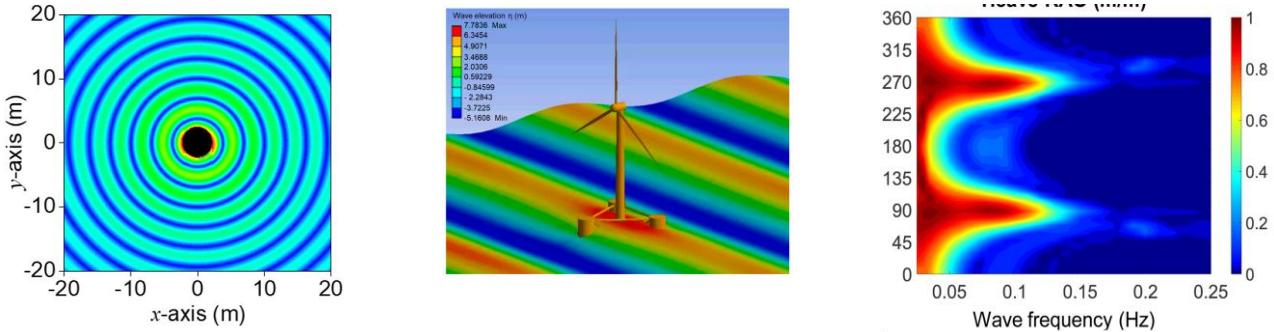


NAVAL HYDRODYNAMICS



I. GENERAL INFORMATION	
1.1	Course
1.2	Code
1.3	Year
1.4	Academic semester
1.5	Credits
1.6	Prerequisite Courses
1.7	Type of course
1.8	Semester/year
1.9	Plan of studies
1.10	Mode
1.11	Professor
1.12	E-mail

II. SUMMARY	
Students of *** Engineering should be prepared to undertake projects in coastal and oceanic environments, where analysing the dynamic response of fixed and floating structures to both regular and irregular wave action is essential. The proposed syllabus equips them with the necessary skills in marine hydrodynamics, which are critical for estimating wave-induced forces on these structures. The exercises will be developed using Python – MatLab.	

III. COURSE COMPETENCIES	
This course aims to enable students of *** Engineering to: (1) Understand and apply hydrodynamic models to marine structures; (2) Evaluate the dynamic behaviour of structures subjected to wave action; (3) Calculate forces and motions using both theoretical and numerical methods that involve the use specialized software (***) Civil, Mechanical, Mechatronics, etc	

IV. CONTENT PROGRAMMING	
This section should detail the synchronous and asynchronous activities that will be carried out during each week, taking into account that synchronous activity is related to the development of conceptual content and asynchronous activities are related to the procedural content of the subject.	

Week	Dates	Description
Week 1	19-08-2026 21-08-2026	Introduction. Objectives of the course. Description of the program bibliography and evaluation methods. Airy wave theory. Solutions. Displacement of Particles. Dispersion Equation. Exercises regular waves.

Week 2	26-08-2026 28-08-2026	Free response of systems of 1DOF . Discrete system components. Equation of motion. Free response solution. Exercises 1DOF
Week 3	02-09-2026 04-09-2026	Forced response of systems with 1DOF .Equation of motion. Forced response solution Exercises for forced systems of 1DOF.
Week 4	09-09-2026 11-09-2026	Free and Forced response of systems with 2DOF . Equation of motion. Solutions of 2DOF vibration system Exercises with free and forced damped systems with 1DOF and 2DOF.
Week 5	16-09-2026 18-09-2026	Stability . Decoupled heave motion. Free body diagram. Equation of motion zero speed. Natural frequency. Exercises: Stability and forced heave motion
Week 6	23-09-2026 25-09-2026	Stability . Decoupled roll and pitch motion. Free body diagram. Equation of motion zero forward speed. Natural frequency. Exercises: Stability and forced roll/pitch motion
Week 7	30-09-2026 02-10-2026	Formulation of Diffraction/Radiation problem. Wave-structure interaction. Exercises
Week 8	07-10-2026 09-10-2026	Exercises review Middle examination
Week 9	14-10-2026 16-10-2026	Solution to Hydrodynamics problem in Frequency Domain . Numerical. Methods. Exercises
Week 10	21-10-2026 23-10-2026	Project work Description, explanation tools
Week 11	28-10-2026 30-10-2026	Surface irregular waves . Long and short crested waves: statistical sea state. Parametric wave spectra. Exercises
Week 12	04-11-2026 06-11-2026	Body response in random waves. Wave climate. Stats of maxima. Exercises
Week 13	11-11-2026 13-11-2026	Project work. Discussions Groups
Week 14	18-11-2026 20-11-2026	Experimental and numerical test comparison Added mass and damping calculation to free and induced motion Exercises
Week 15	25-11-2026 27-11-2026	Applications Offshore Wind Devices : Fixed and Floating Offshore Structures Wave Energy Converters : Onshore and Offshore devices Ship Hydrodynamics : Seakeeping Analysis Exercises
Week 16	02-12-2026 04-12-2026	Exercises review
Week 17	09-12-2026 11-12-2026	Exercises review Final examination

V. TEACHING STRATEGIES (METHODOLOGY)

The course's methodological approach is aimed at developing students' skills in reasoning, critical analysis, reflection, and creative approach to different situations related to the hydrodynamics of marine structures. To this end, a dynamic learning environment will be fostered, based on constant interaction between teacher and student, where the teacher will assume the role of facilitator of the learning process, promoting active participation and independent learning.

Lectures will be used to present theoretical foundations and derive mathematical expressions. Creativity will be stimulated by encouraging students to explore different approaches to solving the same problem, fostering divergent thinking. Learning will be reinforced through practical classroom exercises that allow them to apply the acquired concepts.

Students are expected to attend class having previously reviewed the corresponding topic, dedicating at least two hours of study for each hour of class, plus an additional hour for discussion and application of the content. The course will be supported by various teaching resources, such as class notes, simulations, and discussions of practical work involving the use of specialized software.

VI. LEARNING EVALUATION

Learning assessment is tailored to the online learning environment, considering the skills and performance described for each week. Assessment is conducted before, during, and at the end of the course, using the relevant assessment tools. The following weighting formula is used to determine the final course average:

Continuous Assessment Process (Average of Practical works and project) (CAP)

Midterm Examination (ME)

Final Course Examination (FCE)

$$\text{Final average} = (\text{CAP} + \text{ME} + \text{FCE}) / 3$$

VII. BIBLIOGRAPHY

[1978] Bhattacharyya - Dynamics of Marine Vehicles

[1990] Faltinsen - Sea Loads on Ships and Offshore Structures

[2001] Journee - Offshore Hydromechanics

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