Course No. - MTH 658A

Course Title - Nonlinear Dynamical Systems

Classes: Wednesday and Friday, 9:00 - 10:15, L15

Objective: Main objective of this course is to provide an introduction to discrete and continuous nonlinear dynamical systems and analysis of such systems for the stability of equilibrium points (local as well as global), their local bifurcations and related normal forms, chaotic and other complex dynamics exhibited by them. Some basic features of Matlab programming to simulate nonlinear dynamical systems is also a part of this course.

Course Content: Discrete dynamical system, cobweb diagram, stability of fixed point, periodic points and periodic orbit, chaos and Lyapunov exponent. Linear and nonlinear continuous time dynamical systems, Linear stability theory, Lyapunov stability theorem, Benedixon Theorem, Dulac criteria, Limit cycle. Stable and unstable manifolds of equilibria, Stable manifold theorem, Hartman-Grobman theorem, Examples and applications, Center manifold theorem, Elementary Bifurcation theory, Normal form theory.

Grading: Mid Sem (30%) + Project (20%) + End Sem (50%)

Suggested Books:

M.W. Hirsch, S. Smale, R. L. Devaney: Differential Equations, Dynamical Systems & An Introduction to Chaos.
L. Perko: Differential Equations and Dynamical Systems.
S. H. Strogatz: Nonlinear Dynamics and Chaos.
S. N. Elaydi: Discrete Chaos