Applied thermal engineering

Academic Year: (2019 / 2020) **Review date: 14/05/2019 14:04:10**

Department assigned to the subject: Thermal and Fluids Engineering Department

Coordinating teacher: GARCIA GUTIERREZ, LUIS MIGUEL

Type: Compulsory ECTS Credits : 3.0

Year : 4 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Thermal Engineering (2nd year)
Heat Transfer (3rd year)

OBJECTIVES

The fundamental objective of this course is to use the fundamental concepts of thermodynamics and heat transfer, acquired in the previous courses, in the industrial applications of cold / heat and power generation. To achieve this goal, the student must acquire a series of knowledge, skills and attitudes.

With regard to knowledge, at the end of the course the student will be able to:

- Analyze and solve advanced thermal engineering applications of cold / heat and power generation from a global perspective.

- Analyze and solve the main elements that conform the thermodynamic cycles.

- Design optimal thermodynamic cycles and their elements.

In terms of capabilities, these can be classified into two groups: specific capacities and generic skills.

For the specific abilities, at the end of the course the student will be able to:

- Determine the relevant parameters of thermal engineering applications, such as power, efficiency, etc.

- Size equipment and facilities that conform the thermodynamic refrigeration and power generation cycles.

- Dimension and optimize thermal applications based on thermodynamic cycles.

Regarding the general skills, during the course they will work:

- The ability to solve thermal engineering problems.

- The ability to search, communicate and discriminate which is the relevant information to characterize an installation from the thermodynamic and thermotechnical point of view.

- The ability to apply knowledge of heat transfer and fundamental thermodynamics in the resolution of engineering problems.

- The ability to work in teams and distribute the workload to face complex problems.

Regarding attitudes, the student, after completing the course, should have:

- A critical attitude to identify and evaluate the activities and operation of industrial refrigeration and power generation facilities (power plants).

- Evaluate and design the activities and operation of the equipment that conform refrigeration and power generation facilities using a critical attitude.

- A collaboration attitude that allows the student to search for information and related topics necessary to perform complex tasks

DESCRIPTION OF CONTENTS: PROGRAMME

In the course ¿Applications in Thermal Engineering¿ different aspects of direct application in the field of Thermal Engineering will be studied. In particular, real application of refrigeration cycles, gas cycles, vapor cycles and combined cycles.

Topic 1: Refrigeration cycles:
- Cascade cycles.
- Multistage compression.

Topic 2: Gas cycles:
- Regeration.
- Post-combustion.
- Intercooling.

Topic 3: Vapor cycles:
- Regeneration.
- Reheating.

Topic 4: Combined cycles:
- HRSG.
- Several pressure levels.

Topic 5: Power plants optimizaction

In each of the different topics will developed both in regular class and in computer sessions using software to solve complex thermodynamic cycles. The sessions will be complemented with examples of real plants analysing each of the different components to study their differences depending on the improvement applied on the cycle and as a function of the energy input use for the operation of the power plant / cycle.

LEARNING ACTIVITIES AND METHODOLOGY

- Lectures on theory and applications.
- Solving problems individually and in groups.
- Performing tasks individually and in groups.
- Lab (computer rooms).
- Case study

All of the activities are aimed at obtaining general and specific skills listed above.

ASSESSMENT SYSTEM

% end-of-term-examination/test:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

25% Midterm examinations
25% Application case report
50% Final exam

- Continuous evaluation with partial exam and report.

- Final exam mainly covering practical contents.

BASIC BIBLIOGRAPHY

- Incropera F.P., DeWitt D.P., Bergman T.L., Lavine A.S. Fundamentals of heat and mass transfer, John Wiley & Sons, 2007

- Moran M.J, Shapiro H.N. Fundamentals of engineering thermodynamics : SI version , John Wiley & Sons, 2010

- Thomas C. Elliot Standard Handbook of Power Plant Engineering, McGraw-Hill, 1998

ADDITIONAL BIBLIOGRAPHY

- Dipak Sarkar Thermal Power Plant, Elsevier, 2015

- J.H. Horlock Advanced Gas Turbine Cycles, Pergamon, 2003

- J.H. Horlock Combined Power Plants, Pergamon Press, 2002