1. OVERVIEW

Subject area	Thermodynamics
Degree	Bachelor's Degree in Physics
School/Faculty	School of Architecture, Engineering and Design
Year	Second
ECTS	6
Type	Compulsory
Language(s)	Spanish
Delivery mode	On campus
Semester	First

2. INTRODUCTION

The subject area Thermodynamics belongs to the subject Thermodynamics and Statistical Physics. It is the first point of contact with this branch of physics on the degree programme. Starting with the composition of matter and its transformations when energy is exchanged, different thermodynamic properties will be defined, along with the equations, graphs, tables and software that allow us to establish connections between these thermodynamic properties. One fundamental aspect of this course is the emphasis on relating thermodynamics to its practical aspects, through the thermodynamic study of different devices.

3. SKILLS AND LEARNING OUTCOMES

Key skills (CB, by the acronym in Spanish):

- CB3: Students have the ability to gather and interpret relevant data (usually within their study area) to form opinions which include reflecting on relevant social, scientific or ethical matters.
- CB5: Students have developed the learning skills necessary to undertake further study in a much more independent manner.
- CG1: To understand key concepts, methods and findings in the different branches of physics while gaining a historical perspective of their development.

Transversal skills (CT, by the acronym in Spanish):

- CT04. Written communication/Oral communication: Ability to communicate and gather information, ideas, opinions and viewpoints in order to understand and be able to act upon them, whether they are through spoken word and gestures, or through written word and/or visual aids.

- CT05. Problem solving: Be able to critically evaluate information, separate complex situations into their constituent parts, recognise patterns, and consider alternatives, different approaches and perspectives in order to find optimal solutions and negotiate efficiently.

Specific skills (CE, by the acronym in Spanish):

- CE02. To describe and analyse physical systems, identifying fundamental concepts and principles to make the approximations needed to build a simplified model.
- CE04. To understand the laws and principles of physics, to identify their logical and mathematical structure, their experimental basis and the phenomena described through them.

Learning outcomes (RA, by the acronym in Spanish):

- To describe the macroscopic and microscopic levels of states of equilibrium.
- To state the thermodynamic principles and analyse their consequences.
- To identify thermodynamic potentials and to analyse the thermodynamic behaviour of systems.

The following table shows how the skills developed in the subject area match up with the intended learning outcomes:

Skills	Learning outcomes
CG1, CB3, CB5, CT4, CT5, CE02	To describe the macroscopic and microscopic levels of states of equilibrium.
CG1, CB3, CB5, CT4, CT5, CE02, CE04	To state the thermodynamic principles and analyse their consequences.
CG1, CB3, CB5, CT4, CT5, CE04	To identify thermodynamic potentials and to analyse the thermodynamic behaviour of systems.

4. CONTENTS

1. Thermodynamic variables.
2. First law of thermodynamics. Work and heat. Enthalpy. 3. Second and third laws of thermodynamics. Entropy.
4. Mass, energy and entropy balances.
5. Thermochemistry.
6. Relationship between thermodynamic properties and real gases.

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- Collaborative learning: Students learn to collaborate with other people (classmates and professors) in order to find creative, comprehensive and constructive solutions to questions and problems that arise from the given case studies, using all relevant knowledge and material resources available.

- Problem-based learning: Students are given problems and asked to solve them, working individually or in groups.
- Lectures: Presentations by the professor with the necessary technological tools to maximise comprehension of the learning content.
- Guided academic activities: Individual and group work that is more independent, including information searches, written summaries, debates and the public defence of projects.

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

On campus:

Learning activity	Number of hours
Lectures	60
Oral presentations of projects and debates	5
Report writing	12
Assessment	12
Practical activities (problems, written work, projects, workshops and/or lab work)	24
Tutorials	12
Independent working	25
TOTAL	**150**

7. ASSESSMENT

The assessment systems, plus their weighting in the final grade for the subject area, are as follows:

On campus:

Assessment system	Weighting
Individual on-campus knowledge tests (theory and/or practice)	50.0%
Oral defence	5.0%
Submission of group and/or individual reports, written work, projects or exercises	35%
Performance observation	10%

On the Virtual Campus, when you open the subject area, you'll find details of your assessable tasks, including the submission dates and assessment procedures for each task.

8. BIBLIOGRAPHY

- Fundamentals of Engineering Thermodynamics, Michael Moran, Howard Shapiro. Ed. Wiley and Sons. (Ed Reverté en texto en Castellano)
- Çengel, Y., Boles, M.A. Termodinámica. Ed McGraw-Hill
- Wark, K.; Richards, D.E. Termodinámica. Ed McGraw-Hill