

**ADMISSION EXAMINATION SYLLABUS  
of Mathematics  
(educational program “Mathematics”)  
to apply for Masters education level  
2020/21 academic year**

**1. Mathematical Analysis**

- 1) Limit of a sequence. Limit of a function (pointwise and uniform). Limit of metric space elements.
- 2) Continuous and uniformly continuous functions. Types of discontinuities. Continuity of elementary functions.
- 3) Derivatives and differentials of univariate and multivariate functions.
- 4) Taylor’s formula. Different forms of the remainder term. Basic expansions.
- 5) Riemann integral, conditions for its existence. Newton–Leibniz formula.
- 6) Numerical and functional series. The sum of the series, convergence tests. Absolute convergence. Uniform convergence.
- 7) Taylor series. Basic expansions.
- 8) Properties of the sum of a function series: continuity, integrability, differentiability.
- 9) Necessary and sufficient conditions for differentiability of functions of several variables.
- 10) Sufficient conditions for local extremum of a function of several variables.

**2. Linear Algebra**

- 1) Matrices and operations on them. Matrix inverse.
- 2) The dimension theorem for vector spaces.
- 3) The rank of a matrix.
- 4) Determinants, their properties and applications.
- 5) Linear transformations. Rank and nullity of a linear transformation.

**3. Analytic Geometry**

- 1) Cross product and triple product of vectors.
- 2) Relative position of two straight lines (conditions for skewness, parallelism, intersection and coincidence).
- 3) Second-order curves. Characteristic equation. Canonical equations of second-order curves.
- 4) Canonical equations of second-order surfaces in space.
- 5) Reduction of equations of second-order surfaces to the simplest form.

**4. Differential Equations**

- 1) The Cauchy problem for the first-order differential equation.
- 2) Construction of a fundamental system of solutions for a linear homogeneous equation with constant coefficients and for a linear homogeneous system with constant matrix.
- 3) Solving linear nonhomogeneous differential equations using the method of variation of parameters.

**5. Probability**

- 1) The classical definition of probability.
- 2) Discrete and absolutely continuous random variables. Cumulative distribution function.
- 3) Mean and variance of random variables (discrete and continuous cases).

**6. Mathematical Statistics**

- 1) Estimators and their properties (unbiasedness, consistency, asymptotic normality).
- 2) Construction of estimators. Method of moments. Maximum likelihood estimation.