COURSE DESCRIPTION CARD - SYLLABUS

Course name
Numerical methods [S1EiT1E>MN]

Course

Field of study
Electronics and Telecommunications

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
15

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

The knowledge of the algebra and of the mathematical analysis also of probability theory and of the mathematical statistics elements within the range of first-cycle of studies on technical universities. The knowledge of basesof the programming in MATLAB.

Course objective

Acquaintedness with concepts and theorems from the range of numerical methods. Recognition of numerical algorithms of solution of typical problems from the algebra and the mathematical analysis. Preparation to the practical application of recognized methods to the problem solving from the range of the electronics and telecommunications.

Course-related learning outcomes

Knowledge:
1. Knowledge from the range of numerical methods finding use in the electronics and telecommunications.
2. Orderly and underpinned with the theory the knowledge about rules and limitations of the problem solving with numerical methods.

Skills:
1. Recognition of problems, in this of practical issues which can be solved algorithmically.
2. Selection of proper numerical methods of the problem solving from the range of the electronics and telecommunications.
3. Interpreting of obtained results of calculations with the regard of conditionings of calculations realized with numerical methods.

Social competences:
1. Consciousness of the necessity of the professional approach to the resolution of technical problems and undertakings of the responsibility for proposed solutions.
2. Understanding of the meaning of mathematics and its uses in the solution of modern engineering problems.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture - the basis for grading is a final exam at the end of the semester and additional work assigned by the lecturer.

Projects - the basis for grading is the implementation and reporting of a project aimed at using numerical methods to model a given complex physical process.

Assessment criteria:
<= 50% 2.0
51%-60% 3.0
61%-70% 3.5
71%-80% 4.0
81%-90% 4.5
91%-100% 5.0

Programme content

1. Computer arithmetic, consequences of the floating point representation of numbers. Analysis of the accuracy of numerical algorithms. Conditioning numerical tasks. Stability, correctness, computational complexity of the algorithm.
2. Solving linear systems of algebraic equations. Direct methods (Gaussian elimination, Jordan elimination, LU matrix factorization). Iterative methods (Jacobi's, Gauss - Seidel).
3. Solving nonlinear equation, roots of polynomials - bisection method, regula falsi method (false-position method), secant method, tangent method.
4. Interpolation - polynomial methods, spline function methods.
5. Approximation - least-squares approximation, Pade approximation.
6. Numerical integration - quadrature-based methods, Monte-Carlo methods.

Course topics

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Teaching methods

Lectures - in form of presentations illustrated with examples. The stage_check of the understanding of the content across the discussion.

Projects - numerical elaborating of problems given by lecturer, relying on the realization of three stages: the choice of the method of solution, preliminary calculations of initial parameters, simulation investigations with the use of MATLAB procedures.

Bibliography

Basic:
1. Chapra S., Canale R., "Numerical Methods for Engineers", McGraw-Hill, 2002.
2. Roman Z. Morawski, Andrzej Miękina, "Solved Problems in Numerical Methods for Students of Electronics and Information Technology", Oficyna Wydawnicza Politechniki Warszawskiej, 2021
3. Dryja M., Jankowscy J. i M., "Przegląd metod i algorytmów numerycznych", Cz. II, Wyd. 2, WNT, Warszawa 1988
4. Fortuna Z., Macukow B., Wąsowski J., „Metody numeryczne”, WNT, Warszawa 2021.
5. Jankowscy J. i M., "Przegląd metod i algorytmów numerycznych", Cz. I, Wyd. 2, WNT, Warszawa 1988.

Additional:
1a. Kincaid D., Cheney W., "Numerical Analysis", Wardsworth Group, 2002.
1b. Kincaid D., Cheney W.: "Analiza numeryczna", WNT, Warszawa 2006
2. Stoer J., Bulirsch R., „Wstęp do analizy numerycznej”, PWN, Warszawa 1987.
3. Ralston A., „Wstęp do analizy numerycznej”, PWN, Warszawa 1983.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	31	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	44	1,00