



Course guide

340102 - MAE1-E4009 - Electrical Machines I

Last modified: 03/06/2024

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 709 - DEE - Department of Electrical Engineering.

Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: Lluís Monjo Mur

Others: Lluís Monjo Mur
Torrent Burgues, Marcel

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

6. CE19. Ability to calculate design electrical machines.

Transversal:

1. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 3. Taking social, economic and environmental factors into account in the application of solutions. Undertaking projects that tie in with human development and sustainability.
2. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

TEACHING METHODOLOGY

- In the theory classes, be exposed and develop the theoretical foundations of programmed materials. They consist of theoretical explanations complemented by activities to encourage participation, discussion and critical analysis by students.
- The kinds of problems will arise and solve exercises for the subject under discussion. Students should meet individually or in groups, indicating problems.
- Within hours of laboratory practice the students will be required and submit the relevant report of the activity along with appropriate calculations and critical considerations.
- Group work will be undertaken during the course of a specific topic related to the subject.

LEARNING OBJECTIVES OF THE SUBJECT

- Provide the basics of transformers and rotating electrical machines.
- Know the various constituents and key technological aspects of transformers and rotating electrical machines.
- Present the different types of transformers and their applications.
- Analyze the performance of transformers (single and three phase) from the equivalent circuit.
- To study the electromechanical conversion of energy and implement their primary relationships in machinery and electrical devices.
- Present the main uses of the synchronous machine as a motor and a generator.
- Study the constructive peculiarities of the synchronous machine and its operation principle.
- Analyze the behavior of the synchronous machine in steady state using its equivalent circuit.
- Clearly identify what is meant by the parameters of the plate in electrical machines.
- Plan and implement appropriate laboratory testing electrical machines ..



STUDY LOAD

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

Total learning time: 150 h

CONTENTS

1.- Principles of electric machinery

Description:

- 1.1.- Introduction to electrical machines.
- 1.2.- Main energy circuits.
- 1.3.- Nominal parameters or assigned. Losses.

Full-or-part-time: 31h

Theory classes: 9h
Laboratory classes: 4h
Self study : 18h

2.- Transformers

Description:

- 2.1.- The single-phase power transformer.
- 2.2.- Determination of circuit parameters.
- 2.3.- Three phase transformers.
- 2.4.- Other applications of the transformer.

Full-or-part-time: 40h

Theory classes: 12h
Laboratory classes: 4h
Self study : 24h

3.- Electromechanical Conversion of energy

Description:

- 3.1.- Electromechanical Systems.
- 3.2.- Energy stored in the magnetic field.
- 3.3.- Forces and torque in electromechanical systems.
- 3.4.- Dynamic equations.

Full-or-part-time: 26h

Theory classes: 8h
Practical classes: 2h
Self study : 16h



4.- Technological principles of the rotating electric machinery

Description:

- 4.1.- Air gap magnetic field.
- 4.2.- Electromotive forces induced in the windings.
- 4.3.- Aspects of construction and operation of electrical machines.

Full-or-part-time: 13h

- Theory classes: 4h
- Laboratory classes: 1h
- Self study : 8h

5.- Synchronous Electric Machines

Description:

- 5.1.- General. Constructive ways. Principle of operation.
- 5.2.- Equivalent circuit. Determination of circuit parameters.
- 5.3.- The synchronous generator load. Methods predetermination of excitation load.
- 5.4.- Synchronous Generator: feeding a load operation isolated and connected to the network.
- 5.5.- The synchronous machine as a motor. Curves.
- 5.6.- Magnet synchronous motor.
- 5.7.- Synchronous machine with salient poles.

Full-or-part-time: 40h

- Theory classes: 12h
- Laboratory classes: 4h
- Self study : 24h

GRADING SYSTEM

- First exam carried out during the course (30%).
- Exam conducted at the end of the course (45%).
- Realization laboratory practice (25%).

Reevaluation: There is a reevaluation act that corresponds to the 1st and 2nd exams, according to the EPSEVG rules.

EXAMINATION RULES.

- The written tests are face and individual.
- In classes of problems and / or laboratory practices will be assessed, where appropriate, the prior work with the presentation of results of the activity.

BIBLIOGRAPHY

Basic:

- Chapman, Stephen J. Máquinas eléctricas [on line]. 5a ed. México DF: McGraw-Hill, 2012 [Consultation: 19/02/2024]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=4297. ISBN 9786071507242.
- Fitzgerald, A. E.; Kingsley, Charles; Umans, Stephen D. Máquinas eléctricas. 6a ed. México [etc.]: McGraw-Hill, 2004. ISBN 970104052X.

Complementary:

- Fraile Mora, Jesús. Máquinas eléctricas. 8a ed. Madrid: Ibergarceta, 2016. ISBN 9788416228669.
- Sanz Feito, Javier. Máquinas eléctricas. Madrid [etc.]: Prentice Hall, cop. 2002. ISBN 8420533912.



RESOURCES

Other resources:

Finite Element Method Magnetics <https://www.femm.info/>