

## COURSE OUTLINE

### (1) GENERAL

<b>SCHOOL</b>	School of Engineering		
<b>ACADEMIC UNIT</b>	Department of Naval Architecture		
<b>LEVEL OF STUDIES</b>	Undergraduate		
<b>COURSE CODE</b>	NAOME1331	<b>SEMESTER</b>	5 <sup>th</sup>
<b>COURSE TITLE</b>	<b>SHIP WELDING</b>		
<b>INDEPENDENT TEACHING ACTIVITIES</b>		<b>WEEKLY TEACHING HOURS</b>	<b>CREDITS (ECTS)</b>
<b>Lectures</b>		2	4
<b>Laboratory</b>		2	
<b>Total</b>		4	
<b>COURSE TYPE</b> <i>general background, specialbackground, specialised general knowledge, skills development</i>	Specialized		
<b>PREREQUISITE COURSES:</b>			
<b>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</b>	Greek		
<b>IS THE COURSE OFFERED TO ERASMUS STUDENTS</b>	Yes		
<b>COURSE WEBSITE (URL)</b>	Θεωρία: <a href="https://eclass.uniwa.gr/courses/NAFP157/">https://eclass.uniwa.gr/courses/NAFP157/</a> Εργαστήριο: <a href="https://eclass.uniwa.gr/courses/NAFP140/">https://eclass.uniwa.gr/courses/NAFP140/</a>		

### (2) COURSE GOALS / LEARNING OUTCOMES

The course of Welding in Shipbuilding is an important chapter in the education of the Naval Architecture, as it includes all the scientific and technical knowledge of joining plates and reinforcements of (mainly) the hull. The aim of the course is to familiarize students with welding methods in general, and in particular the methods and issues (because of welding) that occur in shipbuilding, during the construction of ships.

Upon successful completion of the course students will be able to:

- Choose the welding method and technique depending on the area of the ship and the parts to be welded.
- Draw welding symbols on construction drawings.
- Calculate the dimensions of the weld, according to the principles of Engineering and the regulations of the classification societies.
- Calculate the cost of welds.

Students will also have acquired knowledge on how to inspect welds, but also the basic principles of non-destructive welding inspection methods.

### (3) COURSE CONTENT / SYLLABUS

About Welding in general: Advantages and Disadvantages of Welding, Classification of Welding Methods, General Principles of Fusion Welding, Joint Design, Welding Symbols, Welding Positions.

Modern welding methods: Arc welding and oxygen cutting, Shielded metal arc welding, Tungsten electrode (gas protection) arc welding, Gas metal arc welding, Submerged arc welding, Vertical fusion welding methods. Selection of welding methods. The use of different welding methods in Shipbuilding. Regulations of the Classification Societies.

Residual stresses in welding. Deformations of welded structures. Methods of reducing deformations.

Welding defects. Welding control. Non-destructive methods.

Welding Strength calculations and dimensioning.

Calculation of welding costs.

The course also provides laboratory hours in which students, after practicing, are evaluated in performing welds as follows:

1. Arc ignition and arc maintenance.
2. Bead on plate welds in flat position.
3. Butt joint welds of 5,0 mm thick steel hull plates in flat position.
4. Fillet welds of 5,0 mm thick steel hull plates in horizontal position.
5. Lap joint welds of 5,0 mm thick steel hull plates in flat position.
6. Corner joint welds of 5,0 mm thick steel hull plates in horizontal position.
7. Butt joint welds of 5,0 mm thick steel hull plates in horizontal position.
8. Butt joint welds of 5,0 mm thick steel hull plates in vertical-up position.
9. Oxy-fuel cutting.
10. MIG
11. TIG
12. Butt Welding of pipes.
13. Branch connection welds.

Students are aware of what exactly they will be asked to perform/execute days before the Lab.

Students also familiarized with the visual welding inspection equipment and the liquid penetrant / magnetic particle inspection methods. The welding inspection methods of eddy currents, ultrasonic and x-ray are also presented.

#### (4) TEACHING and LEARNING METHODS - EVALUATION

<b>DELIVERY</b> Face-to-face, Distance learning, etc.	Face-to-face Laboratory exercises	
<b>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</b> Use of ICT in teaching, laboratory education, communication with students	Training material is distributed in electronic format through the e-class platform.	
<b>TEACHING METHODS</b> <i>The manner and methods of teaching are described in detail.</i> <i>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.</i> <i>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</i>	<b>Activity</b>	<b>Workload (hours)</b>
	Lectures	26
	Laboratory exercises	26
	Laboratory essay writing	26
	Personal study	26
	Course total	<b>104</b>
<b>STUDENT PERFORMANCE EVALUATION</b> <i>Description of the evaluation procedure</i> <i>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</i>	Weight of final exams (theory and problems solving): 50% Weight of laboratory exercises and oral examination: 50%	

#### ATTACHED BIBLIOGRAPHY

<p><u>Books</u></p> <ol style="list-style-type: none"> <li>1. A.W.S., Welding Handbook (5 volumes), 7<sup>th</sup> edition, American Welding Society, 1976-1984.</li> <li>2. Metals Handbook, vol. 6, Welding, Brazing and Soldering, 9<sup>th</sup> edition, American Society for Metals, Materials Park, Ohio, 1983.</li> <li>3. Davies, A.C., The science and practice of welding (2 volumes), 8<sup>th</sup> edition, Cambridge University Press, 1984.</li> <li>4. Phillip, L.D., Shipyard welding processes for hull construction, Maritime Technology Monograph, No. 7, RINA, London 1980.</li> <li>5. Tera, K., Recent progress of welding in shipbuilding, Australian welding journal, 1974.</li> </ol> <p><u>Indicative Journals</u></p> <ol style="list-style-type: none"> <li>1. Welding Journal</li> <li>2. British Welding Journal</li> <li>3. Journal of the Japan Welding Society</li> <li>4. International Shipbuilding Progress</li> <li>5. Journal of Ship Production and Design</li> <li>6. SNAME Transactions</li> <li>7. ASME Transactions</li> <li>8. Technical Bulletins of Shipyards</li> </ol>
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