# Algebra and Analytic Geometry

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| **Unit Title** | Algebra and Analytic Geometry | | |
| **Level of Study** | Level I – Bachelor's degree | | |
| **Credit Value** | 8 | **ECTS Value** | 4 |
| **Home Department** | Fundamental Mathematics | | |
| **Home Faculty** | Mathematics and Mechanics | | |
| **Unit Co-ordinator** | | | |
| **Key Words** | complex numbers, determinants, matrixes, basic algebraic structures, polynomials, linear spaces, systems of linear equations, quadratic forms, Euclidean space, affine space, vectors, coordinates, straight lines, planes, surfaces | | |
| **Brief Summary** | The course presents notions which often appear in other undergraduate courses. This course offers a sufficiently general background for high school subjects such as algebra and geometry and gives the opportunity to develop some problem solving skills useful for further study activities. Some basic results on vector spaces, matrices, systems of linear equations, eigenvalues, eigenvectors and quadratic forms are considered in algebra part of this course. Basic notions such as vectors, coordinates, straight lines, planes, quadric surfaces, cylindrical, conical and rotation surfaces, their properties are considered in part of analytic geometry of this course. | | |
| **Indicative Content** | Students will study (in algebra part of this course):<br>• operations with complex numbers;<br>• different methods to calculate determinants of any finite order;<br>• operations with matrices;<br>• concept of the rank of the matrix (or rank of the system of vectors) and its application to solving problems;<br>• different techniques to solve systems of linear equations with any finite number of equations and unknown parameters;<br>• linear spaces and their subspaces: definition, bases, dimensions, properties of linearly dependent and independent systems of vectors, coordinates of vectors in different bases; | | |

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| | • linear operators and their matrices;<br>• Euclidian space: definition, different methods to define a scalar product of vectors; vector orthogonalization;<br>• quadratic form: canonical and normal form;<br>• algebraic structures: groups, rings, fields<br>Students will study (in analytic geometry part of this course):<br>• operations with geometric vectors;<br>• affine and metric problems;<br>• equations of the straight line in the plane, equations of plane and equations of straight line in space for different ways of setting;<br>• lines of the second order: ellipse, hyperbola, parabola;<br>• cylindrical, conical surfaces and surfaces of rotation;<br>• cross-section method for the surfaces of the second order. |