

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 – Minor	DSC-M-CHE 113T Basic Chemistry	2	2	2	25	25	50
	DSC-M-CHE 113P	2	4	3	25	25	50

* DSC-M- CHE 113P = CHEMISTRY PRACTICAL

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

No. of students per batch during practical exam = 10

DSC – M – CHE 113T
BASIC CHEMISTRY

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.

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.
- Understand stereochemistry involved in the different organic molecules.
- Solve the problems regarding hybridization and types of bonding.
- Draw the structures, shapes and geometry of the different molecules.

B. Sc. SEMESTER I
DSC – M – CHE 113T
BASIC CHEMISTRY

Unit – I: 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.

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 CH₄, NH₃, H₂O, ClF₃, SF₄, SF₆, I₃⁻, IF₇, Hybridization of atomic orbitals, Rules for Hybridization, Types of hybridization and shape of molecules with sp, sp², sp³, sp³d, sp³d² hybridization.

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 Murillo and 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., Jalandhar – Delhi.

DSC – M – CHE 113P

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.

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.

DSC – M – CHE 113P
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 & $\text{K}_2\text{Cr}_2\text{O}_7$

1. Std. KMnO_4 \rightarrow $\text{FeSO}_4 \cdot 7\text{H}_2\text{O} / \text{FeSO}_4(\text{NH}_4)_2 \text{SO}_4 \cdot 6\text{H}_2\text{O}$

2. Std. $\text{K}_2\text{Cr}_2\text{O}_7$ \rightarrow $\text{FeSO}_4 \cdot 7\text{H}_2\text{O} / \text{FeSO}_4(\text{NH}_4)_2 \text{SO}_4 \cdot 6\text{H}_2\text{O}$

(IV) Complexometry Titration

a). Preparation of standard solutions of EDTA

1. $\text{Ca}^{++} / \text{Mg}^{++}$ \rightarrow Std. EDTA

(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, Vishal Publishing Co., Jalandhar – Delhi.