Universidad Zaragoza

Year : 2019/20

29713 - Technical Thermodynamics and Fundamentals of Heat Transfer

Syllabus Information

Academic Year: 2019/20
Subject: 29713 - Technical Thermodynamics and Fundamentals of Heat Transfer
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 434 - Bachelor's Degree in Mechanical Engineering
330 - Complementos de formación Máster/Doctorado
ECTS: 6.0
Year: XX
Semester: 330 - First semester
434 - First semester
Subject Type: 434 - Compulsory
330 - ENG/Complementos de Formación
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

The methodology followed in this course is oriented towards the achievement of the learning objectives. It is based on participation and the active role of the student favours the development of communication and decision-making skills. A wide range of teaching and learning tasks are implemented, such as lectures, guided assignments, laboratory sessions, autonomous work, and tutorials.

Students are expected to participate actively in the class throughout the semester.

Classroom materials will be available on the website of the course via Moodle. These include a repository of the lecture notes used in class, the course syllabus, as well as other course-specific learning materials.

Further information regarding the course will be provided on the first day of class.

4.2.Learning tasks

The course includes 6 ECTS organized according to:

1. Lectures (45 on-site hours; 1.8 Cr)

During the lectures, the fundamental theoretical contents of the subject will be presented establishing the methodology of resolution of practical exercises. According to this methodology, the problems to be solved in the session will be informed in

advance. Students are encouraged to participate actively in the class throughout the semester. At the same time, it is very important that the students carry out a personal study and preparation work to get the most of the time. Although it is not a mandatory activity, regular attendance is highly recommended.

2. Laboratory sessions (15 on-site hours; 0.6 Cr)

Laboratory sessions aim at complementing theory and problem classes, stimulating both autonomous work and teamwork through the practical application of concepts (application of different models to the calculation of properties, graphical analysis of processes and thermodynamic cycles, calculation of mass and energy balances in the facilities, etc.).

There are five laboratory sessions. Each session lasts about 3 hours and is carried out in groups of 20 people, favoring the exchange of professor-student ideas in a more relaxed atmosphere than the master class. It is considered a privileged area for the paused explanation and the in-depth development of technical topics of relevant interest for the future professional practice of the graduate. It also allows the student to come into contact with experimental measurements on real installations by verifying for themselves the applicability to the real world of the concepts of Technical Thermodynamics and the fundamentals of Heat Transfer.

In the laboratory sessions different software (Thermograph and/or EES) are used. The facilities available in the laboratories of the Machines and Thermal Engines area will also be used.

Important information for the realization of the laboratory sessions:

- Each student must attend laboratory sessions in the group in which they are enrolled.
- It is the responsibility of the students to be informed of the dates and hours of the sessions. The session details are available on the website of the course (ADD, via Moodle).
- It is the responsibility of the students to download from the website of the course (ADD, via Moodle) the materials necessary for the development of the laboratory session.
- It is strongly recommended to assist in the session reading previously the materials provided. It is not possible to change groups except for specific and justified cause and requesting it to the professor.
- The delivery of a session report or a question paper will be done through the website of the course (ADD, via Moodle) within the specified period by the professor.

3. Guided assignments (15 hours; 0.6 Cr)

During the semester key problems of the subject are given to the students to be solved. In general, these problems can be solved with the help of computer software to facilitate calculation operations. It is thus possible to devote sufficient time to deepen into the analysis and understanding of the concepts. Through this type of work, both autonomous learning and group work are strengthened.

4. Autonomous work (75 hours; 3 Cr)

It is important that the student dedicated autonomous work time to study and solve problems, in order to settle the fundamentals of the course. Therefore, the students are encouraged to solved typical exercises, questions and problems in addition to those solved in class. This promotes autonomous work, studying the fundamental concepts and applying it to the resolution of the problems.

5. Tutorials

The use of these tutorials is recommended to raise doubts about the course and ensure adequate progress in learning. It is beneficial for the student to come with clear and specific questions. The professor's office hours will be posted on Moodle and the degree website to assist students with questions and doubts.

6. Evaluation (3h; 0.12 Cr)

In addition to its qualifying function, evaluation is also a learning tool with which the student knows the degree of comprehension and assimilation he has achieved in the subject.

4.3.Syllabus

The course will address the following topics:

- Basic concepts: thermodynamic system, properties and state of a substance, equilibrium, reversible and irreversible processes, energy transfers (heat and work)
- Pure substance behaviour: independent properties, thermodynamic surfaces, Tables of Thermodynamic properties.
- Pure substance treatment: Equation of state, ideal and real gas model, incompressible liquid model.
- The First Law of Thermodynamics: energy equation for a control mass
- The First Law of Thermodynamics: energy equation for a control volume
- The Classical Second Law of Thermodynamics.
- Entropy
- Gas turbine power cycles: The Joule-Brayton cycle
- Steam power cycles: The Rankine cycle
- Refrigeration cycles: The vapour-compression refrigeration cycle
- Fundamentals of psychrometry
- Introduction to heat transfer

4.4.Course planning and calendar

For further details concerning the timetable, classroom and further information regarding this course, please refer to the "Escuela de Ingeniería y Arquitectura " website (https://eina.unizar.es/)

4.5.Bibliography and recommended resources