COURSE DESCRIPTION CARD - SYLLABUS

Course name
Mathematics II [S1AiR1E>MatII]

Course

Field of study
Automatic Control and Robotics

Year/Semester
1/1

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other
0

Tutorials
30

Projects/seminars
0

Number of credit points

6,00

Coordinators

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Lecturers

Prerequisites

High school level mathematical knowledge and the ability to use it in some specific practical situations.

Course objective

To provide students with basic knowledge of algebra, in particular, about the field of complex numbers, linear algebra and some structures of abstract algebra. Developing abstract thinking skills, as well as the ability to apply the acquired knowledge in more practical issues.

Course-related learning outcomes

Knowledge:
The graduates has an advanced knowledge and understanding of selected facts, objects and phenomena and the methods and theories relating to them that explain the complex relationships between them; he has a basic general knowledge of mathematics including algebra, geometry, analysis, probabilistic and elements of discrete mathematics and logic, including mathematical methods and numerical methods necessary to:
▪ describe and analyse the properties of linear and basic non-linear dynamic and static systems,
▪ the description and analysis of complex numbers,

▪ the description of random processes and uncertain quantities,
▪ the description and analysis of combinatorial and sequential logic systems,
▪ description of control algorithms and stability analysis of dynamic systems,
▪ the description, analysis and methods of signal processing in the time and frequency domain,
▪ numerical simulation of dynamic systems in the continuous and discrete time domain [K1_W1 (P6S_WG)].
Skills:
Is able to obtain information from literature, databases and other sources also in a chosen foreign language [K1_U1 (P6S_UW)].
Is able to develop a solution to a simple engineering task and implement, test and run it in a selected programming environment on a PC for selected operating systems [K1_U26 (P6S_UW)].
Social competences:
Is ready to critically assess his/her knowledge; understands the need for and knows the possibilities of continuous training - improving professional, personal and social competence, is able to inspire and organize the learning process of others [K1_K1 (P6S_KK)].
Is aware of the responsibility for his/her own work and is ready to follow the rules of teamwork and take responsibility for jointly implemented tasks; is able to lead a small team, set goals and determine priorities leading to the realisation of the task; is ready toto play a responsible professional role. [K1_K3 (P6S_KR)].
DETAILED EFFECTS
Knowledge:
Student has a knowledge of the basisc of linear and abstract algebra.
Skills:
Student should know the basic methods of linear algebra and be able to illustrate the most important theorems and definitions with appropriate examples.
Social competences:
Student should know the limitations of his own knowledge and understand the need to expand his skills. In addition, he should understand the need to be precise in expressing his thoughts and the value of theoretical thinking.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture - written theoretical knowledge exam (with some possible exercises included) at the end of the semester.
Tutorials - tests and assessment of activity in the classroom.

Programme content

Complex numbers via Hamilton"s construction; de Moivre"s formula; Euler"s formula; roots of complex polynomials and the fundamental theorem of algebra; matrix calculus; Gauss" algorithm; Laplace expansion (cofactor expansion); Cramer"s theorem; symmetries; group of permutations GL(n,R); cyclic group; group action; homomorphism; Cayley"s theorem; subgroup; image and kernel of a homomorphism; modular arithmetic; rings and fields; vector (linear) spaces and linear operators acting on them; linear (in)dependence; basis; dimension; Kronecker-Capelli theorem; representation of a linear operator as a matrix; eigenvalues and eigenvectors of matrices; characteristic polynomial; eigenspaces; geometric and algebraic multiplicity; eigenbasis for matrices; diagonalization and eigendecomposition; Euclidean spaces.

Course topics

none

Teaching methods

Lectures: theory presented in relation to the students" current knowledge; initiating discussions frequently during the lecture; introducing new topics preceded by numerous examples and motivations; recommending materials for self-study and supplementing knowledge.
Tutorials: tasks closely related to the theory presented during the lecture; solving example tasks on the blackboard; detailed reviewing of the solutions to the tasks by the teacher and discussion of the comments; taking into account the activity of students during classes when assigning the final grade.

Bibliography

Basic
1. J. B. Fraleigh, Calculus with analytic geometry, 1980.
2. G. Strang, Introduction to linear algebra, 2009.
3. A. I. Kostrykin, Wstęp do algebry. Podstawy algebry, 2012.
4. T. Jurlewicz i Z. Skoczylas, Algebra liniowa 1, 2003.
5. T. Jurlewicz i Z. Skoczylas, Algebra liniowa 2. 2005.
Additional
1. W. K. Nicholson, Elementary linear algebra with applications, 1986.
2. H. Anton, Calculus with analytic geometry, 1989.
3. M. Grzesiak, Liczby zespolone i algebra liniowa, 1999.

Breakdown of average student's workload

	Hours	ECTS
Total workload	150	6,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	90	3,50