Statistical Mechanics
Couse code – JTL 204(310)

Review of Thermodynamics. Equilibrium states, approach to equilibrium. Laws of thermodynamics. Preliminary discussion of connections to statistical description of macroscopic systems.

Probability concepts. Probability distributions. Sums of random variables. Central limit theorem.

Kinetic theory of gases. Liouville's theorem, BBGKY hierarch, Blotzmann equation. H-theorem.

Classical equilibrium statistical mechanics. Ensembles, partition function, connection to thermodynamics. The ideal gas.

Interacting particles. Imperfect gases. Cluster expansion. Virial coefficients. Properties of the partition function. Yang-Lee theorem. Phase transitions. The van der Waals equation. Mean field theory. Critical phenomena. Landau theory.

Quantum statistical mechanics. Microstates of identical particles. Fermi systems. Bose systems. Vibrations of a solid. Bose-Einstein condensation. Superfluidity.

Nonequilibrium statistical mechanics basics.

Reference books:

1. **M. Kardar, Statistical Physics of Particles, Cambridge University Press, 2007.**
2. K. Huang, Statistical Mechanics, John Wiley and Sons, 1987.
3. S-K Ma, Statistical Mechanics, World Scientific Publishing Co. Ltd. 1985
4. L.D. Landau and E.M. Lifshitz, Statistical Physics, Pergamon Press, 1970.
5. F. Reif, Statistical Physics, McGraw Hill, New Delhi, 2011