

VIDHYADEEP UNIVERSITY
Syllabus of S.Y B.Sc. (Sem-III & IV) CHEMISTRY
EFFECTIVE FROM 2023-2024

Name of Program	B.Sc Chemistry
Abbreviation	CHEM
Duration	02 years
Eligibility Criteria	Basic Science
Program Language	Gujarati / English
Objective of Program	Three years' undergraduate program prepares students by developing knowledge base in theory as well as expertise in experimental science. Because South Gujarat is famous Chemical Industrial Zone, the main objective of this course is to increase the job opportunity of the students by preparing them with the experimental and theoretical aspects of this continuously evolving subject.
Program outcome	<p>PO 1: Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories including those in Organic, Inorganic, Physical and Analytical Chemistries.</p> <p>PO 2: To develop critical thinking, students carry out scientific experiments as well as accurately record and analyze the results of such experiments.</p> <p>PO 3: Students will be skilled in independent problem solving, critical thinking and analytical reasoning as applied to scientific problems.</p> <p>PO 4: Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.</p> <p>PO 5: Students will appreciate the central role of chemistry in our society and use this as a basis for ethical behaviour in issues facing chemists including an understanding of safe handling of chemicals, environmental issues and key issues facing our society in energy, environment, health and medicine.</p> <p>PO 6: To inculcate the scientific temperament in the students and outside the scientific community.</p> <p>PO 7: To develop skills in the proper handling of apparatus and chemicals. To be exposed to the different processes used in industries and their applications.</p>
Program specific outcome	<p>PSO 1: have sound knowledge about the fundamentals and applications of chemical and scientific theories;</p> <p>PSO 2: demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the subject.</p> <p>PSO 3: acquire technical skills required for synthesis, Identification and structural characterization of chemical compounds; Program Outcomes (PO) Goals Program Specific Outcomes (PO)</p> <p>PSO 4: apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories. Handling of basic equipments, acquiring technical skills accurately and effectively communicate scientific ideas in graphic oral and written form;</p> <p>PSO 5: be familiar with the different branches of chemistry like analytical, organic, inorganic, physical, environmental and polymer;</p> <p>PSO 6: gain knowledge to correlate Chemistry with other disciplines of science;</p> <p>PSO 7: help in understanding the causes of environmental pollution and can open up new methods for environmental pollution control.</p>

Mapping between POs and PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
	PO1	√	√			√	√	√
	PO2	√	√	√	√	√	√	
	PO3	√	√	√		√	√	
	PO4	√		√	√	√	√	√
	PO5			√	√	√	√	√
	PO6		√				√	
	PO7	√		√	√	√	√	√

Teaching & Evaluation Scheme (Semester III & IV)

Course name: Bachelor of Science (Chemistry)				Semester III					
Grade System:									
Subject			Teaching Scheme		Examination Scheme		Passing Scheme		Total Marks
Subject Code	Paper No.	Paper Title	Hours/week	Credit	Theory		Passing Head		
					Internal	External	Internal	External	
1091301	CHEM-III	Inorganic Chemistry.	2	2	20	50	9	17	70
1091302	CHEM-IV	Organic Chemistry	2	2	20	50	9	17	70
1091303	CHEM-V	Physical Chemistry	2	2	20	50	9	17	70
1091304	CHEM-Practical	Practical	6	3	30	60	11	21	90

Course name: Bachelor of Science (Chemistry)			Semester VI						
Grade System:									
Subject			Teaching Scheme		Examination Scheme		Passing Scheme		Total Marks
Subject code	Paper No.	Paper Title	Hours/week	Credit	Theory		Passing Head		
					Internal	External	Internal	External	
1091401	CHEM-VI	Inorganic Chemistry	2	2	20	50	9	17	70
1091402	CHEM-VII	Organic Chemistry	2	2	20	50	9	17	70
1091403	CHEM.-VIII	Physical Chemistry	2	2	20	50	9	17	70
1091404	CHEM Practical	Practical	6	3	30	60	11	21	90

S.Y. B.Sc (Chemistry) Semester-III

CHEM- III - Inorganic Chemistry

Subject Code	1091301
Course Title	INORGANIC CHEMISTRY
Credit	02
Teaching Per Week	02
Minimum Weeks Per Semester	15 (Including Class Work, Examination, Preparation, Holidays Etc.)
Effective From	June 2023
Purpose of Course	The paper explores chemistry of elements of first transition metal element and various types of chromatography and its uses. Students gain knowledge of L-S coupling and its electronic configuration. Students be aware of classification and composition of water and various methods of purifications.
Course Objective	To understand D block elements and their binary compounds. To study principle of chromatography. To study various types of chromatography. To acquire knowledge of L-S coupling and J - J coupling. To study classification and composition of water along with different purification methods for potable and industrial purposes.

Course Outcomes	<p>CO 1: define p-block elements; explain characteristic properties of p-block elements and properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states.</p> <p>CO 2: understand of noble gases chemical and structure bonding of Xenone compounds.</p> <p>CO 3: industrial uses and manufacturing process of lime, cement and refractories.</p> <p>CO 4: outline thermodynamic stability of metal complexes and factors affecting a stability of metal complexes. Lability and inertness, Factors affecting lability of metal complexes. Trans effect, theories of Trans effect (i) Electrostatic Polarization Theory (ii) - Bond Theory labile and inert complexes based on VBT and CFT.</p>
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Mapping between CO and PSOs		PSO1	PSO2	PSO3	PSO4	PSO4	PSO6	PSO7
	CO1	✓			✓	✓	✓	
	CO2	✓	✓				✓	
	CO3			✓		✓	✓	✓
	CO4	✓			✓			

Course content

Unit No.	Unit Name	Content	Hours/Week
Unit 1	Chemistry of p-block Elements	Introduction, special characteristics such as metallic character, polarizing power, hydration energy, inert pair effect, relative stability of different oxidation state, diagonal relation of (1) lithium with magnesium (2) boron with silicon, Anomalous behaviour of Li, Be, Formation of complex compound.	08 hrs
Unit 2	Chemistry of Halogens & Noble Gases	Introduction, chemical properties of Noble gases, chemistry of Xenon, Structure and bonding in xenon compounds XeF ₂ , XeF ₄ , XeF ₆ , XeO ₃ , XeOF ₄ Halogen in positive oxidation state halides, pseudohalogens, electro chemistry of halogens and pseudohalogens.	08 hrs
Unit 3	Cementing materials	Introduction, lime, manufacture of lime, properties of lime, plaster of paris, classification and properties of cement. manufacture of Portland cement chemical composition of cement. chemical constitution of Portland cement.	07 hrs
Unit 4	VB Theory	Crystal field theory, splitting of d-orbitals in ligand field CFSE in weak OH and strong field complexes. factors affecting CFSE, d-d transitions and colour of complexes spectro chemical series, Nephelauxatic effect, limitations of CFT and VBT.	07 hrs
Reference Books :	1- Introduction Of Quantum Chemistry by A K.chandra, Tata Mc. Graw Hill Delhi 2- Theoretical Inorganic Chemistry by M C.Day & j.selbin affiliated ,East West pub. pvt.ltd 3- Inorganic Chemistry by R.B. Heslop and P.I.Robinson. Elsevier Pub.Co. NY 4- Environmental Chemistry by A K.De 5- Industrial Chemistry by B K.Sharma 6- Advanced Inorganic Chemistry by Cotton and Wilkinson John Wihn Wiely 7- Principles of Inorganic Chemistry by Puri, Sharma, Kalia. 8- Environmental Chemistry by S.K. Banerji. prentice Hall India Pvt. Ltd.		

Course content

Unit No.	Unit Name	Content	Hours/Week
Unit 1	Nitrogen Containing Organic Compound	(A) Introduction, preparation and physical properties and chemical of reaction of nitriles, isonitriles, carbonates, semicarbazides, and their application in synthetic organic chemistry (B) Structure and nomenclature of amines , preparation of aryl amines , physical properties and chemical reaction. Gabriel-phthalimide reaction, Hofmann bromamide reaction.	08 hrs
Unit 2	Carboxylic acid and its Derivatives	Introduction, structure and nomenclature of acid chloride , ester, amides of monocarboxylic acid, method of formation of mono carboxylic acid derivatives and chemical reaction.	07 hrs
Unit 3	Name Reaction	The General Nature, reaction mechanism of application of following reaction: (1) Reimer-Tiemer reaction (2) Aldol condensation (3) Michael reaction (4) Wolf -kishner reduction (5) Fridel craft reaction (6) Writting reaction (7) Mannich reaction (8) Dickmann reaction	08 hrs
Unit 4	Vitamins, oils and Fats.	Vitamin: Introduction, classification and nomenclature. Sources, deficiency diseases and structures of vitamin A,B,C,D, E and K. Oils and fats: Introduction, natural fats, edible and industrial oils of vegetable origin,common fatty acids , glycerides saponification determination of saponification value.	07 hrs
Reference Book	1- Organic chemistry by R.T. Morison and R.N .Boyd, Prentice Hall India 2- Organic chemistry vol-I & II by I L.Finar 3-Reaction mechanism in Organic Chemistry S M. Mukharji & S P.Singh 4 Organic chemistry by L G Wade jr.prentice Hall 5-Organic chemistry by S H.pine 6- Reaction and reagents in organic synthesis by O P.Agrawak Goel Pub House, Meerut		

S.Y. B.Sc (Chemistry) Semester -III

CHEM- V - Physical Chemistry

Subject Code	1091303
Course Title	PHYSICAL CHEMISTRY
Credit	02
Teaching Per Week	02
Minimum Weeks Per Semester	15 (Including Class Work, Examination, Preparation, Holidays Etc.)
Effective From	June 2023
Purpose of Course	The paper includes theories of reaction rate. it involves three thermodynamics laws. Paper also contain history of polymeric materials and properties of it.
Course Objective	To understand theories of reaction rate. To study thermodynamic laws. To study classification, nomenclature, molecular forces and chemical bonding in polymers. To study physical, thermal, flow and mechanical properties and application of various polymers.
Course Outcomes	CO 1: understand Arrhenius equation and energy of activation with its effect on catalysis. CO 2: study basic thermodynamics including 1 st and 2 nd law of thermodynamics. CO 3: understand statement of third law with Gibbs Helm Holtz equation. CO 4: study classification of polymers with various properties of polymers.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	√	√		√	√	√	
CO2	√		√	√			
CO3		√		√	√	√	
CO4	√	√	√		√	√	√

Course content

Unit No.	Unit Name	Content	Hours/Week
Unit 1	Second law of Thermodynamics	Limitations of first law of Thermodynamics, Spontaneous & Irreversible processes, cyclic process, Carnot cycle Second Law: Carnot theory, Concept of entropy, Entropy change in isothermal expansion of ideal gas. Entropy change for reversible and irreversible processes & phases, Calculation of entropy changes of an ideal gas with change in P, V & T.	08 hrs
Unit 2	Acids and Bases & Semiconductors	Arrhenius Concept, Bronsted- Lowry concept,	07 hrs

		Lewis concept. Gallium arsenide, Germanium and silicon semiconductors, applications of it.	
Unit 3	Distribution law	Nernst distribution law- Statement and its derivation. Distribution constant, Factors affecting on distribution constant, Validity of Distribution law, Modification of Distribution law (When molecules undergo) Association or Dissociation. Application of distribution law in solvent extraction.	08 hrs
Unit 4	Colloids	Colloidal state, Colloidal solutions, Classification of colloids, Lyophilic and Lyophobic colloids, Properties of Lyophilic and Lyophobic colloids , True solution, Colloidal solution and Suspensions	07 hrs
Reference Book	1-Principles of Physical Chemistry by Puri, Sharma & Pathania, Vishal Publishing co. 2-Essential of Physical chemistry by Bahl Tuli & Bahl. 3-Physical Chemistry by B.K. Sharma. 4-Advanced Physical chemistry by D.N. Bajpai.		

S.Y. B.Sc (Chemistry) Semester -III

CHEMISTRY - PRACTICAL

Subject Code	1091304
Course Title	CHEMISTRY `PRACTICAL
Credit	03
Teaching Per Week	06
Minimum Weeks Per Semester	15 (Including Class Work, Examination, Preparation, Holidays Etc.)
Effective From	June 2023
Purpose of Course	Purpose of this course is to identify organic and inorganic compounds and to operate physical instruments of P ^H meter, conductometre and its application.
Course Objective	To provide students with hands on experience and skills in conducting qualitative test to identify organic compounds based on their functional groups and chemical properties, as well as understanding the principles and techniques of organic qualitative analysis. To provide students with practical skills and knowledge in performing volumetric analysis , including the principles , techniques and calculations involved in accurate titrations.
Course Outcomes	CO 1: study the reaction kinetics practically [1st order]. CO 2: study the conduct metric and pH metric principles and application of conduct metric, and pH metric measurement in quantitative analysis. CO 3: do viscosity measurement and its application. CO 4: study the adsorption of given organic acid on charcoal. CO-5: get trained in the quantitative analysis using gravimetric method. CO-6: develop skills required for the qualitative analysis of organic compounds.

		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
Mapping between CO and PSOs	CO1	√	√		√	√	√	
	CO2	√		√	√			
	CO3		√		√	√	√	
	CO4	√	√	√		√	√	√

Course content

Organic Spotting (Minimum 8 organic substances)	<p>Acid: Salicylic acid, Cinnamic acid, Phenyl acetic acid, Benzoic acid, Sulphanilic acid,</p> <p>Phenol: α - Naphthol, β - Naphthol, o- Nitrophenol, p- Nitrophenol</p> <p>Base: p- Nitroaniline, o- Nitroaniline, m-Nitroaniline, p- Toluidine, p- Chloroaniline, Diphenylamine, Dimethylaniline, Diethylaniline</p> <p>Aldehyde: Glucose, Benzaldehyde</p> <p>Ketone: Methyl ethyl ketone, Acetophenone</p> <p>Ester: Ethyl acetate, Butylacetate</p> <p>Alcohol: Ethanol, Butanol</p> <p>Hydrocarbons: Anthracene, Naphthalene, Diphenyl</p> <p>Nitro hydrocarbons: m - Dinitro benzene, Nitro benzene</p> <p>Halogenated hydrocarbons: Chlorobenzene, Bromo benzene, p- Dichlorobenzene</p> <p>Amide: Benzamide, Thiourea</p> <p>Anilide: Acetanilide</p>
Gravimetric Estimations (any two)	<p>(1) Fe^{2+} as Fe_2O_3 (The given solution of $\text{Fe}-\text{NH}_4-\text{H}_2\text{SO}_4$)</p> <p>(2) Ni^{2+} as $\text{Ni}(\text{DMG})_2$ (The given solution of $\text{NiCl}_4 \cdot 6\text{H}_2\text{O} + \text{HCl}$)</p> <p>(3) Mn^{2+} as $\text{Mn}_2\text{P}_2\text{O}_7$ (The given solution of $\text{MnCl}_2 \cdot 4\text{H}_2\text{O} + \text{HCl}$)</p> <p>(4) Ba^{2+} as BaSO_4 (The given solution of $\text{BaCl}_2 \cdot 2\text{H}_2\text{O} + \text{HCl}$)</p>
Volumetric Exercise (any two)	<p>(1) To determine the amount of Nickel by EDTA.</p> <p>(2) To determine the amount of Zinc by EDTA.</p> <p>(3) To determine the amount of Copper by EDTA.</p> <p>(4) Determination of total hardness of Water by EDTA.</p>
Physical practical (any two)	<p>1. P^{H} metery: To determine the normality of weak acid pH metrically using strong base ($\text{CH}_3\text{COOH} \rightarrow \text{NaOH}$)</p> <p>2. Conductometric Titration To determine the normality of strong acid conductometrically using strong base ($\text{HCl} \rightarrow \text{NaOH}$)</p> <p>3. Chemical kinetics - Ester hydrolysis To study the hydrolysis of methyl acetate at two different concentration in 0.5 N HCl.</p> <p>4. Viscosity To determine the viscosity of the liquids and the % of unknown mixture 'C'.</p>

S.Y. B.Sc (Chemistry) Semester-IV

CHEM- VI - Inorganic Chemistry

Subject Code	1091401
Course Title	INORGANIC CHEMISTRY
Credit	02
Teaching Per	02

Week	
Minimum Weeks Per Semester	15 (Including Class Work, Examination, Preparation, Holidays Etc.)
Effective From	June 2023
Purpose of Course	The paper includes study of classification and theory of hydrogen bonding. it also includes CFSE. Student also gains knowledge of ion exchange chromatography and non aqueous solvent.
Course Objective	To understand theory and effect of hydrogen bonding in various fields. To study werner's co ordination theory, CFSE. To study synthesis, characteristic and types of ion exchange resin and application of ion exchange for separation. To study definition and classification of non aqueous solvents.
Course Outcomes	CO 1: define d-block elements; explain characteristic properties of d-block elements and properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states CO 2: understand basic concept of CFT, CFSE, splitting of d-orbital in octahedral and tetrahedral geometry, interaction of visible light and complex compound, ion exchange chromatography, separation of ion through ion exchange chromatography, purification of water. CO 3: property and industrial making process of various ferrous and non-ferrous alloys CO 4: define potable water; explain different methods of purification of water for potable and industrial purposes, explain soft and hard water, discuss method of desalination of sea water by reverse osmosis and electro dialysis

		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
Mapping between CO and PSOs	CO1	√	√		√		√	
	CO2			√		√		√
	CO3	√			√		√	
	CO4	√	√	√		√		

Course content

Unit No.	Unit Name	Content	Hours/Week
Unit 1	Chemistry of first row Transition Elements	Introduction, definition electronic configuration, reversal of energies of 3d&4s orbitals, physical properties such as atomic properties, melting point and boiling point, density reducing properties, spectral and magnetic properties.	07 hrs

		.calculation of spin only magnetic momentum of inner orbital and outer orbital complexes $[\text{NiCl}_4]$, $[\text{Ni}(\text{CN})_4]^{-2}$, $[\text{FeF}_6]$, $[\text{Fe}(\text{CN})_6]^{-4}$,	
Unit 2	Crystal Field Theory of Co-Ordination Compound	Introduction, crystal field theory of bonding in octahedral symmetry, Crystal field stabilization energy, crystal fields theory, splitting of d-orbital in octahedral, tetrahedral and square planar complexes., Factors affecting on CFSE, Application of CFT Magnetic properties and Spectral properties.	08 hrs
Unit 3	Metals and Alloys	Introduction, physical properties of metals, cast iron, Wrought iron, steel, heat treatment of steel, definition of alloys, classification of alloys, alloy of steel and its application, nonferrous alloys and its industrial applications.	08 hrs
Unit 4	Water Parameters and its analysis	Introduction, Classification, Composition of Water, Different methods of purification of Water for potable and industrial purposes Soft and hard water, Desalination of sea water by Reverse osmosis and Electro dialysis.	07 hrs
Reference Book:	1-Atomic Structure and Chemical bond by Manos Chandra, Tata Mc .Graw Hill pub. Co. Ltd. 2-Theoretical Inorganic Chemistry by M C.Day and J.Selbin Affiliated East West Pub. Pvt Ltd. 3- Co -ordination Compounds by S.F.A.Kettle, Nelson. 4- Principles of Inorganic Chemistry by Puri, Sharma, Kalia. 5- Inorganic Chemistry by James E .Huheey, Harper International. 6- Environmental Chemistry by A K.De.		

S.Y. B.Sc (Chemistry) Semester - IV

CHEM- VII - Organic Chemistry

Subject Code	1091402
Course Title	ORGANIC CHEMISTRY
Credit	02
Teaching Per	02

Week	
Minimum Weeks Per Semester	15 (Including Class Work, Examination, Preparation, Holidays Etc.)
Effective From	June 2023
Purpose of Course	This Paper Includes Introduction, Classification, Nomenclature Of Heterocyclic compounds And organic sulfur compound. It also Include compound containing reactive methylene groups students gain knowledge of UV and Visible Spectroscopy.
Course Objective	To understand various heterocyclic compounds its classification and nomenclature. To study variety of organic sulfur compound and its classification. To study compound containing reactive methylene group its preparation and synthetic application. To study various types of spectroscopy.
Course Outcomes	CO 1: study aliphatic sulphur compounds: nomenclature, general methods of preparation and Reaction, Aromatic sulfonic acid: nomenclature, preparation, reactions and uses of sulfonic acids of toluene. CO 3: synthesize and study application of compound containing reactive methylene group like malonic ester and aceto acetic ester, Keto-enol tautomerism: factors affecting Keto-enol tautomerism and its mechanism. CO 2: Study basics of Diazonium salt, its mechanism, mole ratio, different salts, preparation of the diazonium salt. give nomenclature of Diazonium salts. study reactions of Diazonium salts, replacement reactions in which nitrogen is eliminated, its application in the synthesis of aromatic compounds CO 4: learn manufacturing process of soap and detergents with the classification of detergents.

Mapping between CO and PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
	CO1	√	√		√		√	
	CO2			√		√		√
	CO3	√			√		√	
	CO4	√	√	√		√		

Course content

Unit No.	Unit Name	Content	Hours/Week
Unit 1	Sulfur Containing Organic Compounds	Introduction, Classification, (A) Aliphatic Sulfur Compound : Introduction, nomenclature, general methods of preparation and reaction of (1) Mercaptans (2) Thioethers (3) Sulfinic and Sulfonic acid.	08 hrs

		(B) Aromatic sulphonic acid : Introduction, nomenclature, preparation, reaction and uses of Sulphonic acids of Toluene, Sulphonic acid, Chloramine T and Dichloramine T	
Unit 2	Compound Containing Reactive Methylene Groups	(A) Malonic ester: Preparation from acetic acid and its synthetic application (n-butiric acid ,succinic acid, adipic acid, Cinnamic acid) (B) Acetoacetic ester preparation and synthetic application (butanone,1,3 & 1,4diketone, alicyclic compound). (C) Keto -Enol tautomerism: factors affecting keto enol tautomerism and its mechanism.	07 hrs
Unit 3	Diazonium Salts	Mechanism of diazotisation and method of preparation of Diazonium Salts Nomenclature of Diazonium Salts. Reaction of Diazonium Salts, Replacement reaction in which nitrogen atom is eliminated and reaction in which nitrogen atom are retained. Application of Diazonium Salts In the synthesis of aromatic compounds. Laws of coupling, coupling agents, definition of diazoamino and aminoazo compound. Synthesis and uses of- Methyl Red, Methyl Orange, Congored, Erichrome Black-T.	08 hrs
Unit 4	Soaps and Detergents	Introduction, Definition , principle of detergency Classification of surface active agents, types of detergents , manufacturing of soaps, composition and uses.	07 hrs
Reference Book	1- Organic Chemistry vol.I and II by I L.Finar 2- Organic Chemistry by L.G.Wade Jr.Prentice Hall. 3- Reaction Mechanism In Organic Chemistry S.M.Mukharji and S.P.Singh. 4- Organic Chemistry by S.H.pine. 5- Reaction and Reagents in Organic Synthesis by O .P.Agrawal Goel Pub.House, Meerut. 6- Organic Chemistry by R.T.Morison and R.N .Boyd, Prentice Hall India.		

S.Y. B.Sc (Chemistry) Semester - IV

CHEM- VIII - Physical Chemistry

Subject Code	1091403
Course Title	PHYSICAL CHEMISTRY
Credit	02
Teaching Per	02

Week	
Minimum Weeks Per Semester	15 (Including Class Work, Examination, Preparation, Holidays Etc.)
Effective From	June 2023
Purpose of Course	This paper includes electrochemistry and types of adsorptions and adsorption theory. it also includes various electromagnetic spectra and photochemistry.
Course Objective	To understand Kohlraush law and its application. To study types of adsorption and adsorption theory of catalysis. To study different electromagnetic radiation spectra and Hook's law for vibrational rotational spectra. To study electromagnetic radiation, photons, thermal and photochemical laws.
Course Outcomes	<p>CO 1: Discuss formation of ions in solutions, Difference between metallic conductance and Electrolytic conductance, electrolysis, Migration of ions, Transport number of ions and its Determination by moving boundary method. Explain Kohlraush law of ionic conductance and application of Kohlraush law to (a) Determination of degree of dissociation of weak electrolyte. (b) Determination of equivalent conductivity of weak electrolyte at infinite dilution. (c) Determination of solubility and solubility product of sparingly soluble salts. (d) Determination of ionic product of water. Solve numerical problems related to determination of transport number and applications of Kohlrausch law.</p> <p>CO 2: distinguish between adsorption and absorption, physical adsorption and chemical adsorption, explain heat of adsorption, characteristics of adsorption, Freundlich's adsorption isotherm, Langmuir's adsorption isotherm, catalysis, general features of catalysis, heterogeneous catalysis, adsorption theory of catalysis.</p> <p>CO 3 : Study definition of space lattice, Unit cell, Difference between crystalline and amorphous state, types of crystals with illustrations, Law of crystallography. Steno's law and laws of symmetry, lattice planes, Miller indices, Bravais indices, type of cubic system, diagrammatic representation of cubic system and d100, d110, d111 planes, Bragg's equation, Crystal structure of NaCl, KCl.</p> <p>CO 4: understand fundamentals of photochemistry, Basics of electromagnetic radiations, photons, Thermal and Photochemical Laws (a) Grothus Draper's Law (b) Lambert Beer's Law (c) Einstein's Law of photochemical equivalence. Explain Quantum efficiency, Experimental determination of Quantum yields. Reasons of Low and high quantum efficiency, Primary and secondary photochemical reactions, Factors affecting quantum efficiency, Isomeric changes, polymerization, Photosensitization, Photo physical processes Fluorescence, Phosphorescence, Chemiluminescence. Factor affecting Fluorescence, Phosphorescence and Solve numerical problems related to quantum efficiency.</p>

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	√	√		√		√	
CO2			√		√		√
CO3	√	√		√		√	
CO4	√		√		√		

Course content

Unit No.	Unit Name	Content	Hours / Week
Unit 1	Electrochemistry	Ionic mobility, Transport number, Determination of transport number, moving boundary method, Kohlrausch law of ionic conductance. Applications of Kohlrausch law to a) Degree of dissociation of weak electrolyte b) Equivalent conductivity of weak electrolyte at infinite dilution c) Solubility and solubility product of sparingly soluble salts d) Ionic product of water Numerical problems.	07 hrs
Unit 2	Nuclear Chemistry	Introduction, Types of nuclear radiation, Properties of α , β & γ rays. Rate of radioactive decay, Decay constant, Half life average life, Mass defect and binding energy Applications of radioisotopes: In medicine, In Radiotherapy, In mutation of crops, Carbon dating	08 hrs
Unit 3	Adsorption	Adsorption and absorption, heat of adsorption, Characteristics of adsorption, physical and chemical adsorption, distinction between physical and chemical adsorption, Freundlich's adsorption isotherm, Langmuir's adsorption isotherm, catalysis, general features of catalysis, heterogeneous catalysis, Adsorption theory of catalysis.	07 hrs
Unit 4	Photochemistry	Introduction of photochemistry, Basics of electromagnetic radiations, photons, Thermal and photochemical laws. 1) Grothus Draper's law 2) Lambert Beer's law 3) Einstein's law of photochemical equivalence. Quantum yield or efficiency. 4) Experimental determination of quantum yields. Reasons of low and high quantum yield.	08 hrs
Reference Book	1. Principles of Physical Chemistry by Puri, Sharma & Pathania, Vishal Publishing co. 2. Essential of Physical chemistry by Bahl Tuli & Bahl. 3. Physical Chemistry by B.K. Sharma. 4. Advanced Physical chemistry by D.N. Bajpai 5. Spectroscopy by S. Chand publication.		

S.Y. B.Sc (Chemistry) Semester - IV

CHEMISTRY – PRACTICAL

Subject Code	1091404
Course Title	CHEMISTRY PRACTICAL
Credit	03
Teaching Per Week	06
Minimum Weeks Per Semester	15 (Including Class Work, Examination, Preparation, Holidays Etc.)
Effective From	June 2023
Purpose of Course	Purpose of this course is to identify organic and inorganic compounds and to operate physical instruments of P ^H meter, conductometre and its application.
Course Objective	To provide students with hands on experience and skills in conducting qualitative test to identify organic compounds based on their functional groups and chemical properties, as well as understanding the principles and techniques of organic qualitative analysis. To provide students with practical skills and knowledge in performing volumetric analysis , including the principles , techniques and calculations involved in accurate titrations.
Course Outcomes	CO 1: study the reaction kinetics practically [1st order]. CO 2: study the conduct metric and pH metric principles and application of conduct metric, and pH metric measurement in quantitative analysis. CO 3: do viscosity measurement and its application. CO 4: study the adsorption of given organic acid on charcoal. CO-5: get trained in the quantitative analysis using gravimetric method. CO-6: develop skills required for the qualitative analysis of organic compounds.

		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
Mapping between CO and PSOs	CO1	√	√		√		√	
	CO2	√		√		√		√
	CO3		√		√			
	CO4	√		√		√	√	√

Course content

INORGANIC QUALITATIVE ANALYSIS (MINIMUM 8 INORGANIC MIXTURE)	<p>LIST OF INORGANIC CHEMICALS USED FOR INORGANIC QUALITATIVE ANALYSIS:</p> <p>CHLORIDES : Cu⁺², Fe⁺³, Mn⁺², Co⁺², Ni⁺², Ca⁺², Sr⁺², Na⁺, K⁺, NH₄⁺, Ba⁺², Bi⁺³, Cd⁺²</p> <p>BROMIDE : Na⁺, K⁺, NH₄⁺, Sr⁺²</p> <p>IODIDE : K⁺</p> <p>NITRITES: Na⁺, K⁺</p> <p>NITRATE : Pb⁺², Co⁺², Ni⁺², Ba⁺², Sr⁺², Na⁺, K⁺, NH₄⁺, Bi⁺³</p> <p>SULPHIDE : Zn⁺², Sb⁺³</p> <p>SULPHITES: Na⁺</p> <p>SULPHATE : Cu⁺², Al⁺³, Fe⁺², Zn⁺², Mn⁺², Ca⁺², Ni⁺², Mg⁺², Na⁺, K⁺, NH₄⁺, Cd⁺², Fe⁺</p> <p>CHROMATE: Na⁺, K⁺</p> <p>CARBONATES: Cu⁺², Zn⁺², Mn⁺², Co⁺², Al⁺³, Ni⁺², Ca⁺², Fe⁺², Mg⁺², Na⁺, K⁺, NH₄⁺, Pb⁺², Bi⁺³, Ba⁺²</p> <p>PHOSPHATE : Cu⁺², Al⁺³, Fe⁺³, Zn⁺², Mn⁺², Mg⁺², Na⁺, K⁺, NH₄⁺, Co⁺², Ni⁺², Ca⁺², Ba⁺²</p> <p>N.B. Candidate Should Perform The Analysis Of at least 8 Compounds.</p>
ORGANIC ESTIMATIONS (ANY 2)	<p>1- To Determine The Amount Of Acetamide In The Given Solution Hydrolysis By NaOH.</p> <p>2-To Determine The Amount Of Phenol/Aniline In Given Solution By Bromination.</p> <p>3- To Determine The Number Of –COOH Group Of Given Carboxylic Acid.</p> <p>4- Percentage Purity of Ascorbic Acid (Vitamin-C)</p>
ORGANIC PREPARATION (ANY 2)	<p>1-Anthraquinone From Anthracene</p> <p>2-Naphthalene Picrate From Naphthalene</p> <p>3- M-Bromo acetanilide From Acetanilide</p> <p>4- P- Dinitrobenzene From Benzene.</p>
PHYSICAL PRACTICALS (ANY 3)	<p>1-PHASE DIAGRAM To Determine The Phase Diagram Of Phenol Water System.</p> <p>2- ADSORPTION To Study The Adsorption Of Given Organic Acid (Acetic Acid / Oxalic Acid) On Animal Charcoal.</p> <p>3-pH-METRY To Determine The Normality Of Given Mix Acid In (Acetic Acid + Hydrochloric Acid) P^H –Metrically Using Strong Base.</p> <p>4--P^H-METRY To Determine Of Ionisation Constant Of Weak Acid.</p>