



Subject card

Subject name and code	Fatigue and Ultimate Strength, PG_00046547						
Field of study	Ocean Engineering, Ocean Engineering						
Date of commencement of studies	October 2020	Academic year of realisation of subject			2023/2024		
Education level	first-cycle studies	Subject group					
Mode of study	Part-time studies	Mode of delivery			at the university		
Year of study	4	Language of instruction			Polish		
Semester of study	7	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Zakład Mechaniki Konstrukcji Oceanotechnicznych -> Institute of Ocean Engineering and Ship Technology -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Wojciech Puch					
	Teachers	dr inż. Wojciech Puch					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	10.0	0.0	0.0	20.0	0.0	30
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours		Self-study		SUM
	Number of study hours	30	6.0		39.0		75
Subject objectives	Becoming familiar themselves with the problems of fatigue life and ultimate limit strength of ships' structures						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_U05] can formulate a simple engineering task and its specification within the range of design, construction and operation of ocean technology objects and systems	Student analyzes the state of stress in beam models of hull structure of the ship.			[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment		
	[K6_K03] understands non-technical aspects and effects of operation as an engineer, its influence on the environment and is aware of the responsibilities for the decisions taken	The student knows the ecological consequences of loss of tightness caused by fatigue cracks.			[SK4] Assessment of communication skills, including language correctness		
	[K6_W06] has an organized knowledge on engineering methods and design tools allowing the conducting of projects within the construction and operation of ocean technology objects and systems	Student performs assessment of multispans beam plastic limit carrying capacity.			[SW3] Assessment of knowledge contained in written work and projects		
	[K6_W05] has an organized knowledge on design, construction and operation of ocean technology objects and systems	Student performs assessment of ship structure fatigue life acc. to PRS Rules.			[SW3] Assessment of knowledge contained in written work and projects		

Subject contents	<p>Fatigue phenomena in the material. Fatigue tests. S-N curves for constant- and variable-amplitude loadings. Fatigue life under variable-amplitude loading. Fatigue of welded joints. Methods of fatigue life assessment. Post-weld improvement techniques. Introduction to ultimate strength: elastic-plastic limit load capacity, postbuckling state of construction, ultimate limit state of construction. Assessment of plastic carrying capacity of beams and their systems, plastic hinge. Elastic-plastic range of plates under surface loadings. Postbuckling work of construction in elastic range. Criteria of ultimate strength in rules of classification societies. Ultimate bending moment of ship hull. Exercises: Fatigue calculations using S-N curves. Fatigue life calculations under deterministic constant- and variable-amplitude loading. Fatigue life assessment of ship hull acc. to PRS Rules. Calculations of limit state of beam under bending in elastic-plastic and plastic states. Ultimate limit state assessment of thin-wall beam under bending in elastic range.</p>											
Prerequisites and co-requisites	<p>Student should be familiar with the subjects:</p> <ul style="list-style-type: none"> • strength of materials, • ship hull structure. 											
Assessment methods and criteria	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">Subject passing criteria</th> <th style="width: 33%;">Passing threshold</th> <th style="width: 34%;">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td>Projects</td> <td>56.0%</td> <td>65.0%</td> </tr> <tr> <td>Test</td> <td>30.0%</td> <td>35.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Projects	56.0%	65.0%	Test	30.0%	35.0%
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Recommended reading	Basic literature	R.I.Stephens, A.Fatemi, R.R.Stephens, H.O.Fuchs, Metal fatigue in engineering, Wiley, 2001. 45/P Fatigue strength analysis of steel hull structure, Polish Register of Shipping, 1998, 2020. O.F.Hughes, J.K.Paik, Ship structural analysis and design, SNAME, 2010.										
	Supplementary literature	J.K.Paik, A.K.Thayamballi, Ultimate limit state design of steel-plated structures, Wiley, 2003. T.Lassen, N.Recho, Fatigue life analyses of welded structures, ISTE, 2006. L.Pook, Metal fatigue, what it is, why it matters, Springer, 2007.										
	eResources addresses	Adresy na platformie eNauczanie: Wytrzymałość zmęczeniowa i nośność graniczna, 2023/24 – prow.WP - Moodle ID: 31440 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=31440										
Example issues/ example questions/ tasks being completed	<p>Calculation of the plastic section modulus of monosymmetric cross-section. Estimating the fatigue life of welded joints. Selection of the technology of the welded joint with the required fatigue life.</p>											
Work placement	Not applicable											