



Dofinansowane przez Unię Europejską



COURSE SPECIFICATION

Course code	full-time programme:	M#2-S1-ME-505			
	part-time programme:				
Course title in Polish	Metoda Elementów Skończonych				
Course title in English	Finite Element Method				
Valid from (academic year)	2024/2025				

GENERAL INFORMATION

Programme of study	MECHANICAL ENGINEERING
Level of qualification	first-cycle
Type of education	academic
Mode of study	full-time programme
Specialism	all
Department responsible	Department of Machine Design and Machining
Course leader	dr inż. Sebastian Lipiec
Approved by	dr hab. Jakub Takosoglu, prof. PŚk, Dean of the Faculty of Mechatronics and Mechanical Engineering

COURSE OVERVIEW

Course type		programme-specific			
Course status		compulsory			
Language of instruction		English			
Semester of	full-time programme	Semester V			
delivery	part-time programme				
Pre-requisites					
Examination required (YES/NO)		NO			
ECTS value		2			

Mode of instruction		lecture	class	laborator y	project	seminar
No. of hours	full-time programme	15		15		
per semester	part-time programme					

LEARNING OUTCOMES



Fundusze dla Rozw	Europejskie oiu Społeczne	Rzeczpospolita Dofinansowane p go Polska Unie Europe	rzez **** eiska * *		
Category of outcome	Outcome code	Course learning outcomes	Corresponding programme outcome code		
Knowledge	W01	The student knows and understands the basic assumptions of the finite element method and is able to use the assumptions of matrix calculus in calculations.	MiBM1_W01 MiBM1_W09		
	W02	The student has a mastered knowledge of the basic requirements for numerical load simulations of typical engineering components.	MiBM1_W14 MiBM1_W15		
	U01	The student is able to correctly carry out the discretisation of an element accepted for strength analysis using FEM.	MiBM1_U02 MiBM1_U12		
SKIIIS	U02	The student is able to perform optimisation of the element/structure considered in the simulation programme.	MiBM1_U01 MiBM1_U09		
	K01	Is aware of the non-technical consequences of technological disasters resulting from mistakes in strength analysis.	MiBM1_K02		
Competence	K02	The student is ready to critically evaluate his/her knowledge and the necessity to improve professional qualifications (through second and third degree studies, postgraduate studies, professional courses).	MiBM1_K01 MiBM1_K03		

COURSE CONTENT

Type of instruction lecture	Topics covered
lecture	Fundamentals of matrix calculus in relation to application in FEA solutions. Congruent loading. Characteristics of finite element programs. Principles of operation of the graphical user interface in an FEM calculation system. Principles of data processing and analysis of FEM results using examples of selected 1D and 2D engineering problems. Basic concepts used in the finite element method (FEM). Stages of the FEM procedure. General modelling principles. Presentation of FEM assumptions by means of an example of a rod and beam element solution. General principles and objectives of element optimisation. Examples of FEM calculations for typical engineering problems.
laboratory	General principles for the application of numerical simulations when solving engineering problems. Static analysis in finite element software. Steps in the implementation of a CAD model for numerical calculations. Principles of discretisation of geometric models using CAE software. Methods of analysing and editing calculation results. Overview of post-processing module capabilities. Principles of optimisation of engineering components.

ASSESSMENT METHODS

Outcome	Methods of assessment (Mark with an X where applicable)								
code	Oral examination	Written examination	Test	Project	Report	Other			
W01			Х						
W02			Х						
U01			Х						



Projekt "Dostosowanie kształcenia w Politechnice Świętokrzyskiej do potrzeb współczesnej gospodarki" nr FERS.01.05-IP.08-0234/23

Fund	undusze Europejskie la Rozwoju Społecznego		Rzeczpos Polska	polita D	ofinansowane przez Unie Europeiska	***
U0 2			X			* * *
K01			Х			
K02			X			Х

ASSESSMENT TYPE AND CRITERIA

Mode of instruction	Assessment type	Assessment criteria
lecture	non-examination assessment	Successful completion of the final test. Achieving at least 50 % of the points.
laboratory	non-examination assessment	Successful completion of tests during the semester. The final grade is the arithmetic mean.

OVERALL STUDENT WORKLOAD

ECTS weighting												
			Student workload									Unit
No.	Activity type		fu	II-tin	ie mo		part-time					
		1	C	Jh	P	S	1		l h	P	S	
1.	Scheduled contact hours	15	0	15		0			20		0	h
2.	Other contact hours (office hours, examination)	2	2 2							h		
3.	Total number of contact hours		34					h				
4.	Number of ECTS credits for contact hours	1,4									ECTS	
5.	Number of independent study hours		16							h		
6.	Number of ECTS credits for independent study hours		0,6							ECTS		
7.	Number of practical hours		25								h	
8.	Number of ECTS credits for practical hours	1,0							ECTS			
9.	Total study time	50					h					
10.	ECTS credits for the course 1 ECTS credit = 25-30 hours of study time					2	2					ECTS

READING LIST

1. O. C. Zienkiewicz, R. L. Taylor, and J. Z. Zhu, editors , in The Finite Element Method: Its Basis and Fundamentals (Seventh Edition) (Butterworth-Heinemann, Oxford, 2013), p. i.

2. T. Łodygowski and W. Kąkol, Metoda Elementów Skończonych w Wybranych Zagadnieniach Mechaniki Konstrukcji Inżynierskich (Wydawnictwo Politechniki Poznańskiej, Poznań, 1994).

3. F. Hartmann and C. Katz, Structural Analysis with Finite Elements (Springer, Berlin, Heidelberg, 2007).

4. J. Domański, SolidWorks 2022. Projektowanie maszyn i konstrukcji (Helion, 2022).

5. A. Neimitz, Elementy Mechaniki Ośrodków Ciągłych i Ciała Stałego (Wydawnictwo Politechniki Świętokrzyskiej, 2016).



Projekt "Dostosowanie kształcenia w Politechnice Świętokrzyskiej do potrzeb współczesnej gospodarki" nr FERS.01.05-IP.08-0234/23





Rzeczpospolita

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Wprowadzenie do metody elementów skończonych (Oficyna Wydawnicza Politechniki Warszawskiej, 2008).

7. T. Zagrajek, G. Krzesiński, and P. Marek, Metoda elementów skończonych w mechanice konstrukcji: ćwiczenia z zastosowaniem systemu ANSYS (Oficyna Wydawnicza Politechniki Warszawskiej, 2005).



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