

# Syllabus

for course at advanced level

**Electrodynamics  
Elektrodynamik**

**7.5 Higher Education  
Credits  
7.5 ECTS credits**

<b>Course code:</b>	FK7045
<b>Valid from:</b>	Autumn 2019
<b>Date of approval:</b>	2017-01-16
<b>Changed:</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 was established by the Board of Science at Stockholm University on 2017-01-16, and a technical revision was made on 2019-04-29.

## 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) and Electromagnetism and Waves, 7.5 credits, (FK5019) 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	Electrodynamics	7.5

## Course content

The course contains: Gauss' Law, the Poisson and Laplace equations, boundary value problems, Green functions, the method of images, orthogonal functions and solutions of boundary value problems, multipole expansions, dielectrical media and the displacement field, the continuity equation, magnetostatics, Faraday's Law of induction, Maxwell's equations, the scalar and vector potentials, gauge transformations, the wave equation, electromagnetic energy densities and Poynting's theorem, rotations and discrete symmetries, special relativity theory, the Lorentz group, the covariant formulation of electrodynamics. Some applications of Maxwell's equations.

## Learning outcomes

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

- apply Maxwell's equations and methods to solve them, in particular in the presence of boundary conditions and with the help of Green functions
- describe and apply concepts like multipole moments and multipole expansions of electromagnetic fields, and understand how these fields behave within polarizing media
- apply the 4-vector formalism within special relativity theory, and to electrodynamics in its Lorentz covariant formulation.

## Education

Instruction consists of lectures and exercises.

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

### **Forms of examination**

a. The course is examined as follows: knowledge assessment takes the form of written and oral exams. If the instruction is in English, the examination may also be conducted in English.

b. Grades will be set according to a seven-point scale related to the learning objectives of the course:

A = Excellent

B = Very good

C = Good

D = Satisfactory

E = Adequate

Fx = Fail, some additional work required

F = Fail, much additional work required

c. The grading criteria will be distributed at the beginning of the course.

d. In order to pass the course, a minimum grade of E is required.

e. Students who receive a failing grade on a regular examination are allowed to retake the examination as long as the course is still provided. The number of examination opportunities is not limited. Other mandatory course elements are equated with examinations. A student who has received a passing grade on an examination may not retake the examination to attain a higher grade. A student who has failed the same examination twice is entitled to have another examiner appointed, unless there are special reasons to the contrary. Such requests should be made to the department board.

The course includes at least two examination opportunities per year when the course is given. At least one examination opportunity will be offered during a year when the course is not given.

f. Students awarded the grade Fx are given the opportunity to improve their grade to E. The examiner decides the supplementary assignments to be performed and the pass mark criteria. The supplementary assignments will take place before the next examination session.

### **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 (FK8003) 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's website at least two months before the start of the course.