Subject/ discipline: Applied Mathematics, Physics
Level of course: 200 - level / introductory graduate level
Number of credits: 3
Course type & evaluation: lectures, assignments, mid + end-term examinations & project

Instructor: Prof. Janaki Balakrishnan (janaki05@gmail.com)

Course name: Introduction to Dynamical Systems

Course content:

Linear stability analysis, attractors, limit cycles, Poincare-Bendixson theorem, relaxation oscillations, elements of bifurcation theory: saddle-node, transcritical, pitchfork, Hopf bifurcations, integrability, Hamiltonian systems, Lotka-Volterra equations, Lyapunov function & direct method for stability, dissipative systems, Lorenz system, chaos & its measures, Lyapunov exponents, strange attractors, simple maps, period-doubling bifurcations, Feigenbaum constants, fractals. Both flows (continuous time systems) & discrete time systems (simple maps) will be discussed.
Assignments will include numerical simulations.

Prerequisites, if any:
Familiarity with linear algebra - matrices, and ordinary differential equations
Desirable: ability to write codes for solving simple problems.

Suggested Books:

1. S. Strogatz, Nonlinear Dynamics and Chaos: with Applications to Physics, Biology, Chemistry, and Engineering, Westview, 1994
2. S. Wiggins, Introduction to applied nonlinear dynamics & chaos, Springer-Verlag, 2003.
3. K. Alligood, T. Sauer, & James A. Yorke, Chaos: An Introduction to Dynamical Systems, Springer-Verlag, 1996.
4. M. Tabor, Chaos and Integrability in Non-linear Dynamics, Wiley, 1989.