GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	OPIMAL DESIGN OF ENGINEERING STRUCTURES, PG_00042242						
Field of study	Civil Engineering						
Date of commencement of studies	February 2024		Academic year of realisation of subject	2024/2025			
Education level	second-cycle studies		Subject group	Optional subject group			
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	exam			
Conducting unit	Structural Mechanics Department -> Faculty of Civil and Environmental Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Marcin Kujawa					
	Teachers	dr hab. inż. Marcin Kujawa					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	15.0	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	Understanding the principles of engineering design. Knowledge of optimization methods and their applicability in the design process. Ability to formulate the optimization problem - the possibility of using modules in the commercial optimization software engineering. The ability to use a sensitivity analysis in the design of the structure. Show the applicability of sensitivity analysis for strengthening or setting of research of the existing facilities.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U02] can design and dimension complex steel, concrete (including reinforced), wood and masonry construtions and its details		[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
[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		[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
[K7_W02] knows principles of analysis, design and dimensioning of complex constructions and its elements		[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
[K7_K02] Rocognizes the significance of knowledge in solving cognitive and practical problems; reliably evaluates results of his own and team research		[SK5] Assessment of ability to solve problems that arise in practice
[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		[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge

Subject contents

Basics of design theory and its application in civil engineering. Formulation of optimal design problems. A review of optimization problems and solution methods. Graphic and analytical methods. Method of multipliers Lagrangea. Non-linear programming. Iterative methods. Optimal design of structures and rational design applications. Basic of modeling process. A review of models applied in designing. Problems of sensitivity theory. First order sensitivity theory discrete and continuous description. Applications of sensitivity theory.

Prerequisites and co-requisites

Basic knowledge of : structural mechanic strength of materials numerical methods design of structures based on codes

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Project	50.0%	50.0%
Written exam	50.0%	50.0%

Recommended reading

Basic literature	1. Szymczak C.: Elementy teorii projektowania, PWN, Warszawa 1998. 2. Brandt A.M. (red.): Kryteria i metody optymalizacji konstrukcji, PWN, 1977. 3. Gelfannd I.M., Fomin S.W.: Rachunek wariacyjny, PWN, Warszawa 1970. 4. Murzewski J.: Bezpieczeństwo konstrukcji budowlanych, Arkady, Warszawa 1970. 5. Haug E.J., Choi K.K., Komkov V., Design Sensitivity Analysis of Structural Systems, Academic Press, Orlando 1986.
Supplementary literature	No requirements
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed

Describe design methods used in the practice.

Formulate an optimization problem.

Describe methods for solving optimization problems.

Define the problem of sensitivity analysis on the example of the civil engineering structure.

Describe the applicability of sensitivity analysis in problems of the civil engineering constructions.

Work placement

Not applicable

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