

**Topics for the
Mathematics and Computer Science
Bachelor Graduation Examination**

I. Algebra

1. Groups, rings and fields (definitions, basic properties, examples, the kernel of a homomorphism, Lagrange Theorem, integral domains, subrings, subfields, homomorphisms).
2. Vector spaces (definitions, basic properties, examples, subspaces, generated subspace, linear independence, bases, dimension, dimension formulas).
3. Linear maps and matrices, systems of linear equations (the matrix of a linear map, connecting linear map operations with matrix operations, the consistency of a system of linear equations, solving systems of linear equations).

II. Mathematical Analysis

1. Series of real numbers (definitions and terminology, series with positive terms, convergence criteria for series with positive terms).
2. Taylor's formula (Taylor's polynomial and its properties, Taylor's theorem, formulations of the remainder in Taylor's formula).
3. The Riemann Integral (the definition of the Riemann Integral, antiderivatives, the Leibniz-Newton formula, computing methods for integrals: side integration, change of variable method).

III. Analytic Geometry

1. Cartesian equations of the lines with respect to an orthonormal coordinate system in plane (line given by a point and a direction vector, line given by two distinct points, the intercept form of the line), the angle between two lines, parallel lines, perpendicular lines, distance from a point to a line, area of triangles.
2. Circle (definition, determination of the equation of a circle given by its center and radius), ellipse, hyperbola, parabola (definitions, determination of the reduced (canonical) equations, tangent at a point of the parabola, optical property of a parabola).

IV. Algorithms and Programming

1. Search (sequential and binary), sorting (selection sort, bubblesort, quicksort).
2. Algorithms and specifications. Developing an algorithm starting by a given specification. Determination of the output by running a given algorithm.
3. OOP concepts in programming languages (Python, C++, Java, C#). Classes and objects. Members of a class and access modifiers. Constructors and destructors.
4. Relationships between classes. Derived classes and the inheritance relation. Method overloading. Polymorphism. Dynamic binding. Abstract classes and interfaces.