Course guide
820731 - ESEC - Power Systems

Last modified: 08/04/2026

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 ENERGY ENGINEERING (Syllabus 2022). (Compulsory subject).

Academic year: 2026 **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

Any academic fraud, plagiarism or use or possession of unauthorised means in an assessment activity leads to a mark of zero (0) for the affected test or assignment. Furthermore, in accordance with the University's regulations, if disciplinary proceedings are initiated the subject is recorded as "Pending Assessment" until a decision is reached. These incidents are managed in accordance with the **Action Framework for Academic Integrity in Assessment at the UPC**.

FG = 0,4* TG + 0,6* EG (if EG >= 4)
FG = EG (if EG < 4)
FG: Final Grade
TG: Team project Grade
EG: Final Exam Grade

If the final grade (FG) does not reach 5.0, students will have a reassessment test that will replace the EG grade. Likewise, if the TG grade is below 5.0, students will be allowed to improve their work in order to reach a TG grade of 5.0.

BIBLIOGRAPHY

Basic:
- Çengel, Yunus A ; Boles, Michael A ; Kanoglu, Mehmet. Thermodynamics : an engineering approach. 10th ed. New York: McGraw Hill, 2023. ISBN 9781266152115.