

Academic Year/course: 2022/23

29816 - Technical Thermodynamics and Heat Transfer Basics

Syllabus Information

Academic Year: 2022/23

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

2. Learning goals

3. Assessment (1st and 2nd call)

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, students are welcomed to work in small groups to develop additional tasks and submit them to the professor at the date due.

In the blended learning method followed by the EUPT, the teaching of the theoretical aspects and the problems will be performed in a non-face-to-face asynchronous way, structured at the content level. Blended learning students will have materials in Moodle, including detailed problem-solving videos, as well as explanations of some theoretical concepts.

4.2. Learning tasks

The course includes the following learning tasks:

Lectures, exercises and lab sessions, 2.4 ECTS (60 hours)

- 1) Lectures (30 hours): the professor explains the contents of the syllabus (see 4.3).
- 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. Sometimes, 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 (type T6) (10 hours).
- 5) Individual study (type T7) (74 hours).
- 6) Assessment (type T8) (6 hours).

In the blended learning method followed by the EUPT, all lectures and problems will be asynchronous non-face-to-face. The master classes are replaced by the continuous work of the student with adapted materials, always with the support of the professor as a guide and for the resolution of doubts through the available telematics tools. Students will carry out the tasks and computer practices autonomously, using computer environments that allow collaborative work with other students and supervision by the professor both synchronously and asynchronously (for example, Google Collaboratory).

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 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.