



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Mathematics [S1MiBM2>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

Polish

Form of study

full-time

Requirements

compulsory

### Number of hours

Lecture

15

Laboratory classes

0

Other (e.g. online)

0

Tutorials

30

Projects/seminars

0

### Number of credit points

4,00

### Coordinators

dr Zbigniew Walczak

zbigniew.walczak@put.poznan.pl

### Lecturers

### Prerequisites

The student has knowledge and skills in the subject of Mathematics taken during the first semester of studies.

### Course objective

Learning about the applications of mathematical tools and methods to solve simple technical problems and indicating the possibilities of using mathematics in more complex problems.

### Course-related learning outcomes

Knowledge:

1. The student has the knowledge in mathematics including selected sections of mathematical analysis, algebra and analytic geometry.
2. Has knowledge of the use of mathematical apparatus to describe mechanical problems.
3. Has knowledge of the application of appropriate computational techniques supporting the engineer's work while understanding their limitations.

Skills:

1. The student is able to use mathematical methods in the analysis of mechanical problems.

Social competences:

1. The student is aware of the need to deepen and expand knowledge.
2. Is aware of the importance of mathematics in solving mechanical problems and is able to seek the opinion of experts in case of difficulties in solving a problem independently.

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: assessment of knowledge and skills demonstrated in the written exam. The exam is assessed in a point system. The condition of passing the exam is obtaining at least 50% of points.

Tutorials: two written assignments carried out under the teacher's supervision. The condition of receiving a positive grade from tutorials is obtaining at least 50% of points. Additional points can be obtained for activity during classes.

### Programme content

1. ELEMENTS OF DIFFERENTIAL CALCULUS OF FUNCTIONS OF MULTIPLE VARIABLES
2. SELECTED ORDINARY DIFFERENTIAL EQUATIONS AND THEIR SOLVING METHODS
3. MULTIPLE INTEGRALS
4. LINEAR ALGEBRA

### Course topics

Lecture:

#### 1. FUNCTIONS OF TWO VARIABLES

- domain and range, graph
- limits
- partial derivatives
- increments and differentials
- extrema of functions of two variables

#### 2. DIFFERENTIAL EQUATIONS

- definition of differential equation, partial solution, general solution, boundary value problem
- homogeneous and nonhomogeneous first-order differential equations, separable equations, first-order linear differential equations, Bernoulli equation, exact first-order equations, integrating factors,
- homogeneous and nonhomogeneous second-order linear equations with constant coefficients

#### 3. MULTIPLE INTEGRALS

- double integrals
- evaluation of double integrals
- areas and volumes
- moments and center of mass
- double integrals in polar coordinates
- triple integrals
- evaluation of triple integrals
- applications of triple integrals
- triple integrals in cylindrical and spherical coordinates

#### 4. LINEAR ALGEBRA

- Cramer's rule
- Inverse matrix method
- Gaussian elimination

Tutorials:

#### 1. FUNCTIONS OF TWO VARIABLES

- domain and range, graph
- limits
- partial derivatives
- increments and differentials
- extrema of functions of two variables

#### 2. DIFFERENTIAL EQUATIONS

- definition of differential equation, partial solution, general solution, boundary value problem
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### 4. LINEAR ALGEBRA

- Cramer's rule
- Inverse matrix method
- Gaussian elimination

### Teaching methods

Lecture: multimedia presentation accompanied with examples presented on the blackboard and with questions to the group of students

Tutorials: solving problems on the board, initiating discussion about the solutions

### Bibliography

Basic:

1. M. Gewert, Z. Skoczylas, Analiza Matematyczna 2, Definicje, twierdzenia i wzory, Oficyna Wydawnicza GiS, Wrocław 2019.
2. W. Kryszicki, L. Włodarski, Analiza matematyczna w zadaniach cz. I i II, Wydawnictwo Naukowe PWN, Warszawa 2015.
3. M. Gewert, Z. Skoczylas, Analiza Matematyczna 2, Przykłady i zadania, Oficyna Wydawnicza GiS, Wrocław 2018.
4. W. Żakowski, W. Kołodziej, Matematyka cz. II, Analiza matematyczna, WNT, Warszawa 2017.
5. T. Jurlewicz, Z. Skoczylas, Algebra liniowa 1 i 2, Przykłady i zadania, Oficyna Wydawnicza GiS, Wrocław 2006.

Additional:

1. J. Morchało, Z. Ratajczak, J. Werbowski, Matematyka, Równania różniczkowe zwyczajne w zastosowaniach, Wydawnictwo Politechniki Poznańskiej, Poznań 1992.

### 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