

FACULTY OF ELECTRICAL  
ENGINEERING**SUBJECT CARD**

Name in Polish: **Analiza matematyczna 2.1 A**  
 Name in English: **Mathematical Analysis 2.1 A**  
 Main field of study (if applicable): **Control Engineering and Robotics**  
 Specialization (if applicable):  
 Level and form of studies: **1st level, full-time**  
 Kind of subject: **obligatory / university-wide**  
 Subject code: **MAT001423**  
 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. Knowledge of differential and integral calculus of function of one variable.

**SUBJECT OBJECTIVES**

- C1. Knowledge of basic properties of infinite series and power series.  
 C2. Understanding the basic concepts of differential calculus of several variables.  
 C3. Understanding the basic concepts of integral calculus of functions of several variables.  
 C4. Understanding the Laplace transform and Fourier transform.

**SUBJECT EDUCATIONAL EFFECTS***relating to knowledge:*

- PEK\_W01 Know the basic criteria of convergence of infinite series.  
 PEK\_W02 Know the basic concepts of differential and integral calculus of functions of several variables.  
 PEK\_W03 Know the notion of Laplace and Fourier transform.

*relating to skills:*

- PEK\_U01 Can find power series of a function, knows how to use power series for approximations of functions  
 PEK\_U02 Can compute the partial derivatives, directional and gradient functions of several variables and interpret the wielkości, able to solve problems for the optimization of functions of several variables  
 PEK\_U03 Is able to calculate and interpret the integral multiple, able to solve engineering problems using double and triple integrals, can calculate integral transforms from simple functions

*relating to social competences:*

- PEK\_K01 Understand the role played by Mathematical Analysis to analyze technical problems

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours:
Lec 1	Improper integrals. Cauchy principal value.	2
Lec 2	Infinite series. The basic criteria for convergence of series. Absolute and conditional convergence. Leibniz criterion.	2
Lec 3	Power series. The radius and interval of convergence. Cauchy theorem - Hadamard. Taylor Series.	2
Lec 4	Properties of the space $R^n$ . Subsets of the space $R^n$ . Functions of several variables.	2
Lec 5	Partial derivatives of the first order. Definition. Geometric interpretation. Higher order partial derivatives. Schwarz theorem.	2
Lec 6	The plane tangent to the graph of a function of two variables. Directional derivatives. Gradient of a function.	2
Lec 7	Local extremes of functions of two variables. Sufficient conditions for the existence of extreme. The smallest and the largest value of the function on the set. Examples of extremal problems in geometry and technology.	2
Lec 8	Conditional extremes conditional function of two variables. Applications. Examples of optimization problems.	2
Lec 9	Double integrals. The definition of the double integral. Geometric and physical interpretation. Calculation of double integrals normal regions.	2
Lec 10	Properties of double integrals. Jacobian function. Change of variables in double integrals. Double integral in polar coordinates.	2
Lec 11	Triple integrals. Reversal iterated integrals. Change of variables in cylindrical and spherical coordinates.	2
Lec 12	Applications of double and triple integrals in geometry and physics	2
Lec 13	Laplace transform.	2
Lec 14	Inverse Laplace transform and its applications	2
Lec 15	Introduction to the Fourier transform.	2
Total hours:		<b>30</b>

Form of classes - class		Number of hours:
Cl 1	Infinite series	2
Cl 2	Power series	2
Cl 3	The functions of two variables.	2
Cl 4	Partial derivatives.	2
Cl 5	Gradient. Tangent planes.	2
Cl 6	Extremes of functions of two variables.	2
Cl 7	Conditional Extremes.	2
Cl 8	The study of functions of several variables - I	2
Cl 9	The study of functions of several variables - II	2
Cl 10	Double integrals.	2
Cl 11	Triple integrals.	2
Cl 12	Integrals of functions of several variables.	2
Cl 13	Applications of multiple integrals.	2
Cl 14	Laplace transform.	2
Cl 15	Integral transforms.	2
Total hours:		<b>30</b>

TEACHING TOOLS USED
N1. Lecture - traditional method
N2. Classes - traditional method
N3. Student's self work with the assistance of mathematical packages

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation <i>F – forming (during semester) P – concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(w)	PEK_W01 PEK_W02 PEK_W03	Exam
P(w)	P=F1	
F1(c)	PEK_U01 PEK_U02 PEK_U03 PEK_K01	Colloquium during classes
P(c)	P=F1	

PRIMARY AND SECONDARY LITERATURE	
<b>PRIMARY LITERATURE:</b> A1. F. Leja, Rachunek Różniczkowy i Całkowy, Wydawnictwo Naukowe PWN, 2012 A2. R. Leitner, Zarys Matematyki Leczącej dla Studiów Technicznych, Cz. 1-2 WNT, Warszawa, 2006.	
<b>SECONDARY LITERATURE:</b> B1. W. Kryszicki, L. Włodarski, Analiza Matematyczna w Zadaniach, Cz. II, PWN, Warszawa 2006 B2. G. M. Fichtenholz, Rachunek Różniczkowy i Całkowy, T. I-II, PWN, Warszawa 2007 B3. M. Gewert, Z. Skoczylas, Analiza Matematyczna 2. Przykłady i Zadania, Oficyna Wydawnicza GiS, Wrocław 2011	

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**MAT001423 - Mathematical Analysis 2.1 A**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Control Engineering and Robotics**

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	K1AiR_W03	C.1	Lec1 Lec2 Lec3	N.1 N.3
PEK_W02	K1AiR_W03	C.2 C.3	Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12	N.1 N.3
PEK_W03	K1AiR_W03	C.4	Lec13 Lec14 Lec15	N.1 N.3
PEK_U01	K1AiR_U03	C.1	CI1 CI2	N.2 N.3
PEK_U02	K1AiR_U03	C.2	CI3 CI4 CI5 CI6 CI7 CI8 CI9	N.2 N.3
PEK_U03	K1AiR_U03	C.3	CI10 CI11 CI12 CI13 CI14 CI15	N.2 N.3
PEK_K01	K1AiR_K03 K1AiR_K07	C.1 C.2 C.3 C.4	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15 CI1 CI2 CI3 CI4 CI5 CI6 CI7 CI8 CI9 CI10 CI11 CI12 CI13 CI14 CI15	N.1 N.2 N.3