



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Applied Mathematics

### Course

Field of study

Civil Engineering

Area of study (specialization)

Level of study

**Second-cycle studies**

Form of study

part-time

Year/Semester

**1/2**

Profile of study

general academic

Course offered in

**Polish**

Requirements

compulsory

### Number of hours

Lecture

**18**

Tutorials

**10**

Laboratory classes

Projects/seminars

Other (e.g. online)

### Number of credit points

**3**

### Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

### Prerequisites

### Course objective

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



## Course-related learning outcomes

Knowledge

**Błąd! Nie zdefiniowano zakładki.**

Skills

Social competences

The student is aware of the importance of the methods of higher mathematics in the description of physical and technical issues and responsibility for the decisions made.

## Methods for verifying learning outcomes and assessment criteria

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-Lagrange equation.
3. Solutions to some selected classical problems.

### 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. Folyńska, Z. Ratajczak, Z. Szafranski: Matematyka dla studentów uczelni technicznych, cz.1, cz.2, cz.3, Wydawnictwo Politechniki Poznańskiej, Poznań 2004.

3. F. Leja, Rachunek różniczkowy i całkowy, PWN Warszawa 2020.

4. D. Bobrowski, J. Mikołajski, J. Morchało, Równania różniczkowe cząstkowe, Wydawnictwo PP, Poznań 1995.

5. W. Krywicki, 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	83	3
Classes requiring direct contact with the teacher	28	1
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) <sup>1</sup>	55	2

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1 delete or add other activities as appropriate

