



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Mathematics

### Course

Field of study

Materials engineering

Area of study (specialization)

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

1/2

Profile of study

general academic

Course offered in

polish

Requirements

compulsory

### Number of hours

Lecture

30

Laboratory classes

Other (e.g. online)

Tutorials

15

Projects/seminars

### Number of credit points

4

### Lecturers

Responsible for the course/lecturer:

dr inż. Kinga Cichoń

Responsible for the course/lecturer:

e-mail: kinga.cichon@put.poznan.pl

tel. 61665-2687

Wydział Automatyki, Robotyki i Elektrotechniki

Instytut Matematyki

ul. Piotrowo 3A, 60-965 Poznań

### Prerequisites

A student has the knowledge in mathematics including selected sections of mathematical analysis, algebra and analytic geometry lectured at the mathematics course in the first semester of studies. The student has the following skills acquired at the mathematics course lectured in the first semester of studies: finding the derivative of a given function, drawing the graphs of elementary functions, finding the indefinite integral of a given function, finding the definite integral of a given function, performing the basic operations on matrices. The student is aware of the need for further education.

### Course objective

Acquainting with problems of differential and integral calculus of functions of many variables and



ordinary differential equations. Developing students' skills to solve simple mathematical problems by using different types of equations.

### Course-related learning outcomes

#### Knowledge

The student has the knowledge in mathematics including selected sections of mathematical analysis, algebra, analytic geometry and theory of differential equations [KW01]

#### Skills

The student is aware of the need to deepen and expand knowledge [K\_U10].

#### Social competences

The student is aware of the need to deepen and expand knowledge [K\_K01].

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge acquired as part of the lecture is verified by a 60-minute exam conducted in the exam session. Passing threshold: 50% of exam points and student activity during classes. Lecture for the grade. Exam issues, on the basis of which questions are developed.

The knowledge acquired in the exercises is verified through two tests implemented at the 3rd and 7th classes lasting 45 minutes, as well as class activity. Each of the tests consists of the same number of points. Passing threshold: 50% of the total points obtained from the tests and class activity.

### Programme content

#### LECTURE:

DIFFERENTIAL ACCOUNT OF FUNCTIONS OF MANY VARIABLES: definition of functions of two variables, partial derivative, Schwarz's theorem, extremum of functions of two variables.

MULTI-DIMENSIONAL INTEGRAL: calculating, exchanging the order of integration of variables double integral for polar coordinates, the use of double integral in Cartesian and polar coordinates.

ORDINARY DIFFERENTIAL EQUATIONS: definition of ordinary differential equation, general and special solution, with separated variables, 1st order linear differential equation, complete equation, Bernoulli equation, 2nd order linear differential equation with constant coefficients.

LAPLACE TRANSFORMATION: definition of the Laplace transformation and its application for solving differential equations and systems of differential equations.

#### EXERCISES:

DIFFERENTIAL ACCOUNT OF FUNCTIONS OF MANY VARIABLES: definition of functions of two variables, partial derivative, Schwarz's theorem, extremum of functions of two variables.



**MULTI-DIMENSIONAL INTEGRAL:** normal area, double integral - calculation, conversion of integration order, conversion of variables in double integral to polar coordinates, use of double integral in Cartesian and polar coordinates.

**ORDINARY DIFFERENTIAL EQUATIONS:** ordinary differential equations with separated variables, homogeneous equation, ordinary heterogeneous 1st order linear differential equation, 2nd order ordinary differential heterogeneous equation with constant coefficients.

### Teaching methods

**Lecture:** conducted using a visualizer, theory illustrated with examples. Conducted in an interactive way with the formulation of questions to a group of students. Initiating discussions during the lecture.

**Exercises:** solving tasks given by the teacher on the board along with analyzing the next stages. The method of solving the task by students on the board is reviewed by the tutor. Completed with tasks for independent solution at home.

### Bibliography

#### Basic

1. W. Kryszewski, L. Włodarski, Analiza matematyczna w zadaniach, T. 1-2, PWN, Warszawa 2011.
2. I. Foltyńska, Z. Ratajczak, Z. Szafranski, Matematyka dla studentów uczelni technicznych, T. 1-3, Wydawnictwo Politechniki Poznańskiej, Poznań 2004.
3. M. Gewert, Z. Skoczylas, Analiza matematyczna 2/Definicje, twierdzenia, wzory/ Oficyna Wydawnicza GiS, Wrocław 2011.
4. M. Gewert, Z. Skoczylas, Analiza matematyczna 2/Przykłady i zadania/ Oficyna Wydawnicza GiS, Wrocław 2011.
5. F. Leja, Rachunek różniczkowy i całkowy, PWN, Warszawa 2008.
6. G. M. Fichtenholz, Rachunek różniczkowy i całkowy, PWN, Warszawa, 1986.
7. J. Morchała, Z. Ratajczak, J. Werbowski, Równania różniczkowe w zastosowaniach, Wyd. Politechniki Poznańskiej, Poznań, 1995.

#### Additional

1. W. Żakowski, Matematyka, T. 1-2, WNT, Warszawa 2003.
2. W. Stankiewicz, J. Wojtowicz, Zadania z matematyki dla wyższych uczelni technicznych, T. 1-2, PWN, Warszawa 2003.
3. M. Lassek, Matematyka dla studentów technicznych, T. 1-2, Wydawnictwo Wspierania procesu edukacji, Warszawa 2004



### Breakdown of average student's workload

	Hours	ECTS
Total workload	115	4,0
Classes requiring direct contact with the teacher	50	2,0
Student's own work (literature studies, preparation for tutorials and laboratory classes, preparation and analysis of laboratory results, preparation for tests and for the exam) <sup>1</sup>	65	2,0

<sup>1</sup> delete or add other activities as appropriate