**PH 527: Phase Transitions and Critical Phenomena (3-0-0: 3)**

**Introduction**

Order of Phase transition, Ehrenfest criterion, examples of First and second order phase transition,

critical points and exponents, inequalities. **[4L]**

**Models**

The spin - 1/2 Ising model, spin - 1 Ising model, q state Potts model, X-Y model, Heisenberg model.

**[5L]**

**Mean field theories**

Introduction to mean field theory, Weiss mean field theory, Bragg-Williams mean field theory, Transfer matrix formalism, correlation functions, Landau theory of phase transition, scaling laws, upper critical dimension. **[10L]**

**Series expansions**

Series expansion, applications to Ising model. **[4L]**

**Monte Carlo simulations**

Importance sampling, Metropolis algorithm, error analysis. **[5L]**

**The renormalization group**

Renormalization Group transformation, RG flow equations, scaling and critical exponents, applications to 1D Ising model. **[8L]**

**Text Books & References**

1. H. E. Stanley, “Introduction to Phase Transitions and Critical Phenomena”, Oxford University Press.
2. J. M. Yeomans, “Statistical Mechanics of Phase Transitions”, Oxford University Press.
3. D. Chandler, “Introduction to Modern Statistical Mechanics”, Oxford University Press.
4. R. K. Pathria and P. Beale, “Statistical Mechanics”, Academic Press.
5. M. Plischke and B. Bergersen, “Equilibrium Statistical Physics”, Wspc.