POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Mathematics 2 - Algebra [S1EiT1E>MAT2ALG]

Course

Field of study	Year/Semester
Electronics and Telecommunications	1/1
Area of study (specialization)	Profile of study
–	general academic
Level of study	Course offered in
first-cycle	English
Form of study	Requirements
full-time	compulsory

Number of hours

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

Number of credit points

3,00

Coordinators	Lecturers
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Prerequisites

Mathematical knowledge from the secondary school. Ability to solve problems and mathematical modeling at the level of secondary school. Awareness of the need to broaden their competences, willingness to work together as a team.

Course objective

Learning method of classical linear algebra such as complex numbers, matrix calculus, theory of linear spaces and linear operators, the scalar product in the Euclidean space.

Course-related learning outcomes

Knowledge:
1. has knowledge of the complex numbers, operations on complex numbers, forms of complex numbers and their applications, the quadratic equation in the complex domain.
2. has knowledge of the matrix, operations on matrices, determinants of matrices, inverse matrix calculation, the use of matrix to solve systems of linear equations (Gaussian method), rank of the matrix.
3. has knowledge about linear spaces, the dimension and the basis of a linear space.
4. has knowledge about linear operators, eigenvalue problem of the operator given by the matrix.

5. has knowledge about the scalar product of vectors in three-dimensional space, about the orthogonal basis in that space.

Skills:
1. Can operate on complex numbers, can find sets on the complex plane, can solve simple equations in the complex domain.
2. can perform operations with matrices, can find an inverse matrix using the method of elementary operations on rows, calculate the determinant of a matrix, solve the system of linear equations using Gaussian method of elimination
3. can determine the dimension and the basis of linear space, can find coordinates of fixed element in different bases, can solve the eigenvalue problem of the operator given by the matrix.
4. can check if the operator is linear, can find the matrix of the linear operator in a given basis.
5. can perform operations on vectors in three-dimensional space, can calculate the scalar product and ckeck if the basis is orthogonal.

Social competences:
He can think and act precisely in the area of process description in technical sciences

Methods for verifying learning outcomes and assessment criteria
Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Tutorials
- continuous evaluation - rewarding the activity manifested in the discussion and in cooperation in solving practical tasks,
- continuous evaluation - rewarding the increase of skills in using the techniques learned,
- obtaining additional points for activity during classes, including the presentation of reports discussing additional aspects of issues, in particular the application of the theory in other sciences or a reference to the place in the history of mathematics,
Skills acquired as part of the tutorials are verified on the basis of 2 colloquia carried out during about the 7th and 15th weeks, consisting of 5-7 tasks with possible various points depending on their level of difficulty . Passing threshold: 50% of total points.
Lecture
Knowledge acquired during the lecture is verified by the exam in a written form (during the session) concernig the theoretic part of the subject possible with some examples (exercises) included. The written exam is a collection of questions in which a descriptive answer is expected (using a precise language of the theory). Passing threshold: 50% of points. Final issues on the basis of which questions are prepared will be sent to students by e-mail using the university e-mail system.

Programme content
Lecture: theoretical issues (definitions, lemmas, theorems, corollaries, algorithms) and suitable examples for the issues:
complex numbers,
abstract fields,
 linear spaces,
 linear operators,
matrix calculus
3-dimensional Eucledean spaces and scalar product.
Tutorials
Exercises: solving practical problems illustrating the concepts discussed on the lecture and examples of problems using the theoretical machinery from the lecture,

Course topics
Lecture: theoretical issues (definitions, lemmas, theorems, corollaries, algorithms) and suitable examples for the issues:
complex numbers, abstract fields, linear spaces, base, dimension, linear operators, eigenvalues and eigenvectors of a linear operators, matrices, determinants, systems of linear equations, 3-dimensional Eucledean spaces and scalar product.

Tutorials

Exercises: solving practical problems illustrating the concepts discussed on the lecture and examples of problems using the theoretical machinery from the lecture, e.g .:

using algebraic, trigonometric or exponential forms to solve algebraic equations, determining sets on the complex plane, solving simple matrix equations using operations on matrices, calculating determinants, finding ranks of matrices, solving systems of linear equations using the Gauss method, determining the inverse matrix, verifying linear dependence and independence of elements in a linear space, determining the dimension and the basis of the linear space, determining the coordinates of an element after changing the basis, studying linear subspaces, examining the linearity of the operator and determining the matrix of operator in the given basis, solving the eigenvalue problem of the operator given by the matrix, finding the scalar product in the Euclidean space.

Teaching methods

Lecture

1. a lecture on board with interactive questions for a group of students,
2. students" activity (preparation of historical reports on mathematicians related to the presented material, reports on the use of algebra in engineering sciences) during classes will be taken into account during the final assessment,
3. initiating discussions during the lecture,
4. theory presented in connection with the current knowledge of students from previous lectures,
5. presentations using a projector at some lectures.

Tutorials

1. solving problems on the board
2. detailed reviewing the solutions of tasks by the teacher and discussions on comments.

Bibliography

Basic

1. Fraleigh, John B., Calculus with analytic geometry, Addison-Wesley. Addison-Wesley, cop. 1980.
2. Bodewig, Ewald, Matrix calculus, North-Holland, 1956.
3. Edelen, Dominic G. B., Kydoniefs, Anastasios D., An Introduction to linear algebra for science and engineering, Elsevier, 1976.
4. Hartfiel, Darald J., Hobbs, Arthur M., Elementary linear algebra, Prindle, Weber & Schmidt, c1987.
5. Nering, Evar D., Linear algebra and matrix theory, John Wiley and Sons, Inc., 1963.
6. S. Przybyło, A. Szlachtowski, Algebra i wielowymiarowa geometria analityczna w zadaniach, WNT Warszawa 1994 (i późniejsze).
7. T. Jurlewicz, Z. Skoczylas, Algebra liniowa 1, Wrocław 2003.
8. T. Jurlewicz, Z. Skoczylas, Algebra liniowa 2, Wrocław 2005.

Additional

1. Anton, Howard, Calculus with analytic geometry, John Wiley & Sons, 1989.
2. Brown, William C., A Second Course in Linear Algebra, John Wiley, 1987.
3. Kolman, Bernard, Introductory linear algebra with applications, Macmillan Publishing Co., 1976.
4. Nicholson, W. Keith., Elementary linear algebra with applications, Prindle, Weber & Smith, 1986.
5. Brown, William C., A second course in linear algebra, John Wiley & Sons, cop. 1988
6. Chih-Han Sah., Abstract algebra, New York ; London : Academic Press, cop. 1967.
7. M. Grzesiak, Liczby zespolone i algebra liniowa, Wydawnictwo PP, Poznań 1999,
8. A. I. Kostrykin, Wstęp do algebry, cz.1 Podstawy algebry, PWN, Warszawa 2004.
9. A. I. Kostrykin, Wstęp do algebry, cz.2 Algebra liniowa, PWN, Warszawa 2004.
10. A. I. Kostrykin, Zbiór zadań z algebry, PWN, Warszawa 2005.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	55	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00