

First handout for the course
PHY604A: Review of Statistical Mechanics
Instructor: Taraknath Mandal

(Weekly 1 lecture and 3 tutorials. Only the PhD students of Physics Department are encouraged to take the course. Students, who have already taken PHY412A, should opt for other elective courses.)

1. Brief review of thermodynamics and probability theory.
2. Basics of classical statistical mechanics; micro-canonical, canonical and grand-canonical ensembles. Partition functions and derivation of thermodynamic quantities.
3. Quantum statistical mechanics; density matrix, non-interacting Bose and Fermi gas.
4. Interacting systems; Ising model of magnetism, transfer matrix method, cluster expansion, mean field theory, Phase transition, Landau theory, scaling relations near critical point, brief idea of renormalization group.
5. Very brief overview of numerical simulations; Molecular dynamics and Monte Carlo methods.

Reference Books

1. *R. K. Pathria and P. D. Beale, Statistical Mechanics (Academic Press, 2007).*
2. *M. Kardar, Statistical Physics of Particles (CUP, 2007).*
3. *K. Huang, Statistical Mechanics (Wiley, 1987).*
4. *D. Chowdhury and D. Stauffer, Principles of Equilibrium Statistical Mechanics (Wiley, 2000).*
5. *F. Reif, Fundamentals of Statistical and Thermal Physics (McGraw Hill, 1985).*
6. *N. Goldenfeld, Lectures on Phase Transitions and The Renormalization Group (Taylor & Francis Group LLC, 1992)*
7. *D Frenkel and B Smit, Understanding Molecular Simulation (Elsevier, 2002)*