COURSE DESCRIPTION CARD - SYLLABUS

Course name
Linear algebra with analytic geometry I [S1MwT1>ALzGA1]

Course

Field of study
Mathematics in Technology

Year/Semester
1/1

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
30

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

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Prerequisites

Basic knowledge of the high school. Ability to efficiently perform algebraic operations, knowledge of number sets and properties of operations. He is aware of the need to expand his competences and is ready to cooperate.

Course objective

Learning the basics of the calculus of complex numbers. Getting to know the matrix calculus and applying it to solve systems of linear equations. Getting to know the basics of the theory of linear spaces and linear operators, acquiring the ability to solve the eigenvalue problem of linear operator. Using the calculus of vector algebra to analyze a line and a plane in the space.

Course-related learning outcomes

Knowledge:
1. has knowledge about the notion of a complex number in different forms, about the basic concepts of

the matrix calculus, the theory of linear spaces and linear operators, understands the proofs of more important selected theorems or the ideas of proofs from the above area .
2. has knowledge of the basic concepts of vector algebra, is able to recognize the equations of a line and a plane in the space .

Skills:
1. has the ability to calculate determinants, is able to determine the rank of the matrix, inverse matrix, use matrix calculus to solve systems of linear equations, recognize linear subspaces and the dimension of a linear space, solve the eigenvalue problem of a linear operator given by a matrix .
2. can determine the equation of a line and a plane in space with the use of vector algebra, use the basic calculus of complex numbers .

Social competences:
1. can think and behave in good mathematical manner in the area of linear algebra and analitical geometry.
2. knows the limitation of own knowledge and understand the need of more far education and the necessity of systematic work.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture
-assessment of knowledge and skills on a written exam that checks the knowledge of notions and the ability to prove theorems and illustrate theories with examples (also possible short practical tasks). Passing threshold: at least 50% of points. The issues for the exam, on the basis of which the questions are prepared, will be sent to students with the use of university electronic systems.
Tutorials:
- continuous assessment - rewarding activity (additional points) manifested in the discussion and cooperation in solving practical tasks,
- continuous assessment - rewarding the increase in the ability to use the techniques learned,
- obtaining additional points for activity during classes, including for the preparing presentations (discussing additional aspects of the issues, in particular the application of the discussed theory in other sciences or a reference to the location in the history of mathematics) and for comments on improving teaching materials
- active participation in consultations deepening knowledge and directing further work.
The knowledge acquired during the exercises is verified by two tests carried out on approx. 7 and 15 weeks (alternatively 1 test at the end of the semester). Passing threshold: at least 50% of points.
The rules for completing the course and the exact thresholds for passing the course will be provided to students at the beginning of the semester with the use of university electronic systems.

Programme content

Update: 30.08.2022r.
I. Lecture: theoretical issues (definitions, lemmas, theorems, corolaries, algorithms) and suitable examples for the following issues:
1. Complex numbers (algebraic, trigonometric and exponential forms, operations on complex numbers, algebraic equations).
2. Number fields, abstract fields. Linear spaces, basis, dimension. Linear transformations (operators), eigenvalues and eigenvectors of a linear transformation.
3. Matrices, determinants, systems of linear equations, matrix equations, matrix rank, inverse matrix.
4. Vector algebra (scalar, vector and mixed product of vectors), line and plane in space.
II. Tutorials: solving practical problems illustrating the concepts discussed and example problems with the use of theoretical machinery from the lecture, e.g .:
using the algebraic, trigonometric or exponential form to solve algebraic equations, determining sets on the complex plane, determining the dimension of a linear space, determining the coordinates of an element after changing the basis, studying linear subspaces, studying linearity of the operator and determining the operator"s matrix in a fixed basis, solving the eigenproblem of operator, solving matrix equations, calculating determinants, solving systems of linear equations using the Gaussian method, determining the inverse matrix, rank of the matrix, using the calculus of vector algebra in geometry to

determine and analyze the equation of a line and a plane.

Teaching methods

I. Lectures
1. a lecture conducted on the blackboard in an interactive way with the formulation of questions to a group of students, the lecture supplemented by a computer presentation
2.the activity of students is taken into account (preparation of historical talks on mathematicians related to the presented material, papers on the use of algebra in engineering sciences, presenting evidence left to be done on their own) during classes when issuing the final grade,
3.initiating discussions during the lecture,
4. theory presented in connection with the current knowledge of students from previous lectures.
II. Tutorials
1. solving example tasks on the blackboard
2. detailed reviewing of the solutions to the tasks by the tutor and discussion of the comments.

Bibliography

Basic
1. A. I. Kostrykin, Wstęp do algebry, cz.1 Podstawy algebry, PWN, Warszawa 2004.
2. A. I. Kostrykin, Wstęp do algebry, cz.2 Algebra liniowa, PWN, Warszawa 2004.
3. A. I. Kostrykin, Zbiór zadań z algebry, PWN, Warszawa 2005.
4. M. Grzesiak, Liczby zespolone i algebra liniowa, Poznań 1999.
5. T. Jurlewicz, Z. Skoczylas, Algebra liniowa 1, Wrocław 2003.
6. T. Jurlewicz, Z. Skoczylas, Algebra liniowa 2, Wrocław 2005.
7. F. Leja, Geometria analityczna, PWN, Warszawa 1961.
Additional
1. H. Arodź, K. Rościszewski, Zbiór zadań z algebry i geometrii analitycznej dla fizyków, PWN, 1990.
2. J. Rutkowski, Algebra liniowa w zadaniach, PWN.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	63	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	62	2,50