# SI1140 Mathematical Methods in Physics 9.0 credits

**Fysikens matematiska metoder**

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 SI1140 valid from Autumn 2007

## Grading scale

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

## Education cycle

First cycle

## Main field of study

Physics,Technology

## Specific prerequisites

Recommended prerequisites: To master the contents of the mathematics courses that precede each part of this course in the course plan for the technical physics program.

## Language of instruction

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

## Intended learning outcomes

In Part 1 the students should learn to master the tools from vector and tensor analysis that are important prerequisites for other theoretical physics courses like electrodynamics or continuum
mechanics.
The subject of Part 2 are initial- and boundary value problems for linear partial differential equations which are important in electrodynamics, quantum mechanics etc. The students should learn to formulate specific physics problems through mathematical models of this kind, to master various important analytical and numerical methods to solve such models, and to give physical interpretations of the solutions of such models.

## Course contents

**Vector analysis (Part 1):**

Gradient, divergens and curl. The theorems of Gauss and Stokes. The nabla-operator. Simplification of vector expressions using nabla calculus and/or tensor. Orthogonal coordinates, especially cylinder coordinates and spherical coordinates. Singular vector fields, especially the point source and point vortex. Laplace- and Poisson equations. Cartesian tensors with applications to electro dynamics and continuum mechanics.

**Partial differential equations (Part 2):**

Physical problems that can be modeled by differential equations such as the wave equation, the Laplace- and the Poisson equation. d'Alemberts method, separation of variables, Hilbert spaces, spectral theory of self-adjoint Hilbert space operators, Sturm-Liouville systems. Separation of variables in cartesian, cylindrical and spherical coordinated; special functions like Bessel functions, Legendre polynomials and spherical harmonics.

## Course literature

Kurslitteratur bestäms av Institutionen för Teoretisk Fysik och meddelas studenterna via kurshemsidan senast fyra veckor innan kursstart för respektive del.

## Examination

- TEN1 - Examination, 4.0 credits, grading scale: A, B, C, D, E, FX, F
- TEN2 - Examination, 5.0 credits, grading scale: A, B, C, D, E, FX, 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

Separate written examinations in vector analysis (TEN1; 4 university credits) and partial differential equations (TEN2;  5 university credits).

## 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.