COURSE DESCRIPTION CARD - SYLLABUS

Course name
Numerical methods [S1MwT1>MN]

Course

Field of study
Mathematics in Technology

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
45

Other (e.g. online)
0

Tutorials
15

Projects/seminars
0

Number of credit points

6,00

Coordinators

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Lecturers

Prerequisites

The student should have knowledge of mathematics (linear algebra, differential and integral calculus) and computer science (basic data structures and programming). The student should be aware of the need to expand their competences, understand the need for further education, and be ready to cooperate within the team.

Course objective

1. Familiarizing students with topics related to numerical methods, e.g. with the differences between real and computer arithmetic, numerical errors, discretization, and basic numerical algorithms. 2. Application of learned algorithms to solve selected mathematical problems and simple engineering tasks. 3. Supporting calculations with appropriate IT tools. 4. Verification of the obtained solutions.

Course-related learning outcomes

Knowledge:
1. The student has knowledge about the use of mathematical methods and tools in the field of numerical methods.
2. The student has theoretically founded knowledge of numerical methods.

3. The student knows at least one software package or programming language.

Skills:
1. The student is able to use knowledge in higher mathematics.
2. The student can use numerical tools and methods to solve simple engineering problems.
3. The student can construct the algorithm of solving a simple engineering task and implement it and test it in the chosen development environment.
4. The student is able to operate the devices in accordance with general requirements and knows how to apply the principles of health and safety at work in a computer laboratory.
5. The student can use the knowledge and methods and tools to solve typical engineering tasks.
6. The student knows how to use a foreign language to the extent that it is possible to use English-language software.

Social competences:
1. The student is aware of the level of his knowledge.
2. The student is aware of deepening and expanding knowledge to solve technical problems.
3. The student is able to think and act in a creative way, is aware of the responsibility for the effects of the work of the team, as well as its individual participants.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired during the lectures is verified during the written and/or oral exam. Exam issues will be given to students at the last lecture and posted through e-courses.

The skills acquired during the auditorium exercises are verified on the basis of the colloquium taking place during the last class, consisting of tasks with various points. Passing threshold: 50% of points.

The skills acquired during laboratory classes are verified on the basis of completed projects. Passing threshold: 50% of points. In addition, points are awarded for preparing the student for laboratory classes, carrying out laboratory exercises, and assessing the ability to work in a team.

Programme content

1. Floating point arithmetic, round-off errors.
2. Numerically stable and unstable algorithms, 'well-conditioned' and 'ill-conditioned' problems.
3. Numerical solutions of nonlinear equations.
4. Polynomial interpolation.
5. Taylor polynomials.
6. Newton–Cotes quadrature rules.
7. Numerical differentiation.
8. Initial-value problems for first-order ordinary differential equations (selected methods of Runge-Kutta type).

Teaching methods

lectures and auditorium classes:
1.Lecture with multimedia presentation supplemented by examples given
on the blackboard.
2.Lecture conducted in an interactive way of formulating questions to students.
3.Student activity is taken into account during the course of the assessment.
4.Theory presented in connection with practice.
5.Theory presented in connection with the current knowledge of students,
6.Taking into consideration various aspects of the presented issues,
7. introducing a new topic, preceded by a reminder of related content, known to students from other subjects.

laboratories:
1. computational experiments,
2. reviewing reports by the laboratory"s leader,

3. work in teams,

Bibliography

Basic
1. Fortuna, Macukow, Wąsowski, Metody numeryczne, WNT: PWN, 2017
2. Kincaid, Cheney, Analiza numeryczna, WNT 2006,

Additional
1. Burden, Faires, Numerical analysis, Prindle, Weber&Schmidt, Boston,
2. E. Kącki, A. Małolepszy, A. Romanowicz, Metody numeryczne dla inżynierów, Wyd. Politechniki Łódzkiej 2000
3. Magnucka-Blandzi, Dondajewski, Gleska, Szyszka, Metody numeryczne w MatLabie. Wybrane zagadnienia, Wyd. Politechniki Poznańskiej 2013,

Breakdown of average student's workload

	Hours	ECTS
Total workload	160	6,00
Classes requiring direct contact with the teacher	98	4,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	62	2,00