COURSE DESCRIPTION CARD - SYLLABUS

Course name
Mathematics [N1Bud1>MAT]

Course

Field of study
Civil Engineering

Year/Semester
1/1

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
20

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

Knowledge: Student has knowledge of mathematics at the secondary school level - [PRK 4] Skills: Student is able to solve problems and has the ability to use mathematical tools to solve tasks in the field of secondary school. Has the ability to think logically - derivation of new facts basing on known - [PRK 4] 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 knows formulas, diagrams and properties of elementary functions and knows the meaning of a limit of function - [K1_W01]

2. Student knows the meaning of derivative of a function and its geometric and physical interpretation. It knows rules of derivations of functions, meaning of indefinite integral of function and basic method of integration and geometric interpretation of definite integral - [K1_W01]
3. 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. Student uses notation of limit for study of behavior of function on ends of domain intervals - [K1_U01]
2. Student analyses properties of functions with applications of differential calculus methods - [K1_U01]
3. Student apply integral calculus in engineering practice - [K1_U02, K1_U07]
4. Student builds mathematical models of simple phenomena and processes in nature - [K1_U09, K1_U10]
5. 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:

Lecture – written exam
Tutorials – test(s) and class participation
In both forms of classes, the following percentage thresholds are applied:
below 50% – grade 2.0
50%–59% – grade 3.0
60%–69% – grade 3.5
70%–79% – grade 4.0
80%–89% – grade 4.5
90%–100% – grade 5.0

Programme content

The update 2020/2021.
Issues:
An overview of the functions of one independent variable. Trigonometric and cyclometric functions. Numerical sequences. The number of Euler.
Limits of functions (at point, left-sided, right-handed, incorrect, in infinite). Continuity of functions. Asymptotes.
Differential calculus of functions of one variable with selected applications (the de L"Hospital rule, function study, optimization tasks).
Integral calculus of functions of one variable:
Indefinite integral - definition of indefinite integral and primary function, properties, basic formulas, integration by substitution and by parts, examples;
Definite integral - definition, geometrical interpretation, Newton-Leibnitz formula, properties, basic formulas, integration by substitution and parts. Examples and applications.
Matrix calculus - definition of matrices, their types and arithmetic; determinant of the square matrix and its properties (Laplace theorem, Sarrus scheme, calculating the determinant by the elementary operations method using the Laplace development); inverse matrix and methods of finding it.
Systems of linear equations (matrix notation, Cramer"s theorem, matrix method of Gauss elimination).

Course topics

1. Functions and Limits

Composition of functions. Inverse functions, inverse trigonometric functions.

Limit of a sequence. The number e and the natural logarithm.

Limit and continuity of a function.

2. Differential Calculus

Derivative and differential of a function. Differentiability of functions.

Equation of the tangent and normal to the graph of a function.

L'Hospital's rule for indeterminate limits.

Monotonicity and extrema of functions.

Convexity and concavity of functions, inflection points.

Study of the behavior of functions.

3. Integral Calculus

Indefinite integral.

Integration by substitution.

Integration by parts.

Integration of rational functions.

Integration of functions involving trigonometric expressions.

Definite integral.

Geometric applications of definite integrals to calculating areas of plane regions, arc lengths of curves, surface areas, and volumes of solids of revolution.

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 the school,
- 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

Basic
1. M. Mączyński, J. Muszyński, T. Traczyk, W. Żakowski, Matematyka - podręcznik podstawowy dla WST, PWN, t. I - Warszawa 1979, t. II - Warszawa 1981.
2. J. Mikołajski, Z. Sołtysiak, Zbiór zadań z matematyki dla studentów wyższych szkół technicznych, Wydawnictwo PWSZ w Kaliszu, cz. II - Kalisz 2010.
3. M. Gewert, Z. Skoczyłaś, Analiza Matematyczna 1 - Definicje, twierdzenia, zwory, Oficyna Wydawnicza

GIS, Wrocław 2021 i Wrocław 2019.
4. M. Gewert, Z. Skoczyłaś, Analiza Matematyczna 1 - Przykłady i zadania, Oficyna Wydawnicza GIS, Wrocław 2021 i Wrocław 2019.
Additional
1. G. Decewicz, W. Żakowski, Matematyka t. I. WNT, Warszawa 2003.
2. F. Leja, Rachunek różniczkowy i całkowy. PWN, Warszawa 2008.
3. I. Foltyńska, Z. Ratajczak, Z. Szafrański, Matematyka cz. I i II, Wydawnictwo Politechniki Poznańskiej, Poznań 2001.
4. W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach, t. I, PWN, Warszawa 2006.
5. W. Stankiewicz, Zadania z matematyki dla wyższych uczelni technicznych, PWN, Warszawa 2003.

Breakdown of average student's workload

	Hours	ECTS
Total workload	127	5,00
Classes requiring direct contact with the teacher	42	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	85	3,50