VNIVERSITAT DE VALÈNCIA

Course Guide
34782 Energy technology and process integration

COURSE DATA

Data Subject	
Code	34782
Name	Energy technology and process integration
Cycle	Grade
ECTS Credits	4.5
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1401 - Degree in Chemical Engineering	School of Engineering	4	Second term

Subject-matter

Degree	Subject-matter	Character
1401 - Degree in Chemical Engineering	23 - Optional subjects	Optional

Coordination

Name	Department
GIMENEZ GARCIA, JUAN BAUTISTA	245 - Chemical Engineering
MARTINEZ SORIA, VICENTE	245 - Chemical Engineering

SUMMARY

The optional subject Energy Technologies and Integration is taught in the fourth year of the Chemical Engineering degree. It consists of 4.5 ECTS in the syllabus. The aim of this subject is to provide students with practical knowledge related to technology, management, integration and energy efficiency of processes and equipment. This course complements the knowledge acquired in previous courses related to energy and its use, as well as in the design of processes and equipment involved in energy transfer, such as 'Applied Thermodynamics and Heat Transfer' and 'Basic Operations in Chemical Engineering II'. The contents of the course are summarised in: energy sources, fuels and combustion, energy integration and efficiency, renewable energy technology, energy management, cogeneration systems and furnaces. Classes will be taught in Valencian.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

Student should have acquired the skills of the subjects: Basis of Chemical Engineering I and II, Applied Thermodynamics and Heat Transfer, Fluid Mechanics and Unit Operations in Chemical Engineering II.

1401 - Degree in Chemical Engineering

- O1 - More comprehensive skills than those acquired in compulsory subjects.

- Understanding and critical analysis of the current situation of energy sources (O1).
- Understanding fuels and their properties (O1).
- Know and apply the audit, certification and management system of energy (O1).
- Understand the energy saving techniques and determine their potential viability (O1).
- Be able to perform calculations of energy savings, including economic evaluation (O1).
- Know and be able to apply methods of thermal integration (O1).
- Be able to design a network of heat exchangers (O1).
- Know the characteristics of the different renewable energies: applications, environmental and economic aspects, present situation and perspectives (O1).
- Meet in operation and energy analysis of a cogeneration plant (O1).
- Knowing how to perform energy analysis of a furnace (O1).

DESCRIPTION OF CONTENTS

1. Introduction

Energy sources. Energy supply and demand. Current status and perspectives. Primary, intermediate and final energy: energy transformations.

2. Energy management

Tools and techniques of energy management. Energy Audit: Energy Company profile: production process, consumption, cost, etc.. Benchmarking: indicators, sector specific consumption, use of best practices, etc.. Analysis of opportunities for improvement. Economic calculations: estimation of benefits. Energy certificate. Energy management systems.

3. Integration and energy efficiency

Concept of energy saving and energy efficiency. Energy saving techniques. Practical examples of improvements in thermal efficiency: boilers, insulation, burners, heat recovery, etc. Process integration. Heat exchanger networks.

4. Fuels

Fundaments. Oil, coal and subproducts. Biomass. Others. Types and properties of fuels. Stoichiometry and thermochemistry of combustion.

5. Renewable energy technology

Concept and types. Solar: thermal, thermoelectric, photovoltaic. Wind. Small hydro. Biomass. Biofuels: types.

6. Cogeneration systems and furnaces

Cogeneration. Benefits. Types of systems. Gas turbine. Steam turbine. Combustion engine. Combined cycle. Measure of efficiency. Economic prospects. Constituent elements of a furnace. Classification of furnaces. Energy balance of furnaces.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	25,00	100
Classroom practices	20,00	100
Development of individual work	20,00	0
Study and independent work	35,00	0
Preparation of evaluation activities	2,50	0
Preparing lectures	5,00	0
Preparation of practical classes and problem	5,00	0
TOTAL	**112,50**	

TEACHING METHODOLOGY

Theoretical activities: topics will be developed in the lectures by providing a comprehensive and integrated vision, analyzing in more detail the key aspects of greater complexity and encouraging at all times, student participation. Also adequate resources for the subsequent preparation of the issue in depth by the student will be recommended (O1).

Practical work: Practical classes will complement the theoretical activities in order to apply the basics and expand the knowledge and experience they acquire during the performance of the proposed work (O1). This will be done in the classroom or in small groups. They include the following types of classroom activities:

Classes of problems and issues in the classroom. The teacher will explain a number of sample problems that allow students to acquire the skills necessary to analyze, formulate and solve the problems of each topic. Student skills for decision making will be enhanced.

Discussion sessions and troubleshooting or work. In these sessions, which are conducted in small groups, are analyzed and discussed a series of exercises or work previously posed by the teacher and the students worked in small groups.

Tutorials: In them, the teacher will guide the student on all elements of the learning process. In addition, the teacher will guide the student on the most appropriate methodology for learning basic knowledge of the subject. (O1)

The exercises will work and proposed a timetable for completion and delivery by the students. It will consist of individual growth or small group of case studies of application (O1).

EVALUATION

Assessment of student learning will take place proposing two types of evaluation:

A) This method is only applicable to students who have attended more than 80% of the classes. 5% of the grade will be for the assessment of student participation and attendance. 25% of the grade will be for the evaluation of the work. The remaining 70% corresponds to a test score. Be a minimum requirement to pass the course more of a 4.5 on the exam (over 10.0)

B) The mark will be obtained from record of an exam (80%) to be held on the official date and the grade obtained in the work (20%). Be a minimum requirement to pass the course more of a 4.5 on the exam.

Students who choose Option A), and do not pass the course in the first option must be submitted to the consideration of the second opportunity and the evaluation form will then be that of the B mode).

Anyhow, the evaluation system will be based on the guides stated in the “Reglament d’Avaluació i Qualificació de la Universitat de València per a Graus i Màsters” (https://goo.gl/UdDYS2).

REFERENCES

Basic

- M. Alarcón, Tecnología Energética en Ingeniería Química Diego Marín Ediciones, 2007

- J.M. Fernández, Tecnología de las energías renovables, AMV Ediciones 2009
- Y. Calventus et al. Tecnología Energética y medio ambiente Ediciones UPC 2006
- IDAE, Guías Técnicas de Ahorro y Eficiencia Energética 2007-2010.
- J.M. Lujan, J.L. Peidró y C. Guardiola. Problemas de Tecnología y Gestión Energéticas. Universidad Politécnica de Valencia 2003
- R. Sinnott and G. Towler Diseño en Ingeniería Química Editorial Reverté 2012

Additional

- Cámara Oficial de Comercio e Industria de Madrid y Comunidad de Madrid. Manual de Auditorías Energéticas. Madrid 2003
- Mejoras horizontales de ahorro y eficiencia energética .Sector industrial. Energía térmica. Edita Junta de Castilla y Leon