A short summary of topics in mathematics and statistics which are considered as prerequisite knowledge in all or many courses is provided here:

Core competences from the first year onwards:

Basic mathematics
- Basic mathematical notation (sum sign, product sign, Greek symbols,…)
- Absolute value , set operations (union, intersection, subsets, …), factorial
- Sequences and series

Matrix Algebra
- Vector and matrix operations (addition, multiplication,…)
- Solving a system of linear equations
- Inverse of a matrix
- Eigenvectors and eigenvalues

Calculus
- Basic functions (exponential, logarithmic, polynomial)
- Basic calculus (limits, continuity, differentiation, integration)

Concepts Probability and Statistics
- Probability, conditional probability, rule of Bayes
- Random variables, continuous and discrete random variables
- Density function and cumulative distribution function
- Continuous distributions (uniform, normal, exponential,…)
- Discrete distributions (binomial, Poisson,…)
- Random sample from a population (finite of infinite)
- Graphical data representation (histogram, frequency tables, …)
- Sample mean, variance, skewness, kurtosis
- Expectations, moments
- Sampling distribution (central limit theorem)
- Construction of confidence intervals
- Testing hypotheses and type I and type II error
- General understanding of a p-value

Additional competences, for some courses, from the first year onwards:

Calculus
- Multivariate functions (functions of several variables)
- Taylor series approximation

Concepts Probability and Statistics
- Delta-method

Numerical Analysis
- Optimization techniques (Newton-Raphson, …)

<u>Core competences from the second year onwards:</u>

Matrix Algebra
- Matrix decompositions
- Generalized inverse of a matrix

<u>Additional competences, for some courses, from the second year onwards:</u>

Calculus
- Trigonometric functions

Concepts Probability and Statistics
- Moment generating function, characteristic function

Differential Equations
- Solution of first order differential equations
- Basic separable differential equations
- Basic second order differential equations

Numerical Analysis
- Numerical integration
- Interpolation

References to Free online course material
1. http://bookboon.com/en/statistics-and-mathematics-ebooks [Collection of free e-books]
2. http://academicearth.org/mathematics/ [Collection of free weblectures]