GUJARAT UNIVERSITY

B. Sc. SEMESTER I

CHEMISTRY

EFFECTIVE FROM – JUNE 2023

ACCORDING TO NEP - 2020

Course Structure with respect to credit, hours and marks

Course Type	Course	Credit	Work Hours/ week	Exam hours	Marks		Total Mark
					Internal	External	
Discipline specific Courses – Core	DSC-C-CHE 111T General Chemistry - I	4	4	2.5	50	50	100
	DSC-C-CHE 112P	4	8	6	50	50	100

*** Practical Exam (3 Hour + 3 Hour = 6 Hour)**

*** DSC-C- CHE 112P = CHEMISTRY PRACTICAL**

N.B.: Each practical batch should have 10 students

No. of students per batch during practical exam = 10

DSC – C – CHE 111T

GENERAL CHEMISTRY - I

Learning Objectives:

- To understand the fundamental concepts of organic chemistry and basic knowledge of hydrocarbons.
- To study the application of hydrocarbons.
- To understand different types of chemical bonds in the molecules.
- To study the formation of ionic bond, covalent bond and co-ordinate bond, Metallic bond in different compounds.
- To know the concepts of hybridization and shape of the molecules.
- To understand the fundamental concepts of stereo chemistry and visualizing the organic molecules in three dimensional space.
- To develop the skill to distinguish the different isomers of organic molecules.
- To study the mechanism of different organic reactions.
- To study organic compound having -OH functional group.
- To understand preparations and properties of alcohol and phenol.

Learning outcomes:

By the end of the course, the students will be able to:

- Learn the preparations of alkanes, alkenes and alkynes and their reactions.
- Draw the IUPAC and Bond line structures of hydrocarbons.
- Solve the problems regarding hybridization and types of bonding.
- Draw the structures, shapes and geometry of the different molecules.
- Understand stereochemistry involved in the different organic molecules.
- Know the difference between configuration and conformation.
- Understand the principles involved in the different organic reactions.

- Distinguish alcoholic - OH and phenolic - OH functional group.

B. Sc. SEMESTER I

DSC – C – CHE 111T

GENERAL CHEMISTRY - I

Unit – I: Aliphatic Hydrocarbons **[25 Marks]**

[15 Hours]

Alkane:

Introduction, IUPAC Nomenclature and Bond line Structure, Methods of Preparation: - Wrutz 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.

Unit – II: Bonding and Structure [25 Marks]

[15 Hours]

Chemical bond, Types of Bond (Ionic, Covalent, Coordinate and Metallic Bond), Ionic Bond, Conditions and factors governing the formation of Ionic Bond, Properties of Ionic Compounds, Covalent Bond, Covalency, Conditions for the formation of Covalent Bond, Properties of Covalent Compounds, Failure of octet rule (Lewis Concept) in Covalent Compounds, Covalent Bond having partial Ionic character, Co-ordinate Bond, Condition for the formation of Co-ordinate Bond, , Properties of Co-ordinate Compounds, Metallic Bond, Conditions for the formation of Metallic Bond, Hydrogen Bond, Properties of Hydrogen Bond, Types of Hydrogen Bond, Sidgwick Powel theory, VSEPR theory and its application for CH_4, NH_3, H_2O, CIF_3, SF_4, SF_6, I_3^-, IF_7, Hybridization of atomic orbitals, Rules for Hybridization, Types of hybridization and shape of molecules with sp, sp^2, sp^3, sp^3d, sp^3d^2 hybridization.

Unit – III: Fundamentals of Stereochemistry: - [25 Marks]

[15 Hours]

Introduction, Stereochemical aspects of organic molecules, Chirality, Optical isomerism, Enantiomers and Diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D- L and R-S system of nomenclature, Geometric isomerism — determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in

oximes and alicyclic compounds, Difference between configuration and conformation, Conformational analysis of Ethane, n-Butane & Cyclohexane, Axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives (only one example), Newman projection and Sawhorse formula, Fischer and flying wedge formula.

Unit – IV: (a) Fundamentals of Organic Reactions [13 Marks]

[8 Hours]

Fission of covalent bond, types of reagents, Substitution Nucleophilic Unimolecular reaction mechanism (SN^1), Substitution Nucleophilic Bimolecular reaction mechanism (SN^2), Electrophilic Aromatic Substitution(ASE) reaction mechanism (Nitration, Sulfonation, Halogenation & Friedel- Crafts Alkylation and Acylation)

(b) Alcohols and Phenols [12 Marks]

[7 Hours]

Alcohols: Nomenclature, methods of preparation, chemical properties (reactions due to fission of C-OH and CO-H bond), identification of primary, secondary and tertiary alcohols, mechanism of dehydration.

Phenols: Nomenclature, methods of preparation, chemical properties, electrophilic substitution reactions (nitration, Reimer Tiemann reaction, Kolbe Synthesis)

REFERENCE BOOKS

1. **'Organic Chemistry'** Morrison, R.T. and Boyd, R.N. 6th Ed. 1992, Prentice Hall International, Inc., London.

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

3. '**Text book of Organic Chemistry**' by P. S. Kalsi, 1999, MacMillan of India Pvt. Ltd.

4. '**Organic Chemistry'** by Bhupinder Mehta, Manju Mehta, 2/E, 2015, Prentice Hall of India Pvt. Ltd, New Delhi.

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

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

7. '**Inorganic Chemistry'** by Shriver & Atkins, 5th Ed., 2013, Oxford University Press.

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

9. **'Principles of Inorganic Chemistry'** by Puri, Sharma and Kalia, 2018, Vishal Publishing Co., Jallandhar – Delhi.

DSC – C – CHE 112P

Learning Objectives:

- Laboratory course of this semester is useful to know how to use different glassware and chemicals in the laboratory.
- To know the importance of calibration of glassware.
- To gain the skill of preparation of different standard solutions.
- To obtain the skill of accuracy in the experiments.
- To know the concepts of organic qualitative analysis.
- To know the function group present in the organic compounds.

Learning outcomes:

By the end of the course, the students will be able to:

- Prepare different types of standard solutions.
- Handle properly chemical and glassware.
- Calibrate the apparatus used in the titrations.
- Understand the theory and applications of titrations.
- Find Normality, Molarity, Gram/liter of the solutions.
- Find the elements present in organic compounds.
- Find melting point and boiling point of the organic compounds.

DSC – C – CHE 112 P

CHEMISTRY LAB – C I LAB

[50 marks]

[60 Hours]

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 Succinic acid, hydrous & anhydrous Oxalic acid, NaOH.

1. Std. Succinic acid → NaOH/ KOH

2. Std. hydrous & anhydrous Oxalic acid → NaOH/ KOH

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

(III) REDOX TITRATION

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

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

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

(IV) Complexometry Titration

a). Preparation of standard solutions of EDTA

1. Ca^{++} / Mg^{++} → Std. EDTA

(V)Viva-Voce questions

CHEMISTRY LAB – C II LAB

[50 marks]

[60 Hours]

ORGANIC QUALITATIVE ANALYSIS

Concept of types of organic compound, lassaigne's elements, Organic functional groups, water soluble/ insoluble compounds, Aromatic character, MP/ BP and their measurement, Chemical properties of different organic compounds.

Organic spotting

Acids:

Solid: Benzoic acid, Salicyllic acid**,** Succinic acid, Oxalic acid

Phenol:

Solid: alpha-naphthol & beta-naphthol

Base:

Solid: P-nitoaniline

Liquid: Aniline

Neutral:

Solid: Urea, Thiourea, Naphthalene

Liquid: Acetone, Ethanol, Ethyl acetate, Benzaldehyde, Nitrobenzene, Chloroform

DEMONSTRATION

Purification of organic compounds

1. Simple distillation

Introduction to distillation, Types of distillation, Principle of simple distillation, purification of organic liquid by distillation.

2. Crystallization

Introduction to crystallization, purification of benzoic acid by crystallization.

3. Sublimation

Introduction to Sublimation, purification of Naphthalene by sublimation.

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, Vishal Publishing Co., Jallandhar – Delhi.