Optimization and Dynamics

Course Title	Optimization and Dynamics
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Course Objective	The course gives an introduction to dynamical systems, both discrete and continuous. Students will learn the basic quantitative and qualitative methods to solve problems arising in the study of dynamical systems and will become acquainted with typical phenomena associated with linear and non linear systems.
Prerequisites	First courses in linear algebra and analysis
References	R. L. Devaney, *An introduction to chaotic dynamical systems*, Addison-Wesley, 1989 D. K. Arrowsmith and C. M. Place, *An introduction to dynamical systems*, Cambridge Univ. Press, 1990 (Additional references may be given during the lectures.)
Description	Discrete and continuous dynamical systems; linear and non-linear stability; bifurcations; chaos.

Tentative content	• Dynamical systems with discrete time:
	  ○ one-dimensional systems and d-dimensional systems
	  ○ linear and non-linear systems
	  ○ stability
	  ○ bifurcations
	  ○ period doubling
	 • Dynamical systems with continuous time:
	  ○ linear differential equations
	  ○ non-linear autonomous differential equations
	  ○ existence, uniqueness and stability of solutions
	  ○ flow
	 • Symbolic dynamics
	
	 Note: Content may be adapted according to the knowledge and needs of the students, some items may be added or skipped.

Teaching Method	Lectures, tutorials, exercises
Evaluation	One final exam
Problem Sets	Assigned weekly; students need 50% of the marks to take the final exam.
Module Details	`https://ekvv.uni-bielefeld.de/sinfo/publ/modul/27461018`