

Satyaniketan's

Adv. M. N. Deshmukh Arts, Science and Commerce College, Rajur.

Tal. Akole. Dist. Ahmednagar.

Department of Chemistry

ANNUAL TEACHING PLANNING (Tentative) 2026-2027

Class- FYBSc

(As Per National Education Policy-2020)

Subject- CHE-101-T: Fundamentals of Chemistry-I

Month	Chapters	Hours
Semester - I		
July	Chapter 2: Atomic Structure ➤ Bohr's theory, its limitations and atomic spectrum of hydrogen atom. ➤ Sommerfield modification. ➤ Quantum numbers ➤ Introduction to the concept of atomic orbitals; shapes, radial and angular probability diagrams of s, p and d orbitals (qualitative idea).	03
August	➤ Many electron atoms and ions: Pauli's exclusion principle, Hund's rule, exchange energy, Aufbau principle and its limitations. ➤ Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. ➤ Relative energies of atomic orbitals. ➤ Quantum Mechanics: Wave particle duality, de Broglie hypothesis, and the uncertainty principle.	04
September	Chapter 4: Catalysis and Surface chemistry ➤ Catalysis, Types of catalyst and catalysis, specificity and selectivity, mechanism of catalyzed reactions at solid surfaces (diffusion theory of catalysis). ➤ Introduction to surface Chemistry - some basic terms related to surface Chemistry adsorption, adsorption materials,	03
October	➤ Factors affecting adsorption, ➤ Characteristics of adsorption, ➤ Types of adsorption, ➤ Classification of adsorption isotherms, Langmuir adsorption isotherm, Freundlich's adsorption isotherm, ➤ Application of adsorption, problems	03

Semester – I Subject- OE-101-CHE (A): Kitchen and Daily Life Chemistry		
July	Chapter 1: Macromolecules in Food Understanding the role of carbohydrates, proteins, and lipids in food systems, Chemical structures and functions of macromolecules in cooking and nutrition,	04
August	Impact of macromolecules on the taste, texture, and nutritional value of food Chapter 2: Chemistry of Cooking Physical and Chemical changes, Stability of nutrients during cooking.	04
September	Microwave cooking, Food sterilization, Chemistry of spices and herbs, Safety protocols and best practices in kitchen chemistry. Chapter 3: Classification and sources of nutrients a) Carbohydrate-rich foods: Wheat, rice, potato, sugar, etc. b) Protein-rich foods: Egg, milk, meat, fish, pulses, etc.	04
October	c) Fat-rich foods: Oil, ghee, butter, groundnut, etc. d) Vitamins rich foods: Fruits, green leafy vegetables e) vitamins and minerals	02



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Subject- CHE-151-T: Fundamentals of Chemistry-II

Month	Chapters	Hours
Semester - II		
December	Chapter 1: Photochemistry Introduction, Difference between thermal and photochemical processes. b. Laws of photochemistry i) Grothus - Draper law ii) Stark-Einstein law. c. Quantum yield, Reasons for high and low quantum yield. Factors affecting Quantum yield, Experimental method for the determination of quantum yield & Problems. d. Fluorescence, Phosphorescence, Chemiluminescence.	06
January	Chapter 2: Chemical Kinetics Recapitulation: Rate of a reaction (Average and instantaneous), order and Molecularity of a reaction, rate law and specific rate constant, First order and Pseudo molecular reaction (Without derivation). Second order reaction expression, Numerical based on rate of reaction, half-life period and rate constant of First order reaction only.	04
OE-151-CHE (A): Chemistry for Competitive Examination – II		
February	Chapter-1: Introduction to Physical Chemistry a. Chemical classification of matter: Introduction, Elements, Compounds, Molecules and compounds, Molecular mass and Mole concept, Formula mass, Empirical and Molecular formula, Mole fraction, Mixture, Homogeneous and Heterogeneous mixture, Important points. b. Thermodynamics: Introduction, Heat and Temperature, Specific heat, Effects of heat, Heat transfer, Laws of Thermodynamics, Entropy. Reference:	08
March	Chapter-4: Miscellaneous Chemistry a. Fertilizers: Introduction, Classification, Uses b. Dyes: Introduction, Different classes, its uses c. Types of glasses, d. Soap and Detergent, e. Food preservative like, benzoates, propionate, sorbates. f. Artificial sweeteners: aspartame, saccharin, dulcin, sucralose, Flavors like vanillin, monosodium glutamate. g. Artificial food colourant. h. Environmental Chemistry: Hydrologic cycle, Air Pollution, Water pollution.	10

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Class- SYBSc

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Subject- CHE-201-MJ-T: Physical Chemistry-I [Credit 2, 36 L]

CHE-241-MN-T: Physical and Inorganic Chemistry [Credit 1, 18 L]

Month	Chapters	Periods
Semester – III		
July	Chapter 1 : Chemical Kinetics [8 Hours] ➤ (Recapitulation: rate of chemical reaction, order of reaction, integrated rate law :zero-order, first order, second order) ➤ Third-order reactions, Derivation of integrated rate law for third-order reactions with equal initial concentrations, characteristics and examples of third-order reaction. ➤ Methods to determine the order of reaction using: Integrated rate equation method, Graphical method, Half-life method and Differential method. ➤ Effect of temperature on reaction rate ➤ Arrhenius equation ➤ Temperature dependence of reaction rates ➤ Interpretation of Arrhenius parameters ➤ Numericals	08
August	Chapter 2 : Chemical Thermodynamics [7 Hours] ➤ (Recapitulation: Introduction, terminology of thermodynamics, thermodynamic equilibrium, properties, thermodynamic processes) ➤ First law of thermodynamics ➤ Enthalpy ➤ Heat capacity ➤ Relation between C_p and C_v ➤ Expansion of ideal gas and changes in thermodynamic properties: Isothermal process, Adiabatic process ➤ Limitations of the first law ➤ Need for the second law ➤ Cyclic process ➤ Carnot cycle ➤ Second law of thermodynamics ➤ Concept of entropy ➤ Entropy change in isothermal expansion ➤ Reversible and irreversible processes ➤ Phase change and entropy of mixing of ideal gases ➤ Work and free energy function. ➤ Numericals	07

September	Chapter 3 : Electrolytic Conductance [8 Hours] ➤ <i>(Recapitulation: Electrolytes, Ohm's law and Electrical units, electrolytic conductance, resistance and specific resistance) .</i> ➤ Electrolytic Conductance ➤ Specific and equivalent conductance ➤ Variation of equivalent conductance with concentration. ➤ Kohlrausch's law and its applications to determine: ➤ Equivalent conductance at infinite dilution of a weak electrolyte ➤ The ionic product of water, Solubility of sparingly soluble salts. ➤ Migration of ions and ionic mobilities ➤ Absolute velocity of ions ➤ Transport number determination by: Hittorf's method, ➤ Moving boundary method ➤ Relation between ionic mobility ➤ ionic conductance and transport number ➤ Ionic theory of conductance. ➤ Numericals	08
October	Chapter 4 : Phase Equilibrium [7 Hours] ➤ Introduction, Phase ➤ Components and Degree of Freedom of a system, Stability of Phases ➤ Criteria of Phase equilibrium ➤ Gibb's Phase rule and its thermodynamic derivation ➤ Phase Diagrams of One Component system: Water, Carbon Dioxide and Sulphur system	06
November	➤ Numericals.	01

CHE-241-MN-T: Physical and Inorganic Chemistry		
July	Chapter 2 : Chemical Thermodynamics [7 Hours] ➤ (Recapitulation: Introduction, terminology of thermodynamics, thermodynamic equilibrium, properties, thermodynamic processes) ➤ First law of thermodynamics ➤ Enthalpy ➤ Heat capacity ➤ Relation between C_p and C_v ➤ Expansion of ideal gas and changes in thermodynamic properties: Isothermal process, Adiabatic process ➤ Limitations of the first law ➤ Need for the second law	06
August	➤ Cyclic process ➤ Carnot cycle ➤ Second law of thermodynamics ➤ Concept of entropy ➤ Entropy change in isothermal expansion ➤ Reversible and irreversible processes ➤ Phase change and entropy of mixing of ideal gases ➤ Work and free energy function. ➤ Numericals	06
September	Chapter 3 : Electrolytic Conductance [8 Hours] ➤ (Recapitulation: Electrolytes, Ohm's law and Electrical units, electrolytic conductance, resistance and specific resistance) . ➤ Electrolytic Conductance ➤ Specific and equivalent conductance ➤ Variation of equivalent conductance with concentration. ➤ Kohlrausch's law and its applications to determine: ➤ Equivalent conductance at infinite dilution of a weak electrolyte ➤ The ionic product of water, Solubility of sparingly soluble salts.	06
October	➤ Migration of ions and ionic mobilities ➤ Absolute velocity of ions ➤ Transport number determination by: Hittorf's method, ➤ Moving boundary method ➤ Relation between ionic mobility ➤ ionic conductance and transport number ➤ Ionic theory of conductance. ➤ Numericals	06



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Class- TYBSc

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Subject- CHE-301-MJ-T: PHYSICAL CHEMISTRY II

CH-511 (A) : Environmental Chemistry

CHE-351-MJ-T: PHYSICAL CHEMISTRY III

Month	Chapters	Periods
Semester – V		
CHE-301-MJ-T: PHYSICAL CHEMISTRY II [Credit -2, 36 L]		
July	Chapter 2: Nuclear Chemistry Introduction (10 Hrs) ➤ Radioactivity: Types (α, β, γ) and properties of radiations. ➤ Detection & Measurement: Geiger-Muller Counter, Scintillation Counter, ➤ Ionization Chamber, Film Badges. ➤ Nuclear structure. Classification of nuclides (Isotopes, Isobars, Isotones, Isomers). ➤ Radioactive decay processes, Group Displacement Law. ➤ Kinetics of decay: Decay constant, half-life, average life. ➤ Nuclear energy: Mass defect, Binding energy. ➤ Applications of radioisotopes as tracers: Chemical investigation (Esterification, Friedel-Crafts), Structural determination (PCl_5), Age determination (Tritium, C-14 dating).	10

August	Chapter 3: Quantum Chemistry (10 Hrs) ➤ Introduction: Need for quantum mechanics. ➤ Recapitulation: de Broglie hypothesis, Heisenberg's uncertainty principle. ➤ Postulates of quantum mechanics, operators, and observables. ➤ Time-independent Schrödinger wave equation ➤ Conditions for a well-behaved wave function. ➤ Particle in a 1-D box (derivation), 2-D and 3-D box (concept). ➤ Physical interpretation of ψ and ψ^2, sketching for 1-D box. Degeneracy. ➤ Applications to conjugated systems. Vibrating particle: vibrational energy levels, zero-point energy, concept of quantum tunneling. ➤ Numerical.	10
September	Chapter 1: Electrochemical Cells (10 Hrs) ➤ Electrochemical cells: concept, construction, working. Reversible and irreversible cells. ➤ Electromotive force (e.m.f.) and its measurement. ➤ Reference electrodes: Standard Hydrogen Electrode (SHE), Calomel, Ag/AgCl electrode. ➤ Weston standard cell (historical mention) ➤ Nernst equation for electrode potential and cell e.m.f. Sign convention, cell representation. ➤ Thermodynamics of reversible cells: Relationship between E, ΔG, and K. ➤ Electrochemical series and applications. ➤ Concentration cells, liquid junction potential, salt bridge. Applications: pH determination (Hydrogen & Glass electrode). Potentiometric titrations (Acid-base & Redox). ➤ Batteries: Primary and Secondary types, applications. ➤ Fuel cells: Types, principle, advantages, limitations. ➤ Comparison of batteries and fuel cells.	10

CH-511 (A) : Environmental Chemistry

October	3. Analytical Techniques in water Analysis (10 L) ➤ Water quality parameters and standards, ➤ Domestic water quality parameters, surface water, sampling, preservation, ➤ Monitoring techniques and methodology (pH, conductance, DO, ammonia, nitrate and nitrite, Cl, F, CN, Sulfide, sulphate, phosphate, total hardness, boron, ➤ Metals and metalloids- As, Cd, Cr, Cu, Fe, Pb, Mn, Hg (Exclude polarographic and AAS methods), ➤ COD, BOD, TOC, phenols, pesticides, surfactants, tannis and lignins, ➤ E. Coli, Case studies of water pollution.	10
November	4. Water pollution and treatment methods (10 L) ➤ Water pollutants, Eutrophication, ➤ Waste water treatment (domestic waste water, ➤ Aerobic treatment, anaerobic treatment, ➤ Upflow aerobic sludge bed, industrial waste water treatment, ➤ Drinking water supplies, ➤ Trace elements in water, ➤ Chemical speciation (Cu, Pb, Hg, As, Se, Cr)	10
December		

Semester – VI CHE-351-MJ-T: PHYSICAL CHEMISTRY III [Credit -2, 30 L]		
January	Chapter 3: Kinetics of Reactions in the Solid State (7 Hrs) ➤ Some General Considerations, ➤ Factors affecting reactions in Solids, ➤ Rate Laws for Reactions in Solids , ➤ The Parabolic Rate Law, ➤ The First-Order Rate Law, ➤ The Contracting Sphere Rate Law, ➤ The Contracting Area Rate Law, ➤ The Prout–Tompkins Equation, ➤ Rate Laws Based on Nucleation, ➤ Applying Rate Laws, ➤ Results of Some Kinetic Studies, ➤ The Deaquation-Anation of $[\text{Co}(\text{NH}_3)_5\text{H}_2\text{O}]\text{Cl}_3$, Two Reacting Solids.	07
February	Chapter 2: Crystal structure (9 Hrs) ➤ Types of Solids: Isotropy and Anisotropy, Isomorphism and polymorphism, ➤ Laws of crystallography: Law of constancy of interfacial angles, Law of rational indices, Law of crystal symmetry, ➤ Weiss indices and Miller indices, ➤ Crystal Structure: Parameters of the Unit Cells, ➤ Cubic Unit Cells: Three Types of Cubic Unit Cells, ➤ Calculation of Mass of the Unit Cell, ➤ Methods of Crystal structure analysis: The Laue method and Braggs method: Derivation of Bragg’s equation, ➤ Determination of crystal structure of NaCl by Bragg’s method, ➤ X ray analysis of NaCl crystal system, ➤ Calculation of d and λ for a crystal system, Numerical.	09
March	Chapter 1: Investigation of Molecular structure (14 Hrs) ➤ Introduction: Molar refraction and molecular structure, Dipole moment and molecular structure, electromagnetic spectrum, energy of molecules, ➤ Types of molecular spectra Microwave Spectroscopy: Introduction, ➤ Classification of molecules on the basis of moment of Inertia, ➤ Rotational spectra of rigid diatomic molecules, relative intensities of spectral lines, effect of isotopic substitution on the rotational spectra, ➤ Determination of bond length and moment of inertia from rotational spectra, ➤ Problems Infrared Spectroscopy: Introduction, Simple Harmonic oscillator, ➤ Modes of vibration, force constant, ➤ Vibrational spectrum of a diatomic molecule: Vibrational Energy expression, ➤ Allowed vibrational energies, zero-point energy, Selection rule, ➤ Vibrational energy level diagram with transitions, spectrum depiction, ➤ Vibration-rotation Spectra: Born-Oppenheimer approximation, ➤ Energy expression for vibrational rotor, ➤ Selection rules, Vibrational-rotational energy level diagram with transitions,	10

April	3. Nuclear Chemistry [10L] ➤ Radioactivity, ➤ Types of Radiations, Properties of Radiations, ➤ Detection and Measurement of Radioactivity: Cloud chamber, ➤ Ionization Chamber, ➤ Geiger-Muller Counter, ➤ Scintillation Counter and Film Badges, ➤ Nuclear structure, Classification of nuclides, ➤ Types of Radioactive Decay, ➤ The Group Displacement Law, ➤ Kinetics of Radioactive Decay, ➤ Half-life, average life, ➤ Energy released in nuclear reaction, ➤ Mass Defect, ➤ Nuclear Binding Energy, ➤ Some applications of radio-isotopes as tracers: ➤ Chemical investigation – Esterification, ➤ Friedel -Craft reaction, ➤ Structural determination – Phosphorus pentachloride, ➤ Age determination – use of tritium and C14 dating, ➤ Problems	10
	➤ Nature of vibrational spectra, P, Q and R branches of lines of the IR spectra, Problems. ➤ Raman Spectroscopy: Introduction, Classical and Quantum theory of Raman effect, ➤ Rayleigh, Stokes and anti-stokes lines, ➤ Pure rotational Raman spectra of linear diatomic molecules	