Attachment No. 5 to Rector's ordinance No. 22/2020

DESCRIPTION OF THE COURSE OF STUDY

Course code	0541.6.MAT2.C.AZ	
Name of the course in	Polish	**Analiza Zespolona**
	English	**Complex Analysis**

1. LOCATION OF THE COURSE OF STUDY WITHIN THE SYSTEM OF STUDIES

1.1. Field of study	mathematics
1.2. Mode of study	full-time studies
1.3. Level of study	Graduate (Master)
1.4. Profile of study*	general academic profile of studies
1.5. Person/s preparing the course description	dr Michał Zakrzewski
1.6. Contact	zakrzewski@mimuw.edu.pl

2. GENERAL CHARACTERISTICS OF THE COURSE OF STUDY

2.1. Language of instruction	Polish and English
2.2. Prerequisites*	Mathematical Analysis III and IV, Linear Algebra and Geometry

3. DETAILED CHARACTERISTICS OF THE COURSE OF STUDY

3.1. Form of classes		lectures and classes
3.2. Place of classes		classes in the UJK teaching room
3.3. Form of assessment		Exam (lectures), graded credit (classes)
3.4. Teaching methods		Lecture Classes - discusions, solving problems
3.5. Bibliography	**Required reading**	1. F. Leja, Funkcje Zespolone, PWN, 2006. 2. B. W. Szabat, Wstęp do Analizy Zespolonej, PWN, 1974.
	Further reading	1. W. Rudin, Analiza rzeczywista i zespolona, PWN, 2009

4. OBJECTIVES, SYLLABUS CONTENT AND INTENDED LEARNING OUTCOMES

4.1. Course objectives ***(including form of classes)***

Lecture

C1 - to get acquainted with the theory and basic methods of complex analysis and numerous relationships of this field of mathematical analysis.

C2 - to acquire basic skills in using methods of complex analysis

C3 - to present basic properties of objects that are the subject of study of complex analysis

Classes

C1 - to master the apparatus concerning holomorphic functions

C2 - to develop the habit of learning, improving one's own work and formulating questions to deepen one's own understanding of complex analysis

4.2. Detailed syllabus ***(including form of classes)***

Lectures

Complex differentiability, Cauchy Riemann equations, path integral, Cauchy formula, analyticity of holomorphic function, consequences of Cauchy formula; maximum principle, Louiville's theorem, proof of the fundamental theorem of algebra, singularities of analytic functions, poles, meromorphic and rational functions, residues, applications of residues in calculating improper integrals and in summation of series, Conformal mappings, Riemann's mapping theorem. Information on essential singularities; Picard's theorem.

Classes

Homographies and their properties, applications of complex functions in classical geometry. Complex differentiability, Cauchy-Riemann equations, path integral, Cauchy formula, analyticity of holomorphic function. Calculation of improper integrals by the residue method, finding formulas for conformal transformations of given areas, locating zeros of polynomials.

4.3 Intended learning outcomes

Code	**A student, who passed the course**	**Relation to learning outcomes**
within the scope of **KNOWLEDGE:**		
W01	knows the equivalent definitions of the holomorphic function	MAT2A_W01 MAT2A_W02
W02	knows the basic properties of holomorphic and harmonic functions and their applications (fun-	MAT2A_W01

	damental theorem of algebra)	MAT2A_W02 MAT2A_W03
W03	knows the concept of pole, residue and their applications	MAT2A_W01 MAT2A_W02 MAT2A_W03
W04	knows the concept of conformal mapping and applications of analytic functions related to this notion	MAT2A_W01 MAT2A_W02 MAT2A_W03
within the scope of **ABILITIES:**		
U01	checks the analyticity of functions and represents meromorphic functions as Laurent series.	MAT2A_U01 MAT2A_U03
U02	calculates integrals along paths.	MAT2A_U01 MAT2A_U03
U03	calculates selected integrals and sums series using the residue method.	MAT2A_U01 MAT2A_U03
within the scope of **SOCIAL COMPETENCE:**		
K01	Analyzes the logical accuracy of his own and other people's speech, strives for precision in writing down text	MAT2A_K04 MAT2A_K05
K02	Strives to fully understand issues by asking appropriate questions.	MAT2A_K04

4.4. Methods of assessment of the intended learning outcomes

Teaching outcomes *(code)*	**Method of assessment (+/-)**																				
	Exam oral/written*			**Test***			**Project***			**Effort in class***			**Self-study***			**Group work***			**Others* e.g. standardized test used in e-learning**		
	Form of classes			***Form of classes***			***Form of classes***			***Form of classes***			***Form of classes***			***Form of classes***			***Form of classes***		
	L	*C*	*...*	*L*	*C*	*...*	*L*	*C*	*...*	*L*	*C*	*...*	*L*	*C*	*...*	*L*	*C*	*...*	*L*	*C*	*...*
W01	+				+					+	+		+	+							
W02	+				+					+	+		+	+							
W03	+				+					+	+		+	+							
U01					+					+	+		+	+							
U01					+					+	+		+	+							
U02					+					+	+		+	+							
U03					+					+	+		+	+							
U04					+					+	+		+	+							
K01	+				+					+	+		+	+							
K02	+									+	+		+	+							

delete as appropriate

4.5. Criteria of assessment of the intended learning outcomes

Form of classes	**Grade**	**Criterion of assessment**
lecture (L) (including e-learning)	**3**	at least 50% and no more than 60% of the total number of points possible
	3,5	more than 60% and no more than 70% of the total number of points possible
	4	more than 70% and no more than 80% of the total number of points possible
	4,5	more than 80% and no more than 90% of the total number of points possible
	5	more than 90% of the total number of points possible
classes (C)* (including e-learning)	**3**	at least 50% and no more than 60% of the total number of points possible
	3,5	more than 60% and no more than 70% of the total number of points possible
	4	more than 70% and no more than 80% of the total number of points possible
	4,5	more than 80% and no more than 90% of the total number of points possible
	5	more than 90% of the total number of points possible

5. BALANCE OF ECTS CREDITS – STUDENT'S WORK INPUT

Category	**Student's workload**

	Full-time studies	Extramural studies
NUMBER OF HOURS WITH THE DIRECT PARTICIPATION OF THE TEACHER /CONTACT HOURS/	***64***	
*Participation in lectures**	30	
*Participation in classes, seminars, laboratories**	30	
*Preparation in the exam/ final test**	4	
INDEPENDENT WORK OF THE STUDENT/NON-CONTACT HOURS/	***36***	
*Preparation for the lecture**	10	
*Preparation for the classes, seminars, laboratories**	10	
*Preparation for the exam/test**	16	
TOTAL NUMBER OF HOURS	***100***	
ECTS credits for the course of study	***4***	

****delete as appropriate***

Accepted for execution *(date and legible signatures of the teachers running the course in the given academic year)*

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