

# Syllabus

for course at advanced level

**Mathematical Methods in Physics**  
**Fysikens matematiska metoder**

**7.5 Higher Education  
Credits**  
**7.5 ECTS credits**

|                          |                                                                         |
|--------------------------|-------------------------------------------------------------------------|
| <b>Course code:</b>      | FK7048                                                                  |
| <b>Valid from:</b>       | Autumn 2017                                                             |
| <b>Date of approval:</b> | 2017-01-16                                                              |
| <b>Department</b>        | Department of Physics                                                   |
| <b>Main field:</b>       | Physics                                                                 |
| <b>Specialisation:</b>   | A1N - Second cycle, has only first-cycle course/s as entry requirements |

## Decision

This course plan has been established by the Board of Science at Stockholm University on 2017-01-16.

## Prerequisites and special admittance requirements

Admission to the course requires knowledge equivalent to passed courses (excluding introductory courses) of 45 credits in mathematics and 60 credits in physics, where the courses Mathematics II - Analysis, part B, 7.5 credits (MM5011), Quantum Mechanics, 7,5 hp (FK5020) and Atomic and Molecular Physics, 7,5 hp (FK5023) should be included. Additionally, admission to the course requires knowledge equivalent to upper secondary school English B/English 6.

## Course structure

| Examination code | Name                            | Higher Education Credits |
|------------------|---------------------------------|--------------------------|
| HELA             | Mathematical Methods in Physics | 7.5                      |

## Course content

The course treats differential equations which occur frequently in physics as well as their exact and approximate solution methods. The contents are focused on ordinary and partial differential equations and consist of: Field equations for heat transport and diffusion; hermitian problems; small amplitude oscillations and the wave equation; Dirac's delta function; Fourier integrals; expansions in orthogonal basis functions; orthogonal polynomials; ordinary differential equations; Bessel's and Legendre's equations; partial differential equations; separation of variables in cartesian, cylindrical and spherical coordinates; fundamental solutions and Green's functions; Spherical harmonic and Bessel functions; analytic functions; Cauchy's integral theorem; calculus of residues; the Laplace transform and its' inverse.

## Learning outcomes

Upon completion of the course, students are expected to be able to:

- \* describe and apply the different mathematical functions that are included in the course
- \* describe different methods for solving mathematical problems and how the properties of the functions are being used
- \* apply the methods to physical problems

## Education

Instruction consists of lectures, exercises and hand-ins.

The course will be given in English if requested by any student enrolled.

### **Forms of examination**

- a. The student's knowledge will be tested by a written and oral exam.
- b. Grading is carried out according to a 7-point scale related to learning objectives:  
A = Excellent  
B = Very Good  
C = Good  
D = Satisfactory  
E = Sufficient  
Fx = Fail  
F = Fail
- c. Grading criteria for the course will be distributed at the start of the course.
- d. A minimum grade of E is required to pass the course.
- e. Students who fail to achieve a pass grade in an ordinary examination have the right to take at least further four examinations, as long as the course is given. The term “examination” here is used to denote also other compulsory elements of the course. Students who have achieved a pass grade on an examination may not retake this examination in order to attempt to achieve a higher grade. Students who have failed to reach a pass grade on two occasions have the right to request that a different teacher be appointed to set the grade of the course. A request for such appointment must be sent to the departmental board.

### **Interim**

Students may request that the examination be conducted in accordance with this course plan even after it has ceased to be valid. However, this may not take place more than three times over a two year period after course instruction has ended. Requests must be made to the departmental board. The provision also applies in the case of revisions to the course plan (and the revisions of the course literature).

### **Limitations**

The course may not be included in examinations in combination with course Electrodynamics II (FK8005) or equivalent.

### **Misc**

The course can be included as part of the master's programs offered at the Physics department, but is also offered as a separate course.

### **Required reading**

The course literature is decided by the department board and published on the Department of Physics' website at least two months before the start of the course.