EF2270 Applied Plasma Physics 6.0 credits

Teknisk plasmafysik

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for EF2270 valid from Autumn 2009

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Electrical Engineering,Engineering Physics,Physics

Specific prerequisites

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

The goal of the course is to make the student familiar with a broad range of technical plasma devices, and able to analyze and describe their main plasma physical characteristics and principles of operation. After the course the student shall be able to:

- Describe the plasma physical processes, and characterizing parameters, that are listed in the course content.
- Explain the functioning, with focus on the dominating plasma physical processes, of the six discharge types that are listed in the course content.
- Describe the technical applications of plasma processing that are listed in the course content, and explain how the discharge types' characteristic parameters are related to the desired use of the devices.

For the highest grade the student shall be able to apply the knowledge also to analyze and characterize other discharge types than those treated in the course.

Course contents

Instead of treating the whole, very wide field, of industrial plasma discharge types, the course focuses on six discharge types that have been selected so that they together exemplify most of the knowledge basis in applied plasma physics. For each discharge type the focus is on the plasma processes that determine its characteristics, and one or two examples of industrial applications are treated.

- Plasma physical processes: electron influx from surfaces by ion impact, thermal emission, field emission, cathode spots and corona emission. The balance of electron energy, both in ac and dc discharges. Plasma gain by ionization, and plasma loss by diffusion, recombination, and current losses. The self-bias process. Electron avalanches and streamers.
- Characterizing parameters: collisionality, degree of ionization, degree of magnetization (for ions and for electrons). Scale lengths: gyro radii, mean free paths for elastic collisions and for ionization, and sheath thicknesses. The Hall, Pedersen, and parallel conductivities.
- Discharge types: DC glow discharges, arc discharges, barrier discharges, corona discharges, sputtering magnetrons, and RF discharges.
- Technical applications: Plasma etching and deposition in the microelectronics industry. Ion implantation. Medical sterilization. Electrostatic dust collectors. Plasma waste treatment. Plasma spray deposition. Plasma rocket propulsion. Plasma-chemical ozone production.

Course literature

To be communicated at the course start.

Examination

- TEN1 - Examination, 6.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH’s coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Other requirements for final grade

Written examination.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.