WFY MODULE DESCRIPTION

Subject	
Mathematics	
Semester	**Semester hours per week**
1 & 2	**5**
Module description	

First Semester:

Future students of engineering and economics should use the basic concepts of mathematics (especially analysis, algebra and stochastics) to solve problems with mathematical knowledge and skills. The goal is the acquisition of knowledge in different ways. This is constantly practised, among other things, with the use of various aids (formulae and tables). In addition to the linguistic vocabulary expansion, the aim is to build up skills in the direction of standardised mathematical algorithms.
The focus of the module is on deepening mathematical procedures for problem-solving. For this purpose, basic mathematical concepts and laws are reproduced linguistically and technically. Building on the concept of quantity, number ranges and propositional logic is repeated and the concept of function is derived.
The module focus on descriptive statistics and probability theory repeat and deepen the concepts of probability theory (including urn models, probability diagrams, experiments, samples) and how to deal with them.
An excursion into the area of complex numbers deepens the participants' skills in the calculation of variables and in changing different coordinate systems.

Second Semester:

In the module Mathematics II, methods of analysis are shown as the basis of economics, engineering and natural sciences. In addition to functions and differential calculus, an insight into integral calculus provides tools for calculating non-linear surfaces and bodies, solving extreme value problems.
The students are familiar with the terms of differential and integral calculus and the curve discussion. They are familiar with the various techniques and rules for the graphical representation of real functions such as zeros, intercepts, extreme and inflection points, behaviour at poles and at infinity, DB/WB. They are familiar with the concept of continuity.
Derivative and integration rules are extended by substitution.
Simple differential equations from technology and economics are solved with infinite-simal calculus.
In addition to applications of systems of equations and trigonometric functions, problem tasks in the areas of area and body calculations, material and cost calculations are developed individually and jointly.

Participation requirement: German/English language level
German B1
Module objectives
First Semester: Reproduction of basic mathematical methods and concepts (equations, functions, calculation and representation of solids) Development of computational and graphical generally valid solution methods/strategies Interpretation of mathematical formulae and calculations. **Second Semester:** Reproduction of basic procedures and concepts of higher mathematics (differential calculus, integral calculus) and analytical geometry. Elaboration/derivation of general derivation rules/stem functions/substitution rules Application to extreme value problems/differential equations

Descriptions of the subjects by semester week

Semester	**Learning outcomes and summary of module content**
1	**Propositional logic and set theory:** • Intervals, sets of numbers, cardinalities. • Euler diagram, Venn diagram • Logical equations and basic functions • Truth tables
1	**Sequences, series:** • Arithmetic and geometric sequences and series • Explicit and recursive rules of formation • Concept of limit values • Applications of sequences/series: exponential growth/decay/compound interest
1	**Solving and simplifying equations and inequalities:** • Polynomials of 1st to 4th degree (biquadratic equations, polynomial division), • Solvability in the known number ranges (real, complex) • Root equations • Trigonometric functions, special function values, simple addition theorems • Logarithm and exponential equations/functions • Equation/function of magnitude • Solving/simplifying inequalities (also absolute value inequalities)
1	**Calculating with complex numbers** • Basic arithmetic operations, exponentiation, root extraction • Solving quadratic equations, quadratic addition • Representation: Cartesian, trigonometric, polar according to Euler • Coordinate systems and transformation
1	**Descriptive statistics and probability:** • Laplace model • Tree diagram/ 4-field table • Calculation of statistical parameters (mean, mode, median. (Co-)variance, standard deviation, etc.) • Binomial and normal distribution

Semester	Learning outcomes and summary of module content
2	**Analytic geometry:** • Description of straight lines and planes in R^2 and R^3 in parameter notation, normal and coordinate form. • Pairwise positional relationship of straight lines and planes • Angle calculation • Distance calculation using systems of linear equations • Substitution, equation and addition methods for systems with 2 unknowns • Gaussian elimination method with several unknowns
2	**Curve discussion of real functions:** • Introduction differential calculus/derivation rules • Intersections with the axes • Poles • Symmetry • Extreme / inflection / saddle points • Behaviour at zero and pole points, at infinity/ l'Hospital's rule • Continuity/monotonicity • Definition and value range • Qualitative sketch
2	**Integral calculus and applications:** • Concepts of primitive functions • Simple integration rules • Substitution and partial integration • Solving extreme value problems and differential problems from technology and economics
1&2	**Complex exercises from the chapters for consolidation**