Kielce University of Technology

FACULTY OF MECHATRONICS AND MECHANICAL ENGINEERING

Annex 9
to the Rector's Ordinance No. 35/19
of 12 June 2019

COURSE SPECIFICATION

Course code	**M#1-S1-ME-102**
Course title in Polish	**Analiza matematyczna**
Course title in English	**Calculus**
Valid from (academic year)	**2019/2020**

GENERAL INFORMATION

Programme of study	**MECHANICAL ENGINEERING**
Level of qualification	**first-cycle**
Type of education	**academic**
Mode of study	**full-time**
Specialism	**all**
Department responsible	**Department of Manufacturing Engineering and Metrology**
Course leader	**dr inż. Paweł Łabędzki**
Approved by	

COURSE OVERVIEW

Course type	**basic**
Course status	**compulsory**
Language of instruction	English
Semester of delivery	**semester 1**
Pre-requisites	**None**
Examination required (YES/NO)	YES
ECTS value	**6**

Mode of instruction	**lecture**	**class**	**laboratory**	**project**	**seminar**
No. of hours per semester	**40**	**40**			

LEARNING OUTCOMES

Category of outcome	Outcome code	Course learning outcomes	Corresponding programme outcome code
Knowledge	W01	Has knowledge of elementary functions and their properties. He knows the concept of the limit of a function and the asymptote of a function. He knows the basics of differential calculus of functions of one variable and many variables and its selected applications. He knows the basics of integral calculus of functions of one variable. Knows selected geometric and technical applications of the definite integral	MiBM1_W01
	W02	He knows the basic issues of ordinary differential equations - differential equations with separated variables, linear differential equations.	MiBM1_W01
Skills	U01	Student is able to solve equations and inequalities. He can characterize the properties of functions. He can calculate the limits of a function, recognize its asymptotes and determine them. He can calculate the derivative of a function. He can use calculus to study the properties of functions and other technical applications	MiBM1_U01
	U02	Student is able to choose the methods of integration for specific types of functions. He can use the definite integral in selected problems in geometry and mechanics. He can calculate partial derivatives, directional derivative and determine the extremes of functions of two variables. He can solve selected ordinary differential equations - differential equations with separated variables, first-order linear differential equations, linear with constant coefficients. Can choose the method (prediction method and constant variation method) to the type of linear differential equation.	MiBM_U01
Competence	K01	He understands the need for continuous training and improving his competences in the field of mathematical methods used to solve typical engineering problems. He can complete and improve the acquired knowledge and skills in the field of methods of solving equations and systems of linear equations, matrix calculus, vector calculus.	MiBM_K06
	K02	The student is aware of the responsibility for their own work and is able to submit to the rules of teamwork.	MiBM_1K04

COURSE CONTENT

Type of instruction*	Topics covered
lecture	Functions of one real variable and their basic properties. Complex and inverse functions. Overview of elementary functions: polynomials, rational, trigonometric, exponential, logarithmic, hyperbolic, cyclometric functions. Limit and continuity of a function. Function asymptotes. The derivative of a function. Physical and geometric interpretation of the derivative. Differentiation rules. Derivatives of elementary functions. Derivative of the inverse function. Derivative of a complex function. Function differential. Higher order derivatives. Taylor formula. Lagrange's theorem. Application of the first derivative to study the properties of a function (monotonicity, extremes). Study of the course of function variability. Primitive function. Indefinite integral. Integration by parts and substitution methods. Decomposition of a rational function into simple fractions. Integration of rational functions. Integration of irrational and trigonometric functions. Riemman definition of definite integral. Newton-Leibnitz theorem. Geometric and mechanical applications of definite integrals. Functions of many variables. Partial derivatives. Differentiation of a complex function. Higher order derivatives. Differential of functions of two variables. Taylor formula. Directional derivative. Gradient. Local extremes of multivariable functions Information about first-order ordinary differential equations. Differential equations with separated variables. Linear differential equations. The method of varying the constant. Prediction method. Linear differential equations with constant coefficients. Prediction method.
class	Determining the domain of functions. Solving polynomial, rational, exponential, logarithmic and trigonometric equations and inequalities. Calculation of function limits. Continuity of functions. Finding the asymptote of a function. Calculating the derivative of a function including the derivative of a complex function. Determining the tangent to the function graph. Approximating a function with a Taylor polynomial. Approximating expressions using the Taylor differential and the Taylor formula. Calculating limits using de L'Hospital rules. Determining the intervals of monotonicity and extremes of functions. Study of the course of function variability. Calculation of indefinite integrals by substitution. Calculation of indefinite integrals by parts. Integration of rational functions. Integration of irrational functions. Integration of trigonometric functions. Calculation of definite integral. Calculating the area of a flat area. Applications of definite integrals in geometry and mechanics. Computing the partial derivative of a function of several variables. Application of the first order differential to estimate measurement errors. Calculation of the directional derivative. Finding local extremes of functions of two variables. Solving differential equations with separated variables. Solving linear differential equations by the constant variation method. Solving linear differential equations with constant coefficients by the prediction method.

*) Please delete rows in the table above that are not applicable.

ASSESSMENT METHODS

Outcome code	Methods of assessment *(Mark with an X where applicable)*					
	Oral examination	Written examination	Test	Project	Report	Other
W01		x				
W02		x				
U01			x			
U02			x			
U03			x			
K01						x
K02						x

ASSESSMENT TYPE AND CRITERIA

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

*) Please delete rows in the table above that are not applicable.

OVERALL STUDENT WORKLOAD

ECTS weighting							
	Activity type	**Student workload**					**Unit**
1.	Scheduled contact hours	L	C	Lab	P	S	h
		40	40				
2.	Other contact hours (office hours, examination)	4	2				h
3.	**Total number of contact hours**	**86**					h
4.	**Number of ECTS credits for contact hours**	**1,8**					ECTS
5.	**Number of independent study hours**	**54**					h
6.	**Number of ECTS credits for independent study hours**	**2,2**					ECTS
7.	**Number of practical hours**	**50**					h
8.	**Number of ECTS credits for practical hours**	**2,0**					ECTS
9.	**Total study time**	**100**					h
10.	**ECTS credits for the course** *1 ECTS credit = 25-30 hours of study time*	**6**					ECTS

READING LIST

1. Gdowski B., Pluciński E., Zadania z rachunku wektorowego i geometrii analitycznej, PWN, Warszawa 1982.
2. Hożejowska S., Hożejowski L., Maciąg A., Matematyka w zadaniach dla studiów ekonomiczno-technicznych, Wydawnictwo Politechniki Świętokrzyskiej, Kielce 2005.
3. Jurlewicz T., Skoczylas Z., Algebra liniowa 1. Definicje, twierdzenia, wzory, Oficyna wydawnicza GiS, Wrocław 2004.
4. Tarnowski S., Wajler S., Matematyka w zadaniach cz.II. PŚk. Kielce
5. Trajdos T., Matematyka. Cz. 3, WNT, Warszawa 1987.
6. Wstęp do matematyki, red. A Płoski, Wydawnictwo Politechniki Świętokrzyskiej, Kielce 1995.
7. Skrypt z Algebry: http://wzimk-moodle.tu.kielce.pl/