29816 - Technical Thermodynamics and Heat Transfer Basics

1.General information

1.1.Introduction

1.2.Recommendations to take this course

1.3.Context and importance of this course in the degree

1.4.Activities and key dates

2.Learning goals

2.1.Learning goals

2.2.Importance of learning goals

3.Aims of the course and competences

3.1.Aims of the course

3.2.Competences

4.Assessment (1st and 2nd call)

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

5.Methodology, learning tasks, syllabus and resources

5.1.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.

5.2.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, presential): 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. Aditional work that must be done in small groups (up to 5 students) 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.
- calculation.
- Experimental characterization of convection coefficient for a cylinder in cross flow.
- Cálculo de disipadores con bancos de aletas. Estudios paramétricos.
- Calculation of forced convection coefficient. Application to electronic devices cooling.
- Calculation of free convection coefficient. Application to electronic devices cooling.
- Thermodinamyc 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).

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

5.4.Course planning and calendar

Lectures and practical sessions timetable will be published in 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 with the joint schedule of the semester.

5.5.Bibliography and recommended resources

1. Moran, Michael J.. Fundamentos de termodinámica técnica / Michael J. Moran, Howard N. Shapiro . 2ª ed. en español, reimp. Barcelona [etc.] : Reverté, D. L. 2005

2. engel, Yunus A.. Termodinámica / Yunus A. Çengel, Michael A. Boles ; revisión técnica, Ignacio Apraiz Buesa ... [et al.] . 7ª ed. Mexico [etc.] : McGraw-Hill Interamericana, cop. 2012

3. Velasco Callau, María Carmen. Termodinámica técnica / Carmen Velasco Callau, Amaya Martínez Gracia y Tomás Gómez Martín . 1ª ed. Zaragoza : Prensas Universitarias de Zaragoza, 2010

4. Velasco Callau, María Carmen. Termodinámica técnica (II) : termodinámica aplicada a instalaciones térmicas / Carmen Velasco Callau, Amaya Martínez Gracia y Tomás Gómez Martín . 1ª ed. Zaragoza : Prensas Universitarias de Zaragoza, 2011

5. engel, Yunus A.. Fundamentals of thermal-fluid sciences / Yunus A. Çengel, Robert H. Turner . Boston, Massachusetts [etc.] : McGraw-Hill, cop. 2001

6. Incropera, Frank P.. Fundamentos de transferencia de calor / Frank P. Incropera, David P. DeWitt . - 4a ed. México : Prentice Hall, 1999