COURSE SPECIFICATION

Course code	full-time programme:	**M#2-S1-ME-102**
	part-time programme:	
Course title in Polish	**Analiza matematyczna**	
Course title in English	**Calculus**	
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 Mathematics and Physics**
Course leader	**Dr inż. Paweł Łabędzki**
Approved by	**dr hab. Jakub Takosoglu, prof. PŚk, Dean of the Faculty of Mechatronics and Mechanical Engineering**

COURSE OVERVIEW

Course type		**basic**
Course status		**compulsory**
Language of instruction		**English**
Semester of delivery	full-time programme	**Semester I**
	part-time programme	
Pre-requisites		
Examination required (YES/NO)		**YES**
ECTS value		**5**

Mode of instruction		**lecture**	**class**	**laboratory**	**project**	**seminar**
No. of hours per semester	full-time programme	**30**	**30**			
	part-time programme					

LEARNING OUTCOMES

Category of outcome	Outcome code	Course learning outcomes	Corresponding programme outcome code
Knowledge	W01	A student knows fundamental concepts in Calculus (for the case of single variable and multivariable functions) and notation connected with it.	MiBM1_W01
	W02	A student knows the theorems connecting derivative of the function and its monotonicity and convexity. Student knows fundamental theorem of calculus and its application to calculate definite integrals.	MiBM1_W01
	W03	A student knows application of calculus in mechanics.	MiBM1_W01
Skills	U01	A student can perform typical exercises in Calculus (e.g., finding limits, differentiation, function analysis, integration, approximation, optimization)	MiBM1_U01
	U02	A student can interpret the results of calculations and is proficient in applying mathematical tools to solve problems of mechanics.	MiBM1_U01
	U03	A student can use mathematical notation correctly.	MiBM1_U01
Competence	K01	A student understands the necessity of continuous learning.	MiBM1_K01 MiBM1_K02
	K02	A student understands the relationship between effort and its result.	MiBM1_K01

COURSE CONTENT

Type of instruction lecture	Topics covered
lecture	Definition of the function. Review of elementary functions. The limit and continuity of a function. Definition of the derivative of a function and its geometrical and physical interpretations. Differentiation rules. Higher order derivatives. Application of derivatives to analyze behaviour of a function. Differential of a function. Taylor's theorem and its application in approximate calculations. Applications of calculus in mechanics. Definite integral and its properties. Indefinite integral. Integration techniques: by parts and by substitution. Selected application of definite integral in geometry and mechanics. Multivariable functions. Partial derivatives. Gradient and its interpretation. Directional derivative. Total derivative. Higher order partial derivatives. Taylor's theorem for multivariable functions. Local extrema of multivariable functions.
class	Finding domain of a function. Making graphs of elementary functions and describing its properties based on its graphs. Calculation of function limits. Continuity of a function. Calculating derivatives (including derivative of a composite function). Determining extrema and the intervals of monotonicity of the function. Approximate calculations based on function differential and Taylor's theorem. Approximation of a function by polynomial. Definite integral. Integration by parts and by substitution. Selected application of calculus in mechanics. Calculating partial derivatives. Directional derivative. Higher order partial derivatives. Application of the total differential and Taylor's theorem for multivariable function in approximate calculations. Determining the extrema of two variable functions.

ASSESSMENT METHODS

Outcome code	Methods of assessment *(Mark with an X where applicable)*					
	Oral examination	Written examination	Test	Project	Report	Other
W01		X	X			
W02		X	X			
W03		X	X			

U01		X	X			
U02		X	X			
U03		X	X			
K01						X
K02						X

ASSESSMENT TYPE AND CRITERIA

Mode of instruction	Assessment type	Assessment criteria
lecture	examination assessment	The pass mark in a minimum of 50% from the final test.
class	non-examination assessment	The pass mark is a minimum of 50% for all the in-class tests.

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
		30	**30**									
2.	Other contact hours (office hours, examination)	**4**	**2**									h
3.	**Total number of contact hours**	**66**										h
4.	**Number of ECTS credits for contact hours**	**2,6**										ECTS
5.	**Number of independent study hours**	**59**										h
6.	**Number of ECTS credits for independent study hours**	**2,4**										ECTS
7.	**Number of practical hours**	**63**										h
8.	**Number of ECTS credits for practical hours**	**2,5**										ECTS
9.	**Total study time**	**125**										h
10.	**ECTS credits for the course** *1 ECTS credit = 25-30 hours of study time*	**5**										ECTS

READING LIST

1. Decewicz G., Żakowski W., Matematyka. Cz. 1, WNT, Warszawa 1997.
2. Hożejowska S., Hożejowski L., Maciąg A., Matematyka w zadaniach dla studiów ekonomiczno-technicznych, Wydawnictwo Politechniki Świętokrzyskiej, Kielce 2005.
3. Krysicki W., Włodarski L., Analiza matematyczna w zadaniach. Cz. 1 i cz. 2, PWN, Warszawa 2002.
4. Stewart J., Calculus : early transcendentals, Brooks/Cole Publishing Company, Pacific Grove 1991.
5. Żakowski W., Kołodziej W., *Matematyka. Cz. II*, WNT, Warszawa 1997.