Numerical methods - course description

General information

Course name	Numerical methods
Course ID	11.9-WE-INFD-NumMet-Er
Faculty	Faculty of Computer Science, Electrical Engineering and Automatics
Field of study	Computer Science
Education profile	academic
Level of studies	Second-cycle Erasmus programme
Beginning semester	winter term 2021/2022

Course information

Semester	1
ECTS credits to win	4
Course type	obligatory
Teaching language	english
Author of syllabus	• prof. dr hab. Roman Gielerak

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Lecture	15	1	-	-	Credit with grade
Laboratory	30	2	-	-	Credit with grade

Aim of the course

-to familarize students with basic numerical algorithms for solving most frequently appearing in the professional activity computational problems

-to introduce students to work within Matlab environement and similar on - engineers oriented packages

Prerequisites

Foundations of calculus and linear algebra ,programming foundations

Scope

Float-point arithmetics :arithmetic-conversions, float-point representations,standards od single- and double- precisions formats, classification of numerical errors, numerical instabilities and badly numerically conditioned problems

Linear Algebra problems :linear systems of equations,Gauss elimination methods , iterative methods of Jacobi and Gauss -Seidel.Unstable linear systems , numerical conditiong of systems.

Nonlinear equations case :scalar equations , bisection algoritms and its acceleration by Newton , Newton algorithm, fixed-point algorithms .Newton algorithm for systems of equations.Applications to nonlinear optimalisation problems.

Interpolation:polynomial interpolation methods : Lagrange formula and Newton method , cubic splines techniques.Applications to numerical integration- Newton - Cotes formulas.

Approximation based methods :discrete and continous least -squares approximation problems . Fourier series . Orthogonal polynomials .

Ordinary differential equations algorithms : Euler algorithm. Runge_Kuta algorithms. Application to real problems .

Teaching methods

Series of lectures

Laboratory exercises in Matlab enviroments

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form

Outcome description	Outcome symbols	Methods of verification	The class form
Knowledga of basic numerical methods and algorithms applied for solving computational problems which are used overall in engineering computations		• a final test • activity during the classes • an observation and evaluation of activities during the classes	• Lecture • Laboratory
Can use Matlab in computer performed computations		• a final test • an observation and evaluation of activities during the classes • carrying out laboratory reports	• Laboratory
Is aware of the fact, that computer calculations are always connected with errors, understand their nature and know methods to avoiding these threats		• a final test • an evaluation test • an ongoing monitoring during classes	• Lecture • Laboratory

Assignment conditions

Lecture –the necessary passing condition is to obtain a positive grade from final exam.
Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

Calculation of the final grade: lecture 50% + laboratory 50%

Recommended reading

1. Lloyd N. Trefethen and David Bau, III: Numerical Linear Algebra, SIAM, 1997

2. H.M. Antia: Numerical Methods for Scientists and Engineers, Birkhauser, 2000

3. Richard L. Burden, J. Douglas Faires, Numerical analysis, Brooks /Cole Publishing Company, ITP An International Thomson Publishing Company, sixth edition, 1997

4. Kendall Atkinson, Elementary numerical anlysis, John Wiley & Sons, Inc., second edition, 1993

Further reading

1. Tutorials of Matlab

2. List of problems to be solved in Laboratory

Notes

Modified by prof. dr hab. Roman Gielerak (last modification: 14-07-2021 13:00)