

Curricular Unit Sheet

1. Curricular Unit Syllabus.

1.1. Curricular Unit

Traction and Electrical Vehicles

1.2. Scientific area acronym

EE – Electrical Engineering

1.3. Duration

Semester

1.4. Total of Working Hours

1.5. Contact hours

67,5 hours

1.6. ECTS

6,0

1.7. Observations

2. Responsible Academic staff and lecturing load in the curricular unit (enter full name)

Miguel Cabral Ferreira Chaves

3,0 hours

3. Other academic staff and lecturing load in the curricular unit

Paulo Gambôa

1,5 hours

4. Learning outcomes of the curricular unit

Provide actual concepts and technology used in electric vehicles.

Students should be able to:

Identify and analyse the main solutions used in electric road and rail vehicles, namely power storage and power systems and variable speed drive systems;

Calculate the fundamental quantities in electric traction leading to the design of electrical power drives systems applied to electrical traction: resistance to movement, traction effort, acceleration, speed, power and energy consumed.

5. Syllabus

1 - Introduction: the evolution of transport and electric road and rail mobility systems, environmental and energy constraints in the development of transport and electric mobility;

2 - Electric road vehicles;

2.1 - Topologies of electric traction used in road vehicles;

2.2 - Embedded systems for storage and or production of electric energy in road vehicles: electrochemical batteries and hybrid solutions;

2.3 – Electrical drive systems for electric road vehicles: machines; converters and command and control systems;

2.4 - Fundamentals of vehicle dynamics: applied forces, power and energy;

3 – Electric railway vehicles;

3.1 - Electric traction topologies used in railway vehicles;

3.2 - Electric railway power supply systems in dc and ac;

3.3 – Electrical drive systems for electric railway vehicles: machines; converters and command and control systems;

3.4 - Fundamentals railway dynamics: applied forces, power and energy;

4 - Examples of advanced road and rail electric traction systems.

6. Demonstration of the syllabus coherence with the curricular unit's objectives

The objectives of the curricular unit are achieved based on a coherent program that leads students progressively through the fundamental contents of electric traction systems: Energy source; energy storage system; vehicle dynamic and variable speed electromechanical conversion systems applied to electrical power traction.

7. Teaching methodologies (including evaluation)

The curricular unit is taught in Theoretical (T), Theoretical-Practical (TP) and Practical (P) classes:

In T classes the contents of the CU are presented in an expositive way; the TP classes are designed to carry out practical case problems and the P classes are used for the development of simulation / practical works.

The assessment of knowledge is composed of three parts:

- 1 - Exam, minimum grade of 9,5 (NE);
- 2 - Preparation and presentation of a research work, minimum grade of 9,5 values (NT);
- 3 - Realization and discussion of the practical works, minimum grade of 9,5 (NP).

Final Note = 40% NE + 30% NT + 30% NP.

8. Demonstration of the coherence between the teaching methodologies and the learning outcomes

The theoretical exposition of the CU contents is accompanied by practical examples, problem solving and simulation and practical work.

The accomplishment of problems and practical works, articulated with the theoretical classes, allows the students to efficiently consolidate the contents of the CU.

9. Bibliography

1 - Modern electric, hybrid electric and fuel cell vehicles; M. Ehsani, Y. Gao, S. Longo, K. Ebrahimi; 3ª edição, CRCPress, 2018; ISBN: 978-1-4987-6177-2.

2 – Vehicle Dynamics: Theory and Application; R. Jazar; Springer, 2008; ISBN: 978-0-387-74243-4.

2 - Fundamentals of vehicle dynamics; T. Gillespie. Society of automotive engineers; ISBN 1-56091-199-9.

3 - Traction électrique – Volume 1; Roger Kaller, Jean-Marc Allenbach, Pierre Chapas, Michel Comte; Presses Polytechniques et Universitaires Romandes; ISBN 978-2-88074-674-2.

4 - Traction électrique - Volume 2; Roger Kaller et Jean-Marc Allenbach; Presses Polytechniques et Universitaires Romandes; ISBN 2-88074-275-7.