REM master basic syllabus

Title:
CE4020 Environmental Hydrodynamics

Credit value:
5 ECTS

Mandatory/Optional:
Optional

Semester:
1

Lecturer/s:
Jimmy Murphy

University:
University College Cork

Department:
School of Engineering

Rationale:
This course provides the students with an understanding of basic hydrodynamic principles in relation to the natural environment and in particular marine systems (estuaries, bays, seas, oceans etc.). It provides fundamental knowledge required by engineers working in the marine renewable energy sector

Objectives:

- Develop mathematical description of hyrodynamic behaviour.
- Derive expressions for Stream Function and Potential Function.
- Quantify flow patterns for fluid / structure interactions.
- Calculate wave behaviour using the Airy linear wave theory and understand the limitations in the derivation.
- Quantify the kinematics and dynamics of surface wave motions.
- Quantify the propagation of a surface wave into the shoreline.
- Describe the options for measurement and description of real sea waves and tides.
- Understand tide theory and the characteristics of tides.
- Develop solutions for diffusion in one dimensional streams.
- Learn the fundamentals of numerical modelling of marine 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. Understand the underlying principles of environmental hydrodynamics and have the ability to apply this knowledge in practical applications	X			X		X	
L3.2. Ability to setup and run numerical models for different coastal and open sea environments subject to wind, wave and tidal forcing	X		X	X			
L3.3. Analyse wave and current data, undertake extreme analysis to enable design and estimation of power production of renewable energy technologies	X	X					

Teaching and learning methods:

Lectures – comprise of presentations, videos, open discussion, case study analysis and worked example
Computer Labs - To learn the fundamentals of numerical modelling
Assignment – Numerical modelling to understand the hydrodynamics of a coastal site
Tutorial – Revision of course

Allocation of student time:

	Attendance (classroom, lab,…)	**Non attendance (lecture preparation, self study…)**
Lectures	24 hours	10 hours
Tutorials	2hours	0 hours
Assignment	10 hours	20 hours
Private study		41 hours

Assessment:

Final Exam, reports from 2 assignments

Assessment Matrix:

Subject skills	**Assessment method**					
	Exam	**Class test**	**Coursework**	**Report**	**…**	**…**
All	80%	-	10%	10%		

Programme:

Lesson 1	Introduction to Environmental Hydrodynamics Distribution (2 h theory)
Lesson 2	Flow Definitions, Equations of Fluid Motion,. Distribution (2 h theory)
Lesson 3	Streamlines, Stream Functions, Flow Nets, Turbulence, Boundary Layers Distribution (2 h theory)
Lesson 4	Numerical Modelling Introduction and basic principles. Distribution (2 h theory)
Lesson 5	Numerical Modelling – Hydrodynamic and Wave modelling. Distribution (2 h theory)
Lesson 6	Numerical Modelling – Dispersion, diffusion, sediment transport, wastewater Distribution (2 h theory)
Lesson 7	Wave Definitions, Linear Wave Theory, Wave Measurement. Distribution (2 h theory)
Lesson 8	Waves Life Cycle (generation to dissipation) Distribution (2 h theory)
Lesson 9	Tsunamis, extreme waves, infragravity waves, ship waves, wave analysis Distribution (2 h theory)
Lesson 10	Astronomical Tides Distribution (2 h theory)
Lesson 11	Meteorological Tides, Storm Surge, Coastal Flooding Distribution (2 h theory)
Lesson 12	Tidal Bores, Seiches, Tidal Energy, Ocean Circulation, Climate Change Distribution (2 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.

Computer lab equipped with 20+ computers.

Bibliography:

Applied Hydrodynamics Hubert Chanson ISBN-13:978-1138000933

Coastal Engineers Manual https://www.publications.usace.army.mil/USACE-Publications/Engineer-Manuals/u43544q/636F617374616C20656E67696E656572696E67206D616E75616C/

TIDAL DYNAMICS. Volume I: Theory and Analysis of Tidal Forces Author(s): Fergus J. Wood
Source: Journal of Coastal Research, Special Issue No. 30. TIDAL DYNAMICS. Volume I: Theory and Analysis of Tidal Forces (2001), pp. i-v, vii-xlix, 1-15, 17-81, 83-97, 99-157, 159-221, 223-257, 259-326

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Further comments: