

Course name : Introduction to numerical methods		
Type of study: Mathematics	Type of study: Full-time	Examination: Assignment
Course characteristics: Compulsory	Level: First (B.Sc.)	Year: Full year
Type of classes: lectures, laboratory	Hours per week: 1 lect, 3 lab	ECTS points: 6 ECTS

COURSE GUIDE

AIMS

- A1. Making the students familiar with the selected elements of numerical methods.
- A2. Acquaint students with practical skills to formulate, solve and interpret solutions to problems in the field of numerical methods.
- A3. Introducing the students using the computer implementation of the presented algorithms.

PREREQUISITES

1. Course of linear algebra.
2. Course of the calculus of one variable
3. Ability to use different sources of information.
4. Ability to work independently and in a group.

LEARNING OUTCOMES

- EE 1 – student is familiar with the basic theory of numerical methods
- EE 2 – student is able to solve equations and systems of equations in Maple,
- EE 3 – student is able to perform numerical differentiation and integration.

CONTENT

Lectures	Hours
Lect. 1 – Course introduction. Taylor series. Order of convergence.	1
Lect. 2 – Error Analysis.	1
Lect. 3 – Solving equations.	1
Lect. 4 – Solving systems of equations.	1
Lect. 5 – Orthogonal polynomials.	1
Lect. 6 – Linear and piecewise linear interpolation.	1
Lect. 7 – Polynomial interpolation.	1
Lect. 8 – Spline interpolation.	1
Lect. 9, Lect. 10 – Linear Algebra.	2
Lect. 11 – Numerical differentiation.	1
Lect. 12, Lect. 13 – Numerical integration – interpolatory quadrature .	2
Lect. 14, Lect. 15 – Numerical integration – Gauss quadrature.	2
LABORATORY	Hours
Lab. 1 – Maple introduction.	3
Lab. 2 - Error Analysis.	3

Lab. 3 – Solving equations by using Maple.	3
Lab. 4 – Solving systems of equations by using Maple.	3
Lab. 5 – Orthogonal polynomials in Maple.	3
Lab. 6 – Linear, piecewise linear and polynomial interpolation.	3
Lab. 7 – Spline interpolation.	3
Lab. 8 – Linear Algebra in Maple.	3
Lab. 9 – Numerical differentiation – estimation of the order of convergence.	3
Lab. 10, Lab.11 – Numerical integration – interpolatory quadrature.	6
Lab.12, Lab. 13 – Numerical integration – Gauss quadrature.	6
Lab 14 – Error and convergence analysis of rules for numerical integration	3
Lab. 15 – Test.	3

TEACHING TOOLS

1. Lectures with multimedia presentations
2. Blackboard and chalk or whiteboards and markers
3. Computer laboratory

LITERATURE

Lecture notes.
Lloyd N. Trefethen and David Bau, Numerical Linear Algebra, SIAM, 1997.
Gégoire Allaire and Sidi Mahmoud Kaber. Numerical linear algebra, volume 55 of Texts in Applied Mathematics. Springer, New York, 2008. Translated from the 2002 French original by Karim Trabelsi.
W.H. Press, S.A. Teukolsky, W.T. Vetterling and B.P. Flannery, Numerical Recipes: The Art of Scientific Computing, 3rd Ed. Cambridge University Press, New York, 2007.
Jonathan M. Borwein, Matthew P. Skerritt, An Introduction to Modern Mathematical Computing with Maple, Springer Undergraduate Texts in Mathematics and Technology, Springer-Verlag, New York, 2011.
W. Cheney, D. Kincaid, Numerical Mathematics and Computing, Brooks/Cole: Cengage Learning, 2013.

TEACHERS

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ADDITIONAL NOTES

Links to course unit teaching materials can be found on the <http://www.pcz.pl/english/ects-subjects> website for current students.