



# SI2540 Complex Systems 7.5 credits

## Komplexa system

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

The course syllabus is valid from Spring 2022 according to the school principal's decision: S-2022-0529 Decision date: 2022-02-24

## Grading scale

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

## Education cycle

Second cycle

## Main field of study

Physics

## Specific prerequisites

English B / English 6

## Language of instruction

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

## Intended learning outcomes

Upon completion of the course, you will

- be familiar with analytical and numerical methods for the analysis of coupled nonlinear differential equations
- be able to interpret and characterize different solution types
- know, and be able to develop, applications to physics, biology, chemistry, engineering and other areas

## Course contents

Coupled nonlinear differential equations. Phase space, trajectories. Iterative maps. Stability analysis of singular points. Limit cycles, strange attractors. Poincaré-Bendixson theorem. Bifurcations. Chaos. Lyapunov exponents. Feigenbaum renormalization. Fractals, fractal dimensions. Lorenz equations, logistic map, Hénon map, Rössler system. Applications to Physics, Biology, Chemistry, Engineering: Lasers. Superconducting Josephson junctions. Population dynamics. Chemical kinetics. Electronic oscillators. Nonlinear mechanical systems.

## Examination

- INL1 - Assignment, 7.5 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

Home assignments and an oral exam (INL1 + TEN1; 7,5 hp).

## 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.