

FACULTY W4

SUBJECT CARD

Name in English **MATH-ANALYSIS 2**
 Name in Polish **MATEMATYKA – ANALIZA 2**
 Main field of study (if applicable): **ECE**
 Specialization (if applicable):
 Level and form of studies: **1st level, full-time**
 Kind of subject: **university-wide**
 Subject code **MAT001510**
 Group of courses **YES**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30	30			
Number of hours of total student workload (CNPS)	60	90			
Form of crediting	exam	crediting with grade			
For group of courses mark (X) final course	X				
Number of ECTS points	5				
including number of ECTS points for practical (P) classes		2			
including number of ECTS points for direct teacher-student contact (BK) classes	1	1			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Differential and integral calculus of one variable.
 Basic concepts of algebra.

SUBJECT OBJECTIVES

C1. Understanding the basic properties of ordinary differential equations and methods of solving them.
 C2 Understanding the basic properties of differential equations.
 C3. Understanding the basic concepts of functions of several variables (including multiple integrals and differential operators).

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge a student

PEK_W01 knows the basic concepts of differential and difference equations and basic methods of solving them
 PEK_W02 knows the definitions and basic properties of curvilinear and surface integrals, and their applications
 PEK_W03 knows the basic differential operators for scalar and vector

relating to skills a student

PEK_W01 is able to derive and solve simple differential equation by different methods
 PEK_U02 can calculate line and surface integrals, oriented and non-oriented and knows how to apply them in engineering problems
 PEK_U03 knows how to apply differential operators for scalar sand vectors in engineering calculus

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours
Lec 1,2	Systems of linear ordinary differential equations of the first order - the theorem on the existence, uniqueness and extending solutions. Basic methods of solving of differential equations.	4
Lec 3	Stability and asymptotic stability of equilibrium points of autonomous systems of ordinary differential equations of the first order - testing by the eigenvalues of matrix system, linearization method, the use of Lyapunov's functions.	2
Lec 4,5	Linear ordinary differential equations of higher orders - the characteristic polynomial, the method of undetermined coefficients and variation of parameters.	4
Lec 6,7	Laplace transform; application for solving differential equations	4
Lec 8	Fundamentals of difference calculus - the introduction; the general solution of difference equations; initial issue for the difference equation and the particular solution of difference equations. Linear difference equations of the first order – forms of solutions for general and special cases when some coefficients are constant.	2
Lec 9,10,11	Homogeneous linear difference equations of higher orders with constant coefficients - the characteristic polynomial and form a solution. Inhomogeneous linear difference equations of higher orders - the method of undetermined coefficients. Z-transform -application for solving difference equations	6
Lec 12	Partial derivatives of first order. Definition. Geometric interpretation. The plane tangent to the function of two variables. Exact differential	2
Lec 13,14	Directional derivatives. Gradient of a function. Higher order partial derivatives. Local extremes of functions of two variables. Elements of field theory. Differential operators for scalar and vector. Gauss and Stokes theorems. Examples of applications of curvilinear and surface integrals. The definition of line surface and volume integrals;. Geometric interpretation. Examples of calculations of integrals.	4
Lec 15	Partial Differential Equations - examples of applications	2
	TOTAL	30
Form of classes - class		Number of hours
Cl 1	Systems of linear ordinary differential equations of the first order - the claim about the existence, uniqueness and extending solutions. Basic methods of solving of differential equations.	2
Cl 2	Stability and asymptotic stability of equilibrium points of autonomous systems of ordinary differential equations of the first order - testing by the eigenvalues of matrix system, linearization method, the use of Lyapunov's functions.	2
Cl 3	Linear ordinary differential equations of higher orders - the characteristic polynomial, the method of undetermined coefficients and variation of parameters.	2
Cl 4,5,6	Laplace transform; application for solving differential equations	6
Cl 7	Fundamentals of difference calculus - the introduction; the general solution of difference equations; initial issue for the difference equation and the particular solution of difference equations. Linear difference equations of the first order – forms of solutions for general and special cases when some coefficients are constant.	2

CI 8,9,10	Homogeneous linear difference equations of higher orders with constant coefficients - the characteristic polynomial and form a solution. Inhomogeneous linear difference equations of higher orders - the method of undetermined coefficients. Z-transform -application for solving difference equations	6
CI 11,12	Partial derivatives of first order. Definition. Geometric interpretation. The plane tangent to the function of two variables. Exact differential	4
CI 13	Directional derivatives. Gradient of a function. Higher order partial derivatives. Local extremes of functions of two variables. Elements of field theory. Differential operators for scalar and vector. Gauss and Stokes theorems. Examples of applications of curvilinear and surface integrals. The definition of line surface and volume integrals;. Geometric interpretation. Examples of calculations of integrals.	2
CI 14	Partial Differential Equations - examples of applications	2
CI 15	Summary	2
	TOTAL	30

TEACHING TOOLS USED

N1. Chalkboard
N2. Consultations
N3. Self-education

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 -3	Written exam
F2	PEK_U01 -3	Test
P = P = (0.51*F1+0.49*F2); F1 and F2 must be positive		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

SECONDARY LITERATURE:

- [1] [F. Leja, Rachunek różniczkowy i całkowy ze wstępem do równań różniczkowych, PWN, Warszawa 2008.
- [2] W. Krysiński, L. Włodarski, Analiza matematyczna w zadaniach, Cz. II, PWN, Warszawa 2006.
- [3] W. Żakowski, W. Kołodziej, Matematyka, Cz. II, WNT, Warszawa 2003.
- [4] W. Żakowski, W. Leksiński, Matematyka, Cz. IV. WNT, Warszawa 2002.
- [5] M. Gewert, Z. Skoczylas, Analiza matematyczna 2. Przykłady i zadania, Oficyna Wydawnicza GiS, Wrocław 2005.
- [6] M. Gewert, Z. Skoczylas, Analiza matematyczna 2. Definicje, twierdzenia, wzory, Oficyna Wydawnicza GiS, Wrocław 2005.
- [7] M. Gewert, Z. Skoczylas, Elementy analizy wektorowej. Teoria, przykłady, zadania, Oficyna Wydawnicza GiS, Wrocław 2005.
- [8] M. Fichtenholz, Rachunek różniczkowy i całkowy, T. II-III, PWN, Warszawa 2007.
- [9] W. Stankiewicz, Zadania z matematyki dla wyższych uczelni technicznych, Cz. B, PWN, Warszawa 2003

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)
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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
MATH-ANALYSIS 2 MAT001510
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY ECE
 AND SPECIALIZATION

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01-2	K1ECE_W03	C1-2	Wy1-15	N1-3
PEK_U01-3	K1ECE_U03	C1-2	Cw1-15	N1-3