



Subject card

Subject name and code	OPIMAL DESIGN OF ENGINEERING STRUCTURES, PG_00042242						
Field of study	Civil Engineering						
Date of commencement of studies	February 2023	Academic year of realisation of subject			2023/2024		
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_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		[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
	[K7_K02] Recognizes 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_W02] knows principles of analysis, design and dimensioning of complex constructions and its elements		[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
	[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		[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
	[K7_U02] can design and dimension complex steel, concrete (including reinforced), wood and masonry constructions and its details		[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
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
	Written exam	50.0%	50.0%
	Project	50.0%	50.0%
Recommended reading	Basic literature	<ol style="list-style-type: none"> <li>1. Szymczak C.: Elementy teorii projektowania, PWN, Warszawa 1998.</li> <li>2. Brandt A.M. (red.): Kryteria i metody optymalizacji konstrukcji, PWN, 1977.</li> <li>3. Gelfand I.M., Fomin S.W.: Rachunek wariacyjny, PWN, Warszawa 1970.</li> <li>4. Murzewski J.: Bezpieczeństwo konstrukcji budowlanych, Arkady, Warszawa 1970.</li> <li>5. Haug E.J., Choi K.K., Komkov V., Design Sensitivity Analysis of Structural Systems, Academic Press, Orlando 1986.</li> </ol>	
	Supplementary literature	No requirements	
	eResources addresses	Adresy na platformie eNauczanie: Optymalne projektowanie konstrukcji inżynierskich 2023/24 - Moodle ID: 33988 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=33988">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=33988</a>	
Example issues/ example questions/ tasks being completed	<p>Describe design methods used in the practice.</p> <p>Formulate an optimization problem.</p> <p>Describe methods for solving optimization problems.</p> <p>Define the problem of sensitivity analysis on the example of the civil engineering structure.</p> <p>Describe the applicability of sensitivity analysis in problems of the civil engineering constructions.</p>		

Work placement	Not applicable
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