

**GUJARAT UNIVERSITY**  
**B.Sc. SEMESTER IV**  
**CHEMISTRY**  
**ACCORDING TO NEP-2020**

**Course Structure with credit, hours and marks**

Course Type	Course	Credit	Work hours/ week	Exam hours	Marks		Total Marks
					Internal	External	
Discipline Specific Courses-Minor	DSC-M-CHE-244T General Chemistry	2	2	1	25	25	50
	DSC-M-CHE-244P Analytical Chemistry Practicals	2	4	3	25	25	50

**\*Practical Exam (3 Hour)**

**\*DSC-M-CHE 243P = MINOR CHEMISTRY PRACTICAL**

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

**No. of students per batch during practical exam = 10**

**DSC – M- CHE 244T**  
**GENERAL CHEMISTRY**

**Learning Objectives:**

- To Learn the effect of hybridization on acidity.
- To Learn the condition of resonance and the drawing of resonating structures.
- To Understand the basic principles of UV spectra and various transitions of UV.
- To Learn calculations of  $\lambda$  max.
- To study the basic principles of quantitative and qualitative analysis.
- To know different types of volumetric analysis.
- To understand the basic principles of different types of volumetric analysis.

**Learning Outcomes:**

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

- Gain detailed knowledge of acidity and basicity of Organic compounds
- Gain knowledge of resonance, and tautomerism.
- Gain knowledge of UV spectroscopy and calculations of  $\lambda$  max. Identify different cations and anions present in the given sample.
- Calculate different types of concentration terms of the solution.

**B.Sc. SEMESTER-IV  
DSC-M-CHE 244T  
GENERAL CHEMISTRY**

**Unit I:**

**[A] Acid- Base Properties Of Organic Compounds** **[13 Marks]**  
**[8 Hours]**

Introduction To Acids And Bases, Scale ( $PK_a$  And  $PK_b$ ) Of Acidity And Basicity, Factors Affecting Strength of Acid And Base: Inductive Effect, Resonance Effect, Steric Effects, Effect Of Hydrogen Bonding, Effect Of Change Of Hybridization, Solvent Effect, Brief Introduction To Tautomerism, Keto – Enol Tautomerism.

**[B] UV Spectroscopy** **[12 Marks]**  
**[7 Hours]**

Principle, Origin Of UV Spectra, Transitions, Relative Position Of  $\lambda_{max}$ , Effect Of Solvents, Steric Effect, Conjugative Effect, Hyperchromic Shift, Hypochromic Shift, Bathochromic Shift, Hypsochromic Shift, Woodward-Fieser Rules, Problems Of Dienes, Enones, Aromatic Ketones, Aldehydes And Esters.

**UNIT II: Basic Concepts Of Qualitative And Quantitative Analysis**

**[25 Marks]**  
**[15 Hours]**

Introduction, Solubility Product Principle, Common Ion Effect, Separation Of Cations Into Groups, Detection And Separation Of Cations Of Each Groups, Separation And Detection Of Anions (Acid Radicals), Basic Principle Of Quantitative Analysis, Introduction of Titration, End Point And Equivalence Point, Indicator, Standard Solution, Primary Standard, Secondary Standard, Volumetric (Titrimetric) Calculations, Calculation Based On Normality And Molarity Of The Solution. Conditions For Volumetric Analysis And Types Of Titrimetric.

## REFERENCE BOOKS

1. **‘Organic Chemistry’** by Robert Thornot Morrison and Robert Neilson, Pearson Publication, Seventh edition, 2010.
2. **‘Organic Chemistry’** by I. L. Finar, Pearson Education Pvt Ltd, New Delhi, Sixth Edition.
3. **‘Organic Chemistry’** by James B Hendrickson, Donald J. Cram and George S. Hammond, Mc-Graw-Hill, Third Edition.
4. **‘Advance Organic Chemistry’** by Arun Bahl, B. S. Bahl, S. Chand and Co. Ltd. New Delhi, Fifth Edition, 2012.
5. **‘Organic Chemistry’** by Bhupinder Mehta, Manju Mehta, Prentice Hall of India Pvt Ltd, New Delhi, 2005.
6. **‘Organic Chemistry’** by G. Marc Loudon, Oxford University Press, Fourth Indian edition 2010.
7. **‘Advanced General Organic Chemistry- A modern Approach’** by S.K. Ghosh, Third Edition, Part I and II, New Central book agency (p) Ltd.-2011
8. **‘Elementary Organic spectroscopy’** by Y.R. Sharma, S chand and Company Ltd.- 2008.
9. **‘Spectrometric Identification of Organic compound’** by Silverstein, John wiley and Sons, 2005.
10. **‘Spectroscopy of Organic Chemistry’** by P.S. Kalsi, New Age International Publishers, Sixth Edition, 2015.
11. **‘The Applications Of Absorption Spectroscopy Of Organic Compounds’** by J.R. Dyer, Prentice-Hall, 1965.
12. **‘Analytical Chemistry’** by Dhruva Charan Dash, PHI Learning Pvt. Ltd., New Delhi, 2011.
13. **‘Quantitative Analysis’** by R. A. Day, A. L. Underwood, , Prentice-Hall of India Pvt. Ltd., New Delhi, Sixth Edition, 2004.
14. **‘Analytical Chemistry’** by Gary D. Christian, John Wiely & Sons, INC, New York, Fifth Edition, 1994.
15. **‘Analytical Chemistry an Introduction’** by Douglas A. Skoog, Donald M. West, F. James Holler, Saunders College Publishing, Harcourt Brace College Publishers, Philadelphia, Sixth Edition, 1994.

**DSC-M-CHE 244P**  
**ANALYTICAL CHEMISTRY PRACTICALS**  
**CHEMISTRY LAB VIII**

**Learning Objectives:**

1. To learn different steps involved in the Quantitative analysis.
2. To learn back titration and it's necessity in analysis.
3. To learn Concept and types of Volumetric and Gravimetric analysis.
4. To learn the Estimation of Amount / functional group in the Organic compound.

**Learning Outcomes:**

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

1. Gain detailed knowledge to maintain accuracy during Gravimetric and Volumetric analysis.
2. Gain knowledge of principles involved in the back titration.
3. Gain knowledge of the mathematical calculations involved in the quantitative analysis.
4. Gain knowledge of the estimation of organic compounds and it's calculations.

## CHEMISTRY LAB.-VIII

**[50 Marks]**  
**[60 Hours]**

### **Analytical Chemistry Practicals.**

#### **Volumetric Analysis:**

- (1) Determine the amount of Nitrite ( $\text{NO}_2^{-1}$ ) in the given solution of  $\text{KNO}_2$  or  $\text{NaNO}_2$  by back titration using  $\text{KMnO}_4$  and  $\text{FeSO}_4(\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$  solution.
- (2) Determine the amount of Nickel ( $\text{Ni}^{+2}$ ) in the given solution of  $\text{NiCl}_2 \cdot 2\text{H}_2\text{O}$  by back titration using EDTA solution.
- (3) Determine the Amount of Ca & Mg by EDTA (Complexometric Titration) in the given solution of  $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$  and  $\text{MgCl}_2 \cdot 2\text{H}_2\text{O}$ .
- (4) Determination of available  $\text{Cl}_2$  in bleaching powder.
- (5) Standardization of HCl with Borax.
- (6) Determine the number of water molecules of crystallisation in sodium carbonate (washing soda) using 0.1 N HCl solution.
- (7) Determine the amount of Acetamide in the given solution.
- (8) Determine the amount of Glucose in the given solution.
- (9) Determine the amount of Aniline or Phenol in the given solution.

#### **Gravimetric Analysis:**

- (1) Determine the amount of iron ( $\text{Fe}^{+2}$ ) as  $\text{Fe}_2\text{O}_3$  gravimetrically in the given solution of  $\text{FeSO}_4(\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$  or  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  and free  $\text{H}_2\text{SO}_4$ .
- (2) Determine the amount of Aluminium ( $\text{Al}^{+3}$ ) as  $\text{Al}_2\text{O}_3$  gravimetrically in the given solution of  $\text{Al}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$  and free  $\text{H}_2\text{SO}_4$ .
- (3) Determine the amount of Barium ( $\text{Ba}^{+2}$ ) as  $\text{BaSO}_4$  gravimetrically in the given solution of  $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$  and free HCl.
- (4) Determine the amount of Nickel ( $\text{Ni}^{+2}$ ) as  $\text{Ni}(\text{DMG})_2$  gravimetrically in the given solution of  $\text{NiCl}_2 \cdot 2\text{H}_2\text{O}$  and free HCl.

#### **Viva-voce questions**

## REFERENCE BOOKS

1. **‘Elementary Practical Organic Chemistry Part-II, Qualitative Organic Analysis’**, by A.I Vogel, CBS Publishers & Distributers, New Delhi, Second Edition, 2004.
2. **‘Elementary Practical Organic Chemistry Part III Quantitative Organic Analysis’, Part III Quantitative Organic Analysis’**, by A.I Vogel, CBS Publishers & Distributers, New Delhi, Second Edition, 2004.
3. **‘Comprehensive Practical Organic Chemistry – Qualitative Analysis’**, by V.K. Ahluwalia, Sunita Dhingra, First India Edition, 2010, University Press (India) Private Limited, Hyderabad,
4. **‘Organic Analytical Chemistry theory and Practice’** by Mohan Jag, Narosa Publication, New Delhi, 2003.
5. **‘Advanced Practical Organic Chemistry’** by J Leonard, B Lygo, G Procter, , Stanley Thornes Publishers Ltd., First Indian Edition, 2004.
6. **‘Analytical Chemistry: Practice’** by John H. Kennedy, Saunders College Publishing, New York, Second Edition, 1990.
7. **‘Quantitative Analysis’** by R.A.Day, A.L.Underwood, Prentice-Hall of India Pvt.Ltd., New Delhi, Sixth Edition, 2004.
8. **‘Analytical Chemistry’** by Gary D. Christian, , John Wiley & Sons, INC, New York, Fifth Edition, 1994.