SUBJECT CARD	
Name of subject in Polish	**ANALIZA MATEMATYCZNA 1A**
Name of subject in English	**MATHEMATICAL ANALYSIS 1A**
Profile:	**academic**
Level and form of studies:	**1st level, full-time**
Kind of subject:	**obligatory**
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)	**125**	**75**			
Form of crediting	Examination	crediting with grade*			
For group of courses mark (X) final course					
Number of ECTS points	**5**	**3**			
including number of ECTS points for practical classes (P)		**3**			
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	**1,5**	**1,5**			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

High school graduation at basic 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:
PEU_W01 knows the graphs and properties of basic elementary functions,
PEU_W02 knows basic notions and theorems of differential calculus of functions of a single variable,
PEU_W03 knows the concept of the definite integral, its properties and the basic applications.

Relating to skills a student:
PEU_U01 can solve typical equations and inequalities with elementary functions,

PEU_U02 can examine a function and draw its graph, can apply differential calculus to solve practical problems,
PEU_U03 can evaluate typical indefinite integrals and calculate definite integrals and can apply integral calculus to solve practical problems.

Relating to social competences a student:
PEU_K01 understands the need for systematic and independent work on mastery of course material.

PROGRAMME CONTENT

	Lecture	**Number of hours**
Lec 1	**Repetition and completion of information about functions.** Elements of mathematical logic. Definition of a function. Composition of functions. Transformations of graphs of functions. Monotonic, one-to-one function. Linear, quadratic, polynomials, rational functions.The inverse function and its graph. Power and exponential functions and their inverses. Unit (trigonometric) circle. Trigonometric and inverse trigonometric functions.	8
Lec 2	**Sequences of real numbers.** Bounded, monotonic sequences. Finite and infinite limit of a sequence. Theorems on limits of sequences. Indeterminate expressions. The number e.	3
Lec 3	**Limits of a function, asymptotes, continuous functions.** The limit of a function at a point and the limit at infinity. Limit theorems. Examples of the limits of certain indeterminate expressions. Asymptotes. Continuity of a function at a point and on an interval. Basic properties of continuous functions. Approximate solutions of equations.	4
Lec 4	**Differential calculus.** Definition of the derivative of a function. Geometrical and physical interpretations of the derivative. Derivatives of basic elementary functions. Differentiation rules. Differential of a function. Lagrange's theorem. Intervals of monotonicity of a function. De l'Hospital's rule. Local and global extrema. Examples of optimization problems.	7
Lec 5	**Indefinite integral.** Definition and basic properties of indefinite integral. Basic rules/formulas. The substitution rule and integration by parts. Integration of rational and trigonometric functions.	4
Lec 6	**Definite integral.** Definition and basic properties of definite integral. Fundamental theorem of calculus (Newton-Leibniz theorem). Applications of integral calculus (e.g. average value of a function, area of a flat region, arc length, volumes and lateral surface area of solids of revolution).	4
	Total hours	**30**

	Classes	**Number of hours**
Cl 1	**Repetition and completion of information about functions.** Elements of mathematical logic (logical connectives, quantifiers). Determination of the domain of a function. Checking whether a function is even or odd. Composition of functions. Transformations of graphs of functions. Typical equations and inequalities with exponential and	8

	logarithmic functions. The inverse function. Trigonometric and inverse trigonometric functions. Typical trigonometric equations and inequalities.	
Cl 2	**Sequences of real numbers.** Examination of monotonicity and boundedness of sequences. Computing limits of sequences.	2
Cl 3	**Limits of functions, asymptotes, continuous functions.** Computing limits of a function at a point and at infinity. Determination of asymptotes. Continuity testing. Approximate solutions of equations.	4
Cl 4	**Differential calculus.** Definicja pochodnej. Rules of differentiation Tangent line. Differential of a function. De l'Hospital's rule. Intervals of monotonicity of a function. Determining local and global extrema of a function.	7
Cl 5	**Indefinite integral.** Evaluation of indefinite integrals. Integration by parts and by substitution. Integration of rational and trigonometric functions.	3
Cl 6	**Definite integral.** Calculation of definite integrals. Usage definite integrals for calculating areas of flat regions, arc lengths, volumes and surface areas of solids of revolution.	4
Cl 6	**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 LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming during semester), P – concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
F, P - Cl	PEU_U1-PEK_U3 PEU_K1	Tests, oral presentations, quizzes
P - Lec	PEU_W1-PEU_W3	exam

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 2021.
[3] M. Gewert, Z. Skoczylas, Analiza matematyczna 1. Przykłady i zadania, Oficyna Wydawnicza GiS, Wrocław 2021.
[4] W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach, Cz. I, PWN, Warszawa 2006

SECONDARY LITERATURE:

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

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)
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