KH1111 Mathematics 15.0 credits

Matematik

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for KH1111 valid from Autumn 2016

Grading scale

A, B, C, D, E, FX, F

Education cycle

First cycle

Main field of study

Technology

Specific prerequisites

Completion of upper-secondary school before 1 July 2011 and adult education at upper-secondary level before 1 July 2012

Specific entry requirements: Mathematics D, Physics B and Chemistry A. The grade Passed or 3 in each of the subjects is required.

Completion of upper-secondary school from 1 July 2011 and adult education at upper-secondary level from 1 July 2012 (Gy2011)

Specific entry requirements: Physics 2, Chemistry 1 and Mathematics 3c. A pass in each of the subjects is the lowest acceptable grade.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

The general aim of the course is to provide the student the knowledge that is required for a mathematical treatment of the technical problems that are included in other courses within the chemical engineering. The course also intends to build a good ability for mathematical analysis prior to new technical applications.

Mathematics I

After passing a course module, the student should

- be able to account for the structure of the number system
- be able to carry out algebraic simplifications
- be able to handle roots, absolute value, powers, logarithms and trigonometric relationships
- be familiar with elementary functions with inverse functions and their graphs
- be able to describe quadratic curves (circle, ellipse)
- be able to solve differences of higher grade
- be able to solve equations with absolute value polynomial -, exponential -, power -, logarithm and trigonometric equations
- be able to prove and treat trigonometric identities
- be able to illustrate complex numbers in the complex number plane
- be able to decide the conjugate to a complex number
- be able to carry out calculations on complex numbers in normal -, polar and exponential form
- be able to solve equations that give imaginary roots and equations with complex coefficients
- be able to decide distance in two and three dimensions
- be able to add and subtract vectors, multiply a vector with a number and decide the length of a vector
- be able to decide and apply inner product and cross product for vectors
- be able to state an equation for a line in two and three dimensions
- be able to calculate distance, angle and intersections between lines in two and three dimensions

- be able to give an equation for a plane in the space
- be able to calculate distance, angle and possible intersection between lines and a plane or plane and a plane in the space
- be able to calculate the area for a triangle and parallelogram in two and three dimensions and the volume for a cuboid in the space
- be able to calculate sum/difference/product of matrices and apply this in matrix equvations
- be familiar with the identity matrix and be able to invert matrices of order 2 and 3
- be able to solve linear equation systems with Gauss elimination method and by means of matrices
- be able to use the Least squares method to adapt a curve to given points
- be able to use Matlab to solve certain mathematical problems

Mathematics II

After passing a course module, the student should

- be able to carry out calculations on arithmetic and geometric number sequences in economic and scientific applications
- be familiar with the meaning of a function and know real, composite, monotonous, inverse and arc functions
- be able to calculate limits when x goes to infinity and when x goes against a and be able to calculate the limit of a number sequence n when it goes to infinity
- be able to derive and use L´Hospital's rule in boundary value calculations
- be able to decide if a function is continuous
- be familiar with the definition of the derivative and be able to use this to calculate the derivative of elementary functions
- be able to use differentials for error estimate
- be able to derive and use chain-, product -, and the quotient rule in derivatives
- be able to carry out logarithmic derivatives and be able to differentiate implicitly
- be able to solve equations numerically with Newton's method and with a pocket calculator
- be able to apply derivatives during the construction of curves, calculation of change rates, and in optimization problems
- be able to determine primitive functions to elementary functions and be able to carry out partial integration substitution of variables and be able to integrate rational functions
- be able to integrate numerically with Trapet's -, and Simpson's methods and with a pocket calculator
- be able to precisely calculate defined and generalised integrals
- be able to apply integrals at area calculation, volume calculation and calculation of arc length
- identify a curve given in polar form
- be able to calculate volumes with double integrals

- be able to solve differential equations numerically with Euler's step metod by hand and by means of Excel
- be able to solve separable differential equations and be able to use an integrating factor to solve linear differential equations of the 1st order
- be able to solve linear homogeneous differential equations of 1st and the 2nd order
- be able to derive Mac Laurin series for elementary functions and use these in integral calculus and boundary value calculations

Course contents

Mathematics I: Algebra and Geometry. Elementary functions. Complex numbers. Polynomial and algebraic equations. Linear equation systems. Matrices and determinants. Vectors and vector geometry. Laboratory sessions with computer support.

Mathematics II: Calculus. Limits and continuity. Derivatives. Integrals. Differential equations. Taylor's formula. Number sequences and series. Functions et al variables. Applications within chemical engineering.

Course literature

Rodhe, Sollevall, Matematik för ingenjörer, Studentlitteratur

Examination

- LABA - Computer Lab Works 1, 1.0 credits, grading scale: P, F
- LABB - Computer Lab Works 2, 1.0 credits, grading scale: P, F
- TENA - Written exam A, 3.0 credits, grading scale: P, F
- TENB - Written examination B, 4.0 credits, grading scale: P, F
- TENC - Written examination C, 6.0 credits, grading scale: P, F

Based on recommendation from KTH’s coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Other requirements for final grade

The final grade is based on the results of the three examinations

Ethical approach

- All members of a group are responsible for the group's work.

- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.