REM master basic syllabus

Title:
EE9X3 Power Electronics Devices, Drives, Machines & Applications

Credit value:
5 ECTS

Mandatory/Optional:
Mandarory

Semester:
1

Lecturer/s:
Max Parker

University:
University of Strathclyde

Department:
Department of Electronic and Electrical Engineering

Rationale:
Offshore renewable energy technologies have gone through significant developments and improvements in the electrical energy conversion systems, namely the generators and the power electronic interfaces that enable the integration of these generation sources to the power grid. This module focuses on the fundamentals of operation of typical generators, semiconductors and converter types.

Objectives:
To provide students with…

1. Understanding the operating principles of common AC and DC machines (torque and back-emf production in DC machines, torque production in induction motors, and the derivation of the induction motor equivalent circuit).
2. Learn design principles of rotating electrical machines.
3. Familiarise with two-axis model of AC machines (origin of the two-axis model, and stationary and synchronous reference frames)
4. Learn the dynamic models of AC and DC machines

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

Subject skills	**REM Master Skills**						
	L2.1	**L2.2**	**L2.3**	**L2.4**	**L2.5**	**L2.6**	**L2.7**
L3.1. Students learn basic techniques to analyse magnetic circuits		X	X			X	X
L3.2. Students get familiarise with AC machines components, operation.		X	X			X	X
L3.3. Students are able to model AC machines in the dq frame	X	X	X			X	X
L3.4. Students are able to develop models for common electromagnetic systems such as transformers, and DC and AC machines.	X	X	X			X	X

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Teaching and learning methods:

Description of the methodology: lectures, lab, group presentations…

The teaching method is based on a series of lectures where the lecturer explains the main concepts through power point presentations and worked out examples on the board. The students are also presented with a variety of issues of practical nature during the lectures. To support the learning process part of the modules covers tutorial-like sessions where the students are put to the challenge of working together and addressing problems of slight higher technical complexity.

Allocation of student time:

	Attendance (classroom, lab,…)	**Non attendance (lecture preparation, self study…)**
Lectures	24 hours	24
Tutorials	12 hours	12
Assignments	40	13

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Assessment:

Basic description of the assessment methodology

Assessment will be based on a written examination where suitable questions will be integrated in the module paper. The number of questions and weight is flexible and to be agreed with the coordinator of the module.

Assessment Matrix:

Subject skills	**Assessment method**					
	Exam	**Presentation**	**Homework**	**Report**	**…**	**…**
L3.1	100%					
L3.2	100%					
L3.3	80%			20%		
L3.4	80%			20%		

Programme:

Lesson 1	***Revision of the operating principles of common AC and DC machines (torque and back-emf production in DC machines, torque production in induction motors, and the derivation of the induction motor equivalent circuit).*** *Distribution (6h theory + 3 h tutorial-like session)*
Lesson 2	***Design principles of rotating electrical machines.*** *Distribution (4 h theory + 3h tutorial-like session)*
Lesson 3	***Two-axis model of AC machines (origin of the two-axis model, and stationary and synchronous reference frames)*** *Distribution (8h theory + 3h tutorial-like session)*
Lesson 4	***Dynamic models of AC and DC machines*** *Distribution (6h theory +3h tutorial-like session)*

Resources:

Classrooms, Blackboard, laptop, projector, audio, computer room, laboratory, security issues,…

- *A classroom, equipped with a blackboard and audio-visual resources (laptop/computer with Matlab/Simulink installed and Internet connection + projector), for the lectures. A blackboard and a projector may be sufficient if the lecturer uses her/his own laptop.*

Bibliography:

Basic textbooks, deepening bibliography, Internet addresses of interest, specific journals, etc…

The following titles are examples of texts that may be consulted in support of the lecture series. The module does not rely on any of these texts in particular. Students are encouraged to consult any of the numerous other texts that exist on the topics of power electronics and electrical machines.

'Power Electronics', 3rd Ed, C W Lander (McGraw-Hill), ISBN 0-07-084162-4
'Principles of Electric Machines and Power Electronics', P.C. Sen (Wiley), ISBN 0-471-61717-2
'Electrical Machines, Drives and Power Systems', T. Wildi (Prentice-Hall), ISBN 0-13-082460-7
'Power Electronics: Converters, Applications and Design', N Mohan et.al. (Wiley), 0-471-22693-9

Further comments: