Thermal Engineering

Academic Year: (2020 / 2021) **Review date: 08-07-2020**

Department assigned to the subject: Thermal and Fluids Engineering Department

Coordinating teacher: SERRANO GARCIA, DANIEL

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

- Calculus I
- Calculus II
- Physics I

In Aula Global there are two documents that present the concepts of these subjects that are essential to evolve properly in the present subject

OBJECTIVES

At the end of this course, students will be able to:

1. Know and understand about thermodynamics and heat transfer.
2. Apply their knowledge and understanding to identify, formulate and solve thermodynamic and heat transfer problems using the established methodology.
3. Design and carry out experiments, understand experimental data and obtain conclusions.
4. Have technical and laboratory knowledge.
5. Select and use adequate equipments, tools and methods.
6. Combine theory and practice to solve thermodynamic and heat transfer problems.
7. Understand the limitations of the techniques and methodology applied to thermodynamics and heat transfer.

DESCRIPTION OF CONTENTS: PROGRAMME

This is a basic course of thermodynamics and an introduction to heat transfer.
The program can be divided in 2 main blocks, one about thermodynamics and another about heat transfer.

FIRST PART (THERMODYNAMICS AND CYCLES):

- Review of previous concepts of thermodynamics acquired by the student, thermodynamic properties, T-s diagram of water, incompressible liquid and ideal gas models.
- Mass, energy and entropy balance for closed systems.
- Mass, energy and entropy balance for open systems.
- Equipments under steady state: nozzles, diffusers, pumps, compressors, turbines, open and closed heat exchangers, and valves.
- Thermal engines. Carnot cycle.
- Rankine cycle.
- Brayton cycle.
- Internal combustion engines.
- Inverse Carnot cycle. Refrigeration cycle.

SECOND PART (HEAT TRANSFER):

- Introduction to heat transfer: Fourier's Law, Newton's Law, Stefan-Boltzmann's Law.
- One-dimensional steady state conduction with and without heat generation. Plane wall, cyclindrical and spherical geometries. Thermal resistances.
- Transient conduction.
- Fins: formulation, design and performance analysis. Finned surfaces.

EVALUATION

The evaluation will be based on the following criteria:

- Labs (15%)
- Partial test (25%)

- Final exam (60%)

LEARNING ACTIVITIES AND METHODOLOGY

The learning methodology includes:
(1) Lectures covering the main topics described within the course outline. To facilitate the sessions, the students will have available the lecture's notes as well as reference books to complete their learning.
(2) Case study and problem solving lectures, where some issues are addressed from a practical point of view.
(3) Exercises solved by the student to self-assess their knowledge and acquire the necessary skills.
(4) Group projects.

ASSESSMENT SYSTEM

The continuous assesment will be evaluated under the following criteria:

PROBLEMS AND TESTS SOLUTIONS. MID-TERM EXAM
- Individual evaluation with tests and exercises.
- Workgroup projects or/and laboratory work.

FINAL EXAM
The students' knowledge will be evaluated.

Participation with positive contributions during the classes will be very welcomed and taken into account.

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- F.P. Incropera and D.P. DeWitt Fundamentals of Heat and Mass Transfer, John Wiley & Sons. 6th edition, 2007

- M.J. Moran , H.N. Shapiro Fundamentals of Engineering Thermodynamics, John Wiley & Sons. 6th edition, 2010

ADDITIONAL BIBLIOGRAPHY

- Yunus Cengel and Michael Boles Thermodynamics: An Engineering Approach (8th Ed.), McGraw-Hill Education, 2014