REM master basic syllabus

Title:
ECFMRC Environmental conditions for marine renewable concepts

Credit value:
3 ECTS

Mandatory/Optional:
Mandatory

Semester:
2

Lecturer/s:
Íñigo Losada Rodríguez, César Vidal Pascual, Raúl Guanche García

University:
University of the Basque Country & University of Cantabria

Department:
Electronic Technology

Rationale:
The aim of this course is to provide to the students the necessary knowledge about the different the environmental conditions and environmental loads that a marine renewable project has to consider. The course will provide the skills for a rational design criteria for load assessment on marine renewable structures. Environmental conditions cover natural phenomena which may contribute to structural damage, operation and failures. The most phenomena that will be analysed will be wind, waves, currents and tides. Environmental loads are the loads caused by environmental phenomena. They will be studied paying special attention on the most important effects over the structure and its performance.

Objectives:
The course is intended to provide students with the following benefits:

(1) Understanding the concept metocean conditions and its importance for offshore structures
(2) Understanding and capabilities for wave conditions assessment
(3) Understanding and capabilities for wind conditions assessment
(4) Understanding and capabilities for sea level and currents conditions assessment
(5) Ability to evaluate environmental loads and design conditions.

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. Ability to understand metocean conditions fundamentals and its application to offshore engineering projects.	X		X	X	X		
L3.2. Ability to handle computer programs for metocean conditions assessment.	X	X					X
L3.3. Ability to organize information and produce effective reports individually and in a team				X		X	X
L3.4. Ability to communicate in various formats: group discussion, and oral presentations					X	X	

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Teaching and learning methods:

The teaching and learning strategy will be based on lecture and demonstration work, with tutorial work to help develop an understanding of Metocean conditions assessment. Use will be made of statistical models and diagrams. Real problem scenarios will be drawn on to provide the critical flow analysis on the components being investigated. The students will be encouraged to identify by means of real problem scenarios to identify the critical aspects to be considered from the environmental loads and design conditions assessment.

Lectures 17 hours
Group Tutorial (Classroom and PC based) 13 hours
Total 30 hours

Allocation of student time:

	Attendance (classroom, lab,…)	**Non attendance (lecture preparation, self study…)**
Lectures	20 hours	35 hours
Computer Lab	10 hours	10 hours
Presentations	1 hours	4 hours

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Assessment:

Basic description of the assessment methodology

1. Class attendance and active participation: 50 %
2. Team assignment: 25 %
3. Individual assignments (written exam): 25 %

Class attendance

Attendance of students in class includes performance, discussion, in-class exercises and presentation. Class participation will be determined on the basis of their comments in each class session, and the completion of the exercise sheets handed in at the end of the lectures.
Some of the criteria that we will used to judge effective class participation include:
1. Is the participant a good listener?
2. Is the participant concise and articulate?
3. Are the points made relevant to the current discussion? Are they linked to the comments of others?
4. Do the comments show clear evidence of appropriate and insightful analysis of the case?

Team assignments

The team assignments are intended to be carried out by teams of students. The students use the knowledge from the Environmental conditions for marine renewable concepts course, and complete the assignments through team work cooperation. Through accomplishing the team assignments, each student of the teams can have a good understanding of the principles and solution procedures of Environmental Loads Assessment. Each team is required to give a presentation of the team assignment work, and the quality of the team work will be graded. The team assignments must be completed on or before the scheduled due date in order to maintain the project schedule.

Individual assignments

Individual assignments help the students enhance their understanding of the Metocean. The students are required to complete their individual assignments independently, which reflects their personal understanding of the topic.

Assessment Matrix:

Subject skills	Assessment method					
	Exam	**Presentation**	**Homework**	**Report**	**…**	**…**
L3.1.	50 %	25 %	25%	%	%	%
L3.2.	25 %	50 %	25 %	%	%	%
L3.3.	%	%	%	100 %	%	%
L3.4.		100 %				

Programme:

Lesson 1	***Wind conditions*** *Introduction to wind climate. Wind data (instrumental and numerical data), wind modeling, short term and long term wind statistics.* *Distribution (3 h theory + 1 h practical classroom + 1 h computer + 0 h seminar)*
Lesson 2	***Wave conditions*** *Introduction to wave climate. Wave data (instrumental and numerical data), wave modeling, short term and long term wave statistics.* *Distribution (3 h theory + 1 h practical classroom + 1 h computer + 0 h seminar)*
Lesson 3	***Current and tide conditions*** *Introduction to currents and tide climate. Currents and tide data (instrumental and numerical data), currents and tide modeling, short term and long term statistics.* *Distribution (3 h theory + 1 h practical classroom + 1 h computer + 0 h seminar)*
Lesson 4	***Environmental loads*** *Review of the most important phenomena and calculation methods.(1)Wind loads: pressure and forces, (2)Wave loads over slender elements, (3) Wave loads over large volume structures, (4) Wave overtopping, impact and slamming forces, (5)Currents loads description* *Distribution (6 h theory + 2 h practical classroom + 3 h computer + 1 h seminar)*
Lesson 5	***Review of rules and standards for marine renewables*** *Review of the most common and applied offshore rules and stantards from the metocean assessment point of view.* *Distribution (2 h theory + 1 h practical classroom + 0 h computer + ? h seminar)*
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Resources:

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

Bibliography:

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

[1] RG Dean, RA Dalrymple, Water wave mechanics for engineers and scientists. 1991. World Scientific Pub. Singapure.

[2] Mei, C. C. The applied Dynamics of Ocean Surface Waves. 1989. World Scientific Pub. Singapure.

[3] Wind Energy Explained: Theory, Design and Application, 2nd Edition James F. Manwell, Jon G. McGowan, Anthony L. Rogers ISBN: 978-0-470-01500-1 December 2009

[4] Wind Turbines Fundamentals, Technologies, Application, Economics Hau, Erich Ed. Sprimger 2013

[5] The European Wind Energy Association (EWEA). Wind in Power: European Statistics. February 2015. http://www.ewea.org/fileadmin/files/library/publications/statistics/EWEA-Annual-Statistics-2014.pdf

[6] Joao Cruz. (2008). Ocean Wave Energy. Current Status and Future Prespectives. Green Energy and Technology(Virtual Series). ISBN: 978-3-540-74894-6 (Print) 978-3-540-74895-3 (Online). Springer.

[7] Falnes, J., 2002, "Ocean waves and oscillating systems: linear interactions including wave-energy extraction", Cambridge University Press.

Internet addresses of interest

[8] https://www.dnvgl.com/rules-standards/index.html

Specific journals

[9] Ocean Engineering

[10] Renewable Energy

[11] Coastal Engineering

[12] Wind Energy

[13] Marine Structures

[14] Journal of Fluid Mechanics

[15] Applied Ocean Research

Further comments: