Statistical Mechanics

Couse code – JT 204

Review of Thermodynamics: Description of Equilibrium States, Laws of Thermodynamics, Heat Engines, Thermodynamic Potentials, Legendre Transformation, Introduction to Phase Transitions.

Equilibrium Statistical Mechanics: Liouville's Theorem, Ergodic Hypothesis, Ensembles (Microcanonical, Canonical, Grandcanonical), Partition Functions, Contact Between Statistics and Thermodynamics,
Quantum Mechanical Representations, Detailed Balance, Finite versus Thermodynamic Limit, Equivalence of Ensembles, Classical and Quantum Statistics (Maxwell-Boltzmann, Fermi-Dirac, Bose-Einstein), Applications.

Phase Transitions and Critical Phenomena: Overview of Universality
(Experimental and Theoretical Pictures of Critical Exponents), Ising Model, Mean Field (Weiss Molecular Field Theory and Bethe Approximation) and Exact (1D) Solutions of Ising Model, Landau Theory, Scaling Theory.

Out-of-Equilibrium Phenomena: Brief Introduction.

References:
1. R.K. Pathria, Statistical Mechanics, Elsevier, 1996.
2. K. Huang, Statistical Mechanics, John Wiley and Sons, 1987.
3. M. Plischke and B. Bergersen, Equilibrium Statistical Physics, World Scientific, 2006.
4. L.D. Landau and E.M. Lifshitz, Statistical Physics, Pergamon Press, 1970.