PERSONA CIÈNCIA EMPRESA
UNIVERSITAT RAMON LLULL

# COURSE: APPLIED THERMODYNAMICS

**SUBJECT MATTER**: Fundamentals of Thermal and Fluids Engineering
**MODULE**: Core Topics of Industrial Engineering
**PROGRAM**: Degree in Chemical Engineering



## GENERAL CHARACTERISTICS

**Type:** ☐ Basic Formation, ☑ Compulsory, ☐ Elective

☐ Final Degree Project, ☐ Internship

**Duration**: Semestral **Semester/s**: 6
**Number of ECTS credits**: 5
**Language/s**: Spanish, Catalan, English

## DESCRIPTION

### BRIEF DESCRIPTION AND JUSTIFICATION

Subject that increases the knowledge of Chemical Thermodynamics showing how should be applied to chemical and biological processes. 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

- Be able to understand advanced knowledge of thermodynamics in the practice Chemical Engineering (E4).
- Be able to use new technics and new tools in Chemical Engineering (E9).
- Knowledge of applied thermodynamics and heat transmission. Basic principles and their application to engineering problem solving (CRI1).

### PREREQUISITES

According to current academic teaching planning and regulations.

### CONTENTS

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, combustión.
II.3.-Chemical reaction equilibria in non-ideal systems.

## METODOLOGY

### LEARNING ACTIVITIES

| Learning activities | Hours | ECTS Credits | Competences |
|---|---|---|---|
| Lectures | 30 | 1,1 | E4, CRI1 |
| Case and Problem-Solving Sessions | 8 | 0,4 | E9, CRI1 |
| Seminars | 5 | 0,2 | E4, CRI1 |
| Practical & Lab Work | | -- | -- |
| Presentations | 3 | 0,2 | E9, CRI1 |
| Personal study | | 2,75 | E4, E9, CRI1 |
| Assessment Tasks (Exams, Continuous Assessment...) | 5 | 0,35 | E4, CRI1 |
| **TOTAL** | | **5.0** | |

### TEACHING METHODOLOGY

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.

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.

## ASSESSMENT

### ASSESSMENT METHODS

| Assessment Methods | Weight | Competencies |
|---|---|---|
| Final Exam | 40% | E4, E9, CRI1 |
| Midterm Exam/s | -- | -- |
| Follow-up Activities | 20% | E4, E9, CRI1 |
| Reports and Presentations | 30% | E4, E9, CRI1 |
| Lab or Field Work | -- | -- |
| Projects | -- | -- |
| Host Student Evaluation | -- | -- |
| Participation | 10% | CRI1 |

### LEARNING OUTCOMES

- The student must demonstrate knowledge and understanding the meaning and scope of the basic concepts of Thermodynamics (→ E4)
- The student must demonstrate capability to use new technics and tools of Chemical Engineering (→ E9)
- The student must demonstrate knowledge of applied thermodynamics and heat transmission, know the basic principles and their application to the resolution of engineering problems. (→ CRI1)

### QUALIFICATION

The overall mark of the subject will consider the follow up activities (AS) 20% of the final mark, works and presentations (TP) 30%, participation (P) 10%, and final exam (EF) 40%.

The final mark (CF) is calculated as follows: CF = 0,4 EF + 0,2 AS + 0,3 TP + 0,1 P only if the individual mark of each part is equal or bigger tan 4. In other case, the mark will be the minimum between (0,4 EF + 0,2 AS + 0,3 TP + 0,1 P) and 4.

**ASSESSMENT OF THE COMPETENCES**

To evaluate each competence the following indicators will be taken into account:
E4: Final exam (EF) and follow up activities (AS)
E9: Follow activities (AS) and works/presentations (TP)
CRI1: Final mark (CF)

## BIBLIOGRAPHY

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## DOCUMENT HISTORY

**PREVIOUS REVISIONS**

25th of July 2016, Dr. Oriol Pou
2nd June 2014, Dr. Oriol Pou

**CURRENT REVISION**
25th February 2019, Dr. Oriol Pou