

FACULTY ELECTRONICS					
SUBJECT CARD					
Name of subject in Polish:		Matematyka – Analiza 2			
Name of subject in English:		Math – Analysis 2			
Main field of study (if applicable):		Electronic and Computer Engineering			
Specialization (if applicable):				
Profile:		academic			
Level and form of studies:		1 st 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	crediting with grade	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		3			
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1	1			

*delete as applicable

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: student..

PEU_W01 knows the basic concepts of differential and difference equations and basic methods of solving them

PEU_W02 knows the definitions and basic properties of curvilinear and surface integrals, and their applications

PEU_W03 knows the basic differential operators for scalar and vector

relating to skills: Student..

PEU_W01 is able to derive and solve simple differential equation by different methods

PEU_U02 can calculate line and surface integrals, oriented and non-oriented and knows how to apply them in engineering problems

PEU_U03 knows how to apply differential operators for scalar and vectors in engineering calculus

relating to social competences:

PROGRAMME CONTENT

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.	4

	The definition of line surface and volume integrals;. Geometric interpretation. Examples of calculations of integrals.	
Lec 15	Partial Differential Equations - examples of applications	2
	TOTAL	30
Classes		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
Cl 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
Cl 11,12	Partial derivatives of first order. Definition. Geometric interpretation. The plane tangent to the function of two variables. Exact differential	4
Cl 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
Cl 14	Partial Differential Equations - examples of applications	2
Cl 15	Summary	2
	TOTAL	30
TEACHING TOOLS USED		
N1.Chalkboard N2. Consultations N3. Self-education		

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at semester end))	Learning outcomes code	Way of evaluating achievement
F1	PEU_W01 – PEU_W03	Written exam
F2	PEU_U01 – PEU_U03	Test
P = P = (0.51*F1+0.49*F2); F1 and F2 must be positive		
PRIMARY AND SECONDARY LITERATURE		
<u>PRIMARY LITERATURE:</u>		
<p>[1] [1] M. Spiegel, S. Lipschutz...., Complex Variables, 2nd edition, McGraw Hill [2] R. Bronson, Differential Equations, 4th edition, McGraw Hill [3] P.DuChateau, D. Zachmann, Partial Differential Equations, McGraw Hill [4] S. Elaydi, An Introduction to Difference Equations, Springer</p>		
<u>SECONDARY LITERATURE:</u>		
<p>[5] [F. Leja, Rachunek różniczkowy i całkowy ze wstępem do równań różniczkowych, PWN, Warszawa 2008. [6] W. Krywicki, L. Włodarski, Analiza matematyczna w zadaniach, Cz. II, PWN, Warszawa 2006. [7] W. Żakowski, W. Kołodziej, Matematyka, Cz. II, WNT, Warszawa 2003. [8] W. Żakowski, W. Leksiński, Matematyka, Cz. IV. WNT, Warszawa 2002. [9] M. Gewert, Z. Skoczylas, Analiza matematyczna 2. Przykłady i zadania, Oficyna Wydawnicza GiS, Wrocław 2005. [10] M. Gewert, Z. Skoczylas, Analiza matematyczna 2. Definicje, twierdzenia, wzory, Oficyna Wydawnicza GiS, Wrocław 2005. [11] M. Gewert, Z. Skoczylas, Elementy analizy wektorowej. Teoria, przykłady, zadania, Oficyna Wydawnicza GiS, Wrocław 2005. [12] M. Fichtenholz, Rachunek różniczkowy i całkowy, T. II-III, PWN, Warszawa 2007. [13] W. Stankiewicz, Zadania z matematyki dla wyższych uczelni technicznych, Cz. B, PWN, Warszawa 2003</p>		
SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)		
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