

# 29816 - Technical Thermodynamics and Heat Transfer Basics

## Syllabus Information

**Academic Year:** 2019/20

**Subject:** 29816 - Technical Thermodynamics and Heat Transfer Basics

**Faculty / School:** 110 - Escuela de Ingeniería y Arquitectura

326 - Escuela Universitaria Politécnica de Teruel

**Degree:** 440 - Bachelor's Degree in Electronic and Automatic Engineering

444 - Bachelor's Degree in Electronic and Automatic Engineering

**ECTS:** 6.0

**Year:** 2

**Semester:** Second semester

**Subject Type:** Compulsory

**Module:** ---

## 1.General information

### 1.1.Aims of the course

### 1.2.Context and importance of this course in the degree

### 1.3.Recommendations to take this course

## 2.Learning goals

### 2.1.Competences

### 2.2.Learning goals

### 2.3.Importance of learning goals

## 3.Assessment (1st and 2nd call)

### 3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

## 4.Methodology, learning tasks, syllabus and resources

### 4.1.Methodological overview

This course includes oral presentations, practical sessions with exercises in the blackboard and practical sessions using dedicated software EES to solve longer problems and parametric studies. Also, after computer practical sessions students are welcomed to work in small groups to complete the tasks that have been commenced during the class and submit them to the professor at the date due.

### 4.2.Learning tasks

**The course includes the following learning tasks:**

#### **Work in class, 2.4 ECTS (60 hours)**

- 1) Lectures (30 hours): the professor explains the contents of the syllabus (see 5.3).
- 2) Large group exercises (15 hours): At the end of each lesson, some complete exercises are presented to the students using the knowledge gained in the lesson.
- 3) Computer lab sessions (15 hours, on-site): there are 5 computer sessions where a more complex case is presented and solved by the use of dedicated software (EES). The concepts learned in lectures are completed and developed in these practical sessions. Additional work must be done in small groups by students after the practical sessions and submitted in

the date due for assessment. The contents of these practical sessions can be among the following:

- Thermal circuits of electronic devices and systems. Parametric studies.
- Performance of extended surfaces for heat sinks. Parametric studies.
- Experimental characterization of convection coefficient for a cylinder in crossflow.
- Calculation of the forced convection coefficient. Application to electronic devices cooling.
- Calculation of free convection coefficient. Application to electronic devices cooling.
- Thermodynamic properties of pure substances. Power cycle calculations. Cooling cycle
- Experimental characterization of a cooling cycle.

### **Individual work, 3.6 ECTS (90 hours)**

- 4) Group works (tipo T6) (20 hours).
- 5) Individual study (tipo T7) (64 hours).
- 6) Assessment (tipo T8) (6 hours).

### **4.3.Syllabus**

The course will address the following topics:

1. Introduction to thermodynamics
2. Evaluation of thermodynamic properties.
3. First Law of Thermodynamics
4. The second law of thermodynamics
5. Power and refrigeration cycle
6. Introduction to heat transfer
7. The heat diffusion equation
8. One-dimensional, Steady-state conduction: Thermal resistance and thermal circuits.
9. Further questions about steady-state conduction.
10. Extended surfaces
11. Transient conduction
12. Introduction to convection
13. Forced convection
14. Free convection

### **4.4.Course planning and calendar**

Lectures and practical sessions timetable will be published on the web page of each center ([http://eina.unizar.es/intraneteina/index.php?r=calendarioExtN/index\\_oficial](http://eina.unizar.es/intraneteina/index.php?r=calendarioExtN/index_oficial) or <http://eupt.unizar.es/>). Practical sessions are in small groups, lectures are in large groups.

Other activities will be fixed according to the joint schedule of the semester.

### **4.5.Bibliography and recommended resources**

[http://biblos.unizar.es/br/br\\_citas.php?codigo=29816&year=2019](http://biblos.unizar.es/br/br_citas.php?codigo=29816&year=2019)