M. Marks: 32   **Time: 3 Hrs.**

Note: Nine questions will be set. **Q. No. 1**, based on whole syllabus, is compulsory. There will be four questions from section **A and** four from section **B**. Candidates will be required to attempt five questions in all, selecting at least two questions from each section. Question no. 1 carry 8 marks and all questions in Section A & B (not more than 2 - 3 parts) carry 6 marks each.

Section- A (22 Periods)

Thermodynamics

Second law of thermodynamics, need for the law, different statements of the law, Carnot's cycles and its efficiency, Carnot's theorem, Thermodynamics scale of temperature. Concept of entropy
– entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, entropy as a criteria of spontaneity and equilibrium.
Third law of thermodynamics: Nernst heat theorem, statement of concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs function (G) and Helmholtz function (A) as thermodynamic   quantities,   Gas   criteria   for   thermodynamic equilibrium and spontaneity, its advantage over entropy change. Variation of G with P, V and T.

Section- B (23 Periods)

Electrochemistry

Electrolytic and Galvanic cells – reversible & irreversible cells, conventional representation of electrochemical cells.
Calculation of thermodynamic quantities of cell reaction ($\blacktriangle$G, $\blacktriangle$H & K).
Types of reversible electrodes – metal- metal ion, gas electrode, metal – insoluble salt- anion and redox electrodes. Electrode reactions, Nernst equations, derivation of cell EMF and single electrode potential. Standard Hydrogen electrode, reference electrodes, standard electrode potential, sign conventions, Concentration cells with and without transference, liquid junction potential and its measurement. Applications of EMF measurement in solubility product and potentiometric titrations using glass electrode. More stress on numerical problems.