

Semester	JAN 2022
Open to semester	8,14,22
Course code	PHY342/PH6424
Course title	Non-linear Dynamics
Credits	3 /4
Course Coordinator & participating faculty (if any)	Deepak Dhar
Nature of Course	Lectures
Pre-requisites	None
Objectives (goals, type of students for whom useful, outcome etc)	<p>This is an introductory course. General features of evolution of nonlinear systems will be introduced and discussed. Topics discussed are analysis of fixed points of dynamical systems, linear stability analysis, bifurcations and physical applications to modelling real world systems, population dynamics, epidemics, chemical reactions, lasers etc, characterization of steady states including chaos.</p> <p>Analysis of time series data, power spectra, fractals etc</p>
Course contents (details of topics /sections with no. of lectures for each)	<p>Course Content:</p> <ol style="list-style-type: none"> 1. Introduction: classification, chaos, discrete and continuous time evolutions. 2 lectures 2. Discrete dynamical systems : logistic map, bifurcations and period doubling, lyapunov exponents, 2-d Henon -Heiles map, quasiperiodicity, Arnold tongue -5 lectures 3. Continuous dynamical systems: fixed points, stability analysis, limit cycles, bifurcation predator- prey systems, Lorenz system -5 lectures 4. Chaos in Hamiltonian systems - 2 lectures 5. Measures of chaos: Poincare map, FFT, Lyapunov exponents – 2 lectures 6. Frctals aand multifractals- different dimensions, f-alpha spectrum 5 lectures 7. Non linear time series analysis 4 lectures 8 Coupled systems and synchronization – 4 lectures 9. Dynamics on networks : 4 lectures

Evaluation /assessment	End-Sem Examination-60% Mid-Sem Examination-40% Others- For PhD and Iphd: Midterm 35%, Final 40%, project report and presentation 25% %
Suggested readings (with full list of authors, publisher, year, edn etc.)	Non-linear dynamics and Chaos: Steven Strogatz (Pegasus Books) Topics in nonlinear dynamics, NPTEL course by Prof. V. Balakrishnan