COURSE DESCRIPTION CARD - SYLLABUS

Course name
Mathematics [S1IŚrod2>Mat2]

Course

Field of study
Environmental 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
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
45

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

Knowledge of real function calculus. Calculations of derivatives and integrals of one variable functions. Student understands the need and cnows the possibility of studying, improving language skills, professional, personal and social skills.

Course objective

-The recognizing methods and applications of analytical geometry (vectors, lines in space, planes), mathematical analysis (calculus of funtions of several variables)and differential equations.

Course-related learning outcomes

Knowledge:
1. Methods of calculation and applications of multiple and line integrals to describe and analyze selected physical phenomenons.
2. Methods of solving differential equations.
3. The student explains the basic mathematical laws and explains conditions for their application.

Skills:

1. The student uses the literature and also other sources of knowledge.
2. The student learns to calculate and apply multiple and line integrals to describe and analyze selected physical phenomenons.

Social competences:
1. The sens of usefulness of mathematical competence in engineering practice.
2. The ability to work in a team.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

LECTURE.A two-part written examination at the and of the semestr:
-sat.1 theoretic knowledge;
-sat.2 applications in practical exercises.
Duration of test: 70 minutes.
Classes: tests during the semestr (5x30 minutes).

Programme content

-Matrices end determinants, systems of linear equations.
-Vectors, the dot product, the vector product. Lines in space, planes.
--Multiple integrals with applications.
-Ordinary differential equations (separable, exact, homogeneous, Bernoulli, first-order and secondorder-linear).
-Number series and power series.

Course topics

Lecture
Matrices and determinants - operations on matrices, definition of determinant, Sarrus method.
Calculation of determinants using the Laplace method. Properties of determinants. Definition of an inverse matrix. Determination of the inverse matrix by definition, using the method of algebraic complements.
Determination of the inverse matrix using the nondeterminant method. Systems of linear equations, the main matrix of the system, the matrix supplemented by a column of intercepts.
Solving systems of linear equations using the inverse matrix method, Cramer's formulas, using the Gaussian elimination method.
Solving systems of linear equations using the Kronecker-Capelli theorem. Definition of a vector space, basis of a space R^3. Calculating the coordinates of a vector and its length, basic operations on vectors.
Dot and vector product. Application of dot product to calculate the angle between vectors.
Use of the cross product to calculate the area of a parallelogram and the area of a triangle. Mixed product, applications to calculate the volume of parallelepiped and tetrahedron. The condition of the coplanarity of the three vectors, the condition of parallelism and perpendicularity of the vectors. Determination of eigenvalues and eigenvectors of matrices. Equation of the plane.
Equation of a plane passing through 3 points. The distance of the point from the plane. Angle between planes.
Parametric, directional, and edge equation of a line in R^3.
Determining the distance of a point from a line, determining the distance between lines in space R^3.
Definition, properties and geometric interpretation of the double integral integral. Definition of the normal area with respect to one of the system's axes. Theorem about the conversion of a double integral into an iterated one.
Calculating the double integral after a rectangle. Polar coordinate system. The relationship between the Cartesian and polar systems.
Definition of Jacobian, Jacobian for polar coordinates. Theorem about the conversion of Cartesian coordinates into polar coordinates in integral II.
Geometric applications of the double integral: volume of a solid, area of a planar surface, area of a surface lobe, other examples of technical applications. Introduction to differential equations, separable variable equations.
Characteristic equation. Solving homogeneous linear equations of the second order with constant coefficients.
Solving non-uniform linear equations with constant coefficients using the constant variation method.

Solving homogeneous, complete and Bernoulli equations.
Reducing second-order differential equations to first-order equations.
Examples of convergence criteria of linear and power series (quotient, root, integral), a necessary condition for the convergence of a series.

Practical lessons.
Use of definite integrals to calculate volumes and areas of solids of rotation.
Calculating the arc length of a curve using the definite integral.
Matrices and determinants - operations on matrices, definition of determinant, Sarrus method.
Calculation of determinants using the Laplace method. Properties of determinants. Inverse matrix by definition, using the method of algebraic complements.
Determination of the inverse matrix using the nondeterminant method. Systems of linear equations, the main matrix of the system, the matrix supplemented by a column of intercepts.
Solving systems of linear equations using the inverse matrix method, Cramer's formulas, using the Gaussian elimination method.
Solving systems of linear equations using the Kronecker-Capelli theorem. Calculating the coordinates of a vector and its length, basic operations on vectors. Dot and vector product. Application of dot product to calculate the angle between vectors.
Use of the cross product to calculate the area of a parallelogram and the area of a triangle. Mixed product, applications to calculate the volume of parallelepiped and tetrahedron. The condition of the coplanarity of the three vectors, the condition of parallelism and perpendicularity of the vectors. Determination of eigenvalues and eigenvectors of matrices. Equation of the plane.
Equation of a plane passing through 3 points. The distance of the point from the plane. Angle between planes.
Parametric, directional, and edge equation of a line in R^3.
Determining the distance of a point from a line, determining the distance between lines in space R^3.
Theorem about the conversion of a double integral into an iterated one.
Calculating the double integral after a rectangle. Polar coordinate system. The relationship between the Cartesian and polar systems.
Theorem about the conversion of Cartesian coordinates into polar coordinates in integral II.
Geometric applications of the double integral: volume of a solid, area of a planar surface, area of a surface lobe, other examples of technical applications.
Separable variable equations.
Characteristic equation. Solving homogeneous linear equations of the second order with constant coefficients.
Solving non-uniform linear equations with constant coefficients using the constant variation method.
Solving homogeneous, complete and Bernoulli equations.

Teaching methods

Traditional education:
Lecture with presentation supplemented by examples given on the board. Interactive lectures with problems and questions for students. The activity of students is taken into account in valuation of them. Discussion during lectures is expected.
Connections with others mathematical subjects are indicated.
Practical lessons. Solving of exemplary exercises on a blackboard. Discussion of solutions with relative comments.

Bibliography

Basic:
1. W. Stankiewicz, J. Wojtowicz, Zadania z matematyki dla wyższych uczelni technicznych, PWN, część pierwsza i druga, Warszawa.
2. M. Gewert, Z.Skoczylas, Analiza matematyczna 2. Definicje, twierdzenia, wzory. Oficyna Wydawnicza GiS.
3. H. Jurlewicz, Z. Skoczylas, Algebra liniowa 1, Oficyna Wydawnicza GiS, Wrocław.

Additional:

1. E. Swokowski, Calculus with analytic geometry, Prindle, Weber, Schmidt, Boston, Massachusetts.
2. Dennis G.Zill, A first course in differential equations with applications, Prindle, Weber ; Schmidt, Boston.
3. W. Krysicki, L.Włodarski,Analiza matematyczna w zadaniach, PWN, Warszawa.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	75	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	50	2,00