Faculty of Science

FYSN31, Physics: Mathematical Methods of Physics, 7.5 credits

Fysik: Fysikens matematiska metoder, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by The Education Board of Faculty of Science on 2024-11-28. The syllabus comes into effect 2024-11-28 and is valid from the autumn semester 2025.

General information

The course is an elective course for second-cycle studies for a Degree of Master of Science (120 credits) with a specialisation in physics.

Language of instruction: English

Main field of study	*Specialisation*
Physics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Learning outcomes

The aim of the course is that the student, after completing the course, should have acquired knowledge of advanced mathematical tools and methods common in physics and the application of these methods to concrete physical systems.

Knowledge and understanding

On completion of the course, the student shall be able to:

- explain Cauchy-Riemann's equations, Cauchy's integral theorem and the Laurent expansion.
- explain concepts such as self-adjoint operators and complete function systems.
- explain important partial differential equations in physics, such as the wave and the heat equations and Poisson's equation.
- explain the Green function method.

- explain the method of images.

Competence and skills

On completion of the course, the student shall be able to:

- apply calculus of residues.
- make use of the gamma function, Bessel functions, Legendre polynomials and spherical harmonics.
- make use of Fourier series and Fourier transforms.
- make use of Laplace transforms.
- master series solutions.
- apply the method of separation of variables.
- apply the Green's function method to one-dimensional problems.

Judgement and approach

After completing the course, students should be able to:

- choose an appropriate solution method for a given problem within the subjects covered by the course

Course content

This course contains

- Analytic functions
- Special functions (gamma function, Bessel functions, Legendre polynomials and spherical harmonics)
- Fourier series and Fourier transforms
- Laplace transforms,
- Ordinary differential equations,
- Partial differential equations,
- Green functions.

Course design

The teaching consists of lectures and exercises.

Assessment

The examination consists of a written exam at the end of the course. Students who do not pass the regular exam are offered a re-exam shortly after the regular exam.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Grades

Grading scale includes the grades: Fail, Pass, Pass with distinction
For a Pass grade on the whole course, the student must have a Pass grade on the exam. The final grade of the course is determined by the written exam.

Entry requirements

Admission to the course requires 75 credits in physics and 45 credits in mathematics, or a bachelor's degree in physics. English 6/B and basic eligibility.

Further information

The course replaces FYTN01, Theoretical physics: Mathematical Methods of Physics, 7.5 credits and credits from that course cannot count towards a degree together with this course.

The course is offered at the Department of Physics, Lund University.