

Tárgytematika / Course Description

Computational Methods I.

NGD_MDA001_1

Tárgyfelelős neve /

Teacher's name: dr. Gáspár Csaba

Félév / Semester: 2022/23/2

Beszámolási forma /

Assesment: Vizsga

Tárgy heti óraszám /

Teaching hours(week): 0/0/0

Tárgy féléves óraszám /

Teaching hours(sem.): 12/0/0

OKTATÁS CÉLJA / AIM OF THE COURSE

Learning objectives:

- an outline of the fundamental theoretical tools that are needed for the computational mathematics,
- to learn some fundamental, widely used algorithms (with the exception of differential equations).

TANTÁRGY TARTALMA / DESCRIPTION

Topics:

1. A brief outline: normed spaces, Banach spaces. What does the distance of two functions mean? Euclidean spaces, Fourier series, Fast Fourier Transform, applications.
2. Methods for nonlinear problems: Banach's fixed point theorem, Newton's method and its generalizations.
3. Systems of linear equations and solution methods. Condition number. Direct methods: Gaussian elimination and its variants. LU-, Cholesky- and QR-decomposition. A fast method for 3-diagonal matrices (double sweep). Iterative methods: Richardson-, Jacobi-, Seidel-method. Relaxation methods. Variational methods: gradient, conjugate gradient method. Tikhonov's regularization technique.
4. Eigenvalue problems. Gersgorin's theorem. The power iteration method; the inverse iteration. Jacobi's and Cholesky's method. 5. Singular value decomposition, generalized inverse.
5. Interpolation problems. Lagrange-, Hermite- and spline interpolation. Novel methods: multivariate interpolation, Shepard's method and the method of radial basis functions.

SZÁMONKÉRÉSI ÉS ÉRTÉKELÉSI RENDSZERE / ASSESSMENT'S METHOD

Homeworks: –

Grade: based on written examination.

KÖTELEZŐ IRODALOM / OBLIGATORY MATERIAL

Compulsory literature:

- Stoyan Gisbert – Takó Galina: Numerikus módszerek I-III. Typotex, Budapest, 1998

Recommended literature:

- Stoyan Gisbert: Numerikus matematika - Mérnököknek és programozóknak - Elméleti matematika. Typotex, Budapest, 2007.
- Stoyan Gisbert: Numerikus Matematika (e-könyv) Typotex Kiadó, 2014.