REM master basic syllabus

Title:
GCHYD General concepts of Hydrodynamics

Credit value:
4 ECTS

Mandatory/Optional:
Optional

Semester:
3

Lecturers:
Pierre Ferrant, Lionel Gentaz, David Le Touzé

University:
Ecole Centrale Nantes

Department:
Fluid Mechanics and Thermodynamics

Rationale:
The purpose of this course is to give to the students a general introduction to hydrodynamics preparing them to take the best out of more focused courses proposed in the sequel of the program

Objectives:
The objectives of this course are to give a general overview to students about use of Hydrodynamics in marine and ocean engineering fields, about modelling and physics of free surface flows, numerical simulation in Hydrodynamics, hydrostatic and stability of floating structures.
This global overview will be then detailed in other courses of the Master program.

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. Explain the purpose of Hydrodynamics modeling in Marine and Ocean Engineering today	X						X
L3.2. Explain and demonstrate knowledge and understanding of the main mathematical models to describe Free Surface flows	X					X	
L3.3. Determine and Explain which mathematical model is adapted for which problem of Hydrodynamics	X	X		X		X	
L.3.4. Explain and demonstrate knowledge and understanding of the main aspects of numerical simulation in Hydrodynamics	X					X	
L3.5. Explain main aspects of the stability for floating structures		X					
L.3.6. Use a software dedicated to stability for simple cases	X		X	X		X	
L3.7. Acquire new skills, organize information						X	

Teaching and learning methods:

The course is based on lectures for the theoretical part. These are divided into four main parts as described in the program.

In addition to those master classes, lab work on computer is proposed for the part dedicated to stability of floating structures.

Allocation of student time:

	Attendance (classroom, lab,…)	**Non attendance (lecture preparation, self study…)**
Lectures	20 hours	34 hours
Tutorials	6 hours	14 hours
Lab (computer)	6 hours	20 hours

Assessment:

The assessment of this course is based on a final written exam that covers the whole range of knowledge taught in the lectures.

The computer lab work will lead to the writing of a report that will be evaluated.

Assessment Matrix:

Subject skills	**Assessment method**	
	Exam	**Report**
L3.1.	100%	0%
L3.2.	100%	0%
L3.3.	100%	0%
L.3.4.	100%	0%
L.3.5.	50%	50%
L.3.6.	0%	100%
L.3.7.	0%	100%

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Programme:

Lesson 1	***Industrial, R&D and research activities connected to free surface hydrodynamics and ocean engineering*** *A state of the art of problems of engineering or applied research where use of Hydrodynamics is required* *2h theory*
Lesson 2	***Different classes of approximation used in Hydrodynamics*** *Presentation of different mathematical models which can be used in Hydrodynamics to describe free surface incompressible free surface flows (Navier-Stokes equations, Euler equations, Laminar and turbulent boundary layer equations, Potential flow model) and main problems of free surface Hydrodynamics for which each model is adapted* *8h theory + 2h tutorials*
Lesson 3	***Introduction to Numerical Simulation*** *Following parts will be described:* - *Methodology for numerical simulation of a physical problem*

	- *Implementation of a numerical method* - *Pre- and post-treatment* - *High-performance computing* *6h theory*
Lesson 4	***Hydrostatic and Stability of ships and marine structures*** *Intact and damaged stability of floating structures are investigated through theoretical and practical aspects. Computer lab work is done with state of art industry software.* *4 h theory + 4 h tutorials + 6 h computer lab*

Resources:

For theoretical courses and Tutorials: Classrooms with Blackboard and projector for computer.
For lab work: computer room

Bibliography:

- J.N. Newman, *Marine Hydrodynamics*, The MIT press, 1977
- V. Bertram, *Practical Ship hydrodynamics*, Elsevier, 2012 (2nd Edition)
- A.J. Hermans, *Water Waves and Ship Hydrodynamics: An Introduction*, Springer, 2010 (2nd Edition)
- Biran, *Ship Hydrostatics and Stability*, Butterworth-Heinemann, 2003

Further comments: