EF2270 Applied Plasma Physics 6.0 credits

Teknisk plasmafysik

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

Establishment

On 04/21/2020, the Head of the EECS School has decided to establish this official course syllabus to apply from autumn semester 2020, registration number: J-2020-0552.

Grading scale

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

Education cycle

Second cycle

Main field of study

Electrical Engineering, Physics, Engineering Physics

Specific prerequisites

Completed course EF2200 Plasma Physics or equivalent.

Active participation in a course offering where the final examination is not yet reported in LADOK is considered equivalent to completion of the course. This applies only to students who are first-time registered for the prerequisite course offering or have both that and the applied-for course offering in their individual study plan.

Language of instruction

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

Intended learning outcomes

After passing the course, the student should be able to

- explain the physical mechanisms behind different plasma-surface interaction processes as well as their effect and importance in different plasma environments
- discuss practical applications of electron emission physics relevant to plasma discharges and to diagnostic components
- 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 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
- describe applications of plasma discharges that are connected to sustainable development goals and discuss advantages / disadvantages with respect to competing non-plasma technologies

in order 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.

Course contents

- Plasma-surface interactions: electron-induced electron emission (secondary electron emission, electron backscattering, electron reflection), ion-induced electron emission (kinetic, potential), thermionic emission, field emission, photoelectric emission, sputtering (physical, chemical), ion backscattering.
- The balance of electron energy, both in ac and dc discharges. Plasma gain by ionization, and plasma loss by diffusion, recombination, and current losses.
- 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.
- Discharge types: DC glow discharges, sputtering magnetrons, arc discharges and RF discharges.
- Applications connected to sustainable development goals: carbon dioxide conversion, ozone generation, water purification, medical applications, waste treatment

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.

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

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.