Program	Type of studies (cycle)	Third cycle
	Name of the program	Natural and mathematical sciences in education

Course

Course title	Topological dynamical systems

Course code	Semester	Course status	ECTS credits	Contact hours
AMAT 605				30

Teaching staff	Teacher	Prof. Dr. Senada Kalabušić
	Other staff	Doc. Dr. Esmir Pilav
Course goals	The goal of the course is to give to the students a basic knowledge about topological dynamical systems.	

Course content/topics

Discrete dynamical systems. Difference equations. Population growth model.
Linear dynamical systems.
Maps. Arnold's cat map, Baker's map, Circle map, Henon map, Horseshoe map,
Logistic map, Duffing map, Complex quadratic map,
Fixed (Equilibrium) points. Periodic points. Graphical iteration and stability. Fixed points for qudaratic family
Limit sets. $\alpha-$limit set. $\omega-$limit set. Nonwandering point. Invariant set
Invariant Cantor sets for the quadratic family.
Conjugacy and structural stability.
Homeomorphisms of the circle. Rotation number. Examples.
The period doubling. $2-$cycles. 2^2-cycles. Beyond μ_∞ .
Li-Yorke theorem. Sharkovski ordering. Sharkovski theorem. Examples for Sharkovski theorem.

LITERATURE

[1] K.T. Alligood, T.D. Sauer, J.A. Yorke, Chaos (An Introduction to Dynamical Systems), Springer, 1996.
[2] S. Lynch, Dynamical systems with applications using Mathematica, BirkhÄauser, 2007.
[3] G. Teschl, Ordinary Differential Equations and Dynamical Systems, Springer, 2009.
[4] M. Hirsh, S. Smale, R. Devaney, Differential equations, dynamical systems and an introduction to chaos, Elsevier, 2004.
[5] Robert L. Devaney, An Introduction to Chaotic Dynamical Systems, 2nd edition, 2003.
[6] Saber N. Elaydi, Discrete Chaos, Chapman-Hall/CRC, 2000.
[7] M.R.S. Kulenović, O. Merino, Discrete Dynamical Systems and Difference Equations with Mathematica, Chapman-Hall/CRC, 2002.
[8] C. Robinson, Dynamical Systems, CRC, 2nd edition, 1999.
[9] S. Wiggins, Introduction to applied nonlinear dynamical systems and chaos, Springer, 2003.

Grading

	Criterion	Points	Cut-off points
1.	Homework assignment	20	10
2.	Project	30	15
3	Final exam	50	30
	Total	100	55