

Satyaniketan's
Adv. M. N. Deshmukh Arts, Science and Commerce College, Rajur.
Tal. Akole. Dist. Ahmednagar.

Department of Chemistry
ANNUAL TEACHING PLANNING (Tentative) 2024-2025
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. Sommerfeld 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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Class- FYBSc

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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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ANNUAL TEACHING PLANNING (Tentative) 2024-2025

Class- SYBSc Choice Based Credit System [CBCS]

Subject- CH-301: Physical and Analytical Chemistry [Credit 2, 36 L]

CH-401: Physical and Analytical Chemistry [Credit 2, 36 L]

Month	Chapters	Periods
Semester - III		
July	Ch-1) Chemical Kinetics: [12 L] ➤ Introduction to kinetics, ➤ The rates of chemical reactions ➤ Definition of rates, ➤ Rate laws and rate constants,	03
August	➤ Reaction order and molecularity, ➤ Determination of rate law, ➤ Factors affecting reaction rates, ➤ Integrated rate laws – zeroth-order reactions, ➤ First-order reactions, ➤ Second-order reactions (with equal and unequal initial Concentration of reactants), ➤ Half-life period,	06
September	➤ Methods for determination order of a reactions, ➤ Arrhenius equation- temperature dependence of reaction rates, Interpretation of Arrhenius parameters, ➤ Reaction dynamics - collision theory and transition-state theory of bimolecular reactions, ➤ Comparison of the two theories, ➤ Problems.	06
October	Ch-2) Surface Chemistry [6L] ➤ Introduction to surface chemistry ➤ Some basic terms related to surface chemistry adsorption, ➤ Adsorption materials, ➤ Factors affecting adsorption, ➤ Characteristics of adsorption,	06
November	➤ Types of adsorption,	06

	➤ Classification of adsorption isotherms, ➤ Langmuir adsorption isotherm, ➤ Freundlich's adsorption isotherm, ➤ BET theory (only introduction), ➤ Application of adsorption, ➤ Problems.	
December		
Semester - IV		
January	Ch-1) Phase equilibrium [9L] ➤ Introduction ➤ Definitions of phase ➤ Components and degrees of freedom of a system ➤ Stability of phases,	06
February	➤ Criteria of phase equilibrium m. ➤ Gibbs phase rule and its thermodynamic derivation, ➤ Phase diagrams of one- component systems- water ➤ Carbon dioxide and sulphur systems ➤ Problems.	06
March	Ch-2) Ideal and real solutions [9L] ➤ Introduction ➤ Chemical potential of liquids ➤ Ideal solutions, ideal dilute solutions ➤ Raoult's and Henry's Law ➤ Liquid mixtures,	06
April	➤ Phase diagram of binary systems ➤ Liquids - vapour pressure diagrams ➤ Temperature composition diagrams ➤ Liquid-liquid phase diagrams ➤ Solubility of partially miscible liquids-critical solution temperature ➤ Effect of impurity on partially miscible liquids, Problems.	06



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Class- TYBSc Choice Based Credit System [CBCS]

Subject- CH-501: Physical Chemistry- I
CH-511 (A) : Environmental Chemistry
CH-601 : Physical Chemistry-II

Month	Chapters	Periods
Semester – V		
DSEC-I: CH-501: Physical Chemistry- I [Credit -2, 36 L]		
July	Ch-1) Quantum Chemistry [10 L] ➤ Introduction ➤ de Broglie hypothesis ➤ The Heisenberg's uncertainty principle ➤ Quantisation of energy ➤ Operators ➤ Schrodinger wave equation ➤ Well behaved function ➤ Particle in a one ➤ Two and three-dimensional box (no derivation) ➤ Physical interpretation of the ψ and ψ^2 ➤ Sketching of wave function and probability densities for 1D box	10
August	➤ Degeneracy ➤ Applications to conjugated systems ➤ Zero-point energy and quantum tunnelling ➤ Numerical Ch-3) Photochemistry [10 L] ➤ Introduction ➤ Difference between thermal and photochemical processes ➤ Laws of photochemistry: ➤ Grothus - Draper law ➤ ii) Stark-Einstein law,	10

	➤ Quantum yield, ➤	
September	➤ Reasons for high and low quantum yield ➤ Factors affecting Quantum yield ➤ Experimental method for the determination of quantum yield ➤ Types of photochemical reactions ➤ Photosynthesis ➤ Photolysis ➤ Photocatalysis ➤ Photosensitization ➤ Jablonski diagram depicting various processes occurring in the excited state ➤ Qualitative description of fluorescence and phosphorescence ➤ Chemiluminescence ➤ Problems	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 – IV DSEC-IV: CH-601 : Physical Chemistry-II [Credit -2, 36 L]		
January	Ch- 1) Electrochemical Cells [16 L] ➤ Electrochemical cells, ➤ Reversible and irreversible cells with examples, ➤ The e.m.f. of electrochemical cell and its measurement, ➤ The Weston standard cell, ➤ Reference electrodes: ➤ The primary reference electrode and Secondary reference electrodes, ➤ The Nernst equation for E.M.F. of a cell. ➤ Types of reversible electrodes, ➤ The sign convention for electrode potentials, ➤ Thermodynamics of reversible cells and reversible electrodes, ➤ E.M.F. and equilibrium constant of cell reaction, ➤ Electrochemical series, ➤ Types of concentration cells, ➤ Liquid junction potential, ➤ Salt bridge, ➤ Applications of emf measurements: 1. Determination of pH of a solution by using hydrogen electrode, ➤ Quinhydrone electrode and glass electrodes.	10
February	➤ 2.Potentiometric titrations: ➤ Acid-base titrations, ➤ (ii) Redox titrations. ➤ (iii) Precipitation titration, ➤ Batteries: Primary and Secondary batteries, ➤ Applications for Secondary Batteries, ➤ Fuel Cells: ➤ Types of fuel cells, ➤ Advantages, ➤ Disadvantages of fuels cells, ➤ Comparison of battery Vs fuel cell	06
March	2. Crystal structure [10 L] ➤ Types of Solids: Isotropy and Anisotropy, ➤ Laws of crystallography: Law of constancy of interfacial angles, ➤ Law of rational indices,	10

	➤ 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.	
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



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Class- TYBSc Choice Based Credit System [CBCS]

Subject- Sem- V CH-505

Sem- VI CH-610B

Month	Chapters	Periods
Semester – V		
DSEC-II: CH-505: Industrial Chemistry - I [Credit -2, 36 L]		
July	1. Modern Approach to Chemical Industry (6 L) Introduction, basic requirements of chemical industries, chemical production, unit process and unit operations, Quality control and quality assurance, process control, research and development, human resource, safety measures, classification of chemical reactions, batch and continuous process, Conversion, selectivity and yield, copy-right act, patent act, trademarks.	08
August	2 Manufacture of Basic Chemicals (7 L) a) Ammonia: Manufacture of ammonia by modified Haber-Bosch process, Physico-chemical principles involved and uses of ammonia. b) Nitric acid: Manufacture of nitric acid by Ostwald's process, Physico-chemical principles involved and uses of nitric acid. c) Sulphuric acid: Manufacture of sulphuric acid by contact process, Physico-chemical principles involved and uses of sulphuric acid.	08
September	3. Sugar and Fermentation Industry (7 L) a. Sugar: Introduction, manufacture of cane sugar, extraction of juice, purification of juice, sulfitation and carbonation, evaporation, crystallization, separations of crystals, drying refining, grades, recovery of sugar from molasses, by-product of sugar industry, Reference No.-1: Page No.1208- 1218 b. Fermentation Industry: Introduction, importance, conditions favorable for fermentation, Characteristics of enzymes, short account of some fermentation processes, Alcohol beverages, Manufacture of beer, manufacture of spirit, manufacture of wines, manufacture of vinegar, manufacture of power alcohol, ethyl alcohol from molasses.	08
	4. Soap and detergents (8 L) (a) Soap: Soap and Fatty Acids: Introduction, Chemistry, Manufacturing Technology, Raw Materials, Functional Properties of Soap, Manufacturing Processes, Saponification Reactor,	06

	Cooling, Soap Separator, Soap Extraction, Centrifugation, Neutralization, Direct Neutralization, Carbonate Neutralization, Partial Neutralizing with Soda Ash, Carbon Dioxide Separation, Raw Material Dosing, Caustic Soda, Completion of Neutralizing with Caustic Soda, Neutralization Soap Viscosity,	
October	(b) Detergents: Synthetic Detergents: Introduction, Characteristic Features of Surfactants, Raw Materials for Surfactant Production, intermediates for Surfactant Production, Anionic Surfactants, Non-ionic Surfactants, Amphoteric Surfactants, Cationic Surfactants, Detergent Additives, Production of Synthetic Detergents, and Washing action of soap and detergents.	04
November	5. Dyes and Pigments (8 L) (a) Dyes: Introduction, qualities of good dye, Colour constituents (Chromophore, auxochrome), classification of dyes according to their application, Synthesis and uses of following dyes: Nitroso dye-martius yellow, Azo dyes-Methyl orange and aniline yellow, Triphenylmethane dye-Crystal violet, Phthalein dye - Phenolphthalein, Xanthane-Fluorescein, Antha-quinnoe-Alizarin and Indigo dyes - Indigo. (b) Pigments: Introduction, classification and general properties of pigments. Inorganic pigments: i) Zinc oxide pigments (Fundamentals and properties, Raw materials, Direct process (American process), Precipitation process) ii) Iron oxide pigments (Fundamentals and properties, Production of iron oxide pigment by precipitation process),	10
December		
Semester – VI CH-610 (B) Introduction to Forensic Chemistry		
January	1. History of Development of Forensic Science in India [10 L] Functions of forensic science. Historical aspects of forensic science. Definitions and concepts in forensic science. Scope of forensic science. Need of forensic science. Basic principles of forensic science. Frye case and Daubert standard.	10
February	Work nature of forensic science. Qualifications of forensic scientists. Duties & Code of conduct for forensic scientists. 2. Introduction to Narcotics Drugs and Psychotropic Substances [10 L] Definition of narcotics drugs and psychotropic substances. Broad classification – Narcotics, stimulants, depressants and hallucinogens.	14
March	General characteristics and common example of each classification. Natural, synthetic and semi-synthetic narcotics drugs and psychotropic substances. Designer drugs. Tolerance, addiction and withdrawal symptoms of narcotics, drugs and psychotropic substances. Introduction to NDPS Act-1985 and awareness about Punishment for Offences.	14

April	3. Analysis of Narcotics Drugs and Psychotropic Substances [16 L] Crime scene search for narcotic drugs and psychotropic substances – searching a suspect, searching a dwelling, searching a vehicle. Clandestine drug laboratories. Collection and preservation of drug evidence. Testing of narcotics drugs and psychotropic substances. Isolation techniques for purifying narcotics drugs and psychotropic substances – thin layer chromatography, gas-liquid chromatography and high performance liquid chromatography. Presumptive and screening tests for narcotics drugs and psychotropic substances. Microcrystalline testing of Drug Abuse and Illicit Trafficking. Analysis of narcotics drugs and psychotropic substances in urine, and antemortem blood & in postmortem blood. Dope tests.	18
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