

**SEMESTER – I**  
**CC I - GENERAL CHEMISTRY-I**

**Int Mark : 25**  
**Ext Mark: 75**

**Subject Code : UQA**  
**Exam Hours : 3**

**Pre-requisite:**

- 1. Knowledge of introductory organic chemistry*
- 2. Basic idea on chemical bonding, electronegativity and periodic properties*
- 3. Basic knowledge of atomic structure, molecules and valence.*

**Objectives :**

- 1. To understand the basic properties and naming of organic compounds.*
- 2. To learn various methods of preparation and mechanism of reactions of Hydrocarbons.*
- 3. To know the nature of compounds formed by p – block elements.*
- 4. To understand the different kinds of chemical forces and chemical bond in inorganic compounds.*

**UNIT –I**

**(18 Hours)**

**1.1. Nomenclature of organic compounds** – IUPAC naming of simple and substituted aliphatic, aromatic and alicyclic compounds. Priorities of functional group suffixes in poly functional compounds.

**1.2. Alkanes & Cycloalkanes** – Preparation by Wurtz Reaction, Mechanism of free radical substitution in alkanes. Methods of preparing cycloalkanes Bayers strain theory & limitations.

**1.3. Alkenes** – Preparation and Properties of alkenes – electrophilic and free radical addition, addition reactions with hydrogen bromide (peroxide effect), sulphuric acid, water, hydroboration, ozonolysis, hydroxylation with  $\text{KMnO}_4$  – allylic substitution by NBS (with mechanisms of all the above reactions)

**UNIT –II**

**(18 Hrs )**

**2.1. Basic concepts in organic chemistry** – catenation - Hybridization and geometry of molecules – methane, ethane, ethylene and acetylene (sigma and pi bonds, bond lengths, bond angles, bond energy)

**2.2. Electron displacement effects** – Inductive, resonance, hyperconjugation and steric effects.

**2.3. Cleavage of bonds** – homolytic and heterolytic fission of carbon – carbon bonds.

**2.4. Reaction intermediates** – free radicals, carbocations and carbanions, carbenes, nitrenes and arynes – their stability.

**UNIT –III**

**(18 Hrs )**

**3.1 Group IA elements** – General characterization of group IA- Lithium diagonal relationship of Li and Mg. Comparison with other members of the family – justification of its position in the periodic table – Extraction. Preparation, physical & chemical properties of  $\text{NaOH}$ ,  $\text{Na}_2\text{CO}_3$

**3.2 Group IIA elements** – General characterization of group II A- Beryllium – diagonal relationship of Be & Al- diagonal relationship with Al comparison with Mg. Justification of their position of Be and Mg in the periodic table – Beryl extraction and uses of Be. Extraction of Ca – physical & chemical properties –uses –cement manufacture- types- chemistry of setting of cement

## UNIT –IV

(18 Hrs )

**4.1 CHEMICAL BONDING** - Lattice energy and Born – Haber Cycle - Pauling and Mulliken's scales of electronegativity. Polarising power and Polarisability – Partial ionic character from electronegativity – Transition from ionic to covalent character and vice-versa – Fajan's rules – concept of hard and soft acids and bases.

**4.2. VSEPR Theory**:- Shapes of simple inorganic molecules ( $\text{BeCl}_2$ ,  $\text{BF}_3$ ,  $\text{SiCl}_4$ ,  $\text{PCl}_5$ ,  $\text{SF}_6$ ,  $\text{IF}_7$ ,  $\text{H}_2\text{O}$ ,  $\text{NH}_3$ ,  $\text{XeF}_6$ ) containing lone pair and bond pairs of electrons – Lewis structures .

## UNIT –V

(18 Hours )

**5.1. Gaseous state** – Kinetic molecular theory of gases – Kinetic gas equation – Derivation of the gas laws – Kinetic energy and Temperature – Maxwell's distribution of molecular speeds – Types of molecular velocities – Collision diameter – Collision cross section – Collision number – Collision frequency – mean free path.

**5.2** The Gas constant "R" in different units - deviation from ideal behaviors - Van der Waal's equation for real gases - Critical Phenomena – PV isotherms of real gases, critical temperature, continuity of state relation between critical constants and vander Waals constants- Determination of critical volume – the law of corresponding states – reduced equation of state.

## TEXT BOOKS

1. B.S. Bahl and Arun Bahl, "Advanced Organic Chemistry", (12<sup>th</sup> edition) New Delhi, Sultan Chand and Co., (1997)
2. B.R Puri, L.R.Sharma and M.S.Pathania, "Principles of Physical Chemistry",
3. Puri B.R., Sharma L.R., Kalia K.K principles of Inorganic chemistry. 35<sup>th</sup> edition, New edition: Shoban Lal Nagin chand and co. 2013.

## REFERENCES:

1. J.D.Lee, "Concise Inorganic Chemistry", 20<sup>th</sup> revised edition, Sultan Chand and Sons, 2000.
2. R.T Morrison and R.N.Boyd, "Organic Chemistry" (6<sup>th</sup> edition) New York, Allyn & Bacon Ltd., (2006).
3. Gilbert W.Castellan "Physical chemistry" (3<sup>rd</sup> edition), Narosa publishing House, New Delhi (2004)
4. Huheey J. E., Keiter E. A. and Keiter R. L. and Medhi O. K., *Inorganic Chemistry - Principles of Structure and Reactivity*, 4<sup>th</sup> edition, Pearson Education, 2006.

**SEMESTER – I AND II**  
**CC II - VOLUMETRIC ANALYSIS (P)**

**Int Mark : 40**

**Ext Mark: 60**

**Subject Code : UQBY**

**Exam Hours : 3**

**Objectives**

1. To introduce the basic chemistry skills through qualitative analytical experiments
2. To learn the techniques of titrimetric analysis.
3. To know the estimation of several cations and anions.
4. To know the estimation of total hardness of water.

**I Titrimetric Quantitative analysis**

1. Estimation of HCl
2. Estimation of  $\text{Na}_2\text{CO}_3$
3. Estimation of oxalic acid
4. Estimation of Iron (II) Sulphate
5. Estimation of Ca (II)
6. Estimation of  $\text{KMnO}_4$
7. Estimation of Fe (II) solution using internal and external indicators
8. Estimation of Cu (II) sulphate by  $\text{K}_2\text{Cr}_2\text{O}_7$  solution
9. Estimation of Mg (II) by EDTA Solution
10. Estimation of Ca (II) by EDTA Solution
11. Estimation of Chloride (in neutral and acid media)

**II-Applied Experiments**

1. Estimation of Total hardness of water
2. Estimation of Saponification value of an oil

**References:**

1. V.Venkateshwaran,R.Veerawamy, A.R.Kulandai velu Basic Principles of Practical Chemistry 2<sup>nd</sup> edition 1997
2. David T Plummer- An Introduction to practical biochemistry 3<sup>rd</sup> edition, Tata McGraw Hill Publishing company.
3. G.Svehla- Vogel's Quantitative Inorganic Analysis 7<sup>th</sup> edition Pearson education Ltd.
4. J.Mendham, R.C. Denney, J.D. Barnes & M.J.K.Thomas- Vogel's Textbook of quantitative chemical analysis 6<sup>th</sup> edition Pearson education Ltd.

**SEMESTER – II**  
**CC III - GENERAL CHEMISTRY –II**

**Int Mark : 25**  
**Ext Mark: 75**

**Subject Code : UQC**  
**Exam Hours : 3**

**Pre-requisite:**

1. *Knowledge of introductory organic chemistry*
2. *Basic idea on chemical bonding, electronegativity and periodic properties*
3. *Basic knowledge of atomic structure, molecules and valence.*

**Objectives:**

1. *To introduce the basic inorganic chemistry concepts and the properties of the Halogen, Boron and Carbon family compounds.*
2. *To understand the mechanism of Reaction in Hydrocarbons and Dienes.*
3. *To Know about Liquid and Colloid state.*

**UNIT – I**

**(18 Hrs)**

**1.1. Alkyne**-preparation – properties and uses - Acidity of alkynes, formation of acetylides, addition of water with  $\text{HgSO}_4$  catalyst, addition of hydrogen halides and halogens, oxidation, ozonolysis and hydroboration.

**1.2. Dienes** - types of dienes – Stability and chemical reactivity – 1,2 and 1, 4 additions, kinetic and thermodynamic controls of a reaction. Diels-Alder reaction.

**1.3. Alkyl Halides** – Preparation-properties – Vicinal and gem dihalides – Grignard reagent – preparation and synthetic applications.

**UNIT – II**

**(18 Hrs)**

**2.1 HALOGEN FAMILY** - Halogen family – comparative study of halogens and their compounds - Oxides and oxyacids of halogens (structure only) – estimation of available chlorine in bleaching powder.

**2.2 Interhalogen compounds** – preparation, properties and uses.

**2.3 Pseudohalogens** – Preparation, properties and uses of cyanogens and thiocyanogen

**UNIT –III**

**( 18 Hrs )**

**3.1 BORON FAMILY** - Comparative study of boron family elements –Compounds of boron – diborane structure discussion, borax, boron nitride, boron carbide , borazole, boron trioxide, orthoboric acid boron halides and borazine

**3.2 Compounds of Aluminium** – Aluminium Oxide, Aluminium Chloride, Sulphates - Alum.

**3.3 CARBON FAMILY** - Comparative study of carbon family elements and their compounds ( hydrides , halides and oxides ).Chemistry of Cyanogens, Hydrocyanic acid, Cyanic Acid, Thiocyanic acid, Ammonium Thiocyanate and Carbon Disulphide. Properties, Structures & uses of Graphite, Diamond and Fullerenes.

**3.4 Silicon** - Types, Preparation, properties and structure of silicon application. Compounds of Silicon : Silicon dioxide, Silicon carbide Silicon tetra chloride & hydrofluorosilicic acid – Preparation, Properties, Structure and Uses.

**UNIT –IV**

**( 18 Hrs )**

**4.1. Liquid State:** Properties of liquids, Vapour pressure, measurement of vapour pressure, heat of vaporization, Trouton's rule, Surface tension, measurement of surface tension and vapour pressure, variation of surface tension with temperature.

**4.2 Viscosity**- Determination of viscosity, variation of viscosity with temperature and pressure, liquid crystals, definition of liquid crystals, classification, theory of liquid crystals, molecular viscosity.

**4.3 Physical properties and chemical constitution** – additive and constitution property, molar volume and chemical constitution – Kopp's law, the parachor and chemical constitution – Parachor, atomic parachor, structural parachor and application of parachor in deciding structures.

#### UNIT –V

( 18 Hrs )

**5.1. Colloids** – types of colloidal system – true solution – colloidal solution and suspension – property of colloidal system – optical property – Brownian movement, electrical properties – Electrophoresis – Electro Osmosis of colloidal – Gold number – Theories of protection – Stabilities of sols.

**5.2 Gel and Emulsion** – Preparation, Properties and Uses.

**5.3 Macromolecules** - Number average and weight average molecular weight of macromolecules – determination of molecular weight by viscometry and osmometry.

#### TEXT BOOKS

1. B.S. Bahl and Arun Bahl, “ Advanced Organic Chemistry , (12<sup>th</sup> edition) New Delhi, Sultan Chand and Co., (1997)
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2. R.T Morrison and R.N.Boyd , “ Organic Chemistry” (6<sup>th</sup> edition) New york, Allyn & Bacon Ltd., (2006).
3. Gilbert W.Castellan “Physical chemistry” (3<sup>rd</sup> edition),Narosa publishing House, New Delhi (2004)
4. Huheey J. E., Keiter E. A. and Keiter R. L. and Medhi O. K., *Inorganic Chemistry - Principles of Structure and Reactivity*, 4<sup>th</sup> edition, Pearson Education, **2006**.
5. Sharpe A. G., *Inorganic Chemistry*, 3<sup>rd</sup> edition, Pearson, **2010**