



Subject card

Subject name and code	Finite Element Modeling, PG_00065549						
Field of study	Modelowanie MES						
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	Part-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 -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Beata Zima				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	18.0	0.0	0.0	27.0	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		10.0		70.0	125
Subject objectives	Providing students with theoretical and practical knowledge of the Finite Element Method (FEM) and developing their ability to apply this method to the analysis and solution of engineering problems in the fields of ocean engineering and structural mechanics.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[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 input data, and performs stress, stability, and natural frequency analyses for truss, beam, and shell structures using an FEM system.	[SU2] Ocena umiejętności analizy informacji [SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu [SU4] Ocena umiejętności korzystania z metod i narzędzi [SU5] Ocena umiejętności zaprezentowania wyników realizacji zadania
	[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 knows and understands the differences between the types of analyses performed in an FEM program.	[SW3] Ocena wiedzy zawartej w opracowaniu tekstowym i projektowym
	[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 mathematical foundations of analyses performed using the Finite Element Method (FEM).	[SU2] Ocena umiejętności analizy informacji [SU1] Ocena realizacji zadania
	[K7_U02] formulates and tests hypotheses concerning problems related to shipborne and offshore systems/processes, as well as simple research problems	The student understands the differences related to the choice of discretization method and is able to select the type of analysis appropriate to the nature of the problem.	[SU4] Ocena umiejętności korzystania z metod i narzędzi [SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu
	[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	The student understands the concept of the Finite Element Method.	[SW2] Ocena wiedzy zawartej w prezentacji [SW1] Ocena wiedzy faktograficznej
	[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 correctly interprets the results obtained from FEM analyses.	[SU5] Ocena umiejętności zaprezentowania wyników realizacji zadania [SU4] Ocena umiejętności korzystania z metod i narzędzi
Subject contents	Course content – lecture Introduction, numerical methods in structural theory. Discussion of weighted residual methods. Equilibrium equations in the context of the Finite Element Method (FEM). The RayleighRitz method. Derivation of the stiffness matrix for a finite element of arbitrary dimension. Construction of interpolation functions. Description of FEM in the case of plane strain/stress. Discretization of geometric models. Discussion of typical two-dimensional FEM elements.		
	Course content – project Project: Presentation of the capabilities of FEM software using a selected program and learning its fundamentals. Application of the FEM program to solving selected engineering problems.		
Prerequisites and co-requisites	Knowledge of higher mathematics and structural mechanics consistent with the scope of the degree program.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Exam	60.0%	60.0%
	Project assignment	60.0%	40.0%
Recommended reading	Basic literature	KLEIBER M.: Introduction to the Finite Element Method. 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. Arkady 1972	
	eResources addresses		
Example issues/ example questions/ tasks being completed	What are 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 tested?		

Practical activities within the subject	Not applicable
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