



Subject card

Subject name and code	Finite element method, PG_00064835						
Field of study	Mechanical Engineering						
Date of commencement of studies	February 2026		Academic year of realisation of subject		2026/2027		
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		4.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Division of Applied Mechanics and Biomechanics -> Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology -> Wydziały Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Marek Krawczuk				
	Teachers						
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		7.0		33.0	100
Subject objectives	Presentation of the theoretical basis of the Finite Element Method. Understanding the basics of the method will enable students to consciously use the commercial software of the method, without treating it as a black box.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_U02] formulates and solves technical problems specific to Mechanics and Mechanical Engineering using appropriate tools including CAD and MES systems, and prepares technical documentation		Student is able to plan and implement a numerical experiment using FEM		[SU3] Assessment of ability to use knowledge gained from the subject		
	[K7_W01] explains and describes, on the basis of general knowledge of the scientific disciplines forming the theoretical basis of Mechanics and Mechanical Engineering, the structure and principles of operation of mechanical systems and processes		The student knows the basics of numerical modeling of structures in accordance with FEM procedures		[SW3] Assessment of knowledge contained in written work and projects		
	[K7_U12] develops her/his own potential and independently plans own, lifelong learning, while also being able to guide others in this regard		The student knows the basics of numerical methods used in FEM.		[SU3] Assessment of ability to use knowledge gained from the subject		

Subject contents	Lecture: Fundamentals of FEM, methods of discretization, the concept of a finite element. Shape function, ways of creating shape functions. Approximation of deformation and stress fields in FEM. Derivation of the characteristic matrices of a finite element. Examples of the structure of matrices characteristic for one-, two- and three-dimensional elements. Derivation of the equations of motion of a discretized body FEM. Creating global matrices in FEM. Modeling of boundary conditions, mechanical properties of the construction material, loading method. Solving equations of motion in FEM. Accuracy of the method. Linear and nonlinear analysis of statics and dynamics. Commercial software. Project: Development of own FEM program to solve the problems of statics and dynamics of one-dimensional structures, with particular emphasis on the impact of the assumptions (type of theory, element type, boundary conditions model, material model, load model) on the accuracy of the obtained results.		
Prerequisites and co-requisites	The student has theoretical and practical skills in technical mechanics, strength of materials and the basics of programming.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Project	100.0%	50.0%
	Test of theoretical knowledge	60.0%	50.0%
Recommended reading	Basic literature 1. Jaworski A.(1981), Metoda elementów skończonych w wytrzymałości konstrukcji, Wyd. PW, Warszawa, 2. Rakowski G., Kacprzyk Z. (1993), Metoda elementów skończonych w mechanice konstrukcji, Oficyna Wyd. Pol. Warszawskiej, Warszawa 3. Zienkiewicz O.C. (1972), Metoda elementów skończonych. Arkady, Warszawa 4. Król K.(2007), Metoda elementów skończonych w obliczeniach konstrukcji, PR, Radom,		

	Supplementary literature	1. Szmelter W., Dacko M., Dobrociński S. (1979), Wieczorek M.: Metoda elementów skończonych w statyce konstrukcji, Arkady, Warszawa, 2. Zagrajek T., Krzesiński G., Marek P. (2005), Metoda elementów skończonych w mechanice konstrukcji. Ćwiczenia z zastosowaniem systemu Ansys, Oficyna Wyd. Pol. Warszawskiej, Warszawa. 3. Liu G.R., QUEK S.S. (2003), The finite element method. A practical course. Butterworth-Heinemann 4. Rusiński E., Czmochoński J., Smolnicki T., (2000) Zaawansowana metoda elementów skończonych w konstrukcjach nośnych, Oficyna Wyd. Pol. Wrocławskiej., Wrocław 5. Moaveni S. (1999), Finite element analysis. Theory and application with Ansys. Prentice Hall
	eResources addresses	
Example issues/ example questions/ tasks being completed	Zdefiniować pojęcie elementu skończonego. Macierz mas i sztywności belki wg. teorii elementarnej oraz teorii Timoshenko. Wpływ typu elementu skończonego na dokładność obliczeń.	
Work placement	Not applicable	

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