REM master basic syllabus

Title:
NM833 Marine Renewable Energy Systems

Credit value:
5 ECTS

Mandatory/Optional:
Mandatory

Semester:
1

Lecturer/s:
Tahsin Tezdogan

University:
University of Strathclyde

Department:
Nava Architecture, Ocean and Marine Engineering

Rationale:
This module aims to give an overview of the most promising offshore renewable energies, namely wind, wave and tidal. The module provides key aspects of each technology and environment to be able to understand the design and operation of these generating sources.

Objectives:
This module aims to provide students with:

1) An understanding of the ways in which the maritime environment can offer a significant, sustainable contribution to global energy demands.

2) The ability to undertake aerodynamic and hydrodynamic assessments of the design and operation of marine energy generating systems.

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. Have an appreciation of global energy demand, current and future, and how this can be addressed via the maritime environment.	X	X				X	X
L3.2. Assess the relative merits of different marine energy systems based on engineering, environmental, political, social and economic issues.	X	X				X	X
L3.3. Understand and modify a variety mathematical models of tidal, wind and wave energy devices.	X	X				X	X

Teaching and learning methods:

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	22 hours	10 hours
Tutorials	0 hours	22 hours
Assignment	10 hours	20 hours
Private study		41 hours

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Assessment:

The exams and practice coursework will test the students' understanding of the learning outcomes and their ability to apply their learning to problems.

Assessment Matrix:

Subject skills	**Assessment method**					
	Exam	**Class test**	**Coursework**	**Report**	**…**	**…**
L3.1.	70%	20%	10%			
L3.2.	70%	20%	10%			
L3.3.	70%	20%	10%			

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Programme:

Lesson 1	***Global energy demand; sustainability; environmental impact; political/social/economic constraints.*** *Distribution (2 h theory)*
Lesson 2	***Linear wave theory; wave kinematics; wave forces; Dynamic motion response equation*** *Distribution (2 h theory)*
Lesson 3	***Tidal energy and power generation*** ***Tidal barrages; tidal stream energy; tidal stream turbines*** *Distribution (6 h theory)*
Lesson 4	***Wind energy; wind turbine; offshore wind foundations; aerodynamics of wind turbines Blade Element Momentum Method*** *Distribution (6 h theory)*
Lesson 5	***Wave energy; wave power-device theory*** ***Case study: Heave buoys, Oscillating water columns, Flaps and wave-contouring (Pelamis) wave energy devices.*** *Distribution (6 h theory)*

Resources:

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:

Boyle, Godfrey, 2004, Renewable energy. 2nd edition. Boyle, Godfrey, (eds.) Oxford University Press & The Open University, Oxford, UK. ISBN 0199261784
British Wind Energy Association, 2003, UK Offshore Wind Conference Proceedings.

Burton et al, 2012, Wind Energy handbook, 2nd Ed., Wiley

Dispower, Distributed Generation with High penetration of Renewable Energy, www.dispower.com

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DTI/Hartley Anderson, 2003, Strategic Environment Assessment, document 4.

DTI/Met Office/Proudman, Atlas of UK Marine Renewable Energy Resources.

Frerris, L.L., 1990, Wind Energy Conversion Systems, Prentice Hall International.

I. Mech. E., 2004, Engineering Challenges at the Dawn of Wave and Tidal Energy, Conference Proceedings, London.
Shaw, R., 1982, Wave Energy a design challenge, Ellis Horwood.

Further comments: