students will be able to:

1. Have knowledge and understanding of the physical principles related with mechanics and thermodynamics.
2. Have the ability to apply their knowledge and understanding to identify, formulate and solve problems related to mechanics and thermodynamics using established methods.
3. Have the ability to design and carry out mechanics and thermodynamics experiments, analyze the data and draw conclusions.
4. Handling laboratory instruments for data collection in experiments related to mechanics and thermodynamics laboratory sessions.
5. Have the ability to select and use appropriate tools and methods to solve problems of mechanics and thermodynamics.
6. Have the ability to combine theory and practice to solve problems of mechanics and thermodynamics.

**DESCRIPTION OF CONTENTS: PROGRAMME**

1. Kinematics of a particle and relative motion
  - 1.1 Vectors position, velocity and acceleration. Equation of trajectory
  - 1.2 Intrinsic components of acceleration
  - 1.3 Circular motion
  - 1.4 Relative motion
2. Dynamics of a particle I
  - 2.1 Fundamental concepts: mass and force
  - 2.2 Newton's laws
  - 2.3 Free body diagrams
3. Dynamics of a particle II
  - 3.1 Linear momentum
  - 3.2 Linear momentum conservation
  - 3.3 Momentum of a force and angular momentum
4. Conservative and non-conservative forces. Work and energy
  - 4.1 Escalar and vectorial fields. Gradient and rotational functions
  - 4.2 Work and power
  - 4.3 Kinetic energy
  - 4.4 Conservative forces and potential energy
  - 4.5 Non conservative forces
  - 4.6 Conservation of energy
5. Systems of particles
  - 5.1 Internal and external forces
  - 5.2 Center of mass and movement of the center of mass
  - 5.3 Kinetic energy of a system of particles
  - 5.4 Conservation theorems
6. Kinematics of the Rigid Body
  - 6.1 Rotation and translation motion
  - 6.2 Motion of the rigid body in the plane

- 6.3 Moment of inertia
- 6.4 Theorem of Steiner

## 7. Dynamics of the Rigid Body

- 7.1 Equations of motion of the rigid body
- 7.2 Rotation work and power
- 7.3 Kinetic energy of rotation
- 7.4 Rolling

## 8. Introduction to Thermodynamics

- 8.1 Thermodynamics: concepts. Ideal gas
- 8.2 Equilibrium States. Quasistatic processes and reversible processes
- 8.3 Work
- 8.4 Temperature definition
- 8.5 Thermometry. Ideal gas temperature scale
- 8.6 Thermal coefficients: expansion and isothermal compressibility

## 9. First principle

- 9.1 Heat: Heat capacity and specific heat
- 9.2 Phase Changes: phase diagrams and latent heat
- 9.3 Internal energy. Internal energy of an ideal gas
- 9.4 Experiment of Joule. The first law of thermodynamics
- 9.5 Application of the First Law to ideal gases: quasistatic processes

## 10. Second principle

- 10.1 Heat engines. Efficiency
- 10.2 Statement of Kelvin-Planck
- 10.3 Refrigerators and heat pumps
- 10.4 Statement of Clausius
- 10.5 Cycle of Carnot

## 11. Entropy

- 11.1 Theorem of Clausius
- 11.2 Entropy. Reversible process
- 11.3 Entropy in ideal gases
- 11.4 Diagrams T-S
- 11.5 Entropy in irreversible processes
- 11.6 Second law of the thermodynamics

## LEARNING ACTIVITIES AND METHODOLOGY

- Lectures on the specific topics. Provide a theoretical background on physics.
- Recitation classes for solving assigned problems and discussion of specific concepts previously addressed.
- Practical laboratory sessions. Students must carry out experimental measurements and analyse the results
- Office hours

## ASSESSMENT SYSTEM

- Laboratory sessions (15% of final mark)

Attendance to the laboratory sessions is compulsory.

Evaluation of the reports.

- Recitation classes (25% of final mark)

A regular evaluative process is conducted through short exams and activities. This process accounts for 25% of the final mark.

- Final exam (60% of final mark)

This exam is made at the end of the semester.

For the final mark, a minimum score of 3 out of 10 in the final exam is required to take into account the continuous evaluation mark.

**% end-of-term-examination:** 60

**% of continuous assessment (assignments, laboratory, practicals...):** 40

## BASIC BIBLIOGRAPHY

- Bedford, Fowler Mechanics for engineering, Addison Wesley..
- Beer, Johnston y Cornwell Vector Mechanics for Engineers. , Mc Graw Hill. .

- Paul Tipler Physics for the science and the technology. , Ed. reverté 2005.
- Sears, Zemansky, Young, Freedman Física Universitaria, Wesley 2004.
- Serway, Raymond A. Physics: for sciences and engineering. , Thomson 2005.

#### ADDITIONAL BIBLIOGRAPHY

- Alonso-Finn. Physics, Ed. Addison-Wesley Iberoamericana, 1995.
- Y. Çengel, M. Boles. Thermodynamics, Mc Graw Hill, 2006