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

DESCRIPTION OF THE COURSE OF STUDY

Course code	0541.6.MAT2.C.MNAA	
Name of the course in	Polish	**Metody numeryczne i analiza algorytmów**
	English	**Numerical Methods and Analysis of Algorithms**

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 Anatolii Nikitin
1.6. Contact	anatolii.nikitin@ujk.edu.pl

2. GENERAL CHARACTERISTICS OF THE COURSE OF STUDY

2.1. Language of instruction	Polish and English
2.2. Prerequisites*	

3. DETAILED CHARACTERISTICS OF THE COURSE OF STUDY

3.1. Form of classes		Lectures and laboratories
3.2. Place of classes		classes in the UJK teaching room
3.3. Form of assessment		Graded credit (lecture, laboratory exercises)
3.4. Teaching methods		lecture - informative lecture laboratory exercises - problem-solving with the participation of the laboratory teacher, discussion, work with a book.
3.5. Bibliography	**Required reading**	F. Szidarovszky, S. J. Yakowitz. Principles and Procedures of Numerical Analysis, Springer, 1978 T. Cormen, C. Leiserson, R. Rivest, Introduction to algorithms, WNT, 1997.
	Further reading	D. Kincaid, W. Cheney, Numerical Analysis, WNT, 2006. A.V. Aho, J.E. Hopcroft, J.D.Ullman, Algorithms and Data Structures, Helion, 2003. L. Banachowski, K.Diks, W. Rytter, Algorithms and data structures, WNT, 2001, 2003. Z. Fortuna, B. Macukow, J. Wasowski, Numerical methods, WNT, 1993. A. Kiełbasiński, H. Schwetlick, Numerical Linear Algebra, WNT, 1992. J. Povstenko, Introduction to umber methods, Akade-micka Oficyna Wydawnicza EXIT, 2005.

4. OBJECTIVES, SYLLABUS CONTENT AND INTENDED LEARNING OUTCOMES

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

Lectures

C1 - familiarizing students with the field of numerical methods and selected issues of numerical analysis, numerical linear algebra, and numerical solution of differential equations

C2 - presentation of the fundamental issues of algorithm analysis

Laboratories

C1 - teaching practical computer implementation of selected numerical methods, in particular algorithm analysis

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

Lecture:

Formalization of the concept of error. Sources of errors. Floating point arithmetic, loss of significant digits, numerical error. Approximation of functions. Error of the Lagrange interpolation polynomial. Numerical differentiation. Numerical integration. Numerical solution of equations and systems of equations. Numerical solution of ordinary and stochastic differential equations. Algorithm. Correctness of the algorithm. Algorithm analysis. Computational complexity of algorithms (pessimistic, expected). Complexity classes - P problem, NP problem. Recursion. Recursive equations and methods of solving them. Stable and unstable algorithms.

Laboratory exercises:

Learning about selected numerical algorithms and their application to solve mathematical problems. Computer realizations of selected numerical methods. Identifying and specifying algorithmic problems. Analysis of the complexity of algorithms. Discussion of self-implemented projects.

4.3 Intended learning outcomes

Code	A student, who passed the course	Relation to learning outcomes
within the scope of **KNOWLEDGE:**		
W01	understands the concept of an algorithm and its correctness	MAT2A_W05
W02	defines the computational complexity of algorithms	MAT2A_W05
W03	knows the computational complexity classes of algorithms	MAT2A_W05
W04	defines the error of numerical calculations and knows their sources	MAT2A_W01 MAT2A_W05
W05	knows numerical methods related to selected mathematical problems	MAT2A_W05
within the scope of **ABILITIES:**		
U01	recognizes the problem, including practical issues that can be solved algorithmically.	MAT2A_U15
U02	understands the mathematical foundations of algorithm analysis and is able to determine the computational complexity of selected algorithms	MAT2A_U15
U03	is able to construct algorithms for solving selected numerical problems	MAT2A_U15
U04	can arrange and analyze an algorithm compliant with the specification and write it in a selected programming language	MAT2A_U15
U05	compiles, runs and tests a self-written computer program	MAT2A_U15
U06	can independently search for necessary information in the literature	MAT2A_U13
within the scope of **SOCIAL COMPETENCE:**		
K01	formulates precisely questions to deepen his own understanding of a given topic or to find missing elements of reasoning	MAT2A_K02
K02	analyzes the logical accuracy of other people's statements and strives for the precision of his own statements	MAT2A_K04

4.4. Methods of assessment of the intended learning outcomes

Teaching outcomes *(code)*	Method of assessment (+/-)					
	Reports			Project*		
	Form of classes			*Form of classes*		
	L	*C*	*Lab*	*L*	*C*	*Lab*
W01	+					
W02	+					
W03	+					
W04	+					
W05	+					
U01						+
U02						+
U03						+
U04						+
U05						+
U06						+
K01						+
K02						+

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

laboratiries (Lab)* (in-cluding 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/	***45***	
*Participation in lectures**	15	
*Participation in classes, seminars, laboratories**	30	
INDEPENDENT WORK OF THE STUDENT/NON-CONTACT HOURS/	***30***	
*Preparation for the lecture**	0	
*Preparation for the classes, seminars, laboratories**	10	
Preparation of reports	10	
*Gathering materials for the project/Internet query**	10	
TOTAL NUMBER OF HOURS	***75***	
ECTS credits for the course of study	***3***	

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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