GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00065236		
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	
Mode of study	Part-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish
Semester of study	5	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Structural Mechanics Department -> Faculty of Civil and Environmental Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Łukasz Smakosz	
	Teachers	dr inż. Łukasz Smakosz dr inż. Magdalena Oziębło	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	10.0	0.0	25.0	0.0	0.0	35

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	35	0.0	0.0	35

Subject objectives

The aim of the course is to introduce numerical methods for solving structural mechanics problems, such as the matrix displacement method and the finite element method.

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 computer programs and use them for further analyses 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_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 has the ability to define basic computational models for analyzing structural mechanics problems. The student has the ability to write algorithms for the direct displacement method in 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
[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 foundations 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

Subject contents	Matrix displacement method. Discretization of the system. Global stiffness and flexibility matrix of a frame structure. Local stiffness matrix of beam, truss, and frame elements. Transformation matrix. Assembly of the global stiffness matrix. Extraction of displacement vectors. Determination of forces in members. Displacement method algorithm. Condensation and modification of the stiffness matrix. Elastic supports. Fundamentals of the finite element method. Plane stress/strain element. Application of the finite element method to solve engineering problems.
Prerequisites and co-requisites	Knowledge of structural mechanics in the classical approach for statically determinate and indeterminate frame systems. Knowledge of strength of materials. Proficiency in programming in MATLAB.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Quiz (lecture)	50.0%	25.0%
Control tasks (laboratory)	50.0%	75.0%

Recommended reading

Basic literature	1. Rucka M., Burzyński S., Sabik A., Macierzowa analiza konstrukcji prętowych w środowisku Matlab, Wydawnictwo PG, 2018. 2. Chmielewski T., Nowak H., Sadecka L., 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. 3. Zienkiewicz O.C., Metoda elementów skończonych. Arkady, Warszawa 1972.
eResources addresses	Adresy na platformie eNauczanie: Podstawy mechaniki komputerowej 2024/2025 - Moodle ID: 40692 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=40692

Example issues/ example questions/ tasks being completed	1. Divide the given static system into elements. Describe the degrees of freedom. 2. Perform the assembly of the global stiffness matrix for the frame structure. 3. Using a self-prepared program based on the matrix displacement method, draw diagrams of internal forces and sketch the deformation of the given frame structure.
Work placement	Not applicable

Document generated electronically. Does not require a seal or signature.