Annual Teaching Plan

Academic year: 2024-2025

Name of Teacher: Dr. V. D. Jadhav

Program: B.Sc. II Semester: III

Subject: Chemistry Paper No: V

Course Title: Physical chemistry

<table>
<tr><td colspan="3">Month: August</td><td>Module</td><td>Subunit planned</td></tr>
<tr><td>Lecture</td><td>Practical</td><td>Total</td><td rowspan="2">Unit III:
Phase Equilibrium</td><td rowspan="2">3.1 Phases, components and degrees of freedom of a system, criteria of phase equilibrium.
3.2: Gibbs Phase Rule and its thermodynamic derivation.
3.3 Derivation of Clapeyron and Clausius – Clapeyronequation and its importance in phase equilibria</td></tr>
<tr><td>6</td><td>-</td><td>6</td></tr>
<tr><td colspan="3">Month: September</td><td>Module</td><td>Subunit planned</td></tr>
<tr><td>Lecture</td><td>Practical</td><td>Total</td><td rowspan="2">Unit IV:
Nuclear Chemistry</td><td rowspan="2">4.1:Introduction,
4.2:Types of Nuclear radiation, properties of α, β and γ radiations , Detection and measurement of nuclear radiations by Scintillation and
4.3:Geiger muller counter methods, radioactive equilibrium and range of α-particles, Geiger Nuttal relations
4.4:determination of radioactive constant (decay constant).</td></tr>
<tr><td>6</td><td>-</td><td>6</td></tr>
<tr><td colspan="3">Month: October</td><td>Module</td><td>Subunit planned</td></tr>
<tr><td>Lecture</td><td>Practical</td><td>Total</td><td>Unit V:</td><td>5.1:Introduction,</td></tr>
<tr><td>6</td><td>-</td><td>6</td><td>Chemical Kinetics</td><td>5.1: Third order reactions: derivation of rate constant, characteristics and examples of third order reaction.
5.3:Theories of reaction rates as Collision theory and Transition state theory (only quantitative aspect, derivation not expected),
.</td></tr>
</table>

Month: November	Theory examinations	------

Program: B.Sc. III Semester: V

Subject: Chemistry Paper No: XI

Course Title: Physical chemistry

Month: August			Module	Subunit planned
Lecture 6	Practical -	Total 6	Unit I: Elementary quantum mechanics	1.1 Introduction. 1.2 Drawbacks of classical mechanics, Black body radiation, Photoelectric effect, Compton effect, Duel nature of matter and energy: De Broglie hypothesis. 1.3 The Heisenberg's uncertainty principle. 1.4 Concept of energy operators (Hamiltonian). 1.5 Derivation of Schrodinger wave equation, well behaved function. 1.6 Physical interpretation of the ψ and ψ2 . 1.7 Particle in a one dimensional box. 1.8 Numerical problems. 2.1 Introduction.

			Unit II: Spectroscopy	2.2 Electromagnetic radiation. 2.3 Interaction of radiation with matter, Electromagnetic spectrum, Energy level diagram. 2.4 Rotational spectra of diatomic molecules: Rigid rotor model, moment of inertia, energy levels of rigid rotor, selection rules, Intensity of spectral lines, determination of bond length, isotope effect, Microwave oven 2.5 Vibrational spectra of diatomic molecules: Simple Harmonic oscillator model, Vibrational energies of diatomic molecules, Determination of force constant, overtones. 2.6 Raman spectra: Concept of polarizability, pure rotational and pure Vibrational Raman spectra of diatomic molecules, selection rules. 2.7 Comparative study of IR and Raman spectra, rule of mutual exclusion- CO2 molecule. 2.8 Numerical problems
Month: September			Module	Subunit planned

Lecture	Practical	Total	Unit III: Photochemistry	

6	-	6	Unit IV: Solutions	3.1 Introduction, Difference between thermal and photochemical processes. 3.2 Laws of photochemistry: i) Grotthus - Draper law ii) Lambert law iii) Lambert – Beer's law (with derivation) iv) Stark-Einstein law. 3.3 Quantum yield, Reasons for high and low quantum yield. 3.4 Factors affecting Quantum yield. 3.5 Photosensitized reactions – Dissociation of H2, Photosynthesis. 3.6 Photodimerisation of anthracene, decomposition of HI and HBr. 3.7 Jablonski diagram depicting various processes occurring in the excited state: Qualitative description of fluorescence and phosphorescence. 3.8 Chemiluminescence, Electroluminescence and Bioluminescence. 3.9 Numerical problems. 4.1 Introduction. 4.2 Ideal solutions, Raoult's law, Vapour pressure of ideal and non ideal solutions of miscible liquids. 4.3 Composition of liquid and vapour, vapour pressure and boiling point diagrams of miscible liquids. Distillation of miscible liquid pairs. Type I : Systems with intermediate total vapour pressure (i.e. System in which b.p. increases regularly – Zeotropic). Type II : Systems with a maximum in the total vapour pressure (i.e. System with a b.p. minimum – Azeotropic). Type III : Systems with a minimum in the total vapour pressure (i.e. System with a b.p. Maximum – Azeotropic).
Month: October			Module	Subunit planned
Lecture	Practical	Total	Unit IV: Solutions	4.4 Solubility of partially miscible liquids. i. Maximum solution temperature type: Phenol – water system. ii. Minimum solution temperature type: Triethyl amine – water system. iii. Maximum and minimum solution temperature type: Nicotine – water system. Distillation of partially miscible liquid pairs. 4.5 Vapour pressure and distillation of immiscible liquids, steam distillation. 5.1 Introduction 5.2 Thermodynamics of electrode potentials, Nernst equation for electrode and cell potentials in terms of activities.
6	-	6		

			Unit V: Electromotive force	5.3 E.M.F. series. 5.4 Types of electrodes: Description in terms of construction, representation, half cell reaction and emf equation for i) Metal – metal ion electrode. ii) Amalgam electrode. iii) Metal – insoluble salt electrode. iv) Gas – electrode. v) Oxidation – Reduction electrode. 5.5 Reversible and Irreversible cells. i. Chemical cells without transference. ii. Concentration cells with and without transference. iii. Liquid – Liquid junction potential: Origin, elimination and determination. 5.6 Equilibrium constant from cell emf, Determination of the thermodynamic parameters such as ΔG, ΔH and ΔS. 5.7 Applications of emf measurements : i. Determination of pH of solution using Hydrogen electrode. ii. Solubility and solubility product of sparingly soluble salts (based on concentration cells). 5.8 Numerical problems
Month: November			Theory examinations	------

Program: B.Sc. II Semester: IV

Subject: Chemistry Paper No: VII & VIII

Course Title: Inorganic & Organic chemistry

Month: January			Module	Subunit planned
Lecture	Practical	Total	Unit V: Inorganic semi-micro qualitative analysis	5.1 Theoretical principles involved in qualitative analysis. 5.2 Applications of solubility product and common ion effect in separation of cations into groups. 5.3 Application of complex formation in a) Separation of II group into IIA and IIB subgroups. b) Separation of Copper from Cadmium. c) Separation of Cobalt from Nickel.
6	-	6		

<table>
<tr><td colspan="3"></td><td></td><td>d) Separation of Cl^-, Br^-, I^-.
e) Detection of NO_2^-, NO_3^- (Brown ring test). .</td></tr>
<tr><td colspan="3">Month: February</td><td>Module</td><td>Subunit planned</td></tr>
<tr><td>Lecture</td><td>Practical</td><td>Total</td><td rowspan="2">Unit V:
Inorganic semi-micro qualitative analysis

Unit V:
Stereochemistry</td><td rowspan="2">5.4 Application of oxidation and reduction in
a) Separation of Cl^-, Br^-, I^- in mixture b) Separation of NO_2^- and NO_3^- in mixture.
5.5 Spot test analysis

5.1 Conformational isomerism – Introduction.
5.2 Representation of conformations of ethane by using Saw- Horse, Fischer (dotted line wedge) and Newmann’s projection formulae.</td></tr>
<tr><td>6</td><td>-</td><td>6</td></tr>
<tr><td colspan="3">Month: March</td><td>Module</td><td>Subunit planned</td></tr>
<tr><td>Lecture</td><td>Practical</td><td>Total</td><td rowspan="2">Unit V:
Stereochemistry</td><td rowspan="2">5.3 Conformations and conformational analysis of ethane and n-butane by Newmann’s Projection formula with the help of energy profile diagrams. 5.4 Cycloalkanes relative stability - Baeyer’s strain theory, Theory of strainless rings.
5.5 Conformations and stability of cyclohexane and monosubstituted cyclohexanes Cyclohexanol, bromocyclohexane and methyl cyclohexane. Locking of conformation in t-butyl cyclohexane.</td></tr>
<tr><td>6</td><td>-</td><td>6</td></tr>
<tr><td colspan="3">Month: April</td><td>Theory examinations</td><td>------</td></tr>
</table>

Program: B.Sc. III Semester: V

Subject: Chemistry Paper No: XI

Course Title: Physical chemistry

<table>
<tr><td colspan="3">Month: December</td><td>Module</td><td>Subunit planned</td></tr>
<tr><td>Lecture
6</td><td>Practical
-</td><td>Total 6</td><td>Unit I: Phase Equilibria</td><td>1.1 Introduction.
1.2 Gibbs phase rule : Phase rule equation and explanation of terms involved in the equation.
1.3 Phase diagram, true and metastable equilibria.
1.4 One component systems: i. Water system. ii. Sulphur system with explanation for polymorphism.
1.5 Two component systems: i. Eutectic system: (Ag – Pb system); Desilverisation of lead. ii. Freezing mixture: (KI –H2O system). iii. Formation of compound with congruent melting point (FeCl3 – H2O).
1.6 Three component solid-liquid system: i. Development of triangular phase diagram: (Acetic acid – Chloroform –water system).</td></tr>
<tr><td colspan="3">Month: January</td><td>Module</td><td>Subunit planned</td></tr>
<tr><td>Lecture</td><td>Practical</td><td>Total</td><td rowspan="2">Unit II: Thermodynamics</td><td rowspan="2">2.1 Introduction.
2.2 Free energy: Gibbs function (G) and Helmholtz function (A), Criteria for thermodynamic equilibrium and spontaneity.
2.3 Relation between ΔG and ΔH : GibbsHelmholtz equation.
2.4 Phase equilibria : Clapeyron – Clausius equation and its applications.
2.5 Thermodynamic derivation of law of mass action, Van’t – Hoff isotherm and isochore.
2.6 Fugacity and activity concepts.
2.7 Partial molar quantities, Partial molar volume, Concept of chemical potential, GibbsDuhem equation.
2.8 Numerical problems.

3.1 Introduction: Space lattice, lattice sites, lattice planes, unit cell.
3.2 Laws of crystallography: i. Law of constancy of interfacial angles ii. Law of rational indices iii.</td></tr>
<tr><td>6</td><td>-</td><td>6</td></tr>
</table>

			Unit III: The Solid State	Law of crystal symmetry.
Month: February			Module	Subunit planned
Lecture	Practical	Total	Unit III: The Solid State Unit IV : Chemical Kinetics	3.3 Weiss indices and Miller indices. 3.4 Cubic lattice and types of cubic lattice, planes or faces of a simple cubic system, spacing of lattice planes. 3.5 Diffraction of X-rays, Derivation of Bragg's equation. 3.6 Determination of crystal structure by Bragg's method. 3.7 Determination of crystal structure of NaCl and KCl on the basis of Bragg's equation. 3.8 Numerical problems 4.1 Introduction. 4.2 Simultaneous reactions such as i. Opposing reaction: (Derivation of rate equation for first order opposed by first order expected). ii. Side reaction. iii. Consecutive reactions. iv. Chain reaction. v. Explosive reaction (Derivation of rate equation and Numerical problems are not expected).
6	-	6		
Month: March			Unit V: Distribution law	5.1 Introduction, solute, solvent and solution, miscible and immiscible liquids. 5.2 Nernst distribution law and its limitations. 5.3 Modification of distribution law with respect to change in molecular state of solute (association and dissociation of solute in one of the solvent). 5.4 Applications of the distribution law i. Process of extraction (derivation expected). ii. Determination of solubility of solute in particular solvent. iii. distribution indicators. iv. determination of molecular weight of solute in different solvents. 5.5 Numerical problems ------
Lecture	Practical	Total		
6	-	6		

			Practical examination	
Month: April			Theory examination	------

Annual Teaching Plan

Academic year: 2024-2025

<table>
<tr><td colspan="3">Month: August</td><td>Module</td><td>Subunit planned</td></tr>
<tr><td>Lecture</td><td>Practical</td><td>Total</td><td rowspan="2">Unit III: Valence bond theory (VBT)</td><td rowspan="2">3.1 Inroduction, Concept of hybridization, different types of hybridization
3.2 Geometry of
• sp hybridization,
• sp^2 hybridization, sp^3 hybridization</td></tr>
<tr><td>4</td><td>-</td><td>4</td></tr>
<tr><td colspan="3">Month: September</td><td>Module</td><td>Subunit planned</td></tr>
<tr><td>Lecture</td><td>Practical</td><td>Total</td><td rowspan="2">Unit IV: Molecular orbital theory (MOT)</td><td rowspan="2">4.1 Introduction, LCAO method, formation of bonding, anti-bonding and nonbonding molecular orbitals, comparison between bonding and antibonding.
4.2 Conditions and types of overlaps
• -S-S,
• S-px,
• Px-Px,
• Py-Py,
Pz-Pz .</td></tr>
<tr><td>4</td><td>-</td><td>4</td></tr>
<tr><td colspan="3">Month: October</td><td>Module</td><td>Subunit planned</td></tr>
<tr><td>Lecture</td><td>Practical</td><td>Total</td><td rowspan="2">Unit IV: Molecular orbital theory (MOT)</td><td rowspan="2">4.3 Bond order with its significance and energy level sequence for molecular orbital when n=1 & 2.
4.4 MO diagrams for,
• Homonuclear diatomic molecule.
• Heteroatomic diatomic molecule.</td></tr>
<tr><td>4</td><td>-</td><td>4</td></tr>
</table>

Name of Teacher: Mrs Nikeeta.D. Kamble

Program: B.Sc. I Semester: I

Subject: Chemistry Paper No: I

Course Title: Inorganic chemistry

Month: November 11 Nov-23 Nov Diwali vocation	Practical examinations ------	------ ------
Month: December	Theory examination	------

Program: B.Sc. II Semester: III

Subject: Chemistry Paper No: V and VI

Course Title: Physical and Industrial chemistry

Month: August			Module	Subunit planned
Lecture	Practical	Total	Unit IV: Nuclear Chemistry	4.1 Introduction 4.2 Types of Nuclear radiation 4.3 Properties of α, β and γ radiations 4.4 Detection and measurement of nuclear radiations by Scintillation and Geiger muller counter methods 4.5 Radioactive equilibrium and range of α-particles 4.6 Geiger Nuttal relations 4.7 Determination of radioactive constant (decay constant).
6	-	6		
Month: September			Module	Subunit planned
Lecture	Practical	Total	Unit IV : Nuclear Chemistry Unit V: Soaps and Detergents	4.6 Geiger Nuttal relations 4.7 Determination of radioactive constant (decay constant). 5.1 Introduction, Soaps - Raw materials, Types of soaps, Cleansing action of soap. 5.2 Manufacture of soap - Hot or Cold Process. .
6	-	6		
Month: October			Module	Subunit planned

Lecture	Practical	Total	Unit V: Soaps and Detergents	5.3 Detergents - Raw Materials, Types of Detergents: Anionic, cationic and amphoteric, Preparation of Teepol and Deriphat, cleansing action of detergent. 5.4 Comparisons between soaps and detergents, Application of soap and detergents .
6	-	6		
Month: November			Theory examinations	------

Program: B.Sc. III Semester: V

Subject: Chemistry Paper No: IX

Course Title: Inorganic chemistry

Month: August			Module	Subunit planned
Lecture	Practical	Total	Unit I: Acids, Bases and Non aqueous solvents	1.1 Introduction to theories of Acids and Bases – Arrhenius concept, Bronsted-Lowry concept , Lux-Flood Concept (definition and example) 1.2 Hard and soft Acid and Bases. (HSAB Concept) 1.2.1 Classification of acids and bases as hard, soft and borderline. 1.2.2 Pearson's HSAB Concept. 1.2.3 Acid-Bases strength and hardness-softness. 1.2.4 Applications and limitations of HSAB principle.
6	-	6		

			Unit II: Metal Ligand bonding in Transition Metal Complexes	2.1 Crystal Field Theory (CFT) 2.1.1 Introduction; Shapes of dorbitals, Basic assumptions of CFT. 2.1.2 Crystal field splitting of dorbitals of metal ion in octahedral, tetrahedral, square planer complexes and John–Teller distortion . 2.1.3 Factors affecting the Crystal field splitting	
Month: September			Module	Subunit planned	
Lecture	Practical	Total	Unit II: Metal Ligand bonding in Transition Metal Complexes	2.1.4 High spin and low spin octahedral complexes w.r.t Co (II). 2.1.5 Crystal Field stabilization energy (CFSE), Calculation with respect to octahedral complexes only. 2.1.6 Limitation of CFT. 2.2 Molecular orbital theory (MOT). 2.2.1 Introduction. 2.2.2 MOT of octahedral complexes with sigma bonding such as $[Ti(H_2O)_6]^{3+}$, $[CoF_6]^{3-}$, $[Co(NH_3)_6]^{3+}$ 2.2.3 Merits and demerits of MOT..	
6	-	6			
Month: October			Module	Subunit planned	

Lecture	Practical	Total	Unit III: Metals, Semiconductors and Superconductors. Unit IV: Organometallic Chemistry	3.1 Introduction. 3.2 Properties of metallic solids. 3.3 Theories of bonding in metal. i. Free electron theory. ii. Molecular orbital theory (Band theory) 3.4 Classification of solids as conductor, insulators and semiconductors on the basis of band theory. 3.5 Semiconductors Types – intrinsic and extrinsic and applications of semiconductors. 3.6 Superconductors: Ceramic superconductors –Preparation and structures of mixed oxide $YBa_2Cu_3O_{7-x}$. 3.7Applications of superconductors. 4.1 Definition Nomenclature of organometallic compounds. 4.2 Synthesis and structural study of alkyl and aryl compounds of Be and Al. 4.3 Mononuclear carbonyls – Nature of bonding in simple mononuclear carbonyls. $[Ni(CO)_4]$, $[Fe(CO)_5]$, $[Cr(CO)_6]$.
6	-	6		
Month: November			Theory examinations	------

Program: B.Sc. I Semester: II

Subject: Chemistry Paper No: III

Course Title: Physical chemistry

Month: January			Module	Subunit planned
Lecture	Practical	Total		

4	-	4	Unit III: Kinetic Theory of Gases	3.1 Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation. Ideal and Non ideal gases 3.2 Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. Van der Waals equation of state for real gases. Explanation of real gas behaviour by Van der Waal's equation	
Month: February			Module	Subunit planned	
Lecture	Practical	Total	Unit IV: Chemical Kinetics	4.1 Introduction, Rate of reaction, Definition and units of rate constant, Factors affecting rate of reaction. (Nature of reactant, Concentration, pressure, temperature and catalyst.) Order and Molecularity of reaction. 4.2 Zero order reaction, First order reaction, Characteristics of first order reaction. examples, Pseudo-unimolecular reactions, examples. Second order reaction: Derivation of rate constant for equal and unequal concentration of the reactants.	
4	-	4			
Month: March			Module	Subunit planned	
Lecture	Practical	Total	Unit IV: Chemical Kinetics	4.3 Characteristics of Second order reaction., Determination of order of reaction by i) integration method ii) graphical method iii) Half life method, Effect of temperature on rate of reaction. 4.4 Arrhenius equation, Concept of energy of activation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only). Numerical problems.	
4	-	4			
			Practical examinations	------	

Month: April	Theory examination	------

Program: B.Sc. II Semester: IV

Subject: Chemistry Paper No: VII

Course Title: Inorganic chemistry

Month: January			Module	Subunit planned
Lecture	Practical	Total	Unit III: Chemistry of elements of first transition series	3.1Position of elements in periodic table 3.2Characteristics of d-block elements with special reference to i) Electronic structure ii) Oxidation states, stability of oxidation states of Fe with respective to Latimer diagram iii) Magnetic character iv) Colored ions v) Complex formation.
6	-	6		
Month: February			Module	Subunit planned
Lecture	Practical	Total	Unit III: P- Block elements (Group 13, 14 and 15)	3.1. Position of elements in periodic table 3.2. Characteristics of p-block elements with special reference to Electronic configuration and Periodic properties 3.3. Compounds of group 13,14 and 15 3.3.1Boron-Diborane method of preparation and nature of bonding (structure)
6	-	6		
Month: March			Module	Subunit planned
Lecture	Practical	Total		

6	-	6	Unit III: P- Block elements (Group 13, 14 and 15)	3.3.2Borazine method of preparation and nature of bonding (structure) 3.3.3Allotropes of carbon and phosphorus 3.3.4Oxyacids of nitrogen – HNO_2 , HNO_3. Hydrides of Nitrogen- NH_3 and
Month: April			Theory examinations	------

Program: B.Sc. III Semester: VI

Subject: Chemistry Paper No: XIII

Course Title: Inorganic chemistry

Month: December			Module	Subunit planned
Lecture 6	Practical -	Total 6	Unit I: Coordination Chemistry	A. Inorganic Reaction mechanism 1.1 Introduction. 1.2 Classification of Mechanism: Association, dissociation, interchange and the rate determining steps. 1.3 SN 1 and SN 2 reactions for inert and labile complexes. 1.4 Mechanism of substitution in cobalt (III) octahedral complexes. 1.5Trans effect and its theories. 1.6 Applications of trans effect in synthesis of Pt (II) complexes B. Thermodynamic and Kinetic aspects of metal complexes. 1.7 Introduction. 1.8 Thermodynamic stability 1.9 Kinetic Stability. 1.10 Relation between thermodynamic and kinetic stability. 1.11 Stepwise stability constant.

<table>
<tr><td colspan="3"></td><td></td><td>1.12 Factor affecting the stability of complexes.
1.13 Determination of Stability constant by Job variation, Mole ratio and Slope ratio method.</td></tr>
<tr><td colspan="3">Month: January</td><td>Module</td><td>Subunit planned</td></tr>
<tr><td>Lecture</td><td>Practical</td><td>Total</td><td rowspan="2">Unit II: Nuclear Chemistry</td><td rowspan="2">2.1 Nuclear reactions and energetic of nuclear reactions.
2.2 Types of nuclear reactions
i. Artificial transmutation. ii. Artificial radioactivity.
iii. Nuclear fission and its application in heavy water nuclear reactor. iv. Nuclear fusion.
2.3 Use of Thorium, Uranium and Plutonium in atomic energy
2.4 Applications of radio-isotopes as tracers.
i. Chemical investigation – Esterification. ii. Structural determination – Phosphorus pentachloride. iii. Analytical Chemistry – Isotopic dilution method for determination of volume of blood. iv. Age determination – Dating by C_{14}.</td></tr>
<tr><td>6</td><td>-</td><td>6</td></tr>
<tr><td colspan="3">Month: February</td><td>Module</td><td>Subunit planned</td></tr>
<tr><td>Lecture</td><td>Practical</td><td>Total</td><td rowspan="2">Unit III: Chemistry of f-Block Elements</td><td rowspan="2">A] Lanthanides
3.1 Introduction.
3.2 Occurrence.
3.3 Electronic Configuration.
3.4 Oxidation State.
3.5 Lantahnide contraction.
3.6 Separation of Lanthanides by Ion exchange method.
B] Actinides
3.7 Position in periodic table.
3.8 Electronic configuration.
3.9 General methods of preparation of transuranic elements.
i. Neutron capture – followed by β decay.
ii. Accelerated projectile bombardment. iii. Heavy ion bombardment.</td></tr>
<tr><td>6</td><td>-</td><td>6</td></tr>
</table>

				3.10 IUPAC nomenclature of the super heavy elements with atomic number (Z) greater than 100. Unit.
Month: March			Unit IV: Iron and Steel. Practical examination	4.1 Occurrence and ores of iron. 4.2 Definition of the Terms- Ore , Mineral, Slag, Flux, Gangue , Matrix, Calcinations, Reduction, Roasting, Smelting and Leaching. 4.3 Extraction of iron by Blast furnace. 4.4 Steel: Definition and types. 4.5 Conversion of cast iron into steel by i. Bessemer process. ii. L.D. process. 4.6 Heat treatment on steel. ------
Month: April			Theory examination	------

Annual Teaching Plan

Academic year: 2024-2025

Name of Teacher: Mrs. Prameya. P. Jadhav

Program: B.Sc. I | Semester: I

Subject: Chemistry | Paper No: II

Course Title: Organic chemistry

<table>
<tr><td colspan="3">Month: August</td><td>Module</td><td>Subunit planned</td></tr>
<tr><td>Lecture</td><td>Practical</td><td>Total</td><td rowspan="2">Unit I: Fundamentals of Organic Chemistry</td><td rowspan="2">1.1 Introduction.
1.2 Basic concept of organic reactions, Bonds formation and cleavage, mechanism of curves arrow notation.
1.3 Types of reactions.</td></tr>
<tr><td>4</td><td>-</td><td>4</td></tr>
<tr><td colspan="3">Month: September</td><td>Module</td><td>Subunit planned</td></tr>
<tr><td>Lecture</td><td>Practical</td><td>Total</td><td rowspan="2">Unit I :- Fundamentals of Organic Chemistry</td><td rowspan="2">1.4 Types of reagents: Nucleophiles (negative and neutral) and electrophiles(positive and neutral). Electronic Displacements:.
1.5 Inductive Effect, Electromeric Effect, Resonance and hyperconjugation effect, electron withdrawing group.
1.6 Reactive Intermediates: Generation, Structure, Stability and reactions of Carbocations, Carbanions and free radicals.</td></tr>
<tr><td>4</td><td>-</td><td>4</td></tr>
<tr><td colspan="3">Month: October</td><td>Module</td><td>Subunit planned</td></tr>
<tr><td>Lecture</td><td>Practical</td><td>Total</td><td rowspan="2">Unit II: Stereochemistry</td><td rowspan="2">2.1 Introduction, Types of Stereoisomerim.
2.2 Optical Isomerism: Concept of Chirality
2.3 Elements of Symmetry, Optical Isomerism in tartaric acid, 2, 3 dihydroxybutanoic acid, Enantiomerism, Diastereomerism and Meso compounds.</td></tr>
<tr><td>4</td><td>-</td><td>4</td></tr>
<tr><td></td><td></td><td></td><td></td><td>2.4 Geometrical isomerism in C=C, C=N and alicyclic compounds.
2 .5 Nomenclature of stereoisomers: D and L, erythro and threo, R and S, E and Z</td></tr>
</table>

Month: November 11 Nov-23 Nov Diwali vocation	Practical examinations ------	------ ------
Month: December	Theory examination	------

Program: B.Sc. II Semester: III

Subject: Chemistry Paper No: VI

Course Title: Industrial Chemistry

Month: August			Module	Subunit planned
Lecture	Practical	Total	Unit I: Basic Concepts in Industrial Chemistry	1.1 The difference between classical chemistry and industrial chemistry, Raw material for the Chemical Industry. 1.2 Material Safety data sheets, Units that make up a chemical process-unit operation and unit processes, Flow Diagrams, Block Diagram, Process flow diagram / flow sheets. 1.3Material Balances-The purpose of mass balance calculations, Material Balance Equations, Mass balance calculation procedure and simple example.
6	-	6		
Month: September			Module	Subunit planned
Lecture	Practical	Total		

<table>
<tr><td>6</td><td>-</td><td>6</td><td>Unit I: Basic Concepts in Industrial Chemistry</td><td>1.4 Definition and Explanation of terms - Normality, Equivalent weight, Molality, Molecular weight, Molarity, Molarity of mixed solution, Acidity of base, Basicity of acid, ppt, ppm, ppb solutions.

1.5 Mole Fraction, Weight fraction, Percentage composition by W/W, W/V, V/V, Problems based on Normality, Molarity, mole fraction, mixed solution, etc.</td></tr>
<tr><td colspan="3">Month: October</td><td>Module</td><td>Subunit planned</td></tr>
<tr><td>Lecture</td><td>Practical</td><td>Total</td><td rowspan="2">Unit II: Unit Operations</td><td rowspan="2">2.1 Size reduction- Principle, Jaw crusher, ball mill.
2.2 Size Enlargement –Principle, Pellet mill, tumbling agglomerators.
2.3 Separation – Magnetic separation, Froth flotation, Distillation-Distillation of liquid mixtures, Types of distillation, Types of columns and packing, Condensers, Vacuum distillation, Spinning-band distillation, Steam distillation.</td></tr>
<tr><td>6</td><td>-</td><td>6</td></tr>
<tr><td colspan="3">Month: November</td><td>Theory examinations</td><td>------</td></tr>
</table>

Program: B.Sc. III Semester: V

Subject: Chemistry Paper No: IX, X, XII

Course Title: 1. Inorganic chemistry

2. Organic chemistry

3. Analytical chemistry

Month: August			Module	Subunit planned
Lecture 6	Practical -	Total 6	Unit V: Catalysis	5.1 Introduction. 5.2 Classification of catalytic reaction – Homogeneous and Heterogeneous 5.3 Types of catalysis. 5.4 Characteristics of catalytic reactions. 5.5 Mechanism of catalysis. i. Intermediate compound formation theory ii. Adsorption theory. 5.6 Industrial applications of catalysis.
Month: September			Module	Subunit planned
Lecture	Practical	Total	Unit I: Introduction to	

6	-	6	Spectroscopy	1.1 Meaning of spectroscopy. 1.2 Nature of electromagnetic radiation: wavelength, frequency, energy, amplitude, wave number and their relationship. 1.3 Different units of measurement of wavelength and frequency. 1.4 Different regions of electromagnetic radiations. 1.5 Interaction of radiation with matter: absorption, emission, fluorescence and scattering. 1.6 Types of spectroscopy and advantages of spectroscopic methods. 1.7 Energy types and energy levels of atoms and molecules.
Month: October			Module	Subunit planned
Lecture	Practical	Total		
6	-	6	Unit V: Chromatographic techniques and Quality control	5.1 Introduction, classification 5.2 Column chromatography: Introduction, types, Principle of adsorption column chromatography, solvent system, stationary phases, MethodologyColumn packing, applications of sample, development, detection methods, recovery of components, Applications. 5.3 Ion exchange chromatography: Introduction, Principle, Types and properties of ion exchangers, Methodology-Column packing, application of sample, elution, detection/analysis, Applications. 5.4 Concepts in Quality control i. Introduction and Concept of quality. ii. Quality control. iii. Quality assurance. iv. ISO series. v. Good laboratory practices

Month: November	Theory examinations	------

Program: B.Sc. I Semester: II

Subject: Chemistry Paper No: IV

Course Title: Analytical Chemistry

Month: January			Module	Subunit planned
Lecture	Practical	Total	Unit I: Introduction to analytical Chemistry	1.1 Introduction, Importance of analysis 1.2 Analytical processes (Qualitative and Quantitative), Methods of analysis (Only classification) 1.3 Sampling of solids, liquids and gases, Classification of separation method. 1.4 Errors, types of errors (determinate and indeterminate), methods of expressing accuracy
4	-	4		

				(Absolute and relative error), Significant figures, mean, median, standard deviation (Numerical problems expected)
Month: February			Module	Subunit planned
Lecture	Practical	Total	Unit II :- Chromatography	2.1 Introduction, Basic Principle of

4	-	4		Chromatography, Basic terms, Classification of Chromatography, advantages of chromatography 2.2 Paper Chromatography- Principle, Methodology-types of papers and treatment, sample loading, choice of solvent, developmentascending, descending, circular, location of spots, determination of Rf value, Applications, advantages and disadvantages 2.3 TLC- Principle, Methodology 2.4 Comparison of paper chromatography and TLC.
Month: March			Module	Subunit planned
Lecture	Practical	Total	Unit III: Theory of titrimetric Analysis	3.1 Introduction, Acid-base indicators, Theory of indicators w.r.t. Ostwald's ionization theory and quinoid theory 3.2 Neutralization curves and choice of indicators for Strong acid – strong base, Weak Acid- Strong Base, Weak Base- Strong acid 3.3 complexometric titrations a. Introduction b. Types EDTA titrations c. Metallochromic indicators-Eriochrome black- T d. Indicator Action of Eriochrome black- T
4	-	4		
			Practical examinations	------
Month: April			Theory examination	------

Program: B.Sc. II Semester: IV

Subject: Chemistry Paper No: VIII

Course Title: Organic Chemistry

<table>
<tr><td colspan="3">Month: January</td><td>Module</td><td>Subunit planned</td></tr>
<tr><td>Lecture</td><td>Practical</td><td>Total</td><td rowspan="2">Unit I: Carboxylic acids and their derivatives</td><td rowspan="2">1.1 Monocarboxylic acid: Introduction, IUPAC nomenclature Methods of Formation from Alcohols, Aldehydes, Ketones, Nitriles and Alkyl benzenes. Chemical Reaction: HellVohlard-Zelinsky (HVZ) reaction.

1.2 Formation of Halo Acids, Mono, Di, Tri-chloro acetic acid. Substitution reaction of Monochloro acetic acid by Nucleophile OH-, I-, CN-and NH3

1.3 Hydroxy acids: Malic and Citric acid Methods of formation of Malic acid from maleic acid, from Alpha bromo succinic acid and moist Ag2O. Chemical Reactions: Reactions of Malic acid- Action of heat, oxidation by KMnO4 and reduction reaction with HI.</td></tr>
<tr><td>6</td><td>-</td><td>6</td></tr>
<tr><td colspan="3">Month: February</td><td>Module</td><td>Subunit planned</td></tr>
<tr><td>Lecture</td><td>Practical</td><td>Total</td><td rowspan="2">Unit I: Carboxylic acids and their derivatives</td><td rowspan="2">1.4 Uses of Malic acid Method of formation of Citric acid from glycerol. Chemical Reactions: Reaction of citric acid: acetylation by acetic anhydride, reduction by HI, action of heat. Uses of citric acid. Unsaturated acid: Cinnamic acid: method of formation from benzaldehyde using diethyl malonate and by using acetic anhydride and sodium acetate. Chemical Reactions- Bromination, Oxidation. Uses of cinnamic acid Acrylic acid: Method of formation from acrolein and by dehydration of beta hydroxy propionic acid. Chemical Reactions: Addition of water, Reduction by Na/ C2H5OH. Uses of acrylic acid.

1.5 Dicarboxylic acid: Succinic and phthalic acid Method of formation of succinic acid from</td></tr>
<tr><td>6</td><td>-</td><td>6</td></tr>
</table>

				ethylene dibromide, maleic acid Chemical Reactions: Action of heat, Action of NaHCO3, C2H5OH in presence of acid. Uses of succinic acid. Phthalic acid: Method of formation from oxylene and Naphthalene Chemical Reactions: Action of heat, reaction with sodalime, ammonia, uses of phthalic acid. 1.6 Carboxylic acid derivatives: Introduction Acid halide derivative: Acetyl chloride: formation from acid, by action with PCl3 and SOCl2 , reaction with water, alcohol (Mechanism of esterification is expected) and ammonia. Uses of acetyl choride. Acid anhydride derivative: Method of formation of acetic anhydride by dehydration of acetic acid, reactions with water, alcohol and ammonia, uses of acetic anhydride. Ester and Amides.
Month: March			Module	Subunit planned
Lecture	Practical	Total		2.1 Introduction, Classification, Nomenclature, structure.

6	-	6	Unit II: Amines and Diazonium Salts	2.2 Methods of preparation: a) From Alkyl halide by Amonolysis, b) By Reduction of Nitriles or Cyanides, c) From Unsubstituted amides (Hoffmann degradation), d) By Gabrial Synthesis (From Phthalamide). 2.3 Reactions: Carbylamine reaction, SchottenBaumann reaction, Electrophilic substitution' (Aniline), Nitration, Bromination, Sulphonation. 2.4 Diazonium salt: Introduction, Preparation of diazonium salts. Properties and application of congo red and methyl orange. 2.5 Reactions: Replacement by Halogen(Sandmeyer), Replacement by Iodine, Replacement by –OH, C and N Coupling reactions: Synthesis of Methyl orange and Congo red.Reduction of BDC.
			Practical examinations	------
Month: April			Theory examinations	------

Program: B.Sc. III Semester: VI

Subject: Chemistry Paper No: XIII, XIV, XVI

Course Title: 1. Inorganic chemistry

2. Organic chemistry

3. Industrial chemistry

Month: January			Module	Subunit planned
Lecture 6	Practical -	Total 6	Unit V: Bio-inorganic Chemistry	5.1 Introduction. 5.2 Essential and trace elements in biological process. 5.3 Metalloporphyrins with special reference to hemoglobin and myoglobin. 5.4 Biological role of alkali and alkaline earth metal ions with special referenc to Na+ , K+ and Ca2+.
Month: February			Module	Subunit planned
Lecture	Practical	Total	Unit V: Pharmaceuticals	5.1 Introduction ethambutal, benzocaine, 5.2 Classification. 5.3 Qualities of ideal drug. 5.4 Synthesis and uses of phenobarbitone, isoniazide, Chloramphenicol,paludrine. 5.5 Drug action of sulpha drugs.
6	-	6		
Month: March			Module	Subunit planned
Lecture	Practical	Total	Unit V: Nanotechnology	

6	-	6		5.1 Introduction of nanotechnology, history, Classification of nanoparticles based on size. 5.2 Optical properties of Nanomaterial's i. Semiconducting NPs. ii. Metallic NPs. 5.3 Synthetic Routes of nanomaterials: Topdown and bottom-up approaches. 5.4 Synthesis methods: Sol-gel, precipitation, chemical reduction, chemical vapor deposition, hydrothermal, electrodeposition.
				5.5 Characterization of nanomaterials: X-Ray diffractometer, Scanning Electron Microscope, Transmission electron microscope. 5.6 Applications of nanotechnology.
			Practical examinations	------
Month: March			Theory examinations	------