



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Mathematics [S1IMe1E>MAT2]

Course

Field of study

Mechanical Engineering

Year/Semester

1/2

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

English

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

30

Laboratory classes

0

Other

0

Tutorials

15

Projects/seminars

0

Number of credit points

4,00

Coordinators

Lecturers

Prerequisites

The student has knowledge of mathematics, including selected topics of mathematical analysis, algebra, and analytic geometry, acquired during the mathematics course in the first semester of studies. The student is able to calculate derivatives, draw graphs of elementary functions, compute indefinite and definite integrals, and perform basic matrix operations. The student is aware of the need for further education.

Course objective

The main aim of this course is to familiarize students with selected advanced topics of higher mathematics. After completing the course, students will be able to solve selected types of first-order ordinary differential equations, solve second-order linear differential equations with constant coefficients, compute double and triple integrals, calculate surface areas and volumes using multiple integrals, evaluate line integrals over directed and undirected curves, and solve systems of linear equations.

Course-related learning outcomes

Knowledge:

The student has knowledge of mathematics, including selected areas of mathematical analysis, algebra, analytic geometry, and the theory of differential equations.

Skills:

The student is able to apply mathematical methods in the analysis of technical and engineering problems.

Social competences:

The student is aware of the need to deepen and expand their knowledge.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Tutorials:

Skills acquired during tutorials are verified on the basis of one written test. To pass the tutorials, the student must obtain at least 50% of the points from this test.

Lecture:

Knowledge acquired during lectures is verified through a written examination. To pass the lecture component, the student must obtain at least 50% of the points.

Grading system:

0-50% - 2.0

50-60% - 3.0

60-70% - 3.5

70-80% - 4.0

80-90% - 4.5

90-100% - 5.0

Programme content

Lecture:

First-order ordinary differential equations and methods of solving them.

Second-order linear ordinary differential equations with constant coefficients.

Multiple integrals: double and triple integrals in various coordinate systems and their applications.

Line integrals over directed and undirected curves, Green's theorem, and path independence.

Systems of linear equations, inverse matrices, eigenvalues and eigenvectors.

Tutorials:

Solving differential equations, evaluating multiple and line integrals, applying Green's theorem, and solving systems of linear equations using analytical and algebraic methods.

Course topics

The course focuses on advanced topics of higher mathematics relevant to engineering and biomedical applications. It includes ordinary differential equations of the first and second order, methods for solving systems of linear equations, and the theory and applications of multiple and line integrals. Lectures introduce theoretical foundations of differential equations, linear algebra, and multivariable calculus, while tutorials emphasize practical problem-solving, analytical calculations, and the application of mathematical methods to technical problems. Special attention is given to geometric and physical interpretations of integrals, as well as to developing analytical thinking and mathematical modeling skills.

Teaching methods

Lectures: traditional lectures presenting theory in relation to students' prior knowledge.

Tutorials: blackboard-based problem solving with the support of the instructor.

Bibliography

Basic:

W. Krysicki, L. Włodarski, *Analiza matematyczna w zadaniach 1*, PWN, Warszawa 2018.

W. Krysicki, L. Włodarski, *Analiza matematyczna w zadaniach 2*, PWN, Warszawa 2018.

M. Gewert, Z. Skoczylas, *Analiza matematyczna 1*, GiS, Wrocław.

T. Jurlewicz, Z. Skoczylas, *Algebra i geometria analityczna*, GiS, Wrocław.

M. Gewert, Z. Skoczylas, *Równania różniczkowe zwyczajne: teoria, przykłady, zadania*, Oficyna Wydawnicza GiS, Wrocław, 201

Additional:

T. Jurlewicz, Z. Skoczylas, Algebra liniowa: przykłady i zadania, Oficyna Wydawnicza GiS, Wrocław, 2017.

T. Jurlewicz, Z. Skoczylas, Algebra i geometria analityczna: przykłady i zadania, Oficyna Wydawnicza GiS, Wrocław, 2015.

M. Gewert, Z. Skoczylas, Analiza matematyczna 2: przykłady i zadania, Oficyna Wydawnicza GiS, Wrocław 2014

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	47	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	53	2,00