Program	Level	First cycle
	Name of the program	All study programs

COURSE				
Course title	**Dynamical Systems**			
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)
AMAT 340	V	Elective course	4	2+2+0
Lecturer				
Course Goals	The goal of this course is to introduce fundamental techniques for analyzing discrete dynamical systems in one dimension.			
Learning Outcomes	On completion of the course, the student should be able to: • explain the basic concept of difference equations; • explain the meaning of the solutions of difference equations; • find equilibrium and periodic solutions to autonomous difference equations, and investigate their stability properties; • analyze difference equations models by using computational and analytic tools; • find and classify by type the bifurcation points of difference equations; • use computer simulations; • apply difference equations in some real-world problems.			

COURSE CONTENT

Dynamics of autonomous first-order difference equations. Linear first-order difference equations. Equilibrium points. Graphical iteration and stability. Criteria for stability. Hyperbolic and nonhyperbolic equilibrium points. Period points and cycles. The logistic equation and period-doubling. Bifurcations (Tangent, Transcritical, Period-doubling). Basin of attraction of equilibrium points. Basin of attraction of periodic orbits. Global stability. Applications.

LITERATURE

[1] Saber N. Elaydi: Discrete Chaos, 2nd edition, Chapman & Hall/CRC 2007.

[2] Saber N. Elaydi: An Introduction to Difference Equations, 3rd edition, Springer 2004

[3] Morris W. Hirsch, Stephen Smale, Robert L. Devaney: Differential Equations, Dynamical Systems & An Introduction to Chaos, Elsevier Academic Press 2003.

[4] Mustafa R.S. Kulenović, Orlando Merino: Discrete Dynamical Systems and Difference Equations with Mathematica, Chapman & Hall/CRC 2002.

[5] Ronald E. Mickens: Difference Equations Theory and Applications, Chapman & Hall/CRC, Second Edition 1998 .

[6] C. Robinson: Dynamical Systems, Stability, Symbolic Dynamics and Chaos, CRC Press, 1999.

STUDENT WORKLOAD (hours in a semester)

Lectures	30	Tutorial	30	Individual work	40	T o t a l	100

GRADING			REMARKS
Criterion	Maximum points	Minimum points	**Midterm exam**: only once in semester (end of November or first week of December). Students altogether write 120 minutes long test. This test is evaluated by max 50 points. The minimal score of the test is 25 points. **Final exam:** Students who do not reach the midterm exam minimal score must take the entire course in the final exam. In this case, the final exam is evaluated by max 100 points. The final exam's minimal score is 55 points. Students who reach the midterm exam minimal score take only the part of the final exam that is not covered by the midterm test. In this case, the final exam is evaluated by max 50 points. The minimal score is 30 points.
Midterm exams	50	25	
Homework assignment			
Project			
Laboratory assignments			
Final exam	50	30	
T o t a l	100	55	