REM master basic syllabus

Title:
PEIOPS Power Electronics in Offshore Power Systems

Credit value:
3 ECTS

Mandatory/Optional:
Optional

Semester:
3

Lecturer/s:
Inigo Martinez de Alegria, Jon Andreu, Inigo Kortabarria

University:
University of the Basque Country

Department:
Electronic Technology

Rationale:
Power Electronics is an enhancing vector in the development of renewable energy and efficient electrical energy management. Many of the systems necessary for offshore power production involve the use of power electronics, such as HVDC, FACTS or electric machine drives, studied in other courses in the master. This class presents the state of art in power electronics technology in terms of: devices, packaging, thermal design, design, and industry applications with similar operating requisites and provide the student with skills to select and design the proper components for offshore power converters.

Objectives:
To provide students with the ability to choose the proper power device, package and cooling method in each offshore power converter.

To provide students with the ability to design the main elements of an offshore power converter.

To provide a wide perspective of previous experience in other industries with similar challenges as offshore power conversion.

To provide students with the ability to critically evaluate the impact of different power convert topologies on the offshore power generation system

Skills: *(according to the list of skills provided)*

Subject skills	More Master Skills						
	L2.1	**L2.2**	**L2.3**	**L2.4**	**L2.5**	**L2.6**	**L2.7**
L3.1. Students are able to evaluate the different aspects relevant to the selection of a proper semiconductor device package for the construction of power converters.	X			X			
L3.2. Students are able to design the main elements of a power converter, such as gate drives, protection and passive elements.	X						
L3.3. Students are able to calculate the proper thermal parameters necessary for the correct operation of power converters.	X	X					
L3.4. Students are able to evaluate and compare the relevant merits of different power converters and their suitability for offshore power			X	X			X

conversion.							
L3.5. Students are able to identify power converters used in other industries that are also suited for offshore power conversion.		X	X			X	X

Teaching and learning methods:

Lectures, laboratory experiments and exercises, all in English.

Compulsory laboratory experiments with report.
Compulsory project work.
Compulsory assignments

Allocation of student time:

	Attendance (classroom, lab,…)	**Non attendance (lecture preparation, self study…)**
Lectures	15 hours	22.5 hours
Lab	11 hours	16.5 hours
Seminar	4 hours	6 hours

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Assessment:
Compulsory assignments, laboratory reports and project work allow the professor to supervise progress of students but assessment of the necessary skills is evaluated through a final exam.

Assessment Matrix:

Subject skills	**Assessment method**					
	Exam	**Presentation**	**Home work**	**Report**	**…**	**…**
L3.1.	10%					
L3.2.	25%					
L3.3.	25%					
L3.4.	20%					
L3.5.	20%					

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Programme:

Lesson 1	***Introduction*** *Introductory classroom session with the main description of the course contents and the basic concepts that will be used along the course* *Distribution:(1 h theory)*
Lesson 2	***Power semiconductor packaging technology*** *Description of the main problems of connectivity, cooling and isolation of power semiconductors and state of the art in power packaging technology and implications in offshore power converter design.* *Distribution (1 h theory + 1 h seminar)*
Lesson 3	***Power electronics cooling*** *Description, modelling and simulation of the thermal behaviour of power semiconductors in power converters.* *Distribution (3 h theory + 3 h computer + 1 h seminar)*
Lesson 4	***Gate drive design*** *Description and design of power semiconductor gate drivers* *Distribution (3 h theory + 2 h practical classroom + 3 h lab)*
Lesson 5	***Power converter protection*** *Description, design and selection of power converter protection* *Distribution (2 h theory + 2 h computer + 1 h seminar)*
Lesson 5	***Power converter Industry applications*** *Study of the most relevant industry power converters with requisites similar to offshore power conversion* *Distribution (3 h theory + 3 h computer + 1 h seminar)*

Resources:

The classroom will not require any resources over and above the standard audiovisual equipment and internet acces. The lab session require a computer room for power simulations and an electronics laboratory. There are no relevant security issues because all experiments are carried away in low voltage (below 48 V).

Bibliography:

Specific references for each topic will be given before and in lectures. The following are indicative of the textbook material that will be used for the class:

"Power Electronics" Daniel W. Hart. Ed. Prentice Hall
"Power Electronics: Converters, Applications and Design" N. Mohan. Ed. Jophn Wiley and Sons
"Fundamentals of Power Electronics" R.W. Erickson, Kluwer.
"Power Electronics: devices, drivers, Applications and passive components" Barry W. Williams, http://homepages.eee.strath.ac.uk/~bwwilliams/book.htm

IEEE Transactions on Power Electronics
Bodo´s Power Systems

http://cusp.umn.edu/: "Consortium of Universities for Sustainable Power (CUSP)"
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