Master's program
Entrance examination topics

Mathematics

1. Real numbers. Sequences and series of numbers. Complex numbers.

2. Functions of real variable. Derivative. Taylor's formula.

3. Riemann integral of a function. Fundamental theorem of calculus. Newton-Leibniz's formula.

4. Differential equations. Linear systems.

5. Power series. Taylor's expansion. Trigonometric series.

6. Functions of more independent variables. Continuity and limits. Differentiability and partial derivatives. Taylor's theorem. Maximum and minimum values.

7. The Fourier integral. Inverse Fourier transform. Time- and frequency domain descriptions.

8. Complex functions. Line integral of complex functions. Zeros and poles.

9. Vector spaces. Linearly Independent Sets, Bases. Coordinate Systems. Dimension.

10. Vector algebra. 2d and 3d Vectors: Inner Product, Cross-Product, Mixed Product.

11. Matrix Operations: addition, multiplication, transpose. Inverse of a Matrix.

12. Vector Equations of a linear system of equations. The Matrix Equation $Ax = b$

13. Determinants. Applications: Area, Volume and Determinants. Cramer's Rule.

14. Representing Graphs, Graph Isomorphism. Euler and Hamilton Circles. Trees.

15. Propositional calculus. Basic and derived argument forms.

16. Cardinality of Sets and Subsets. Countable and uncountable sets. Continuum Cardinality.

17. Combinatorics: Counting Problems, Permutations, Combinations, Binomial Theorem

18. Probability, Discrete and Continuous Random Variables, Expected Value, Variance

Recommended literature:

R. Courant – F. John: *Introduction to Calculus and Analysis I-II.* Springer.

D. C. Lay: *Linear Algebra and Its Applications*. University of Maryland, Pearson.

K. H. Rosen: *Discrete Mathematics with Applications.* Mcgraw Hill.

J. Stewart – Daniel K. Clegg – Saleem Watson: Multivariable Calculus. ISBN-13: 9780357439432

D. P. Apte: Probability and Combinatorics. ISBN: 8174465200