B.Sc I yr CHEMISTRY SEMESTER WISE SYLLABUS SEMESTER II Paper II **Chemistry - II**

Unit-I (Inorganic Chemistry)

S2-I-1 p-block Elements -II

Oxides: Types of oxides (a) Normal- acidic, basic amphoteric and neutral (b) Mixed(c) sub oxide d) peroxide e) superoxide. Structure of oxides of C, N, P, S and Cl - reactivity, thermal stability, hydrolysis.

Oxy acids: Structure and acidic nature of oxyacids of B, C, N, P, S and Cl.Redox properties of oxyacids of Nitrogen: HNO₂ (reaction with FeSO₄, KMnO₄, K₂Cr₂O₇), HNO₃ (reaction with H₂S, Cu), HNO₄ (reaction with KBr, Aniline), H₂N₂O₂ (reaction with KMnO₄). Redox properties of oxyacids of Potasium: H₃PO₂ (reaction with HgCl₂), H₃PO₃ (reaction with AgNO₃, CuSO₄). Redox properties of oxyacids of Sulphur: H₂SO₃ (reaction with KMnO₄, K₂Cr₂O₇), H₂SO₄ (reaction with Zn, Fe, Cu), H₂S₂O₃ (reaction with Cu, Au), H₂SO₅ (reaction with KI, FeSO₄), $H_2S_2O_8$ (reaction with FeSO₄, KI)

Interhalogens- classification- general preparation- structures of AB, AB₃, AB₅ and AB₇ type and reactivity. Poly halides- definition and structure of ICl₂, ICl₄ and I₃. Comparison of Pseudohalogens with halogens.

S2-I-2 Chemistry of Zero group elements

General preparation, structure, bonding and reactivity of Xenon compounds - Oxides, Halides and Oxy-halides.Clatherate compounds and Anomalous behavior of He (II)

S2-I-3Chemistry of d-block elements

Characteristics of d-block elements with special reference to electronic configuration variable valence, ability to form complexes, magnetic properties &catalytic properties.Stability of various oxidation states and SRP Comparative treatment of second and third transition series with their 3d analogues.Study of Ti, Cr and Cu traids.Titanium triad - electronic configuration and reactivity of +3 and +4 states - oxides and halides.Chromium triad - reactivity of +3 and +6 states. Copper triad – reactivity of +1, +2 and +3 states.

Unit - II(Organic chemistry)

S2-O-1:Aromatic Hydrocarbons

Concept of aromaticity -definition, Huckel's rule - application to Benzenoids and Non -Benzenoids (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation).

Preapartions: From acetylene, phenols, benzene carboxylic acids and sulphonic acids

mechanism of Reactions General electrophilic substitution. mechanism of nitration, sulphonation, and halogenation, Friedel Craft's alkylation(polyalkylation) and acylation. Orientation of aromatic substitution - Definition of ortho, para, and meta directing groups. Ring activating and deactivating groups with examples. Orientation – (i) activating groups: Amino, methoxy and alkyl groups. (ii) Deactivating groups - carboxy, nitro, nitrile, carbonyl and sulphonic acid& halo groups.

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15 h (1 hr/week)

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15 h (1 hr/week) 7 h

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S2-O-2: Arenes and Polynuclear Aromatic Hydrocarbons

Preparation of alkyl benzenes by Friedel Craft's alkylation, Friedel Craft's acylation followed by reduction, Wurtz-Fittig reaction.Chemical reactivity: Ring substitution reactions, side chain substitution reactions and oxidation.

Polynuclear hydrocarbons – Structure of naphthalene and anthracene (Molecular Orbital diagram and resonance energy) Reactivity towards electrophilic substitution. Nitration and sulphonation as examples.

S2-O-3: Halogen compounds

Nomenclature and classification: alkyl (primary, secondary, tertiary), aryl, aralkyl, allyl, vinyl, benzyl. Chemical reactivity - reduction, formation of RMgX, Nucleophilic substitution reactions – classification into S_N^1 and S_N^2 . Mechanism and energy profile diagrams of S_N^1 and S_N^2 reactions. Stereochemistry of S_N^2 (Walden Inversion) 2-bromobutane, S_N^1 (Racemisation) 1-bromo-1-phenylpropane explanation of both by taking the example of optically active alkyl halide.Structure and reactivity – Ease hydrolysis - comparison of alkyl, vinyl, allyl, aryl, and benzyl halides.

Unit – III (Physical Chemistry)

S2-P-1:Solutions

Liquid - liquid mixtures, ideal liquid mixtures, Raoult's and Henry's laws. Non ideal systems. Azeotropes $HCl-H_2O$ and $C_2H_5OH - H_2O$ systems. Fractional distillation, Partially miscible liquids- Phenol – Water, Trimethyl amine – Water and Nicotine –Water systems. Lower upper consolute temperatures. Effect of impurity on consolute temperature. Immiscible liquids andsteam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law with solvent extraction.

S2-P-2: Dilute Solutions & Colligative Properties

Dilute Solutions, Colligative Properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis - laws of osmotic pressure, its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point.Derivation of relation between molecular weight and elevation in boiling point and depression in freezing point.Experimental methods for determining various colligative properties.Abnormal molar mass, Van'thoff factor, degree of dissociation and assocoation of solutes.

S2-P-3: Solid state Chemistry

Laws of Crystallography – (i) Law of Constancy of interfacial angles (ii) Law of Symmetry, Symmetry elements in crystals (iii) Law of rationality of indices. Definition of space lattice, unit cell.Bravais Lattices and Seven Crystal systems (a brief review).X-ray diffraction by crystals; Derivation of Bragg's equation, Determination of structure of NaCl, KCl&CsCl (Bragg's method and Powder method).

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15 h (1 hr/week)

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S2-G-1: Theory of Quantitative Analysis

Unit – IV (General Chemistry)

Volumetric Analysis: Introduction, standard solutions, indicators, end point, titration curves, Types of titrations: i)neutralization titration- principle, theory of acid base indicators, titration curves and selection of indicators- strong acid - strong base, strong acid -weak base, weak acidstrong base and weak acid -weak base.

Gravimetric analysis- Introduction, nucleation, precipitation, growth of precipitate, filtration and washing, drving and incineration of precipitate, coprecipitation and post precipitation. Determination of Ni²⁺

S3-G-2: Theories of bonding in metals:

Valence bond theory, Explanation of metallic properties and its limitations, Free electron theory, thermal and electrical conductivity of metals, limitations, Band theory, formation of bands, explanation of conductors, semiconductors n-type and p-type, extrinsic & intrinsic semiconductors, and insulators.

S2-G-3: Material Science

Classification of materials- classification as metals, ceramics, organic polymers, composites, biological materials etc. The property of super conductivity of materials.

Super conducting materials- elements, alloys and compounds. Properties of super conductorszero resistivity, Meisener effect and thermal properties. Composites- meaning of composites, advanced composites, classification -particle rein forced fiber reinforced and structural composites general characters of composite materials-Particle- reinforced composites - large particle and dispersion- strengthened composite. Fiber reinforced composites (continuous and discontinuous fiber composites).

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References

Unit I

- 1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications 1996.
- 2. Concise Inorganic Chemistry by J.D. Lee 3rdedn.
- 3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L.Gaus 3rdedn
- 4. Wiley Publishers 2001.Chem
- 5. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press 1989.
- 6. Inorganic Chemistry by Shriver and Atkins 3rdedn Oxford Press 1999.
- 7. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4thedn.
- 8. Textbook of inorganic chemistry by R Gopalan

Unit II

- 1. Text book of organic chemistry by Morrison and Boyd.
- 2. Text book of organic chemistry by Graham Solomons.
- 3. Text book of organic chemistry by BruiceYuranisPowla.
- 4. Text book of organic chemistry by Soni.
- 5. General Organic chemistry by Sachinkumar Ghosh.
- 6. Text book of organic chemistry by C N pillai

Unit III

- 1. .Principles of physical chemistry by Prutton and Marron.
- 2. Text Book of Physical Chemistry by Soni and Dharmahara.
- 3. Text Book of Physical Chemistry by Puri and Sharma
- 4. Text Book of Physical Chemistry by K. L. Kapoor
- 5. Physical Chemistry through problems by S.K. Dogra.
- 6. Elements of Physical Chemistry by Lewis and Glasstone.
- 7. Material science by Kakani&Kakani

Unit IV

- 1. Vogel's Text Book of Quantitative Analysis by G.H.Jeffery, J.Bassett, J.Mendham and R.C. Denney 5thedn Addison Wesley Longman Inc. 1999.
- 2. Quantitative Analysis by Day and Underwood Prentice Hall (India) VI Edn..
- 3. Nano: The Essentials by T. Pradeep, McGraw-Hill Education.
- 4. Chemistry of nanomaterials: Synthesis, Properties and applications by CNR Rao et.al.
- 5. Nanostructured Materials and Nanotechnology, edited by Hari Singh Nalwa, Academic Press
- 6. College Practical chemistry by V K Ahluwalia, SunithaDhingra and Adarsh Gulati

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Laboratory Course

45hrs (3 h / week)

Paper II - Qualitative Analysis - II

I Semi micro analysis of mixtures

Analysis of two anions and two cations in the given mixture.

Anions: $\text{CO}_3^{2^-}$, $\text{SO}_3^{2^-}$, S^{2^-} Cl⁻, Br⁻, l⁻ CH₃COO⁻, NO₃⁻ PO₄³⁻, BO₃³⁻, SO₄²⁻ Cations: Ag⁺, Pb²⁺, Hg⁺, Hg²⁺ Pb²⁺, Bi³⁺, Cd²⁺, Cu²⁺, As^{3+/5+}, Sb^{3+/5+}, Sn^{2+/4+} Al³⁺, Cr³⁺, Fe³⁺ Zn²⁺, Ni²⁺, Co²⁺, Mn²⁺ Ca²⁺, Sr²⁺, Ba²⁺ Mg²⁺, NH₄⁺

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