GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Modelling of engineering structures, PG_00044257		
Field of study	Civil Engineering		
Date of commencement of studies	October 2020	Academic year of realisation of subject	2023/2024
Education level	first-cycle studies	Subject group	Optional subject group
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	4	Language of instruction	Polish
Semester of study	7	ECTS credits	5.0
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 hab. inż. Ireneusz Kreja	
	Teachers	dr inż. Marcin Krajewski dr hab. inż. Ireneusz Kreja	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	15.0	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	60.0	125

Subject objectives	The aim of the course is to introduce students to the basics of creating and using computational models in Structural Analysis. The starting point is the knowledge acquired by students during the previously completed subjects with particular emphasis on Computational Methods (PG_00044016) and Computer Analysis of Structures (PG_00043969). As part of the Modeling of Engineering Structures subject, the issues of Structural Analysis are extended to include such topics as structural stability analysis, limit load capacity and basics of nonlinear structural analysis.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W16] Has deeper and adequate knowlege of civil engineering, within offered specialization	The student has the ability to use an extensive knowledge in the field of engineering structures by solving complex tasks basing on synthesis of the knowledge and skills achieved within the program of various courses	[SW1] Assessment of factual knowledge
[K6_W11] Knows selected software supporting the calculation and design of construction as well as construction management	The student is fluent in applying engineering software in the field of analysis and design demonstrating knowledge of the organization construction works.	[SW1] Assessment of factual knowledge
[K6_U17] has specialized skills in civil engineering within offered specialization	The student knows how to use a wide range of engineering knowledge covered by the program of separated teaching items by freely combining the above ranges in the solution of a given task.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
[K6_U02] is able to define basic calculation models used in computer calculations	The student models the structures behind using different types of bar elements with Robot software or applying matrix methods of structural analysis in MATLAB environment. The student models the beam structures with consideration 2nd order effects, elastic foundation and bracing in in terms of statics and stability.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment

Subject contents

Structural modeling, mathematical and physical models, creating computational models, basic assumptions at the stage of model idealization. Elements of matrix analysis of bar structures: discretization of the structural system, stiffness matrices of typical bar elements. Condensation and modification of the stiffness matrix. Change of the coordinate system, transformation matrix, rotation of the coordinate system. Algorithm for Direct Stiffness Method in static analysis of beam and frame systems. The stiffness matrix of a bending bar taking into account the influence of normal forces; geometric matrix and its application in the problems of stability and statics of beam and frame systems (second order theory). Elements with partially-rigid connections. The influence of elastic supports. Stiffness matrix of a beam element on a Winkler elastic foundation. Outline of other issues of Structural Analysis: modeling of plate and shell structures. Composite structures modeling of. Notes on the modeling and analysis of structural systems: structural stability analysis, limit load-bearing capacity, dynamic analysis, basics of nonlinear structural analysis.

Prerequisites and co-requisites

Structural Mechanics
Strength of Materials

Computational Methods

Computational Analysis of Structures

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Writing test on practical issues	60.0%	30.0%
four computational problems	60.0%	40.0%
Writing test on lectured material	60.0%	30.0%

Recommended reading	Basic literature	1. *Z. Kacprzyk, P. Czumaj, S. Dudziak: Modelowanie konstrukcji budowlanych, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2021.* 2. *C. Branicki: Komputerowa analiza konstrukcji prętowych Bezpośrednią Metodą Przemieszczeń. Politechnika Gdańska, 1999.* 3. *M. Guminiak, J. Rakowski: Mechanika konstrukcji prętowych w ujęciu macierzowym, Wydawnictwo Politechniki Poznańskiej, Poznań, 2012.* 4. *C. Branicki, M. Wizmur: Metody macierzowe w mechanice budowli i dynamika budowli. Skrypt Politechniki Gdańskiej, 1984.* 5. *G. Rakowski (red.): Mechanika Budowli z elementami ujęcia komputerowego, Arkady, Warszawa, 1991.* 6. *G. Rakowski i Z. Kacprzyk. Metoda Elementów Skończonych w Mechanice Konstrukcji. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2016.* 7. *Z. Waszczyszyn, Cz. Cichoń, M. Radwańska: Metoda Elementów Skończonych w Stateczności Konstrukcji, Arkady, Warszawa 1990.*
	Supplementary literature	no items
	eResources addresses	Adresy na platformie eNauczanie: Modelowanie Konstrukcji Inżynierskich 2023/2024 - Moodle ID: 29071 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=29071
Example issues/ example questions/ tasks being completed	Computing the cross-sectional forces and deflections of bar systems by means of matrix methods.	
Work placement	Not applicable	