

## **IT- 454 : Statistical Mechanics of Complex Systems**

Kinetic Exchange Theory: Ideal gas theory, kinetic wealth exchange model (with homogenous and heterogenous saving), application to opinion dynamics.

Cooperative behavior and critical phenomena: Magnetism (Ising Model 1D and 2D), scaling theory, power laws.

Self-organised criticality: Bak Tang Wiesenfeld model for sandpile, Bak Sneppen model, avalanche dynamics and power law in cluster size distribution.

Percolation theory and its application: Bond and site percolation in 1.D and 2D lattices, percolation threshold and cluster size distribution, Hoshen-Kopelman and Leath algorithms, Fractals and Hausdorff dimensionality.

Cellular automata: 1D, 2D rules and pattern formation, Moore and von Neumann neighbourhood's, Conway's game of life.

Combinatorial Optimization: P and NP-hard classes, k-SAT and Travelling salesman problems, greedy algorithm and simulated annealing algorithm.

Text book: Statistical Mechanics, Sethna (OUP, 2006)