DESCRIPTION OF THE COURSE OF STUDY

Course code	**0719-2ID-F65-MMF**	
Name of the course in	Polish	***Metody matematyczne w fizyce***
	English	***Mathematical methods in physics***

1. **LOCATION OF THE COURSE OF STUDY** within the system of studies

1.1. Field of study	**Data engineering**
1.2. Mode of study	**Full time**
1.3. Level of study	**First-cycle degree**
1.4. Profile of study*	**General academic**
1.5. Person/s preparing the course description	**Tadeusz Kosztołowicz**
1.6. Contact	**tadeusz.kosztolowicz@ujk.edu.pl**

2. **GENERAL CHARACTERISTICS OF THE** course of study

2.1. Language of instruction	**English**
2.2. Prerequisites*	**Knowledge of the material covered in the subjects Mathematics 1 and Mathematics 2**

3. **DETAILED CHARACTERISTICS OF THE COURSE OF STUDY**

3.1. **Form of classes**		**lectures, classes**
3.2. **Place of classes**		**classes in the teaching rooms of UJK**
3.3. **Form of assessment**		**lectures – pass with grade, classes – pass with grade**
3.4. **Teaching methods**		**lectures, classes**
3.5. **Bibliography**	**Required reading**	**1. H.S. Carslaw, J.C. Jaeger, Conduction of heat in solids, Clarendon, Oxford** **2. F.W. Byron, R.W. Fuller, Mathematics of classical and quantum physics, vol. I and II, Dover Publ., NY 1992**
	Further reading	1. **S. Selcuk Bayin, Essentials of mathematical methods in science and engineering, Wiley 2008** 2. **S.D. Lindenbaum, Mathematical methods in physics, World Sci. 1996**

4. **OBJECTIVES, SYLLABUS CONTENT AND INTENDED LEARNING OUTCOMES**

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

Lectures:

C1. Introduction to linear ordinary and partial differential equations describing physical processes and methods for solving them.

C2. Familiarization with the basics of applying matrix calculus to operator calculus used in physical models.

Classes:

C3. Acquiring the ability to solve linear ordinary and partial differential equations.

C4. Acquiring the ability to apply matrix calculus to linear operator calculus.

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

Lectures

Elements of vector calculus, basis and dimension of vector spaces. The dot product of vectors. Orthogonal and orthonormal bases. Linear operators, matrix representation of linear operators. Hermitian and unitary operators. Eigenvalues and eigenvectors of linear operators. The vector product. The Fourier transform and the Laplace transform. The Dirac delta function. Solving first- and second-order linear ordinary equations with constant coefficients. Linear partial differential equations with constant coefficients, the transform method and the separation of variables method for solving these equations. Integrals of functions of several variables. Undirected and directed line integrals. Independence of the directed line integral from the path of integration. Field operators: gradient, divergence, rotation, Laplacian.

Exercises.

Determining the bases of various vector spaces. Determining the coordinates of a vector in various bases. Determining the matrices of linear operators and their operations. Using the dot product in vector calculations. Calcu-

lating the eigenvalues and eigenvectors of linear operators. Solving differential equations using the transform method and the separation of variables method. Calculating line integrals. Deriving identities for field operators.

4.3 Intended learning outcomes

Code	A student, who passed the course	Relation to learning outcomes
within the scope of **KNOWLEDGE:**		
W01	knows the basic methods of modeling physical processes	ID1A _W01 ID1A _W11 ID1A _W12
W02	knows the basic methods of solving equations occurring in these models	ID1A _W01 ID1A _W11 ID1A _W12
within the scope of **ABILITIES:**		
U01	is able to perform basic calculations related to the calculus of vectors and linear operators, in particular is able to use matrix calculus in these calculations	ID1A_U01 ID1A_U08 ID1A_U11
U02	Is able to solve linear differential equations and calculate line integrals	ID1A_U01 ID1A_U08 ID1A_U11
within the scope of **SOCIAL COMPETENCE:**		
K01	is able to define priorities for the implementation of the task	ID1A_K01 ID1A_K03
K02	is able to formulate questions and problems precisely	ID1A_K01 ID1A_K03

Teaching outcomes *(code)*	Exam oral/written*			Test*			Project*			Effort in class*			Self-study*		
	Form of classes			*Form of classes*			*Form of classes*			*Form of classes*			*Form of classes*		
	L	*C*	*P*	*L*	*C*	*P*	*L*	*C*	*P*	*L*	*C*	*P*	*L*	*C*	*P*
W01	+				+				+					+	+
W02	+				+				+					+	+
U01	+				+				+		+			+	+
U02	+				+				+		+			+	+
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**	Achievement <50 - 60) % of the requirements used in the assessment methods
	3,5	Achievement <60 - 70) % of the requirements used in the assessment methods
	4	Achievement <70 - 80) % of the requirements used in the assessment methods
	4,5	Achievement <80 - 90) % of the requirements used in the assessment methods
	5	Achievement <90 - 100) % of the requirements used in the assessment methods
classes (C)* (including e-learning)	**3**	Achievement <50 - 60) % of the requirements used in the assessment methods
	3,5	Achievement <60 - 70) % of the requirements used in the assessment methods
	4	Achievement <70 - 80) % of the requirements used in the assessment methods
	4,5	Achievement <80 - 90) % of the requirements used in the assessment methods

	5	Achievement <90 - 100) % of the requirements used in the assessment methods

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/	***75***	
*Participation in lectures**	***30***	
Participation in classes	***30***	
Project	***15***	
INDEPENDENT WORK OF THE STUDENT/NON-CONTACT HOURS/	***50***	
*Preparation for the lecture**	***5***	
Preparation for the classes	***10***	
*Preparation for the exam/test**	***15***	
Gathering materials for the project	***20***	
TOTAL NUMBER OF HOURS	***125***	
ECTS credits for the course of study	***5***	

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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