# CHE 113(T+P): Inorganic and Organic Chemistry

## Course Outcomes:

After the completion of this course, student will be able to-

CO-1. Gain the fundamental knowledge of theory of atoms, wave functions, quantum mechanics, different hydrocarbons and organic compounds and different types of titrations.

CO-2. Understand the basic concepts of Structure of atom**,** hydrocarbons and principles involved in different titrations.

CO-3. Solve the problems related to atom, quantum numbers, organic reaction, Organic reaction mechanism, organic compounds.

CO -4. Analyse the different topics of structure of atom, organic reaction mechanism.

CO-5. Criticize and evaluate the principles of structure of atom, organic hydrocarbons, organic reaction mechanism.

CO-6. Create, modify and synthesise the facts regarding orbit and orbitals, quantum numbers, different reactions of hydrocarbons.

CO-PSO mapping (connecting COs with PSOs)

| CO | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 | PSO-6 |
|---|---|---|---|---|---|---|
| CO-1 | 3 | 3 | 2 | 3 | 2 | 2 |
| CO-2 | 3 | 3 | 2 | 2 | 2 | 3 |
| CO-3 | 2 | 3 | 3 | 2 | 3 | 2 |
| CO-4 | 3 | 2 | 3 | 3 | 2 | 3 |
| CO-5 | 3 | 2 | 3 | 2 | 2 | 3 |
| CO-6 | 3 | 3 | 3 | 2 | 2 | 3 |

**Credit – (2T+2P), Theory Hours – 30, Practical Hours – 60**

**UNIT – I - Structure of atom** **[25 Marks]**
**[15 Hours]**

Bohr's principle and its limitations, Atomic spectrum of Hydrogen atom, Development leading to Quantum or Wave mechanical model of atom, de Broglie equation, Heisenberg's Uncertainty principle and its significance, Need of Quantum mechanical model of atom, Derivation of Schrodinger wave equation, significance of $\psi$ and $\psi^2$, Quantum mechanical model of atom (Concept of atomic orbital), Difference between orbit and orbital, Quantum numbers and their significance, Radial and angular wave function for hydrogen atom, Radial function plots, Radial probability distribution plots, Shape of s, p and d atomic orbitals, Boundary surface diagram, Relative energies of orbitals, Aufbau principle and its limitations, Pauli Exclusion principle, Hund's rule of maximum multiplicity.

**UNIT – II - Aliphatic Hydrocarbons** **[25 Marks]**
**[15 Hours]**

**Alkane:**

Introduction, IUPAC Nomenclature and Bond line Structure, Methods of Preparation: - Wurtz reaction, Corey–House Synthesis (Gilman reagent), Hydrolysis of R-Mg-X, Decarboxylation of carboxylic acids and Kolbe electrolysis, Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity (with Energy considerations), Nitration of alkane (only reaction).

**Alkene:**

Introduction, IUPAC Nomenclature and Bond line Structure, Methods of Preparation: - Dehydration of alcohols (with mechanism), Regioselectivity in

alcohol dehydration, dehalogenation, dehydrogenation, dehydro halogenation of alkyl halides, The Saytzeff rule, Hofmann elimination (Only introduction, without mechanism), Mechanisms involved in hydrogenation, electrophilic and free radical additions, Markovnikov's rule, peroxide effect, hydroboration-oxidation, and oxymercuration - reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation (i) with cold alkaline $KMnO_4$ (Baeyer's reagent), (ii) Oxidative cleavage with acidified or hot $KMnO_4$ (iii) Ozonolysis ($O_3$), Polymerization of alkenes, substitution at the allylic and vinylic positions of alkenes.

**Alkynes:**

Introduction, IUPAC Nomenclature and Bond line Structure, Methods of Preparation: Dehydrohalogenation, dehalogenation, Acidity of Alkynes (Na, Ag, Cu), Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal ammonia and metal reductions (cis and trans), and polymerization.

## REFERENCE BOOKS


1. 'Introductory Quantum Chemistry' by A. K. Chandra, 4th Ed., 2017, TataMc Graw Hill PublishingCompany Limited, New Delhi.

2. 'Quantum chemistry' by R. K. Prasad, 2nd Ed.,1996, New Age International publishers.

3. 'Basic Inorganic Chemistry' by F. A. Cotton, Geoffrey Wilkinson, CarlosA Murilloand Manfred Bochmann, 6th Ed., Wiley publication.

4. 'Concise Inorganic Chemistry' by J. D. Lee, 5th Ed., 2013, Wiley India.

5. 'Satya Prakash's Modern Inorganic Chemistry' by Dr. R. D. Madan, 1987, S. Chand, New Delhi.

6. ‘Principles of Inorganic Chemistry’ by Puri, Sharma and Kalia, 2018, Vishal Publishing Co., Jallandhar – Delhi.

7. ‘Organic Chemistry’ Morrison, R.T. and Boyd, R.N. 6th Ed. 1992, Prentice Hall International, Inc., London.

8. ‘Text book of Organic Chemistry’ by P. L. Soni and H. Chawla, 26/E, 1995, Sultan Chand & Sons Publication, New Delhi.

9. ‘Text book of Organic Chemistry’ by P. S. Kalsi, 1999, MacMillan of India Pvt. Ltd.

10. ‘Organic Chemistry’ by Bhupinder Mehta, Manju Mehta, 2/E, 2015, Prentice Hall of India Pvt. Ltd, New Delhi.

## CHE 113(P): Chemistry Practical

## Chemistry Lab- I

**Credit – 2, Hours – 60, Marks - 50**

Safety Practices in the chemistry laboratory, identification of different apparatus, knowledge about toxic chemicals and safety precautions in their handling, how to proper uses of different glass wares.

### (I) Titrimetric analysis

(a). Calibration of glassware and use of apparatus to be discussed

1. Calibration of 10 ml pipette

2. Calibration of 25 ml burette

3. Calibration of 100 ml measuring flask

(b). Preparation of solutions of different Normality, Molarity and %V/V, %W/V, %W/W to be discussed

### (II) Acid base titrations

(a). Principle of Acid base titration to be discussed

(b). Preparation of standard solutions of 0.1N Succinic acid, 0.1N Hydrous & Anhydrous Oxalic acid, 0.1N NaOH.

1. Std. Succinic acid (0.1N) → NaOH/ KOH

2. Std. hydrous & anhydrous Oxalic acid (0.1N) → NaOH/ KOH

3. Std. NaOH (using Succinic acid) (0.1N) → HCl

### (III) REDOX TITRATION

(a). Preparation of standard solutions of (0.05N) $KMnO_4$ & (0.01N) $K_2Cr_2O_7$

1. Std. $KMnO_4$ (0.05N) → $FeSO_4 . 7H_2O$ / $FeSO_4(NH_4)_2 SO_4 .6H_2O$

2. Std. $K_2Cr_2O_7$ (0.05N) → $FeSO_4 . 7H_2O$ / $FeSO_4(NH_4)_2 SO_4 . 6H_2O$

**(IV) Complexometry Titration**

a). Preparation of standard solutions of (0.01M) EDTA

1. $Ca^{++}$ / $Mg^{++}$ → Std. EDTA (0.01M)

**(V) Viva-Voce questions**

## REFERENCE BOOKS


1. 'Vogel's Textbook of Quantitative Chemical analysis' Revised by G. H. Jeffery, J. Bassett, J. Mendham & R. C. Denney, ELBS (English Language Book Society) Longman. 5th Ed., New York.

2. 'Analytical Chemistry' by Dhruba Charan Dash, 2011, 2th Ed., PHI Learning Private Ltd, New Delhi.

3. 'Analytical Chemistry' by Gary D. Christian, 1986, 4th Ed., John Wiley & Sons.

4. 'Advanced Practical Inorganic Chemistry' by Gurdeep Raj, 9th Ed., Goel Publishing House, Meerut.

5. 'Advanced University Practical Chemistry' by P. C. Kamboj, VishalPublishing Co., Jallandhar – Delhi.