



# Course guide

## 820731 - ESEC - Power System

Last modified: 21/06/2024

**Unit in charge:** Barcelona School of Industrial Engineering  
**Teaching unit:** 709 - DEE - Department of Electrical Engineering.  
748 - FIS - Department of Physics.

**Degree:** MASTER'S DEGREE IN ENERGY ENGINEERING (Syllabus 2013). (Compulsory subject).  
MASTER'S DEGREE IN ELECTRIC POWER SYSTEMS AND DRIVES (Syllabus 2021). (Compulsory subject).  
MASTER'S DEGREE IN ENERGY ENGINEERING (Syllabus 2022). (Compulsory subject).

**Academic year:** 2024    **ECTS Credits:** 5.0    **Languages:** English

### LECTURER

**Coordinating lecturer:** Freixa Terradas, Jordi  
**Others:** Villafáfila Robles, Roberto  
Freixa Terradas, Jordi

### REQUIREMENTS

Basic knowledge of thermodynamics, electric systems and heat transfer is recommended.

### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

**Specific:**  
CEMT-2. Identify and describe the components of electrical systems (production, transportation, distribution, markets, procurement and consumption) and evaluate the technological solutions used in the production of electricity.

### TEACHING METHODOLOGY

Theoretical lectures  
Practical sessions  
Guided work

### LEARNING OBJECTIVES OF THE SUBJECT

To describe the different technologies related to the production of electric energy by means of thermal processes  
To have an insight into the more significant aspects of electricity transportation and distribution  
To apply the acquired knowledge to solve practical cases

### STUDY LOAD

Type	Hours	Percentage
Hours large group	45,0	36.00
Self study	80,0	64.00

**Total learning time:** 125 h

## CONTENTS

### Topic 1: Introduction

**Description:**

This first topic describes the main characteristics of the structure of the world power supply, concerning both demand and production.

**Specific objectives:**

To give the students a general overview of the power system.

**Full-or-part-time:** 3h

Theory classes: 2h

Self study : 1h

### Topic 2: Electrical energy production by means of thermal processes

**Description:**

This course provides a comprehensive overview of electrical energy production through various thermal processes. Students will explore the fundamental principles and technologies behind converting thermal energy into electrical power. The course covers key topics such as the thermodynamics of power cycles, including the Rankine and Brayton cycles, which are the basis for steam and gas turbine power plants, respectively.

Advanced topics include combined cycle power plants, cogeneration, and emerging technologies like concentrated solar power (CSP) and biomass energy conversion.

By the end of the course, students will be equipped with the knowledge to critically analyze different thermal energy production methods and their applications.

**Related activities:**

Resolution of practical cases

**Full-or-part-time:** 35h

Theory classes: 14h

Guided activities: 7h

Self study : 14h

### Topic 3: Transport and distribution

**Description:**

Description of the main characteristics of transport and distribution infrastructures (transmission and distribution systems, transforming stations and conversion stations)

Analysis of the technological aspects related to the grid regulation.

**Specific objectives:**

Students should know the difference between transport and distribution.

They should be aware of the causes of electrical energy losses during its transport and distribution in order to reason about maximum lengths of the grid.

Students should know the main characteristics of transport and distribution infrastructures.

**Related activities:**

Calculation of power lines.

Resolution of practical cases.

**Full-or-part-time:** 26h

Theory classes: 10h

Guided activities: 6h

Self study : 10h



## GRADING SYSTEM

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$FQ = 0,5 * QC + 0,5 * QE$  (if  $QE \geq 4$ )

$FQ = QE$  (si  $QE < 4$ )

FQ: Final Qualification

CQ: Class qualification. This qualification is obtained weighting the different activities performed using the proportion of hours of each topic related to the total amount of hours of the course.

EQ: Exam qualification. At the end of the semester students will have to answer an exam to determine the achieved level of understanding.

## BIBLIOGRAPHY

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### Basic:

- Cengel, Yunus A. and Boles, Michael A.. Thermodynamics : an engineering approach. 8th ed. New York: McGraw Hill, 2015. ISBN 9780073398174.