COURSE SPECIFICATION

Course code	full-time programme:	**M#2-S2-ME-204**
	part-time programme:	
Course title in Polish	**Metody numeryczne w inżynierii mechanicznej**	
Course title in English	**Numerical Methods in Mechanical Engineering**	
Valid from (academic year)	**2024/2025**	

GENERAL INFORMATION

Programme of study	**MECHANICAL ENGINEERING**
Level of qualification	**second-cycle**
Type of education	**academic**
Mode of study	**full-time programme**
Specialism	**all**
Department responsible	**Department of Machine Design and Machining**
Course leader	**dr hab. inż. Sławomir Błasiak, prof. PŚk**
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 delivery	full-time programme	**Semester II**
	part-time programme	**Semester II**
Pre-requisites		
Examination required (YES/NO)		**YES**
ECTS value		**2**

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

LEARNING OUTCOMES

Category of outcome	Outcome code	Course learning outcomes	Corresponding programme outcome code
Knowledge	W01	Has an in-depth knowledge of mathematics, including integration, differentiation and interpolation used in numerical methods necessary for solving complex engineering tasks in the field of mechanics and mechanical engineering, especially in the development of computational algorithms.	MiBM2_W01
	W02	Has the in-depth and structured knowledge necessary to understand physical phenomena and the complex relationships between them in relation to their analysis and simulation.	MiBM2_W02
Skills	U01	Is able to apply advanced computer software to complex problems related to the analysis and simulation of physical phenomena using numerical methods.	MiBM2_U02
	U02	Can be proficient in the use of information and communication tools appropriate for complex engineering tasks in the implementation of numerical methods necessary for solving mathematical models describing basic physical phenomena.	MiBM2_U05
Competence	K01	Is aware of the need to independently supplement and extend knowledge in the analysis and simulation of physical phenomena using numerical methods.	MiBM2_K01

COURSE CONTENT

Mode of instruction	Topics covered
lecture	The lectures in the course "Numerical Methods in Mechanical Engineering" introduce basic and advanced numerical methods and their applications in engineering. Algorithms such as finite difference, finite element and boundary element methods will be discussed, including their implementation and optimisation. Methods for solving partial and integral differential equations used in the analysis of heat conduction, fluid mechanics, stress or contact problems will also be presented. Optimisation issues, including algorithms for determining the extremes of functions, and data analysis using approximation and regression will also be addressed. Students will learn about programming tools, and techniques for optimising numerical code. The course will conclude with a discussion of development trends, such as parallel algorithms and the use of artificial intelligence in numerics.
laboratory	The laboratories provide practical application of numerical methods in solving real engineering problems. Students will learn to develop programmes to solve complex physical problems based on finite difference, finite element and boundary element methods. The class will conclude with the development of a report integrating the learned methods into a complex engineering problem. This provides students with the skills to practically apply numerical methods in a professional environment.

ASSESSMENT METHODS

Outcome code	Methods of assessment					
	Oral examination	Written examination	Test	Project	Report	Other
W01		X				

W02		X				
U01					X	
U02					X	
K01						X

ASSESSMENT TYPE AND CRITERIA

Mode of instruction	Assessment type	Assessment criteria
lecture	non-examination assessment	Passing the final examination, i.e. obtaining at least 50% of the marks.
laboratory	non-examination assessment	Final evaluation on the basis of the reports produced. Achievement of at least 50% of the points.

OVERALL STUDENT WORKLOAD

ECTS weighting												
No.	**Activity type**	**Student workload**										**Unit**
		full-time programme					**part-time programme**					
1.	Scheduled contact hours	L	C	Lb	P	S	L	C	Lb	P	S	h
		15		**15**								
2.	Other contact hours (office hours, examination)	**4**		**2**								h
3.	**Total number of contact hours**	**36**										h
4.	**Number of ECTS credits for contact hours**	**1,4**										ECTS
5.	**Number of independent study hours**	**14**										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**										ECTS

READING LIST

1. T. Pang, „Metody obliczeniowe w fizyce: fizyka i komputery”
2. D. Potter, „Metody obliczeniowe fizyki”
3. W. H. Press, S. A. Teutolsky, W. T. Vetterling, and B. P. Flannery, „Numerical Recipes”
4. D. Kincaid, W. Cheney, „Analiza numeryczna”
5. R. Grzymkowski, D. Słota, „Wybrane metody obliczeniowe równań całkowych”
6. P. Gregory, „Bayesian logical data analysis for the physical sciences”