

Program Outcomes (PO)

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.

PO-2: To develop critical thinking, students carry out scientific experiments as well as accurately record and analyze the results of such experiments.

PO-3: Students will be skilled in independent problem solving, critical thinking and analytical reasoning as applied to scientific problems.

PO-4: Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.

PO-5: 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, environment, health and medicine.

PO-6: To inculcate the scientific temperament in the students and outside the scientific community.

PO-7: To develop skills in the proper handling of apparatus and chemical. To be exposed to the different processes used in industries and their applications.

Program Specific Outcomes (PSO)

After successful completion of the course the student will be able to:

PSO-1: Have sound knowledge about the fundamentals and applications of chemical and scientific theories.

PSO-2: Demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the subject.

PSO-3: Acquire technical skills required for synthesis, Identification and structural characterization of chemical compounds.

PSO-4: Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories. Handling of basic equipment, acquiring technical skills accurately and effectively communicate scientific ideas in graphic oral and written form.

PSO-5: Be familiar with the different branches of chemistry like analytical, organic, inorganic, physical, environmental and polymer.

PSO-6: Gain knowledge to correlate Chemistry with other disciplines of science;

PSO-7: Help in understanding the causes of environmental pollution and can open up new methods for environmental pollution control.

PSO-8: Develop analytical skills and problem solving skills requiring application of chemical principles.

VIDHYADEEP UNIVERSITY

Anita

Institute Name: Vidhyadeep Institute of Science			Department Name: Chemistry			
Recommended Programs : B.Sc. Chemistry-V						
Course Name	Inorganic Chemistry		Course Code	1091501		
Credit Hours	L	T	P	N	Total Credits	2
		2				
Minimum weeks per Semester	15 (Including Classwork, examination, preparation, holidays etc.)					
Effective From	June 2024					
Prerequisites (if any)	Basic Science					
Course Objectives	<ul style="list-style-type: none"> ✓ To understand distinguish between atomic and molecular orbitals, bonding and antibonding molecular orbitals. ✓ Draw MO energy level diagram for metal complexes and its magnetic properties. ✓ To understand define boron hydride and its classification, Wade's rule, bonding and structure in tetra Boranes. ✓ Study outline thermodynamic stability of metal complexes and factors affecting a stability of metal complexes. ✓ Define and give importance of corrosion, types of corrosion. 					
Course Content	Unit I: Boron Hydride					7 hours
	Introduction, Boron hydride and its classification ,Wade's Rule preparation, properties, structure and bonding in diborane, tetra borane (10), penta borane (9), penta borane (11), hexaborane (10).					
	Unit II: Thermodynamic and Kinetic Aspects of metal complexes					8 hours
Introductions, A brief out line of thermodynamic stability of metal complexes and factors affecting stability of metal complexes, Lablity and inertness. Factors affecting lablity of metal complexes. Labile and inert complexes on the basis of reaction rate, VBT and CFT.						
Unit III: Bonding in Transition Metal Complexes					8 hours	
Introductions Jahn Teller Theorem, Distortion in octahedral complexes. Ligand Field Theory. Molecular energy level diagram and magnetic properties for $[\text{CoF}_6]^{3-}$, $[\text{Co}(\text{NH}_3)_6]^{3-}$, $[\text{FeF}_6]^{3-}$, $[\text{Fe}(\text{CN})_6]^{3-}$ π - bonding in octahedral complexes.						

	<p>Unit IV: Corrosion and its Protection</p> <p>Introductions, Definition and importance of corrosion, Types of corrosion: uniform, pitting, inter crystalline and stress cracking corrosion, electro-chemical theory of corrosion. Protection methods: Coating, Inhibitors (Organic, Inorganic, anodic, cathodic), anodic and cathodic protection.</p>	7 hours
<p>Teaching Methodology</p>	<p>Classwork, Discussion, Self-Study, Seminars and/or Assignment.</p>	
<p>References</p>	<ul style="list-style-type: none"> ✓ Chemical Bonding - an introduction By Rawal, Patel & Patel. ✓ M. R. (2008) Concepts of Genetics, 9th Ed., Benjamin Cummings. ✓ Introduction to Inorganic Chemistry by Durrant and Durrant. ✓ Corrosion Engineering by Fontana M.G. and Green N.D., Mc Graw Hi. ✓ Corrosion and Corrosion Control, Uhlig H., Wiley. ✓ The corrosion and oxidation of metals by Evans U.R. (1961), Arnold, London. ✓ A Text book of Inorganic Chemistry by P.L.Soni. ✓ Structural Inorganic chemistry by A. F. Wells. 	
<p>Course Outcomes</p>	<ul style="list-style-type: none"> ✓ CO-1:To understand distinguish between atomic and molecular orbitals, bonding and antibonding molecular orbitals, different theories of co-ordination chemistry ✓ CO-2:Draw MO energy level diagram for metal complexes and its magnetic properties ✓ CO-3:Define boron hydride and its classification, Wade's rule, bonding and structure in tetra Borane (10), penta borane (9) . ✓ 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 ✓ CO-5:Define and give importance of corrosion, types of corrosion: uniform, pitting, intercrystalline and stress cracking corrosion, electro-chemical theory of corrosion, protection methods and importance of coating, inhibitors (organic, inorganic, anodic, cathodic), anodic and cathodic protection. 	

Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	Knowledge Levels (K ₁ , K ₂ , ..., K ₆)
CO1	Y							Y								K1
CO2			Y						Y							K2
CO3	Y								Y							K3
CO4													Y			K4,K5
CO5				Y									Y			K6

High-3 Medium-2 Low-1

K₁ =>Remember K₂ =>Understand K₃ =>Apply K₄ =>Analyze K₅ =>Evaluate K₆ =>Create

VIDHYADEEP UNIVERSITY

Anita

Institute Name: Vidhyadeep Institute of Science			Department Name: Chemistry			
Recommended Programs : B.Sc. Chemistry-V						
Course Name	Organic Chemistry		Course Code	1091502		
Credit Hours	L	T	P	N	Total Credits	2
		2				
Minimum weeks per Semester	15 (Including Classwork, examination, preparation, holidays etc.)					
Effective From	June 2024					
Prerequisites (if any)	Basic Science					
Course Objectives	<ul style="list-style-type: none"> ✓ To Understand give Different types of mechanism for esterification and hydrolysis: BAC² AAC² AAC¹ AAL¹ BAL². ✓ Study mechanism of formation and hydrolysis of amides and pyrolytic elimination Cope and Chugaev reactions. ✓ To understand Hormons General Introduction, Classification, Structural determinations and Synthesis of Thyroxine and Adrenalene. ✓ To study get introduction to Aromaticity, Huckel's Rule, Aromatic Character of Arenes, Definition & Examples of Aromatic, Non-Aromatic, Anti-Aromatic Compounds. ✓ Study basic concept of Alkaloids, Occurrence and classification of Alkaloids, General methods of determine of their structure, Analytical and synthetic evidence to prove the structure of Nicotine and papavarine. ✓ Introduce drugs, definition of drugs and ideal drugs, classification of drugs based on pharmacological or functions, important synthesis and uses their. 					
Course Content	Unit I: Part-I Reaction Mechanism Introduction, Different types of mechanism for Esterification and Hydrolysis: BAC ² , AAC ² , AAC ¹ , AAL ¹ , Mechanism of formation and hydrolysis of amides, Pyrolytic elimination: Cope and Chugaev reaction. Part-II Organic Name Reaction Knoevenagel Reaction Reformatsky Reaction Claisen Condensation Reaction.					10hours

	<p>Unit II: Aromaticity</p> <p>Introduction to Aromaticity , Huckel’s Rule, Aromatic Character of Arenes ,Definition& Examples of Aromatic, Non-Aromatic, Anti-Aromatic Compounds (Benzenoids andNon-Benzenoids).</p>	5 hours
	<p>Unit III: Alkaloids and Hormons</p> <p>The occurrence ,Classification ,General methods to determine their structure ,Analytical andSynthetic evidence to prove the structure of Nicotine and Papavarine. General Introduction, Classification, Structural determinations and Synthesis of Thyroxine and Adrenalene.</p>	8 hours
	<p>Unit IV Synthetic Drugs</p> <p>Introducation, Classificationbased on pharmacological action ,Synthesis and uses of Amylnitrate,Chloroquine, Pyrimethamine, Sulpha Pyrimidine, Diazepam, Lidocaine, Chlorpropamide, Dapsone, Isoniazide, 5-Fluoro Uracil.</p>	7 hours
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment.	
References	<ul style="list-style-type: none"> ✓ Mechanism and Structure in organic chemistry-Goulde. S. ✓ Reaction mechanism in organic chemistry by Mukhargy & Singh ✓ Principles of reaction mechanism in organic chemistry by Dharmaraha & Chawla ✓ Organic Chemistry by Morrison and Boyd. ✓ Organic reaction mechanism by Bansal Tata Mac. Hill ✓ Organic Chemistry (Vol I & II) 6 th Edn, I. L. Finar ✓ Basic Principles of Organic chemistry, by R. Y. Caserio, W. A. Benjamin ✓ Synthetic drugs by Tyagi and Yadav. ✓ Synthetic Organic Chemistry by O. P. Agarwal ✓ Organic reactions & their mechanism by P. S. Kalsi, New age international publishers. 	
Course Outcomes	<ul style="list-style-type: none"> ✓ CO-1:Give Different types of mechanism for esterification and hydrolysis: BAC²,AAC²,AAC¹, AAL¹,BAL² and mechanism of formation and hydrolysis of amides. pyrolytic elimination reactions. ✓ CO-2:Hormons General Introduction, Classification, Structural determinations and Synthesis of Thyroxine and Adrenalene ✓ CO-3:Get introduction to Aromaticity, Huckel’s Rule, Aromatic Character of Arenes, Definition & Examples of Aromatic, Non-Aromatic, Anti-Aromatic Compounds. ✓ CO-4:Study basic concept of Alkaloids, Occurrence and classification of Alkalodis, General methods of determine of their structure, Analytical and synthetic evidence to prove the structure of Nicotine and papavarine. ✓ CO-5:Introduce drugs, definition of drugs and ideal drugs, classification of drugs based on pharmacological or functions, important synthesis and uses of Amylnitrate, Chloroquine, Pyrimethamine, Sulpha Pyrimidine, Diazepam, Lidocaine, Chlorpropamide, Dapsone, Isoniazide, 5-Fluoro Uracil 	

Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	Knowledge Levels (K ₁ , K ₂ , ..., K ₆)
CO1				Y						Y						K1
CO2	Y												Y			K2
CO3	Y														Y	K3
CO4				Y				Y	Y							K4
CO5						Y							Y			K5,K6

High-3 Medium-2 Low-1

K₁ =>Remember K₂ =>Understand K₃ =>Apply K₄ =>Analyze K₅ =>Evaluate K₆ =>Create

VIDHYADEEP UNIVERSITY

Anita

Institute Name: Vidhyadeep Institute of Science			Department Name: Chemistry			
Recommended Programs : B.Sc. Chemistry-V						
Course Name	Physical Chemistry		Course Code	1091503		
Credit Hours	L	T	P	N	Total Credits	2
		2				
Minimum weeks per Semester	15 (Including Classwork, examination, preparation, holidays etc.)					
Effective From	June 2024					
Prerequisites (if any)	Basic Science					
Course Objectives	<ul style="list-style-type: none"> ✓ To study physical, thermal, flow and mechanical properties and application of various polymers. ✓ To understand and explain partial molal free energy, derive from Gibb's Duhem equation, chemical potential in case of a system of ideal gases, concept of fugacity, fugacity function, fugacity at low pressures, physical significance of fugacity. ✓ Study explain stable and unstable isotopes, separation of isotopes by different methods, gaseous diffusion, thermal diffusion, distillation, chemical exchange methods. 					
Course Content	Unit I: OPEN SYSTEM THERMODYNAMICS Partial molal free energy, (chemical potential), Derivation of Gibb's Duhem Equation, chemical potential in case of a system of ideal gases. Concept of fugacity, Fugacity function, Fugacity at low pressures, Physical significance of fugacity, Graphical method for determination of fugacity, Lewis fugacity rule. Activity and activity coefficient (Only concept). Standard state, Standard state of Solid, Liquid and Gas, Numerical problems.					8 hours
	Unit II: THE THIRD LAW OF THERMODYNAMICS The Nernst Heat Theorem (NHT), limitations of NHT, Statement of The third law of Thermodynamics, Consequence of third law of thermodynamics, Determination of absolute entropy of gases and liquids and solid, Applications of third law of thermodynamics, Exceptions to the third law of thermodynamics, Numerical problems.					7 hours
	Unit III: Electrochemistry Concept of Oxidation and Reduction, Electrochemical series (Reduction series), definition of electrode, half-cell and cell, single electrode potential, sign of electrode potential, standard electrode potential					8 hours

	(oxidation and reduction potential), Electrochemical process, Galvanic cell with example of Daniel cell, EMF of a cell and its measurements, Standard Weston cell, Different types of reversible electrodes, Determination of single electrode potential, Calculation of standard EMF of cell and Determination of cell reaction, Standard Hydrogen Electrode, Calomel electrode and Ag –AgCl electrode. Numerical problems.	
	<p>Unit IV: NUCLEAR CHEMISTRY</p> <p>Stable and unstable isotopes, separation of isotopes by different methods, gaseous diffusion, thermal diffusion, distillation, chemical exchange methods, Bainbridge velocity focusing</p> <p>mass spectrograph, Dempster’s direction focusing mass spectrograph.</p> <p>Particle accelerators : Linear accelerator, Cyclotron, Discovery of artificial disintegration,</p> <p>Classification of nuclear reaction based on overall energy transformations and - particles used as projectiles, Merits and demerits of different projectiles, Numerical problems</p>	7 hours
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment.	
References	<ul style="list-style-type: none"> ✓ Elements of physical chemistry by Glasstone and Lewis ✓ Physical chemistry by G.M. Barrow ✓ Physical chemistry by W. Moore ✓ Physical chemistry by Puri, Pathania, Sharma ✓ Essential of Physical chemistry by Bahl and Bahl ✓ Nuclear chemistry by Arnikar ✓ Electro chemistry by S. Glasstone ✓ Electrochemistry by B.K.Sharma ✓ Physical chemistry by Baliga, Dhavale and Zaveri Vol 1-3. 	
Course Outcomes	<p>CO-1: Understand and explain partial molal free energy, derive from Gibb’s Duhem equation, chemical potential in case of a system of ideal gases, concept of fugacity, fugacity function, fugacity at low pressures, physical significance of fugacity, graphical method for determination of fugacity, Lewis fugacity rule, activity and activity coefficient, standard state of solid, liquid and gas, the Nernst heat theorem, its limitations, statement of the third law of thermodynamics, consequence of third law of thermodynamics, determination of absolute entropy of gases and liquids and solid, applications of third law of thermodynamics, concept of residual entropy, exceptions to the third law of thermodynamics, solve numerical problems related to fugacity, graphical method to determine fugacity and determination of absolute entropy.</p> <p>CO-2: Explain and discuss concept of Oxidation and Reduction, Electrochemical series, definition of half-cell and cell, single electrode potential, sign of electrode potential, standard electrode potential, Electrochemical process, Galvanic cell with example of Daniel cell, EMF of a cell and its measurements, Standard Weston cell, Different types of reversible electrodes, Determination of single electrode potential,</p>	

Calculation of standard EMF of cell and Determination of cell reaction, Standard Hydrogen Electrode, Calomel electrode and Ag-AgCl electrode, Chemical and concentration cell, electrode and electrolyte concentration cell, liquid junction potential (LJP), salt bridge in elimination of LJP, concentration cell with and without transference, Free energy change and Electrical energy, Prediction of spontaneity of cell reaction,
 Relation of standard free energy change with equilibrium constant, Temperature coefficient of EMF of a cell, Entropy change and Enthalpy change of cell reaction. Solve numerical problems related to cell construction from electrochemical reaction, electrode potential, EMF of various types of cell, rate constant, LJP;
CO-3: Explain Stable and unstable isotopes, separation of isotopes by different methods, gaseous diffusion, thermal diffusion, distillation, chemical exchange methods, Bainbridge velocity focusing mass spectrograph, Dempster's direction focusing mass spectrograph, Different types of Particle accelerators e.g. Linear accelerator, Cyclotron, Discovery of artificial disintegration, Classification of nuclear reaction based on overall energy transformations and - particles used as projectiles, Merits and demerits of different projectiles, Numerical problems on Cyclotron.

Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 8	Knowledge Levels (K ₁ , K ₂ , ..., K ₆)
CO1	Y		Y								Y		Y		K ₁ ,K ₂
CO2			Y												K ₃ ,K ₄
CO3		Y										Y			K ₅ ,K ₆

High-3 Medium-2 Low-1

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VIDHYADEEP UNIVERSITY

Anita

Institute Name: Vidhyadeep Institute of Science			Department Name: Chemistry			
Recommended Programs : B.Sc. Chemistry-V						
Course Name	Industrial Chemistry		Course Code	1091504		
Credit Hours	L	T	P	N	Total Credits	2
		2				
Minimum weeks per Semester	15 (Including Classwork, examination, preparation, holidays etc.)					
Effective From	June 2024					
Prerequisites (if any)	Basic Science					
Course Objectives	<ul style="list-style-type: none"> ✓ To Understand define nitration, Nitrating agent, Reaction mechanism of Nitration and Sulphonation, methods of sulphonation, sulphonating agents, mechanism of sulphonation. ✓ To Learn small scale preparation of (1) Safety matches (2) Naphthalene balls (3) Wax candles (4) Shoe polish (5) Writing/ fountain pen ink (6) Chalk crayons (7) Plaster of paris. ✓ Study manufacture of Freon-12 from fluorspar, Manufacture of freon-12 from vinylidene fluoride. ✓ To Understand define amination, Amination by reduction and Amination by amonolysis. 					
Course Content	Unit I: Unit process-I (A) Nitration Definition, Nitrating agent, Reaction mechanism of Nitration. Nitration of Acetylene, Benzene, Toluene and Naphthalene, Artificial perfumes: Musk xylene, Musk ketone, Musk ambrette, Explosives: Trinitrophenol, Trinitrotoluene, Trinitro glycerine, Emitol.					8 hours
	(B) Sulphonation Definition, Sulphonating agents, Mechanism of sulphonation. Sulphonation of Benzene, Toluene and Anthracene, Preparation of Phenol and Resorcinol from benzene. Importance of Sulphonation reaction in industry in the manufacture of Saccharine, Chloramine T and Alizarine Red S.					
	Unit II: Unit Process-II Introductions, Definition, Amination by reduction: Metal - Acid reduction (strong and weak), Metal - Alkali reduction (strong and weak), Catalytic reduction. Amination by ammonolysis : Amination of Chlorobenzene, Phenol & Benzene sulphonic acid. Importance of amination in the manufacture of Bismark Brown G dye					8 hours

	from mphenylene diamine, Synthetic fibre (Nylon 6,6) from HMDA, Methyl Red Indicator from Anthranilic acid, Cyclonite explosive from Hexamethylene tetramine.	
	<p>Unit III: Fluorocarbons</p> <p>Introduction, Nomenclature of chloro fluoro derivatives of Methane & Ethane, General methods of preparation, Properties and Uses of Fluoro carbons. Manufacture of Freon-12 from fluorspar, Manufacture of Freon-12 from Vinylidene fluoride. Pollution hazards of Fluorocarbons.</p>	7 hours
	<p>Unit IV: Some small scale preparation of</p> <p>(1) Safety matches (2) Naphthalene balls (3) Wax candles (4) Shoe polish (5) Writing/ fountain pen ink (6) Chalk crayons (7) Plaster of paris.</p>	7 hours
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment.	
References	<ul style="list-style-type: none"> ✓ Vogel's Text Book Inorganic Quantitative Analysis, 6th ed. ✓ Industrial Chemistry by Clerk Ranken; Andesite press. ✓ Industrial Chemistry by B.K.Sharma Goel Pub. ✓ Quantitative Analysis by R.A.Day & A.L.Underwood, 6th ed. Pub. Prentice Hall of India ltd. ✓ Unit Process in Organic Synthesis by D.H.Groggins. ✓ Reigel's Industrial Chemistry Ed. by James A. Kent. 	
Course Outcomes	<ul style="list-style-type: none"> ✓ CO-1: Define nitration, Nitrating agent, Reaction mechanism of Nitration. Nitration of acetylene, nitration of Benzene, Nitration of Naphthalene, Nitration of Toluene, Artificial perfumes: Musk xylene, Musk ketone, Musk ambrette. Explosives: Trinitrophenol, Trinitrotoluene, Trinitro glycerine, Emitol. ✓ CO-2: Define Sulphonation, methods of sulphonation, sulphonating agents, mechanism of sulphonation. Sulphonation of Benzene, Toluene, & Anthracene, Preparation of Phenol and Resorcinol from benzene, Importance of Sulphonation reaction in industry in the manufacture of Saccharine, Chloramine T and Alizarine Red. ✓ CO-3: Learn small scale preparation of (1) Safety matches (2) Naphthalene balls (3) Wax candles (4) Shoe polish (5) Writing/ fountain pen ink (6) Chalk crayons (7) Plaster of paris. ✓ CO-4: Study manufacture of Freon-12 from fluorspar, Manufacture of freon-12 from vinylidene fluoride. 	

Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	Knowledge Levels (K ₁ , K ₂ , ..., K ₆)
CO1		Y		Y			Y		Y						Y	K ₁
CO2		Y		Y			Y				Y				Y	K ₂ ,K ₃
CO3		Y														K ₄ ,K ₅
CO4	Y							Y								K ₆

High-3 Medium-2 Low-1

K₁ =>Remember K₂ =>Understand K₃ =>Apply K₄ =>Analyze K₅ =>Evaluate K₆ =>Create

VIDHYADEEP UNIVERSITY

Anita

Institute Name: Vidhyadeep Institute of Science			Department Name: Chemistry			
Recommended Programs : B.Sc. Chemistry-V						
Course Name	Analytical Chemistry		Course Code	1091505		
Credit Hours	L	T	P	N	Total Credits	2
		2				
Minimum weeks per Semester	15 (Including Classwork, examination, preparation, holidays etc.)					
Effective From	June 2024					
Prerequisites (if any)	Basic Science					
Course Objectives	<ul style="list-style-type: none"> ✓ To Study get introduction to chemical and instrumental Analysis, advantages and disadvantages, Overview of methods used in Quantitative analysis in different physical state. ✓ To Study factors affecting solubility of precipitates, the precipitation process, nucleation growth, Von Weimarn's theory of relative super saturation. digestion of precipitates. ✓ To Understand factors affecting quality of precipitate. ✓ To understand explain EDTA titration, absolute and conditional stability constant, distribution of various species of EDTA as function of pH, absolute and conditional stability constants. 					
Course Content	Unit I: INTRODUCTION TO ANALYTICAL CHEMISTRY Chemical and Instrumental Analysis (advantages and disadvantages) Overview of methods used in Quantitative analysis (classification of classical and instrumental analysis), Factors affecting the choice of analytical methods (in brief), Step in quantitative analysis (Flow diagram), Analytical methods on the basis of Sample size (in brief), Sampling methods. Sampling in different physical states.					8 hours
	Unit II: ACID BASE TITRATION Different terms for titrant, titrant, analyte, end point and equivalence point. Theory of acid base indicators. Indicator range. Selection of proper indicators Calculation of pH at different stages of titrations of monobasic and dibasic acid with strong base Construction of titration curve, Titration of carbonate mixture and amino acids, Examples.					7 hours

	<p>Unit III: COMPLEXOMETRIC TITRATIONS</p> <p>EDTA titration, Absolute and conditional stability constant, Distribution of various species of EDTA as function of pH. Derivation of factors: α_4 for effect of pH, β_4 for the effect of auxiliary complexing agent. Construction of Titration curves: Theory of metallochromic indicators, Masking, Demarking and kinetic masking. Types of EDTA titrations, Examples.</p>	8 hours
	<p>Unit IV: GRAVIMETRIC ANALYSIS</p> <p>Factors affecting solubility of precipitates. (1) Common ion (2) Diverse ions (3) pH (4) Hydrolysis (5) Complex formation (With Numerical problems) The precipitation process. Nucleation growth. Von Weimarn's theory of relative supersaturation. Digestion of precipitates Factor affecting quality of precipitate: Co-precipitation and post precipitation Precipitation from homogeneous solution with Illustration of Barium and Aluminium. Thermogravimetry, general principle. General applications of TGA : Determination of purity and thermal stability of primary and secondary standards, determination of correct drying temperature, determination of curie point, automatic determination of mixtures, analysis of alloys, Specific application in analysis of (1) $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ (2) $\text{MgC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ [No instrumentation].</p>	7 hours
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment.	
References	<ul style="list-style-type: none"> ✓ Vogel's Text Book Inorganic Quantitative Analysis, 6 th ed. ✓ Analytical Chemistry (Principles & Technique) by Lary G. Hargis. ✓ Fundamental of Analytical Chemistry by Skoog D. A. & West D. M. ✓ Holler F.J. Instrumental Methods of Analysis by B. K. Sharma ✓ Instrumental analysis by R.D. Braun Mc Graw Hill. 	
Course Outcomes	<ul style="list-style-type: none"> ✓ CO-1: Get introduction to chemical and instrumental Analysis, advantages and disadvantages, Overview of methods used in Quantitative analysis, classification of classical and instrumental analysis, factors affecting the choice of Analytical Method (in brief), step in quantitative analysis (Flow diagram), Analytical methods on the basis of Sample size (in brief), Sampling methods. Sampling in different physical state ✓ CO-2: Study factors affecting solubility of precipitates: (1) common ion (2) diverse ions (3) pH (4) hydrolysis (5) complex formation, the precipitation process, nucleation growth, Von Weimarn's theory of relative super saturation. digestion of precipitates. ✓ CO-3: Factors affecting quality of precipitate: Co-precipitation and post precipitation, Precipitation from homogeneous solution with illustration of barium and aluminum; thermogravimetry, general principle, application with following two specific examples (1) $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ (2) $\text{MgC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ ✓ CO-4: Explain EDTA titration, absolute and conditional stability constant, distribution of various species of EDTA as function of pH, absolute and 	

conditional stability constants, derivation of factors: α_4 for effect of pH, β_4 for the effect of auxiliary complexing agent, construction of titration curves: theory of metallochromic indicators, masking, demasking and kinetic masking, types of EDTA titrations.

Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	Knowledge Levels (K ₁ , K ₂ , ..., K ₆)
CO1		Y		Y							Y				Y	K ₁ ,K ₂
CO2		Y		Y												K ₃ ,K ₄
CO3			Y									Y				K ₅
CO4		Y	Y												Y	K ₆

High-3 Medium-2 Low-1

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VIDHYADEEP UNIVERSITY

Anita

Institute Name: Vidhyadeep Institute of Science			Department Name: Chemistry			
Recommended Programs : B.Sc. Chemistry-V						
Course Name	General Chemistry		Course Code	1091506		
Credit Hours	L	T	P	N	Total Credits	2
		2				
Minimum weeks per Semester	15 (Including Classwork, examination, preparation, holidays etc.)					
Effective From	June 2024					
Prerequisites (if any)	Basic Science					
Course Objectives	<ul style="list-style-type: none"> ✓ To study get introduction to chemical and instrumental Analysis, advantages and disadvantages, Overview of methods used in Quantitative analysis. ✓ To understand define and explain error and types of errors. ✓ To study factors affecting solubility of precipitates. ✓ To understand calculate pH at different stages of titrations of monobasic and dibasic acid with strong base construction of titration curve, titration of carbonate mixture, numerical 					
Course Content	Unit I: IR SPECTROSCOPY IR absorption spectroscopy: Terms, Instrumentation, Molecular vibrations, Hook's law, Selection rules, Intensity and position of IR bands. Measurement of IR spectrum, Finger print region, Characteristics absorption of various functional groups. Application of IR spectra. Factors influencing IR vibrational frequency.					7 hours
	Unit II: LABORATORY HYGENE AND SAFETY Handling of chemicals [Carcinogenic chemical, Toxic and poisonous chemicals], List of Hazardous chemicals. General procedure for avoiding accidents [Apron, Safety goggles, Gloves pipetting process] First aid technique [Organic substance in skin, Acid on clothing, Burns in eyes, Inhalation of toxic vapors etc...] Colour codes and symbols for safety in chemical plants (i) classification of colour codes and symbols (ii) colour codes for gas cylinders and (iii) colour codes for pipelines.					7 hours

	<p>Unit III: CHEMISTRY OF COSMETICS AND PERFUMES</p> <p>A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, suntan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours. Essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, sandalwood oil, eucalyptus, rose oil, 2-phenyl ethyl alcohol, Jasmine, Civetone, Muscone.</p>	8 hours
	<p>Unit IV: UNITS OF SOLUTION AND STANDARD SOLUTION</p> <p>Definitions of terms: Solute, Solvent, and Solution Composition of solution- normal solution, molar solution, molal solution, mole fraction, % solution, saturated, unsaturated and supersaturated solution and solubility. Effect of temp. on various units of concentration. Inter conversion of one unit into another unit. Preparation of solutions of some primary standard substances (e.g. Oxalic acid, succinic acid, KHP, K₂Cr₂O₇, As₂O₃) Standardisation of the following solution using primary standard solutions/ standardised solution:</p> <ol style="list-style-type: none"> 1. NaOH/KOH 2. I₂ solution 3. KMnO₄ 4. Acids 5. Na₂S₂O₃ solution. 	8 hours
<p>Teaching Methodology</p>	<p>Classwork, Discussion, Self-Study, Seminars and/or Assignment.</p>	
<p>References</p>	<ul style="list-style-type: none"> ✓ Elementary Organic Spectroscopy by Y.L.Sharma. ✓ Organic Spectroscopy by K.K.Sharma. ✓ Quantitative analysis by R.A. Day and A.L. Underwood. ✓ Elements of Analytical Chemistry by R. Gopalan ; P. S. Subramanian and K. Rengarajan. ✓ Vogel's qualitative inorganic analysis. ✓ Vogel's qualitative organic analysis. ✓ E. Stocchi: Industrial Chemistry, Vol -I, Ellis Horwood Ltd. UK. ✓ P.C. Jain, M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi. 	
<p>Course Outcomes</p>	<p>CO-1: define spectroscopy, wavelength, frequency of radiation, wave number and classify spectroscopy atomic and molecular spectroscopy, different region of IR radiation.</p> <p>CO-2: describe instrumentation of IR spectroscopy, preparation of sample for IR spectroscopy, stretching vibration of different molecule and explain effect of IR radiation on matter, factors affecting on absorption frequencies.</p> <p>CO-3: calculate estimated absorption frequencies for various functional groups.</p> <p>CO-4: understand laboratory hygiene and safety, handling of chemicals, general procedure for avoiding accidents, first aid techniques;</p> <p>CO-5: define terms: solute, solvent, and solution composition of solution-normal solution, molar solution, molal solution, mole fraction, % solution, saturated, unsaturated and supersaturated solution and solubility, effect of temperature on various units of concentration, interconversion of one unit into another unit,</p>	

preparation of solutions of some primary standard substances, standardization of the solution using primary standard solutions/standardized solution.

Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	Knowledge Levels (K ₁ , K ₂ , ..., K ₆)
CO1		Y		Y				Y								K1
CO2		Y		Y									Y			K2
CO3	Y	Y					Y									K3,K4
CO4		Y		Y							Y					K5
CO5			Y				Y						Y			K6

High-3 Medium-2 Low-1

K₁ =>Remember K₂ =>Understand K₃ =>Apply K₄ =>Analyze K₅ =>Evaluate K₆ =>Create

VIDHYADEEP UNIVERSITY

Anita

Institute Name: Vidhyadeep Institute of Science			Department Name: Chemistry			
Recommended Programs : B.Sc. Chemistry-V						
Course Name	Chemistry Practicals		Course Code	1093507		
Credit Hours	L	T	P	N	Total Credits	2
		2				
Minimum weeks per Semester	15 (Including Classwork, examination, preparation, holidays etc.)					
Effective From	June 2024					
Prerequisites (if any)	Basic Science					
Course Objectives	<ul style="list-style-type: none"> ✓ To provide students with practical skills and knowledge in performing volumetric analysis, including the principles, techniques and calculations involved in accurate titrations. ✓ To study angle of rotation as well as specific rotation of optically polar substances using polarimetry. ✓ To understand develop laboratory skills for the purpose handling different instruments, interpretation of results of experiments and their correlation with theory. ✓ To get training in the quantitative analysis using gravimetric method. ✓ To study develop skills required for the qualitative analysis of organic mixture. 					
Course Content	<p><u>1. INORGANIC QUALITATIVE ANALYSIS</u></p> <p>LIST OF INORGANIC CHEMICALS USED FOR INORGANIC QUALITATIVE ANALYSIS</p> <p>CHLORIDES- Cu^{+2}, Cd^{+2}, Fe^{+3}, Mn^{+2}, Co^{+2}, Ni^{+2}, Ca^{+2}, Ba^{+2}, Sr^{+2}, Na^{+1}, K^{+1}, NH_4^{+1}.</p> <p>BROMIDES- Sr^{+2}, Na^{+1}, K^{+1}, NH_4^{+1}</p> <p>IODIDE – K^{+1}</p> <p>NITRITE – Na^{+1}, K^{+1}</p> <p>NITRATE – Co^{+2}, Ni^{+2}, Ba^{+2}, Sr^{+2}, Na^{+1}, K^{+1}, NH_4^{+1}</p> <p>SULPHITE – Na^{+1}</p> <p>SULPHIDE – Zn^{+2}, Sb^{+3}</p> <p>SULPHATE – Cu^{+2}, Cd^{+2}, Al^{+3}, Fe^{+2}, Zn^{+2}, Mn^{+2}, Co^{+2}, Ni^{+2}, Mg^{+2}, Na^{+1}, K^{+1}, NH_4^{+1}</p> <p>CARBONATE – Cu^{+2}, Cd^{+2}, Zn^{+2}, Mn^{+2}, Co^{+2}, Ni^{+2}, Ca^{+2}, Ba^{+2}, Sr^{+2}, Mg^{+2}, Na^{+1}, K^{+1}, NH_4^{+1}</p> <p>PHOSPHATE - Cu^{+2}, Al^{+3}, Fe^{+3}, Zn^{+2}, Mn^{+2}, Co^{+2}, Ni^{+2}, Ca^{+2}, Ba^{+2}, Sr^{+2}, Mg^{+2}, Na^{+1}, K^{+1}, NH_4^{+1}</p> <p>BORATE- Boric Acid</p>					20hours

	<p>Inorganic qualitative analysis of a mixture containing three positive and three negative radicals. The mixture may be soluble in water or dilute hydrochloric acid or concentrated hydrochloric acid including Chromate and Borate. N. B. Candidate should perform the analysis of at least 06 mixtures.</p>	
	<p><u>2.ORGANIC ESTIMATIONS (Any Three)</u></p> <ol style="list-style-type: none"> 1. Determination of saponification value of an oil. 2. Determination of percentage purity of Aspirin. 3. Determination of amount of Ethyl acetate in the given solution. 4. Determination of amount of Glycine in the given solution. 5. Determination of amount of Formaldehyde in given solution. (Instead of sample weighing, solutions to be given) 	10hours
	<p>3.CHROMATOGRAPHY(Any Two) Chromatographic separation of amino acid mixture by ascending paper chromatography</p> <ol style="list-style-type: none"> 1. Glycine + Methionine 2. Alanine + Methionine 3. Alanine + Valine 	10 hours
	<p>4. PHYSICAL EXERCISE(Any Four)</p> <ol style="list-style-type: none"> 1. To investigate rate of reaction between $K_2S_2O_8$ and KI, $a = b, a \neq b$. 2. To investigate rate of reaction between H_2O_2 and KI, $a = b$. 3. pH metry: To determine the dissociation constant of weak acid (CH_3COOH) and weak base (NH_4OH) by different dilutions. 4. Conductometry: To determine the amount of NaCl in the given solution using $AgNO_3$ solution. 5. Potentiometry: To determine the solubility and solubility product of sparingly soluble salt AgCl by the titration of $AgNO_3$ and NaCl. 	20 hours
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment.	
References	<ul style="list-style-type: none"> ✓ Elements of physical chemistry by Glasstone and Lewis ✓ Physical chemistry by G.M. Barrow ✓ Physical chemistry by W. Moore ✓ Organic Chemistry by Morrison and Boyd. ✓ Organic reaction mechanism by Bansal Tata Mac. Hill ✓ Organic Chemistry (Vol I & II) 6 th Edn, I. L. Finar ✓ Basic Principles of Organic chemistry, by R. Y. Caserio, W. A. Benjamin. ✓ Vogel's qualitative inorganic analysis. ✓ Vogel's qualitative organic analysis. 	
Course Outcomes	CO-1: study and justify kinetics of 2nd order reactions practically; CO-2: study precipitation titration, mix acid titration using conductivity meter;	

CO-3: determine degree of dissociation and dissociation constant of weak monobasic acid using pH metry;

CO-4: determine solubility and solubility product of sparingly soluble salt using potentiometry;

CO-5: study angle of rotation as well as specific rotation of optically polar substances using polarimeter;

CO-6: maintain records of chemical and instrumental analysis. Develop laboratory skills for the purpose of collecting, interpreting, analyzing, practical data;

CO-7: develop laboratory skills for the purpose handling different instruments, interpretation of results of experiments and their correlation with theory;

CO-8: get training in the quantitative analysis using gravimetric method;

CO-9: develop skills required for the qualitative analysis of organic mixture.

Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8	Knowledge Levels (K ₁ , K ₂ , ..., K ₆)
CO1		Y					Y				Y					K1
CO2		Y					Y									K1
CO3		Y		Y			Y				Y					K2
CO4		Y									Y					K3
CO5		Y									Y					K2
CO6		Y					Y									K4
CO7		Y					Y									K5
CO8		Y		Y			Y									K5
CO9		Y		Y						Y						K6

High-3 Medium-2 Low-1

K₁ =>Remember K₂ =>Understand K₃ =>Apply K₄ =>Analyze K₅ =>Evaluate K₆ =>Create

VIDHYADEEP UNIVERSITY

Anita

Institute Name: Vidhyadeep Institute of Science			Department Name: Chemistry			
Recommended Programs : B.Sc. Chemistry-V						
Course Name	Petrochemicals		Course Code	1093508		
Credit Hours	L	T	P	N	Total Credits	2
		2				
Minimum weeks per Semester	15 (Including Classwork, examination, preparation, holidays etc.)					
Effective From	June 2024					
Prerequisites (if any)	Basic Science					
Course Objectives	<ul style="list-style-type: none"> ✓ To understand Composition, Natural gas as Petrochemical feed stock, Crude oil. ✓ Study Petrochemicals obtained from C₁cut of petroleum manufacture and application. ✓ To understand Natural fuels and Synthetic fuels. 					
Course Content	Unit I: Natural gas and Crude oil Introducation, Natural gas :Composition, Natural gas as Petrochemical feed stock, Crude oil: Composition, Distillation cracking corrosion, electro-chemical theory of corrosion, protection methods and importance and Refining, Utilization of various fractions (oil product).					7 hours
	Unit II: Three Generation of Petrochemicals Introducation, First, Second and Third generation petrochemicals. Conversion process: Cracking reforming, Isomerisation, Hydrogenation, Alkylation and Hydrodealkylation, Dehydrocyclisation of petroleum products, Polymerization of gaseous hydrocarbons.					7 hours
	Unit III:Petrochemicals obtained from C₁ Petrochemicals obtained from C ₁ cut of petroleum manufacture and application of Methanol, Synthesis gas, Ammonia, HCN,Formaldehyde, Hexamethylene tetramine, Chlorinated methanes, Perchloro ethylene.					8 hours
	Unit IV: Industrial Fuels Introducatio ,Natural fuels, Synthetic fuels, Hydrogen- Fuel of tomorrow, Fuel for rocket (Hydrazine).					8 hours

Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment.
References	<ul style="list-style-type: none"> ✓ Introduction to petrochemicals by Sukumar Maiti oxford and IBH pubs co. New Delhi. ✓ A text on petrochemicals by Dr. B. K. Bhaskar Rao, Khanna pubs. New Delhi. ✓ Chemicals from petroleum by A. L. Wadams (ELBS and John Murray London) ✓ Petrochemicals by S. L. Venkatewarn (Colour pubs. Pvt. Ltd. Bombay) ✓ Petrochemicals digest by MGK Manon (Asia Publishing house Bombay) ✓ Synthetic dyes by G. R. Chatwal, Himalaya Publishers. ✓ Synthetic Drugs by G. R. Chatwal, Himalaya Publishers.
Course Outcomes	<p>CO-1: source of petrochemicals, natural gas: composition, natural gas as petro-chemical feed stock, crude oil: composition, distillation, and refining, utilization of various fractions.</p> <p>CO-2: classify petrochemicals, first, second and third generation petrochemicals, conversion process: cracking reforming, isomerisation, hydrogenation, alkylation and hydrodealkylation, dehydrocyclisation of petroleum products, polymerization of gaseous hydrocarbons.</p> <p>CO-3: study Petrochemicals obtained from C₁ cut of petroleum manufacture and application of methanol, synthesis gas, ammonia, HCN, formaldehyde, hexamethylenetetramine, chlorinated methanes, per chloroethelene.</p> <p>CO-4: Industrial fuels, Natural fuels, synthetic fuels, hydrogen fuel of tomorrow, fuel for rocket, Intermediates of Pharmaceuticals and Dyes.</p>

Mapping of Course outcome with Program Outcomes, PSO's, and Knowledge Levels (As per Blooms Taxonomy)

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	Knowledge Levels (K ₁ , K ₂ , ..., K ₆)
CO1		Y					Y				Y			Y		K1
CO2		Y		Y					Y							K2
CO3	Y												Y		Y	K2
CO4		Y			Y						Y				Y	K3

High-3 Medium-2 Low-1

K₁ =>Remember K₂ =>Understand K₃ =>Apply K₄ =>Analyze K₅ =>Evaluate K₆ =>Create