PAPER-III

PHYSICAL CHEMISTRY

Time-3 Hrs.   M.M. 50

NOTE : The paper will be divided into THREE sections.

Section-A   Ten questions (short type answer) two from each Unit will be asked. Each question will be of half mark and the candidates are required to attempt all questions.   **Total 5 marks**

Section-B   Five questions (answer not exceeding 250 words) one from each Unit with internal choice will be asked and the candidates are required to attempt all questions. Each question will be of 5 marks.   **Total 25 marks**

Section-C   Four questions may be in parts covering all the five Units (answer not exceeding 500 words) will be asked. The candidates are required to attempt any TWO questions. Each question will be of 10 marks.   **Total 20 marks**

UNIT - I

Mathematical Concepts :- Logarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation of function like k_x, e^x, x^n, $\sin x$, $\log x$, maxima and minima, partial differentiation and reciprocity relations, integration of some useful

relevant functions, permutations and combinations, factorials, probability.

Computers - General introduction to computers, different components of a computer, hardware and software, input-output devices, binary numbers and arithmetic, introduction to computer languages, programming operating systems.

UNIT - II

Gaseous State - Postulates of kinetic theory of gases, deviation from ideal behavior, Van- der Waals equation of state.

Critical Phenomena - PV isotherms of real gases, continuity of states, the isotherms of Van der Waals equation, relationship between critical constants and Van der Waals constants, the law of corresponding states, reduced equation of state.

Molecular Velocities - Root mean square, average and most probable velocities, qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter, liquefaction of gases (based on Joule - Thomson effect).

Liquid State - Intermolecular forces, structure of liquid (a qualitative description).

Liquid Crystals - Difference between liquid crystal, solid and liquid, classification, structure of smetic, nematic and cholestric phases, theory of liquid crystals and its applications, thermography and seven segments cell.

UNIT-III

Solid State - Definition of space lattice, unit cell, Bravais lattices.

Laws of crystallography- (i) Law of constancy of interfacial angles (ii) Law of rationality of indices, Weiss and Miller indices (iii) Law of symmetry, symmetry elements in crystals, classification of crystals, X-ray diffraction by crystals, derivation of Bragg equation, determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).

Colloidal State - Definition of colloids, classification of colloids.

Solids in liquid (sols): Properties - kinetic, optical and electrical, stability of colloids, protective action, Hardy - Schulze law, gold number.

Liquids in Liquid (emulsions): Types of emulsions, preparation, emulsifier.

Liquids in solid (gels)- classification, preparation and properties, inhibition, general applications of colloids.

UNIT- IV

Nuclear and Radiochemistry - Elementary idea of nucleus, nuclear forces, packing fraction, mass defect and binding energy, nuclear fission and fusion reactions, calculation of Q - values of nuclear reactions, liquid drop and shell models of nucleus, theory of radioactivity, G. M. Counter, half life period, average life, radioactive disintegration, radioactive

steady state, group dis-placement law, radioactive series, separation and identification of isotopes, application of radioactivity and radioactive tracers.

UNIT-V

Atomic Structure - Dual nature of electron, De Broglie equation, Davisson and Germer experiment, Heisenberg uncertainty principle, Schrodinger wave equation, significance of ψ and ψ^2, probability distribution curves, shapes of s, p and d - orbitals, Zeeman and Stark effects.

Physical Properties and Molecular Structure - Physical properties of liquids, vapour pressure, measurement of vapour pressure, heat of vaporization, Trouton's rule.

Surface tension, measurement of surface tension.

Viscosity and its measurement, effect of temperature on the surface tension and viscosity. use of these properties in determination of chemical constitution.

Books Recommended:

1. Principles of Physical Chemistry: B. R. Puri and L. R. Sharma.

2. A Text Book of Physical Chemistry: A. S. Negi and S. C. Anand.

3. Physical Chemistry, Pt. I & II : C.M. Gupta, J.K. Saxena and M. C. Purohit.

4. Physical Chemistry (Hindi Ed.) : Suresh Ameta, R.C.Khandelwal, R. Ameta & J. Vardia, Himanshu Pub.

5. Computers and Applications to Chemistry, Ramesh Kumari, Narosa Publishing House Pvt. Ltd.