



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Mathematics [N1Bud1>MAT2]

Course

Field of study

Civil Engineering

Year/Semester

1/2

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

Polish

Form of study

part-time

Requirements

compulsory

Number of hours

Lecture

20

Laboratory classes

0

Other

0

Tutorials

10

Projects/seminars

0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Knowledge: Student has knowledge of mathematics from the first semester of the first-cycle studies

[K1_W01] Skills: Student is able to solve problems and has the ability to use mathematical tools to solve

tasks from the first semester of the first-cycle studies. Has the ability to think logically - derivation of new

facts basing on known - [K1_U01] Social competencies: The student understands the need for continuous

improvement of competences (language, professional and social) and knows the importance of higher

mathematics methods in the description of physical and technical issues. Can independently search for

information in the literature.

Course objective

The main aim is the understanding of basic notions and methods theory in order to apply them to solving

technical problems and indication of the possibility of the application of mathematics in more complex

issues.

Course-related learning outcomes

Knowledge:

1.Student has knowledge of the elements of linear algebra (complex numbers) - [K1_W01]

2. Student has knowledge of the actions on vectors in three-dimensional space and basic geometric structures (line, plane) - [K1_W01]
3. Student has basic knowledge of partial derivatives and total differential of functions of two variables and knowledge of methods of solving ordinary differential equations of the first and second order - [K1_W01]
4. The student has knowledge of the use of appropriate computational techniques, supporting the work of an engineer, while understanding certain limitations - [K1_W01]

Skills:

1. The student knows how to use analytical methods to formulate and solve tasks in the field of measuring physical quantities - [K1_U05]
2. The student is able to calculate partial derivatives and local extremes of functions of two variables - [K1_U05]
3. The student is able to solve simple ordinary differential equations of the first and second order - [K1_U03]
4. The student has the ability to self-education - [K1_U02]

Social competences:

1. The student is aware of the importance of compliance with the principles of professional ethics - [K1_K01]
2. The student understands the need for critical knowledge assessment and continuous education. It is able to think and act in a creative and enterprising way - [K1_K03]
3. Student is aware of the social role of a technical university graduate (understands the need to formulate and provide the public with information and opinions on technical achievements and other aspects of engineering activities) - [K1_K07]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lectures: written or oral exam in theory and tasks.

Classes: evaluation of written tests during the semester and the direct activity during the classes.

Getting extra points related with activity (presentations of examples of applications of mathematics, use of literature, discussion of problems, presenting reports concerning applications of the theory and diligence of the study).

Programme content

The update 2020/2021.

Issues:

Complex numbers and their applications - description and different forms (algebraic, trigonometric, exponential); geometric interpretation; activities in a set of complex numbers (Moivre's formula, complex element); polynomials (the basic theorem of algebra).

Elements of analytic geometry in three-dimensional space:

- vectors, actions on vectors (addition/subtraction, multiplication by number, scalar product, vector product, mixed product of ordered three of vectors) and their applications;
- mathematical plane, straight, straight and plane.

Functions of several variables - definition, domain, partial derivatives; geometric interpretation of the function of two variables; local extrema of the functions of two variables; a complete differential of the function of two variables and its applications.

Integral calculus of functions of several variables - definition of a normal area; definition of double integral and geometric interpretation; conversion of double integral into iterated integral, replacement of the integration order. Examples and applications of double integral (area of plane area; static moment, inertia and deviation of cross-sections of beams ...).

Examples and applications of the triple integral (solid volume, a mass).

First order differential equations - definition, general and specific solutions; Cauchy's problem. Selected types of equations and methods of solving them.

Second order ordinary differential equations importable to first order differential equations - selected types of equations and methods of solving.

Course topics

Lecture

1. Matrices – basic definitions, operations on matrices, determinant.
2. Inverse matrix, matrix equations. Systems of linear equations – Gaussian elimination method.
3. Complex numbers – algebraic, trigonometric, and exponential forms; operations on complex numbers including powers and roots; equations with complex numbers.
4. Vectors – operations on vectors (dot product, cross product, scalar triple product). Applications of vectors to calculating angles, areas, and volumes.
5. Plane. Line in space.
6. Functions of several variables – basic definitions. Continuity and graphs of functions of two variables. Polar coordinates.
7. Partial derivatives and the total differential of a function.
8. Local extrema of functions of two variables.
9. Double integral.
10. Applications of the double integral in geometry (areas, volumes).

Classes

1. Operations on matrices, determinants.
2. Systems of linear equations – Gaussian elimination method.
3. Algebraic and trigonometric forms of complex numbers. Operations on complex numbers including powers and roots.
4. Operations on vectors and applications to calculating angles, areas, and volumes.
5. Plane and line in space.

Teaching methods

1) Lectures:

- interactive lecture with questions to students or specific students,
- using partially a multimedia presentation (e.g. examples, animations),
- theory presented in connection with the current knowledge of students,
- presenting a new topic preceded by a reminder of related content known to students from other subjects,
- taking into account various aspects of the issues presented (economic, ecological, social),
- student activity is taken into account during the course of the assessment.

2) Classes:

- solving sample tasks on the blackboard,
- initiate discussion on solutions,
- homework / additional tasks.

Bibliography

- 1) T. Jurlewicz, Z. Skoczylas , Algebra liniowa 1, Definicje, twierdzenia, wzory.
- 2) T. Jurlewicz, Z. Skoczylas , Algebra liniowa 1, Przykłady i zadania.
- 3) M. Gewert, Z. Skoczylas, Analiza matematyczna 2, Definicje, twierdzenia, wzory.
- 4) M. Gewert, Z. Skoczylas, Analiza matematyczna 2, Przykłady i zadania.
- 5) M. Gewert, Z. Skoczylas, Równania różniczkowe zwyczajne, Teoria, przykłady, zadania.
- 6) J. Mikołajski, Z. Sołtysiak, Zbiór zadań z matematyki dla studentów wyższych szkół technicznych, Część I, Algebra i geometria.
- 7) J. Mikołajski, Z. Sołtysiak, Zbiór zadań z matematyki dla studentów wyższych szkół technicznych, Część III, Rachunek różniczkowy i całkowy funkcji wielu zmiennych.

Breakdown of average student's workload

	Hours	ECTS
Total workload	85	3,00
Classes requiring direct contact with the teacher	32	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	53	2,00