GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00064911		
Field of study	Civil Engineering		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2024/2025
Education level	first-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	3	Language of instruction	Polish
Semester of study	5	ECTS credits	2.0
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	dr hab. inż. Agnieszka Sabik	
	Teachers	dr inż. Łukasz Pachocki dr hab. inż. Agnieszka Sabik mgr inż. Tomasz Wiczenbach dr inż. Karol Daszkiewicz	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	10.0	0.0	20.0	0.0	0.0	30
	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	30	0.0	0.0	30

Subject objectives	The course is aimed at solving structural mechanics problems with the use of numerical methods, e.g. the Matrix Slope and Deflection Method and the Finite Element Method (FEM).

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U05] Conducts research (obtaining information, simulations, experimental methods) in the field of construction in order to solve specific tasks and report research results.	The student is able to interpret the results of structural engineering software, to apply it for further analysis in the field of structural mechanics.	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject
[K6_W05] Demonstrate knowledge and understanding of research methods (obtaining information, simulations, experimental methods) in the field of civil engineering.	The student knows the theoretical background of the matrix displacement method and the finite element method.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[K6_W01] Demonstrate knowledge and understanding of mathematics as well as sciences and engineering disciplines underlying civil engineering at a level necessary to achieve the other programme outcomes.	The student uses matrix calculus to solve structural mechanics problems.	[SW1] Assessment of factual knowledge
[K6_U02] Analyse & solve engineering issues & problems in the field of civil engineering by applying appropriate and relevant established analytical, numerical and experimental methods.	The student defines basics computational models for analysis of structural mechanics problems. The student implement algorithms of direct displacement methods within the MATLAB environment.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools

Subject contents

Matrix displacement method. Discretization of the system. Global stiffness and compliance matrix of a wire system. Local stiffness matrix of a beam, truss or frame element. Transformation matrix. Global stiffness matrix aggregation. Displacement vector extraction. Determining forces in wires. Algorithm of the displacement method. Condensation and modification of stiffness matrix. Spring supports. Foundations of the finite element method. Plane stress/strain element. Application of the finite element method in solving engineering problems.

Prerequisites and co-requisites

Knowledge of structural mechanics and strength of materials, in particular the ability to solve statically indeterminate systems. Programming skills in MATLAB.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Skill test	50.0%	25.0%
Project	50.0%	50.0%
Test	50.0%	25.0%

Recommended reading

Basic literature

1. Rucka M., Burzyński S., Sabik A., Macierzowa analiza konstrukcji prętowych w środowisku Matlab, Wydawnictwo PG, 2018.

2. Chmielewski Tadeusz , Nowak Henryk, Sadecka Lilianna, Metoda przemieszczeń i podstawy MES Obliczenia w środowisku MatLab, PWN, 2016.

3. Kłosowski P., Ambroziak A., Metody numeryczne w mechanice z przykładami w programie MATLAB. Wydawnictwo PG, Gdańsk 2011.

4. Obara P., Metoda przemieszczeń w analizie konstrukcji prętowych, Wydawnictwo Politechniki Świętokrzyskiej, 2011.

5. Rakowski G., Kacprzyk Z., Metoda elementów skończonych w mechanice konstrukcji. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005.

	Supplementary literature	1. Branicki Cz. , Ciesielski R., Kacprzyk Z., Kawecki J., Kączkowski Z., Rakowski G., Mechanika budowli. Ujęcie komputerowe t. 1, Arkady, Warszawa 1991. 2. Rakowski G., Kacprzyk Z., Metoda elementów skończonych w mechanice konstrukcji .Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005.
	eResources addresses	Adresy na platformie eNauczanie: Podstawy Mechaniki Komputerowej 2024/2025 - Moodle ID: 21717 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=21717
Example issues/ example questions/ tasks being completed	Aggregate the global stiffness matrix of the wire system with the use of the indicated functions in the MATLAB environment. Using own program of the matrix displacement method create diagrams of internal forces and sketch the deformation of the given structure. Determine the distribution of displacements, strains and stresses in the given plane stress system.	
Work placement	Not applicable	

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