Numerical Analysis I

1. SYLLABUS INFORMATION

1.1. Course title
Numerical Analysis I

1.2. University
Pázmány Péter Catholic University

1.3. Semester
1st year, 1st semester

2. COURSE DETAILS

2.1. Course nature
Compulsory

2.2. ECTS Credit allotment
4

2.3. Faculty data
Dr. Kovács Mihály

3. COMPETENCES AND LEARNING OUTCOMES

3.1. Course objectives
The purpose of the course is to give an introduction to selected modern topics in numerical analysis. Upon completion of the course the students will have a basic understanding of various numerical methods; both theory and practice. The students will be able to write a computer code for the algorithms they study and solve practical problems with them.

3.2. Course contents
Solving System of Linear Equations: Gaussian elimination, Jacobi and Gauss-Seidel iteration. Computing eigenvalues: power method, Jacobi's method, LU algorithm. Polynomial interpolation: Lagrange interpolation, Hermite interpolation, least squares method. Numerical integration: Newton-Cotes formulae, composite formulae. Solution of equations by iteration: Simple iteration, Newton method.

Some least squares problems: fitting lines. rectangles, squares in the plane.

Savitzky-Golay Filter.

Fourier coefficients, Discrete Fourier transform (DFT), properties of the transform, the inverse of DFT. The Hadamard product, relation between the convolution product and the DFT. Trigonometric interpolation.

Some applications of DFT, multiplication of polynomials, data smoothing, sound analysis, solving fourth-order boundary value problem of differential equation with DFT.

Algorithm and operating requirements of Fast Fourier transformation (FFT).

3.3. Course bibliography

Gander, W., Hrebicek, J.: Solving Problems in Scientific Computing Using Maple and MATLAB. Springer, 1995

4. EVALUATION

Exam