Course syllabus

Faculty of Technology

Department of Mathematics

4MA425 Dynamiska system, 7.5 credits
Dynamical Systems

Main field of study
Mathematics

Subject Group
Mathematics

Level of classification
Second Level

Progression
A1N

Date of Ratification
Approved 2014-10-03
Revised 2022-06-13 by Faculty of Technology. Type of instruction, examination (assessment methods) and literature are revised.
The course syllabus is valid from spring semester 2023

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.

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 a written examination, 5 credits (A-F), and an essay, 2.5 credits (A-F). The grade of the course as a whole is determined as a weighted average of the grades on the individual test elements.

Repeat examination is offered in accordance with Local regulations for courses and examination at the first and second-cycle level at Linnaeus University.If the university has decided that a student is entitled to special pedagogical support due to a disability, the examiner has the right to give a customised exam or to have the student conduct the exam in an alternative way.

Course Evaluation
During the implementation of the course or in close conjunction with the course, a course evaluation is to be carried out. Results and analysis of the course evaluation are to be promptly presented as feedback to the students who have completed the course. Students who participate during the next course instance receive feedback at the start of the course. The course evaluation is to be carried out anonymously.

Credit Overlap
The course cannot be included in a degree along with the following course/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, Robert L: *An Introduction to Chaotic Dynamical Systems*, Westview Press, latest edition, 335 pages

Supplementary literature

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