60827 - HVAC Heating Ventilating and Air Conditioning

Información del Plan Docente

Academic Year	2016/17
Academic center	110 - Escuela de Ingeniería y Arquitectura
Degree	532 - Master's in Industrial Engineering
ECTS	6.0
Course	2
Period	First semester
Subject Type	Optional
Module	---

1.Basic info

1.1.Recommendations to take this course

The student is recommended active class attendance and continuous study of the contents of the subject and lapreparación practical cases that can be resolved in subsequent sessions.
Continued work is essential to overcome with the maximum use of this subject , since each party estudiagra dually with a progressive procedure. So when doubts arise , it is important to resolve as soon as possible to ensure the smooth progress in this area.

1.2.Activities and key dates for the course

This is a subject of 6 ECTS credits, equivalent to 150 hours of student work, to perform both as classroom contact hours.

The schedule of the course is adapted to the established in the School of Engineering and Architecture (EINA) and their schedules and exam schedule , and all of them can be found on their website : http://eina.unizar.es .
The practice sessions will be scheduled depending on the number of students since the beginning of the semester students will have the detailed schedule of activities (practical and laboratory , ...) that will be provided by the corresponding teacher.

2.Initiation

2.1.Learning outcomes that define the subject

The student, for passing this subject, should demonstrate the following results ...

- Knowledge of the specific regulations on air conditioning systems and their application.
- Knowledge of the specific regulations on energy certification and enforcement.
- Computing capacity of the heat demand of a building.
- Knowledge of the basics, equipment and air conditioning systems installations.
- Knowledge of the fundamentals of energy efficiency and certification of buildings.
- Ability to choose the installation type most suitable climate and integrate properly in the building.
- Being able to design, calculate predimensionar and air conditioning systems and perform their respective measurements and project plans.
- Aptitude for placing and maintenance of air conditioning systems.
- Ability to write weatherization projects.
- Ability to certify energy buildings.

2.2.Introduction

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Brief presentation of the subject

The teaching of the subject HVAC focuses on the calculation and design of heating, refrigeation (air conditioning) , ventilation and hot water , as well as the development and use of tools for energy certification buildings . In order to ensure the proper use of energy and energy efficiency in buildings.

3.Context and competences

3.1.Goals

The subject and its expected results meet the following approaches and objectives:

By raising the educational objectives of the course HVAC is necessary to consider a subject that is constantly evolving, therefore student learning should include two complementary aspects . The first one to know the equipment and existing facilities at present, but above this objective acquire the capacity for independent and lifelong learning. With this feature we get to have a good professional at present and in the future, continuing education. So:

- Students will learn descriptive and functional aspects of the various standard equipment in air conditioning compressors, heat exchangers, valves, chillers, boilers, heat pumps, recuperators, pumps, fans, diffusers, regulatory elements, accumulation systems ...
- The student must achieve the necessary knowledge to project air-conditioning.
- The student must achieve the necessary knowledge on energy efficiency taking into account the specific technologies for saving energy and using alternative energy in air conditioning systems.
- The student must achieve the necessary knowledge to certify energy housing.
- The student must acquire the basic knowledge and reasoning schemes that enable and facilitate the autonomous learner.

3.2.Context and meaning of the subject in the degree

3.3.Competences

Generic skills

- CG1 - Have adequate knowledge of scientific and technological aspects of: mathematical, analytical and numerical methods in engineering, electrical engineering, power engineering, chemical engineering, mechanical engineering, continuum mechanics, industrial electronics, automation, manufacturing, materials, methods quantitative management, industrial computing, urban planning, infrastructure, etc .
- CG2 - Projecting, calculate and design products, processes, facilities and plants.
- CG4 - Conduct research, development and innovation in products, processes and methods.
- CG5 - Conduct strategic planning and apply to both constructive and production, quality and environmental management systems.
- CG8 - Apply the acquired knowledge and solve problems in new or unfamiliar environments within broader and multidisciplinary contexts environments.
- CG9 - Being able to integrate knowledge and handle complexity, and formulate judgments based on information that was incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments.
- CG10 - Knowing how to communicate the conclusions -and the knowledge and rationale underpinning these, to specialist and non-specialist audiences clearly and unambiguously.
- CG11 - Possess learning skills that will allow further study of a self-directed or autonomous mode.
- CG12 - Knowledge, understanding and ability to implement the necessary legislation in the exercise of the profession of

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Transversal skills:

- CB6 - knowledge and understanding that provide a basis or opportunity for originality in developing and / or applying ideas, often in a research context
- CB7 - That the students can apply their knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study
- CB8 - That students are able to integrate knowledge and handle complexity, and formulate judgments based on information that was incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments
- CB9 - That students can communicate their conclusions and the knowledge and rationale underpinning to specialists and non-specialists in a clear and unambiguous
- CB10 - Students must possess the learning skills that enable them to continue studying in a way that will be largely self-directed or autonomous

Specific skills

- C. M. 5 Knowledge and skills for the design and analysis of machines and internal combustion engines, hydraulic machines and systems and industrial cooling heat
- C. M. 6 Knowledge and capacities to understand, analyze, operate and manage the different sources of energy.
- C.M.20 Knowledge and skills for the project and design intelligent electrical and fluid, lighting, air conditioning and ventilation, saving and energy, acoustic efficiency installations, communications, automation and security buildings and facilities Industrial Engineer.

3.4.Importance of learning outcomes

The successful completion of the course aims to complete the technical training of the student, and set specific knowledge of Industrial Engineering in the field of Climate and Energy Efficiency. A basic aspect of their professional skills.

4.Evaluation

The student is evaluated through a theoretical and practical exam at the end of the semester, practices and assessment of a proposed facility made throughout the course. The valuation of each party in the final grade will be:

- Theoretical and practical written exam: 40%
- Practice: 15%
- Project: 45%

The requirements for passing the course are:

- Present practices
- Deliver and defense of the project in the announced dates.
- Get at least 5 in the project.
- Get at least 5 in the examination.
- Get at least 5 overall grade in the subject.

The note is calculated from the following equation:
A = 0.4 * Et + Pra + 0.15 * 0.45 * Pro
Where: A is the note in the minutes of 10 (or global note in the subject)
Et is the exam of theoretical and practical out of 10
Pra is the practices of 10
Pro is the project of 10
If the note of A is less than 5, the note Project and practices for the calls of the same academic year will be saved.
If a student does not pass the Project or fails to deliver and / or defense of the project and / or practices on the agreed dates, you must perform a practical exam, in addition to the theoretical and practical at the end of the semester.
In this case the conditions to pass the course are:

- Get at least 5 in the practical test.

- Get at least 5 in the theoretical and practical exam.
- Get at least 5 overall grade in the subject.

The note is calculated from the following equation:
A = Et + 0.5 * 0.5 * Ep
Where: A is the note in the minutes of 10 (or global note in the subject)
Et is the exam of theoretical and practical out of 10
Ep is the practical exam of 10
No exam notes or project are saved for subsequent calls

5.Activities and resources

5.1.General methodological presentation

The learning process that is designed for this subject is based on the following:

The learning process has been proposed to encourage continued student work and participation, and focuses on the theoretical and practical aspects to understand, analyze and apply knowledge to solve real problems. In the lectures the theoretical bases that form the subject will develop, solving some model problems.
Practices (short papers) are effective adjunct to lectures, allowing verify compression of matter and in turn help the student to acquire a point of view more applied and solve more complex and complete problems with the help of appropriate resources.
Finally, the air conditioning project to be performed by the student complement the above.

5.2.Learning activities

The program that the student is offered to help you achieve the expected results includes the following activities ...

Lectures (30 contact hours, 2 h / week) .It taught the theory of the proposed topics and model problems will be solved.

Problem-solving classes and cases (15 contact hours 1 h / week). In these classes, students solve problems supervised by the teacher. Problems or cases will be related to the theoretical part explained in lectures.

Practice (15 contact hours 1 h / week). They will strengthen the student developed content in lectures and problem classes. They will be made individually or in groups and will be supervised by teachers. The evaluation of the practices will be continuous reporting the student's level of achievement of program objectives.

Tutored work (15 h Non-contact). 1 or 2 activities will be proposed during the course (HVAC Projects), which will be held individually and be supervised by teachers. They consist of the development of a climate project (part of the) proposed by the teacher. It shall defend / present to the teacher and the report will be evaluated.

Personal care study (70 h non-contact). S tudents perform individual study continuously throughout the semester is recommended.

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Evaluation tests (5 h). An examination will be conducted to assess the theoretical and practical knowledge gained by the student.

5.3.Program

0.- Regulations

1.- Energy demand in building

1.1.- Thermal Loads
1.2.- Internal conditions
1.3.- External conditions
1.4.- Estimation of cooling demand
1.5.- Estimating demand for heating
1.6.- Practical examples

2.- HVAC Projects

2.1.- Introduction
2.2.- Overview of the building
2.3.- Load Calculation
2.4.- HVAC Systems

3. HVAC Systems

3.1.- Schemes
3.2.- Production

3.3.- Distribution

4.- A ir conditioning units

4.1 Introduction and Definitions
4.2 Sections of an air conditioner unit
4.3 Calculation of air conditioners units

5.- Calculation and selection of terminal elements

5.1.- Introduction.
5.2.- Issuers of water heating
5.3.- water radiant floor
5.4.- Electric heating
5.5.- Fancoils
5.6.- Inductors

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6. Hot Water

6.1.- Introduction
6.2.- Systems and components
6.3.- Accumulation and Instant Production
6.4.- Schemes
6.5.- Examples
6.6.- HE4

7. Auxiliary systems

7.1.- Introduction
7.2.- Expansion vessels
7.3.- Hydraulic diagrams for auxiliary elements
7.4.- The collector
7.5.- Networks of pipes and ducts

8. Control systems in air-conditioning

8.1.- Introduction
8.2.- Management Systems technical installations of buildings
8.3.- Evolution of technology
8.4.- Checkpoints

9. Air diffusion systems

9.1.- dissemination systems by mixing
9.2.- dissemination systems Displacement

10.- Boiler rooms

10.1.- Introduction
10.2.- Elements of boiler rooms
10.3.- UNE 60601.

10.4.- Examples

11. Energy Efficiency

11.1.- current regulatory .
11.2.- Energy certification of buildings Ppograms
11.3.- Lider-Calener
11.4.- Calener VyP
11.5.- CE3X

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5.4.Planning and scheduling

Schedule sessions and presentation of works

Lectures and solving problems classes are held according to schedule established by the EINA. The laboratory practice sessions will be planned inthe depending on the number of students and will be announced in good time. In addition, cadaprofesor inform its hours of tutoring

5.5.Bibliography and recomended resources

- FUNDAMENTOS DE CLIMATIZACIÓN. Edita: Atecyr. ISBN: 978-84-95010-34-6
- DTIE 9.05. SISTEMAS DE CLIMATIZACIÓN. Autor: José Manuel Cejudo. Edita: Atecyr. ISBN: 978-84-95010-32-2
- DTIE 7.05: CÁLCULO DE CARGAS TÉRMICAS. Autor: Jose Manuel Pinazo. Edita: Atecyr. ISBN: 978-84-95010-42-1 http://www.atecyr.org/eATECYR/publicaciones/ver_dties.php?id=105
- COMENTARIOS REGLAMENTO DE INSTALACIONES TÉRMICAS DE LOS EDIFICIOS (RITE 2007). Edita: IDAE. ISBN: 978-84-96680-23-4
- DTIE 3.01: PSICROMETRIA. Autor: José Manuel Pinazo. Edita: Atecyr. ISBN: 978-84-95010-33-9
- DTIE 9.04. SISTEMA DE SUELO RADIANTE. Autor: Francisco Javier Rey. Edita: Atecyr. ISBN: 978-84-95010-23-0
- GUIA TECNICA DE INSTALACIONES DE CALEFACCION INDIVIDUAL. Edita: IDAE
- GUIA TECNICA DE AGUA CALIENTE SANITARIA CENTRAL. Edita: IDAE. ISBN: 978-84-96680-52-4

- AUDITORIAS ENERGETICAS EN LA EDIFICACION. Edita: Atecyr. ISBN: 978-84-95010-38-4
- CONDICIONES DE DISEÑO DE ATECYR PARA CÁLCULO DE INSTALACIONES DE CALEFACCIÓN. Edita: Atecyr.
- DTIE 1.05: PREVENCIÓN DE LA CORROSIÓN INTERIOR DE LAS INSTALACIONES DE AGUA. Autor Adrián Gomila Vinent. Atecyr.
- DTIE 11.02. REGULACION Y CONTROL EN INSTALACIONES DE CLIMATIZACION. Autor: José Manuel Bartolomé. Edita: Atecyr. ISBN: 978-84-95010-36-0
- DTIE 17.03. CONTENIDOS DE PROYECTO Y MEMORIA TÉCNICA DE LAS INSTALACIONES TÉRMICAS. Edita: Atecyr.
- DTIE 4.01 CRITERIO DE CÁLCULO Y DISEÑO DE TUBERÍAS EN LA EDIFICACIÓN. Autores: Aurelio Alamán, José Luis Esteban y José Mª Chillón. Edita: Atecyr. ISBN: 978-84-95010-19-3
- DTIE 4.02 CIRCUITOS HIDRÁULICOS Y SELECCIÓN DE BOMBAS. . Edita: Atecyr.
- DTIE 8.03 INSTALACIONES SOLARES TERMICAS PARA PRODUCCION DE A.C.S. Autor Valeriano Ruiz, Germán López y Juan Carlos Martínez. Atecyr. ISBN: 978-84-95010-20-9
- DTIE 8.04 ENERGIA SOLAR. CASOS PRACTICOS. Autor Pedro Vicente Quiles. Atecyr.
- GUÍA PRÁCTICA SOBRE INSTALACIONES CENTRALIZADAS DE CALEFACCIÓN Y AGUA CALIENTE SANITARIA (ACS) EN EDIFICIOS DE VIVIENDAS. Edita: IDAE.
- GUIA TECNICA DE AHORRO Y RECUPERACION DE ENERGIA EN INSTALACIONES DE CLIMATIZACION. Edita: IDAE.
- GUIA TECNICA DE INSTALACIONES DE CLIMATIZACION CON EQUIPOS AUTONOMOS. Edita: IDAE.
- GUIA TECNICA DE INSTALACIONES DE CLIMATIZACION POR AGUA. Edita: IDAE.
- GUÍA TÉCNICA DE MANTENIMIENTO DE INSTALACIONES TÉRMICAS. Edita: IDAE. ISBN: 978-84-96680-06-7
- GUIA TECNICA DE SELECCION DE EQUIPOS DE TRANSPORTE DE FLUIDOS. Edita: IDAE. ISBN: 978-84-96680-54-8
- GUÍA TÉCNICA PARA EL DISEÑO Y CÁLCULO DEL AISLAMIENTO TÉRMICO DE CONDUCCIONES, APARATOS Y EQUIPOS. Edita: IDAE. ISBN: 978-84-96680-08-1