Course guide
820323 - GEEEN - Electricity Generation

Last modified: 04/06/2026

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

Degree: BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2026 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: MARIA ELENA MARTIN CAÑADAS

Others:

Primer quadrimestre:
JUAN CRUZ VAQUER - Grup: T11, Grup: T12
MARIA ELENA MARTIN CAÑADAS - Grup: T11, Grup: T12

Segon quadrimestre:
JUAN CRUZ VAQUER - Grup: M11, Grup: M12, Grup: M13
MARIA ELENA MARTIN CAÑADAS - Grup: M11, Grup: M12, Grup: M13

PRIOR SKILLS

Alternating current electric circuits analysis

REQUIREMENTS

SISTEMES ELÈCTRICS - Prerequisit

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEENE-340. Apply the principles of operation and main technologies that allow the generation of electrical energy

Transversal:
4. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.
3. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.
11. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

TEACHING METHODOLOGY

The subject will be structured in two types of classroom sessions:
- Classes of theory and solved examples: theoretical aspects and worked examples will be explained, and the items autonomously learned by the students will be commented.
- Practice sessions: Experiences will be done at the laboratory of electrical machines and simulations with specialised software may also be performed.

The students will do also off-site tasks including individual and teamwork.

LEARNING OBJECTIVES OF THE SUBJECT

The aim of the course is to enable the student to understand and analyze the different technologies of electric generators.

The specific objectives include:
- Understanding the principles of operation of the various electrical machines, focusing on synchronous and induction generators
- Analysingthe steady-state and transient regimes of the different electrical machines
- Understanding the operation and control principles of the electric generators connected directly to the network
- Understanding the operation and control principles of the electric generators connected to the network through a converter (wind and PV energy)

STUDY LOAD

Type	Hours	Percentage
Hours large group	45,0	30.00
Hours small group	15,0	10.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

(ENG) Basic principles

Description:
Basic principles of conversion of electrical energy. Classification of electric generator technologies.

Full-or-part-time: 30h
Theory classes: 10h 30m
Laboratory classes: 1h 30m
Self study : 18h

(ENG) Technologies of electric generators

Description:
Synchronous generators. Induction generators. Other electric generators. Fundamental aspects of each technology. Equivalent models. Applications.

Full-or-part-time: 60h
Theory classes: 21h
Laboratory classes: 3h
Self study : 36h

(ENG) -Generators directly connected to the electricity grid

Description:
Operation of electrical generators connected directly to the network. Stationary and transient analysis. Control. Stability. Interactions with the network.

Full-or-part-time: 30h
Theory classes: 10h 30m
Laboratory classes: 1h 30m
Self study : 18h

(ENG) Generators connected to the electric grid through a converter (wind and photovoltaic energy)

Description:
Generator technologies. Converter technologies. Control systems. Wind and solar photovoltaic generation. Integration of renewable energy sources to the electricity grid.

Full-or-part-time: 30h
Theory classes: 10h 30m
Laboratory classes: 1h 30m
Self study : 18h

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**.

The final mark will be calculated according to the following equation
NF=PR*0.2+EP*0.25+TR*0.2+EF*0.35
TF Work
PR Practices
EP Partial Exam
EF Final Exam
This subject will not have a re-evaluation exam.
The marks associated to the generic competence/s avaluation will bea the mean value of the marks of the laboratoy practices and the proposed work.

BIBLIOGRAPHY

Complementary:
- Fitzgerald, A. E.; Kingsley, Charles; Umans, Stephen D. Electric machinery. 7th ed. Boston [etc.]: McGraw-Hill, cop. 2014. ISBN 9780071326469.
- Chapman, Stephen J. Electric machinery and power system fundamentals. New York: McGraw-Hill, 2002. ISBN 9780071226202.
- Boldea, I. Synchronous generators : the electric generators handbook. Boca Raton: CRC, 2006. ISBN 084935725X.
- Freris, L. L.; Infield, D. G. Renewable energy in power systems. Chichester, U.K: John Wiley & Sons, 2008. ISBN 9780470017494.
- Fraile Mora, Jesús. Máquinas eléctricas. 7a ed. Madrid [etc.]: Garceta, cop. 2015. ISBN 9788416228133.

RESOURCES

Hyperlink:
- Atenea. Hi haurà materials disponibles a la web

Other resources:
Licensed software