Institutionen för teoretisk fysik

PhD course in theoretical physics: *Grundlägganda Elektromagnetism (Fundamental Electromagnetism) 5p*

As deciced by the institute board on 2004-03-26
English translation, note that the Swedish version is the official one, translation provided for information only

Prerequisites:

Maxwell's equations, microscopic and macroscopic, vector- and scalar-potential Poynting vector, electromagnetic waves: diffraction and reflection, optical properties of matter. This corresponds to e.g. (parts of) chpater III in Hans-Uno Bengtsson, Bengtsson om klassisk fysik (Gleerups Förlag, 1995, ISBN 91-40-62020-4).
Vectoranalysis, basics of partial differential equations (e.g. separation of variables and expansion in eigenfunctions, especially spherical eigenfunctions).
Basics of special relativity.

Goal:

To give a basic deep understanding and overview of electromagnetic field theory and some of its applications.

Content:

Basic electro- and magnetostatics, multipole expansion, dielectric medium. Time dependent fields, Maxwell's equations, fieldenergy. Electromagnetic waves, diffractions and reflection, frequencydependence (dielectrical materials, conductors, plasma), wavepropagation in dispersive media, magnetohydrdynamic waves. Radiation, dipoleradiation and simple dispersiontheory. Waveguides.

Plus an overview of: Lagrangeformulation of the electromagnetic fieldequations.Energyloss of charged particles in a medium. Rdaiation from accelerated charged particles, Bremsstrahlung.

Literature:

J.D. Jackson, Classical Electrodynamics (John Wiley & Sons, 3. uppl., ISBN 0-471-30932-X).

	Part with exercises:	
Chapter 1	Section 1–11	22 pages
Chapter 4	Section 1–3	10 pages
Chapter 5	Section 1–8	20 pages
Chapter 6	Section 1,2,3,4,6,7	25 pages
Chapter 7	Section 1,2,3,4,5,7,8,9	33 pages
Chapter 8	Section 1–4	9 pages
Chapter 9	Section 1,2,3,4a	12 pages
Total		131 pages

	Basis understanding only	
Chapter I	Complete (prerequisite)	
Chapter 12	Section 2	2 pages
Chapter 13	Section 1,2	7 pages
Chapter 14	Section 1–5	16 pages
Chapter 15	Section 1,2	13 pages
Total		38 pages

The course is a selfstudy course

Exam: Hand-in exercises and oral exam.

Teacher: Johan Bijnens