



IDENTIFYING DATA

(*)Enxeñaría Térmica II

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|---------------------|--|----------|------|------------|
| Subject | (*)Enxeñaría Térmica II | | | |
| Code | V04M141V01205 | | | |
| Study programme | (*)Máster Universitario en Enxeñaría Industrial | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 3 | Optional | 1st | 2nd |
| Teaching language | Spanish English | | | |
| Department | | | | |
| Coordinator | Sieres Atienza, Jaime | | | |
| Lecturers | Sieres Atienza, Jaime | | | |
| E-mail | jsieres@uvigo.es | | | |
| Web | | | | |
| General description | In this subject pretends that the student purchase the basic knowledges for the selection, design and calculation of installations of air conditioning (ventilation, refrigeration and heating). | | | |

Competencies

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|------|--|
| Code | |
| A4 | Students can communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and non-specialist audiences clearly and unambiguously. |
| A5 | Students must possess the learning skills that enable them to continue studying in a way that will be largely self-directed or autonomous. |
| C1 | CET1. Project, calculate and design products, processes, facilities and plants. |
| C9 | CET9. Knowing how to communicate the conclusions -and the knowledge and rationale underpinning these, to specialist and non-specialist audiences clearly and unambiguously. |
| C10 | CET10. Possess learning skills that will allow further study of a self-directed or autonomous mode. |
| C16 | CTI5. Knowledge and skills for the design and analysis of thermal machines and engines, hydraulic machines and facilities for heat and industrial refrigeration |
| D1 | ABET-a. An ability to apply knowledge of mathematics, science, and engineering. |
| D3 | ABET-c. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. |
| D5 | ABET-e. An ability to identify, formulate, and solve engineering problems. |
| D11 | ABET-k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. |

Learning outcomes

| Expected results from this subject | Training and Learning Results |
|---|------------------------------------|
| Know the properties and thermodynamic processes of the humid air to be able to apply it to the calculation of systems of air conditioning | C1 C16 D1 D5 D11 |
| Know and comprise the diverse systems and teams used in the systems of air conditioning, so much of heating as of refrigeration | C1 C16 D1 D3 D5 D11 |

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|--|---|
| Know and comprise the teams of generation of heat and/or cold used in systems of air conditioning | C1 C16 D1 D3 D5 D11 |
| Capacity to calculate machines and thermal engines and his main components | C1 C10 C16 D1 D3 D5 D11 |
| Capacity to realise designs, calculations and essays of machines and thermal engines as well as of the installations of heat and cold industrial | A4 A5 C1 C9 C10 D5 |

Contents

| Topic | |
|---|--|
| 0. REVIEW OF PSYCHROMETRY AND TRANSMISSION OF HEAT | 1. The humid air 2. Psychrometric properties 3. Psychrometric diagrams 4. Mechanisms of transmission of heat 5. Thermal resistance 6. Calculation of coefficients of convection |
| 1. PSYCHROMETRIC TRANSFORMATIONS | 1. Introduction 2. Adiabatic mix of currents 3. Straight of manoeuvre and factor of sensitive warming 4. Warming and sensitive cooling 5. Deshumidification by cooling 6. Warming and moistening 7. Adiabatic moistening 8. Warming and deshumidification |
| 2. EXCHANGERS OF HEAT | 1. Introduction 2. Classification 3. Thermal balance. Distribution of temperatures 4. Tanks of dirt 5. Analysis of exchangers of heat |
| 3. SYSTEMS OF REFRIGERATION AND HEAT PUMPS | 1. Introduction 1.1. Refrigeration Machine and bomb of heat 1.2. The cycle of Carnot invested 2. Ideal cycle of refrigeration by compression of steam 3. Thermodynamic diagrams 4. Practical cycle or dry cycle 5. Basic components of a refrigeration circuit 5.1 Compressor 5.2 Evaporator 5.3 Condenser 5.4. Device of expansion 6. Parameters of calculation 7. Real cycle of refrigeration 8. Influence of the thermal conditions 9. Liquid exchanger-steam |
| 4. COMPONENTS OF A SYSTEM OF REFRIGERATION BY COMPRESSION | 1. Compressor 2. Condenser 3. Evaporator 4. Device of expansion 5. Lines of coolants and accessories 6. Systems of control and security |

5. SYSTEMS OF AIR CONDITIONING

1. Introduction
 - 1.1 Concept of thermal load
 - 1.2. Concepts of venue, zone and building
 - 1.3 Types of thermal loads
2. Types of systems
3. Systems all air
 - 3.1. Foundations
 - 3.2. Description of the system and components
 - 3.3. Calculation of the system
4. Systems all waters
 - 4.1. Foundations
 - 4.2. Description of the system and components
 - 4.3. Calculation of the system
5. Systems air-waters
 - 5.1. Foundations
 - 5.2. Description of the system and components
 - 5.3. Calculation of the system
6. Systems of direct expansion
 - 6.1. Foundations
 - 6.2. Description of the system and components
 - 6.3. Calculation of the system

(*)6. SISTEMAS DE COMPRESIÓN MÚLTIPLE

- (*)1. Campo de utilización
2. Clasificación de los sistemas de compresión múltiple directa
3. Análisis de sistemas de compresión múltiple directa
4. Análisis de sistemas de compresión múltiple indirecta

Planning

| | Class hours | Hours outside the classroom | Total hours |
|---|-------------|-----------------------------|-------------|
| Master Session | 18 | 27 | 45 |
| Laboratory practises | 6 | 6 | 12 |
| Autonomous troubleshooting and / or exercises | 0 | 14 | 14 |
| Long answer tests and development | 3 | 0 | 3 |
| Other | 1 | 0 | 1 |

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

| | Description |
|---|--|
| Master Session | Exhibition by part of the professor of the contents of the matter object of study, where will procure the maximum participation of the student, through his direct implication in the approach of questions and/or problems. |
| Laboratory practises | Experimentation of real processes in laboratory and that complement the contents of the matter, completed with the utilization of specific software |
| Autonomous troubleshooting and / or exercises | Resolution of problems and/or exercises related with the subject that the student will realise by his account in base to the guidelines given in in classroom and/or laboratory. They will resolve problems of character "type" and/or practical examples. It will emphasize the work in posing methods of resolution and no in the results. |

Personalized attention

| Methodologies | Description |
|----------------------|--|
| Laboratory practises | Approach of doubts in the schedule of tutorings. The student will pose the doubts relating to the contents to develop of the subject, and/or exercises or relative problems to the application of these contents |
| Master Session | Approach of doubts in the schedule of tutorings. The student will pose the doubts relating to the contents to develop of the subject, and/or exercises or relative problems to the application of these contents |

Assessment

| | Description | Qualification | Training and Learning Results |
|-----------------------------------|---|----------------|---|
| Long answer tests and development | Final examination in the date fixed by the centre, that consist in a group of proofs written on the contents of all the matter. | 80 A4 A5 | C1 D1 C9 D3 C10 D5 C16 D11 |

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|-------|--|----|----------|------------------------|-----------------------|
| Other | The corresponding note to the Continuous Evaluation will be based in proofs or works | 20 | A4 A5 | C1 C9 C10 C16 | D1 D3 D5 D11 |
|-------|--|----|----------|------------------------|-----------------------|

Other comments on the Evaluation

Evaluation:

The final qualification of the student will determine adding the points obtained in the final examination (80%) and the obtained by continuous evaluation (20%).

The points reached by Continuous Evaluation (20%) will have validity in the two official announcements (1^a and 2^a edition) of examination of the course.

Any of the qualifications obtained in the the final examination of the first edition (no type of evaluation realised in the final examination) will save for the second edition.

Ethical commitment: It is expected an adequate ethical behaviour of the student. In case of detecting unethical behaviour (copying, plagiarism, unauthorized use of electronic devices, etc.) shall be deemed that the student does not meet the requirements for passing the subject. In this case, the overall rating in the current academic year will be Fail (0.0).

Sources of information

ASHRAE, **ASHRAE handbook. Fundamentals**, ASHRAE,

ASHRAE, **ASHRAE handbook. Refrigeration**, ASHRAE,

ASHRAE, **ASHRAE handbook: heating, ventilating, and air-Conditioning systems and equipment**, ASHRAE,

ASHRAE, **1995 ASHRAE handbook : heating, ventilating and air-conditioning applications**, ASHRAE,

Wang S.K, **Handbook of air conditioning and refrigeration**, MacGraw-Hill,

Yunus A. Çengel, Afshin J. Ghajar, **Transferencia de calor y masa : fundamentos y aplicaciones**, McGraw-Hill,

Torrella Alcaraz E., Navarro Esbrí J., Cabello López R., Gómez Marqués F., **Manual de climatización**, AMV Ediciones,

Carrier Air Conditioning Company, **Manual de aire acondicionado**, Marcombo,

Recommendations

Other comments

It recommends have studied subjects where give contained of thermodynamics, transmission of heat and thermal technology.

Besides, the student has to to have previous knowledges on Psychrometry and psychrometric transformations.