



## Course syllabus

Faculty of Technology  
Department of Mathematics

4MA425 Dynamiska system, 7,5 högskolepoäng  
Dynamical Systems, 7.5 credits

### **Main field of study**

Mathematics

### **Subject Group**

Mathematics

### **Level of classification**

Second Level

### **Progression**

A1N

### **Date of Ratification**

Approved 2014-10-03

Revised 2018-06-08 by Faculty of Technology. Assessment methods are changed.

The course syllabus is valid from spring semester 2019

### **Prerequisites**

60 credits in mathematics inclusive 2MA401 Ordinary Differential equations 7.5 credits or equivalent.

## Objectives

Upon completion of the course, the student should be able to:

- explain and prove basic results in the field of dynamical systems
- use methods within the theory of dynamical systems for solving problems with theoretical and applied character
- analyze dynamical systems and list properties that are left invariant with respect to coordinate changes and smaller perturbations
- derive consequences of Sharkovsky's Theorem for one-dimensional maps
- be able to analyze maps that give rise to horseshoe phenomena
- use symbolic dynamics
- construct unstable and stable manifolds for simple nonlinear systems
- understand the hyperbolicity concept and its consequences
- show ability to penetrate and understand sections that belong to the course in an independent and safe manner and report results in a written form
- show the ability to referee work of other students within this field and evaluate those

## Content

The course comprises:

- Examples of dynamical systems
- Homeomorphisms and diffeomorphisms
- Topological classification and structural stability
- Sharkovsky's Theorem
- Hyperbolic sets and horseshoe maps
- Unstable and stable manifolds
- Symbolic dynamics
- Writing an essay about some smaller part within the field of dynamical systems

## Type of Instruction

Lectures and seminars. Group assignments and mandatory assignments may be given during the course.

## Examination

The course is assessed with the grades A, B, C, D, E, Fx or F.

The grade A constitutes the highest grade on the scale and the remaining grades follow in descending order where the grade E is the lowest grade on the scale that will result in a pass. The grade F means that the student's performance is assessed as fail (i.e. received the grade F).

The student's knowledge is assessed in the form of oral and/or written examinations. Continuous examination through written and/or oral presentations occurs. The principal assessment method is decided at the beginning of the course.

## Course Evaluation

A course evaluation will be carried out and compiled after the course is completed. The compilation will be presented to the current board as well as to the students and filed.

## Credit Overlap

The course cannot be included in a degree along with the following courses of which the content fully, or partly, corresponds to the content of this course: 4MA125 Dynamical Systems, 7.5 credits

## Other

Grade criteria for the A–F scale are communicated to the student through a special document. The student is to be informed about the grade criteria for the course by the start of the course at the latest.

An essay is a short written presentation of about 3–4 pages containing the solutions of some exercises within a relevant context. Associated theory must be introduced and explained. Seminars containing presentations of the essay are arranged during the course.

## Required Reading and Additional Study Material

### Required reading

- Devaney, RL // An Introduction to Chaotic Dynamical Systems, Second Edition, Westview Press, 2003, ISBN 978-0-8133-4085-2, 335 pages

### Supplementary literature

- Barreira L, Valls C // Dynamical Systems - An Introduction, Springer, 2012, ISBN 978-1-4471-0, 209 pages