SF1648 Partial Differential Equations 7.5 credits

Partiella differentialekvationer

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 SF1648 valid from Autumn 2007

Grading scale

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

Education cycle

First cycle

Main field of study

Mathematics,Technology

Specific prerequisites

SF1646 Mathematics IV, or similar (for SF1641). SF1649 Vector analysis and complex functions, or similar (for SF1648).

Language of instruction

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

Intended learning outcomes

Partial differential equations describe relations between continuously changing quantities which depend on two or more variables (e.g., time and one or several space coordinates). A major part of physics and its applications in engineering sciences is based on models involving partial differential equations. To acquire basic understanding of the most common partial differential equations, and to learn some methods for solving them, therefore should be of central importance in civil engineering programmes, in particular such programmes which are directed towards fundamental technology and physics. The main goal of the course is that the student, after finished studies, should be able to solve boundary value problems for Laplace's equation, the heat equation, the wave equation and the Schrödinger equation by separation of variables, in cartesian, polar, spherical and cylindrical coordinates. As part of this, the student need

- to be able to solve linear ordinary differential equations, by using elementary methods (characteristic roots, Ansatz, etc.) in the case of constant coefficients, by using power series expansion around regular and singular points in the case of equations with analytic coefficients.

- to be able to expand one variable functions in series along bases of orthogonal functions, for example in Fourier series, Bessel series, Legendre series.

- to be able to find the weight function, eigenvalues and orthogonal function system (eigenfunctions) for a given Sturm-Liouville problem.

- be able to use the Fourier and Laplace transform as part of solving a boundary value problem.

- be able to use handbooks (like BETA) as a tool when solving problems as above.

Course contents

Linear partial differential equations, in particular of the second order and with the main types represented by Laplace's equation, the heat equation, the wave equation and the Schrödinger equation. The method of separation of variables for solving boundary value problems for equations of the above types. Adaptation of the separation method to polar, spherical and cylindrical coordinates. Sturm-Liouville problems and systems of orthogonal functions. Special functions, like Bessel and Legendre functions. The power series method for solving ordinary differential equations. Transform methods, in particular the Fourier and Laplace transform.

Course literature

- N. Asmar: Partial Differential Equations and Boundary Value Problems, Prentice Hall, 2005.

- Formelsamlingen BETA, Studentlitteratur.

Examination

- TEN1 - Examination, 7.5 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

Written examination.

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.