



Department of Physics, Indian Institute of Technology Kanpur

PHY604A: Review of Statistical Physics

Instructor-in-charge: Sagar Chakraborty

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

Course Contents:

1. Review of thermodynamics and probability theory.
2. Basic principles of equilibrium classical statistical mechanics; micro-canonical, canonical and grand-canonical ensembles.
3. Quantum statistical mechanics, density matrix, path integral, ideal quantum gases and their properties, Bose–Einstein condensation, free electron gas.
4. Ising model of magnetism, transfer matrix method, mean field theory, phase transitions, Curie–Weiss theory, Landau theory, scaling near a critical point.
5. Brief overview of non-equilibrium statistical mechanics: random walk, brownian motion, diffusion equation, Langevin and Fokker–Planck equations, Markov processes and master equation, systems near equilibrium linear response theory, fluctuation dissipation theorem, escape over a barrier relaxation phenomena, critical dynamics.

References Books:

1. *F. Reif, Fundamentals of statistical and thermal physics (McGraw Hill, 1985).*
2. *L. D. Landau and E. M. Lifshitz, Statistical Mechanics (Academic Press, 1975).*
3. *K. Huang, Statistical Mechanics (Wiley, 1987).*
4. *M. Kardar, Statistical Physics of Particles (CUP, 2007).*
5. *R. K. Pathria and P. D. Beale, Statistical Mechanics (Academic Press, 2007).*
6. *S. K. Ma, Statistical Mechanics (World Scientific, 1985).*
7. *R. P. Feynman, Statistical Mechanics: A Set Of Lectures (Reading, MA : Benjamin, 1972).*
8. *D. Chowdhury and D. Stauffer, Principles of Equilibrium Statistical Mechanics (Wiley, 2000).*
9. *J. K. Bhattacharjee and D. Banerjee, Intermediate Statistical Mechanics: A Handbook (World Scientific, 2017).*