

FACULTY W10

SUBJECT CARD

Name in English

MATHEMATICAL ANALYSIS I

Name in Polish

ANALIZA MATEMATYCZNA I

Main field of study (if applicable)

Specialization (if applicable)

Level and form of studies

I level, full time

Kind of subject

obligatory

Subject code

MAT001648

Group of courses

NO

	Lecture	Exercise class	Laboratory	Project	Seminar
Number of hours of organized University classes (ZZU)	30	30			
Number of hours of total student workload (CNPS)	150	90			
Form of crediting	exam	crediting with grade			
For a group of courses mark the final course (X)					
Number of ECTS points	5	3			
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes					

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

It is recommended that the knowledge of mathematics is equivalent to high school certificate at the advanced level.

SUBJECT OBJECTIVES

- C1. Exposition of basic elementary functions and their properties.
- C2. Exposition of basic notions and theorems of differential calculus of functions of a single variable.
- C3. Introduction of the concept of the definite integral, its basic properties and methods of calculation.
- C4. Presentation of practical applications of methods of differential and integral calculus of functions of a single variable.

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge a student:

PEK_W1 knows the graphs and properties of basic elementary functions,

PEK_W2 knows basic notions and theorems of differential calculus of functions of a single variable,

PEK_W3 knows the concept of the definite integral, its properties and the basic applications.

Relating to skills a student:

PEK_U1 can solve typical equations and inequalities with elementary functions,

PEK_U2 can examine a function and draw its graph,

PEK_U3 can evaluate typical indefinite integrals and calculate definite integrals,
 PEK_U4 can apply differential and integral calculus to solve practical problems.

Relating to social competences a student:

PEK_K1 understands the need for systematic and independent work on mastery of course material.

PROGRAMME CONTENT		
Form of classes - lecture		Hours
Lec1	Definition of a function. Basic examples: linear, quadratic and polynomial functions. Rational functions. Composition of functions. Transformations of graphs of functions.	3
Lec2	Injective functions. The inverse function and its graph. Power and exponential functions and their inverses. Properties of logarithms.	2
Lec3	Trigonometric functions. Unit (trigonometric) circle. Inverse trigonometric functions.	2
Lec4	Sequences of real numbers. Finite and infinite limit of a sequence. Basic theorems on limits of sequences. Indeterminate expressions. The number e .	3
Lec5	The limit of a function at a point and the limit at infinity. Examples of the limits of certain indeterminate expressions. Asymptotes.	2
Lec6	Continuity of a function at a point and on an interval. Basic properties of continuous functions. Approximate solutions of equations.	2
Lec7	The derivative of a function. Geometrical and physical interpretations of the derivative. Tangent line. Differential of a function. Derivatives of basic elementary functions. Differentiation rules.	2
Lec8	Lagrange's theorem. Intervals of monotonicity of a function. De l'Hospital's rule.	2
Lec9	Local and global extrema. Examples of optimization problems.	2
Lec10	Definition and basic properties of indefinite integral. Basic rules. The substitution rule and integration by parts.	2
Lec11	Definition and basic properties of definite integral. Fundamental theorem of calculus (Newton-Leibniz theorem).	2
Lec12	Applications of integral calculus (e.g. average value of a function, area of a flat region, volumes of solids of revolution, arc length etc.)	2
Lec13	Integration of rational and trigonometric functions.	2
Lec14	Examples of applications of methods of mathematical analysis of a single variable (e.g. Taylor's theorem, convexity and inflection points of a function or other applications typical for the field of study).	2
Total hours		30
Form of classes – classes		Hours
Cl1	Elements of mathematical logic (logical connectives, quantifiers). Determination of the domain of a function. Even and odd functions.	2
Cl2	Composition of functions. Transformations of graphs of functions. Polynomial and rational equations and inequalities.	2
Cl3	The inverse function. Typical equations and inequalities with exponential and logarithmic functions.	2
Cl4	Trigonometric and inverse trigonometric functions. Unit (trigonometric) circle. Typical trigonometric equations and inequalities.	2
Cl5	Monotonicity and boundedness of sequences. Computing proper and improper limits of sequences.	2
Cl6	Limits of functions. Asymptotes.	2
Cl7	Continuity of a function. Approximate solutions of equations.	2

CI8	Derivative of a function. Rules of differentiation. Tangent line. Differentials and their applications.	2
CI9	De l'Hospital's rule. Intervals of monotonicity of a function.	2
CI10	Determining local and global extrema of a function.	2
CI11	Evaluation of indefinite integrals of elementary functions. Integration by parts and by substitution.	2
CI12	Calculating definite integrals. Area of a flat region as an application of definite integral.	2
CI13	Applications of definite integral.	2
CI14	Integration of rational and trigonometric functions.	2
CI15	Test.	2
Total hours		30

TEACHING TOOLS USED

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F-forming; P - concluding)	Educational effect number	Way of evaluating educational effect achievement
F-CI	PEK_U1-PEK_U4, PEK_K1	tests, oral presentations, quizzes
F-Lec	PEK_W1-PEK_W3	exam
P - rules set by the lecturer		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

- [1] G. Decewicz, W. Żakowski, Matematyka, Cz.1, WNT, Warszawa 2007.
- [2] M. Gewert, Z. Skoczylas, Analiza matematyczna 1. Definicje, twierdzenia, wzory, Oficyna Wydawnicza GiS, Wrocław 2015.
- [3] M. Gewert, Z. Skoczylas, Analiza matematyczna 1. Przykłady i zadania, Oficyna Wydawnicza GiS, Wrocław 2015.
- [4] W. Kryszicki, L. Włodarski, Analiza matematyczna w zadaniach, Cz. I, PWN, Warszawa 2006.

SECONDARY LITERATURE:

- [1] F. Leja, Rachunek różniczkowy i całkowy, PWN, 2012.
- [2] R. Leitner, Zarys matematyki wyższej dla studiów technicznych, cz.1-2, WNT, Warszawa 2006.
- [3] M. Zakrzewski, Markowe wykłady z matematyki. Analiza, Oficyna Wydawnicza GiS, Wrocław 2013.

SUBJECT SUPERVISORS

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**CORRELATION MATRIX BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
MATHEMATICAL ANALYSIS 1 MAT001648
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
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_W1		C1	Lec1-Lec6	N1-N4
PEK_W2		C2	Lec7-Lec9, Lec14	N1-N4
PEK_W3		C3	Lec10-Lec13	N1-N4
PEK_U1		C1	Lec1-Lec3, C11-C14	N1-N4
PEK_U2		C1	Lec5-Lec9, C15-C17	N1-N4
PEK_U3		C3	Lec10, Lec11, Lec13, C111, C112, C114	N1-N4
PEK_U4		C2, C4	Lec7, Lec12, Lec14, C18-C110, C112, C113	N1-N4
PEK_K1		C1-C4	Lec1-Lec14, C11-C114	N1-N4