

Name: Applied Mathematics (Master Degree)	Neptun-code: BTXAME1MNF, BTXTGE1MNF, BTXMGE1MNF	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, Dr. Zsombor SZILÁGYI	Position: Associate professor (responsible) Assistant 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.), sketching 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 its 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.

Week 7. Bode diagram. Frequency filtering.

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, Numerical Solutions

Week 14. Midterm test

MatLab programming, Simulink and applications every week!!!

Requirements:**1. Midterm test:**

Week 14. midterm test, (50 points). Midterm test is a written test, mathematical problems must be solved, no theory in the test.

2. Matlab project work. (40 points) A Matlab code or a Simulink model for a engineering problem with a documentation in pdf form. Deadline is the 13th week.

3. Signature: Taking the test is mandatory including the Matlab project work! Midterm can be retaken on the first week of the exam period.

4. Exam: Offered exam mark

The grade is determined by the sum of points you achieved. The total is 50+50=100.

<u>Evaluation of exam mark:</u>	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 and on 'siva': 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: Elementary linear algebra, Saylor, 2012
8. Boyce_DiPrima: Elementary differential equations and boundary value problems, Wiley&Sons 2001. etc.

Budapest, 01. September, 2026.

Dr. Laszlo HANKA
responsible