PY542: NON-EQUILIBRIUM STATISTICAL PHYSICS
TENTATIVE COURSE OUTLINE FALL 2011

1. **DIFFUSION/RANDOM WALKS** [(a,b) 2 lects. (c) 1 lect. (d) 2 lects. (e) 3 lects.]
   (a) Master equation description of hopping processes
   (b) Central limit theorem
   (c) Anomalous random walk processes
   (d) Langevin and Fokker-Planck equations
   (e) First-passage phenomena: transience/recurrence, exit probabilities, exit times
2. **COLLISIONS, TRANSPORT PROCESSES, HYDRODYNAMICS** [(a) 1 lect. (b) 1 lect.]
   (a) Elementary kinetic theory
   (b) Navier-Stokes equation and some consequences
3. **KINETICS OF AGGREGATION** [3 lects.]
   (a) Overview of solution methods
   (b) Illustrative examples: constant and product kernel solutions
   (c) Influence of steady input
4. **ADSORPTION PHENOMENA** [3 lects.]
   (a) Random sequential adsorption in one dimension
   (b) Application to physical fragmentation
   (c) Reversible adsorption
   (d) Application to polymer translocation
5. **SPIN DYNAMICS** [3 lects.]
   (a) The central dogma and basic phenomenology
   (b) Detailed balance condition
   (c) Ising-Glauber model
   (d) Conserved order-parameter dynamics
6. **COARSENING** [2 lects.]
   (a) Basic models: non-conserved and conserved order parameter
   (b) Evolution in idealized geometries: domain walls and droplets
   (c) Lifshitz-Slyozov-Wagner coarsening
   (d) Extremal processes
7. **POPULATION DYNAMICS** [2 lects.]
   (a) Fundamental models: logistic, competition, prey-predator dynamics, epidemics
   (b) Discrete reactions: branching processes, annihilation
   (c) Small-fluctuation expansion
8. **REACTION KINETICS** [2 lects.]
   (a) Role of spatial dimension
   (b) Basic examples: trapping, coalescence, aggregation, propagating waves
9. **COMPLEX NETWORKS** [3 lects.]
   (a) Erdös-Rényi random graph
   (b) Random recursive trees
   (c) Preferential attachment models