Course guides
205217 - EM - Electromobility and Electrical Aircraft Systems

Last modified: 29/05/2020

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).
BACHELOR'S DEGREE IN AEROSPACE TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN AEROSPACE VEHICLE ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN TEXTILE TECHNOLOGY AND DESIGN ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2020 **ECTS Credits:** 3.0 **Languages:** English

LECTURER

Coordinating lecturer: Jordi-Roger Riba

Others:

TEACHING METHODOLOGY

The course is developed through lectures including theoretical sessions imparted with the aid of powerpoint presentations and more applicative and more visual sessions with videos, stellar catalogues and simulations

LEARNING OBJECTIVES OF THE SUBJECT

The main objective of the course is to introduce students into theoretical and practical aspects of electromobility, with special emphasis on more electrical aircrafts. Students after this course should be able to identify and understand the different electrical and electronic systems used in electromobility applications such as hybrid and electrical vehicles and aircrafts.
Additionally, some aspects related to energy storage systems, electrical machines technology, power converters, energy efficiency, power density, carbon footprint or life cycle assessment will also be considered.
Capabilities to be acquired by the student: English language, team work, autonomous learning, solvent use of information resources.

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

Description:
- Brief history
- Overview
- Basic principles
- Elecromobility: current status and future trends
- Trends of more electrical aircrafts

Related activities:
- Theoretical sessions
- Activities in class. Activity 1

Full-or-part-time: 5h
Theory classes: 2h
Self study : 3h

Module 2: Energy storage and power sources

Description:
- Batteries
- Fuel-cells
- Plug-in systems
- Lifetime costs

Related activities:
- Theoretical sessions
- Activities in class. Activity 2

Full-or-part-time: 10h
Theory classes: 4h
Self study : 6h

Module 3: Brushless electric motors and generators

Description:
- Generator and motor principles
- AC generators for aircrafts
- Three-phase generation and distribution in aircrafts
- Brushless AC motors

Related activities:
- Theoretical sessions
- Practical sessions: Simulations
- Activities in class. Activity 3

Full-or-part-time: 22h 30m
Theory classes: 9h
Self study : 13h 30m

Module 4: Power conversion and electronic DC/DC regulation

Description:
- Transformers
- Transformer-rectifier units (TRU)
- Inverters
- DC-DC power converters
- Filters
- Auxiliary power unit (APU)
- Emergency power
- Distribution of power supplies

Related activities:
- Theoretical sessions
- Practical sessions: Simulations
- Activities in class. Activity 4

Full-or-part-time: 22h 30m
Theory classes: 9h
Self study : 13h 30m

Module 5: The more electrical aircraft: next generation aircraft power

Description:
- Full view of the electrical and electronic system of MEA
- Towards high-voltage systems
- Operating environment
- Wiring, insulation materials, and circuit protection

Related activities:
- Theoretical sessions
- Activities in class. Activity 5

Full-or-part-time: 10h
Theory classes: 4h
Self study : 6h

Module 6: Environment aspects and life cycle assessment (LCA)

Description:
- Principles of LCA
- Application to all electric and hybrid vehicles
- Application to aircraft systems

Related activities:
- Theoretical sessions
- Activities in class. Activity 6

Full-or-part-time: 5h
Theory classes: 2h
Self study : 3h

GRADING SYSTEM

The qualification of the subject is divided in two parts:
Guided project: 40%
Written mid-term exam: 20%
Written final exam: 40%
The guided project will be handed over at the end of the subject.
All modules will be covered between the written mid-term and final exams. They will be done at mid-term and the end of the subject, respectively.

Final_Mark = 0.2·Exam_Mid-Term_Grade + 0. 4·Exam_Final_ Grade + 0.4·Guided_Project_ Grade

Any student who cannot attend any of the written exams or that wants to improve the grade obtained, will have the re-conduction possibility. It is an additional global written exam that will take place the dated fixed in the final exams calendar. The grade obtained in this exam will replace that of the previous exams only in case it is higher.