



Subject card

Subject name and code	Mathematical modeling and optimization, PG_00065615						
Field of study	Naval Architecture and Offshore Structures						
Date of commencement of studies	February 2025		Academic year of realisation of subject		2024/2025		
Education level	second-cycle studies		Subject group		Obligatory subject group in the field of study 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	1		Language of instruction		English		
Semester of study	1		ECTS credits		4.0		
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. Aleksander Kniat				
	Teachers		dr inż. Aleksander Kniat dr inż. Paweł Chodnicki				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	30.0	0.0	60
	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	60		10.0		30.0	100
Subject objectives	The aim of the subject is to apply mathematical modelling for solving physical problems. In particular subject includes numerical methods and enhances the skills to create algorithms / computer programs, as well as using ready-made software tools to perform simulations in shipbuilding.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_U15] evaluates the feasibility of advanced methods and tools for solving complex engineering tasks of a practical nature, characteristic of the field of study, and selects and applies appropriate methods and tools for this purpose		Student is able to describe physical phenomena with differential equation and propose a numerical solution method.		[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment		
	[K7_W02] demonstrates structured and theory supported knowledge encompassing key issues in the field of Naval Architecture and Ocean Engineering, enabling modeling and analysis of shipborne and offshore systems, devices, and processes		Student knows principles of algorithm creation and uses structural/ objective programming language to implement algorithms.		[SW1] Assessment of factual knowledge		

Subject contents	searching for zeros of functions: bisection method Newton's method searching for local minimum/maximum: Newton's method Lagrange multipliers method numerical integration: square/trapezium method Simpson's method solving differential equations: Euler's method Runge-Kutta method interpolation: polynomial (Lagrange's polynomial) splines		
Prerequisites and co-requisites	1. fundamental skills in using personal computer, 2. basic knowledge about operating system and file system, 3. bachelor's course in mathematics		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	exercises	60.0%	100.0%
Recommended reading	Basic literature	Chapra S., Clough D., Applied Numerical Methods with Python for Engineers and Scientists, 1st Edition, Mc Graw Hill, 2022 Moin P., Fundamentals of Engineering Numerical Analysis, Cambridge University Press, 2-nd Edition, 2010 Bjorck A., Dahlquis G., Numerical methods, Dover Publications Inc., Prentice Hall, 1974	
	Supplementary literature	Nocedal J., Wright S., Numerical Optimization, Springer Science & Business Media, 2006 Robinson R.C., Introduction to Mathematical Optimization, Northwestern University, 2013	
	eResources addresses	Podstawowe http://numerics.stanford.edu/ta/index.html - Fundamentals of Engineering Numerical Analysis https://pythonnumericalmethods.studentorg.berkeley.edu/notebooks/Index.html - Python programming and numerical methods Uzupełniające Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	1. Solving one dimensional physical problems defined with differential equation e.g.: damping oscillations of a mass hanged on spring, damping oscillations of a cylinder fallen into water 2. Interpolation with Lagrange polynomial 3. Interpolation with Splines		
Work placement	Not applicable		

Document generated electronically. Does not require a seal or signature.