



HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

Course Name: B. Sc. Chemistry Semester: VI

PROGRAM CODE: SCIUG102

COURSE CODE: SC23MJDSCCHE601

Type of course: Major Discipline Specific course

Name of course: Fundamentals of Chemistry IV (Major1)

Total Marks: 100

Effective from June 2025 Under NEP 2020

Total Credits: 04	Teaching Hours per Week: 04	Theory	External 50 Marks
	Teaching Hours per Semester: 60		Internal 50 Marks

Course Objectives:

1. To understand the core concepts of Valency.
2. To understand physical chemistry concepts of Metal carbonyl compounds.
3. To know about the basic Concepts of Electrophilic and Free radical addition reactions.
4. To study about the Nucleophilic aromatic substitution reactions and applications.

Course Outcome:

1. Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories including those in, inorganic and organic chemistry.
2. Students will appreciate the central role of chemistry in our society and use this as a basis for ethical behavior in issues facing chemists including an understanding of safe handling of chemicals, environmental issues and key issues facing our society in energy, health and medicine.
3. Students will be able to design and carry out scientific experiments as well as accurately record and analyse the results of such experiments.
4. Students will be skilled in problem solving approach, creative thinking and analytical reasoning as applied to scientific problems.
5. To know about the Volumetric titrations and calculations for estimation.

Unit	Topic	Credit	Hours
1	Valency Variation method, Secular Equation, Stability of H_2^+ ion; M.O. approach, Stability of H_2 molecule; V. B. approach, Classical interaction energy Representation of wave function for SP , SP^2 and SP^3 hybrid orbitals, bond angle and bond strength M.O. treatment of O_2 molecules Quantum mechanical representation of Pauli's exclusion principle	1	15
2	Metal Carbonyl Introduction Classification: Mononuclear and Polynuclear Physical and Chemical Properties Metal Carbonyl (M-CO) bonding (On the basis of V.B.T. and	1	15

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	M.O.T.) Use of IR Spectra to determination of structure of metal carbonyl Structure of Metal Carbonyl Ni(CO)_4, Fe(CO)_5, Cr(CO)_6, $\text{Fe}_2(\text{CO})_9$, $\text{Co}_2(\text{CO})_8$, $\text{Mn}_2(\text{CO})_{10}$, $\text{Fe}_3(\text{CO})_{12}$ Calculation of EAN of metal atom in metal carbonyl Metal Nitrosyl complexes: - Bonding in metal nitrosyl Classification of metal Nitrosyl		
3	Electrophilic and Free radical Addition Reactions Addition to carbon carbon double bond Mechanism for addition of halogens Reactivity order of Alkene on electrophilic addition reactions Stereo selective and stereo specific reaction of alkene Markovnikov's rule Addition reaction of H_2O and H_2SO_4 in alkene Rearrangement, Dimerization and Alkylation in electrophilic addition reactions Peroxide effect (Anti markovnikov's rule) Free radical addition, mechanism of peroxide initiated addition of HBr Syn and Anti addition reactions Electrophilic addition to conjugated dienes (1:2 v/s 1:4 addition) Free radical addition to conjugated dienes	1	15
4	Nucleophilic Aromatic Substitution Reaction and its Application Nucleophilic aromatic substitution [Bimolecular displacement (S_N^2) mechanism] Elimination - Addition mechanism via benzyne Stability and properties of benzyne Evidences of Benzyne intermediate	1	15

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Course Name: B. Sc. Chemistry Semester: VI

PROGRAM CODE: SCIUG102
COURSE CODE: SC23MJDSCCHE601A



Type of course: Major Discipline Specific Course

Name of course: Fundamentals of Chemistry V (Major-2)

Total Marks: 100

Effective from June 2025 Under NEP 2020

Total Credits: 04	Teaching Hours per Week: 04	Theory	External 50 Marks
	Teaching Hours per Semester: 60		Internal 50 Marks

Course Objectives:

1. To understand the core concepts of chemical kinetics.
2. To understand physical chemistry concepts of photo chemistry.
3. To know about the chromatography.
4. To study about the infrared spectroscopy.

Course Outcome:

1. Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories including those in, physical and analytical chemistry.
2. Students will appreciate the central role of chemistry in our society and use this as a basis for ethical behavior in issues facing chemists including an understanding of safe handling of chemicals, environmental issues and key issues facing our society in energy, health and medicine.
3. Students will be able to design and carry out scientific experiments as well as accurately record and analyse the results of such experiments.
4. Students will be skilled in problem solving approach, creative thinking and analytical reasoning as applied to scientific problems.
5. To know about the Volumetric titrations and calculations for estimation.

Unit	Topic	Credit	Hours
1	Chemical Kinetics: Effect of temperature on rate of reaction (Arrhenius equation) Concept of Activation energy Theories of reaction rate (1) Collision theory (2) Transition state theory Comparison of collision and transition state theory Theories of Unimolecular reaction Lindemann's theory Trimolecular reaction Trautz's Law Primary salt effect Secondary salt effect Numerical	1	15

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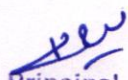
2	Photochemistry Introduction Difference between Thermal and Photochemical reaction The Law of Absorption, Lambert-Beer law Laws of Photochemistry, (1) Grotthuss-Draper law (2) Stark- Einstein law and it's derivation Quantum Efficiency or Quantum Yield Experimental determination of Quantum yield Reason of high and low Quantum yield The Jablonski diagram Types of Photochemical reaction (1) Photosensitized reaction (2) Photochemical equilibrium Qualitative description of fluorescence, phosphorescence and chemiluminescence. Flash Photolysis Numerical	1	15	KPD
3	Chromatography Introduction Classification of chromatographic techniques Column chromatography Paper chromatography Thin layer chromatography Ion exchange chromatography Gas chromatography: Principle, Plate theory and Rate theory (only introduction) Application of chromatographic Techniques	1	15	SPV
4	Infrared spectroscopy Introduction Molecular vibrations (Fundamental vibrations of AX ₂ type molecules) Characteristics of IR spectroscopy Sample techniques , Fingerprint region Effect of IR in geometrical isomerism IR spectra & H-bonding , Factor affecting on >C=O group frequencies Differentiate two compounds by the IR frequencies.	1	15	SUP

Books Suggested:

- Advance Physical Chemistry by Gurdeep Raj.
- Physical Chemistry (Question and Answer) by R. N. Madan, G.D. Tuli, S. Chand.
- Principal of Physical Chemistry by Puri, Sharma, Pathania.
- Chemical Thermodynamics by R.P. Rastogi and R.R. Mishra.
- Physical chemistry by atkins.
- Essentials of Physical Chemistry by B. S. Bahal, ArunBahal, G.D.Tuli,
- Physical Chemistry by P.W. Atkins, 5thedn, Oxford 1994 7th edn-2002.



8. Physical Chemistry by R.A. Alber and R.J. Silby, John Wiley 1995.
9. Physical Chemistry by G.H. Barrow, 5thedn, Mac Graw Hill, 1988, 6th edn, 1996.
10. Physical Chemistry by W.J. Moore, 4thedn, Orient Longmans 1969


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Practical - Major - Bsc - 6



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Course Name: B. Sc. Chemistry Semester: VI

PROGRAM CODE: SCIUG102

COURSE CODE: SC23PMJDSCCHE601B

Type of course: Practical Major Discipline Specific Course

Name of course: Practical's for Fundamentals of Chemistry III(Major-3)

Total Marks: 100

Effective from June 2025 Under NEP 2020

Group-A

Total Credits: 02	Teaching Hours per Week: 04	Practical's	External 25 Marks
	Teaching Hours per Semester: 60		
	Minimum No. of. Practical to be Performed: 12 (Twelve)		Internal 25 Marks

Group-B

Total Credits: 02	Teaching Hours per Week: 04	Practical's	External 25 Marks
	Teaching Hours per Semester: 60		
	Minimum No. Of. Practical to be Performed: 12 (Twelve)		Internal 25 Marks

Type	Topic
1	In Organic Qualitative Practical (Any 08 Mixtures)
2	Organic Practical (Any 04 Estimation & Any 04 Preparation)
3	Physical Practical (Any 08)

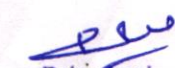
Group	Practicals	Practicals	Marks
A	Inorganic Qualitative Practical (08)	Organic-04(Preparation)	25
B	Physical-08	Organic-04 (Estimation)	25

Course Objectives:

1. To prepare and estimated the organic components.
2. Preparation of solutions and their standardization.

Course Outcome:

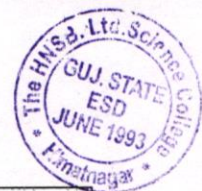
1. Students will gain a comprehensive knowledge and skills in standardization and preparation of solutions for carrying out reactions.


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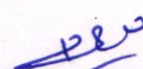
Sr. No	Topic	Credit	Hours
Group-A	(i) Inorganic Qualitative analysis of Inorganic mixture having 6 radicals (Minimum 08Mixture) Negative radical: Cl, Br, I, CO_3^{2-} , NO_2^- , NO_3^- , PO_4^{3-} , SO_4^{2-} , CrO_4^{2-} , BO_3^{3-} Positive Radical: Fe, Al, Cr, Zn, Co, Ni, Ca, Ba, Sr, Mg, NH_4 , Na, K	1	30
	(i) Organic -5 (Preparations) (Minimum 04) (1) Preparation of Schiff base (Benzylideneaniline from Aniline & Benzaldehyde) (Arthur I Vogel) (2) Preparation of Methyl Orange from Sulphanilic Acid (3) Preparation of Chalcone (4) Preparation of Coumarin (5) Preparation of Eosin From Fluoresin (6) Preparation of Anthraquinone from Anthracene	1	30
Group-B	(i) Organic Chemistry practical (Minimum 04) (A) Estimation of functional groups: (Any Four) (1) Estimation of Acetone (2) To Determine the equivalent weight of an acid by Ag-salt method. (3) Estimation of Benzyl Penicillin. (4) Estimation of Amino acid (Glycine) (5) Estimation of Phenol	1	30
	(ii) Physical (Minimum 08) [A] [Instruments): (Minimum 05) (1) To Determine the Normality and Amount of each Base in given mixture of XN ($\text{NaOH} + \text{NH}_4\text{OH}$) by pH metric Titration using 0.1 N HCl. (2) To Determine the normality and amount of KI in given solution of XN KI by Potentiometric titration using 0.1 N KMnO_4 . (3) To Determine the formal Redox potential of $\text{Fe}^{+2}/\text{Fe}^{+3}$ system by Potentiometric titration. (4) To Determine the Normality and Amount of each Base in given mixture of XN ($\text{NaOH} + \text{NH}_4\text{OH}$) by Conductometric Titration using 0.1 N HCl. (5) Determine the concentration of Cu^{+2} ions and Co^{+2} ions in a given mixture of ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O} + \text{CoCl}_2 \cdot 6\text{H}_2\text{O}$).	1	30

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	(6) To Determine the amount of Nitrite in the given unknown Solution by Colorimetric method. [B] Kinetics, Adsorption & Partition Coefficient (7) To Study the Influence of Ionic Strength on Rate of Reaction between $K_2S_2O_8$ and KI. (8) To Study the reaction between $KBrO_3$ and KI at two different Temperature and Calculate the Temperature Coefficient and Energy of Activation. (9) To Study the Distribution of Benzoic Acid between Benzene and Water at Room Temperature and Prove the Dimerization of Benzoic acid in Benzene.		
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Note :- Certified Journal must be compulsory


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