|  |  |
| --- | --- |
| **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.  |
|   |
| **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)  |
|   |
| **Calculation of the exam mark** (to be filled only for subjects with exams)  |
|   |
| **​​Final grade calculation methods:​**  |
|   |
| **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  |