



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Numerical methods in techniques

Course

Field of study

Mathematics in Technology

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

30

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

dr inż. Barbara Szyszka

Responsible for the course/lecturer:

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tel. 61665 2763

Faculty of Control, Robotics and Electrical
Engineering

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Prerequisites

The student has an extended and in-depth knowledge of:

- * mathematics (in terms of material studies grade 1: especially in: linear algebra, differential calculus and the initial-boundary value problems for ordinary and partial differential equations)
- * numerical methods (for studies of the first-cycle studies)
- * computer science (programming in high level language).

The student is able to solve math problems analytically within the range specified above.

The student is able to use at least one software to solve tasks using basic numerical methods.

The student is aware of the level of his knowledge.



The student is aware of deepening and expanding knowledge.

Course objective

Understanding the advanced numerical methods. Applying them to solve complex mathematical and engineering problems. Supporting mathematical and engineering calculations with appropriate IT tools. Verification of obtained solutions.

Course-related learning outcomes

Knowledge

The student has advanced general knowledge about terminology in numerical methods, also in a foreign language.

The student has deepened and theoretically founded knowledge of numerical methods; knows at least one software package or a programming language in detail.

The student has advanced knowledge of computer-aided design.

The student has advanced knowledge of the principles of health and safety at work.

Skills

The student can use knowledge of higher mathematics.

The student is able to construct and analyse complex mathematical models.

The student can use mathematical techniques, tools and methods, including numerical methods to solve advanced engineering tasks or simple research problems.

The student can construct an algorithm for solving a complex engineering task or a simple research problem and implement and test it in a selected programming environment.

The student can formulate and test hypotheses related to engineering tasks or simple research problems, integrate knowledge in the field of exact and natural sciences and engineering and technical sciences, carry out detailed research using analytical and simulation methods, interpret the results obtained and draw conclusions.

The student is able to select the appropriate sources of knowledge and obtain the necessary information from them.

The student can make a critical analysis of the measurement results obtained.

The student is able to use hardware, in accordance with general requirements and technical documentation; knows how to apply the principles of health and safety at work.

Social competences

The student is aware of the role and importance of knowledge in solving practical problems; is aware of the need to deepen and expand knowledge;

The student is ready to think and act in a creative way, taking into account safety work; is aware of the responsibility for the work of the team and its individual participants.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:

* assessment of knowledge and skills demonstrated on the written test.



- * control of perception during lectures.

Laboratory exercises:

- * assessment of skills related to the implementation of project tasks
- * assessment of student preparation for laboratory classes and assessment of skills related to the implementation of laboratory exercises
- * assessment of teamwork skills

Programme content

Update: 31.01.2020.

Initial-value problems for ordinary differential equations (higher-order systems of differential equations).

Boundary value problems for ordinary differential equations.

Numerical differentiation of functions of several variables.

Initial-boundary value problems for partial differential equations - finite difference methods.

Teaching methods

lectures:

lecture with multimedia presentation supplemented with examples given on the blackboard,
lecture conducted in an interactive manner with formulating questions for students,
taking into account the students' activity,
during the lecture initiating the discussion,
theory presented in connection with practice,
theory presented in connection with the current knowledge of students,
taking into account different aspects of the issues presented,
presentation of a new topic preceded by a reminder of related content known to students in other subjects;

laboratories:

laboratories supplemented with multimedia presentations,
reviewing reports by the laboratory's leader,
work in teams,
computational experiments;

Bibliography

Basic

1. Kincaid, Cheney, Analiza numeryczna, WNT 2006,
2. Burden, Faires, Numerical analysis, Prindle, Weber&Schmidt, Boston,
3. Kącki, Równania różniczkowe cząstkowe w zagadnieniach fizyki i techniki, WNT, Warszawa

Additional

1. Zarowski, An introduction to numerical analysis for electrical and computer engineers, Wiley
2. Rośliniec, Wybrane metody numeryczne z przykładami zastosowań w zadaniach inżynierskich,



Oficyna Wydawnicza Politechniki Warszawskiej,

3. B. Szyszka, An Interval Version of Cauchy's Problem for the Wave Equation, AIP Conference Proceedings 1648, s. 800006-1 – 800006-4, 2015 AIP Publishing LLC.

Breakdown of average student's workload

	Hours	ECTS
Total workload	80	3,0
Classes requiring direct contact with the teacher	49	2,0
Student's own work (literature studies, preparation for laboratory classes, preparation for test, project preparation) ¹	31	1,0

¹ delete or add other activities as appropriate