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	**(brak)**	**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)
(brak)	**(brak)**

Education areas and fields of science and art	ECTS distribution (number and %)
the sciences	**7 100%**
Physical 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:

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 Moivre?s formula)

LINEAR ALGEBRA (the Cartesian product, definition of a matrix, algebraic operations: addition of two matrices, multiplication of a matrix by a number, multiplication of two matrices, the definition of the determinant, properties of determinants, the calculation of three-rowed determinants, Laplacian rule for the development of determinants, inverse matrices, transposed matrices, the definition of the rank of a matrix, algorithms for determining the rank, systems of linear equations and solutions: Cramer's theorem, Kronecker-Capelli theorem, a homogeneous system, the Gaussian algorithm; eigenvalues and eigenvectors)

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, L?Hospital?s 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).

VECTOR ALGEBRA AND VECTOR ANALYSIS

(scalars, vectors, affine vectors, definition of vector, linear combinations, definition of scalar multiplication of a vector, parallelism, definition of vector addition, linear independence, free vectors, definition of the scalar product, orthogonality, definition of the vector product, triple product, expressions in a Cartesian coordinate system, gradient, divergence, curl)

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)

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