

## FACULTY

### SUBJECT CARD

Name in English	<b>Mathematical Analysis</b>
Name in Polish	<b>Analiza Matematyczna</b>
Main field of study (if applicable)	
Specialization (if applicable)	
Level and form of studies	<b>I level, full-time</b>
Kind of subject	<b>obligatory</b>
Subject code	<b>MAT001446</b>
Group of courses	<b>No</b>

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	45	30			
Number of hours of total student workload (CNPS)	150	90			
Form of crediting	exam	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	0	3			
including number of ECTS points for direct teacher-student contact (BK) classes	3	2			

### 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. Understanding the basic methods of analysis of the graph of functions of single variable.
- C2. Understanding the concept of the definite integral and its basic properties and methods of determination.
- C3. Understanding the practical applications of mathematical methods for the analysis of functions of single variable.

### SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:

- PEK\_W1. Knows the basic definitions and theorems from Mathematical Analysis of functions of single variable.
- PEK\_W2. Knows the notion of the derivative and the definite integral and their basic applications.

Relating to skills:

- PEK\_U1. Can examine graphs of simple functions.
- PEK\_U2. Can calculate integrals of simple functions.

Relating to social competences:

- PEK\_K1. Understand how calculus affects on the development of technical civilization

<b>PROGRAM CONTENT</b>		
<b>Form of classes - lectures</b>		<b>Hours</b>
Wy1	Mathematical notation with quantifiers, elements of set theory, real numbers, subsets of real numbers (intervals, half-lines). Linear and quadratic functions.	3.0
Wy2	Basic properties of functions (symmetry, monotonicity, periodicity). Algebra of functions. New functions from old functions, transformations of functions.	3.0
Wy3	Composite functions. The inverse function. Power and exponential functions and their inverses. Properties of logarithms.	3.0
Wy4	Trygonometric functions and their graphs. Trygonometric identities. Cyclometric functions and their graphs .	3.0
Wy5	Sequences and limits. Limits Laws. Squeeze theorem. Monotonic sequence theorem and the number e. Improper limits.	3.0
Wy6	The limit of a function at a point. One-sided limits. Limits Laws. Squeeze Theorem.	3.0
Wy7	Limits involving infinity. Asymptotes of functions.	
Wy8	Continuity of a function at a point and on an interval. Basic properties of conituous functions. Intermediate Value Theorem and approximate solutions of equations. Points of discontinuity.	3.0
Wy9	The derivative of a function. Geometrical and physical interpretations of the derivative. Rules of differentiation. The Mean Value Theorem.	3.0
Wy10	Indetetminate forms and L'Hospital's rule. Extreme values. Derivatives and the Shapes of curves. Convexity of a function.	3.0
Wy11	The closed interval method. Optimization problems	3.0
Wy12	Antiderivatives and indefinite integrals. The substitution rule and integration by parts. Integration of rational functions by partial fractions.	3.0
Wy13	The definite integral and its area interpretation. The Fundamental Theorem of Calculus.	3.0
Wy14	Applications of Integration: Average value of a function, Areas, Arc length, Volumes of solids .	3.0
Wy15	Applications of methods of mathematical analysis of single variable.	3.0
<b>Total hours</b>		<b>45</b>
<b>Form of classes - classes</b>		<b>Hours</b>
Cw1	Statements, logic connectives, union, intersection, difference and complement of a set. Cartesian product.	2.0
Cw2	Natural numbers, integers, rational and real numbers. Absolute value	2.0
Cw3	Properties of functions. Transformations of functions	2.0
Cw4	Inverse function. Composite functions.	2.0
Cw5	Trygonometric functions and trygonometric identities. Cyclometric functions	2.0
Cw6	Limist of sequences.	2.0
Cw7	The limit of a function at a point. Limit laws.	2.0
Cw8	Continuous functions. Points of discontinuity. Solutions of equations	2.0
Cw9	Derivatives. Rules of differentiation..	2.0
Cw10	Indeterminate forms and L'Hospital's rule.	2.0
Cw11	The closed interval method and optimization problems	2.0
Cw12	Derivatives and the Shapes of Curves.	2.0
Cw13	Integration – I.	2.0
Cw14	Integration – II.	2.0
Cw15	Applications of Integration.	2.0
<b>Total hours</b>		<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 (F-forming; P - concluding)	Educational effect number	Way of evaluating educational effect achievement
P-Cw	PEK_U01, PEK_U02, PEK_K1	quizzes, in class presentations
P-W	PEK_W01, PEK_W02	exam

**PRIMARY AND SECONDARY LITERATURE**

**PRIMARY**

- A1. J. Stewart, Calculus: concepts and contexts, single variable, Brooks/Cole Publishing Company 1998  
 A2. F. Leja, Rachunek Różniczkowy i Całkowy, Wydawnictwo Naukowe PWN, 2012  
 A3. W. Kryszicki, L. Włodarski, Analiza Matematyczna w Zadaniach, Cz. I, PWN, Warszawa 2006

**SECONDARY**

- B1. K. Kuratowski, Rachunek Różniczkowy i Całkowy. Funkcje Jednej Zmiennej, Wydawnictwo Naukowe PWN, 2012  
 B2. M. Gewert, Z. Skoczylas, Analiza Matematyczna 1. Przykłady i Zadania, Oficyna Wydawnicza GiS, Wrocław 2011

**SUBJECT SUPERVISORS**

1. Wydziałowa Komisja Programowa ds. kursów ogólnouczelnianych  
 2. prof. dr hab. Krzysztof Kołodziejczyk (Krzysztof.Kolodziejczyk@pwr.edu.pl)

**MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT**

**Mathematical Analysis MAP001100**

**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	Wy1 Wy2 Wy3 Wy4 Wy5 Wy6 Wy7 Wy8 Wy9 Wy10 Wy11 Wy12 Wy13 Wy14 Wy15 Cw1 Cw2 Cw3 Cw4 Cw5 Cw6 Cw7 Cw8 Cw9 Cw10 Cw11 Cw12 Cw15	N1, N2, N3
PEK_W2		C2 C3	Wy11 Wy12 Wy13 Wy14 Wy15 Cw13 Cw14 Cw15	N1, N2, N3
PEK_U1		C1	Wy1 Wy2 Wy3 Wy4 Wy5 Wy6 Wy7 Wy8 Wy9 Wy10 Wy15 Cw1 Cw2 Cw3 Cw4 Cw5 Cw6 Cw7 Cw8 Cw9 Cw10 Cw11 Cw12 Cw15	N1, N2, N3
PEK_U2		C1 C2 C3	Wy11 Wy12 Wy13 Wy14 Wy15 Cw13 Cw14 Cw15	N1, N2, N3
PEK_K1		C1 C2	Wy9 Wy10 Wy11 Wy12 Wy13 Wy14 Wy15 Cw12 Cw13 Cw14 Cw15	N1, N2, N3