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| **lInstitute of Applied Mathematics** | | | | | | Semester 1. of the curriculum  2023-24-1 | | | |
| Name of the subject: | | | | Code of the subject: | Credits: | Weekly hours: | | | |
|  | lec | sem | lab |
| **Linear algebra** | | | | NMXLA1EMNF | 4 | full-time | 2 | 1 | 0 |
| Responsible person for the subject: Dr. SZŐKE Magdolna | | | | | | Classification: senior lecturer | | | |
| Subject lecturer(s): | | | | | | | | | |
| Prerequisites: | | | |  |  | | | | |
| Way of the assessment: | | | | mid-term grade |  |  | | | |
| **Course description** | | | | | | | | | |
| Goal: | | To review and organize knowledge of linear algebra at the MSc level; development of the student's conceptualisation, abstraction and problem-solving abilities by getting to know the basic topics of linear algebra, as well as their applications in problem solving and model creation. | | | | | | | |
| Course description: | | Fields, the general concept of a vector space, basic definitions. Systems of linear equations, matrices, determinants. Matrix decompositions, eigenvalues, diagonalizability, Spectral theorem, SVD. Classification of Euclidean and unitary spaces, bilinear forms, quadratic forms. Perron-Frobenius theorem. | | | | | | | |
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| **Lecture schedule** | | | | | | | | | |
| Education week | | Topic | | | | | | | |
| 1. | | Notion of field and vector space; linear independence, generating system, basis. | | | | | | | |
| 2. | | Linear transformations, transformation matrix, kernel and image. | | | | | | | |
| 3. | | Systems of linear equations, Gaussian elimination, rank decomposition. | | | | | | | |
| 4. | | Elementary matrices, LU decomposition, fundamental subspaces, pseudo inverse. | | | | | | | |
| 5. | | Eigenvalues, eigenvectors, algebraic and geometric multiplicities, diagonalizability. | | | | | | | |
| 6. | | Real spectral theorem. Generalised eigenspaces, Jordan canonical form. | | | | | | | |
| 7. | | 1st midterm test. | | | | | | | |
| 8. | | Euclidean spaces, orthogonalization QR decomposition. | | | | | | | |
| 9. | | Singular value decomposition. | | | | | | | |
| 10. | | Unitary spaces, orthogonalization, SVD in unitary spaces. | | | | | | | |
| 11. | | Bilinear and quadratic forms, Sylvester's law of inertia, definiteness. | | | | | | | |
| 12. | | Positive matrices, Perron theorem. | | | | | | | |
| 13. | | 2nd midterm test. | | | | | | | |
| 14. | | Test retake. | | | | | | | |
| **Mid-term requirements** | | | | | | | | | |
| Conditions for obtaining a mid-term grade/signature | | | 50% of the midterms in average | | | | | | |
| **Assessment schedule** | | | | | | | | | |
| **Education week** | | Topic | | | | | | | |
| **7.** | | Material covered during the first six education weeks | | | | | | | |
| **13.** | | Material covered during education weeks 7 to 12 | | | | | | | |
| **14.** | | Material of either of the midterm tests | | | | | | | |
| **Method used to calculate the *mid-term grade*** (to be filled out only for subjects with mid-term grades) | | | | | | | | | |
| Based upon the sum of the scores reached at the midterm test:  0-49%: fail  50-61%: pass  62-73%: satisfactory  74-85%: good  86-100%: excellent | | | | | | | | | |
| **Type of the replacement** | | | | | | | | | |
| Type of the replacement of written test/mid-term grade/signature | | | In the last week of the period either of the midterm tests can be rewritten. In case of failure, the mid-term grade can be acquired in the grade-retake exam held during the first 10 days of the examination period. | | | | | | |
| **Type of the exam** (to be filled out only for subjects with exams) | | | | | | | | | |
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| **Calculation of the exam mark** (to be filled only for subjects with exams) | | | | | | | | | |
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| **​​Final grade calculation methods:​** | | | | | | | | | |
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| **References** | | | | | | | | | |
| Obligatory: | Carl. D. Meyer: Matrix analysis and applied linear algebra, SIAM (Society for Industrial and Applied Mathematics) Press, Philadelphia, 2000, ISBN 0-89871-454-0  A.J. Laub: Matrix Analysis for Scientists and Engineers, SIAM, 2005  S. Axler: Linear Algebra Done Right, 2nd ed., Springer, 1997 | | | | | | | | |
| Recommended: | D. Cherney, T. Denton, A. Waldron: Linear algebra | | | | | | | | |
| Other references: | Material uploaded to the e-learning system of the university | | | | | | | | |