GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fatigue and Ultimate Strength, PG_00045101		
Field of study	Ocean Engineering		
Date of commencement of studies	October 2021	Academic year of realisation of subject	2023/2024
Education level	first-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish
Semester of study	6	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	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	15.0	0.0	0.0	30.0	0.0	45

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	45	5.0	25.0	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_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 cosequances 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 multispan 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	The student is able to use the rules of the Classification Society for determining the fatigue life and ultimate limit state of the ship's hull	[SW1] Assessment of factual knowledge
[K6_U06] in compliance with a formulated specification and with the aid of appropriate tools and methods, is able to complete a simple engineering task within the range of design, construction and operation of ocean technology objects and systems	Student performs assessment of ship structure fatigue life acc. to PRS Rules.	[SU4] Assessment of ability to use methods and tools

<table>
<tr><td>Subject contents</td><td>Fatigue phenomena in the material. Fatigue tests.
S-N curves for constant- and variable-apmplitude 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 loadnings.
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 elstic range.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Student should be familiar with the subjects:

• strength of materials,
• ship hull structure.</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<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>
</table>
</td></tr>
<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>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.
O.F.Hughes, J.K.Paik, Ship structural analysis and design, SNAME, 2010.</td></tr>
<tr><td>Supplementary literature</td><td>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.</td></tr>
<tr><td>eResources addresses</td><td>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</td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>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.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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