GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Finite element method, PG_00064835		
Field of study	Mechanical Engineering		
Date of commencement of studies	February 2027	Academic year of realisation of subject	2027/2028
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 -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Marek Krawczuk	
	Teachers		

Lesson types

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_U12] dvelops 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
[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_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

<table>
<tr><td>Subject contents</td><td>Course content – lecture

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.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>The student has theoretical and practical skills in technical mechanics, strength of materials and the basics of programming.</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>Test of theoretical knowledge</td><td>60.0%</td><td>50.0%</td></tr>
<tr><td>Project</td><td>100.0%</td><td>50.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td>Basic literature</td><td>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,</td></tr>
</table>

	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- Heinmann 4. Rusiński E., Czmochowski 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.	
Practical activites within the subject	Not applicable	

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