COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Engineering		
ACADEMIC UNIT	Department of Naval Architecture		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	NAOME1360	**SEMESTER**	**9ο**
COURSE TITLE	**LIFTING FLOWS AND PROPELLER THEORY**		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS (ECTS)**
Lectures		5	6

COURSE TYPE *general background, specialbackground, specialised general knowledge, skills development*	Specialized
PREREQUISITE COURSES:	NAOME 1325 (SHIP RESISTANCE - PROPULSION - SHIP HYDRODYNAMICS)
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (English)
COURSE WEBSITE (URL)	https://eclass.uniwa.gr/courses/NA228/

(2) COURSE GOALS / LEARNING OUTCOMES

The mathematical problem of propeller performance interacting with the ship hull can be treated either by solving Navier – Stokes equations including in the modelling the propeller-hull-free surface, or with hybrid methodologies. The second approach, combines Navier-Stokes Equations for the simulation of the flow around the hull and potential flow theory and Boundary Element Methods for the modelling of the flow around the propeller.

Students will develop the following abilities through the present course:

- Analyze the flow field around the propeller
- Understand the interaction between propeller and hull
- Design optimal wake adapted propellers
- Calculate the hydrodynamic loads required both for the hull and machinery structural study
- Formulate problems, to think creatively, to synthesize information exploiting modern technologies
- Communicate effectively through written, oral, and graphical presentations
- Work autonomously and in teams to solve multi-faceted problems
- Work in an interdisciplinary environment

(3) COURSE CONTENT / SYLLABUS

Euler equations, Navier Stokes Equations. Helmholtz laws for the conservation of vorticity in curvilinear coordinate systems. Wake models, free vortex sheets. Kutta-Joukowski theorem. Kutta Condition. Bound and free vorticity fields on the foil surface and the wake of the foil. Mathematical modeling of the flow around foils. Steady and unsteady lifting flow hydrodynamic problems. Potential Theory. Representation theorems of the velocity potential. Numerical treatment of lifting flow problems with Boundary Element Methods. Viscosity corrections exploiting boundary layer theory.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>• Use of ICT in teaching.
• Communication with students and support of learning procedure through the electronic e-class platform.</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.
The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</td><td>
<table>
<tr><th>Activity</th><th>Workload (hours)</th></tr>
<tr><td>Lectures</td><td>65</td></tr>
<tr><td>Project</td><td>39</td></tr>
<tr><td>Study</td><td>52</td></tr>
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<tr><td>Course total</td><td>156</td></tr>
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<tr><td>STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure
Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</td><td>Written examination including theory questions and problem solution (70%)
Evaluation of project (30%)</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- *Books*

1. Γ. Πολίτης, Γ. Τζαμπίρας, 2016, Πρόωση Πλοίου: Τόμος Β' Αναλυτική Σχεδίαση Ελίκων, Ελληνικά Ακαδημαϊκά Συγγράμματα – Κάλλιπος.
2. J. E. Kerwin, J. B. Hadler, 2010, Principles of Naval Architecture Series: Propulsion, SNAME, ISBN: 978-0-939773-83-1.

1. L. Birk, 2019, Fundamentals of Ship Hydrodynamics, Fluid Mechanics, Ship Resistance and Propulsion, Wiley.