EF2270 Applied Plasma Physics 6.0 credits

Teknisk plasmafysik

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

Establishment

The official course syllabus is valid from. autumn semester 2026 as decided by the Director of First and Second Cycle Education. Decision date: 2026-04-10

Grading scale

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

Education cycle

Second cycle

Main field of study

Electrical Engineering, Physics, Engineering Physics

Specific prerequisites

Knowledge of plasma physics, 6 credits, equivalent to completed course EF2200. Active participation in EF2200 during period 1 of the same academic year is equated with completed course. Those who are registered are expected and considered to be actively participating.

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

- INL1 - Hand-in assignments, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- TENA - Written exam, 3.0 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.

Transitional regulations

The previous module TEN1 is replaced by both INL1 and TENA.

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.