FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Analiza matematyczna 1**
Name in English:	**Mathematical Analysis 1**
Main field of study (if applicable):	**Electrical Engineering**
Specialization (if applicable):	
Level and form of studies:	**1st level, full-time**
Kind of subject:	**obligatory / university-wide**
Subject code:	**MAT001737**
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):	150	90			
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 (P) classes :		3			
including number of ECTS points for direct teacher-student contact (BK) classes:	3.50	2.10			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. 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 LEARNING OUTCOMES

relating to knowledge:

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 notion of definite integral and its basic applications.

relating to skills:

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, can apply integral calculus to solve practical problems,

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	Definition of a function. Basic examples: linear, quadratic and polynomial functions. Rational functions. Composition of functions. Transformations of graphs of functions.	3
Lec 2	Injective functions. The inverse function and its graph. Power and exponential functions and their inverses. Properties of logarithms.	2
Lec 3	Trigonometric functions. Unit (trigonometric) circle. Inverse trigonometric functions.	2
Lec 4	Sequences of real numbers. Finite and infinite limit of a sequence. Basic theorems on limits of sequences. Indeterminate expressions. The number e.	3
Lec 5	The limit of a function at a point and the limit at infinity. Examples of the limits of certain indeterminate expressions. Asymptotes.	2
Lec 6	Continuity of a function at a point and on an interval. Basic properties of continuous functions. Approximate solutions of equations.	2
Lec 7	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
Lec 8	Lagrange's theorem. Intervals of monotonicity of a function. De l'Hospital's rule.	2
Lec 9	Local and global extrema. Examples of optimization problems.	2
Lec 10	Definition and basic properties of indefinite integral. Basic rules. The substitution rule and integration by parts.	2
Lec 11	Definition and basic properties of definite integral. Fundamental theorem of calculus (Newton-Leibniz theorem).	2
Lec 12	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
Lec 13	Integration of rational and trigonometric functions.	2
Lec 14	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 - class		**Number of hours:**
Cl 1	Elements of mathematical logic (logical connectives, quantifiers). Determination of the domain of a function. Even and odd functions.	2
Cl 2	Composition of functions. Transformations of graphs of functions. Polynomial and rational equations and inequalities.	2
Cl 3	The inverse function. Typical equations and inequalities with exponential and logarithmic functions.	2
Cl 4	Trigonometric and inverse trigonometric functions. Unit (trigonometric) circle. Typical trigonometric equations and inequalities.	2
Cl 5	Monotonicity and boundedness of sequences. Computing proper and improper limits of sequences.	2
Cl 6	Limits of functions. Asymptotes.	2
Cl 7	Continuity of a function. Approximate solutions of equations.	2
Cl 8	Derivative of a function. Rules of differentiation. Tangent line. Differentials and their applications.	2
Cl 9	De l'Hospital's rule. Intervals of monotonicity of a function.	2
Cl 10	Determining local and global extrema of a function.	2
Cl 11	Evaluation of indefinite integrals of elementary functions. Integration by parts and by substitution.	2
Cl 12	Calculating definite integrals. Area of a flat region as an application of definite integral.	2
Cl 13	Applications of definite integral.	2
Cl 14	Integration of rational and trigonometric functions.	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	
F1(C)	PEU_U01 PEU_U02 PEU_U03 PEU_K01	oral presentations, quizzes, tests
P(C)	P=F1	

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. Krysicki, 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 SUPERVISOR

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