SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

B.Sc. (Chemistry) Sem. VII

Course Type	Course Code	Course Title	Teaching-Learning Scheme L-P-T	Total Notional Hours	Course credits
Major Course	US07HMACHE01	Topics in Organic Chemistry- I	4-0-0	120	04

- **Course Learning Outcomes (CLOs)**

On completion of this course, students will be able to:

CLO1: Evaluate and design reaction mechanisms for elimination, addition, and substitution reactions using experimental evidence, mechanistic tools, and scientific reasoning.

CLO2: Illustrate fundamental concepts of organic chemistry from an Indian Knowledge Systems perspective and interpret elimination, addition and aromatic substitution reactions, including their mechanisms, orientation, and reactivity patterns, using suitable chemical representations and reasoning skills.

CLO3: Justify principles of reactive intermediates and named rearrangement reactions to predict reaction pathways, mechanisms, and products in diverse chemical contexts.

CLO4: Demonstrate a comprehensive understanding of stereochemistry, including chirality, stereoisomerism, and projection systems, and interpret molecular structures using established nomenclature and symmetry principles.

CLO5: Evaluate stereochemical and mechanistic aspects of organic reactions, including stereoselectivity, stereospecificity, topicity, and prostereoisomerism, to draw logical and evidence-based conclusions.

Unit	Course Content	Learning Pedagogies	CLO(s)
I	**Aromatic substitution reactions (Electrophilic and Nucleophilic):** Mono-substituted benzenes - Reactivity and Orientations, Orientation in Benzene Rings with more than One Substituent, ipso substitution, Orientation in Other Ring Systems, Primary Kinetic Isotope Effect and Mechanisms of Friedel-Crafts reactions, Nitration, Sulphonation, Halogenation, Diazocoupling and Formylation. Benzyne Mechanisms for Aromatic Nucleophilic Substitution Reactions. Addition – Elimination mechanism.	Interactive Lectures, Problem-Based Learning, ICT-Enabled Learning, Micro-Projects	CLO1, CLO2
II	**Reactive Intermediates in Molecular Rearrangements:** 2.1 Molecular Rearrangement involving Non-Classical Carbocation: Neighbouring group participation by π(pi) and σ(sigma) bonds. 2.2 Molecular Rearrangement involving Carbocation: Wagner-Meerwein, Demjanov Rearrangement. 2.3 Molecular Rearrangement involving Carbanion: Baker Venkataraman, Favorskii, Benzil-Benzilic Acid, Stevens, and Sommelet-Hauser Rearrangement.	Interactive Lectures, Tutorial, Industrial Visit, Experiential Learning	CLO3

	2.4 Molecular Rearrangement involving Free Radical: Barton and Fries Rearrangement 2.5 Molecular Rearrangement involving Nitrene: Schmidt, Lossen Rearrangement 2.6 Molecular Rearrangement involving Carbene: Riemer-Tiemann and Wolf Rearrangement		
III	**Elimination and Addition Reactions:** 3.1 Elimination Reactions: Mechanisms and Orientation, E1, E1cb, E2, Ei spectrum, Effects of changes in substrate, Base, leaving group, and medium on reactivity, Hoffman and Saytzef eliminations, Bredt's rule, Pyrolytic eliminations- Cope and Chugaev eliminations. 3.2 Addition reactions: Mechanisms, Orientation and Reactivity, Markonikoff and anti-Markonikoff additions, Reactions including Hydro-Halo, Hydro-Hydroxy, Hydro-Alkoxy, Dihydro, Dihydroxy, Woodward-Prevost hydroxylation.	Interactive Lectures, Collaborative Learning, Experiential Learning	CLO2
IV	**Stereochemistry:** Concept of Chirality, Chirality and symmetry, Sawhorse, Newman and Fischer Projections, Interconversion of projection formula, Elements of chirality including chiral centre, Chiral axis, Chiral plane and Helicity, Geometrical isomerism, CIP Nomenclature, Molecules with more than one chiral centre, Total number of stereoisomer in such molecules, Enantiomeric and diastereomeric relationship, Chirogenicity and Stereogenecity, Pseudochirality, Topicity and Prostereoisomerism, Determination of Topic relationship between homomorphic ligands in intact molecules, Concept of stereoselective and stereospecific reactions, Optical purity with examples.	Interactive Lectures, Problem-Based Learning	CLO4 CLO5

- **Weightage of Learning Efforts for Assessment**

Unit	**Aligned CLOs**	**Total Learning Hours**	**Approximate weightage (Marks) to Learning levels (BT)**			**Total Marks**
			Remember (R)	**Understanding (U)**	**Analyse& above (A)**	
I	CLO1, CLO2	32	1	1	11	13
II	CLO3	32	1	1	11	13
III	CLO2	28	0	1	11	12
IV	CLO4, CLO5	28	0	1	11	12
		120	02	04	44	50

- **Assessment Methodologies/Tools**

(A) Internal Assessment

(a) Formative assessment (30 Marks)

- Quiz
- Assignment, Self-learning, and Term work
- Seminar/Presentation
- Regularity

(b) Summative Assessment (20 Marks)

- Mid Term Examination: 20 Marks

(B) External Assessment

- Term End Examination: 50 Marks

- **Assessment and Evaluation**

Sr. No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	Seminars, Assignments, Quizzes, Class Regularity,	50
2	End-Semester Examination	Written Exam/Practical Exam Project Evaluation, (Report, Presentation, Viva)	50

- **CLOs – PLOs Matrix**

CLO	PLO									
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	3	3	1	1	1	1	3	1	1
CLO2	3	2	3	3	1	1	2	3	1	1
CLO3	3	2	3	1	-	1	-	3	1	1
CLO4	3	-	3	1	-	1	-	2	1	1
CLO5	3	1	3	1	-	1	-	3	1	1

Values to the CLO-PLO matrix are assigned **by judging the importance of the particular CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

- **Suggested Learning Materials Books:**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Organic Reactions, Stereochemistry and Mechanism	P. S. Kalsi	3rd Revised Ed., 2017	New Age International
2	Principles of Organic Synthesis	R. O. C. Norman & J. M. Coxon	3rd Ed., 1993	Nelson Thornes / ELBS
3	A Guidebook to Mechanism in Organic Chemistry	Peter Sykes	6th Ed., 1999	Pearson / Orient Longman
4	Modern Methods of Organic Synthesis	W. Carruthers & Iain Coldham	4th Ed., 2004	Cambridge University Press
5	Organic Reaction Mechanisms	V. K. Ahluwalia & R. K. Parashar	4th Ed., 2010	Narosa Publishing House
6	Organic Chemistry	Jonathan Clayden, Nick Greeves & Stuart Warren	2nd Ed., 2012	Oxford University Press
7	March's Advanced Organic Chemistry	Jerry March (rev. by M. B. Smith)	6th Ed., 2007	Wiley

- **Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	MIT OpenCourseWare – Organic Chemistry (Lecture notes, assignments, and exams covering stereochemistry and reaction mechanisms)	https://ocw.mit.edu/courses/5-13-organic-chemistry-ii-fall-2003/
2	LibreTexts – Open-access Organic Chemistry textbook (Chirality, stereochemistry, elimination, addition, aromatic substitution)	https://chem.libretexts.org/Bookshelves/Organic_Chemistry
3	Master Organic Chemistry – Reaction mechanism guide (Detailed explanation of E1, E2, addition, and aromatic substitution reactions)	https://www.masterorganicchemistry.com/reaction-guide/

Course Type	Course Code	Course Title	Teaching-Learning Scheme L-P-T	Total Notional Hours	Course credits
Major Course	US07HMACHE02	Topics in Physical Chemistry-I	4-0-0	120	04

- **Course Learning Outcomes (CLOs)**

On completion of this course, students will be able to:

CLO1: Analyze and evaluate thermodynamic principles, Gibbs free energy, entropy, chemical potential, and chemical kinetics principles, including rate laws and factors influencing reaction rates.

CLO2: Relate chemical kinetics to industrial processes and environmental systems reactions.

CLO3: Analyze kinetic data using graphs e.g., concentration vs time.

CLO4: Solve problems using integrated rate laws for different reaction orders.

CLO5: Demonstrate and apply electrochemistry of solutions and electrified interfaces; analyze interface structures and evaluate electrochemical kinetics.

CLO6: Illustrate and apply surface chemistry concepts, including micellar systems, surfactant behavior, and surface phenomena; analyze their thermodynamics and interactions.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	Chemical Thermodynamics: Thermodynamic Potentials: Concepts of laws of Thermodynamics: Energy, Entropy, Free energies. Applications of Thermodynamics: Free energy, chemical potential. Partial molar properties: partial molar free energy, partial molar volume, and partial molar heat content, and their significance. Determinations of these quantities. Non-ideal systems: Excess functions for non-ideal solutions, Activity, activity coefficient, Debye-Huckel theory for activity coefficient of electrolytic solutions; determination of activity and activity coefficients; ionic strength.	Classroom Lecture (CL), ICT-Enabled Learning (ICT), Problem-Based Learning (PBL), Seminar (S)	CLO1 CLO2
II	Chemical Kinetics: Fundamentals of Chemical Kinetics, Arrhenius equation, concept of activation energy, reaction mechanisms and examples; unimolecular reactions, bi-molecular reactions, trimolecular reactions. Kinetics of Complex reactions: - Opposing reactions, Consecutive reactions, Parallel reactions, Reactions in flow systems, Chain reactions, Ionic reactions and salt effect, enzyme-catalyzed reactions, kinetics of fast reactions, Kinetically and thermodynamically controlled products.	Classroom Lecture, ICT-Enabled Learning, Problem-Based Learning, Seminar	CLO3 CLO4

III	Electrochemistry: Electrochemistry of solutions, Debye-Hückel Onsager treatment and its extension, ion solvent interactions, Thermodynamics of electrified interface equation, Derivation of electro-capillary, Lippmann equations (surface excess), Structure of electrified interfaces, Perrin, Guoy-Chapman and Stern models, Over potentials, exchange current density, derivation of Butler-Volmer equation, Tafel plot.	Classroom Lecture, ICT-Enabled Learning, Problem-Based Learning, Seminar	CLO5
IV	Surface Chemistry: Sorption, Adsorption Of Gases, Influence Of Temperature And Pressure, Nature Of Adsorbent And Adsorbed Gas, Unimolecular Layers, Langmuir Adsorption Isotherm, Types Of Adsorption, Vander Waals Adsorption, Chemisorption, Adsorption at Surfaces Of Solutions, Adsorption by Solids From Solutions.	Classroom Lecture, ICT-Enabled Learning, Problem-Based Learning, Seminar	CLO6

- **Weightage of Learning Efforts for External Assessment**

Unit	**Aligned COs**	**Total Learning Hours**	**Approximate weightage (Marks) to Learning levels (BT)**			**Total Marks**
			Remember (R)	**Understanding (U)**	**Application /Analyze & above (A)**	
I	CLO1	30	3	7	4	14
II	CLO2, CLO3, CLO4	32	3	3	4	10
III	CLO5	28	2	7	3	12
IV	CLO6	30	2	8	4	14
		120	**10**	**25**	**15**	**50**

- **Assessment Methodologies/Tools**

(A) Internal Assessment

(a) Formative assessment (30 Marks)

(a) Quiz
(b) Assignment, Self-learning, and Term work
(c) Seminar/Presentation
(d) Regularity

(b) Summative Assessment (20 Marks)

- Mid Term Examination: 20 Marks

(B) External Assessment

- Term End Examination: Marks 50

- **Assessment and Evaluation**

Sr. No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	Seminars, Assignments, Quizzes, Class Regularity, written Internal Exam	50
2	End-Semester Examination	Written Exam/Practical Exam Project Evaluation (Report, Presentation, Viva)	50

(A) CLOs – PLOs Matrix

CLO	PLO									
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	2	3	2	1	1	1	1	2	2
CLO2	3	3	2	1	2	1	2	2	1	1
CLO3	3	3	2	1	1	1	1	1	2	1
CLO4	2	2	3	1	1	3	3	2	1	2
CLO5	3	2	3	2	1	1	1	1	3	3
CLO6	2	3	2	2	1	2	2	3	1	2

Values to the **CLO-PLO** matrix are assigned **by judging the importance of the particular CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

- **Suggested Learning Materials Books:**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Physical Chemistry	P. Atkins and J. de Paula, Atkins	8th edition, 2006.	Oxford University Press,
2	Physical Chemistry	I. N. Levine	5th edition, 2002	Tata McGraw-Hill, New Delhi
3	Physical Chemistry - a molecular approach	D. A. McQuarrie and J.D. Simon	1998	Viva Books Pvt. Ltd.
4.	An Introduction to Chemical Thermodynamics	R. P. Rastogi and P. R. Misra	1995	Vikas Publishing House Pvt.Ltd.

5.	Thermodynamics	P. C. Rakshit	1983	The New Book Stall, Calcutta
6.	Thermodynamics for Chemists	S. Glasstone	2006 (Digital)	East-West Edition, Third Edition
7.	Chemical Kinetics	K. J. Laidler	1987	McGraw-Hill Publisher
8.	Modern Electrochemistry, Vol. I and Vol. II	J. O. M. Bockris and A. K. N. Reddy	1998	Plenum press
9.	Surfactants and Interfacial Phenomena	Milton J. Rosen	2004	Wiley Interscience, Third Edition
10.	Colloid and Interface Science	Pallab Ghosh	2009	PHI Learning Private Limited

*** The latest edition of the textbooks should be used**

- **Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	**Video lectures.**	**www.swayam.gov.in,**
2	**Specially prepared reading material that can be downloaded/printed.**	**www.epgp.inflibnet.ac.in,**
3	**Self-assessment tests through tests and quizzes.**	**www.ndl.iitkgp.ac.in,**
4	**An online discussion forum for clearing doubts**	**www.nptel.ac.in**

Course Type	Course Code	Course Title	Teaching-Learning Scheme L-P-T	Total Notional Hours	Course credits
Major Course	US07HMACHE03	Organic and Physical Practical	0-8-0	**120**	04

- **Course Learning Outcomes (CLOs)**

On completion of this course, students will be able to:

CLO1: Perform **purification of solids** via crystallization and validate compound purity through the precise determination of **melting points, boiling points, and mixed melting points**

CLO2: Apply **gravimetric and volumetric techniques** to determine the composition of synthesized salts and the concentration of organic functional groups (Hydroxyl, Phenol, Aniline) with high analytical precision.

CLO3: Design and perform varied titrations to estimate binary mixtures, such as Acid + Amide or Acid + Ester, utilizing differences in hydrolysis rates and acidity constants.

CLO4: Critically evaluate the thermodynamic stability of systems by determining **Critical Solution Temperature (CST)** and **Heat of Solution**, using these parameters to predict the behavior of complex mixtures under varying industrial or environmental conditions.

CLO5: Evaluate dissociation constants of dibasic acids and hydrolysis constants of aniline hydrochloride using distribution methods, and interpret the results.

CLO6: Correlate their laboratory findings with contemporary chemical literature, comparing their experimental results against published models and peer-reviewed data

CLO4: Communicate their experimental findings say complex chemical phenomena and synthetic pathways into high-quality technical reports or manuscripts, with the clarity and depth

Subject		Learning Pedagogies*	CLO(s)
Organic	Estimations: 1. Hydroxyl Group Estimation 2. Unsaturation Estimation 3. Phenol/ Aniline Estimation 4. Ascorbic Acid (Vitamin-C) Estimation 5. Acid + Amide / Acid + Ester Estimation	Experiential Learning, Seminar, Mini Research Tasks, Industrial Visit, Problem-Based Learning, Research-Oriented Learning	CLO1 CLO2 CLO3 CLO6 CLO7
Physical	1. To determine the dissociation constants (k1 and k2) of a dibasic acid pH metrically. 2. To find out the (a) cell constant of a given conductivity cell, (b) to determine the critical micelle concentration (CMC) of an ionic surfactant. 3. To determine the solubility and solubility product of silver chloride by the potentiometry technique. 4. To verify the law of additive absorbance for a mixture of colored substances in solution using potassium permanganate and potassium dichromate solutions.	Experiential Learning, Reflective Practices (Learning Journals, Reflective Notes)	CLO4 CLO5 CLO6 CLO7

	5.To determine the heat of solution of the given acid by solubility method 6. Determination of hydrolysis constant of aniline hydrochloride by distribution method 7. Determination of the critical solution temperature (CST) of the phenol/water system and to study the effect of additive on CST 8. To determine the surface tension of methyl acetate, ethyl acetate, hexane and chloroform and hence calculate the atomic parachors of C, H,Cl etc		

- **Weightage of Learning Efforts for External Assessment**

Subjects	Aligned COs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyze& above (A)	
Organic	CLO1 CLO2 CLO3 CLO6 CLO7	60	**10**	**10**	**30**	**50**
Physical	CLO4 CLO5 CLO6 CLO7	60				
		120	**10**	**10**	**30**	**50**

- **Assessment Methodologies/Tools**

(A) Internal Assessment

(a) Formative assessment (30 Marks)

(a) Quiz
(b) Assignment, Self-learning, and Term work
(c) Seminar/Presentation
(d) Regularity

(b) Summative Assessment (20 Marks)

- Mid Term Examination: 20 Marks

(B) External Assessment

- Term End Examination: 50 Marks

- **Assessment and Evaluation**

Sr. No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	Journal/record book, oral quiz, Periodic tests, Laboratory Regularity	50
2	End-Semester Examination	Practical Exam/ Project Evaluation (Report, Presentation, Viva)	50

- **CLOs – PLOs Matrix**

CLO	PLO									
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**
CLO1	1	3	2	1	1	1	2	2	1	1
CLO2	3	3	3	1	2	1	2	2	2	2
CLO3	3	3	2	2	1	2	1	3	2	1
CLO4	3	2	2	1	1	2	2	2	2	3
CLO5	3	2	2	1	1	1	2	2	1	1
CLO6	2	3	2	2	1	3	1	3	3	2
CLO7	1	2	2	3	1	2	2	1	2	2

Values to the **CLO-PLO** matrix are assigned **by judging the importance of the particular CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

- **Suggested Learning Materials Books:**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Elementary Practical Organic Chemistry	A. I. Vogel	Part-1 to 3	CBS publication
2	Advanced Physical Chemistry Experiments	Gurtu and Gurtu	7th Edition	Pragati Prakashan, Meerut
3	Advanced Physico-Chemical Experiments	J. Rose	1964	Sir Isaac Pitman & Sons Ltd., London
4	Experimental Physical Chemistry	V. D. Athawale and Parul Mathur	1st Edition	New Age International Publishers, New Delhi
5	Vogel's Textbook of Macro and Semimicro Qualitative Inorganic Analysis	A. I. Vogel Revised by G. Svehla	5th Edition, 1979	Longman Group Ltd. London

- **Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	IGNOU eGyanKosh – Qualitative Inorganic Analysis	http://egyankosh.ac.in//handle/123456789/79535
2	IGNOU Block Resources (Cation & Anion Detection Modules)	https://egyankosh.ac.in/handle/123456789/24825?utm_source

Course Type	Course Code	Course Title	Teaching-Learning Scheme L-P-T	Total Notional Hours	Course credits
Minor Course	US07HMICHE01	Topics in Polymer Science	2-0-0	60	02

- **Course Learning Outcomes (CLOs)**

On completion of this course, students will be able to:

CLO1: Explain fundamental concepts of polymer science and structure–property relationships
CLO2: Apply molecular weight concepts and relevant working equations for polymer characterization
CLO3: Analyze mechanisms and factors affecting different types of polymerization
CLO4: Evaluate polymer solubility behavior and the role of additives in modifying properties
CLO5: Design suitable polymer processing and compounding strategies for specific industrial Applications

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	**Fundamentals of Polymer Science: Molecular Weight and Polymerization** Oligomer, Monomer, Polymer, Polymerization and Functionality, Repeating Unit, Degree of Polymerization, Bonding in Polymers, Classification of Polymers, Glass Transition Temperature (Tg), Structure–property relationships, Molecular Weight Concepts, Molar Mass and Molecular Weight Distribution, Calculation of Molecular Weights, Methods of molecular weight determination: End group analysis, osmometry, viscosity method, light scattering and Gel Permeation Chromatography (GPC), Free Radical Polymerization, Factors affecting polymerization: Temperature, initiator concentration, monomer concentration, pressure and Concept of equilibrium, Ionic Polymerization, Cationic and anionic mechanisms and Living polymers, Coordination Polymerization (Ziegler–Natta catalysis (basic concept), Copolymerization, Step-growth polymerization.	Classroom Lecture**,** Problem-Based Learning, Case-Based Learning, Research-Oriented Learning (Literature Review, Tool Construction, Data Analysis Exercises), ICT-Enabled Learning (LMS-based Tasks, Digital Resources, Virtual Labs/Webinars)	**CLO 1-CLO5**
II	**Polymer Solubility, Additives, Processing, and Compounding** Polymer solubility and solutions: Introduction, General rules for polymer solubility, Thermodynamic basis of Polymer Solubility, Prediction of Solubility, Examples based on the calculation of the solubility parameter for solvent & polymer. Additives for Polymers title for this course: Polymer Solubility, Solutions, and Polymer	Classroom Lecture, Problem-Based Learning, Case-Based Learning, Collaborative Learning, Self-Directed	**CLO1-5**

	Additives and their applications, Introduction to polymer processing, Classification of polymer processing.	Learning (Guided Readings, Concept Exploration Tasks), ICT-Enabled Learning (LMS-based Tasks, Digital Resources, Virtual Labs/Webinars)	

- **Assessment Methodologies/Tools**

(A) Internal Assessment

(a) Formative assessment (15 Marks)

- Quiz
- Assignment, Self-learning, and Term work
- Seminar/Presentation
- Regularity

(b) Summative Assessment (10 Marks)

- Mid Term Examination: 10 Marks

(B) External Assessment

- Term End Examination: Marks:25 Marks

- **Weightage of Learning Efforts for External Assessment**

Unit	Aligned Cos	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application /Analyze& above (A)	
I	**CLO1 CLO2 CLO3 CLO4 CLO5**	30	**2**	**3**	**7**	12
II	**CLO1 CLO2 CLO3 CLO4 CLO5**	30	**2**	**4**	**7**	13
		60	**4**	**7**	**14**	**25**

- **Assessment and Evaluation**

Sr.No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	Seminars, Assignments, Quizzes, Class Regularity,	50
2	End-Semester Examination	Written Exam/Practical Exam Project Evaluation (Report, Presentation, Viva)	50

- **CLOs – PLOs Matrix**

CLO	PLO/PSO									
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	3	2	2	2	2	2	2	2	2
CLO2	3	2	3	2	2	2	2	2	3	2
CLO3	2	3	2	2	3	2	2	2	3	3
CLO4	3	2	3	2	3	2	3	2	3	2
CLO5	3	3	3	3	3	2	3	2	2	3

Values to the **CLO-PLO** matrix are assigned **by judging the importance of the particular CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

- **Suggested Learning Materials Books:**

Sr.No.	Title	Author(s)	Edition/Year	Publisher
1	Principles of Polymerization	George Odian	4th Ed., 2004	Wiley
2	Polymer Science and Technology	Joel R. Fried	3rd Ed., 2014	Pearson
3	Polymer Processing: Principles and Design	Donald G. Baird, Dimitris I. Collias	3rd Ed., 2014	Wiley

- **Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	NPTEL lectures on Polymer Chemistry, Polymer Processing, and Materials Science	https://nptel.ac.in/
2	SWAYAM online courses on polymer science and industrial chemistry	https://swayam.gov.in/
3	MIT Open Course Ware – Polymer Science and Materials Engineering	https://ocw.mit.edu/
4	e-PG Pathshala (UGC) – Chemistry and Polymer Science modules	https://epgp.inflibnet.ac.in/
5	National Digital Library of India (NDLI) – e-books and lecture notes	https://ndl.iitkgp.ac.in/
6	Polymer Database – Material properties and polymer data	https://polymerdatabase.com/

Course Type	Course Code	Course Title	Teaching-Learning Scheme L-P-T	Total Notional Hours	Course credits
Minor Course	US07HMICHE02	Applied and Industrial	2-0-0	**60**	02

CLO 1: Explain the principles, reaction mechanisms, and industrial applications of major chemical industrial processes such as alkylation, amination, calcination, carbonylation, esterification, halogenation, hydrogenation, hydrolysis, sulphonation, and double decomposition.
CLO 2: Analyze the manufacturing processes of important inorganic nitrogen chemicals including ammonia, nitric acid, ammonium nitrate, and urea, with emphasis on raw materials, process conditions, chemical reactions, and process flow.
CLO 3: Describe and compare the classification, raw materials, manufacturing processes, and chemical reactions involved in the production of glass, cement, and lime, and evaluate their industrial significance.
CLO 4: Explain the fundamentals of petrochemicals, including feedstocks, manufacturing routes, major petrochemical products, and their industrial applications.
CLO 5: Evaluate industrial chemical manufacturing processes with respect to process efficiency, energy utilization, environmental impact, safety, and sustainable practices.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	**Principle of Chemical Industrial Process:** Alkylation, Amination by Aminolysis, Calcination, Carbonilation, Double Decomposition, Esterification, Halogenation, Hydrogenation, Hydrolysis, Sulphonation **Inorganic Nitrogen Chemicals:** Ammonia, Nitric Acid, Ammonium Nitrate, Urea	Classroom, Lectures, Seminars, Problem-Based Learning, Self-Directed Learning, ICT-Enabled Learning (Digital Resources)	CLO1 CLO2
II	**Manufacturing process** (Glass, Cement and Lime) Introduction, Classification and types, basic raw materials, principal of manufacturing process including chemical reactions. Petrochemicals: Introduction, Manufacture of petrochemicals.	Classroom, Lectures, Seminars, Research-Oriented Learning, Collaborative Learning, Case-Based Learning ICT-Enabled Learning (Digital Resources)	CLO3 CLO4 CLO5

(A) Assessment Methodologies/Tools

(B) Internal Assessment

(b) Formative assessment (15 Marks)

- Quiz
- Assignment, Self-learning, and Term work
- Seminar/Presentation
- Regularity

(b) Summative Assessment (10 Marks)

- Mid Term Examination: 10 Marks

(B) External Assessment

- Term End Examination: Marks:25 Marks

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

Unit	Aligned Cos	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyze& above (A)	
I	**CLO1 CLO2 CLO3 CLO4 CLO5**	30	**2**	**3**	**7**	12
II	**CLO1 CLO2 CLO3 CLO4 CLO5**	30	**2**	**4**	**7**	13
		60	**4**	**7**	**14**	**25**

- **Assessment and Evaluation**

Sr. No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	Seminars, Assignments, Quizzes, Class Regularity,	50
2	End-Semester Examination	Written Exam/Practical Exam Project Evaluation (Report, Presentation, Viva)	50

Values to the **CLO-PLO** matrix are assigned **by judging the importance of the particular CLO** in relation to the **PLOs**.

- **CLOs – PLOs Matrix**

CLOs / PLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	**3**	**–**	**2**	**1**	**–**	**–**	**1**	**1**	**–**	**–**
CLO2	**3**	**2**	**2**	**1**	**–**	**1**	**2**	**2**	**–**	**1**
CLO3	**3**	**2**	**1**	**1**	**–**	**–**	**2**	**2**	**–**	**2**
CLO4	**3**	**1**	**2**	**1**	**–**	**1**	**1**	**2**	**1**	**2**
CLO5	**2**	**2**	**2**	**2**	**1**	**1**	**3**	**3**	**2**	**3**

- **Suggested Learning Materials Books:**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Industrial Chemistry	B. K. Sharma		Goel Publishing House
2	Shreve's Chemical Process Industries	G. T. Austin		McGraw-Hill Book Company, New Delhi)
3	Comprehensive Industrial Chemistry	Dr. Prakash G. More		Pragati Edition
4.	Unit process in organic systems	Groggins, Tate	5th edition	Mc Graw Hill Co

- **Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	Introduction to Chemical process Industries	https://nptel.ac.in/courses/103107081
2	Petroleum Technology	https://nptel.ac.in/courses/103105221
3	Chemical Process Utilities	https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_ch24

SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

B.Sc. (Chemistry) Sem. VII

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course credits
			L-P-T		
Minor Course	US07HMICHE03	Polymer Chemistry	0-4-0	60	02

- **Course Learning Outcomes (CLOs)**

On completion of this course, students will be able to:

CLO1: Demonstrate proficiency in synthesizing commercially important polymers such as polystyrene, polyvinyl acetate, polyester, nylon, and polyurethane using appropriate polymerization techniques including solution, emulsion, melt condensation, and interfacial polymerization.

CLO2: Apply the principles of polymerization mechanisms, reaction conditions, stoichiometry, and process parameters to obtain polymers with desired characteristics while following standard laboratory practices.

CLO3: Analyze the influence of experimental variables on polymer synthesis, evaluate product quality through yield and physical properties, and interpret observations using scientific reasoning.

CLO4: Demonstrate safe laboratory practices, teamwork, documentation, and technical communication while performing polymer synthesis experiments, maintaining laboratory records, and presenting experimental findings in accordance with professional and ethical standards.

Unit	Course Content	Learning Pedagogies*	CLO(s)
Polyner Chemistry Practical	1. Preparation of polystyrene by Solution Polymerization 2. Preparation of Polystyrene by Emulsion Polymerization 3. Preparation of Polyvinyl acetate by Emulsion Polymerization 4. Preparation of Polyester resin by melt condensation 5. Preparation of Nylon-6,6: Poly (hexamethylene adipamide) 6. Preparation of Polyurethane prepolymer. 7. Preparation of Nylon-6,10 by interfacial polycondensation.	Experiential Learning, Mini Research Task, Research-Oriented Learning, Collaborative Learning	CLO1 CLO2 CLO3 CLO4

- **Weightage of Learning Efforts for External Assessment**

Subject	Aligned CLOs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/Analyze & above (A)	
Polymer Chemistry Practical	CLO1 CLO2 CLO3 CLO4	60	5	10	10	25
		60	5	10	10	25

- **Assessment Methodologies/Tools**

(A) Internal Assessment

(a) Formative assessment (15 Marks)

- Method of Working
- Viva
- Journal Writing
- Regularity

(b) Summative Assessment (10 Marks)

- Mid Term Examination: 10 Marks

(B) External Assessment

- Term End Examination: 25 Marks

- **Assessment and Evaluation**

Sr. No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	Journal/record book, oral quiz, Periodic tests, Laboratory Regularity	50
2	End-Semester Examination	Practical Exam/ Project Evaluation (Report, Presentation, Viva)	50

- **CLOs – PLOs Matrix**

CLO	PLO									
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	3	2	1	1	1	2	2	1	1
CLO2	3	3	3	1	1	2	2	3	1	1
CLO3	2	3	3	2	1	2	2	3	1	2
CLO4	1	1	1	3	3	2	3	2	2	2

Values to the **CLO-PLO** matrix are assigned **by judging the importance of the particular CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

- **Suggested Learning Materials Books:**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Handbook of Analysis of Synthetic Polymers and Plastics	J. Urbanski	1978	Ellis Horwood Ltd. Publication
2	Experiments in Polymer Science	D. G. Hundiwale, V. D. Athawale, U. R. Kapadi and V. V. Gite	2008	New Age International Publsihers

Course Type	Course Code	Course Title	Teaching-Learning Scheme L-P-T	Total Notional Hours	Course credits
Minor Course	US07HMICHE04	Research Methodology	2-0-0	**60**	02

- **Course Learning Outcomes (CLOs)**

CLO1: Evaluate the fundamental concepts, objectives, types, and approaches of scientific research, and formulate appropriate research problems, hypotheses, and research designs for chemical investigations.
CLO2: Identify, evaluate, and synthesize scientific literature using scholarly databases and reference management tools to develop a comprehensive review of literature and research proposal.
CLO3: Apply appropriate methods of data collection, statistical analysis, experimental design, and interpretation to obtain valid, reliable, and reproducible research outcomes in chemical sciences.
CLO4: Create scientific documents including research proposals, technical reports, dissertations, posters, and research papers using accepted conventions of scientific writing, referencing, and publication standards.
CLO5: Demonstrate professional ethics, research integrity, intellectual property awareness, laboratory safety, and responsible conduct of research while communicating scientific findings effectively.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	**Fundamentals of Research Methodology and Research Design** Meaning and objectives of research; Motivation in research; Types of research: Descriptive, analytical, applied, fundamental, quantitative, qualitative, conceptual and empirical research; Research approaches; Significance of research; Research methods and methodology; Scientific method; Importance of research methodology; Research process; Criteria of good research; Problems encountered by researchers in India; Research problem: Meaning, selection, necessity and techniques of defining a research problem; Research design: Meaning, need, features and important concepts; Types of research design; Basic principles of experimental design; Development of research plan.	Classroom, Lectures, Seminars, Problem-Based Learning, Self-Directed Learning, ICT-Enabled Learning (Digital Resources)	CLO1 CLO2 CLO3
II	**Literature Survey, Scientific Information Resources and Research Metrics** Literature review: Definition, objectives and significance; Sources of scientific information: Primary, secondary and tertiary sources; Primary sources: Journals, papers, notes, communications and patents; Journal abbreviations; Secondary sources: Title publications, Current Contents, Chemical Titles, Chemical Abstracts, review articles, monographs, treatises, textbooks and Beilstein; Digital information resources: Electronic journals, Journal TOC alerts, Google Scholar, Scopus, SciFinder, ScienceDirect, ChemSpider, UGC-INFONET, e-consortium and Internet discussion groups; Citation analysis and research metrics: Citation Index, Indian Citation Index (ICI), Journal Impact Factor and h-index; **Use of**	Classroom, Lectures, Seminars, Research-Oriented Learning, Collaborative Learning, Case-Based Learning ICT-Enabled Learning	CLO2 CLO3 CLO4 CLO5

	software tools in chemical sciences: Chemical structure drawing and visualization software, chemical database searching, reference management software, spectral interpretation software and molecular visualization tools.	(Digital Resources)	

(A) Assessment Methodologies/Tools

(A) Internal Assessment

(a) Formative assessment (15 Marks)

- Quiz
- Assignment, Self-learning, and Term work
- Seminar/Presentation
- Regularity

(b) Summative Assessment (10 Marks)

- Mid Term Examination: 10 Marks

(B) External Assessment

- Term End Examination: Marks:25 Marks

Unit	Aligned Cos	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application /Analyze& above (A)	
I	CLO1 CLO2 CLO3	30	**2**	**3**	**7**	12
II	CLO2 CLO3 CLO4 CLO5	30	**2**	**4**	**7**	13
		60	**4**	**7**	**14**	**25**

- **Assessment and Evaluation**

Sr. No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	Seminars, Assignments, Quizzes, Class Regularity,	50
2	End-Semester Examination	Written Exam/Practical Exam Project Evaluation (Report, Presentation, Viva)	50

(B) CLOs – PLOs Matrix

CLO	PLO/PSO									
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**
CLO1	2	3	2	2	2	1	1	2	1	1
CLO2	2	2	1	2	2	3	2	2	2	1
CLO3	2	3	2	2	2	2	2	3	1	2
CLO4	1	1	1	3	2	2	2	1	2	1
CLO5	1	1	1	2	1	1	3	2	2	2

Values to the **CLO-PLO** matrix are assigned **by judging the importance of the particular CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

- **Suggested Learning Materials Books:**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Data Analysis for Chemistry	Hibbert, D. B., & Gooding, J. J.	2006	Oxford University Press
2	Research Methodology: Methods and Techniques	Kothari, C.R.	Revised 2nd ed., 2004	New Age International Publisher
3	Doing a Literature Review: Releasing the Research Imagination	Hart, C.	2nd edition, 2018	Sage Publications
4	Practical Skills in Chemistry	Dean, J. R., Jones, A. M., Holmes, D., Reed, R., Weyers, J., & Jones, A.	2nd edition, 2011	Pearson/Prentice Hall
5	Beyond Bibliometrics: Harnessing Multidimensional Indicators of Scholarly Impact	Cronin, B., & Sugimoto, C. R.	2014	MIT Press
6	An Introduction to Bibliometrics: New Development and Trends	Ball, R.	2017	Chandos Publishing (Elsevier)

Course Type	Course Code	Course Title	Teaching-Learning Scheme L-P-T	Total Notional Hours	Course credits
Major Course	US07HMACHE05	Topics in Inorganic Chemistry-I	4-0-0	**120**	04

- **Course Learning Outcomes (CLOs)**

On completion of this course, students will be able to:

CLO1: Explain and correlate the role of metal ions in biological systems, including structure–function relationships of metalloproteins, heme proteins, and metalloenzymes.

CLO2: Analyze and evaluate biochemical processes involving metal centers such as electron transfer, nitrogen fixation, and enzyme catalysis, along with the role of Vitamin B12 and coenzymes.

CLO3: Assess and justify the application of metal complexes in medicine and toxicology, including anticancer drugs (cisplatin and analogs), mechanisms of metal toxicity, and chelation therapy.

CLO4: Apply and interpret advanced concepts of coordination chemistry, including CFT/LFT, orbital splitting, term symbols, correlation diagrams, and Tanabe–Sugano diagrams for predicting properties of complexes.

CLO5: Examine and differentiate magnetic properties of coordination compounds, including paramagnetic, ferromagnetism, antiferromagnetism, and spin crossover phenomena using theoretical models.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	**Bio-Inorganic Chemistry** The biological roles of metal ions, Structure of heme, Photosystem-II, Hemoglobin and Myoglobin, Cytochrome sof the electrontransport chain, Cytochrome P-450, Methane monooxygenase, Cytochrome C-oxidase, Iron-sulfur proteins (Rubredoxin, [2Fe-2S] and [4Fe-4S]), Bohr effect, Carbonic anhydrase, Carboxy peptidase, Superoxide dismutase, Vitamin B12, Coenzyme B12, Roles of Vitamin B12.	Classroom, Lectures, Seminars, Problem-Based Learning, Self-Directed Learning, ICT-Enabled Learning (Digital Resources)	CLO1, CLO2
II	**(A) Inorganic Polymers** Classification of inorganic polymers. Polymers containing boron and silicon: methods of preparation, physical and chemical properties, structure and their uses. **(B) Mossbauer Spectroscopy** Principle and Instrumentation. Experimental technique. Application for iron complexes.	Classroom, Lectures, Seminars, Problem-Based Learning, Self-Directed Learning, ICT-Enabled Learning (Digital Resources)	CLO2, CLO3

III	**Coordination Chemistry, and Coordination Chemistry in Traditional Systems** Concept of crystal field theory (CFT) and ligand field theory (LFT), Splitting of d-orbitals in various stereochemistry, Tetragonal elongation and compression in octahedral complexes, Nephelauxetic series, derivation of terms for closed subshell, derivation of terms for f2 configurations, Correlation diagrams for octahedral and tetrahedral stereo chemistry of d1, d2, d8, and d9 systems. Tanabe-Sugano diagram for octahedral and tetrahedral stereochemistry of d1, d2, d8 and d9 systems, Determination of Crystal Field Splitting Energy. Coordination Chemistry in Traditional Systems: Metal-ligand interactions in Ayurvedic formulations, Stability and chelation, Comparison with modern coordination chemistry.	Classroom, Lectures, Seminars, Problem-Based Learning, Self-Directed Learning, ICT-Enabled Learning (Digital Resources)	CLO4
IV	**Magneto Chemistry** Magnetic susceptibility: Sources of paramagnetic, diamagnetic susceptibility, antiferromagnetism, Types of antiferromagnetism, antiferromagnetic exchange pathways, Ferromagnetism and magnetic domains, molecular field theory of ferromagnetism, magnetic sublattice, ferrimagnetism and canting, Spin pairing : spin pairing in octahedral complexes; spin pairing in non-octahedral complexes; some aspects of spin pairing and crossover region.	Classroom Lectures, Seminars, Problem-Based Learning, Self-Directed Learning, ICT-Enabled Learning (Digital Resources)	CLO5

(A) Assessment Methodologies/Tools

(A) Internal Assessment

(a) Formative assessment (30 Marks)

- Quiz
- Assignment, Self-learning, and Term work
- Seminar/Presentation
- Regularity

(b) Summative Assessment (20 Marks)

- Mid Term Examination: 20 Marks

(B) External Assessment

- Term End Examination: 50 Marks

Unit	Aligned CLOs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyze& above (A)	
I	CLO1 CLO2	30	1	1	11	13
II	CLO2 CLO3	32	0	1	11	12
III	CLO4	28	0	1	11	12
IV	CLO5	30	1	1	11	13
		120	**02**	**04**	**44**	**50**

- **Assessment and Evaluation**

Sr. No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	Seminars, Assignments, Quizzes, Class Regularity,	50
2	End-Semester Examination	Written Exam/Practical Exam Project Evaluation (Report, Presentation, Viva)	50

(B) CLOs – PLOs Matrix

CLO	PLO									
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**
CLO1	**3**	**2**	**2**	**3**	**3**	**1**	**-**	**3**	**2**	**1**
CLO2	**3**	**2**	**2**	**3**	**3**	**1**	**-**	**3**	**2**	**1**
CLO3	**3**	**2**	**2**	**3**	**3**	**1**	**-**	**3**	**2**	**1**
CLO4	**3**	**1**	**3**	**1**	**-**	**-**	**-**	**2**	**1**	**2**
CLO5	**3**	**2**	**1**	**-**	**1**	**-**	**-**	**1**	**1**	**1**

Values to the CLO-PLO matrix are assigned **by judging the importance of the particular CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

- **Suggested Learning Materials Books:**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Metal Ions in Biochemistry	P. K. Bhattacharya, P. B. Samnani	2nd edition, 2020	Taylor & Francis
2	Inorganic Chemistry	Shriver and Atkins	5th edition, 2010	New York : W. H. Freeman and Co.
3	Concise Inorganic Chemistry	J.D. Lee	5th edition, 1996	Blackwell Science Ltd.
4	Electronic absorption spectroscopy and related techniques	D.N. Sathyanarayana	2001	Universities Press
5	Introduction to ligand fields	B.N. Figgis	1967	Krieger Pub Co
6	Introduction to Magnetochemistry	Alan Earshaw	1968	Elsevier
7	Elements of Magnetochemistry	Dutta and Syamal	2nd edition, 2004	Affiliated East-West Press Pvt Ltd, New Delhi
8	Advanced Inorganic Chemistry	F.A. Cotton, Wilkinson, Murillo and Bochmann	3rd edition, 1999	Interscience Publishers, New York
9	Inorganic Chemistry	James E. Huheey, Eilen A. Keiter, Richard L. Keiter	4th edition, 1993	Harper Collins College Publishers
10	A History of Hindu Chemistry: from the Earliest Times to the Middle of the Sixteenth Century A.D.	Prafulla Chandra Ray	Volume I: 1902 Volume II: 1909	Williams and Norgate, London & Chuckervertty, Chatterjee & Co., Ltd., Calcutta
11	Rasaratna Samucchaya of Vagbhattacharya (Hindi)	Indra Dev Tripathi		Chaukhambhas Sanskrit Sansthan

- **Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	Chemistry in India, by B. N. Sharma, Source: Academia.edu	https://www.academia.edu/49089007/Chemistry_in_India

Course Type	Course Code	Course Title	Teaching-Learning Scheme L-P-T	Total Notional Hours	Course credits
Minor Course	US07HSECHE01	Inorganic Chemistry	0-4-0	**60**	02

- **Course Learning Outcomes (CLOs)**

On completion of this course, students will be able to:
CLO1: Synthesize a variety of **coordination complexes and double salts** applying specific techniques for ligand exchange, chelation, and stabilization of metal oxidation states
CLO2: Execute stereospecific syntheses and explain the geometric or optical isomerism inherent in octahedral and tetrahedral coordination environments.

Subject	Course Content	Learning Pedagogies*	CLO(s)
Inorganic Chemistry Practical	Synthesis of metal complexes and double salts: 1. Hexaamminenickel (II) chloride 2. Cis-potassium dioxalatodiaquachromate (III)dihydrate 3. Mercury(II) tetrathiocyanatocobaltate (II) 4. Tris(acetylacetonato)manganese (III) chelate 5. Potasiumtrioxalatoferrate (III) trihydrate 6. Prussian blue 7. Hexaureachromium (III) chloride 8. Tetraamminecopper (II) sulphate 9. Ferrous ammonium sulphate	Experiential learning, Problem-Based Learning, Research-Oriented Learning, Collaborative Learning	CLO1 CLO2

- **Assessment Methodologies**

(A) Internal Assessment

(a) Formative assessment (10 Marks)

- Method of Working
- Viva
- Regularity
- Journal Writing

(b) Summative Assessment (15 Marks)

- Mid Term Practical Examination: 15 Marks

(B) External Assessment

- Term End Practical Examination: 25 Marks

Weightage of Learning Efforts for External Assessment

Subjects	Aligned CLOs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyze& above (A)	
Inorganic Chemistry Practical	CLO1 CLO2	60	5	5	15	25

- **Assessment and Evaluation**

Sr. No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	Journal/record book, oral quiz, Periodic tests, Laboratory Regularity	50
2	End-Semester Examination	Practical Exam/ Project Evaluation (Report, Presentation, Viva)	50

- **CLOs – PLOs Matrix**

CLO	PLO									
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	2	3	1	1	1	2	2	1	1
CLO2	3	1	3	1	1	1	1	2	2	1

Values to the **CLO-PLO** matrix are assigned **by judging the importance of the particular CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

- **Suggested Learning Materials Books:**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Vogel's Textbook of Quantitative Chemical Analysis	G.H. Jeffery, J. Mendham, R.C. Denney	5th Edition	Longman Group Ltd. London
2	Advanced Practical Inorganic Chemistry	Gurdeep Raj	1st Edition, 2013	Goel Publishing House, Meerut.

- **Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	Comprehensive Coordination Chemistry Lab Manual	https://doi.org/10.13140/RG.2.2.15072.05123
2	LibreTexts – Synthesis of Coordination Compounds	https://chem.libretexts.org/A