

Course guide 240EI031 - 240EI031 - Energy Technology

Last modified: 15/06/2023

Unit in charge: Teaching unit:	Barcelona School of Industrial Engineering 748 - FIS - Department of Physics.		
Degree:	MASTER'S DEGREE IN IND	USTRIAL ENGINEERING (Syllabus 2014). (Compulsory subject).	
Academic year: 2023	ECTS Credits: 3.0	Languages: Catalan, Spanish, English	
LECTURER			

Coordinating lecturer:	Calviño Tavares, Francisco	
Others:	Calviño Tavares, Francisco Cortes Rossell, Guillem Pere Freixa Terrades, Jordi Suarez Cambra, Daniel Pretel Sanchez, Maria Del Carmen Futatani, Shimpei Rives Sanz, Ronny	

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

CEEENE2. Manage the energetic chain (generation, transformation and use) to obtain the highest energetic efficiency in a process or product.

CEEENE1. Apply knowledge and valoration criteria on the design and evaluation of technological solutions for a good use of the renewable sources of energy, both in stand-alone systems as the ones connected to the network. Recognise and value the most innovative technological applications in the field of making a good use of the renewable source of energy.

CEMEI01. Knowledge and ability to analyse and design the generation, transport and distribution systems in electric energy.

CEMEI06. Knowledge and abilities which allow to understand, analyse, operate and manage the different sources of energy.

Generical:

CGMEI01. (ENG) Tenir coneixements adequats dels aspectes científics i tecnològics de: mètodes matemàtics, analítics i numèrics en la ingenieria, ingenieria elèctrica, ingenieria energètica, ingenieria química, ingenieria mecànica, mecànica de medis continus, electrònica industrial, automàtica, fabricació, materials, mètodes quantitatius de gestió, informàtica industrial, urbanisme, infraestructures, etc.

Transversal:

CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

TEACHING METHODOLOGY

The course activities in the classroom are theoretical lectures and practical sessions.

The practical sessions are sessions of group work, under the supervision of the teacher, where the students will carry out the main workload. These sessions are designed to bring the student closer to real-world problems and the orders of magnitude of some characteristic parameters of various energy systems. The practical sessions are used for continuous evaluation The groups of the practical sessions are stable throughout the semester.

In addition, students will carry out a group course project from the beginning of the semester (with the same group of practical sessions). This activity takes place mostly outside the classroom.

Students have at their disposal a collection of notes (presentations) and solved exercises that facilitate the follow-up of the course.



LEARNING OBJECTIVES OF THE SUBJECT

To know the current and developing techniques that allow the generation of energy.

To understand the physical and technological principles of conversion, storage, and transportation of energy, as well as its usage. Be aware of the socio-economical and environmental implications of the transformation and use of energy (energy management). Apply knowledge to real cases.

STUDY LOAD

Туре	Hours	Percentage
Hours medium group	27,0	36.00
Self study	48,0	64.00

Total learning time: 75 h

CONTENTS

Topic 1: Introduction to the energy problem

Description:

Description of fundamental concepts of the energy topic: resources, reserves, primary, secondary, final and useful energy, energy system, energy intensity...

Description of the present energy situation.

Specific objectives:

The student will be able to:

- know the current situation of the main energy sources.

- define the concepts of primary, secondary, final, and useful energy and their relationship.
- draw energy flow diagrams and energy balances.

- explain the relationship between energy consumption and level of development through parameters such as energy intensity, the human development index, etc.

- reason about the sustainability of the current energy system.

Related activities:

Assessment of global energy consumption evolution. Individual work

Full-or-part-time: 3h Theory classes: 2h Self study : 1h



Topic 2: Coal-fired thermal power plants

Description:

Statistics on the use of coal as an energy source. Review of the combustion reaction and the thermodynamic Rankine cycle (steam cycle). Description of the technology of coal-fired thermal power plants. Application of the acquired knowledge to the study of practical cases.

Specific objectives:

Students will be able to:

- know the relative importance of coal as an energy source
- describe the technology and the basic physical principles of coal-fired thermal power plants
- solve practical exercises on coal power plants

Related activities:

Resolution of practical cases on steam power stations. Teamwork.

Full-or-part-time: 5h

Theory classes: 2h Guided activities: 2h Self study : 1h

Topic 3: Combined cycle power plants.

Description:

Statistics on the use of natural gas as an energy source. Review of the gas cycle (Brayton cycle). Description of the combined cycle plants technology: present situation, physical principles, operation, equipment, etc. Resolution of practical cases.

Specific objectives:

Students will be able to:

- know the relative importance of the use of natural gas as an energy source
- describe the technology of combined cycle thermal power plants.
- solve practical exercises on gas and combined cycles power plants.

Related activities:

Resolution of practical cases on gas power plants. Teamwork.

Full-or-part-time: 5h Theory classes: 2h Laboratory classes: 2h Self study : 1h



Topic 4: Renewable Technologies.

Description:

Concentrated solar thermal energy, photovoltaic solar energy, wind energy, and hydraulic energy. Statistics. Basic principles and associated technologies. Resolution of exercises.

Specific objectives:

The student will be able to:

- know the relative importance of the use of renewables energy sources
- describe the main characteristics of renewable energy power plants.
- solve practical exercises on renewable-energy power plants
- assess the importance of these energy sources from an economic and environmental point of view

Related activities:

Resolution of practical cases on renewable energy power plants. Teamwork.

Full-or-part-time: 9h

Theory classes: 4h Laboratory classes: 4h Self study : 1h

Topic 5: Nuclear Power Plants.

Description:

Technology statistics. Introduction to radioactivity, nuclear reactions, and fission reactions. Definition of the basic principles of the nuclear reactor. Description of the nuclear power plant with a pressurized water reactor.

Specific objectives:

The student will be able to:

- recognize the relative importance of the use of nuclear power plants as an energy source
- describe the nuclear reactions useful to obtain energy
- describe the fission reaction, its main characteristics, and its importance to obtain energy.
- define radioactivity, its main processes, and its impact on the nuclear plant technology (residual power, waste products)
- describe the main components of nuclear power plants
- compare a conventional thermal power plant and a nuclear power plant.
- solve practical exercises about nuclear power plants

Related activities:

Resolution of practical cases on nuclear power plants. Teamwork.

Full-or-part-time: 5h Theory classes: 2h Laboratory classes: 2h Self study : 1h



Course project

Description:

Development of a group technical project applying the knowledge that is been acquired throughout the semester to a real situation.

Specific objectives:

The student will be able to:

- analyze the needs of a real case
- apply technical knowledge
- write a technical report
- defend a group's proposal

Related activities:

- Technical report
- Presentation

Related competencies :

CGMEI01. (ENG) Tenir coneixements adequats dels aspectes científics i tecnològics de: mètodes matemàtics, analítics i numèrics en la ingenieria, ingenieria elèctrica, ingenieria energètica, ingenieria química, ingenieria mecànica, mecànica de medis continus, electrònica industrial, automàtica, fabricació, materials, mètodes quantitatius de gestió, informàtica industrial, urbanisme, infraestructures, etc.

CEEENE2. Manage the energetic chain (generation, transformation and use) to obtain the highest energetic efficiency in a process or product.

Full-or-part-time: 48h

Guided activities: 1h Self study : 47h

GRADING SYSTEM

Grading includes:

- the mid-term exam mark (N1)
- the final exam mark (N2)
- the course activities (NC)
- Evaluation of a group course project (NP)

For the course activities, it is necessary to participate in at least 75% of the activities.

The final mark will be the best of the following four options: [1] 0,2 N1 + 0,45 N2 + 0,25 NP + 0,1 NC[2] 0,2 N1 + 0,55 N2 + 0,25 NP[3] 0,1 NC + 0,65 N2 + 0,25 NP[4] 0,75 N2 + 0,25 NP

The retake exam replaces the final exam (N2), and the final grade (NF) will be computed with the option [4]



EXAMINATION RULES.

The mid-term and final exams (N1 and N2), are scheduled on the School calendar They are made of two parts:

The first part consists of a multiple-choice questionnaire and simple calculations. The questions are conceptual. Simple calculations are quantitative about orders of magnitude or carrying out simple computations. The questionnaire covers all topics done so far. Notes are not allowed and wrong answers are penalized in the grading. The weight of the first part is 0.4.

The second part of the test consists of numerical exercises with characteristics similar to those carried out in the practical sessions and contains several sections that are scored individually. A one-sheet note can be consulted. The weight of that second part is 0.6.

Other items to consider:

The retake exam replaces the final exam (N2), and the final grade (NF) will be obtained with the option [4]

RESOURCES

Audiovisual material:

- Problemes amb resolució. Fully solved exercises
- Presentacions dels temes 1 al 5. Collection of slides available through the Intranet of the subject, accessible from ATENEA.