Course guide
3200502 - ST2 - Thermal Systems II

Last modified: 26/04/2023

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 724 - MMT - Department of Heat Engines.

Degree: BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 4.5 **Languages:** Catalan

LECTURER

Coordinating lecturer: Joaquim Rigola
Òscar Ribé

Others: Joaquim Rigola
Òscar Ribé

PRIOR SKILLS

Students will be expected to have passed: Thermal Engineering and Thermal Systems I.

REQUIREMENTS

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. MEC: Skills for the calculation, design and testing of machines.

TEACHING METHODOLOGY

- Face-to-face lecture sessions.
- Face-to-face guided exercise sessions.
- Independent study and small-group exercises.

In the face-to-face lecture sessions, the lecturer will introduce the basic theory, concepts, methods and results for the subject and use examples to facilitate students' understanding.
In the face-to-face practical class work sessions, the lecturer will help students to understand problem statements, analyse the information provided, and solve and check the problems.
Students will be expected to study in their own time so that they are familiar with concepts and are able to solve the exercises set, whether individually or in pairs.

LEARNING OBJECTIVES OF THE SUBJECT

In this subject, students gain an understanding of the basic theoretical concepts of heat transfer and how they relate to technical thermodynamics, as well as the ability to design, analyse and use basic thermal equipment and systems.
Build on the specific transversal competencies associated with coursework, as described below.
Specific competencies
· An understanding of the principles of heat transfer, and the ability to apply those principles to the design of thermal exchangers andd heat and cool systems.
· An understanding of the basic concepts of power cycles (engines) and inverse power cycles (generators) and their main industrial applications.
· The ability to analyse and solve problems in thermal engineering.

· Teamwork.

STUDY LOAD

Type	Hours	Percentage
Hours large group	30,0	26.67
Hours medium group	15,0	13.33
Self study	67,5	60.00

Total learning time: 112.5 h

CONTENTS

TOPIC 1: Heat exchangers

Description:
- Definition and classification.
- Efficacy of heat exchangers.
- Local and global heat transfer coefficients of heat exchangers.
- Thermal design methods.
- F-curve method.
- NTU method.
- Single-current heat-exchanger calculation.
- Additional considerations in heat-exchanger design.

Full-or-part-time: 30h
Theory classes: 8h
Practical classes: 4h
Self study : 18h

TOPIC 2: Heating equipment

Description:
- Fuels and combustion. Flames and burners.
- Boilers and hot-air generators. Thermal efficiency.
- Heaters.
- Solar thermal collectors.
- Cogeneration.

Related activities:
Directed activity: Students will visit the solar collectors installed on the roof of the school and evaluate their thermal efficiency.

Full-or-part-time: 25h 30m
Theory classes: 7h
Practical classes: 3h 30m
Self study : 15h

TOPIC 3: Cooling equipment

Description:
- Introduction to industrial cooling equipment.
- Compression refrigeration.
- Single-stage refrigeration cycle with gas.
- Single-stage refrigeration cycle with vapour.
- Refrigerant properties.
- Cascade and multi-stage compression refrigeration systems.
- Heat pumps.
- Absorption refrigeration. Trigeneration.

Related activities:
Students will evaluate and determine the thermal efficiency of a water-water heat pump located in the basement of the school.

Full-or-part-time: 57h
Theory classes: 15h
Practical classes: 7h 30m
Self study : 34h 30m

GRADING SYSTEM

- Deliverable collector practice 10%
- First examination: 40%
- Deliverable cooling systems 10%
- Second examination: 40%

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.
If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.

EXAMINATION RULES.

BIBLIOGRAPHY

Basic:
- Dossat, Roy J. Principios de refrigeración. México: Compañía Editorial Continental, 1980. ISBN 9682602017.
- Pita, Edward G. Principios y sistemas de refrigeración. México: Limusa, 1991. ISBN 9681839692.

Complementary:
- Márquez Martínez, Manuel. Combustión y quemadores. Barcelona: Marcombo Boixareu, 1989. ISBN 8426707718.
- Ramírez, Juan Antonio. Nueva enciclopedia de la climatización, vol. 1, Refrigeración. Barcelona: CEAC, 2000. ISBN 8432965421.
- Grimm, Nils R. Manual de diseño de calefacción, ventilación y aire acondicionado. Madrid: McGraw-Hill, 1996. ISBN 8448106636.
- Incropera, Frank P. Fundamentos de transferencia de calor. 4a ed. México: Prentice Hall, 1999. ISBN 9701701704.
- Kohan, Anthony L. Manual de calderas: principios de operativos de mantenimiento, construcción, instalación, reparación, seguridad, requerimientos y normativas. Madrid: McGraw-Hill, 2000. ISBN 8448125460.