STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Mathematics		**1010401211010340022**
Field of study	Profile of study (general academic, practical)	Year /Semester
TECHNICAL PHYSICS	**general academic**	**1 / 1**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**Polish**	**obligatory**
Cycle of study:	Form of study (full-time,part-time)	
First-cycle studies	**full-time**	
No. of hours		No. of credits
Lecture: **4** Classes: **3** Laboratory: **-** Project/seminars: **-**		**7**
Status of the course in the study program (Basic, major, other)	(university-wide, from another field)	
other	**university-wide**	
Education areas and fields of science and art		ECTS distribution (number and %)
technical sciences		**7 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Has knowledge of mathematics at the secondary level.
2	**Skills**	Has the ability to think logically (derivation of new facts basing on known). Has the ability to use mathematical tools to solve problems in the field of secondary education. Has the ability to learn with the understanding.
3	**Social competencies**	Knows the limits of his own knowledge and understands the need for further education. Can independently search for information in the literature, including in foreign languages.

Assumptions and objectives of the course:

-Learning the use of mathematical tools and methods to describe and solve simple technical problems. Indication of the possibility of the application of mathematics in more complex issues.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Knows mathematical methods essential for describing basic physical laws and solving problems related to technical physics including: basic concepts of differential and integral calculus, linear algebra and analytical geometry - [K_W01]
2. Has knowledge of mathematics needed to use mathematical tools to describe aspects of mechanics, constructions and technological processes - [K_W07]
3. Has knowledge of the appropriate use of computational techniques, supporting the work of the engineer while understanding the limitations - [K_W01]

Skills:

1. Is able to use knowledge she or he has acquired to describe processes, create models in the area of technical physics - [K_U01]
2. Is able to use analytical methods to formulate and solve problems in the area of measuring physical quantities - [K_U01]
3. Is able to extract information from the literature, databases and other sources, interpret it and draw conclusions, formulate and justify opinions - [K_U02]
4. Is able to plan and arrange self-education process - [K_U03]
5. Is able to make correct use of standard analytical tools, including numerical and calculation ones, to solve detailed physical and technical problems; is able to make a critical evaluation of results of such analysis - [K_U09]

Social competencies:

1. Follows the rules of professional ethics, is responsible for the reliability of results obtained in his or her work and their interpretation, and the assessment of work done by others - [K_K02]
2. Understands the need of and opportunities for continuous self-improvement (first- and second-cycle studies, postgraduate studies) - raising his or her professional, personal and social competences - [K_K03]
3. Is able to think and act in a creative and entrepreneurial manner - [K_K08]

Assessment methods of study outcomes

-Lectures:

Assessment of knowledge and skills in the written exam

Assessment of knowledge and skills during the oral exam

-Classes:

Assessment of knowledge and skills related to solving the tasks on the basis of written tests

Assessment of students readiness for exercises (the questions devoted to issues / tasks discussed in the lecture) on the basis of written tests

Course description

-Lectures:

SEQUENCES OF REAL NUMBERS (the definition of a sequence, bounded sequences, increasing and decreasing sequences, the fundamental definition of limit, rules for manipulating limits, improper limits, rules for manipulations with infinity, theorem of three sequences, Euler number and its value, indeterminant expressions).

ELEMENTARY FUNCTIONS (the definition of a real-valued function, increasing and decreasing functions, injective functions, inverse functions, composed functions, the trigonometric functions, the hyperbolic functions, the inverse trigonometric functions, limits of functions, definition of continuous function at a point, asymptotes, the definition of the derivative and the geometric interpretation, basic rules of derivatives, the rule for differentiating inverse functions, higher derivatives, the derivative of a composed function - the chain rule, del Hospital rule, applications of derivatives, curvature and curvature radius, mean value theorem, local extrema and critical points - necessary and sufficient condition for a local extremum, criterions for increasing or decreasing, inflection points - necessary and sufficient condition for an inflection point, local concavity and local convexity).

INDEFINITE INTEGRAL (definition of the indefinite integral and the primitive function, properties of integrals, integration by parts, substitution formula).

DEFINITE INTEGRAL (definition of the definite integral, properties of integrals, integration by parts, substitution formula, the geometric interpretation of the definite integral, applications to arc length of a plane curve, applications to plane area, applications to the lateral surface and to the volume of a solid of revolution with respect to the axis OX, and OY).

INFINITE SERIES (definition, necessary conditions for convergence, criteria for convergence - the comparison test, the ratio test, the root test, the integral test, Leibniz criterion for alternating series, power series - definition, radius of convergence, Taylor series and application to infinite series - expansion to real functions, Fourier series).

FUNCTION OF TWO VARIABLES (the definition of a real-valued function, the definition of partial derivatives, higher partial derivatives, the derivative of implicit functions, the definition of the total differential, Schwarz theorem, local extrema - necessary and sufficient condition for a local extremum, the local minimum and local maximum)

COMPLEX NUMBERS (absolute value, arguments, the principal value of the argument; a geometric interpretation, Cartesian representation, in polar coordinates, Gaussian plane, rules for arithmetic, roots, square roots, solving quadratic equations in the complex domain, De Moivres formula)

ORDINARY DIFFERENTIAL EQUATIONS OF FIRST-ORDER (definition, the initial-value problem, the general solution, an explicit solution, the equation with separated variables, the homogeneous equation, linear homogeneous and non-homogeneous equations, Bernoulli equation, the exact differential equation, and a general strategy for finding solutions).

ORDINARY DIFFERENTIAL EQUATIONS OF SECOND-ORDER REDUCIBLE TO ORDINARY DIFFERENTIAL EQUATIONS OF FIRST-ORDER (types and a general strategy for finding solutions).

ORDINARY LINEAR DIFFERENTIAL EQUATIONS OF SECOND-ORDER WITH CONSTANT COEFFICIENTS (a form of linear second-order equations with real constant coefficients, homogeneous differential equations with constant coefficients, auxiliary equation - characteristic equation, the complementary function, nonhomogeneous differential equations with constant coefficients, the method of undetermined coefficient, the particular solution, linear dependence and independence of solutions, the Wronskian)

and

applications of the above issues in the technics, particularly in mechanics and physics

-Classes:

the acquisition of practical skills in solving tasks of selected issues discussed during the lectures

Basic bibliography:

1. M. Gewert, Z. Skoczylas: Analiza matematyczna I i II, Algebra liniowa I i II, Równania różniczkowe zwyczajne.
2. I. Foltyńska, Z. Ratajczak, Z. Szafrański: Matematyka dla studentów uczelni technicznych, cz.1, cz.2, cz.3, Wyd. Poznań: Politechnika Poznańska.

Additional bibliography:

1. W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach, cz.1, cz.2, Wydawnictwo naukowe PWN, Warszawa

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	60
2. Participation in classes	45
3. Preparation for tests at each subsequent classes	22
4. Preparation for each classes	11
5. Preparation for written test / oral	10
6. Assessment classes	4
7. The written exam / oral	4
8. Consultations	4

Student's workload

Source of workload	hours	ECTS
Total workload	160	7
Contact hours	117	5
Practical activities	45	2