Elective Paper V (Group C)

Statistical thermodynamics: **60 hrs.**

I. Elements of Statistical Thermodynamics: **15 hrs.**

Microstates, Macrostates, Permutations and Combinations. Combinatory rule. Derivation of Lagrange's method of undetermined multipliers. Stirling's approximation. Partition function and its physical interpretation. Boltzmann Distribution law and its applications. Significance of β and its mathematical evaluation. Partition function and its relationship with internal energy, Helmholtz and Gibb's free energy, entropy, enthalpy, heat capacity and pressure.

II. Statistical Thermodynamics of Independent Systems: **15 hrs.**

Distribution laws and their limit of applicability. Partition function for independent and distinguishable (Localised), independent and indistinguishable (Non-Localised) systems. Relation between partition function for distinguishable and indistinguishable systems. Partition function for mixture of gases. Cannonical and Grand Cannonical partition functions. Relation of Grand Cannonical partion function with thermodynamic state functions. Detailed statistical study of two phase assembly of one component system.

III. Applications of Statistical Thermodynamics to Chemical Systems: **15 hrs.**

Statistical interpretation of chemical equilibrium. Molecular interpretation of basic laws of thermodynamics. Statistical thermodynamics of an ideal crystal. Statistical derivation of equation of state for non-ideal fluids. Statistical thermodynamics of gaseous mixture. Statistical view of isomolecular and isotopic exchange reaction rate. Statistical evaluation of residual entropy.

IV. Nuclear Spin – Statistics and Fluctuations: **15 hrs.**

Symmetry and nuclear spin, ortho and para nuclear states, ortho and para hydrogen, Nuclear spin extended to special cases. Mean Distribution and Mean Square Deviation. Fluctuations in energy in a Cannonical ensemble, Fluctuations in density, radioactive disintegration and Brownian movement.

Books Sugested

1. Classical and Statistical Thermodynamics, Ashley H. Carter, Prentice Hall (2001).
2. Thermodynamics and Statistical Mechanics, Kerson Huang, Second edition, Wiley (1982).
3. Fundamentals of Classical and Statistical Thermodynamics, Bimalendu Narayan Roy, John Wiley & Sons (1982).
4. Macroscopic and Statistical Thermodynamics, Yi-Chen Cheng, World Scientific (2006).
5. Matter in Equilibrium: Statistical Mechanics and Thermodynamics, Stephen R.Berry, Stuart A.Rice and John Ross, Oxford University Press (2001), 2nd ed.
6. Statistical Mechanics: Fundamentals and Modern Applications, Richard E.Wilde and Surjit Singh, Wiley-Interscience (1998).
7. Statistical Thermodynamics, Gupta M.C., New Age International(P) Limited Publication second edition (1990).