

Course guide

340673 - MMEL - Motors and Electric Mobility

Last modified: 18/05/2023

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). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2009). (Optional 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: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: Lluís Monjo Mur

Others: Lluís Monjo Mur

PRIOR SKILLS

Knowledge about electrical machines and systems would be appreciated.

REQUIREMENTS

There are no prerequisites for taking the course.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. CE19. Applied knowledge in electric engineering.

Transversal:

2. 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.
3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.
4. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

TEACHING METHODOLOGY

-The subject is developed in the environment of an activity consisting of choosing, as a team, a specific application that will be developed during the semester. On it are articulated the different topics of theory and problems (which are found in the section of contents).

-At the end of the course, on this activity, there will be an oral and written presentation (for each team) of the work done during the semester.

LEARNING OBJECTIVES OF THE SUBJECT

Electric motors are machines that transform electrical energy into mechanical energy. Today, we can find them in large quantities and in a wide range of powers in any field: industrial, domestic, services, ... as we are surrounded by applications that require movement or positioning of mechanical elements (compressors, fans, pumps, cranes, CNC machine tools, traction, ...).

In recent years, to combat climate change or to reduce pollutant concentrations in urban areas, restrictive measures have had to be taken in the circulation of vehicles powered by internal combustion engines in low-emission areas; in the future these restrictions will increase more and more to achieve sustainable mobility. In this paradigm shift, electric motors are in a very favorable situation as they do not present the problem of emissions and if in addition, there are also changes in the classic electric power generation systems to a new system of generation based on renewable energy sources we can reverse the environmental problem we are in. These structural changes in terms of mobility must be extended not only to increase the fleet of electric and hybrid cars but in a much more general way to other types of vehicles such as single-passenger or transport such as freight, industrial, maritime and air.

In this context, the objectives of this subject will be:

- Analyze the possibilities of application of electric motors in the broad concept of electric mobility with special emphasis on light and heavy vehicles such as "off road vehicles" (excavators, tractors, mining transport ..), trains, planes or ships.
- Study the types of engines that we can use in the previous applications and their characteristics, incorporating the basic criteria for the correct selection of these types of engines to which, today, other considerations must be added such as the aspects thermal, environmental, new materials, energy efficiency and economic.

STUDY LOAD

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

Total learning time: 150 h

CONTENTS

Unit 1.- Introduction to electric mobility.

Description:

- 1.1.- Electric mobility. Current status. Social and environmental implications.
- 1.2.- Challenges for the future.

Full-or-part-time: 11h

Theory classes: 4h

Laboratory classes: 2h

Self study : 5h

Unit 2.- Motors for electric vehicles.

Description:

- 2.1.- Types of motors by electric traction. Operation.
- 2.2.- Assigned Parameters. Named Plate.
- 2.3.- Heating and Type of service of electric motors. Environmental Factors.
- 2.4.- Motor-load coupling. Stability.
- 2.5.- Standardization. Norms.
- 2.6.- Economic importance of efficiency. Energy efficiency classes.
- 2.7.- Determination of Life Cycle Cost (LCC).
- 2.8.- Environmental Aspects. Ecodesign of electric motors. Life cycle analysis.

Full-or-part-time: 59h

Theory classes: 16h

Laboratory classes: 7h

Self study : 36h

Unit 3.- Applications of electric motors to mobility.

Description:

- 3.1.- Road transport and trains.
- 3.2.- Industrial electric vehicles.
- 3.3.- Maritime transport.
- 3.4.- Air transport.
- 3.5.- Other applications.
- 3.6.- Future perspectives.

Full-or-part-time: 80h

Theory classes: 15h

Laboratory classes: 5h

Guided activities: 30h

Self study : 30h

GRADING SYSTEM

Note = 30% partial exam + 30% Final Exam + 40% activities

EXAMINATION RULES.

- Written exams are face-to-face and individual tests.

BIBLIOGRAPHY

Basic:

- Williamson, Sheldon S.; Kathires, M.; Kanagachidambaresan, G. R. E-mobility : a new era in automotive technology [on line]. Cham, Switzerland: Springer, 2022 [Consultation: 18/09/2023]. Available on: <https://link.springer.com/book/10.1007/978-3-030-85424-9>. ISBN 303854248.
- Fuentes Losa, Julio; González Fernández, Francisco Javier. Ingeniería ferroviaria [on line]. 2a ed. Madrid: Universidad Nacional de Educación a Distancia, 2010 [Consultation: 19/09/2023]. Available on: <https://lectura.unebook.es/viewer/9788436261844/1>. ISBN 9788436260748.
- Pistoia, G. Electric and hybrid vehicles [Recurs electrònic] : power sources, models, sustainability, infrastructure and the market [on line]. Amsterdam: Elsevier, 2010 [Consultation: 20/02/2024]. Available on: <https://www.sciencedirect-com.recursos.biblioteca.upc.edu/book/9780444535658/electric-and-hybrid-vehicles>. ISBN 1282879979.