COURSE DESCRIPTION CARD - SYLLABUS

Course name
Mathematics 2

Course

Field of study
Automatic control and robotics
Area of study (specialization)

Level of study
First-cycle studies
Form of study
full-time

Year/Semester
1/1
Profile of study
general academic
Course offered in
English
Requirements
compulsory

Number of hours

Lecture
30
Laboratory classes
0
Other (e.g. online)

Tutorials
30
Projects/seminars

Number of credit points

6

Lecturers

Responsible for the course/lecturer:
dr hab. inż. Paweł Kolwicz, prof. PP
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Responsible for the course/lecturer:

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, analitical geometry in the Euclidean space.

Course-related learning outcomes

Knowledge

1. has knowledge of complex numbers, operations with complex numbers, complex numbers forms and their applications.

2. has knowledge of the roots of complex numbers .

3. has knowledge of the matrix, operations on matrices, determinants of matrices, inverse matrix calculation, the use of matrix to solve systems of linear equations.

4. has knowledge of basic algebraic structures - monoids, groups, rings and fields.

5. has knowledge of n-dimensional vector space, basis of the linear space, basis change, eigenvalue problem of matrix.

6. has knowledge of the operations on vectors in three-dimensional space, of a straight line, planes

Skills

1. Can operate on complex numbers, can find certain types of complex roots

2. can perform operations with matrices, can find an inverse matrix using elementary operations method, calculate the determinant of a matrix, solve the system of linear equations using Gaussian method of elimination

3. is able to recognize the algebraic structures, can use the monoid and group structure to describe issues in technical sciences

4. can determine the dimension of space, can solve the matrix eigenvalue problem.

5. can perform operations on vectors in three-dimensional space and apply the methods of vector calculus to describe straight lines and planes.

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:

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 (alternatively 1 test on the end of the semester), 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:

Relations. Complex numbers and their applications. Calculus matrix and its application in solving systems of linear equations. Algebraic structures: monoids, groups, rings, fields. Linear spaces (n-dimensional), linear operators, analytical geometry of 3-dimensional space: plane, straight line, surfaces.

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 of complex numbers 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, vector and mixed product in the Euclidean space with applications to equations of a plane and straight line.

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 solutions.

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	140	6,0
Classes requiring direct contact with the teacher	70	3,0
Student's own work (literature studies, preparation for lecture/tutorials, preparation for tests/exam) [1]	70	3,0

[1] delete or add other activities as appropriate