COURSE DESCRIPTION CARD - SYLLABUS

Course name
Calculation methods [S1BZ1E>MO]

Course

Field of study
Sustainable Building Engineering

Year/Semester
2/3

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
30

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

prof. dr hab. inż. Wojciech Sumelka
wojciech.sumelka@put.poznan.pl

Lecturers

Prerequisites

Knowledge: Mathematics: matrix calculus, knowledge of definitions and integration rules, elements of probability theory, elements of differential calculus; Skills: operating a computer station, using matrix calculus, basic techniques for solving differential equations, basics of differential calculus; Social competences: awareness of the need to raise professional and personal competences, updating knowledge and skills. Ability to cooperate in a group, respect for Polish;

Course objective

To familiarize students with modern, basic methods and numerical algorithms used in solving engineering tasks. Acquiring basic programming skills, defining goals and expectations of simple calculation applications.

Course-related learning outcomes

Knowledge:
1. Student knows basic numerical methods used in engineering practice - [KSB_W01]
2. The student knows the possibilities of using selected computer programs to implement specific numerical algorithms - [KSB_W12]

3. The student knows the basic methods of construction of numerical algorithms, and measures of their assessment - [KSB_W12]

Skills:
1. Student is able to correctly determine the calculation model used to solve a specific engineering task - [KSB_U01]
2. Student is able to make the right choice of the algorithm needed to solve a given numerical task, and based on the algorithm is able to develop an intermediate application that solves a given task - [KSB_U02, KSB_U09]
3. Student is able to make a critical assessment of the results of numerical analysis - [KSB_U07]

Social competences:
1. Student is able to work independently and with team on a given task - [KSB_K01]
2. Student is able to formulate conclusions and describe the results of own work - [KSB_K02, KSB_K03]
3. Student recognizes the need to respect the Polish language, the need for continuous learning and cooperation in a group. Is aware of the need for self-education - [KSB_K05]
4. Understands the need to protect copyright and the principles of professional ethics - [KSB_K09]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture: checking knowledge through written colloquium - answer to 4-6 questions or if test was chosen on 20 questions. Passing threshold:
50% of points.
Laboratory: knowledge checked by:
a) assessment of student activity in classes,
b) assessment of completed project tasks during classes during the semester (independent or in small teams) involving the preparation of a short application implementing the indicated numerical algorithm, and carrying out calculations for the prepared data sets.
c) tests: two credits in the middle and at the end of the course - independent work at the computer. Passing threshold: 50% of points.

Programme content

Lectures:
Lecture 1 - Solving systems of linear equations
Lecture 2 - Solving nonlinear equations and systems of nonlinear equations
Lecture 3 - Interpolation and approximation
Lecture 4 - Numerical integration and differentiation
Lecture 5 - Numerical solution of differential equation of the 1-st order
Lecture 6 - Numerical solution of differential equation of the 2-nd order
Lecture 7 - Mathematical optimization – basic topics
Lecture 8 - Summary - end-term test
Laboratories
• Laboratory 1
o Introduction to engineering programming (matrix calculus, for-loop and while-loop)
• Laboratory 2
o Exercises on solving systems of linear equations
• Laboratory 3
o Introduction to engineering programming (indexing , plots, graphics, if statement)
• Laboratory 4
o Exercises on solving nonlinear equations and systems of nonlinear equations
• Laboratory 5
o Introduction to engineering programming (user vs. built-in functions,input input/output)
• Laboratory 6
o Exercises on interpolation and approximation
• Laboratory 7
o Exercises on numerical integration and differentiation

• Laboratory 8 - MID-TERM ASSESSMENT
• Laboratory 9
o Introduction to engineering programming (simple script I)
• Laboratory 10
o Exercises on numerical solution of differential equation of the 1-st order
• Laboratory 11
o Introduction to engineering programming (simple script II)
• Laboratory 12
o Exercises on numerical solution of differential equation of the 2-nd order - PART I
• Laboratory 13
o Exercises on numerical solution of differential equation of the 2-nd order - PART II
• Laboratory 14
o Exercises on mathematical optimization
• Laboratory 15 - END-TERM ASSESSMENT

Course topics

Lectures:
Lecture 1 - Solving systems of linear equations
Lecture 2 - Solving nonlinear equations and systems of nonlinear equations
Lecture 3 - Interpolation and approximation
Lecture 4 - Numerical integration and differentiation
Lecture 5 - Numerical solution of differential equation of the 1-st order
Lecture 6 - Numerical solution of differential equation of the 2-nd order
Lecture 7 - Mathematical optimization – basic topics
Lecture 8 - Summary - end-term test
Laboratories
• Laboratory 1
o Introduction to engineering programming (matrix calculus, for-loop and while-loop)
• Laboratory 2
o Exercises on solving systems of linear equations
• Laboratory 3
o Introduction to engineering programming (indexing , plots, graphics, if statement)
• Laboratory 4
o Exercises on solving nonlinear equations and systems of nonlinear equations
• Laboratory 5
o Introduction to engineering programming (user vs. built-in functions,input input/output)
• Laboratory 6
o Exercises on interpolation and approximation
• Laboratory 7
o Exercises on numerical integration and differentiation
• Laboratory 8 - MID-TERM ASSESSMENT
• Laboratory 9
o Introduction to engineering programming (simple script I)
• Laboratory 10
o Exercises on numerical solution of differential equation of the 1-st order
• Laboratory 11
o Introduction to engineering programming (simple script II)
• Laboratory 12
o Exercises on numerical solution of differential equation of the 2-nd order - PART I
• Laboratory 13
o Exercises on numerical solution of differential equation of the 2-nd order - PART II
• Laboratory 14
o Exercises on mathematical optimization
• Laboratory 15 - END-TERM ASSESSMENT

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples on the board.

2. Laboratory: multimedia presentation, illustrated with examples given on a board, and performance of tasks given by the teacher.

Bibliography

Basic
1. D. Kincaid, W. Cheney, Numerical Analysis,Mathematics of Scientific Computing, Austin2006.
2. Z. Fortuna, B. Macukow, J. Wąsowski, Metody numeryczne, WNT, Warszawa 2005.
3. Paul F. Hultquist, Numerical Methods for Engineers and Computer Scientists Clean & Tight Contents Edition, 1988
Additional
1. S. Rosłaniec, Wybrane metody numeryczne z przykładami zastosowań w zadaniach inżynierskich, Oficyna Wydawnicza Politechniki Warszawskiej, 2002.
2. A. Bjorck, G. Dahlquist, Metody numeryczne, PWN, Warszawa 1983.
3. A. Brozi, Scilab w przykładach, Nakom, Poznań 2007.

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,00
Classes requiring direct contact with the teacher	45	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	15	0,50