

New Elective Course - MA 644

School of Basic Sciences, IIT Mandi
Discipline: Mathematics

Course Title	DYNAMICAL SYSTEMS	Course No	MA 644			
Department	MATHEMATICS (Basic Sciences)	Structure	L	T	P	C
			3	0	0	3
Offered for	Ph.D	Status	Elective			
Faculty	Dr. Nitu Kumari	Type	New			
Pre-requisite	Differential Equations	To take effect from	August, 2011			
Submission date	Date of approval by School	Date of approval by BAC	Date of approval by Senate			

Objectives:

This course is an applied mathematics course designed to be an introduction to dynamical systems. The objective of the course is to study the question: What are the possible events in a system governed by nonlinear ordinary differential equations? The coverage will be more by theorem and mathematical approach.

Prerequisites:

The prerequisites are linear algebra (particularly the eigenvalue problem) and basic ordinary differential equations, including matrix methods for systems of equations.

Course contents:

Dynamical systems- Central manifold and Normal form, Plane Autonomous Systems, Attractors, Map-1D map, Logistic map, Poincare' maps, generalized Baker's map, circle map, Bifurcations- Necessary Condition for bifurcation, Saddle node bifurcations, Transcritical Bifurcation, Pitchfork Bifurcation, Normal forms of different types of bifurcations, Reduction to Normal Form, Hopf bifurcation, Strange attractors, Henon map and Rossler system, Box-counting, pointwise and correlation, Hausdorff dimensions, Lyapunov exponent, chaotic transitions, intermittency, crisis.

Textbook

1. Guckenheimer, J., and P. Holmes. *Nonlinear Oscillations, Dynamical Systems and Bifurcations of Vector Fields*. New York, NY: Springer-Verlag, 2002.

References

2. Drazin, P. G. *Nonlinear systems*. Cambridge, UK: Cambridge University Press, 1992.
3. Peitgen, H-O., H. Jurgens, and D. Saupe. *Chaos and Fractals: New Frontiers of Science*. New York, NY: Springer, 2004.
4. Jordan, D. W., and P. Smith. *Nonlinear Ordinary Differential Equations*. New York, NY: Oxford University Press, 1999.
5. Berge, P., Y. Pomeau, and C. Vidal. *Order Within Chaos*. New York, NY: Wiley 1987.