D.B.F. Dayanand College of Arts and Science, Solapur

COURSE OUTCOME

Name of Department: Chemistry

D.B.F. Dayanand College of Arts and Science, Solapur

COURSE OUTCOME

Name of Department: Chemistry

B.Sc. II		
NAME OF SUBJECT: Organic Chemistry		
SEM III		
COURSE NUMBER (PAPER NUMBER): P-V		
TITLE OF COURSE (NAME OF PAPER): Organic Chemistry		
COURSE CONTENT	**OBJECTIVES**	**OUTCOME**
○ **Spectroscopic Methods Ultra-Violet (UV) absorption :** Introduction to Spectroscopy, Beer – Lambert law (mathematical derivation not expected), Types of electronic transitions, Terms used in UV spectroscopy: Chromophore, Auxochrome, BathocromicHypsochromic, Hypochromic and Hyperchromic shifts, Effect of conjugation on position of UV and visible bands. Calculation of _max by Woodward-Fieser rules for conjugated dienes and enones. Applications of UV spectroscopy – Determination of structure and stereochemistry (cis and trans) spectral problems based on UV.	**To study** Introduction to Spectroscopy, Beer – Lambert law (mathematical derivation not expected), Types of electronic transitions, Terms used in UV spectroscopy: Chromophore, Auxochrome, BathocromicHypsochromic, Hypochromic and Hyperchromic shifts, Effect of conjugation on position of UV and visible bands. Calculation of _max by Woodward-Fieser rules for conjugated dienes and enones. Applications of UV spectroscopy – Determination of structure and stereochemistry (cis and	**Student understands the concepts:** Beer – Lambert law, Types of electronictransitions, Terms used in UV spectroscopy: Chromophore, Auxochrome, BathocromicHypsochromic, Hypochromic and Hyperchromic shifts, Effect of conjugation on position of UV and visible bands. **Students are able to solve** the problems related UV spectroscopy.
2. Stereochemistry (8) 2.1. Geometrical isomerism : Introduction,	**To study the** **2.1. Geometrical**	**Students gain an understanding of :** Types of stereoisomerism, their examples, Enantiomers and

Geometrical isomerism in aldoximes and ketoximes, configuration of ketoximes-Beckmann transformation (Mechanism & Proof are not expected) configuration of aldoximes. **2.2. Conformational Isomerism :** Introduction, conformation of ethane and n-butane and their representation by using Saw-Horse, Fischer (dotted Wedge line) and Newmann's projection formulae. **2.3.** Conformational analysis of ethane and n-butane with the help of energy profile diagrams. **2.4.** Nomenclature – D & L, R & S, E & Z systems	**isomerism :** Introduction, Geometrical isomerism in aldoximes and ketoximes, configuration of ketoximes-Beckmann transformation (Mechanism & Proof are not expected) configuration of aldoximes. **2.2. Conformational Isomerism :** Introduction, conformation of ethane and n-butane and their representation by using Saw-Horse, Fischer (dotted Wedge line) and Newmann's projection formulae. **2.3.** Conformational analysis of ethane and n-butane with the help of energy profile diagrams. **2.4.** Nomenclature – D & L, R & S, E & Z systems	diastereoisomers. Racemic modification. Geometrical isomerism-cause of geometrical isomerism. Geometrical isomerism w.r.t. C = C Geometrical isomerism in maleic acid and fumaric acid.
3. Alcohols and Phenols (8) **3.1. Alcohols : Introduction** i. Dihydric alcohols : Nomenclature, Methods of formation of ethylene glycol from ethylene, ethylene dibromide and ethylene oxide, physical properties & chemical reactions of ethylene glycol – acidic nature, reaction with hydrogen halide, oxidation – lead acetate, HIO_4 and nitric acid, Uses of ethylene glycol. Pinacol formation, Pinacol-Pinacolone rearrangement and its mechanism. ii. Trihydric alcohols : Nomenclature, Methods of formation of glycerol – from fats and oils physical properties. Chemical reactions of glycerol –	**To study the** i. Dihydric alcohols : Nomenclature, Methods of formation of ethylene glycol from ethylene, ethylene dibromide and ethylene oxide, physical properties & chemical reactions of ethylene glycol – acidic nature, reaction with hydrogen halide, oxidation – lead acetate, HIO_4 and nitric acid, Uses of ethylene glycol. Pinacol formation, Pinacol-Pinacolone rearrangement and its mechanism. ii. Trihydric alcohols : Nomenclature, Methods of formation of glycerol – from fats and oils physical properties. Chemical reactions of glycerol – reaction with electropositive metals,	**Students gain an understanding of :** To study the acyclic aliphatic and aromatic alcohols Also the study Mono, Di, Tri- hydric alcohols Synthesis of phenols and alcohols Applications of aliphatic and aromatic alcohols

reaction with electropositive metals, reaction with hydrogen halideHCl and HI Reaction with conc. nitric acid in presence of conc. sulphuric acid. Reactions with potassium hydrogen sulphate, esterification, oxidation. Uses of glycerol. **3.2. Phenols :** Introduction, Reactions of phenol (carbolic acid) : i. Acylation and Fries rearrangement ii. Ether formation and claisen rearrangement iii. Gattermann Synthesis iv. Carboxylation – Kolbe's reaction v. Reimer – Tiemann reaction and its mechanism.	reaction with hydrogen halideHCl and HI Reaction with conc. nitric acid in presence of conc. sulphuric acid. Reactions with potassium hydrogen sulphate, esterification, oxidation. Uses of glycerol. **3.2. Phenols :** Introduction, Reactions of phenol (carbolic acid) : i. Acylation and Fries rearrangement ii. Ether formation and claisen rearrangement iii. Gattermann Synthesis iv. Carboxylation – Kolbe's reaction v. Reimer – Tiemann reaction and its mechanism.	
4. Aldehydes and Ketones Introduction, Nomenclature, structure and reactivity of the carboxyl group. Mechanism of nucleophilic additions to carbonyl group. Study of following reactions with mechanism 1) Aldol condensation (base catalysed), 2) Perkin reaction, 3) Cannizzaro's reaction, 4) Knoevenagel reaction 5) benzoin condensation.	**To study** Nomenclature, structure and reactivity of the carboxyl group. Mechanism of nucleophilic additions to carbonyl group. Study of following reactions with mechanism 1) Aldol condensation (base catalysed), 2) Perkin reaction, 3) Cannizzaro's reaction, 4) Knoevenagel reaction 5) benzoin condensation.	**Students gain an understanding of :** Nomenclature, structure and reactivity of the carboxyl group. Mechanism of nucleophilic additions to carbonyl group. Study of following reactions with mechanism 1) Aldol condensation (base catalysed), 2) Perkin reaction, 3) Cannizzaro's reaction, 4) Knoevenagel reaction 5) benzoin condensation`
5. Ethers and Epoxides **5.1. Ethers :** Introduction, Nomenclature, Methods of formation of anisole by Williamson's synthesis and from diazomethane, chemical	**To study** **5.1. Ethers :** Introduction, Nomenclature, Methods of formation of anisole by Williamson's synthesis and from diazomethane, chemical	**Students gain an understanding of :** **Ethers :** Nomenclature, Methods of formation of anisole by Williamson's synthesis and from diazomethane, chemical reactions of anisole with HI, Gravimetric estimation of $-OCH_3$ group by Ziesel's

reactions of anisole with HI, Gravimetric estimation of $-OCH_3$ group by Ziesel's method (Related problems are expected based on % of $-OCH_3$ and number of $-OCH_3$ groups). **5.2. Epoxides :**Introduction, Nomenclature, commercial method of preparation of ethylene oxide. Acid and base catalysed ring opening of ethylene oxide, reactions of Grignard and organolithium reagents with ethylene oxide.	reactions of anisole with HI, Gravimetric estimation of $-OCH_3$ group by Ziesel's method (Related problems are expected based on % of $-OCH_3$ and number of $-OCH_3$ groups). **5.2. Epoxides :**Introduction, Nomenclature, commercial method of preparation of ethylene oxide. Acid and base catalysed ring opening of ethylene oxide, reactions of Grignard and organolithium reagents with ethylene oxide.	method (Related problems are expected based on % of $-OCH_3$ and number of $-OCH_3$ groups). **Epoxides :**Introduction, Nomenclature, commercial method of preparation of ethylene oxide. Acid and base catalysed ring opening of ethylene oxide, reactions of Grignard and organolithium reagents with ethylene oxide.
6. Carboxylic acids (7) **6.1.** Monocarboxylic acids : Introduction. Methods of formation of Halo acids, di- and trichloroacetic acid by HVZ reaction, substitution reactions of monochloroacetic acid by nucleophiles CN^-, OH^-, I^-, and NH_3. **6.2.** Hydroxyacids : Malic acid and citric acid, Methods of formation of malic acid from acid and moist Ag_2O. Reactions of malic acid – action of heat, oxidation reaction and reaction with HI, uses of malic acid. Methods of formation of citric acid from glycerol. Reactions of citric acid. Acetylation with acetic anhydride reduction by HI, Action of heat at 422^0K. Uses of citric acid. **6.3.** Unsaturated acids : Methods of formation of acrylic acid from acrolein and by dehydration of _-hydroxyl	**To study** **6.1.** Monocarboxylic acids : Introduction. Methods of formation of Halo acids, di- and trichloroacetic acid by HVZ reaction, substitution reactions of monochloroacetic acid by nucleophiles CN^-, OH^-, I^-, and NH_3. **6.2.** Hydroxyacids : Malic acid and citric acid, Methods of formation of malic acid from acid and moist Ag_2O. Reactions of malic acid – action of heat, oxidation reaction and reaction with HI, uses of malic acid. Methods of formation of citric acid from glycerol. Reactions of citric acid. Acetylation with acetic anhydride reduction by HI, Action of heat at 422^0K. Uses of citric acid. **6.3.** Unsaturated acids : Methods of formation of acrylic acid from acrolein and by dehydration of _-hydroxyl	**Students gain an understanding of :** Monocarboxylic acids : Introduction. Methods of formation of Halo acids, di- and trichloroacetic acid by HVZ reaction, substitution reactions of monochloroacetic acid by nucleophiles CN^-, OH^-, I^-, and NH_3. Hydroxyacids : Malic acid and citric acid, Methods of formation of malic acid from acid and moist Ag_2O. Reactions of malic acid – action of heat, oxidation reaction and reaction with HI, uses of malic acid. Methods of formation of citric acid from glycerol. Reactions of citric acid. Acetylation with acetic anhydride reduction by HI, Action of heat at 422^0K. Uses of citric acid. Unsaturated acids : Methods of formation of acrylic acid from acrolein and by dehydration of _-hydroxyl propionic acid. Reactions of acrylic acid – Addition of H_2O reduction by Na / C_2H_5OH. Uses of acrylic acid. Methods of formation of cinnamic acid from benzaldehyde using diethyl malonate and by using acetic anhydride and sodium acetate. Reactions of cinnamic acid – bromination, oxidation. Uses of cinnamic acid. Dicarboxylic acids : Succinic and phthalic acids. Methods of formation of succinic acid

propionic acid. Reactions of acrylic acid – Addition of H_2O reduction by Na / C_2H_5OH. Uses of acrylic acid. Methods of formation of cinnamic acid from benzaldehyde using diethyl malonate and by using acetic anhydride and sodium acetate. Reactions of cinnamic acid – bromination, oxidation. Uses of cinnamic acid. **6.4.** Dicarboxylic acids : Succinic and phthalic acids. Methods of formation of succinic acid from ethylene bromide, maleic acid. Reactions of succinic acid – action of heat, action of $NaHCO_3$, C_2H_5OH in presence of acid. Uses of succinic acid. Methods of formation of phthalic acid from o-xylene and naphthalene Reactions of phthalic acid – action of heat, reaction with sodalime, NH_3. Uses of phthalic acid.	propionic acid. Reactions of acrylic acid – Addition of H_2O reduction by Na / C_2H_5OH. Uses of acrylic acid. Methods of formation of cinnamic acid from benzaldehyde using diethyl malonate and by using acetic anhydride and sodium acetate. Reactions of cinnamic acid – bromination, oxidation. Uses of cinnamic acid. **6.4.** Dicarboxylic acids : Succinic and phthalic acids. Methods of formation of succinic acid from ethylene bromide, maleic acid. Reactions of succinic acid – action of heat, action of $NaHCO_3$, C_2H_5OH in presence of acid. Uses of succinic acid. Methods of formation of phthalic acid from o-xylene and naphthalene Reactions of phthalic acid – action of heat, reaction with sodalime, NH_3. Uses of phthalic acid.	from ethylene bromide, maleic acid. Reactions of succinic acid – action of heat, action of $NaHCO_3$, C_2H_5OH in presence of acid. Uses of succinic acid. Methods of formation of phthalic acid from o-xylene and naphthalene Reactions of phthalic acid – action of heat, reaction with sodalime, NH_3. Uses of phthalic acid.
7. Diazonium Salts (4) 7.1 Diazoniumsalts : Introduction, benzene diazonium chloride – preaparation, chemical properties. i. Formation of iodo benzene ii. Sandmeyer's reaction iii. Formation of benzene iv. Formation of phenylhydrazine v. Azo coupling – synthesis of methyl orange and congo red.	**To study** 7.1 Diazoniumsalts : Introduction, benzene diazonium chloride – preaparation, chemical properties. i. Formation of iodo benzene ii. Sandmeyer's reaction iii. Formation of benzene iv. Formation of phenylhydrazine v. Azo coupling – synthesis of methyl orange and congo red.	**Student understands the concepts** 7.1 Diazoniumsalts : Introduction, benzene diazonium chloride – preaparation, chemical properties. i. Formation of iodo benzene ii. Sandmeyer's reaction iii. Formation of benzene iv. Formation of phenylhydrazine v. Azo coupling – synthesis of methyl orange and congo red.

Signature of HOD

B.A. / B.Sc. / M.A. / M.Sc.	: **B.Sc. II**	
NAME OF SUBJECT	: Inorganic Chemistry	
SEM I / II / III / IV / V / VI	: **Sem. III**	
COURSE NUMBER (PAPER NUMBER)	: P -VI	
TITLE OF COURSE (NAME OF PAPER)	**: Inorganic Chemistry**	
COURSE CONTENT	**OBJECTIVES**	**OUTCOME**
1. Co-ordination Chemistry : 1.1 Definition and formation of co-ordinate covalent bond in BF_3: NH_3 and in $[NH_4]^+$. 1.2 Distinction between double salt and complex salt, 1.3 Werner's theory : A. Postulates of theory, B. Applications of theory: Theory applied to cobalt amine viz; a].$CoCl_3.6NH_3$ b] $CoCl_3.5NH_3$, c] $CoCl_3.4NH_3$, d] $CoCl_3.3NH_3$ C. Limitations 1.4 Description of terms –a] ligand, b]co-ordination number, c] co-ordination sphere, d]effective atomic number, e] Geometrical isomerism and optical isomerism in co-ordination compounds for CN = 4 and CN = 6. 1.5 IUPAC nomenclature of co-ordination compounds, 1.6 Valence bond theory of transition metal complexes. A .Introduction B. Postulates of VBT/ basic concepts of VBT C. Role of transition metal in the formation of complex D. Stepwise process of formation of	Students should get knowledge about; 1) Coordinate bond and their mechanism of formation. 2) Werner's and VBT approach for the bonding and characteristics of coordinate bond. 3) Isomerism and IUPAC nomenclature of co-ordination compounds.	Students have understood about Coordinate bonding in the complex compounds along with their Isomerism and IUPAC nomenclature.

complex : Salient features. E. Applications: High spin and low spin complexes w.r.t. CN = 4 and CN = 6. F. Limitations of Valence bond theory.		
2. Chelation 2.1 A brief introduction w.r.t. ligand, chelating agent, chelation and metal chelate. 2.2 Structural requirements of chelate formation. 2.3 Difference between metal chelate and metal complex. 2.4 Classification of chelating agents (with specific illustrations of bidentate chelating agent). 2.5 Applications of chelation w.r.t. chelating agents : EDTA and DMG.	Students should get knowledge about application of coordination chemistry as a chelating agents and metal chelate.	Students have understood about difference between metal complex and metal chelate. Also they understood the applications of chelating agents in our life.
3. Acids and Bases 3.1 Lewis Concept : A.Definition, B.classification,C. merits and D.demerits. 3.2 Hard and soft acids and bases (HSAB) : A. Classification of acids and bases as hard and soft, B. Pearson's HSAB concept, C. Acid-Base strength and hardness-softness, D. Applications and limitations of HSAB principle.	1. To develop the thinking of students for acid base concept. 2. To understand various concepts of acids and bases. 3. To help student to classify Hard and soft acids and bases	1. Students are able to distinguish between various examples. 2. Students are able to apply knowledge in various content.
4. Study of d-block elements 4.1. Introduction, 4.2. Position of d-block elements in periodic table, 4.3.Names& electronic configuration of 1st, 2nd & 3rd three transition series. 4.4. General Characteristics of 3 d-block elements w.r.t. – a) oxidation state b) colour c) Magenetic behavior (spin only formula)	1. Enable students to distinguish between properties s-block, p-block and d-block element 2. To help the students to understand properties of d-block element 3. To help the students to understand electronic configuration, name symbol atomic number of 1^{st} ,2^{nd},3^{rd} transition series elements	1. Students are able to distinguish between properties of s-block, p-block and d- block element 2. Students are able to give properties of d-block element 3. Students are able to give electronic configuration, atomic number , symbol and name of the three transition series element

d) catalytic properties and e) tendency to form complexes. 4.5. Comparison of 1st transition series with 2nd & 3rd transition series w.r.t. – a) electronic configuration b) reactivity c) stability of oxidation state d) magnetic behavior and e) stability of complexes (Brief account only)	4. To help the students to understand various properties of 3-d transition series element 5. To help the students to compare properties of three transition series.	4. Students are able to understand the characteristics of various properties of 3-d block element and students can apply those characters in various concept related to 3-d series elements such as co-ordination chemistry; chelation; acid base concept also in research as studies in metal complexes.

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B.Sc. II		
NAME OF SUBJECT: Physical Chemistry		
SEM IV		
COURSE NUMBER (PAPER NUMBER) P-VII		
TITLE OF COURSE (NAME OF PAPER): Physical Chemistry		
COURSE CONTENT	**OBJECTIVES**	
Electrochemistry 1.1. Introduction, conduction of electricity, Types of conductors :	To study 1.1. conduction of electricity, Types of conductors : electronic and electrolytic.	**Students gain in u** 1.1. Conduction o conductors : electr

electronic and electrolytic. 1.2. Explanation of terms : Conductance, Specific resistance, specific conductance, Equivalent conductance, Molecular conductance. 1.3. Variation of specific and equivalent conductance with concentration, Equivalent conductance at infinite dilution. (Mention Onsager equation, $b\ c\ v = -\infty\ \lambda\ \lambda$from graph) 1.4. Migration of ions, Hittorf's rule, Transport number, Determination of transport number by moving boundary method, factors influencing transport number: Nature of electrolyte, concentration, temperature, complex formation and Degree of hydration. 1.5. Kohlrausch law, Applications of Kohlrausch law : i. Determination of relationship between ionic conductance, ionic mobility and transport number. ii. Determination of equivalent conductance at infinite dilution of weak electrolytes. iii. Determination of degree of dissociation of weak electrolyte. iv. Determination of ionic product of water. v. Determination of solubility of sparingly soluble salts. 1.6. Numerical problems.	1.2. Explanation of terms : Conductance, Specific resistance, specific conductance, Equivalent conductance, Molecular conductance. 1.3. Variation of specific and equivalent conductance with concentration, Equivalent conductance at infinite dilution. (Mention Onsager equation, $b\ c\ v = -\infty\ \lambda\ \lambda$from graph) 1.4. Migration of ions, Hittorf's rule, Transport number, Determination of transport number by moving boundary method, factors influencing transport number: Nature of electrolyte, concentration, temperature, complex formation and Degree of hydration. 1.5. Kohlrausch law, Applications of Kohlrausch law : i. Determination of relationship between ionic conductance, ionic mobility and transport number. ii. Determination of equivalent conductance at infinite dilution of weak electrolytes. iii. Determination of degree of dissociation of weak electrolyte. iv. Determination of ionic product of water. v. Determination of solubility of sparingly soluble salts. **To solve** 1.6. Numerical problems.	1.2. Explanation o resistance, specific conductance, Molecular conduct 1.3. Variation of sp conductance with conductance at infi dilution. (Mention λfrom graph) 1.4. Migration of i number, Determina moving boundary method, factors inf Nature of electroly complex formation and Deg 1.5. Kohlrausch la law : i. Determination o conductance, ionic ii. Determination infinite dilution of iii. Determination weak electrolyte. iv. Determination v. Determination o salts. Student becomes a problems based on
2. Thermodynamics 2.1. Introduction, concept of entropy, Entropy as a state function: Definition, mathematical expression, unit, physical significance of entropy. 2.2. Entropy changes for reversible and irreversible processes in isolated systems. 2.3. Entropy changes for an ideal gas as a function of V and T and as a function of P and T. 2.4. Entropy change in mixing of gases. 2.5. Entropy change in physical transformations :	**To study** 2.1.concept of entropy, Entropy as a state function: Definition, mathematical expression, unit, physical significance of entropy. 2.2. Entropy changes for reversible and irreversible processes in isolated systems. 2.3. Entropy changes for an ideal gas as a function of V and T and as a function of P and T. 2.4. Entropy change in mixing of gases. 2.5. Entropy change in physical transformations :	**Students gain an** 2.1. concept of ent function: Definitio unit,physical signi 2.2. Entropy chang irreversible proces 2.3. Entropy chang of V and T and as P and T. 2.4. Entropy chang 2.5. Entropy chang i. Fusion of a solid ii. Vaporization of

i. Fusion of a solid. ii. Vaporization of a liquid. iii. Transition from one crystalline form to another. 2.6. Third law of thermodynamics, Absolute entropy and Evaluation of absolute entropy, use of absolute entropies: Determination of entropy changes in chemical reactions. 2.7. Numerical problems.	i. Fusion of a solid. ii. Vaporization of a liquid. iii. Transition from one crystalline form to another. 2.6. Third law of thermodynamics, Absolute entropy and Evaluation of absolute entropy, use of absolute entropies: Determination of entropy changes in chemical reactions. **To solve** 2.7. Numerical problems.	iii. Transition from 2.6. Third law of t entropy and Evalu absolute entropies: Determination of e reactions. Students gains con problems.
Physical properties of liquids 1.1 Introduction, additive and constitutive properties 1.2 **Viscosity:** coefficient of viscosity, determination of viscosity by Ostwald's Viscometer 1.3 **Surface tension:**Determination of surface tension by Drop –Weight method 1.4 **Parachor:**Macleod equation and its modification by Sugden, applications of parachor in the determination of molecular structures as benzene and NO2 group 1.5 **Dipole moment:** electrical polarization of molecules 1.6 Use of dipole moment in the study of molecular structure 1.7**Refractometery:** Refractive index, Snell's law 1.8 Specific and molecular refractivity, Abbe's refractometer: Principle-critical angle phenomenon-construction, working and advantages 1.9 Molecular refractivity and chemical constitution	To understand basic concepts of viscosity, S.T,parachore, dipole moment refractive index, etc.	Student should able course.

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B.A. / B.Sc. / M.A. / M.Sc.	: B.Sc. II
NAME OF SUBJECT	: Inorganic Chemistry

SEM I / II / III / IV / V / VI : Sem. IV		
COURSE NUMBER (PAPER NUMBER) : VIII		
TITLE OF COURSE (NAME OF PAPER) **: Analytical and Industrial Inorganic Chemistry**		
COURSE CONTENT	**OBJECTIVES**	**OUTCOME**
1. Volumetric Analysis : 1.1 Introduction, Terminology :- Titrant; Titrand, standard solution; Titration Indicator; Equivalence point; End point.Primary standard ,Secondary standard. Strength of solution, volumetric analysis & their types. 1.2 Acid Base Titration i) Introduction ii) Theory of Acid-Base indicator : A) Colour change Interval B) Theories-Ostwald's theory &Quinoid theory, iii) Neutralization curve and choice of indicator for following titrations : A) Strong acid and Strong Base B) Strong Acid and Weak Base C) Weak Acid and Strong Base 1.3 Complexometric titration : A) General account, B) Types of EDTA Titrations, C) Metallochromic Indicator w.r.t. Eriochrome Black-T	1. To help the students to understand various concepts of volumetric analysis 2. to help the students to understand different types of volumetric analysis 3. to help the students to understand various types of acid base reactions	1. Students are able to understand various type of volumetric analysis 2. Students are able to distinguish between types of titrations 3. Students are able to apply knowdge in various fields of chemistry
2. Gravimetric Analysis: 2.1. Introduction, Terminology :- Gravimetric analysis, Saturation, Super-saturation, Sol, Gel, Coagulation or Flocculation, Coagulation or Flocculation value, Peptisation, Precipitation, Precipitate, Precipitant, Solubility, Aging or digestion, Ignition, 2.2. General steps involved in gravimetry 2.3. Precipitation – A) Physical nature of Precipitate: Gelatinous, Curdy and Crystalline. B) Conditions of Precipitation 2.4. Process of precipitation – A) Nucleation B) Crystal growth C)	1. To enable students to understand various concept of gravimetric analysis 2. to enable students to understand steps in gravimetric analysis 3. to help the students to understand various applications of gravimetric analysis in field of chemistry	1. Students understood various concept of gravimetric analysis 2. Students understood steps of gravimetric analysis 3. Students are able to apply gravimetric analysis in various field of chemistry

Digestion 2.5. Co-precipitation and Post precipitation and their difference. 2.6. Role of Organic precipitants in gravimetric analysis, 2.7. Study of organic precipitants viz. A) DMG, B) Aluminon, C) 8-Hydroxyquinoline. 2.8. Advantages and disadvantages of organic precipitants.		
3. Industrial heavy Chemicals: 3.1. Introduction 3.2. Physicochemical Principles & manufacture of following heavy chemicals: i) Ammonia by Haber process ii) Sulphuric acid by contact process.	To help the students to understand heavy chemicals such as ammonia, sulphuric acid.	Students understood the concept of manufacturing of heavy chemicals.
4. Metallurgy: 4.1. Introduction: Terminology:- Metallurgy, Mineral, Ore, Gangue, Flux, Slag. 4.2. Occurrence of metals: Types of ores 4.3. Steps involved in metallurgical processes: A) Concentration of ores- I. Physical methods: a) Gravity separation method, b) Magnetic separation method, c) Froth flotation process. II. Chemical Methods: a) Calcination b) Roasting B) Reduction- i) Chemical methods of reduction ii) Electrolytic reduction method for e.g. Aluminium and copper	Students should get knowledge about; The concept of Metallurgy, occurrence of metals and their separation methods.	Students understood the existence of metallic elements and the types of their compounds in the nature. They also learn the principle and methodology of separation techniques of metals.
5. Iron and Steel: 5.1 Occurrence of Iron 5.2 Extraction of Iron: Blast furnace 5.3 Types of Iron 5.4 Steel- A) Definition B) Types of Steel C) Manufacture of Steel: a) Bessemer process b) L. D. process	Students should get knowledge about; Chemistry of iron and their compound.	Students understood the occurrence of iron, their separation from source and preparation of steel from cast iron.

D) Heat treatment on Steel		

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