COURSE DESCRIPTION CARD - SYLLABUS

Course name
Applied mathematics [N2Bud1-BDMiK>MS]

Course

Field of study
Civil Engineering

Year/Semester
1/1

Area of study (specialization)
Road, Bridge and Railway Engineering

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
18

Laboratory classes
0

Other (e.g. online)
0

Tutorials
10

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

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Prerequisites

Knowledge: Student has knowledge of first level mathematics (within the scope of algebra, mathematical analysis, composite numbers, matrices, numeric strings, numeric and power series, ordinary and partial derivatives, differential equations, integrals). Skills: Student can make algebraic calculations on composite numbers and matrices, calculate differentials and integrals, solve differential equations.

Course objective

Understand the basic concepts of higher mathematics and apply it in physics, mechanics and technology.

Course-related learning outcomes

Knowledge:
Student have extended and detailed knowledge of mathematics, forming theoretical principles appropriate to formulate and solve tasks related to building engineering.

Social competences:
Student take responsibility for the reliability of working results and their interpretation.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lectures: short written test (credit) concerning mainly the theoretical part of the subject and the ability to use it in practical issues; multimedia presentation.
Classes: assessment of written tests in the semester and direct activity during classes.
Possibility of getting additional points related to activity during classes.

Programme content

I. Elements of linear algebra.
1. Definition of a linear space, linearly independent vectors, basis of a linear space.
2. Definition of the matrix of linear mapping, operations on matrices, addition and multiplication of matrices.
3. Determinant of a square matrix, singular and non-singular matrices.
4. Own problem of matrices.
5. Zero divisors.
4. Elements of vector calculus in three-dimensional space. Definition of dot, vector and mixed product. Basic identities of vector calculus, double product.
5. Multi-line mappings, dual space and k-rank tensors.
6. Symmetric and antisymmetric tensors.
7. Linear transformations of coordinate systems.
II. Function series, special functions, integral transformations
1. Real and complex power series. Relationship between exponential and trigonometric and logarithmic and circular functions.
2. Special functions: Gamma and Beta Euler functions, Bessel functions.
3. Fourier series trigonometric and exponential form.
4. Fourier integral transform.
5. Laplace integral transform.
III. Partial differential equations.
1. Definition of a partial differential equation. First order linear partial differential equation, homogeneous and non-homogeneous, general solution.
2. Second order linear partial differential equations, hyperbolic, parabolic and elliptic, canonical form.
3. Equation of characteristics and applications.
4. Applications in physics and technology.
IV. Calculus of variations.
1. Basic problem of calculus of variations.
2. A necessary condition of a functional minimum - Euler-Lagrage equation.
3. Solutions to some selected classical problems.

Course topics

Elements of the theory of linear spaces; basics and applications of tensor calculus; Variational calculus and its application in engineering tasks

Teaching methods

1) Lectures:
- an interactive lecture with the formulation of questions to a group of students or to identified specific students,
- partly using a multimedia presentation (e.g. examples, photos, animations),
- theory presented in relation to 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 during classes is taken into account when assigning the final grade.
2) Exercises:
- solving example tasks on the blackboard,
- initiating discussions on solutions,
- homework / additional tasks.

Bibliography

Basic
1. I. Foltyńska, Z. Ratajczak, Z. Szafrański: Matematyka dla studentów uczelni technicznych, cz.1, cz.2, cz.3, Wydawnictwo Politechniki Poznańskiej, Poznań 2004.
2. F. Leja, Rachunek różniczkowy i całkowy, PWN Warszawa 2020.
3. D. Bobrowski, J. Mikołajski, J. Morchało, Równania różniczkowe cząstkowe, Wydawnictwo PP, Poznań 1995.
4. W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach, PWN, Warszawa 1974.
Additional
1. L. Siewierski, Ćwiczenia z analizy matematycznej z zastosowaniami, T.1, T.2, PWN, Warszawa 1981.
2. W. Stankiewicz, J. Wojtowicz, Zadania z matematyki dla wyższych uczelni technicznych, T.2, PWN, Warszawa 2001.

Breakdown of average student's workload

	Hours	ECTS
Total workload	78	3,00
Classes requiring direct contact with the teacher	28	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	50	2,00