GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Modelling in machine design, PG_00064917						
Field of study	Mechanical Engineering						
Date of commencement of studies	February 2027		Academic year of realisation of subject	2026/2027			
Education level	second-cycle studies		Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study			
Mode of study	Part-time studies		Mode of delivery	at the university			
Year of study	1		Language of instruction	Polish			
Semester of study	1		ECTS credits	4.0			
Learning profile	general academic profile		Assessment form	exam			
Conducting unit	Division of Machine Design and Medical Engineering -> Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Grzegorz Rotta				
	Teachers						

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	18.0	0.0	0.0	18.0	0.0	36
	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	36	6.0	58.0	100

Subject objectives	The aim of the classes is to introduce students to work in a modern, advanced FEM calculation system (i.e. in Ansys). The learning is practical in nature: it consists of independent (but based on provided, carefully described examples) calculation of several calculation tasks, starting from simple strength tasks in the linear range, up to highly nonlinear problems in terms of material and geometry. In addition to familiarizing students with the technique of operating the calculation system, great emphasis was placed on the requirement to gather detailed knowledge about the design, technology and working conditions of the calculated machine assembly and the need to include these aspects in the calculation model (using the example of a geometric notch, a helical spring, a pre-tensioned screw connection, a thin-walled support at risk of losing stability or a polyurethane seal operating under high pressure). The subject consists of a remote, asynchronous lecture and calculation projects carried out in stationary mode, carried out in stationary mode, in a computer room. As part of the lecture, students must watch approximately two-hour instructional videos and repeat the computational examples presented in the videos on their home computers. In the computer lab, they receive individually formulated tasks, similar to the example in the video, which they must solve during the class to earn another credit point.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U02] formulates and solves technical problems specific to Mechanics and Mechanical Engineering using appropriate tools including CAD and MES systems, and prepares technical documentation	Skills in solving technical problems using modern tools, as exemplified by the ANSYS computational modeling and analysis environment.	[SU1] Assessment of task fulfilment
[K7_U15] evaluates the feasibility of advanced methods and tools for solving complex engineering tasks of a practical nature, characteristic of the field of study, and selects and applies appropriate methods and tools for this purpose	Analysis of the engineering task and selection of the data set, construction of a geometric and FEM model of the analyzed object, determination of the behavior of this object and selection of appropriate boundary conditions and calculation procedure.	[SU1] Assessment of task fulfilment [SU5] Assessment of ability to present the results of task
[K7_W11] interprets social, economic, legal (including industrial and intellectual property laws), and other non-technical aspects of engineering activities, and includes them into engineering practice	The student knows the possibilities of using commercial and open source software in professional work.	[SW1] Assessment of factual knowledge
[K7_W02] demonstrates a structured and theoretically grounded knowledge of the key topics in Mechanical Engineering enabling the analysis and modelling of mechanical systems, processes and devices	The student is able to explain the basic concepts and methods of FEM, the influence of computational decisions on their course and calculation results.	[SW1] Assessment of factual knowledge

Subject contents

Course content – lecture

LK1 - stress concentration calculations and evaluation of the influence of the finite element density on the calculation results

LK2 - geometric model of the helical spring

LK3 - FEM calculations of the helical springLK4 - geometric model of the cantilever with a bolted connection

LK5 - FEM calculations of the cantilever with a bolted connection

LK6 - FEM calculations of the cantilever stability loss

LK7 - FEM calculations of the polyurethane gasket

LK8 - strength calculations in free software

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
LK2 project	56.0%	14.0%
LK8 project	0.0%	0.0%
LK7 project	56.0%	15.0%
LK6 project	56.0%	15.0%
LK5 project	56.0%	14.0%
LK4 project	56.0%	14.0%
LK3 project	56.0%	14.0%
LK1 project	56.0%	14.0%

Recommended reading	Basic literature	Krzesiński G., Zagrajek T., Marek P., Borkowski P.: Metoda elementów skończonych w mechanice materiałów i konstrukcji. Rozwiązywanie wybranych zagadnień za pomocą systemu ANSYS. Oficyna Wydawnicza Politechniki Warszawskiej 2015, ISBN: 978-83-7814-445-8
	Supplementary literature	Rusiński E., Czmochowski J., Smolnicki T.: Zaawansowana metoda elementów skończonych w konstrukcjach nośnych. Oficyna Wydawnicza Politechniki Wrocławskiej 2014. ISBN: 9788370854584
	eResources addresses	
Example issues/ example questions/ tasks being completed	Stress concentration calculations and evaluation of the influence of the finite element density on the calculation results, FEM calculations of a helical spring, FEM calculations of a bracket with a bolted connection, FEM calculations of the stability loss of the bracket, FEM calculations of a polyurethane gasket, strength calculations in free software.	
Practical activites within the subject	Not applicable	

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