Program	Level	Third cycle
	Name of the program	SEE Doctoral Studies in Mathematical Science

COURSE

Course title	**Dynamical systems**			
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)
AMAT 615	I	**Elective course**	10	30
Lecturer				
Course Goals	The aim of the course is to provide students with basic knowledge from discreet and continuous dynamic systems			

COURSE CONTENT

- Introduction to continuous dynamic systems: Phase space, vector field, flow; Cauchy-Peano theorem of existence, theorems of uniqueness; Depending on the initial conditions and parameters; Compact differential mainfold where local flows are global flows.
- Introduction to discrete dynamic systems: Mapping iterations, fixed points and stability; Chaotic behavior; Bernoully's shift mapping, Cat mapping
- Nonlinear systems near the equilibrium: Linearization, Hartman-Grobman theorem, Theorem of stable manifolds, near-periodic systems Bifurcation Theory: A theorem of Central Maniflow
  Saddle-knotted bifurcation; Pitchfork bifurcation of Hopf bifurcation Structural stability: Smale Horseshoe mapping; Hyperbolic systems KAM theory, twist surface-preserving mappings, Poincaré's concict and Birkhoff's evidence, Aubry-Mather's theory

LITERATURE

[1] V.I. Arnold, Ordinary differential equations", various editions
[2] V.I. Arnold, Ordinary Differential Equations
[3] D. K. Arrowsmith and C. M. Place, An Introduction to Dynamical Systems
[4] C. Chicone, Ordinary Differential Equations and Applications
[5] E. A. Coddington and N. Levinson, Theory of Ordinary Differential Equations
[6] J. Guckenheimer and P. Holmes, Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields (Note: this text includes a chapter on chaos.)
[7] A. Katok and B. Hasselblatt, Introduction to the Modern theory of Dynamical Systems
[8] S. Wiggins, Introduction to applied nonlinear dynamical systems and chaos, Springer, 2003.
[9] M. Hirsh, S. Smale, R. Devaney, Differential equations, dynamical systems and an introduction to chaos, Elsevier, 2004.

GRADING

Criterion		Maximum points	Minimum points
1.	Assigments	30	17
2.	Projects	20	13
3.	Final exam	50	25
Total		100	55