# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Mathematics

## Course

Field of study
Education in Technology and Informatics

Year/Semester
1/2

Area of study (specialization)
-

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

## Number of hours

Lecture
30

Laboratory classes
-

Other (e.g. online)

Tutorials
30

Projects/seminars
-

## Number of credit points

5

## Lecturers

Responsible for the course/lecturer:
dr Marek Adamczak

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Faculty of Control, Robotics and Electrical Engineering

ul. Piotrowo 3A, 60-965 Poznań

Responsible for the course/lecturer:

## 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 - [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.

## Course-related learning outcomes

### Knowledge

1. The student knows the mathematical apparatus necessary to describe the basic laws of physics and solve tasks related to physics (basics of differential and integral calculus, elements of linear algebra and analytic geometry) - [K1_W01]

2. The student has knowledge of mathematics necessary to use the mathematical apparatus to describe technical issues - [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. The student is able to use the acquired mathematical knowledge to describe processes, creating models in the field of physics - [K1_U01]

2. The student knows how to use analytical methods to formulate and solve basic tasks in the field of physical quantity measurements - [K1_U01]

3. 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:

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:

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; row of the matrix and its calculation.

Systems of linear equations (matrix notation, Cramer's theorem, Kronecker-Capelli theorem, matrix method of Gauss elimination).

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.

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 application.

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.

First order differential equations - definition, general and specific solutions; Cauchy's problem. Selected types of equations and methods of solving them (with separated variables, linear homogeneous and heterogeneous, complete).

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

Numeric series - description and examples; convergence criteria.

## 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

Basic

1. M. Gewert, Z. Skoczylas, Analiza matematyczna 2, Oficyna Wydawnicza GiS, Wrocław 2006.

2. M. Gewert, Z. Skoczylas, Równania różniczkowe zwyczajne, Oficyna Wydawnicza GiS, Wrocław 2005.

3. T. Jurlewicz, Z. Skoczylas, Algebra liniowa 1, Oficyna Wydawnicza GiS, Wrocław 2007.

4. W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach, cz.1, cz.2, Wydawnictwo naukowe PWN, Warszawa 2010.

Additional

1. I. Foltyńska, Z. Ratajczak, Z. Szafrański: Matematyka dla studentów uczelni technicznych, cz.1, cz.2, cz.3, Wydawnictwo Politechniki Poznańskiej, Poznań 2004.

2. J. Banaś, S. Wędrychowicz, Zbiór zadań z analizy matematycznej, Wydawnictwo WNT, Warszawa 1996.

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 107 | 5,0 |
| Classes requiring direct contact with the teacher | 62 | 3,0 |
| Student's own work (literature studies, preparation for classes, preparation for tests/passing, performing additional tasks) [1] | 45 | 2,0 |

[1] delete or add other activities as appropriate