COURSE DESCRIPTION CARD - SYLLABUS

Course name
Numerical methods and programming

Course

Field of study
Chemical and process engineering

Year/Semester
1/2

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

2

Lecturers

Responsible for the course/lecturer:
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Wydział Technologii Chemicznej

60-965 Poznań

Ul. Berdychowo 4, pok. 124A

Responsible for the course/lecturer:
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60-965 Poznań, ul. Berdychowo 4

Prerequisites

The student starting this course should have basic knowledge of computer science and mathematics in the field of algebra, matrix calculus, differential and integral calculus. He should also have the ability to obtain information from the indicated sources and be ready to cooperate as part of the team.

Course objective

Zapoznanie z podstawami metod numerycznych.

Course-related learning outcomes

Knowledge

1. K_W01 - The student has extended and deepened knowledge in the field of mathematics and computer science necessary for modeling, planning, optimization and characterization of industrial chemical processes as well as planning experiments and processing the results of experimental research.

2. K_W15 - The student knows the basic methods, techniques, tools and materials used in solving simple engineering tasks related to technology and chemical engineering.

Skills

1. K_U07 - The student has the ability to analyze and solve problems related to chemical technology and process engineering, using theoretical, analytical, simulation and experimental methods for this purpose.

2.K_U05 - The student has the ability to self-study.

3. K_U18 - Can choose the right way to solve simple engineering tasks related to chemical and process engineering.

Social competences

1. K_K01 - The student understands the need for training and improving their professional and personal competences.

2. K_K05 - The student can think and act in a creative and entrepreneurial way.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired as part of each subsequent lecture is verified in the form of a multiple-choice test conducted on the eCourses platform within 6 days, starting from the next day after the lecture, preceding the next lecture. The test consists of 10-15 questions (open and closed) scored differently. Passing threshold: 51% of the total number of points. The final grade of the lecture will be issued according to the following criteria: 51%-60% (3.0), 60%-72% (3.5); 72%-85% (4,0), 85%-93% (4,5), 93%-100% (5,0). The issues on the basis of which the questions are developed will be presented to students during the lecture.

Programme content

1. Basic concepts related to numerical calculations: binary system, machine representation of numbers, machine accuracy, floating-point arithmetic operations, task conditioning and algorithm stability.

2. Polynomial interpolation and approximation: approximation with Taylor polynomials, interpolation with Lagrange polynomials, interpolation with spline polynomials of the third degree.

3. Numerical solving of nonlinear equations: bisection method, secant method, Newton-Raphson method, simple iteration method.

4. Numerical differentiation. Two-point methods, n-point methods, Richardson extrapolation.

5. Numerical integration. Trapezoidal method, Simpson's method, compositional methods.

6. Numerical solution of systems of linear equations. Gauss elimination method, Thomas algorithm, iterative methods: Jacobi, Gauss-Seidel.

7. Methods of solving initial problems for ordinary differential equations. Euler method, Taylor n order, Runge-Kutta method.

Teaching methods

Multimedia presentation..

Bibliography

Basic

1. Jankowscy, J. i M., Przegląd metod i algorytmów numerycznych. Część 1. WNT, Warszawa, 1981.

2. Dryja, M., Jankowscy J. i M., Przegląd metod i algorytmów numerycznych. Część 2. WNT, Warszawa, 1982.

3. Fortuna, Z., Macukow, B., Wącowski, J., Metody numeryczne, Seria Podręczniki Akademickie: Elektronika, Informatyka Telekomunikacja, Wyd. IV, WNT, Warszawa, 1998.

Additional

1. Fausett, L., Numerical Methods Using MathCad, Prentice Hall, Upper Saddle River, new Jersey, USA, 2002.

2. Burden, R. L., Faires, J. D., Numerical Analysis. Third Edition, PWS -- KENT Publishing Company, Boston, USA, 1985.

Breakdown of average student's workload

	Hours	ECTS
Total workload	25	2,0
Classes requiring direct contact with the teacher	15	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	10	1,0

[1] delete or add other activities as appropriate