Name: Applied Mathematics (Master Degree)	***Neptun-code:*** BTXAME1MNF	***Number of periods/week (lec/sem/lab)*** regular: 2/2/0
Credit points: 4 ***Requirement (assessment method)***: midterm test, Matlab project work signature and exam		***Prerequisite***: –
Lecturer: Dr. habil László HANKA PhD,	***Position***: Associate professor	***Faculty and Institute name***: Bánki Donát Faculty of Mechanical and Safety Engineering, Institute for Natural Sciences and Basic Subjects
Course Description		

Week 1. Approximation methods, least squares method, best fit curves, best approximate solution.
Week 2. Interpolation methods, Lagrange, Hermite, quadratic and cubic Spline interpolation
Week 3. Linear systems of ordinary differential equations with constant coefficients, homogeneous and nonhomogeneous case with single and multiple eigenvalues
Description of phase plane, critical points (node, saddle, etc.), scketching trajectories, applications
Week 3. Numerical methods for solving ODEs and systems of ODEs, Euler's method, improved Euler, second, third and fourth order Runge-Kutta methods. Mathematics of pandemic.
Week 4. Laplace-transform and it's applications. Laplace of piecewise defined functions, translation theorems,
Week 5. Convolution theorem, transfer function, solving ODEs using Laplace transform. Inverse Laplace with convolution
Week 6. LTI systems, discrete and continuous time signals. Convolution, Eigenfunction, Transfer function, impulse response, step response. Bode diagram. Frequency filtering. MatLab, Simulink and applications on every week!!!
Week 7. **Midterm 1.** (or later)
Week 8. Eigentheory: Eigenvalues and Eigenvectors of a Matrix, simple and repeated eigenvalues (algebraic and geometric multiplicity)
Week 9. Diagonalization of a Matrix, powers of a matrix (and Markov chain), Matrix exponential (and Differential Equations)
Week 10. Singular value decomposition, pseudoinverse
Week 11. Fourier series (sine-cosine form, exponential form, amplitude-phase form), even and odd functions, basic properties
Week 12. Fourier transform, basic properties, Convolution theorem
Week 13. Partial Differential Equations, Analyic Solutions
Week 14. Partial Differential Equations, Numerical Solutions

***Reqirements*:**
1. Midterm test:
Week 7. (or later) midterm test, (30 points) improvement, and make up of missed midterm test ont he last week. Midterm test is a written test, mathematical problems must be solved (practice and not theory!).

2. **Matlab project work**. (30 points) A code or a Simulink model for a engineering problem with a documentation in pdf form. Deadline is the 14th week.

3. Signature: Taking the test is mandatory including the Matlab project work! Midtem can be retaken.

4. Exam: Written exam, (40 points).
The grade is determined by the sum of points you achieved. The total is 30+30+40=100.

Evaluation of exam mark:

0 – 49 %	**fail (1)**
50 - 62 %	**pass (2)**
63 – 75 %	**satisfactory (3)**
76 – 87 %	**good (4)**
88 - 100 %	**excellent (5)**

Exam mark can be improved in the exam period.

Literature: in moodle system: lots of textbooks and problem books can be found there which is related to the curriculum

Recommended:

1. C._Henry_Edwards,_David_E._Penney_Elementary_Differential_Equations; Prentice Hall, NJ 07458, 2008.
2. Strang: Linear algebra and its applications, Brooks/Cole,USA, 1998
3. Schiff: Laplace transform and applications; Springer
4. Thomas_Weir_Hass: Thomas calculus, Pearson, 2012
5. Mathews_Howell: Complex analysis for mathematics and engineering, Jones and Bartlett, 1996

Additional:

6. Paul Blanchard, Robert L. Devaney, Glen R. Hall: Differential Equations; Brooks & Cole, 2012.
7. Kuttler: Elementray linear algebra, Saylor, 2012
8. Boyce_DiPrima: Elementary differetial equations and boudary value problems, Wiley@Sons 2001. etc.

Budapest, 01. September, 2025.

Dr. Laszlo Hanka PhD
responsible