Course guide
240026 - 240026 - Basic Physics II

Last modified: 13/06/2023

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 748 - FIS - Department of Physics.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer:

Others: DAVID ORENCIO LOPEZ PEREZ

TEACHING METHODOLOGY

The course planning is based on continuous work during the whole semester. Attending lectures will be a possitive element in the global evaluation of the course.
Throughout the semester, theory and problem sessions will be flexibly programmed, i.e. there can be certain weeks in which students will mostly receive theory lectures or will be solving problems. Nevertheless, theory sessions will not be more than 50% of classroom time. We consider that the subject's learning necessary implies understanding of theoretic concepts and their application to concrete engineering situations related with thermal and/or wave phenomena in order to achieve specific competencies.
The student's activities in the laboratory, around 8 classroom hours (maximum), will be programmed towards the end of the semester. We intend that the student has an active attitude in the laboratory which allows him/her to reason on theoretical concepts acquired during the semester. This is why it is essential that this activity is programmed towards the end of the semester.

LEARNING OBJECTIVES OF THE SUBJECT

The general objective is to acquire basic competencies on Classic Thermodynamics as well as some wave concepts providing a balanced introduction to the most relevant concepts and phenomena while building a solid base for later development.
Specific objectives:
- Introducing fundamental concepts and principles in an explicit form to provide students with the correct information that will enable them to understand physical phenomena related with thermodynamics as well as with some wave phenomena
- Enabling students to feel comfortable when facing particular problems in the industrial engineering dominion.
- Expressing magnitudes in their IS (international system) units, as well as knowing factor units to convert to other unit systems.
- Knowing the performance of measuring devices related with the subject's content.
- Allowing the students to think over the numerical obtained results.

STUDY LOAD

Type	Hours	Percentage
Hours small group	8,0	5.33
Hours large group	52,0	34.67
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

title englishTopic I. Basic concepts

Description:
Introduction to thermodynamics. Thermodynamic system, thermodynamic variable, balance state, thermodynamic transformation. Zero Principle and Temperature. Thermometers and empirical thermometric scales

Full-or-part-time: 10h 20m
Theory classes: 2h 30m
Practical classes: 1h 30m
Self study : 6h 20m

Topic II. Single-component systems

Description:
Simple PVT system: Thermal equation of state and thermal coefficients. Simple system model: Ideal Gas. Real gases and PVT characteristic surface. Phase equilibria. Real gas' thermal equations of state.

Full-or-part-time: 22h 15m
Theory classes: 3h
Practical classes: 3h 45m
Laboratory classes: 2h
Self study : 13h 30m

Topic III. First Principle of Thermodynamics

Description:
Heat concept. Dilatation work in simple PVT systems. Dissipative work. First Principle of thermodynamics and internal energy. Enthalpy

Full-or-part-time: 19h 10m
Theory classes: 3h
Practical classes: 3h
Laboratory classes: 2h
Self study : 11h 10m

Topic IV. Applications of the First Principle of Thermodynamics

Description:
Energetic properties of a simple PVT system. Joule-Kelvin's experiment and real gas' energetic properties. Ideal gas' energetic properties. Thermodynamic transformations of an ideal gas.

Full-or-part-time: 20h 40m
Theory classes: 3h 30m
Practical classes: 3h
Laboratory classes: 2h
Self study : 12h 10m

Topic V. Second Principle of Thermodynamics: Engines

Description:
Carnot's cycle. Engine's concept: thermal machine, refrigerator machine and thermal-pumps. Second Law of thermodynamics: Clausius and Kelvin-Planck's enunciate. Carnot's theorem. Engines' examples.

Full-or-part-time: 11h 30m
Theory classes: 2h 30m
Practical classes: 1h 30m
Self study : 7h 30m

Topic VI. Second Law of Thermodynamics: Entropy

Description:
Clausius' theorem. Entropy. Entropy of an ideal gas. Entropic wordings of the Second law of Thermodynamics. Energy degradation.

Full-or-part-time: 21h 10m
Theory classes: 3h 30m
Practical classes: 3h 30m
Self study : 14h 10m

Topic VII. Thermodynamics potentials

Description:
Thermodynamic potentials in simple PVT systems. Maxwell relations. Balance conditions. T·dS equations.

Full-or-part-time: 16h 40m
Theory classes: 2h 30m
Practical classes: 3h
Self study : 11h 10m

Topic VIII. Wave motion

Description:
content english

Full-or-part-time: 12h 20m
Theory classes: 2h 30m
Practical classes: 1h 30m
Self study : 8h 20m

Topic iX. Waves in fluids

Description:
Wave equation in pVT fluid systems. Displacement wave and pressure wave.Harmonic analysis. Doppler effect

Full-or-part-time: 12h 55m
Theory classes: 2h 45m
Practical classes: 1h 30m
Self study : 8h 40m

ACTIVITIES

EXPERIMENTAL DATA TREATMENT

Description:
Students will analyse (in groups of 2 people) a collection of experimental data related with thermodynamics and/or waves in which a group of abilities will be asked among others: graphic representation, linear regression and reflexion on the obtained results.

Full-or-part-time: 3h
Laboratory classes: 1h
Self study: 2h

GRADING SYSTEM

The evaluation takes into account three mechanisms:
- Final exam (EF). A written evaluation with exercises and theory enabling to certify the overall level of achievement in specific competences.

- Partial exam in the middle of the semester (MQ). Evaluation of theory-practical exercises in a test and/or non-test format enabling the student a reflection of the level of competences achieved during the first half of the course.

- Laboratory (LAB). Evaluation of the activity made by the student during lab classes by means of an individula exam. The non-assistance of the student will count in this mechanism as a zero (not reached) without the possibility of recovery.
The final mark is calculated with the formula:
Final Mark = 0.6* EF + 0.25*MQ + 0.15* LAB
Partial exam can be recovered by final exam. According to the curretnt academic regulations, the final mark should include this fact.

At the final of semester, reevaluation can be done for those students that do not have reach the lebel mark to pass. In that case only two mechanisms will be taken into account:

- Final exam (EF). A written evaluation with exercises and theory enabling to certify the overall level of achievement in specific competences.
- Laboratory (LAB). Evaluation of the activity made by the student during lab classes by means of an individula exam

The final mark is calculated with the formula:
Final Mark = 0.85* EF 0.15* LAB

EXAMINATION RULES.

The final exam will consist on two well differentiated parts: one with an official formulary made by the professors teaching the course and the other part without it or with that but under prior notice. The professors can decide if any of the parts does not need calculator for its resolution.
The partial exam in the middle of the semester will be carried out with or without the formulary and with or without a calculator.

BIBLIOGRAPHY

Basic:
- Barrio Casado, María del. Problemas resueltos de termodinámica . Madrid, España : Thomson-Paraninfo, cop. 2005. ISBN 8497323491.
- Barrio Casado, María del. Termodinámica básica : ejercicios . Barcelona : Edicions UPC, 2006. ISBN 9788483018712.
- Ortega Girón, Manuel R; Ibàñez Mengual, José A.. Lecciones de física : termologia. 8a ed. Córdoba : Departamento de Física Aplicada, Universidad de Córdoba, 1995-. ISBN 8440442904.
- Tipler, Paul Allen; Martínez García, Lluís M; Suñol Martínez, Joan Josep. Física ; Volum 1. Barcelona [etc.] : Reverté, cop. 1994. ISBN 842914370X.
- Ortega Girón, Manuel R. Lecciones de física: Mecànica 4. 1ª. Córdoba : Universidad. Departamento de Física Aplicada, 1992-. ISBN 8460444457.

Complementary:
- Aguilar Peris, José. Curso de termodinámica . 2ª ed. Madrid : Alhambra, 1989. ISBN 8420513822.

RESOURCES

Audiovisual material:
- Nom recurs. Resource

Other resources:
Use of ATENEA.