Course name : **Introduction to numerical methods**		
Type of study: **Mathematics/Informatics**	Type of study: **Full-time**	Examination: **Assignment**
Course characteristics: **Compulsory**	Level: **First (B.Sc.)**	Year: **Autumn / Spring semester**
Type of classes: **lectures, laboratory**	Hours per week: **1 L, 3 Lab**	ECTS points: **6 ECTS**

COURSE DESCRIPTION

COURSE OBJECTIVE

C1. Making the students familiar with the selected elements of numerical methods.

C2. Acquaint students with practical skills to formulate, solve and interpret solutions to problems in the field of numerical methods.

C3. Introducing the students using the computer implementation of the presented algorithms.

PREREQUISITES/ ASSUMED BACKGROUND

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.

TEACHING-LEARNING OUTCOMES and COMPETENCES TO BE ATTENDED

LO 1 – student is familiar with the basic theory of numerical methods

LO 2 – student is able to solve equations and systems of equations in Maple,

LO 3 – student is able to perform numerical differentiation and integration.

COURSE CONTENT

Lectures - Topics	Hours
L1 – Course introduction. Taylor series. Order of convergence.	**1**
L2 – Error Analysis.	**1**
L3 – Solving equations.	**1**
L4 – Solving systems of equations.	**1**
L5 – Orthogonal polynomials.	**1**
L6 – Linear and piecewise linear interpolation.	**1**
L7 – Polynomial interpolation.	**1**
L8 – Spline interpolation.	**1**
L9, L10 – Linear Algebra.	**2**
L11 – Numerical differentiation.	**1**
L12, L13 – Numerical integration – interpolatory quadrature .	**2**
L14, L15 – Numerical integration – Gauss quadrature.	**2**
Σ	**15**

Laboratory - Topics	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**
Σ	**45**

TEACHING TOOLS

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

RECOMMENDED AND ADDITIONAL BIBLIOGRAPHY

1. Lecture notes.
2. Lloyd N. Trefethen and David Bau, Numerical Linear Algebra, SIAM, 1997.
3. Gŕegoire 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.
4. 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.
5. 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.
6. W. Cheney, D. Kincaid, Numerical Mathematics and Computing, Brooks/Cole: Cengage Learning, 2013.

TEACHERS

1. dr Tomasz Błaszczyk, tomasz.blaszczyk@im.pcz.pl

ADDITIONAL NOTES

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