Last update:

820734 - EQT - Thermal Equipment (DRAFT VERSION)

Coordinating unit: 820 - EUETIB - Barcelona College of Industrial Engineering
Teaching unit: 724 - MMT - Department of Heat Engines
Academic year: 2014
Degree: MASTER IN ENERGY ENGINEERING (Syllabus 2013). (Teaching unit Compulsory)
ECTS credits: 5 Teaching languages: English

Teaching staff

Coordinator: Velo Garcia, Enrique

Others: Perez Segarra, Carlos David
Castro Gonzalez, Jesus
Rigola Serrano, Joaquim

Opening hours

Timetable: To be published in the teaching intranet

Prior skills

- Fundamentals of differential and integral calculus
- Stoichiometry of chemical reactions.

Requirements

Minimum of 10 ECTS completed in Thermal Engineering, including:
- Fundamentals of thermodynamics.
- Fundamentals of heat transfer.
- Fundamentals of fluid mechanics.

Degree competences to which the subject contributes

Specific:

CEMT-5. Employ technical and economic criteria to select the most appropriate thermal equipment for a given application, dimension thermal equipment and facilities, and recognise and evaluate the newest technological applications in the production, transportation, distribution, storage and use of thermal energy.

CEMT-7. Analyse the performance of equipment and facilities in operation to carry out a diagnostic assessment of the use system and establish measures to improve their energy efficiency.

Transversal:

CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

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Teaching methodology

The course teaching methodologies are as follows:

- Lectures and conferences: knowledge exposed by lecturers or guest speakers.
- Participatory sessions: collective resolution of exercises, debates and group dynamics, with the lecturer and other students in the classroom; classroom presentation of an activity individually or in small groups.
- Theoretical/practical supervised work: classroom activity, carried out individually or in small groups, with the advice and supervision of the teacher.
- Homework assignment of reduced extension: carry out homework of reduced extension, individually or in groups.
- Homework assignment of broad extension (PA): design, planning and implementation of a project or homework assignment of broad extension by a group of students, and writing a report that should include the approach, results and conclusions.

Training activities:

The course training activities are as follows:

Face to face activities
- Lectures and conferences: learning based on understanding and synthesizing the knowledge presented by the teacher or by invited speakers.
- Participatory sessions: learning based on participating in the collective resolution of exercises, as well as in discussions and group dynamics, with the lecturer and other students in the classroom.
- Presentations (PS): learning based on presenting in the classroom an activity individually or in small groups.
- Theoretical/practical supervised work (TD): learning based on performing an activity in the classroom, or a theoretical or practical exercise, individually or in small groups, with the advice of the teacher.

Study activities
- Homework assignment of reduced extension (PR): learning based on applying knowledge and presenting results.
- Homework assignment of broad extension (PA): learning based on applying and extending knowledge.
- Self-study (EA): learning based on studying or expanding the contents of the learning material, individually or in groups, understanding, assimilating, analysing and synthesizing knowledge.

Learning objectives of the subject

Objectives
This course focuses on the engineering of heat and cold equipment, as well as on heat exchangers. In this area, it is intended that students acquire the knowledge and skills necessary for the description, selection and sizing of equipment as well as for the calculation of the performance of preexisting equipment and facilities.

Learning Outcomes

At the end of the course, the student:
- Is able to describe the role of thermal equipment in the production and service sectors, as well as their importance in the energy chain: processing, transport, distribution and efficient use of energy.
- Is able to select the most suitable thermal equipment from the energy point of view for each application (industry or services), and to analyze the performance of an existing equipment.
- Is able to propose a project, at basic engineering scale or at functional scale, related to the design, sizing and / or the use of thermal equipment in various industrial and services sectors.
- Is able to propose improvements for thermal systems, by developing new ideas.

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Study load

Total learning time: 125h	Hours large group:	30h	24.00%
	Hours medium group:	0h	0.00%
	Hours small group:	0h	0.00%
	Guided activities:	15h	12.00%
	Self study:	80h	64.00%

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Content

1. Combustion equipment

Learning time: 33h

Large group/Theory: 8h
Medium group/Practical: 4h
Guided activities: 4h
Self study : 17h

Degree competences to which the content contributes:
CEMT-5 (Specific)
CEMT-7 (Specific)

Description:
- Fuels and combustion.
- Flames and burners.
- Combustion chambers and ovens.
- Steam generators.
- DHW systems and thermal fluid equipment

Related activities:
1. Exercises about fuels and combustion

Specific objectives:
That the student acquires the knowledge and skills required for the description, selection and sizing of fuel-burning equipment, as well as for the calculation of the performance of existing equipment and facilities.

2. Heat exchangers

Learning time: 50h

Large group/Theory: 12h
Medium group/Practical: 6h
Guided activities: 6h
Self study : 26h

Degree competences to which the content contributes:
CEMT-5 (Specific)
CEMT-7 (Specific)
CT3 (Transversal)

Description:
- Convection heat transfer.
- Heat recovery systems.
- Condensers.
- Steam boilers and evaporators.

Related activities:
2. Exercises about heat exchangers

Specific objectives:
That the student acquires the knowledge and skills necessary for the description, selection and sizing of heat exchangers, as well as for the calculation of the performance of existing equipment and facilities.

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3. Refrigeration and AC equipment	Learning time: 42h Large group/Theory: 10h Medium group/Practical: 5h Guided activities: 5h Self study : 22h

Degree competences to which the content contributes:
CEMT-5 (Specific)
CEMT-7 (Specific)

Description:
- HVAC Systems
- Industrial refrigeration systems.

Related activities:
3. Exercises about HVAC and industrial refrigeration systems

Specific objectives:
That the student acquires the knowledge and skills necessary for the description, selection and sizing of HVAC and Industrial refrigeration systems, as well as for the calculation of the performance of existing equipment and facilities.

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Planning of activities

1. Exercises about fuels and combustion

Hours: 25h
Guided study: 4h
Self study: 17h
Practical classes: 4h

Degree competences to which the activity contributes:

CEMT-5 (Employ technical and economic criteria to select the most appropriate thermal equipment for a given application, dimension thermal equipment and facilities, and recognise and evaluate the newest technological applications in the production, transportation, distribution, storage and use of thermal energy.)

CEMT-7 (Analyse the performance of equipment and facilities in operation to carry out a diagnostic assessment of the use system and establish measures to improve their energy efficiency.)

CT3 (TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.
)

Description:
- Collective resolution and discussion of examples: resolution of examples in the classroom, and collective discussion on methods and results.
- Supervised resolution and discussion of problems: working in the classroom, individually or in small groups, on the resolution of exercises and problems of different levels of complexity with the advice of the teacher.
- Autonomous resolution of problems: solve, individually or in groups, exercises or problems of different levels of complexity, applying knowledge and presenting results.

Support materials:
- Solved examples.
- Statements of problems with answers (self-learning).
- Statements of problems to be solved by the student (continuous assessment)

Descriptions of the assignments due and their relation to the assessment:
- Resolution of evaluable exercises.
- Reports on results.

Specific objectives:
- To deepen in the theoretical knowledge and its application to solve practical exercises on calculation and dimensioning.
- To develop students skills in the selection and sizing of equipment with combustion as energy input, also on the calculation of the performance of existing equipment and facilities.

2. Exercices on heat exchangers

Hours: 38h
Guided study: 6h
Self study: 26h
Practical classes: 6h

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Degree competences to which the activity contributes:

CEMT-5 (Employ technical and economic criteria to select the most appropriate thermal equipment for a given application, dimension thermal equipment and facilities, and recognise and evaluate the newest technological applications in the production, transportation, distribution, storage and use of thermal energy.)

CEMT-7 (Analyse the performance of equipment and facilities in operation to carry out a diagnostic assessment of the use system and establish measures to improve their energy efficiency.)

CT3 (TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.
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Description:

- Collective resolution and discussion of examples: resolution of examples in the classroom, and collective discussion on methods and results.
- Supervised resolution and discussion of problems: working in the classroom, individually or in small groups, on the resolution of exercises and problems of different levels of complexity with the advice of the teacher.
- Autonomous resolution of problems: solve, individually or in groups, exercises or problems of different levels of complexity, applying knowledge and presenting results.

Support materials:

- Solved examples.
- Statements of problems with answers (self-learning).
- Statements of problems to be solved by the student (continuous assessment)

Descriptions of the assignments due and their relation to the assessment:

- Resolution of assessable exercises.
- Reports on results.

Specific objectives:

- To deepen in the theoretical knowledge and its application to solve practical exercises on calculation and dimensioning.
- To develop students skills in the selection and sizing of heat exchangers, also on the calculation of the performance of existing equipment and facilities.

3. Exercises about HVAC and industrial refrigeration systems	Hours: 32h Guided study: 5h Self study: 22h Practical classes: 5h

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Degree competences to which the activity contributes:

CEMT-5 (Employ technical and economic criteria to select the most appropriate thermal equipment for a given application, dimension thermal equipment and facilities, and recognise and evaluate the newest technological applications in the production, transportation, distribution, storage and use of thermal energy.)

CEMT-7 (Analyse the performance of equipment and facilities in operation to carry out a diagnostic assessment of the use system and establish measures to improve their energy efficiency.)

CT3 (TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.
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Description:
- Collective resolution and discussion of examples: resolution of examples in the classroom, and collective discussion on methods and results.
- Supervised resolution and discussion of problems: working in the classroom, individually or in small groups, on the resolution of exercises and problems of different levels of complexity with the advice of the teacher.
- Autonomous resolution of problems: solve, individually or in groups, exercises or problems of different levels of complexity, applying knowledge and presenting results.

Support materials:
- Solved examples.
- Statements of problems with answers (self-learning).
- Statements of problems to be solved by the student (continuous assessment)

Descriptions of the assignments due and their relation to the assessment:
- Resolution of assessable exercises.
- Reports on results.

Specific objectives:
- To deepen in the theoretical knowledge and its application to solve practical exercises on calculation and dimensioning.
- To develop students skills in the selection and sizing of HVAC and industrial refrigeration systems, also on the calculation of the performance of existing equipment and facilities.

Qualification system

Exam (PE): 60%
Homework (TR): 40%

Regulations for carrying out activities

For the exam, the student may have only one sheet of paper with formulas and a programmable calculator.
The specific rules of individual and group work will be published in the teaching intranet.

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Bibliography

Basic:

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