Name: Applied Mathematics (Master Degree)	***Neptun-code:*** BTXMGE1MNF	***Number of periods/week (lec/sem/lab)*** regular: 3/2/0
Credit points: 4 ***Requirement (assessment method)***: midterm tests, Matlab project work signature and exam		***Prerequisite***: –
Lecturer: Dr. László HANKA PhD, Zsombor SZILÁGYI	***Position***: Associate professor Assistant professor	***Faculty and Institute name***: Bánki Donát Faculty of Mechanical and Safety Engineering, Institute of Mechatronics and Vehicle Engineering
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.**
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. Discrete-Time Fourier Series (DTFS) and Fourier Transform (DTFT)
Week 14. **Midterm 2.**

***Reqirements*:**
1. Midterm tests:
Week 7. midterm test 1, (40 points)
Week 14. midterm test 2, (40 points)

Exam period week 1. improvement, and make up of missed midterm tests
Midterm tests are written tests, mathematical problems must be solved (practice and not theory!).

2. **Matlab project work**. (20 points) A code or a Simulink model for a mechanical engineering problem with a documentation in pdf form.

3. Signature: Taking both test is mandatory including the Matlab project work! If someone achieves 50 points, he/she gets the signature. If not, he/she can take exam for signature on the first week of exam period.

4. Exam: Midterm test results and matlab project are included in the exam mark.

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, 29. July, 2024.

Dr. Laszlo Hanka PhD
responsible