COURSE: THERMODYNAMICS

SUBJECT: Fundamentals in thermal and fluids engineering
MODULE: M2
STUDIES: Degree in Engineering in Industrial Technologies

GENERAL FEATURES*

Type: ☐ Basic training, ☑ Mandatory, ☐ Elective

☐ Final degree project, ☐ External practices

Duration: Semestral **Semester/s**: 3
Number of credits ECTS: 5
Language/s: Spanish, Catalan, English

DESCRIPTION

BRIEF DESCRIPTION AND JUSTIFICATION (the meaning of the subject in relation to the studies. Between 100 and 200 words.)

Thermodynamics are a key part in the formation of an Industrial engineer to carry out actions related to industrial heating and cooling, energy balances or to calculate engine performances. Furthermore, it is important to set the basis for future subjects such as Energy Technology or Environmental Engineering. Covers the following subjects: Evaluation of volumetric and energetic properties of real systems, exergetic analysis of flow processes, thermodynamic diagrams, steam power cycles, gas power cycles, refrigeration systems, variable composition systems, phase equilibria, thermochemistry, combustion and chemical equilibria in real systems.

COMPETENCIES (of the subject according to the competencies pre-assigned in the subject.)

- Increase the knowledge of thermodynamics for the practice of chemical and industrial engineering [E1].
- Capability to solve problems with initiative, creativity and critical reasoning [E4]
- To train the students in how to identify and cope with problems of thermodynamics in logical and sisteematic way, in groups or as an individual [CRI.1]

PREREQUISITES* (modules, subjects, courses or knowledge needed to monitor the course. It can be noted courses which must have been completed.)

Those related to the Basic Module.

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CONTENTS (according to sections which constitute the list of contents of the course to the second level detail.)

I.-FLOW SYSTEMS
I.1.-Volumetrical properties and its relations for a homogeneous phase at constant composition.
I.2.-Energetic properties and its relations for a homogeneous phase at constant composition.
I.3.-Exergy
I.4.-The steam power plant. Mollier Diagram, Rankine cycle, reheated cycle, combined cycles.
I.5.-Gas power plant, internal combustion engines. Otto, Diésel, Brayton, Sabathé and Stirling engines.
I.6.-Refrigeration systems. Heat pumps. Absorption cooling systems.

II.-VARIABLE COMPOSITION SYSTEMS
II.1.-Phase equilibria in non-ideal systems.
II.2.-Termochemistry, combustion.
II.3.-Chemical reaction equilibria in non-ideal systems.

METODOLOGY

TRAINING ACTIVITIES* (complete the table relating activities and workload to ECTS credits and competencies.)

Training activities	ECTS Credits	Competencies
Concept Sessions	2	E1
Sessions solving exercises, problems and cases	0,5	E1, CRI.1
Seminars	-	
Compulsory activities at the teacher's office	-	
Practical work / laboratory	0,5	E4
Presentations	-	
Personal study activities of students	1,5	E1, CRI.1
Evaluation activities (testing, monitoring controls…)	0,5	E1, CRI.1
TOTAL	**5.0**	

EXPLANATION OF TEACHING METHODOLOGY (justifying the teaching methods used related to competencies and course contents. Between 100 and 200 words)

The subject is taught using theory sessions. At the end of each chapter, an hour is dedicated to solve some of the exercises of that topic which the students have prepared at home.

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A total of 5 hour of class are destined to the solution of exercises that will compute directly to the final mark. For this exercises, the students will use the work done at home. Apart from assisting to class, the students must resolve nine sets of exercises.

EVALUATION

METHODS OF EVALUATION* (Complete the table relating assessment methods, competencies and the weight in the rating of the course)

Methods of evaluation	Weight	Competencies
Final exam	40%	E1, CRI.1
Partial exams	-	
Following up activities	50%	E1, CRI.1
Homework and presentations	5%	CRI.1
Experimental work or fieldwork	5%	E4
Projects	-	
Evaluation of the company or institution	-	
Participation	-	

LEARNING OUTCOMES (Explanation of the achievements of students that allow competency assessment, relating to competencies and assessment methods.)

Objetive 1:

- The student must show its own criteria to identify the best method to be applied in each situation.

Objetive 2:

- The student must show enough knowledge and ability to solve different thermodynamics problems.
- The student must show that possesses capacity to criticize the numerical solution obtained.
- The student must show capacity to choose the correct tool to solve each situation.

EVALUATION (Explanation of the evaluation method of the subject.)

The final mark is calculated with the mean value between the final exam (70 % Problems, 30% Theory), the exercises and the homework. The total weight of each part is: 40% for the exam, 50% for the follow activities, 5% for the homework and a final 5% for the practices mark.

EVALUATION OF COMPETENCIES (Define calculation expressions for each competency in terms of the corresponding evaluation activities.)

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To evaluate competence E1, the indicator is the final exam mark.
To evaluate competence CRI.1, the indicator used is the overall subject final mark.
To evaluate competence E4 the indicator used is the practices mark.

BIBLIOGRAPHY (recommended and student accessible.)

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