Course guide
820755 - XI - Smart Grids

Last modified: 08/04/2026

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

Degree: MASTER'S DEGREE IN ENERGY ENGINEERING (Syllabus 2013). (Optional subject).
MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Optional subject).
MASTER'S DEGREE IN ENERGY ENGINEERING (Syllabus 2022). (Optional subject).

Academic year: 2026 **ECTS Credits:** 5.0 **Languages:** English

LECTURER

Coordinating lecturer: Sumper, Andreas

Others: Sumper, Andreas
González Font De Rubinat, Paula
Gadelha, Vinicius

PRIOR SKILLS

Basics on Electric Equipments

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEMT-3. Assess the economic, social and environmental impact of the production, use and management of energy, with a holistic view of the life cycle of the different systems, and recognise and value the most remarkable developments in the fields of energy efficiency and the rational use of energy.

TEACHING METHODOLOGY

Slides-based lecturing. Invited lectures from the industry. Problem-based course project.
Lab sessions.

LEARNING OBJECTIVES OF THE SUBJECT

Knowing the basics of power system operation. Knowing the basic properties and components of the Smart Grid. Being able to apply novel techniques and technologies to the power system.

STUDY LOAD

Type	Hours	Percentage
Hours small group	15,0	12.00
Hours large group	30,0	24.00
Self study	80,0	64.00

Total learning time: 125 h

CONTENTS

Equipment of transmission & distribution systems

Description:
Introduction
Classical Grids & Smart Grids
Modeling and Calculation

Specific objectives:
Understand and apply the models of the elements of the electrical network, both classic and modern. Integrate the models into a general calculation methodology. Use Python-based calculation tools.

Related activities:
A1: Power Flow Calculation (PandaPower)

Full-or-part-time: 22h 30m
Practical classes: 15h
Guided activities: 7h 30m

Smart Grid Technical systems

Description:
Smart Grid architecture
Communications and Information
New technologies

Specific objectives:
Understand classical and current regulatory devices for networks. Apply to specific use cases.

Related activities:
A2: Smart Grid Architecture Modeling (SGAM)

Full-or-part-time: 22h 30m
Theory classes: 7h 30m
Practical classes: 15h

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**.

In order to be able to have an evaluation of the subject, it is a necessary condition to have attended, carried out and delivered the reports of all the laboratory sessions and of the course project. In case this necessary condition is not met, the grade will be NP (Not Presented). If the necessary condition is met, then the calculation will be as follows:
The final grade will be calculated as a weighted sum of tests (continuous evaluation) of the theory sessions (40%), the report of the lab tutorial (20%) and the course project and presentation (40%)

EXAMINATION RULES.

Individual evaluation of the theory content by tests, problem-based learning, production of reports, presentations

BIBLIOGRAPHY

Basic:
- Faulkenberry, Luces M; Coffer, Walter. Electrical power distribution and transmission. Englewood Cliffs, NJ: Prentice Hall, cop. 1996. ISBN 0132499479.
- Acha, Enrique. FACTS : modelling and simulation in power networks. Chichester: John Wiley & Sons, cop. 2004. ISBN 0470852712.
- Sen, Kalyan K; Sen, Mey Ling. Introduction to facts controllers : theory, modeling, and applications. New York: John Wiley & Sons, 2009. ISBN 9780470478752.