IT 462-Multi-Agent Modelling of Complex Systems

Introduction to agent based modelling: Zero intelligence models and models with interacting agents.
kinetic exchange models: Chakraborti-Chakrabarti model, Chatterjee Chakrabarti Manna model
Percolation theory and Herding behaviour models: Galam model, Cont-Bouchaud model.
Self-Organised criticality and cellular automata models:Schelling model, Bak Tang Wiesenfeld model, traffic models.
Game-theoretical models: Cooperative and Non-cooperative games, zero sum and non-zero sum games, Nash equilibrium and Pareto optimality, Prisoner's dilemma game, Minority game, Kolkata paise restaurant problem as model for resource allocation
Network models: Erdos-Renyi model, Watts-Strogatz model, Barabasi-Albert model and their applications.

Textbook: Econophysics, Chakrabarti et al (Wiley, 2010).

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 behaviour 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 1D 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)