Machines and thermal engines

Academic Year: (2024 / 2025) **Review date: 14-01-2025**

Department assigned to the subject: Thermal and Fluids Engineering Department

Coordinating teacher: ACOSTA IBORRA, ANTONIO

Type: Compulsory ECTS Credits : 3.0

Year : 1 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Thermodynamics, Heat Transfer, Fluid Mechanics

OBJECTIVES

Knowledge and abilities for the design and analysis of thermal machines and engines, their processes and performances
Knowledge and abilities that allow understanding, analyzing, exploitation and managing the different sources, transformations, and consumptions of energy for thermal machines and engines, their sustainability characteristics, and sustainability and pollution figures.
Ability to model fluid-thermal processes

DESCRIPTION OF CONTENTS: PROGRAMME

Part-I: Internal combustion engines
1. Introduction. Classification and fundamentals.
2. Gas exchange processes.
3. Operating parameters.
4. Similarity parameters.
5. Turbocharging.
6. Combustion in spark-ignition engines.
7. Combustión in compression-ignition engines.
8. Performance. Solved problems.

Parte-II: Thermal turbomachinery
1. Introduction. Classification and fundamentals.
2. Axial and centripetal turbines.
3. Axial and centrifugal compressor.
4. Characteristic curves.
5. Application to gas turbines.

There is a detailed program available with the teaching material that expands and updates this information. It is published according to calender, academics available and laboratory and informatics available.

LEARNING ACTIVITIES AND METHODOLOGY

Teaching activities
- Theory conferences. Masterclasses. 1.3 ECTS.
- Quizzes and application exercises for comprehension of theory. 1.2 ECTS
- Practice in computer halls. And if there are resources, laboratory practice. 0.2 ECTS.
- Individual or group work. 0.3 ECTS, proposed by the professor on the topics developed in the classroom. Homework delivered as a report.

Teaching methodologies
- Masterclasses/lectures where the knowledge to be acquired by the student will be exposed. There will

be class notes available and basic textbooks will be recommended both for following the subject and to continue knowledge downstream.
- Problem and question solving by the students for self-evaluation and to acquire the abilities required. Exposure and discussion of solving problems that are proposed to the students or proposed by them.
- Laboratory practicals, if available, and/or in computer halls, where the student can experiment with the concepts and results of the theory presented in the lectures.

ASSESSMENT SYSTEM

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

The assessment includes continuous evaluation and evaluation in final exams where the general knowledge, abilities, and capacities will be evaluated.
The beforehand indicated percentages can vary, depending on the extension and/or difficulties of the home works used for the evaluation within the ranges 40-70% for the continuous part and 60-30% for the final part in a written exam.
It is posible to pass if the continuous evaluation is passed.
Activities of continuous evaluation:
- The laboratory sessions and/or practical assessments.
- A first partial exam comprising the first part of the course (reciprocating internal combustion engines).
- A second partial exam comprising the second part of the course (thermal turbomachinery).

To pass the course, the following two requirements need to be met:
1) The mark of the final exam should be equal to or greater than 2.0 over 10.
2) The overall mark of the course should be equal to or greater than 5.0 over 10.

BASIC BIBLIOGRAPHY

- C. Mataix Turboma¿quinas te¿rmicas : turbinas de vapor, turbinas de gas, turbocompresores, Dossat, 1988

- H.I.H. Saravanamuttoo, G.F.C. Rogers, H. Cohen, P.V. Straznicky, A.C. Nix Gas Turbine Theory, Pearson, 2017

- Heywood Internal Combustion Engine Fundamentals, McGraw-Hill, 1988

- Payri, F. y Desantes, J.M Motores de combustión interna alternativos, Universidad Politécnica de Valencia, 2011

ADDITIONAL BIBLIOGRAPHY

- M.J. Moran & H.N. Shapiro Fundamentos de Termodinámica Técnica / Fundamentals of Engineering Thermodynamics (SI version), Wiley , 2004/2007

BASIC ELECTRONIC RESOURCES

- Lecuona et al. . Motores Térmicos: http://ocw.uc3m.es/ingenieria-termica-y-de-fluidos/motores-termicos