



# Exchange programme Vrije Universiteit

Vrije Universiteit Amsterdam - Exchange programme Vrije Universiteit - 2022-2023

## Exchange

Vrije Universiteit Amsterdam offers many English-taught courses in a variety of subjects, ranging from arts & culture and social sciences, neurosciences and computer science, to economics and business administration.

The International Office is responsible for course approval and course registration for exchange students. For details about course registration, requirements, credits, semesters and so on, please [visit the exchange programmes webpages](#).

# Dynamical Systems

Course Code	X_400637
Credits	6.00
Period	P4+5
Course Level	300
Language Of Tuition	English
Faculty	Faculty of Science
Course Coordinator	dr. C. Bick
Examiner	dr. C. Bick
Teaching Staff	dr. C. Bick
Teaching method(s)	Partial Exam, Seminar, Lecture

## Course Objective

At the end of this course students ...

- ... know the existence and uniqueness theorem for initial value problems;
- ... are able to solve constant coefficient linear (matrix) differential equations and know the elementary linear algebra needed for that;
- ... can analyze one- and two-dimensional dynamics and are able to draw phase space / phase plane pictures;
- ... know elementary bifurcation theory and in particular the saddle-node bifurcations;
- ... can recognize and analyze gradient, conservative and Hamiltonian dynamical systems;
- ... know and understand the stable and unstable manifold theorem and the principle of linearization;
- ... know what limit sets are;
- ... are able to apply the Poincaré-Bendixson theorem;
- ... understand the concept of compactification and know the Poincaré sphere.

## Course Content

This course entails the theory of ordinary differential equations from the modern point of view of dynamical systems.

Subjects are:

1. Existence and uniqueness of initial value problems;
2. Linear systems and elementary linear algebra;
3. One-dimensional dynamics and two-dimensional phase plane pictures;
4. Elementary bifurcation theory and saddle-node bifurcations;
5. Gradient dynamics;
6. Conservative systems and Hamiltonian dynamics;
7. Stable and unstable manifolds and linearization;
8. Limiting behavior;
9. The Poincaré-Bendixson theorem;
10. Compactification and the Poincaré sphere.

## Additional Information Teaching Methods

Regular instruction class in combination with tutorial classes.

## Method of Assessment

Hand-in exercises, a midterm and a final exam. The hand-ins count for 10% each. The first midterm counts for 40% and the second midterm counts for 40%.

The resit exam counts for 80% (scores for hand-ins remain).

## Literature

Lawrence Perko, "Differential Equations and Dynamical Systems", third edition, Springer-Verlag 2001, ISBN-10: 0387951164.

In addition there are notes that will be communicated to the students via Canvas.

## Additional Information Target Audience

Bachelor Mathematics Year two

## Additional Information

Additional information on Canvas

## Recommended background knowledge

First year courses Calculus and Analysis.