GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Finite element modeling, PG_00065629						
Field of study	Naval Architecture and Offshore Structures						
Date of commencement of studies	February 2025		Academic year of realisation of subject	2025/2026			
Education level	second-cycle studies		Subject group	Specialty 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	1		Language of instruction	Polish			
Semester of study	2		ECTS credits	5.0			
Learning profile	general academic profile		Assessment form	exam			
Conducting unit	Institute of Naval Architecture -> Faculty of Mechanical Engineering and Ship Technology -> Wydziały Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Beata Zima				
	Teachers		dr inż. Maciej Kahsin				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	45.0	0.0	75
	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	75		12.0	38.0		125
Subject objectives	Learning the basics of the Finite Element Method. Learning to use a selected software using FEM.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U13] evaluates the feasibility and potential for utilizing new technical and technological achievements in accomplishing tasks characteristic for the field of study	The student knows and understands the differences between the types of analyses carried out in the FEM software.	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject
[K7_W04] demonstrates knowledge encompassing selected issues in the field of advanced knowledge, particularly in the scope of methods, techniques, tools, and algorithms specific to Naval Architecture and Ocean Engineering	The student understands the mathematical foundations of analyses performed using the FEM.	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
[K7_U01] applies acquired analytical, simulation, and experimental methods, as well as mathematical models for analysis and evaluation of shipborne and offshore systems and processes	The student understands the differences related to the choice of discretization method and is able to select the type of analysis appropriate to the specifics of the problem.	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools
[K7_U04] creatively designs or modifies, either entirely or in part, a shipborne or offshore system or process according to a given specification, considering both technical and non-technical aspects, estimating costs and adopting design techniques representative for the field	The student formulates a computational model, prepares data, and performs calculations of stress state, stability, and natural vibration frequencies for truss, beam, and shell structures using an FEM system.	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools
[K7_W01] explains and describes, based on general knowledge in the field of scientific disciplines forming the theoretical foundations of Naval Architecture and Ocean Engineering, the construction and principles of operation of marine systems, processes and their components, as well as methods and means of their design and operation	he student understands the idea of the finite element method.	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
[K7_U02] formulates and tests hypotheses concerning problems related to shipborne and offshore systems/processes, as well as simple research problems	The student correctly interprets the results of the obtained FEM analyses.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools

Subject contents

Introduction, numerical methods in structural theory. Discussion of weight methods. Equations of static equilibrium in the FEM approach. Rayleigh-Ritz method. Derivation of stiffness matrix of finite element of arbitrary dimension. Construction of interpolating function. Description of FEM in the case of plane strain/ stress state. Discretization of geometric models. Discussion of typical two-dimensional FEM elements.

Project: Presentation of FEM software capabilities using a selected program and learning its basics. Application of FEM software to solve selected engineering problems

Prerequisites and co-requisites

Mechanics, Strength of Materials, Mathematics, Numerical methods

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Test from lectures content	50.0%	50.0%
Project	50.0%	50.0%

Recommended reading

Basic literature	KLEIBER M.: Wprowadzenie do metody elementów skończonych. Bibl. Mech. Stosowanej IPPT PAN, PWN Warszawa 1989. J. Reddy: An Introduction to The Finite Element Method, McGrawHill, New York, 2005
Supplementary literature	ZIENKIEWICZ O.C.: Finite element method.
eResources addresses	

Example issues/ example questions/ tasks being completed	What is approximation and interpolation? What are shape functions? What types and how many degrees of freedom can be distinguished at a given node? How is the convergence of the method investigated?
Work placement	Not applicable

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