Course guide
220119 - APV - Alternative Propulsion Vehicles

Last modified: 02/04/2024

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 709 - DEE - Department of Electrical Engineering.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2024 **ECTS Credits:** 3.0 **Languages:** English

LECTURER

Coordinating lecturer: JUAN MONTAÑA PUIG

Others: DAVID GONZALEZ DIEZ

TEACHING METHODOLOGY

Theory classes: In these lectures, teachers will introduce basic concepts of energy storage systems, hybrid arquitectures, electric motors and drives and system modeling. All these explanations are practically oriented and they will be illustrated with real examples to facilitate their understanding.
Practical classes: In these lectures, that are concentrated in modules 3 and 4, students will practice the concepts introduced in previous modules.
Self-study: Students, organized in teamworks, need to work on the materials provided by teachers in order to develop the assigned homework.
Teachers provide the curriculum and monitoring of activities through ATENEA

LEARNING OBJECTIVES OF THE SUBJECT

This course gives an overview of state of the art on cars alternative propulsion systems. It covers a description of components, system architectures and operation. The course also considers the modeling and simulation of these systems and at the end of the course, students should be able:
- to know the basics principles, components and operation of alternative propulsion systems
- to model and simulate the performance of these systems

STUDY LOAD

Type	Hours	Percentage
Self study	45,0	60.00
Hours large group	30,0	40.00

Total learning time: 75 h

CONTENTS

Module 1: Introduction to Alternative Propulsion Vehicles

Description:
This introduces basics on alternative propulsion vehicles. It is mainly focused on pure electric and hybrid (petrol-electric) vehicles.
System architectures. Energy Accumulators
State of the art of current technologies is presented as future trends as well

Related activities:
Final exam

Full-or-part-time: 12h 30m
Theory classes: 5h
Self study : 7h 30m

Module 2: Principles of Electric Drives

Related activities:
Final exam

Full-or-part-time: 12h 30m
Theory classes: 5h
Self study : 7h 30m

Module 3: Laboratory of Electric Machines and Drives

Description:
This module is devoted to practice implementation of electric drives
Motor drives. Electric braking

Related activities:
Homework related to Module 3
Final exam

Full-or-part-time: 25h
Theory classes: 10h
Self study : 15h

Module 4: Modeling & Simulation

Description:
This module is devoted to the modeling and simulation of pure electric/hybrid vehicles using Matlab/Simulink. The model is useful for system sizing and design and to predict the vehicle performance.

Related activities:
Final exam.

Full-or-part-time: 25h
Theory classes: 10h
Self study : 15h

GRADING SYSTEM

The final grade depends on the following assessment criteria:

- Laboratory work related to Module 3: 30 %
- Assignments related to Module 4: 30 %
- Final exam: 40 %

Unsatisfying results of the Final exam could be repeated in an exam to be allocated during the period of the final exams. Students with grades lower than 5 points (unsatisfactory) can retake the exam. The new grade, if it is equal or higher than 5 points, will substitute with the Final exam grade with 5 points.

BIBLIOGRAPHY

Basic:
- Ehsani, M.; Gao, Y.; Emadi, A. Modern electric, hybrid electric, and fuel cell vehicles: fundamentals, theory, and design. 2nd ed. Boca Raton: CRC Press, 2010. ISBN 9781420053982.
- Liu, Wei. Introduction to hybrid vehicle system modeling and control [on line]. Hoboken: Wiley, 2013 [Consultation: 20/09/2022]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=918270. ISBN 9781118407387.

Complementary:
- Hodkinson, R.; Fenton, J. Lightweight electric/hybrid vehicle design [on line]. Oxford: Butterworth-Heinemann, 2001 [Consultation: 20/09/2022]. Available on: https://www-sciencedirect-com.recursos.biblioteca.upc.edu/book/9780750650922/lightweight-electric-hybrid-vehicle-design. ISBN 9780750650922.
- Savaresi, S.M.; Tanelli, M. Active braking control systems design for vehicles [on line]. London: Springer, 2010 [Consultation: 13/05/2022]. Available on: https://link-springer-com.recursos.biblioteca.upc.edu/book/10.1007/978-1-84996-350-3. ISBN 9781849963497.
- Westbrook, Michael H. The electric car: development and future of battery, hybrid and fuel-cell cars. Six Hills Way: The Institution of Electrical Engineers, 2001. ISBN 0852960131.
- Miller, John M. Propulsion systems for hybrid vehicles [on line]. 2nd ed. Stevenage, UK: Institution of Engineering and Technology, 2010 [Consultation: 30/09/2022]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=774057. ISBN 9781849191470.