COURSE DESCRIPTION CARD - SYLLABUS

Course name
Mathematics

Course

Field of study
Biomedical 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
English
Requirements
compulsory

Number of hours

Lecture
30
Laboratory classes
0
Other (e.g. online)
0
Tutorials
15
Projects/seminars
0

Number of credit points

4

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:

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

The main aim of this course is to acquaint the student with the basic concepts of higher mathematics. After the course the student will be able to: solve selected types of first order differential equations, solve second order linear differential equations with constant coefficients, find the double integral of a given function, find the triple integral of a given function, calculate the surface area of a surface and the volume of a solid using multiple integrals, find the line integral over an undirected curve, find the line integral over a directed curve, solve systems of linear equations.

Course-related learning outcomes

Knowledge

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

Skills

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

Social competences

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

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Tutorials:

The skills acquired during the classes are verified on the basis of one written test. To pass the classes it is necessary to get at least 50% of the points from the mentioned written test.

Lecture:

The knowledge acquired during the lecture is verified on the basis of a written examination. To pass the lecture it is necessary to get at least 50% of the points from the mentioned written examination.

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 - definition of a first order differential equation and definition of its solution, definition of a Cauchy problem and definition of its solution, the existence and uniqueness of solutions to the first order differential equation, selected types of first order differential equations and methods of solving them (a differential equation of the form dy/dx=g(x)h(y) (the method of separation of variables), a differential equation of the form dy/dx=g(y/x), a first order linear differential equation (the method of variation of constants, the integrating factor method), a Bernoulli differential equation, an exact differential equation),
- second order linear ordinary differential equations - definition of a second order linear differential equation and definition of its solutions, the existence and uniqueness of solutions to the second order linear differential equation, definition of a second order linear differential equation with constant coefficients and definition of its solutions, methods of solving the second order linear differential equations with constant coefficients (the method of undetermined coefficients, the method of variation of constants),
- multiple integrals - double integrals (definition of a double integral and its properties, a double integral in Cartesian coordinates, a double integral in polar coordinates, a surface area of a surface bounded by curves, a volume of a solid bounded by surfaces, a surface area of a surface cuted by other surfaces), triple integrals (definition of a triple integral and its properties, a triple integral in Cartesian coordinates, a triple integral in cylindrical coordinates, a triple integral in spherical coordinates, a volume of a solid bounded by surfaces),
- line integrals - definition of a line integral over an undirected curve and its properties, a length of an arc, a surface area of a cylindrical surface, definition of a line integral over a directed curve and its properties, Green's theorem, the path independence of line integral, a surface area of a surface bounded by a curve,
- systems of linear equations - definition of an inverse matrix, methods of finding the inverse matrix to a given matrix, definition of a system of linear equations and definition of its solution, methods of solving systems of linear equations (the inverse matrix method, Cramer's rule, the Gaussian elimination), a rank of a matrix, the Kronecker–Capelli theorem, eigenvalues of a matrix, eigenvectors of a matrix.

Tutorials:
- first order ordinary differential equations - solving selected types of first order differential equations (a differential equation of the form dy/dx=g(x)h(y) (the method of separation of variables), a differential equation of the form dy/dx=g(y/x), a first order linear differential equation (the method of variation of constants, the integrating factor method), a Bernoulli differential equation, an exact differential equation),
- second order linear ordinary differential equations - solving second order linear differential equations with constant coefficients (the method of undetermined coefficients),
- multiple integrals - double integrals (calculating the double integral of a given function in Cartesian coordinates, calculating the double integral of a given function in polar coordinates, calculating the surface area of a surface bounded by curves, calculating the volume of a solid bounded by surfaces, calculating the surface area of a surface cuted by other surfaces), triple integrals (calculating the triple integral of a given function in Cartesian coordinates, calculating the triple integral of a given function in

cylindrical coordinates, calculating the triple integral of a given function in spherical coordinates, calculating the volume of a solid bounded by surfaces),
- line integrals - calculating the line integral of a given function over an undirected curve, calculating the line integral of a given function over a directed curve, conversion of the line integral over a directed curve to the double integral (Green's theorem), examination the path independence of line integral, calculating the surface area of a surface bounded by a curve,
- systems of linear equations - solving a given system of linear equations by the inverse matrix method, solving a given system of linear equations by Cramer's rule, solving a given system of linear equations by the Gaussian elimination.

Teaching methods

Lecture: traditional lectures (theory presented in connection with the current knowledge of students).

Tutorials: blackboard tutorials (solving of math problems with the help of a teacher).

Bibliography

Basic

1. W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach 2, Wydawnictwo Naukowe PWN, Warszawa, 2015.
2. T. Jurlewicz, Z. Skoczylas, Algebra liniowa: definicje, twierdzenia, wzory, Oficyna Wydawnicza GiS, Wrocław, 2015.
3. T. Jurlewicz, Z. Skoczylas, Algebra i geometria analityczna: definicje, twierdzenia, wzory, Oficyna Wydawnicza GiS, Wrocław, 2012.
4. M. Gewert, Z. Skoczylas, Analiza matematyczna 2: definicje, twierdzenia, wzory, Oficyna Wydawnicza GiS, Wrocław, 2012.
5. M. Gewert, Z. Skoczylas, Równania różniczkowe zwyczajne: teoria, przykłady, zadania, Oficyna Wydawnicza GiS, Wrocław, 2011.

Additional

1. T. Jurlewicz, Z. Skoczylas, Algebra liniowa: przykłady i zadania, Oficyna Wydawnicza GiS, Wrocław, 2017.
2. T. Jurlewicz, Z. Skoczylas, Algebra i geometria analityczna: przykłady i zadania, Oficyna Wydawnicza GiS, Wrocław, 2015.
3. 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	4,0
Classes requiring direct contact with the teacher	47	2,0
Student's own work (literature studies, preparation for tutorials, preparation for test/exam)[1]	53	2,0

[1] delete or add other activities as appropriate