FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Analiza matematyczna 2**
Name in English:	**Mathematical Analysis 2**
Main field of study (if applicable):	**Industrial Control Engineering**
Specialization (if applicable):	
Level and form of studies:	**1st level, full-time**
Kind of subject:	**obligatory / university-wide**
Subject code:	**MAT001738**
Group of courses:	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	30	30			
Number of hours of total student workload (CNPS):	120	90			
Form of crediting:	examination	crediting with grade			
For group of courses mark (X) final course:					
Number of ECTS points:	4	3			
including number of ECTS points for practical (P) classes :		3			
including number of ECTS points for direct teacher-student contact (BK) classes:	2.80	2.10			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student must have basic knowledge in one-variable differential and integral calculus, confirmed by completing the Mathematical Analysis 1 course with a positive grade.

SUBJECT OBJECTIVES

C1. Provide training in basics of infinite series and power series theories.
C2. Presentation of rudiments of multivariable differential calculus.
C3. Exposition of basics of multiple integrals.
C4. Introduction to the idea of the Laplace and Fourier transformations.

SUBJECT LEARNING OUTCOMES

relating to knowledge:

PEU_W01 knows basic convergence tests for infinite series,
PEU_W02 knows rudiments of multivariable differential and integral calculus,
PEU_W03 knows the notions of the Laplace and Fourier transformations,

relating to skills:

PEU_U01 is able to find power series representation of a function and knows how to use it for approximations,
PEU_U02 can calculate and interpret partial derivatives, directional derivatives and gradients of multivariable functions, is able to find local and global extrema of two-variable functions,
PEU_U03 can calculate double and triple integrals and apply multivariable integral calculus to solve engineering problems, can find the Laplace transforms of basic functions.

relating to social competences:

PEU_K01 understands the need for systematic and independent work on mastery of course material.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Improper integrals. Absolute and conditional convergence. Cauchy principal value.	2
Lec 2	Infinite series. The basic tests for convergence and divergence. Absolute and conditional convergence. The alternating series test (Leibniz's theorem).	2
Lec 3	Power series. The radius and interval of convergence. Cauchy-Hadamard theorem. Taylor series.	2
Lec 4	Sets in the plane and in space. Functions of several variables. Graphs of typical two-variable functions. Surfaces of revolution and cylindrical surfaces.	2
Lec 5	The partial derivative. Definition. Geometric interpretation. Higher order partial derivatives. Schwarz's Theorem.	2
Lec 6	The tangent plane to the graph of two-variable function. Directional derivatives. Gradient of a function.	2
Lec 7	Local and global extrema of two-variable function. Necessary and sufficient conditions for the existence of minimum /maximum. Examples of extremal problems in geometry and engineering.	2
Lec 8	Conditional extrema. Applications. Examples of optimization problems.	2
Lec 9	Double integral, its definition and interpretation. Methods of calculation of double integrals over normal regions.	2
Lec 10	Properties of double integrals. Jacobian determinant. Change of variables in double integrals. Double integrals in polar coordinates.	2
Lec 11	Triple integrals. Triple integrals in cylindrical and spherical coordinates.	2
Lec 12	Applications of double and triple integrals in geometry, physics and engineering.	2
Lec 13	Laplace transformation.	2
Lec 14	Laplace inverse transformation and its applications in ordinary differential equations.	2
Lec 15	Fourier transformation.	2
	Total hours:	**30**

Form of classes - class		**Number of hours:**
Cl 1	Improper integrals.	2
Cl 2	Infinite series.	2
Cl 3	Power series	2
Cl 4	Functions of two variables.	2
Cl 5	Partial derivatives.	2
Cl 6	Gradient of a function. Tangent planes.	2
Cl 7	Local and global minima and maxima.	2
Cl 8	Conditional extrema.	2
Cl 9	Double integrals.	2
Cl 10	Double integrals in polar coordinates.	2
Cl 11	Triple integrals.	2
Cl 12	Triple integrals in cylindrical and spherical coordinates.	2
Cl 13	Applications of double and triple integrals.	2
Cl 14	Integral transforms.	2
Cl 15	Test.	2
	Total hours:	**30**

TEACHING TOOLS USED
N1. Lecture - traditional method or using multimedia tools.
N2. Classes - traditional method (problems sessions and discussion).
N3. Student's self-study with the assistance of mathematical packages.
N4. Tutorial.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation *F – forming (during semester)* *P – concluding (at semester end)*	**Educational effect number**	**Way of evaluating educational effect achievement**
F1(W)	PEU_W01 PEU_W02 PEU_W03	exam
P(W)	P=F1	
F2(C)	PEU_U01 PEU_U02 PEU_U03 PEU_K01	oral presentations, quizzes, tests
P(C)	P=F1	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] F. Leja, Rachunek Różniczkowy i Całkowy, Wydawnictwo Naukowe PWN, 2012
[2] R. Leitner, Zarys Matematyki Wyższej dla Studiów Technicznych, Cz. 1 - 2 WNT, Warszawa, 2006.
[3] M. Gewert, Z. Skoczylas, Analiza Matematyczna 2. Definicje, twierdzenia, wzory. Oficyna Wydawnicza GiS, Wrocław 2016

SECONDARY LITERATURE:

[1] W. Krysicki, L. Włodarski, Analiza Matematyczna w Zadaniach, Cz. II, PWN, Warszawa 2006
[2] G. M. Fichtenholz, Rachunek Różniczkowy i Całkowy, T. I - II, PWN, Warszawa 2007
[3] M. Gewert, Z. Skoczylas, Analiza Matematyczna 2. Przykłady i Zadania, Oficyna Wydawnicza GiS, Wrocław 2016

SUBJECT SUPERVISOR

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