



SH2705 Compact Reactor Simulator- Exercises in Reactor Kinetics and Dynamics 6.0 credits

Kompakt reaktorsimulator- övningar i reaktorkinetik och reaktordynamik

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

Establishment

The official course syllabus is valid from spring semester 2027 as decided by the Director of First and Second Cycle Education. Decision date: 2026-09-04

Grading scale

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

Education cycle

Second cycle

Main field of study

Engineering Physics

Specific prerequisites

Courses in reactor physics (SH2600, or equivalent) and reactor power engineering/nuclear reactor technology (SH2702, or equivalent)

Intended learning outcomes

Nuclear reactor power plants are very complex systems that may go through various transients during normal and accident situations. This course is designed to simulate the transients and explain their nature. The power plant simulations are based on Apros - the process simulation software for nuclear and thermal power plant applications.

After the course, students will be able to:

- describe various design bases and beyond design bases accidents,
- explain the behavior of the nuclear reactor and the power plant during normal operation and the transients,
- explain the effect of various feedbacks in the nuclear reactor and the power plant during the transients,
- recognize the cause of a complex transient, and take an appropriate action.

Course contents

Nuclear power plants are systems whose safe and reliable operation requires a thorough understanding of plant dynamics under both normal operating conditions and postulated accident scenarios. This course provides participants with fundamental and advanced knowledge of reactor and plant transient behaviour, with particular emphasis on the physical phenomena, engineering principles, and safety considerations governing nuclear power plant operation.

The course combines theoretical studies with practical simulation exercises using APROS, a state-of-the-art simulation platform widely applied for the analysis of nuclear and thermal power plants. Participants will develop skills in modelling and simulating plant responses to operational disturbances, system malfunctions, and accident conditions, thereby gaining insight into thermal-hydraulic processes, control system performance, and plant safety functions.

Special attention is given to nuclear safety-related concepts, including the principles of defence-in-depth, safety barriers, deterministic safety analysis, and the role of safety systems in mitigating abnormal events. The course also includes a review of significant historical events and operational experiences from the Swedish nuclear power programme, with discussions on lessons learned and their impact on current safety practices and regulatory frameworks.

Furthermore, the course introduces the regulatory and methodological basis for Safety Analysis. Participants will gain an understanding of safety requirements, accident classification, acceptance criteria, and analytical approaches used to demonstrate compliance with national and international nuclear safety standards.

Upon completion of the course, participants will be able to analyse and interpret nuclear power plant transients, apply simulation tools to safety-related studies, and understand the engineering and regulatory foundations of reactor safety analysis.

Examination

- TENX - Exam, 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.

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.