Department of Mathematics, Luleå University of Technology

M0031M Linjär algebra och differentialekvationer

(Linear Algebra and Differential Equations)

28 Föreläsningar (**Lectures**) + Lektioner (**Exercise Sessions) + 3 MATLAB**;

Contact Person: Norbert Euler

Literature:

1) D. C. Lay, *Linear Algebra and its Applications*, 3rd Edition 2003
2) A. Dunkels at all, *Derivator, integraler och sånt*, Studentlitteratur 2000
3) A. Gilat, *MATLAB: an Introduction with Applications*, 3rd Edition. 2008.

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A. Complex Numbers (Dunkels)

L1.	Definition of complex numbers and calculation rules (algebraic properties, conjugate number, modulus=absolute value, triangle inequality)	9.1-2
L2.	Polar form of complex numbers and de Moivre formula	9.3-4
L3.	Algebraic equations (quadratic equations, polynomials and algebraic equations)	9.5-6
L4.	Equation $z^n = w$ and function e^z	9.7-8
L5.	Reserve	

B. Linear Algebra (Lay)

L6.	Vector spaces and subspaces	4.1
L7.	Null spaces, column spaces, and linear transformations	4.2
L8.	Linearly independent sets. Bases	4.3
L9.	Coordinate system	4.4
L10.	The dimension of a vector space. Rank	4.5-6
L11.	Change of basis	4.7
L12.	Eigenvectors and eigenvalues. The characteristic equation	5.1-2
L13.	Diagonalization, eigenvectors and linear transformations	5.3-4
L14.	Inner product, length. Orthogonality and orthogonal sets	6.1-2
L15.	Orthogonal projections. The Gram-Schmidt process	6.3-4
L16.	Least-squares problems	6.5-6
L17.	Inner product spaces	6.7
L18.	Diagonalization of symmetric matrices	7.1
L19-20.	Reserve	

C. Differential Equations (Dunkels)

L21.	Introduction to diferential equations and linear differential equations	10.1-5
L22.	Linear differential equations of first order (method of variation of constant; separable equation)	10.6-7
L23.	Homogeneous differential equations of the second order	10.8

L24.	Nonhomogeneous differential equations of the second order	10.8-9
L25.	Variation of parameters	10.10
L26.	Euler differential equation	10.11-12
L27.	Linear differential equations of higher order	10.13

D. Repetition

L28. Repetition

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G. M0031M – Exercises = 14

Complex Numbers (Dunkels book)

9.11.1: 9.1acg, 9.2b, 9.3a, 9.4, 9.6, 9.7, 9.9, 9.11, 9.13 (9.1bd, 9.2a, 9.3b, 9.4c, 9.8, 9.12)
9.11.2: 9.16abe, 9.17, 9.18, 9.20, 9.21 (9.16cf, 9.22)
9.11.3: 9.25a, 9.29, 9.30acef (9.25b, 9.26, 9.30dg)
9.11.4: 9.32ac, 9.33, 9.34, 9.35, 9.36, 9.37, 9.39acd, 9.41, 9.44ac, 9.45ab, 9.46, 9.50 (9.32b, 9.38, 9.39b, 9.42, 9.44b, 9.45c, 9.47, 9.48)

Linear Algebra (Lay book)

4.1: 1, 3, 5, 9, 12, 15, 21 (7, 10, 13, 18, 22)
4.2: 1, 3, 5, 7, 9, 15, 17, 19, 21, 23, 25, 28, 31, 33 (2, 4, 8, 11, 16, 18, 22, 24, 32)
4.3: 1, 3, 5, 9, 11, 13, 15, 19, 26, 31, 33 (7, 16, 23, 25, 32, 34)
4.4: 1, 3, 5, 9, 10, 11, 13, 17, 21, 27, 32 (4, 7, 12, 14, 22, 31)
4.5: 1, 3, 7, 11, 13, 15, 21, 23, 27 (5, 9, 16, 19, 22, 25)
4.6: 1, 4, 5, 7, 8, 9, 25, 28, 29, 32 (3, 6, 11, 13, 17, 21, 27)
4.7: 1, 3, 5, 7, 13 (2, 6, 8, 11, 14)
5.1: 1, 3, 5, 7, 10, 13, 17, 19, 25, 26, 31 (4, 8, 14, 21, 23, 32)
5.2: 1, 9, 15, 18, 20, 23, 24 (3, 11, 17, 21)
5.3: 1, 3, 5, 7, 13, 19, 23, 31 (4, 9, 11, 17, 24, 25, 32)
5.4: 1, 3, 5, 7, 9, 11, 15, 17, 20, 25, 29 (2, 4, 6, 10, 13, 21, 27)
6.1: 1, 3, 5, 7, 11, 13, 16, 17, 22, 24, 25, 28, 31 (12, 14, 15, 23, 27, 29)
6.2: 1, 5, 7, 9, 11, 13, 15, 17, 21, 26-30 (3, 10, 12, 14, 16, 20, 32)
6.3: 1, 3, 7, 9, 11, 13, 15, 17, 19, 24 (2, 5, 10, 12, 14, 18)
6.4: 3, 4, 6, 11, 22 (2, 9, 16, 17)
6.5: 3, 5, 9, 13, 15, 19, 20, 25 (4, 6, 11, 14, 16, 24)
6.6: 1, 2, 3, 4, 7, 8
6.7: 1, 3, 5, 9, 12, 14, 18, 21, 23, 25 (2, 4, 6, 13, 17, 22, 24, 26)
7.1: 1-6, 8, 13, 17, 19, 21, 23, 28, 30 (11, 22, 24)

Differential Equations (Dunkels book)

10.14.1: 10.1, 10.3, 10.5 (10.6)
10.14.3: 10.15abde, 10.16acde, 10.19, 10.20
10.14.4: 10.28, 10.29abcd, 10.30, 10.31 (10.29e)
10.14.5: 10.40, 10.41c, 10.43, 10.44, 10.46-48, 10.50-51, 10.53, 10.57 (10.41b, 10.43, 10.54)
10.14.7: 10.60ad, 10.61, 10.63 (10.60e, 10.62)
10.14.8: 10.65, 10.66, 10.72, 10.74, 10.81, 10.84, 10.85, 10.86, 10.87, 10.88 (10.67, 10.69, 10.76, 10.93)

MATLAB Exercises (3rd edition of Gilant)

Lab 1:
1.10: 1, 2, 4, 5, 6, 16
2.11: 1, 4, 14

Lab 2:
3.9: 7, 9, 18
6.13: 3, 5, 6, 13

Lab 3:
10.6: 12, 14, 15, 19, 20, 21
11.10: 14, 16