

## APPENDIX-29(S)

### UNIVERSITY OF MADRAS

#### B.Sc. DEGREE COURSE IN CHEMISTRY

#### REVISED SYLLABUS

[w.e.f.2013-2014 (i.e. candidates admitted to the course from the academic year 2013-14 onwards ) ]

Semester	Subject	Total Hours	Credits
II	Core Paper-II-General Chemistry-II	75	5

#### OBJECTIVES:

- To equip learners with concepts in comparative studies of s and p block elements.
- To facilitate them to understand the aspects in gaseous, liquid and solid states.
- To enable them to understand conformational analysis and addition reaction.

#### Unit-I Chemistry of s- Block Elements [Group IA and IIA]

(10 hrs)

Hydrogen: Hydrides-Classification as ionic, molecular and metallic hydrides; one method of preparation, important properties and uses of  $\text{LiAlH}_4$  and  $\text{CaH}_2$  .

Alkali metals: Comparative study of the elements with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li with Mg. Extraction of Li from its silicate ores. Preparation, properties and uses of  $\text{NaOH}$ ,  $\text{Na}_2\text{CO}_3$ ,  $\text{KBr}$  and  $\text{KClO}_3$ .

Alkaline earth metals: Comparative study of the elements with respect to oxides, hydroxides, sulphates, halides and carbonates. Extraction

and anomalous behavior of Be. Biological importance of Group I and Group II metals.

## **Unit-II Chemistry of p-Block Elements (10 hrs)**

2.1 Boron Family[Group-IIIA]: preparation and structure of diborane, boron nitride and borazine. Chemistry of borax. Extraction of Al and its uses. Alloys of Al.

2.2 Carbon Family (Group-IVA) : comparison of carbon with silicon. Manufacture and uses of CO and CO<sub>2</sub> (includes dry ice).carbides-types, preparation and industrial applications. Silicates-classification and structure, silicones –preparation, properties and uses.

Tin- Allotropic forms of Tin, alloys of tin, tinning, tin plating.

Lead-lead accumulator (discharging and recharging), lead pigments.

## **Unit-III Gaseous State (15 hrs)**

Postulates of kinetic theory of gases, derivation of gas laws from the kinetic gas equation. Kinetic energy and temperature-average translational kinetic energy and its calculation. Maxwell's distribution of molecular velocities(no derivation)-mean, root mean square and most probable velocity. Collision diameter, collision number, collision frequency, mean free path. Transport properties-viscosity, thermal conductivity, diffusion. Principle of equipartition of energy. Real gases-Van der waals equation of state-derivation. Boyle temperature. Significance of critical constants. Law of corresponding states, coefficient of compressibility, coefficient of thermal expansion. Joule Thompson effect.

## **Unit-IV Liquid and Solid States (20 hrs)**

### **4.1 Liquid State (5 hrs)**

Some Properties of Liquids(molecular basis)-Equilibrium vapour pressure of a liquid, boiling point, heat of evaporation, heat of condensation, freezing point. Surface tension-definition, measurement of surface tension, effect of temperature on surface tension, surface tension in every day life. Parachor-definition, calculation and applications .Viscosity or fluidity-definition,

measurement and calculation, factors affecting viscosity, viscosity in every day life.

#### 4.2 Solid State and Liquid Crystals (15 hrs)

Classification of solids, isotropic and anisotropic crystals, representation of planes, Miller indices, space lattice, unit cell, crystal systems, packing of ions in crystals {CCP and HCP}. X-ray diffraction-derivation of Bragg's equation, discussion of structures of NaCl, CsCl and ZnS, determination of Avogadro's number. Liquid crystals-introduction to liquid crystals.

#### Unit- V (20 hrs)

5.1 Chemistry of Alkanes and Cycloalkanes : Petroleum ;sources of alkanes, pyrolysis of alkanes. Conformational analysis of ethane and n-butane. Aromatization of cycloalkanes, Baeyer's strain theory. Conformational analysis of cyclohexane (chair, boat and skew boat forms), methyl cyclohexane and dimethyl cyclohexane (1,2; 1,3 and 1,4) [3D visualization through computers].

5.2 Alkenes, Alkynes and Dienes: Preparation of alkenes (dehydrogenation, dehydrohalogenation and dehydration), preparation of alkynes (dehydrohalogenation, dehalogenation). Addition (with mechanisms) of  $H_2$ , X, HX, HOX, B,  $H_6$  and  $O_3$  to alkenes and alkynes. Additional of HBr (peroxide effect; free radical reaction mechanism) to alkenes and alkynes. *Syn* Dihydroxylation of alkenes with  $OsO_4$ . Allylic substitution of alkenes by NBS. Dienes- types, stability; preparation of- 1,3-butadiene, isoprene, and chloroprene. Reactivity: 1,2- and 1,4- additions to butadiene. Diels-Alder reaction. Introduction to Polymers: Polymerisation- types, natural rubber.

#### Textbooks :

Puri, B.R., L.R. Sharma and M.S. Pathania. Principles of Physical Chemistry, 44<sup>th</sup> ed., New Delhi, Vishal Publishing Co., 2009.

Puri, B.R., L.R. Sharma and K.C. Kalia. Principles of Inorganic Chemistry, 30<sup>th</sup> ed., New Delhi, Milestone Publishers and Distributors, 2009.

Soni, P.L., and H.M. Chawla. Textbook of Organic Chemistry, 29<sup>th</sup> ed., New Delhi, Sultan Chand & Sons, 2007.

### Reference Books

1. Lee, J.D. Concise Inorganic Chemistry, 5<sup>th</sup> ed., Blackwell Science, 2005.
2. Soni, P.L. and Mohan Katyal. Textbook of Inorganic Chemistry, 20<sup>th</sup> ed., Sultan Chand & Sons, 2006.
3. Liptrot, G.F. Modern Inorganic Chemistry, 2<sup>nd</sup> ed., The English Language Book Society and Mills & Boon Ltd., 1972.
4. Glasstone Samuel. Textbook of Physical Chemistry, 2<sup>nd</sup> ed., Macmillan India Ltd., 1990.
5. Soni, P.L., O.P.Dharmarha and U.N.Dash. Textbook of Physical Chemistry, 23<sup>rd</sup> ed., New Delhi, Sultan Chand & Sons, 2011.
6. Negi, A.S. and S.C. Anand. A Textbook of Physical Chemistry, New Delhi, New Age International Pvt. Ltd., 2002.
7. Graham Solomons, T.W. Organic Chemistry, 3<sup>rd</sup> ed., John Wiley & Sons.
8. Morrison, R.T. and R.N. Boyd. Organic Chemistry, 6<sup>th</sup> ed., Pearson Education, Asia, 2002.
9. Carey Francis A. Organic Chemistry, 7<sup>th</sup> ed., New Delhi, Tata MacGraw Hill Education Pvt Ltd., 2009.
10. Mukherji, S.M and S.P. Singh. Reaction Mechanism in Organic Chemistry 3<sup>rd</sup> ed., Macmillan India Ltd., 1994.

Semester	Subject	Total Hours	Credits
III	Core Paper-IV-General Chemistry-III	75	5

## OBJECTIVES:

- To enable learners to understand the chemistry of p-block elements.
- To facilitate them with concepts in colloids.
- To provide them with a better understanding of mechanisms of substitution and elimination reactions.

### Unit-I Chemistry of p- Block Elements [15 hrs]

1.1 Group VA elements : General characteristics of GroupVA elements; chemistry of  $\text{H}_2\text{N-NH}_2$ ,  $\text{NH}_2\text{OH}$ ,  $\text{HN}_3$  and  $\text{HNO}_3$ . Chemistry of  $\text{PH}_3$ ,  $\text{PCl}_3$ ,  $\text{PCl}_5$ ,  $\text{POCl}_3$ ,  $\text{P}_2\text{O}_5$  and oxyacids of phosphorous.

1.2 Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power. Peculiarities of F. Halogen acids, oxides and oxyacids. Inter-halogen compounds, pseudo halogens and basic nature of Iodine.

1.3 Noble gases: Position in the periodic table. Preparation, properties and structure of  $\text{XeF}_2$ ,  $\text{XeF}_4$ ,  $\text{XeF}_6$  and  $\text{XeOF}_4$ ; uses of noble gases.

### Unit-II Colloids and Nanomaterials [20 hrs]

#### 2.1 Colloids [15 hrs]

Definition, types, preparation and purification of colloids, properties-kinetic, optical and electrical stability of colloids, gold number, associated colloids. Emulsions-types, preparation, properties and applications. Gels-types, preparation, properties and applications. Donnan membrane equilibrium. Osmosis, reverse osmosis, dialysis and desalination. Macromolecules- determination of molecular weight by osmotic pressure method and light scattering methods.

#### 2.2 Nanomaterials [5 hrs]

Elementary concepts of nanomaterials: Nanoparticles of Au, Ag and  $\text{TiO}_2$  –preparation, properties and uses.

### **Unit-III Nucleophilic Substitution and Elimination Reactions [10 hrs]**

3.1 Nucleophilic substitution :  $S_N1, S_N2, S_Ni$  reactions-mechanisms, effect of solvent, structure of substrate, nucleophilicity of the reagent [nucleophile] and nature of the leaving group.

3.2 Elimination reactions: E1 and E2 reactions and mechanisms: Hofmann and Saytzeff's rules. Elimination vs Substitution.

### **Unit-IV Benzene and Polynuclear Aromatic Hydrocarbons [15 hrs]**

Aromaticity-Huckels rule with respect to benzene, naphthalene, anthracene and phenanthrene; electrophilic substitution in aromatic compounds-general mechanism; nitration, sulphonation, halogenations, Friedel-Crafts alkylation and acylation. Orientation[directive influence} and reactivity in mono substituted benzenes. Polynuclear hydrocarbons-naphthalene, anthracene, phenanthrene-preparation, properties and uses.

### **Unit-V Stereochemistry of Organic Compounds [15 hrs]**

Stereoisomerism - definition, classification into geometric and optical isomerism.

Optical isomerism — Optical activity, asymmetri centre(chirality), symmetry elements ( $\sigma_n, S_n$  and  $i$ ), meaning of (+) or d and (-) or l and D and L notations, concept of enantiomerism and diastereoisomerism; Racemisation – methods of Racemisation (by substitution and tautomerism), Resolution – methods of resolution (by mechanical, seeding and biochemical), Walden inversion.

Projection formulae- Fischer, flying wedge, Sawhorse and Newmann projections, notation of optical isomerism:- Cahn-Ingold and Prelog rules, R and S notations for one and two chirality (stereogenic) centres, erythro and threo representations.

Geometrical isomerism: cis – trans; syn – anti; E – Z descriptors.

[3 D visualization through computers]

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7. Graham Solomons, T.W. Organic Chemistry, 3<sup>rd</sup> ed., John Wiley & Sons.
8. Morrison, R.T. and R.N. Boyd. Organic Chemistry, 6<sup>th</sup> ed., Pearson Education, Asia, 2002.
9. Eliel, Ernest L. Stereochemistry of Carbon Compounds, New Delhi, Tata McGraw-Hill Publishing Company Ltd., 1989.

10. Agarwal, O.P. Organic Chemistry Reactions and agents, Meerut, Goel Publishing house 2005.
11. Raghavan, V.R. Materials Science and Engineering, prentice Hall (India) Ltd., 2001
12. Nanomaterials – An introduction to synthesis, properties and applications, D. Vollath, Wiley, 2008
13. Nanomaterials : A Sojourn (2006) <http://archive.org/details/ost-engineering-nanomaterials> (free download)

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