GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Finite Element Method, PG_00042231		
Field of study	Civil Engineering		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Obligatory subject group 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	Katedra Wytrzymałości Materiałów -> Faculty of Civil and Environmental Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Wojciech Witkowski	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	30.0	0.0	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	5.0	35.0	100

Subject objectives

Finite element method as a tool for solving boundary value problem in civil engineering

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W03] has knowledge of Continuum Mechanics, knows rules of static analysis, stability and dynamics of complex rod, shell and volume structures, both in linear and basic nonlinear regime	student understands finite element method as the basis for solving boundary value problems of continuum mechanics	[SW1] Assessment of factual knowledge
[K7_U04] is able (using Finite Element Method), to define a calculation model and to perform advanced numerical analysis of complex constructions in: linear range and elementary nonlinear range, can criticaly evaluate the results of calculations.	student understands basis of finite element method and is able to conduct simulation of simple engineering structures	[SU4] Assessment of ability to use methods and tools
[K7_W04] has knowledge on advanced strength of materials, modeling and optimisation of materials and constructions; has knowledge of fundamentals of Finite Element Method and general nonlinear analysis of engineering constructions and systems	student is able to select appropriate type of fem analysis for the given problem	[SW1] Assessment of factual knowledge
[K7_U06] is able to choose proper tools (measuring, analytical or numerical) to solve engineering problems, to acquire, filtrate, proces and analyse data	student is able to use advanced fem codes	[SU4] Assessment of ability to use methods and tools

Subject contents

strong and weak formulation of boundary value problem of linear continuum mechanics, fundamentals of finite element formulation, shell as assembly of flat elements, drilling degree of freedom problem, matrix formulation, interpolation, numerical integration, triangular and quadilateral element, evaluation of finite elements

Prerequisites and co-requisites

structural mechanics, structural dynamics, strength of materials, theory of elasticity

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>laboratory</td><td>60.0%</td><td>70.0%</td></tr>
<tr><td>lecture</td><td>60.0%</td><td>30.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>1. RAKOWSKI G., KACPRZYK Z.: Metoda elementów skończonych w mechanice konstrukcji. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005.
2. KLEIBER M (red).: Komputerowe metody mechaniki ciał stałych. Mechanika Techniczna t. XI. PWN, Warszawa 1995.
3. ZIENKIEWICZ O.C.: Metoda elementów skończonych. Arkady 1972.
4. ZIENKIEWICZ O.C., TAYLOR R.L., ZHU J.Z.: Finite Element Method: Volume 1- Its Basis & Fundamentals. Volume 2 - For Solid and Structural Mechanics. Butterworth Heinemann, London 2006.
5. BATHE K.-J.: Finite Element Procedures. Prentice Hall New Jersey 1996.</td></tr>
<tr><td>Supplementary literature</td><td>1. CHRÓŚCIELEWSKI J., MAKOWSKI J., PIETRASZKIEWICZ W.: Statyka i dynamika powłok wielopłatowych. Nieliniowa teoria i metoda elementów skończonych. PAN IPPT, Biblioteka Mechaniki Stosowanej Serii A, monografie, Warszawa 2004.
2. KREJA I.: Mechanika Ośrodków Ciągłych. Wydawnictwo CURE, Politechnika Gdańska, Gdańsk 2003.</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">1) Why is FEM an approximate method?

2) What is approximation and interpolation?

3) Describe spatial dimensionality classification of finite elements.

4) Describe what the shape functions are.

5) What is mesh convergence check.

6) Create a computational model of a shell or beam structure in FEM environbemnt using Abaqus or Sofisitk code and run static linear analysis under the given loads.</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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