

**CHEMISTRY (HONOURS)****Paper III****Time - 3 hours****Full Marks - 75**

Ten questions to be set. Five questions to be answered selecting two from group A (Physical Chemistry) and three from group B (Organic Chemistry). Short answer type questions are recommended. There may be several parts in a question.

**Group A****PHYSICAL CHEMISTRY**

The syllabus consists of following units :-

**Marks - 25****UNIT - I**

10 Hrs

**QUANTUM CHEMISTRY**

Black body radiation, Plank's quantum theory, Wave particle quality, de Broglie equation, Heisenberg uncertainty principle and its importance.

**Motion of Vibrating String**

Postulates of quantum mechanics, Eigen function, Eigen value, Properties of wave function, Orthogonality, Normalisation of wave function, Schrodinger wave equation.

**UNIT - II**

12 Hrs

**ELECTROCHEMISTRY**

- (a) Ostwald dilution law, Its application, Buffer solution, Buffer action, Henderson-Hassel equation, Hydrolysis of salts, Relation between  $K_h$ ,  $K_w$ ,  $K_a$  and  $K_b$ ,  $P^H$  of hydrolysed salt solution, Acid base indicators, Solubility product, Common Ion effect.
- (b) Galvanic cell, Reversible and Irreversible cells, Electrodes, Types of Electrodes, Reference electrodes, H, Calomei, Glass and quinhydrone electrodes.

**UNIT - III****DISTRIBUTION LAW**

Distribution law, its Thermodynamic derivation and limitations, Modification in law for association, dissociation and solvent participation, Applications.

Complex formation between KI and  $I_2$ ,  $CuSO_4$  and  $NH_3$ , Solvent Extraction

## UNIT - II

### INTERFACE CHEMISTRY

Adsorption, Sorption, Desorption, Kinds of adsorption Isotherms, Adsorption of gases on solids, Frenndlick adsorption Isotherm, Langmuirs Isotherm, B.E.T. equation (qualitative only)

### Group B

### INORGANIC CHEMISTRY

The syllabus consists of following units :-

Marks - 50

#### UNIT - I

6 Hrs

#### NATURE OF CHEMICAL BOND

Overlapping of atomic orbitals

$\sigma$ ,  $\pi$ , Tau and delta bond. Bonding in  $B_2H_6$ . Copper (II) acetate and Chromous acetate.

Concept of resonance and delocalisation of orbitals. e.g.  $NO$ ,  $NO_2^-$ ,  $SO_2$ ,  $SO_3$ ,  $SO_4^{2-}$ ,  $PO_4^{3-}$  &  $CO_3^{2-}$  ions.

#### UNIT - II

10 Hrs

#### CHEMISTRY OF ELEMENTS OF FIRST TRANSITION SERIES

Characteristic of d-Block elements.

General study of the elements of First Transition series and their binary compounds, Complex formation in different O-states. C.N. and geometry, Principals behind volumetric estimation of  $Cu^{+2}$ ,  $Fe^{+2}$ , Ions by the use of std. Sodium thiosulphate,  $KMnO_4$  and  $K_2Cr_2O_7$  solution.

#### UNIT - III

10 Hrs

#### CHEMISTRY OF ELEMENTS OF SECOND TRANSITION SERIES

General characteristics, Comparative treatment with their 3d-analogues, in respect of Ionic radii, O-states, Magnetic behaviour of compounds, complex forming tendencies and stereo chemistry.

Ores and extraction of V & Mo.

## UNIT - IV

## NON-AQUEOUS SOLVENTS

Types of solvents and their general characteristics. Reactions in non-aqueous solvents such as Liq.  $\text{NH}_3$  and Liq.  $\text{SO}_2$ .

## UNIT - V

## CO-ORDINATION COMPOUNDS

Double salts and complex compounds, Werner's co-ordination theory and its justification from physical data, Isomerism in complexes, Effective atomic no. concept, Chelates, V.B. Theory of complexes, Nomenclature of complex compounds.

## UNIT - VI

## LANTHANIDES

Electronic configuration, O-States, Ionic radii and Lanthanide contraction, Complex formation, Separation of Lanthanides, Ions exchange method.

## UNIT - VII

## MOLECULAR SYMMETRY

Symmetry Introduction : Symmetry elements and Symmetry operation. Centre of Symmetry, Axis of symmetry and plane of symmetry.

## CHEMISTRY (HONOURS)

## Paper IV

Time - 3 hours

Full Marks - 75

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## Group A

## PHYSICAL CHEMISTRY

The syllabus consists of following units :-

Marks - 25

## UNIT - I

10 Hrs

**CHEMICAL THERMODYNAMICS**

Spontaneous Processes, 2nd law of thermodynamics Carnot cycle and its efficiency, Clausius inequality, Entropy, Physical concepts of entropy, changes in reversible and Irreversible processes and universe  $\Delta S$  in mixture of gases. The variation of entropy with temp. Nernst heat theorem, 3rd law of the thermodynamics and its applications.

**UNIT - II****CHEMICAL KINETICS**

Order and molecularity of reaction, Kinetics of Zero, 1st and 2nd order reactions. Their half life and Mean life, Methods of determination of order of reactions.

Effect of temp. on rates of reaction, Temp. Coefficient, Arrhenius equation, concept of activated state and energy of activation, P.E. diagram, Catalysis, Characteristics, Classification and theories of Catalysis, Promoters, Inhibitors, Catalytic poison, auto-catalysis, Enzyme catalysis and its kinetics, Michaelis Mentum equation.

**UNIT - III****PHASE EQUILIBRIA**

Two component systems

Solid liquid equilibrium

Simple eutectic system.

Ag-Pb system, Desilverisation of lead.

**Solid Solutions**

Compound formation with congruent melting point (Mg-Zn system) and incongruent melting point ( $\text{FeCl}_3\text{-H}_2\text{O}$  &  $\text{CuSO}_4\text{-H}_2\text{O}$  system).

**UNIT - IV**

4 Hrs

**PHOTO CHEMISTRY**

Interaction of radiation with matter, Thermal and photo chemical processes. Laws of photochemistry

Grothus-Draper Law.

Stark Einstein Law.

Quantum Yield.

**ORGANIC CHEMISTRY**

The syllabus consists of following units :-

**Marks - 50****UNIT - I**

10 Hrs

**STEREO CHEMISTRY**

(a) **Optical Isomerism** :- Molecular chirality, Optical activity, Enantiomerism and diastereomerism involving one and two chiral centres, Meso compounds, Racemic mixture, Racemisation, Resolution of racemic mixture, Threo and erythro diastereomers, Relative and absolute configurations, Sequence rules, D.L. and R.S. systems of nomenclature.

**UNIT - II**

8 Hrs

**REACTIONS OF SYNTHETIC IMPORTANCE**

Definition, Mechanism, Applications and limitations (if any) of following name reactions :-

- Aldol Condensation
- Cannizzaro Reaction
- Claisen Condensation
- Knoevenagel Reaction
- Parkin's Reaction
- Reformatsky Reaction
- Reimer-Tiemann Reaction
- Wolf-Kishner reduction

**UNIT - III**

12 Hrs

**AROMATIC CHEMISTRY**

Aromaticity, Huckel's rule, Aromatic, non-aromatic and anti-aromatic species, resonance, Aromatic electrophilic substitution, Mechanism of nitration, Halogenation, Sulphonation and Friedel-Craft's reaction, Effects of substituents on reactivity and orientation, Synthesis and properties of monofunctional derivatives of benzene eg. amines, Phenols, Sulphonic acid, Aldehyde, Ketone and nitro derivatives, Diazonium salts and its synthetic importance.

## UNIT - IV

8 Hrs

## ACTIVE METHYLENE COMPOUNDS

Systems with acidic-Hydrogens.

Keto-enol tautomerism, Preparation and synthetic applications of ethyl acetoacetate and diethyl malonate.

## UNIT - V

10 Hrs

## CARBOXYLIC ACIDS

Types of hydroxy acids (eg.  $\alpha$ ,  $\beta$ ,  $\gamma$ ), general methods of preparation and properties of hydroxy acids with reference to lactic, Tartaric and citric acids, Structure of citric acid.

Preparation and properties of unsaturated monocarboxylic acids and dicarboxylic acids, Effect of heat and dehydrating agents on dicarboxylic acids.

## UNIT - VI

12 Hrs

## CARBOHYDRATE CHEMISTRY

Classification and nomenclature, Open chain structures of glucose and fructose, Mechanism of osazone formation, Interconversion of glucose and fructose, Chain lengthening and chain shortening of aldoses, Configuration of D-glucose and fructose, Cyclic structure of D-glucose, Mechanism of mutarotation.

## CHEMISTRY (HONOURS)

## PRACTICAL

Time - 6 hours

Full Marks - 50

1. (a) (i) Preparation and standardisation of  $\text{KMnO}_4$  and  $\text{Na}_2\text{S}_2\text{O}_3$ .
- (ii) Estimation of  $\text{Fe}^{+2}$  by  $\text{KMnO}_4$  and  $\text{K}_2\text{Cr}_2\text{O}_7$ .
- (iii) Estimation of  $\text{Cu}^{+2}$  using thiosulphate.

(b) Gravimetric analysis

- (i) Estimation of  $\text{Ba}^{+2}$  as  $\text{BaSO}_4$ .
- (ii) Estimation of  $\text{Ni}^{+2}$  as Nickel dimethyl glyoximate.