



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Applied mathematics and mathematical methods

### Course

Field of study

Construction and Exploitation of Means of Transport

Area of study (specialization)

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

1/1

Profile of study

general academic

Course offered in

Polish

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:

Karol Gajda, Ph.D., Eng.

Faculty of Control, Robotics and Electrical

Engineering

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Responsible for the course/lecturer:

### Prerequisites

The student starting this subject should have knowledge and skills from the first-cycle studies in mathematics and computer science. He should also have the ability to obtain information from the indicated sources and be ready to cooperate as part of the team. He should know the limitations of his own knowledge and understand the need for further education.

### Course objective

Presentation of selected numerical methods and analytical methods for solving selected differential equations.

### Course-related learning outcomes

Knowledge



1. Has extended knowledge of mathematics in the field of numerical methods used in optimization tasks, computer simulation, linear algebra, interpolation and approximation
2. Has extended knowledge in the field of computer science, concerning computer programming and engineering calculation programs in the field of computer simulation of physical systems
3. Is aware of the civilization effects of technology

#### Skills

1. Can formulate and test hypotheses related to simple research problems.
2. Can interact with other people as part of team work and take a leading role in teams
3. Can independently plan and implement own learning throughout life and direct others in this regard

#### Social competences

1. Is ready to critically assess the knowledge and content received
2. Is ready to recognize the importance of knowledge in solving cognitive and practical problems and to consult experts in case of difficulties with solving the problem on its own
3. Is willing to think and act in an entrepreneurial manner

#### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired during the course is verified by the assessment of activity, assigned tasks and an exam.

The skills acquired during the tutorials are verified on the basis of the developed projects and the final test.

#### Programme content

Linear differential equations of the order of  $n$ .

Selected nonlinear differential equations.

Selected numerical methods of solving initial problems, interpolation, approximation, optimization.

#### Teaching methods

1) lectures:

- presenting a new topic preceded by a reminder of related content, known to students from other subjects,
- an interactive lecture with the formulation of questions to a group of students or to identified specific students,



- a lecture supplemented with examples given on the blackboard and calculations made with the use of open source software,
- lecture supplemented with tasks for independent solution, the solution of which has an impact on the final grade,
- student activity during classes is taken into account when assigning the final grade.

2) tutorials:

- an example of solving the task on the board along with analyzing the next stages,
- students' way of solving the task on the blackboard is reviewed by the tutor.

**Bibliography**

Basic

1. Fortuna Z., Macukow B., Wąsowski J., Metody numeryczne, WNT, Warszawa, 2020.
2. Kincaid D., Cheney W., Analiza numeryczna [Numerical Analysis: Mathematics of Scientific Computing (The Sally Series; Pure and Applied Undergraduate Texts, Vol. 2)], WNT, Warszawa 2006.
3. W. Kryszicki, L. Włodarski, Analiza matematyczna w zadaniach, t. II, PWN, Warszawa 2020.

Additional

1. Horla D., Metody obliczeniowe optymalizacji w zadaniach, WPP, Poznań, 2016

**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 tutorials, preparation for tests) <sup>1</sup>	30	1,0

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