



*Successful candidates of the MSc “Statistics in Smart Data” degree will have a solid background in the following statistical, mathematical and IT subjects:*

### **Algebra**

- **Complex numbers:** Real and imaginary part of a complex number. Modulus and trigonometric form. Elementary algebraic operations. Exponential of a complex number. Quadratic equations.
- **Polynomials:** Roots of a polynomial, divisibility. Polynomial functions. Degree of a polynomial and roots multiplicity.
- **Vector spaces:** Notion of vector space and vector subspace. Vector subspace generated by a family of vectors. The vector space  $\mathbb{R}^n$ . Linearly independent vectors. Basis. Coordinates of a vector in a basis. Sum of vector subspaces. Complements of a vector subspace. Vector spaces of finite dimension. Dimension of a vector subspace, rank of a system of vectors. Linear maps. Kernel and image of a linear map. Rank-nullity theorem. Linear form and hyperplane. Affine subspaces of a vector space.
- **Matrices:** Sum and product of matrices. Transpose of a matrix. Inverse matrix. Rank of a matrix. Trace. Link between matrices and linear maps. Link between matrices and linear systems. Determinant of matrices and properties.
- **Spectral decomposition of a square matrix:** Eigenvalues, eigenvectors. Basis of eigenvectors. Diagonalization of a matrix. Spectral decomposition of symmetric matrices, positive semi-definite matrices and orthogonal projection matrices.