

Program		Type of studies (cycle)	Third cycle		
		Name of the program	SEE Doctoral Studies in Mathematical Sciences		
Course					
Course title		Topological dynamical systems			
Course code	Semester	Course status	ECTS credits	Contact hours	
	I		10	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 quadratic family Limit sets. α -limit set. ω -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		Grading			
[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, Birkhäuser, 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.			Criterion	Points	Cut-off points
		1.	Homework assignment	20	10
		2.	Project	30	15
		3	Final exam	50	30
		Total		100	55