



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 2022	Academic year of realisation of subject			2024/2025		
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		
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 hab. inż. Wiktoria Wojnicz				
	Teachers						
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_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		
	[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_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_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.			[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge		

Subject contents	<p>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.</p> <p>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.</p> <p>Design task 2 - development in Matlab FEM program for statics and dynamics analysis of isotropic / composite plates of any shape, boundary conditions and loads</p>											
Prerequisites and co-requisites	Algebra, Strength of Materials, Dynamics, Heat transfer											
Assessment methods and criteria	<table border="1" data-bbox="453 546 1492 651"> <thead> <tr> <th data-bbox="453 546 794 577">Subject passing criteria</th> <th data-bbox="794 546 1142 577">Passing threshold</th> <th data-bbox="1142 546 1492 577">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="453 577 794 609">Test of theoretical knowledge</td> <td data-bbox="794 577 1142 609">60.0%</td> <td data-bbox="1142 577 1492 609">50.0%</td> </tr> <tr> <td data-bbox="453 609 794 651">FEM code in Matlab</td> <td data-bbox="794 609 1142 651">60.0%</td> <td data-bbox="1142 609 1492 651">50.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Test of theoretical knowledge	60.0%	50.0%	FEM code in Matlab	60.0%	50.0%
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Recommended reading	Basic literature	<p>Rakowski G., Kacprzyk Z., Metoda elementów skończonych w mechanice konstrukcji. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005</p> <p>Łodygowski T., Kąkol W., Metoda elementów skończonych w wybranych zagadnieniach mechaniki konstrukcji inżynierskich. Politechnika Poznańska, Poznań 1994 (dostępny on-line)</p>										
	Supplementary literature	<p>Kleiber M., ed., Komputerowe metody mechaniki ciał stałych. Seria: Mechanika Techniczna, PWN, Warszawa-Poznań 1995</p> <p>Zienkiewicz O.C., Taylor R.L., The Finite Element Method. Vol. I-III, Butterworth-Heinemann 2000</p>										
	eResources addresses											
Example issues/ example questions/ tasks being completed	Define stiffness matrix of the planar system composed of the bars											
Work placement	Not applicable											