UNIVERSITAT POLITÈCNICA DE CATALUNYA

ESCOLA UNIVERSITÀRIA D'ENGINYERIA TÈCNICA INDUSTRIAL DE BARCELONA

Degree in ENGINEERING (All degrees)

Escola Universitària d'Enginyeria Tècnica Industrial de Barcelona
Consorci Escola Industrial de Barcelona
UNIVERSITAT POLITÈCNICA DE CATALUNYA

Guide of the course (English)

ECTS

Subject:	Electric mobility				
Acronym:	29752	**Type:**	**Optional**		
Code:	29752	**Semester:**	**Spring**		
Year:	**2011**	**Level:**			
Credits:	**Total credits ECTS :**	6	**Total number of hours:**	60	
	In Classroom Credits (Theory):	3	In Classroom hours (Theory):	30	
	In Classroom Credits (Problems):	0	In Classroom hours (Problems):	0	
	Laboratory credits:	1,5	Laboratory hours:	15	
	Guided activities:	0	Guided activities hours:	0	
	Out of the classroom Credits:	1,5	Out of the Classroom hours:	15	
Coordinator:	Daniel Montesinos i Miracle				
Teaching staff:	Daniel Montesinos i Miracle, Roberto Villafáfila Robles				
Consulting timetable:	To be determined				
Prerequisites:	Knowledge on electrical circuits is highly recommended.				
Co-requisites:					
General Objectives:	Electrical aspects of electric mobility will be addressed, from technology description, modeling and on-board energy management system.				
Specific objectives by topic:	1. Introduce types of electric mobility and its basic aspects, including some history 2. Describe different available types of energy sources and energy storage systems. 3. Analyze different types of electric machines used in electric mobility. 4. Delve with power converters for electric mobility and auxiliary systems. 5. Describe different solutions for electric mobility, comparing them. 6. Deals with modeling aspects. 7. Analyze environmental aspects of electric mobility, including the impact on the grid.				
Cross competences:	Work on system efficiency of renewable energies focusing on electrical solutions.				

Topics of the course:

1. Electric mobility introduction
    a. History of electrical mobility
    b. Railway systems
    c. Electric vehicles and hybrid electric vehicles
2. Energy sources and storage systems
    a. Energy from the grid
    b. Bateries
    c. Fuel cells
    d. Supercapacitors
    e. Other energy sources
3. Electric machines in electric mobility
    a. DC motor
    b. Synchronous motors
    c. Induction motors
    d. Other types of motors
4. Power converters
    a. Battery chargers
    b. Traction converters
    c. Auxiliary converters
5. Applications
    a. Railway systems
    b. Electric vehicles
6. Modeling
    a. REM and SMC
    b. Tractive effort
    c. Energy management and control
7. Electric vehicles and the environment
    a. Sustainable energy
    b. V2G
    c. Regulations and markets

Laboratory:

Modelling of electric vehicle:

1. MATLAB/Simulink introduction
2. Modeling power converters
3. Modeling electric machines
4. Modeling energy sources
5. Creating the environment
6. Model testing and validation

Guided Activities:

Students will develop practical exercises focusing on modeling and simulation of electrical vehicle and railway systems. Different groups will select different schemes. The work undertaken will be presented to the other students along with a report with the obtained results.

Student's Weekly work expressed in hours:

Activity type/weekly	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Theory	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2						30
Practice[1]								1	2	2	2	2	2	2	2						15
Problems																					0
Out of the classroom[2]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						15
Practice report delivery [3]																					0
Oral/Written exams																					0
Other activities																					0
TOTAL	3	3	3	3	3	3	3	4	5	5	5	5	5	5	5	0	0	0	0	0	60

[1] The laboratory sessions are two hours biweekly, starting the first week. The odd groups attend the 7 sessions on weeks 3, 5, 7, 9, 11 and 13, while even groups attend to them on weeks 6, 8, 10, 12 and 14.
[2] This includes the individual out of the classroom activity (learning time).
[3] The practice reports entail the work of reduced groups during the whole semester. Each report delivery requires three hours of work (previous preparation of the practice and of the report afterwards).

Teaching/Learning method:

Theory / Problems / Lab presential classes + non-presential exercises

Main bibliographic resources:

1. J. Larminie, J. Lowry, Electric Vehicle Technology Explained, John Wiley & Sons Ltd.
2. John M. Miller, Propulsion systems for hybrid vehicles, The institution of electrical engineers, 2004.
3. I. Husain, Electric and Hybrid vehicles. Design fundamentals, CRC Press,2003.
4. M. Ehsani, Y. Gao, Sebastien E. Gay and A. Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles. Fundamentals, theory and design, 2005.

Complementary bibliographic resources:

Assessment and qualification:

Final exam 50 %
Non-presential activities 40 %
Lab practices 10 %