Numerical methods in engineering - course description

General information

Course name	Numerical methods in engineering
Course ID	11.9-WE-ELEKTD-NumMethinTechn-Er
Faculty	Faculty of Computer Science, Electrical Engineering and Automatics
Field of study	Electrical Engineering
Education profile	academic
Level of studies	Second-cycle Erasmus programme
Beginning semester	winter term 2017/2018

Course information

Semester	1
ECTS credits to win	5
Course type	obligatory
Teaching language	english
Author of syllabus	• prof. dr hab. inż. Igor Korotyeyev

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	-	-	Exam
Laboratory	15	1	-	-	Credit with grade

Aim of the course

- familiarize students with the basic numerical methods properties that are used for engineering calculations

- formation among the students of understanding the need for correct implementation of computer calculations with acceptable errors

- basic ability formation of numerical methods for practical use in computer calculations – using Matlab

Prerequisites

Selected issues of circuit theory I and II

Scope

Mathematical bases. Bases conception and theorems of mathematical analyse used in numerical methods, Taylor's series.

Errors and representation of numbers. Bases definitions and type of errors, badly conditional systems, numerical stability, methods to avoid errors, decimal system, binary system, sexadecimal system, floating point numbers, fixed-point numbers, coupling with errors

Finding roots of nonlinear equations. Methods: bisection method, Newton's method, secant method, Banach fixed point method use, analyse and errors estimation, extrapolation, case of badly conditional system, numerical stability of solutions

Interpolation. Interpolation characterization and its using. Lagrange's formula, residual quotients, property and Newton's formula.

Error analyses: spline Interpolation, Hermite's interpolation. Approximation. Least square method, mean squared error, orthogonal polynomial using. Numerical integration, Newtona-Coatesa's quadrature – trapezium method, Gauss's quadrature, analyses and errors estimation, Richardson's extrapolation.

Teaching methods

Lecture, laboratory exercises

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Can work individually and collectively		• an observation and evaluation of activities during the classes	• Laboratory
Can use Matlab in computer practical calculations		• an observation and evaluation of the student's practical skills	• Laboratory
Know bases numerical methods applied for solving calculation problems, used overall in engineering calculations		• an evaluation test	• Lecture
Can use his general engineering and mathematical knowledge under conducting calculation		• a quiz	• Laboratory

Outcome description	Outcomesymbols	Methods of verification	The class form
Is aware of fact, that with every computer calculations are connected errors, understand there nature and know methods to their avoiding		• an observation and evaluation of activities during the classes	• Lecture

Assignment conditions

Lecture – obtaining a positive grade in written 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. Baron B.: Metody numeryczne, Helion, Gliwice, 1995.
2. Fortuna Z., Macukov B., Wąsowski J.: Metody numeryczne, WNT, Warszawa, 1982.
3. Klamka J. i inni: Metody numeryczne, Oficyna Wydawnicza Politechniki Śląskiej, Gliwice, 1998.

Further reading

1. Bjoerck A., Dahlquist G.: Metody numeryczne, PWN, Warszawa, 1987.

Notes

Modified by dr hab. inż. Radosław Kłosiński, prof. UZ (last modification: 27-04-2017 10:47)