GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fundamentals of Finite Element Method (CAE), PG_00055402		
Field of study	Mechanical Engineering		
Date of commencement of studies	October 2021	Academic year of realisation of subject	2023/2024
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish None
Semester of study	6	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Grzegorz Rotta	
	Teachers	mgr inż. Bartosz Bastian dr inż. Grzegorz Rotta	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	0.0	30.0	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	4.0	36.0	100

Subject objectives

The aim of the study is to acquire knowledge of fundamentals of finite element method

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W08] possesses basic knowledge including the methodology of designing machine parts, mechanical devices, selection of construction materials, manufacturing and operation, with the lifetime cycle	The student is able to assess the usefulness various MES environments to specific solving problems.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
[K6_U07] is able to design a typical construction of a mechanical device, component or a testing station using appropriate methods and tools, adhering to the set usage criteria	The student is able to apply the right tools numeric required for the analyzed solution works.	[SU4] Assessment of ability to use methods and tools
[K6_W11] possesses knowledge on design, technology and manufacturing of machine parts, metrology, and quality control; knows and understands methods of measuring and calculating basic values describing the operation of mechanical systems, knows basic calculating methods applied to analyse the results of experiments	The student is able to build appropriate analysis models layout including nonlinearities encountered in mechanics.	[SW1] Assessment of factual knowledge
[K6_U11] is able to analyse the operation of devices and compare the construction solutions applying usage, safety, environmental, economic and legal criteria	The student understands the basics mathematical FEM.	[SU1] Assessment of task fulfilment

Subject contents	Basic information on modeling methods, structure discretization. The concept of shape function and methods of creating shape functions using different type of polynomials like: algebraic, Lagrange, Hermit, trigonometric polynomials and natural coordinates. The concept of characteristic matrices of a finite element and the method of their construction for the problems of elastic fields and heat transfer. Matrix aggregation and creation of global matrices of the finite element model. Equations of motion in FEM and methods of solving them for linear and nonlinear problems. FEM spectral formulation in the time domain. MES software. Design task 1 - development in Matlab FEM program for statics and dynamics analysis of isotropic beams and frames with any load patterns and boundary conditions. Design task 2 - development in Matlab FEM program for statics and dynamics analysis of isotropic / composite plates of any shape, boundary conditions and loads
Prerequisites and co-requisites	Algebra, Strength of Materials, Dynamics, Heat transfer

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
FEM code in Matlab	60.0%	50.0%
Test of theoretical knowledge	60.0%	50.0%

Recommended reading

Basic literature	Rakowski G., Kacprzyk Z., Metoda elementów skończonych w mechanice konstrukcji. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005 Łodygowski T., Kąkol W., Metoda elementów skończonych w wybranych zagadnieniach mechaniki konstrukcji inżynierskich. Politechnika Poznańska, Poznań 1994 (dostępny on-line)
Supplementary literature	Kleiber M., ed., Komputerowe metody mechaniki ciał stałych. Seria: Mechanika Techniczna, PWN, Warszawa-Poznań 1995 Zienkiewicz O.C., Taylor R.L., The Finite Element Method. Vol. I-III, Butterworth-Heinemann 2000
eResources addresses	Adresy na platformie eNauczanie: Podstawy metody elementów skończonych (CAE), PG_00055402 - Moodle ID: 37774 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=37774

Example issues/ example questions/ tasks being completed	Define stiffness matrix of the planar system composed of the bars
Work placement	Not applicable