STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Mathematics**		Code **101010412101010340004**
Field of study **Civil Engineering First-cycle Studies**	Profile of study (general academic, practical) **general academic**	Year /Semester **1 / 2**
Elective path/specialty **-**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time) **part-time**	

No. of hours				No. of credits
Lecture: **32** Classes: **20** Laboratory: **-** Project/seminars: **-**				**6**

Status of the course in the study program (Basic, major, other) **basic**	(university-wide, from another field) **university-wide**

Education areas and fields of science and art	ECTS distribution (number and %**)**

technical sciences
    Technical sciences
	6 100%
	    6 100%

Responsible for subject / lecturer:	Responsible for subject / lecturer:
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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Has knowledge of mathematics of the first semester of undergraduate study
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 of the first semester of undergraduate study. 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. Student knows formulas, diagrams and properties of elementary functions. - [K_W01]

2. Student knows the meaning of a limit of function . - [K_W01]

3. Student knows: the meaning of derivative of a function and its geometric and physical interpretation, rules of derivations of functions, meaning of indefinite integral of function and basic method of integration and geometric interpretation of definite integral. - [K_W01]

Skills:

1. Student uses notation of limit for study of behavior of function on ends of domain intervals. - [K_U01, K_U02]

2. Student analyses properties of functions with applications of differential calculus methods. - [K_U02, K_U07]

3. Student apply integral calculus in engineering practice. - [K_U02, K_U07]

4. Student builds mathematical models of simple phenomena and processes in nature - [K_U09, K_U10]

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

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)

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)

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)

MULTIPLE INTEGRALS (definition of the double integral, a region of type I (x-section), a region of type II (y-section), iterated integrals, evaluation of double integrals, reversing the order of integration, double integrals in polar coordinates - Jacobian functional determinant, the triple integral, evaluation by iterated integrals, triple integrals in cylinder coordinates and in spherical coordinates - Jacobian functional determinant, conversion of cylindrical coordinates to rectangular coordinates, conversion of spherical coordinates to rectangular coordinates, the area of the region, definition of first moment and the second moment (the moment of inertia) about the x-axis and y-axis, the center of mass, the center of inertia, the volume of the solid)

CURVE INTEGRALS (definitions of the curve integral, the curve integral of scalar functions, the curve integral along smooth curve form A to B, methods of evaluation, independence of the chosen path, a contour integral - the curve integral along closed curves, Green?s theorem, applications of curve integrals)

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?s series and application to infinite series - expansion to real functions).

Basic bibliography:

1. M. Gewert, Z. Skoczylas: Analiza I, Analiza II, Ównania różniczkowe zwyczajne GiS, Wrocław, 2006.

2. I. Foltyńska, Z. Ratajczak, Z. Szafrański: Matematyka dla studentów uczelni technicznych, Wydawnictwo Politechnikii Poznańskiej, Poznań, 2000.

3. N. M. Matwiejew: Zadania z równań różniczkowych zwyczajnych, PWN, Warszawa 1974.

Additional bibliography:

1. W. Krysicki, L. Wlodarski, Analiza matematyczna w zadaniach cz.1, Wydawnictwo Naukowe PWN, Warszawa, 2010

Result of average student's workload

Activity	**Time (working hours)**

1. Preparation for exercise	50
2. Preparation for colloquia	40
3. Exam preparation	30

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	150	6
Contact hours	57	2
Practical activities	55	2