



LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Elektrodynamik Electrodynamics

EITN80, 7,5 credits, A (Second Cycle)

Valid for: 2023/24

Faculty: Faculty of Engineering, LTH

Decided by: PLED E

Date of Decision: 2023-04-11

General Information

Elective for: E4-fh, F4, F4-tf, F4-f, F4-fel, F4-axn, MFOT1

Language of instruction: The course will be given in English on demand

Aim

The course provides a deep and broad understanding of electromagnetic theory. It complements the basic course in key areas related to electromagnetic waves and the interaction between moving charged particles and electromagnetic fields. It also gives the relativistic description of electrodynamics, with the aim of providing a basic understanding of accelerator physics. The course discusses techniques for measurements of electromagnetic fields in experiment and technology.

Learning outcomes

Knowledge and understanding

For a passing grade the student must

- master the Maxwell equations and the mathematical methods used in the solution of electromagnetic problems
- be able to treat the motion of charged relativistic particle in electromagnetic fields
- determine the electromagnetic fields caused by accelerating charged particles
- understand the principles of particle accelerators
- determine the electromagnetic fields that can propagate in various types of metallic waveguides
- understand the concepts waveguide, phase and group velocity and cut-off frequency of waveguides
- to determine the electromagnetic fields that can exist in the resonant cavities

- understand different methods for measurements of electromagnetic fields and the physical limitations of these methods

Competences and skills

For a passing grade the student must

to assess the mathematical and numerical methods suitable for the analysis of various types of time-dependent electromagnetic problems
 to determine which methods are possible to measure the electric and magnetic fields in given frequency ranges and geometries
 assess and design the microwave for accelerators
 able to make reasonable estimates of electromagnetic fields and waves with the help of physical rules of thumb

Judgement and approach

For a passing grade the student must

- to assess the mathematical and numerical methods suitable for the analysis of various types of time-dependent electromagnetic problems
- to determine which methods are possible to measure the electric and magnetic fields in given frequency ranges and geometries
- to assess and design the microwave for accelerators
- be able to make reasonable estimates of electromagnetic fields and waves with the help of physical rules of thumb

Contents

Areas covered include: Maxwell equations, multipolutvecklingar, relativistic transformation of electromagnetic fields, motion of charged particles in electromagnetic fields, radiation from accelerating charges, Waveguides, resonant cavities, the measurement of electromagnetic fields.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)

Assessment: Approved assignments and take home exam are required for grade 3 and passing the course. In addition, grade 4 or 5 can be obtained from an optional oral 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.

Parts

Code: 0118. **Name:** Assignments.

Credits: 4. **Grading scale:** UG. **Assessment:** Approved assignments **Contents:** Three assignments

Code: 0218. **Name:** Take Home Exam .

Credits: 3,5. **Grading scale:** TH. **Assessment:** Approved Take home exam.

Admission

Admission requirements:

- EITF80 Electromagnetic Fields or EITF85 Electromagnetic Field Theory or ETEF01 Electromagnetic Field Theory

The number of participants is limited to: No

The course overlaps following course/s: ETEN01

Reading list

- David J. Griffiths: Introduction to Electrodynamics. Cambridge University Press, 2017, ISBN: 978-1-108-42041-9.
- Anders Karlsson och Gerhard Kristensson: Microwave Theory. 2016.

Contact and other information

Course coordinator: Johan Lundgren, johan.lundgren@eit.lth.se

Course homepage: <http://www.eit.lth.se/course/eitn80>