



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Selected topics in mathematics II

### 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 / 2

Profile of study

general academic

Course offered in

English

Requirements

compulsory

### Number of hours

Lecture

15

Laboratory classes

Other (e.g. online)

Tutorials

15

Projects/seminars

### Number of credit points

2

### Lecturers

Responsible for the course/lecturer:

dr hab. Maciej Ciesielski

Responsible for the course/lecturer:

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Faculty of Control Robotics and Electrical

Engineering

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### Prerequisites

The knowledge from the area of linear algebra and calculus [K1\_W01 (P6S\_WG)].

The abilities of solving some problems of linear algebra and calculus [K1\_U01 (P6S\_UW)].

Awareness of the necessity to improve the knowledge and expertise, readiness to undertake a cooperation in the team [K1\_K01 (P6S\_KK)].

### Course objective

The goal of the subject is to attain the knowledge from the area of the selected topics in mathematics and to get the skills that allow to apply the obtained knowledge to analyze the mathematical problems.



### Course-related learning outcomes

#### Knowledge

Knows and understands in an advanced level selected facts, objects and phenomena, as well as methods and theories explaining the complex relations between them, constituting basic general knowledge of mathematics including algebra, geometry, analysis, probabilistic and elements of discrete mathematics and logic [K1\_W01 (P6S\_WG)].

#### Skills

Is able to work individually and in a team; is able to plan and organize work – both individually and in a team; is able to estimate the time needed to complete a task; is able to develop and implement a work schedule ensuring that deadlines are met [K1\_U02 (P6S\_U0)].

The graduate is able to determine and use models of the selected mathematical problems as well as to use them for the analysis and design of automation and robotics systems [K1\_U05 (P6S\_UW)].

#### Social competences

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

#### Lecture:

- grading knowledge and abilities showed in an written exam

#### Exercises:

- testing knowledge and preparation to exercises,
- awarding practical knowledge obtained during the previous exercises and lectures,
- grading knowledge and abilities related with calculations,
- test for exercises and/or written elaboration (that can be made partially outside of exercises )

### Programme content

1. Normed spaces, Hilbert spaces, linear operator.
2. Orthogonal functions and orthonormal functions, Gram-Schmidt procedure.
3. Fourier series, Fourier transform.
4. Theorem Bessel's inequality.
5. Legendre differential equation, Hermite differential equation.
6. Integral equation, Fredholm integral equation of the first and second kind, Volterra integral equation, Abel integral equation.



7. Methods for finding a solution of the selected linear integral equation.
8. Gamma function and Bessel function.
9. Gradient operator, divergence operator, rotation operator, Laplace transform.

### Teaching methods

Lectures – the lecture is organized with the multimedia presentations and complemented with many examples, showing an application of the presented issues.

Exercises – discussing open problems, comprehensive analysis for selected problems in mathematics, initiation open discussion devoted to methods which might be used to solve problems related to selected topics in mathematics, grading homeworks.

### Bibliography

Basic

1. Wstęp do analizy funkcjonalnej, J. Musielak, PWN 1989
2. Elementy analizy wektorowej, M. Gwert, Z. Skoczylas, GIS 2012
3. Równania całkowe, M. Krasnosielski, A. Koszelew, S. Michlin, PWN 1972
4. Elementary partial differential equations, R. Gribben, Van Nostrand Reinhold 1975

Additional

1. Beginning partial differential equations, P. O'Neil, 2008
2. Linear and nonlinear integral equations - methods and applications, A. Wazwaz, Springer 2011

### Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) <sup>1</sup>	30	1,0

<sup>1</sup> delete or add other activities as appropriate