

SAKTHI COLLEGE OF ARTS AND SCIENCE FOR WOMEN, ODDANCHATRAM

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(Affiliated to Mother Teresa Women's University, Kodaikanal)

PG AND RESEARCH DEPARTMENT OF CHEMISTRY

CURRICULUM FRAMEWORK AND SYLLABUS FOR

OUTCOME BASED EDUCATION IN

SYLLABUS FOR

B.Sc., CHEMISTRY

&

ANCILLARY CHEMISTRY

FRAMED BY

MOTHER TERESA WOMEN'S UNIVERSITY, KODAIKANAL

UNDER

CHOICE BASED CREDIT SYSTEM

2015 - 2018

SEMESTER I
GENERAL CHEMISTRY PAPER – I

UNIT – I ORGANIC CHEMISTRY

- a) Introduction: Sources and classification of organic compounds-Electronic effects.
- b) Functional Groups: Definition -various functional groups-IUPAC Nomenclature – Homologous series.
- c) Molecular weight determination of organic acids and bases.
- d) Problems to derive empirical and Molecular formula incorporating the estimation of elements and molecular weight calculations. Detection of elements- lassaigne's test.

UNIT- II FUNDAMENTAL CONCEPTS

- a) Tetravalency of carbon atom
- b) Cleavage of bonds: Homolytic and heterolytic cleavage of carbon bond.
- c) Reaction Intermediates: Free radicals, carbanion and carbonium ion and their stability.
- d) Nucleophilic and electrophilic reagents.
- e) Types of reactions: Substitution, addition, elimination, rearrangement and polymerization with suitable examples.

UNIT- III INORGANIC CHEMISTRY-I

Basic principles of metallurgy – Froth flotation – magnetic separation – gravity separation-smelting-roasting- Flux – calcination – purification – electrolytic refining – zone refining, Van arkel – DeBoer's process – Alumino – Thermite process.

UNIT – IV GROUP IA & GROUP IB ELEMENTS

Group IA – Elements: Group discussion: Lithium: Diagonal relationship with magnesium and comparison with other members of the family justification of its position – Extraction, properties and uses.

Lithium compounds: Peroxide, carbonate and carbide of Lithium.

Group IB – Coinage metals, group discussion: - Copper – ores, Extraction, properties and uses, alloys and their preparation.

UNIT – V PHYSICAL CHEMISTRY

- a) Gaseous state: Ideal gas laws – deviations – limiting density of gases -van der Waal's equation – Equation of state – clausius, Berthelot and Dieterici – reduced equation of state and the law of corresponding state – Compressibility factor for gases – Boyle and inversion temperature of gases and their calculations Determination of van der Waal's constants.

- b) Critical phenomena of gases: PV isotherms of real and van der Waal's gases – critical state of gases. Definitions and determination of P_c , V_c , T_c – relation between van der Waal's constants.

SEMESTER I

GENERAL CHEMISTRY - PAPER II

UNIT – I ALIPHATIC HALOGEN COMPOUNDS

- Alkyl halide (Mechanisms only – Mechanism of substitution – SN_1 and SN_2 Mechanism of Elimination E_1 and E_2 – elementary treatment of Hofmann and Saytzeff rule.
- Poly halogen derivatives: Chlorofluoro carbons, Westron and Freon preparation and application.
- Halogen derivatives of unsaturated hydrocarbons: vinyl chloride, allyl chloride, allyl iodide and chloroprene preparation and uses.

UNIT – II HYDROXY COMPOUNDS

- Alcohols: Classification with suitable examples – preparation, properties and uses of ethanol, glycol and glycerol.
- Unsaturated monohydric alcohol, allyl alcohol – preparation, properties and uses.
- Estimation of number of hydroxyl groups.

UNIT – III GROUP II A ELEMENTS:

Group discussion, Beryllium, diagonal relationship with Aluminums and comparison with Magnesium – Justification of its position. Extraction, properties and uses.

UNIT – IV KINETIC THEORY OF GASES

Kinetic theory of gases – Maxwellll Boltzmann law of distribution of molecular velocities – graphical representation – experimental verification of Maxwell velocity distribution – root mean square- average and most probable velocities. Mean free path - collision number – collision diameter. Viscosity of gases – Brownian movement and determination of Avogadro number -Loschmidt Number.

UNIT – V SURFACE CHEMISTRY

Catalysis, definition – characteristics – theories of catalysis promoters and poisons-enzyme catalysis –acid – bases catalysis and auto catalysis with suitable examples – applications.

Adsorption – definition of the various terms – adsorption of gases on solids – characteristics of adsorption and chemisorption – factors influencing adsorption — adsorption isotherms – Freundlich and Langmuir adsorption isotherms – BET theory – elementary idea – application of adsorption.

SEMESTER I
GENERAL CHEMISTRY PAPER – III

UNIT – I ORGANIC COMPOUNDS

- a) Definition with examples for alkyl and aryl Grignard reagents. Preparation synthetic applications of CH_3MgI , TEL : preparation and uses.
- b) Organo sulphur compounds: Thio alcohols – thio ethers – preparation, properties and uses.

UNIT – II DISTRIBUTION LAW

Statement – mathematical formulation – experimental verification – conditions under which the distribution law is obeyed – derivation from the distribution law – derivation from the kinetic theory and application of the law.

UNIT – III ENERGETICS OF IONIC BONDING

Solubility of ionic compounds – energetics of formation of ionic compounds, Lattice energy – Born – Lande Equation – Born-Haber's cycle-Fajan's rule – van der waal's forces, ion-ion, ion-dipole interaction, hydrogen bonding, intermolecular theory and applications.

UNIT – IV PHASE RULE

Statement of significance of the terms involving derivation of phase rule.

- i) Application of phase rule to one-component systems. Water, Sulphur and Carbon dioxide.
 - ii) Application of phase rule to two component systems (except salt hydrates).
Condensed systems and reduced phase rule
- a) Solids in solids: simple eutectic with suitable examples.
 - b) Compound formation with congruent and incongruent melting points with suitable examples.

UNIT – V A. LIQUIDS IN LIQUIDS

COMPLETELY MISCIBLE LIQUIDS SYSTEMS:

Ideal and non-ideal system – Raoult's law and Hoff rule – distillation of homogeneous binary liquid mixtures – theory of fractional distillation and azeotropic distillation.

PARTIALLY MISCIBLE LIQUID SYSTEMS:

Variation of solubility with temperature – critical solution temperature (consolute temperature) lower, upper and critical solution temperature – influence of impurities on C.S.T. and applications. Immiscible liquid system: Theory of steam distillation and its applications.

SEMESTER II
PRACTICAL PAPER I
INORGANIC QUALITATIVE ANALYSIS

Mixture containing two acid radicals of which one is interfering ion and two basic radicals.

Acid radicals: Chloride, Bromide, Iodide, Sulphate, Nitrate, Carbonate, Fluoride, Phosphate, Borate, Oxalate.

Basic radicals: Lead, Copper, Cadmium, Bismuth, Antimony, Ferrous, Ferric, Aluminium, Zinc, Calcium, Nickel, Manganese, Cobalt, Barium, Strontium, Magnesium, ammonium.

SEMESTER III

ORGANIC CHEMISTRY – PAPER I

UNIT – I AROMATIC COMPOUNDS

- a) Introduction - general characteristic of aromatic compounds. Aromaticity and Huckel's rule – molecular orbital model of benzene.
- b) Homologues of benzene: preparation, properties, and uses of toluene, xylene, mesitylene and styrene.
- c) Aromatic substitutions:
 - i) Electrophilic, nucleophilic and free radicals substitution, explanations with examples.
 - ii) Inductive effect, Electromeric effect, Resonance – Hyperconjugation, explanation with examples.

UNIT – II REACTIONS OF AROMATIC COMPOUNDS

- a) Mechanism of aromatic mono-substitution (electronic interpretation, nitration, sulphonation and Friedal-Craft's reaction.
- b) Isomerism in disubstituted benzene – Korner's absolute method of orientation relative methods,
- c) Directive influence of substituents – rules of distribution Vorlandor's method. Crum-Brown, Hammic and Illingwoth's rules.
- d) Electrophilic disubstitution – nucleophilic substitution unimolecular, bimolecular – benzyne mechanism – free and homolytic substitution in benzene.

UNIT – III POLYNUCLEAR HYDROCARBONS & FUSED RING SYSTEMS

Polynuclear hydrocarbons and their derivatives. Isolated systems: Naphthalene, Anthracene and Phenanthrene: preparation, properties uses and structure. Derivatives of Naphthalene – preparation, properties and uses of Naphthylamines, naphthols and naphthaquionnes.

UNIT – IV STEREOISOMERISM

- a) Isomerism of maleic and fumaric acids and aldoximes and ketoximes. Determnation of configuration of geometrical Geometrical isomers – E-Z notation.
- b) Optical isomerism
 - i) Optical activity – specific rotation and its polarimetric determination definition of optical isomers – elements of symmetry.

- ii) Optical isomerism of compounds containing asymmetric carbon atom and meso forms – racemisation and resolution of racemic mixtures – Walden inversion – asymmetric synthesis.
- iii) Optical activity of elements other carbon atoms. Quaternary ammonium compounds and tertiary amino oxides.

UNIT – V CHEMISTRY OF DYES

Dyes: Definition – theory of colour and constitution – classification of dyes according to structure and applications

- i) Azodyes – preparation of Methyl Orange, Congo Red and Bismark brown.
- ii) Triphenyl methane dyes – preparation of Malachite green, Rosaniline and Crystal Violet.
- iii) Phthalein dyes – Phenolphthalein, Fluorescein and Eocin – preparation, structure and properties.
- iv) Vat dyes – preparation and structure of Indigo.
- v) Anthraquinone dye – preparation and structure of Alizarin.

SEMESTER III
ELECTIVE PAPER – I
BIOCHEMISTRY

UNIT – I LIPIDS

Introduction – classification of lipids – properties of lipids – properties – structure – biological importance.

UNIT –II PROTEINS:

Introduction – polypeptide chains – classification – properties – structure (only) – biological functions.

UNIT – III AMINO ACIDS:

Introduction – classification – properties – structure – biological functions.

UNIT – IV NUCLEIC ACIDS:

DNA – Occurrence – chemical composition – double helix structure – RNA – Chemical composition – transfer RNA – Biological functions of DNA & RNA

UNIT – V HARMONES

Vertebrate hormones – classification – Testosterone – progesterone – Insulin – Biosynthesis – metabolism – functions.

Text Books:-

- 1) Fundamentals of Biochemistry by Dr. J.L.Jain
- 2) Biochemistry by Dulsy Fatima.

SEMESTER III
NON – MAJOR ELECTIVE
APPLIED CHEMISTRY – PAPER I

UNIT – I

Rubber – natural and synthetic rubbers, composition of natural rubber, neoprene rubber, styrene butadiene rubber (SBR).

UNIT – II

Fibres – definition, natural and synthetic fibres.

UNIT – III

Resins – natural and synthetic resins – distinction between resins and plastics.

UNIT – IV

Plastics – classification, properties, Bakelite, Urea, Formaldehyde, Teflon, Nylon-66, and Dacron.

UNIT – V

Fertilizers – definition, classification, urea, super phosphate, potassium nitrate, mixed fertilizer.

Text Books:

- 1) Industrial Chemistry by B.K Sharma
- 2) Industrial Chemistry by S.S Dhara.

SEMESTER III
SKILL BASED SUBJECT– PAPER I
WATER TREATMENT

UNIT –I

Uses of water – safe and wholesome water – sources of water supply: Rain: hydrological cycle, acid rain, artificial rain, rain water harvesting. Surface water: impounding reservoir, river and tanks – their characteristics and impurities. Ground water; wells and springs. Water borne diseases/substances affecting the potability of water.

UNIT – II

Effects of impurities in natural waters: colour taste and odour, turbidity and sediment and micro organism. Dissolved mineral matter – hardness types – estimation (EDTA method) – methods of softening – boiling, addition of lime – addition of sodium carbonate – ion exchange method.

UNIT – III

Clarification of water: sedimentation and filtration. Coagulation of water electrochemical coagulation – flocculants – sterilization and disinfection of water: chemical methods and physical methods.

UNIT- IV

Demineralization of water – ion exchange process – desalination of sea water: electro dialysis method, reverse osmosis methods.

Water analysis: physical examination – chemical examination bacteriological examination – BOD, COD.

UNIT – V

Miscellaneous methods of water treatment: color, odour and taste removal – iron and manganese removal – fluoridation – defluoridation, prevention of plumb solvency – removal of slime and algae from water - de- oxygenation of water.

SEMESTER IV – Paper VI
INORGANIC CHEMISTRY PAPER – I

UNIT-I ATOMIC STRUCTURE AND WAVE MECHANICS – I

Particle and wave character of electron de Broglie's theory – equation, Davisson – Germer experiment – photo electric effect – Compton effect, Heisenberg's uncertainty principle – the Schrodinger equation derivation - postulates of quantum theory – Eigen values and Eigen functions – significance of ψ and ψ^2 - solutions of Schrodinger equation for a simple system – particle in a box - quantum numbers – Zeeman effect Pauli's exclusion principle.

UNIT – II ATOMIC STRUCTURE AND WAVE MECHANICS – II

Atomic orbitals – probability distribution curves – radial probability distributions – shapes of orbitals representations of angular and radial parts – nodal planes and spheres G & U character – filling up of orbitals – Aufbau principle, (n+1) Hund's rule – Electronic configurations of the elements.

UNIT – III NUCLEAR CHEMISTRY-RADIOACTIVITY

- a) Natural Radioactivity: Detection and Measurements of Radio activity, principles of detection and measurement of radio activity laws - radioactivity equilibrium – rate of radio active disintegration – Half-life period – average life –Radio activity series – modes of decay alpha, beta and gamma and orbital electron capture – nuclear isomerism and internal conversion.
- b) Artificial Radio activity: definition – different types of artificial radio activity brought about by accelerated particles.
- c) Artificial Transmutation of atoms by projectiles, spallation.

UNIT – IV NUCLEAR CHEMISTRY

- a) Nuclear fission and fusion: Theories of fission, application of fission and the principle of atom bomb – nuclear fusion and emission of energy, stellar energy and Hydrogen bomb.
- b) Applications of radio activity: application in medicine, agriculture and industry – tracer elements in the elucidate of structure and the investigation analysis – carbon dating.
- c) Particle accelerators: Linear accelerator cyclotron and synchrotron.

UNIT – V CHEMICAL BONDING

Valence bond theory – overlap of orbital's – viz. s-s, s-p and p-p orbitals – sigma and pi bonds – hybridization of orbital's sp^3 , sp^2 , sp , dsp^2 and d^2sp^3 with suitable examples – shapes of such molecules – VSEPR theory.

Molecular orbital theory – applied to hydrogen molecule – MO diagram for simple homo nuclear molecules :oxygen, hydrogen, chlorine and hetero nuclear molecules: hydrogen chloride – Bond order – difference between valence bond and molecular orbital methods.

SEMESTER IV
PRACTICAL PAPER – II
VOLUMETRIC ANALYSIS

A double titration involving the making up of the solution to be estimated and the preparation of a primary standard

Acidimetry and alkalimetry titration: Acids used- hydrochloric acid, sulphuric acid. Standard solutions prepared: sodium carbonate, sodium bicarbonate, oxalic acid.

Oxidation and reduction titration: Oxidising agents: Potassium permanganate (permanganimetry). Reducing agents: Ferrous sulphate, ferrous ammonium sulphate, oxalic acid

Standard solutions prepared: ferrous sulphate, ferrous ammonium sulphate and oxalic acid.

Iodometry titrations: titrations of liberated iodine against sodium thiosulphate using acidified potassium permanganate, potassium dichromate and copper sulphate solutions Standard solutions: potassium dichromate, copper sulphate.

SEMESTER IV
ELECTIVE PAPER – II
MEDICINAL CHEMISTRY

UNIT – I

Introduction and importance of chemistry in pharmacy .

Important terminologies used their meaning – molecular pharmacology – pharmacodynamics, pharmacophore – metabolites, anti-metabolites – drugs – definition – important drugs dosage – Indian medicinal plants and trees.

UNIT – II VITAMINS

Definition – classification – source, therapeutic uses and deficiency of vitamin A, vitamin B₁, B₂, B₆, vitamin D, vitamin E and K.

UNIT – III

Sulpha drugs, anti-malarials:

Sulpha drugs: sulphadiazine, prontosil – S, Anti-malarials: quinine, plasmo quinine.

UNIT – IV ANESTHETICS

Definition – transport of anesthetics – halogenated hydrocarbons – chloroform – ethylchloride – trichloroethylene – gaseous anesthetics – cyclopropane and nitrous oxide – local anesthetics, classification, characteristics – benzocaine, piperocaine and lidcaine.

UNIT – V

Antibiotics – definition – pencillins, teracyclins, teramycin, streptomycin and chloromycetin.

References:

- a. Pharmaceutical Chemistry – S. Lakshmi.
- b. A text book of Pharmaceutical Chemistry – Jayashree Gosh

SEMESTER IV
NON-MAJOR ELECTIVE
APPLIED CHEMISTRY - PAPER II

UNIT – I

Match Industry – Raw materials – manufacturing process, pyrotechnics coloured smokes.

UNIT – II

Explosives – Definition classification, Nitroglycerine, dynamite cordite, TNT and Picric acid.

UNIT – III

Silicate Industry – Cement and Glass, Raw materials and manufacture of cement and glass.

UNIT – IV

Petrochemicals – Definition, origin, composition chemicals from natural gas, petroleum, light naphtha and kerosene, LPG.

UNIT – V

Photography – colour photography.

Reference:

Inorganic Chemistry by P.L.Soni

SEMESTER IV
SKILL BASED SUBJECT– PAPER II
CLINICAL CHEMISTRY

UNIT –I

Blood – composition and their role in health and disease, blood grouping, Rh factor, Blood pH.

UNIT –II

Electrolytic balance, function of plasma proteins, Albumin – Globulin ratio, clotting mechanism, blood pressure, coagulant and anticoagulant.

UNIT –III

Blood lipid, arteriosclerosis, lipid profile, blood sugar, blood glucose and its regulation, glucose tolerance test (GTT).

UNIT –IV

Urine – normal and abnormal constituents of urine, renal function test.

UNIT –V

Only demonstration

- a) Blood grouping
- b) Rh factor
- c) Blood Glucose
- d) Hb content

SEMESTER V

ORGANIC CHEMISTRY – PAPER II

UNIT – I ALIPHATIC ACIDS

- a) Resonance of carboxylate ion-relative strengths of carboxylic acids.
- b) Halogen substituted acids.
- c) Preparation and properties of monochloro, dichloro and trichloro acetic acids. The overall reactivity of halogen and the influence of halogen atom on the strength of acids.
- d) Amino acids: Preparation and properties of glycine, alanine and phenyl alanine. Action of heat on α , β , and γ amino acids.
- e) Hydroxy acids: General methods of preparation and properties of Hydroxyl acids. Glycollic, lactic, malic, citric and tartaric acids.
- f) Action of heat on α , β , and γ hydroxyl acids.
- g) Aldehydic and ketonic acids: preparation and properties of glyoxalic Acid, pyruvic acids, aceto acetic acid and laevulic acid. Preparation and synthetic uses of acetoacetic ester – Tautomerism of acetoacetic ester.
- h) Dicarboxylic acids
 - i) Saturated acid, preparation and properties of malonic acid – Malonic ester, its synthetic uses – succinic, glutaric and Adipic acids – rule.
 - ii) Unsaturated acid: Preparation and properties of maleic and fumaric acids.

UNIT –II AROMATIC ACIDS

- a) Benzoic and Toluic acids. Effect of substituent on acidic characters. Substituted benzoic acid – salicylic and anthranilic acids – preparation and properties.
- b) Dicarboxylic acids – preparation and properties of phthalic acid, isophthalic acid and terephthalic acids. Derivatives of phthalic acid-phthalic anhydride and phthalimide.
- c) Side chain carboxylic acids: Preparation and properties of phenylacetic acid, mandelic acid and cinnamic acid – coumarin.
- d) Acid derivatives – synthesis and reactions of acid halides, amides, Anhydrides and esters.

UNIT – III ALICYCLIC COMPOUND

General method of preparation and properties of cycloparaffins – Baeyer's Strain theory and its modifications. Conformational analysis – Fischer's plane Projection formula – Newmann's projection formula and Sawhorse formula of ethane, 1,2 Cyclic ketones – Civetone and muscone.

UNIT – IV NITROGEN COMPOUNDS

ALIPHATIC NITROGEN COMPOUNDS

- i) Cyanides and isocyanides – General method of preparation And properties – Distinction between ethylcyanide and isocyanide.
- ii) Alkyl nitrites and nitro alkanes – General method of preparation and properties – Distinction between ethyl nitrite and nitroethane – tautomerism in nitro compounds.
- iii) Amines: Classification – Quaternary ammonium compounds – Basic character of amines – steric effect.
Aliphatic diazo compounds – preparation, properties and Structure of diazomethane and diazoacetic ester.
- iv) Derivatives of carbonic acid
 - a) Manufacture, properties, structure and uses of urea – Estimation of urea.
 - b) Aromatic nitro compounds – preparation and properties of nitro compounds of toluene.
 - c) Aromatic amino compounds – preparation and properties of isomers of toluidines – estimation of amine.
 - d) Synthetic uses of benzene diazonium chloride.

UNIT – V CARBOHYDRATES

- a) Monosaccharides – detailed study of glucose and fructose – structure and configuration – mutarotation and epimerization – Interconversion glucose and fructose – Descent and ascent of the sugar series – Estimation of Glucose.
- b) Disaccharides – structure and properties of sucrose.
- c) Polysaccharides – structure of starch and cellulose – applications of cellulose derivatives.

SEMESTER V

INORGANIC CHEMISTRY PAPER II

UNIT - I COORDINATION CHEMISTRY I

Coordination Chemistry: nomenclature – structure – isomerism including geometrical and optical isomerism – Werner's theory – EAN rule – valence bond theory (VBT), Magnetic properties of transition metal complexes (spin only moment) - EAN rule applied to carbonyls structure and bonding in metal carbonyls, chelates – chelation – application of chelate formation. Application coordination compounds.

UNIT –II COORDINATION CHEMISTRY II

Crystal field theory, spectrochemical series – high spin and low spin complexes – Jahn – Teller distortion, comparison of VBT and CFT.

UNIT – III BIOINORGANIC CHEMISTRY

Role of metal ions biological systems – metallo porphyrins – porphyrins – chlorophyll – heme proteins and vitamin B12 (structure only)

A. ACIDS AND BASES:

Modern concept of acids and bases – Arrhenius, Bronsted – Lewis concept – Usanovich concept – introduction to non-aqueous solvents – leveling effect – differentiating solvent – reactions in liquid ammonia in detail.

UNIT – IV SOLID STATE CHEMISTRY

- Isotropy and anisotropy, Symmetry in crystal systems, space lattice and unit cell. Bravais lattices seven crystal systems, simple, face centered and body centered cubes.
- Bragg's equation – Determination of inter planar distance and wave length of X-rays.
- Types of crystals – ionic, molecular, covalent and metallic crystals.
- Conductors, insulators and semiconductors.

UNIT – V GROUP THEORY

Symmetry elements and symmetry operations – products of symmetry operations definition and properties of a group, sub-group, class, point group H_2O , NH_3 and C_{3v} only.

SEMESTER V
PHYSICAL CHEMISTRY PAPER –I

UNIT – I THERMODYNAMICS – I

Introduction: Scope and importance of thermodynamics – energy and its units – mechanical work and heat and their relation – thermodynamic systems and their characteristics – state of a system – state function and path function and their characteristics – thermodynamic functions – exact and inexact differentials.

First Law: Statement – mathematical formulation – change in constant pressure – C_p - C_v relationship – work done in isothermal, reversible expansion and compression of an ideal gas – Calculation of E , H and w for adiabatic reversible expansion. Reversible isothermal expansion of a real gas – calculation of E , q , w and H for a van der waal's gas – Joule-Thomson effect $(\Delta E/\Delta V)_T$ value for ideal gas – temperature, calculation and significance.

UNIT – II

Variation of enthalpies with temperature – Kirchoff's equation – Hess's law of constant heat summation – statement and applications.

Bond enthalpies – definition – calculation from the thermo chemical data and applications. Zeroth law of thermodynamics and its significance.

THERMODYNAMICS – II

II law of thermodynamics - object of the II law – different ways of stating II law and its significance. Conversion of heat into work – carnot's theorem and cycle – Thermodynamic efficiency – thermodynamic scale of temperature.

UNIT – III

Entropy – definition and significance the concept of entropy – entropy changes in isolated systems – entropy as a thermodynamic function dependence of entropy on variables of the system.

Entropy changes in ideal gas, in mixing of gases, physical transformations and in chemical reactions. Entropy and probability

Free energy functions: Helmholtz free energy (A) – definition and temperature dependence – Gibb's free energy with temperature and pressure – Gibb's-Helmholtz equation and its applications – Maxwell's relations.

UNIT – IV

Partial molar quantities: chemical potential – relationship between partial molar quantities – Gibb's Duhem equation – chemical potential in case of a system of ideal gases –

application of the concept of chemical potential – Clausius-Claypeyron equation – derivation and its applications.

Thermodynamics – III

Nernst heat theorem and its application - Third law of thermodynamics – a simple treatment of the law. Temperature dependence of heat capacity and its use in the determination of absolute entropy. Exceptions to III law – residual entropy of CO, N₂O, H₂O, NO and H₂

UNIT – V CHEMICAL KINETICS

Rate of a reaction – rate law and rate constant – order and molecularity of a reaction. Reactions of first order and pseudo first order reaction – derivation of rate constant and half life period – catalytic decomposition of hydrogen peroxide, conversion of N-chloro acetanilide to p-chloro acetanilide, decomposition of dinitro pentoxide – hydrolysis of ester by acids – inversion of cane sugar.

Reaction of II order: derivation of rate constant and half-life period – saponification of ester. Reactions of III order: derivation of rate constant and half-life period. Reaction between FeCl₃ and SnCl₂.

Methods of determining the order of reactions. Reactions of zero order surface reactions – derivation of rate law – specific examples.

Influence of temperature on the rate of a reaction – Arrhenius rate equation and its significance – measurement of Arrhenius parameters, A and E_a. Theory of reaction rates – Collision theory – unimolecular reactions – Lindemann – Theory of absolute reaction rates.

SEMESTER – V
ANALYTICAL CHEMISTRY

UNIT – I DATA ANALYSIS

- a) Errors: Definition – terms- absolute and relative error – precision and accuracy – classification of errors – confidence limit – students – t-test rejection of experimental data – Q-test sources and elimination of errors – significant figures and computation
- b) Principles of Gravimetric Analysis: Theory of Analytical Chemistry – formation of precipitate – co-precipitation – post precipitation – adsorption – precipitation from homogeneous solutions.

UNIT – II CHROMATOGRAPHY

Definition of chromatography – mobile phase and stationary phase – classification of chromatography – principles of adsorption and partition chromatography.

Column Chromatography: Solid stationary phase – adsorbent requirement of good adsorbent – examples – liquid stationary phase – solid support solvent mobile phase – requirement of a good solvent – preparing a column for chromatography – separation of a mixture of several components using adsorption column chromatography – development – identification of applications of column chromatography.

UNIT – III ATOMIC ABSORPTION SPECTROSCOPY

Introduction, Instrumentation source, burner, flame, monochromators, Detectors, Double beam Absorption Spectrometer, Interference, Applications.

UNIT – IV POLAROGRAPHY

Introduction —migration current-diffusion current-residual current-polarogram-Instrumentation-advantages of DME-Ilkovic equation (no derivation)- Applications.

UNIT V X-RAY METHODS

Introduction – Mosley's Law – Duane Hunt Law- Instrumentation – sources –samples – detectors- photographic detector- gas ionization detector – scintillation detector.

SEMESTER V
SPECTROSCOPY

UNIT – I ROTATIONAL SPECTROSCOPY

- A) Molecular spectra – absorption spectra and its applications in structural studies.
- B) Rotational spectra of diatomic molecules (microwave spectra) frequencies separation – determination of moment of inertia and bond lengths.

UNIT – II VIBRATIONAL SPECTROSCOPY

- A) Vibrational spectra (Infra red spectra) – IR Spectra of diatomic molecules.
- B) Rotation – vibration spectra of diatomic molecules – applications of IR Spectroscopy.
- C) Raman Spectra – comparison of Raman and IR spectra.

UNIT – III ELECTRONIC SPECTROSCOPY

Franck – Condon principle, Electronic spectroscopy Transition metal ions. Examples, d^1 , d^2 , d^9 , d^8 , charge transfer spectra.

UNIT – IV NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

Nuclear magnetic resonance spectroscopy – chemical shift – spectra of Ethanol. Spin-spin coupling and applications.

UNIT – V ELECTRON SPIN RESONANCE SPECTROSCOPY

Electron spin resonance spectroscopy – elementary treatment only.

SEMESTER V
ELECTIVE PAPER – III
POLYMER CHEMISTRY

UNIT – I

- a) Introduction – addition polymers – polythene, PVC, Orlon, Teflon, Polystyrene – preparation, properties and uses.
- b) Mechanism of addition polymerization – free radical polymerization – ionic polymerization.

UNIT – II

Condensation polymers – Definition, Dacron, Nylon – preparation properties, uses – copolymers – preparation, properties and uses of saron.

- a) Thermoplastics and thermosetting polymers.

UNIT – III

Rubber – natural rubber – compounding of rubber, properties, uses, synthetic rubbers – buna-s neoprene, silicone rubber.

UNIT – IV

Molecular weight determination – number average, weight average methods of determination – osmotic pressure, viscosity, light scattering methods.

UNIT – V

Inorganic polymers – introduction – general properties – classification – preparation, properties and uses of Boron Nitride, silicone rubber, silicone resins.

SEMESTER V
SKILL BASED SUBJECT – PAPER III
EVERYDAY CHEMISTRY

UNIT – I

Dairy chemistry milk – definition – general composition of milk – constituents of milk lipids, proteins, carbohydrates, vitamins and minerals. Physical properties of milk – colour, odour, acidity, specific gravity, viscosity and conductivity. Factors affecting the composition of milk – pasteurization, homogenization, toning, standardization, reconstitution of milk - adulteration of milk.

UNIT – II

Mineral metabolism: calcium – source, daily requirement, blood calcium, hypocalcemia, phosphorus – functions of phosphate, requirement, source, normal serum level, functions.

Sodium – normal level of sodium, excretion of sodium, restriction of sodium in diet, hypernatremia.

UNIT – III

Preparation of tooth powder, paste, talcum powder, shampoo, handkerchief perfumers, dry perfume sachets, soap powder, diswashing powder, various soaps, toilet cleaning liquids.

UNIT – IV

Wax products – candles, boot polish, furniture polish paste. Ink – blue, red, blue black, white board marker, printing ink, ink for stamp pad.

UNIT – V

Safety matches – agarbathies naphthalene balls – chalk crayons – insecticides such as lice killer, mosquito repellent, cockroach terminator, mot repellent. Simple medicines: pain balm, digestive tablet, disinfectant solutions

.References:

1. Small Scale Industries by B.S.Sedar,Jaime Publications,ombay,1975.
2. Neengalum Siru Thozil Nadathalam (Tamil version). S.A. Soosairaja, New century Book House Pvt. Ltd., Chennai,1983.

SEMESTER VI

ORGANIC CHEMISTRY PAPER – III

UNIT – I APPLICATION OF SPECTROSCOPY TO ORGANIC MOLECULES

- a) Theory and applications of spectroscopic methods – electromagnetic spectrum – the UV spectroscopy – Identification of conjugation – Woodward Fieser Rule – adsorption maxima.
- a) IR Spectroscopy – functional group detection, finger print region – study in Hydrogen bonds.
- b) NMR Spectroscopy – no of signals – equivalent and non-equivalent protons- chemical shift – peak area and proton counting – splitting of signals – spin-spin coupling.

UNIT – II

- a) Tautomerism: Definition – condition of Tautomerism – prototropy and Anisotropy – types of Tautomerism.
 - i) Keto – enol tautomerism
 - ii) Nitro-acinitro tautomerism
 - iii) Nitro-isonitro tautomerism
 - iv) Lactam – lactim tautomerism and
 - v) Quinone monoxime – p-nitrophenol

Free radicals: Definition – preparation and reactions of short lived and long lived free radical – stability of free radicals – Role of free radicals in Chain reaction. Organic photochemistry – [photochemical reactions of olefins, Cis–trans isomerism and dimerisation.

UNIT – III MOLECULAR REARRANGEMENTS

Detailed mechanisms of the following reactions, Pinacol – Pinacolone, Hofmann Curtius, Benzilic acid, Claisen, Benzidine, Beckmann, Fries and Wagner – Meerwin rearrangements.

UNIT – IV HETEROCYCLIC COMPOUNDS

Heterocyclic compounds containing one hetero atom. Preparation and properties, structure of pyrrole, furan, thiophene, indole, pyridine, quinoline, and isoquinoline.

UNIT – V NATURAL PRODUCTS

- a) Alkaloids: Definition, occurrence, extraction of alkaloids and general methods for determining the structure of alkaloids – Classification of alkaloids - structure and synthesis of the following alkaloids : Cocaine, papaverine, piperine and nicotine.

b) Terpenoids: Introduction, classification occurrence, isolation – general properties – isoprene rule – General methods of determining structure, Synthesis – properties – structures of citral, geraniol, terpinol.

SEMESTER VI

PHYSICAL CHEMISTRY PAPER – II

UNIT – I PHOTOCHEMISTRY

Photochemistry: Photochemical reactions – definition – comparative study of thermal and photochemical reactions – laws of photochemistry: Lambert and Beer's laws, Grotthus – Drapper law, Stark-Einstein law – quantum efficiency and its determination – consequences of light.

Absorption by atoms and molecules – photophysical processes- fluorescence, phosphorescence and other deactivating processes. Jablonskii diagram.

Photochemical processes: Kinetics of photochemical reactions.

- i) Gaseous reactions: Hydrogen-chlorine reaction, decomposition of HBr, HI and photolysis of ammonia.
- ii) Reactions in liquid phase (solutions) – isomeric transformation of maleic to fumaric acid – polymerization of anthracene.
- iii) Photochemical equilibrium – flash photolysis – photosensitization – chemiluminescence.
- iv) Radiation chemistry – application

UNIT – II ELECTROCHEMISTRY – I

Conductance: Definition and determination – specific, equivalent conductance with dilution and its limiting values.

Strong and weak electrolytes: theory of strong electrolytes – Debye-Huckel-Onsager equation (no derivation) ionic activity and activity co-efficient

Ostwald's dilution law and its applications

Kohlrausch's law of ionic mobilities and its applications.

Absolute velocity of ions and its determination – Transport number of ions and their determination.

Applications of conductivity measurements – degree of dissociation – solubility of a sparingly soluble salt – degree of hydrolysis – basicity of acids – conductometric titrations.

UNIT – III ELECTRO CHEMISTRY –II

Ionic Equilibria: Common ion effect and solubility product – quantitative study and their applications. Hydrolysis – degree of hydrolysis (∞) – hydrolysis constant (K_h) – their experimental determination and derivation of these values for different salt solutions – based on K_w , K_a and K_b calculation involving hydrolytic constants. pH of solutions – definition and methods of determination of pH

Buffer solution - definition – theory of buffer action and applications – Henderson equation.

UNIT – IV ELECTROCHEMISTRY – III

Electrode potentials and electrochemical cells. Single electrode potentials – oxidation and reduction potentials. Thermodynamics and electromotive force (emf) – relation between chemical and electrical energies – calculation of ΔG , ΔS , and ΔH of cell reaction. Calculation of emf. Nernst equation – standard electrode potential and its characteristics. Types of electrodes: metal – metal ion, gas, metal – insoluble salt, redox, glass electrodes.

Chemical and voltaic cells: Definition – cell reaction and representations of electrodes and cells – emf of cell – conventions regarding signs of emf – calculation of cell emf from single electrode potentials. Calculation of cell emf with the aid of Nernst equation. Experimental determination of emf of cells. Measurement of single electrode potentials – chemical cells with and without transference – liquid junction potential and salt bridge.

Concentration cells: Definition and calculation of emf – types of concentration cells – concentration cells with and without transference – determination of activity coefficient of electrolytes.

UNIT – V

Commercial cells: Primary and secondary cells – Weston Cadmium cell, lead storage cell, Ni-Cd cell, fuel cell.

- a) Applications of emf measurements.
- b) Determination of solubility and solubility product of sparingly soluble salts.
- c) Determination of pH – using Hydrogen electrode, glass electrode, quinhydrone electrode.
- d) Determination of valency of ion.
- e) Potentiometer titrations – acid-base, redox, precipitation and complexometric titrations.
- f) Determination of transport number.

Electrolysis and polarization: Over voltage, decomposition potential, hydrogen over voltage.

VI SEMESTER – Paper – XV
INDUSTRIAL CHEMISTRY

UNIT – I

- A. Fertilizers: Definition - Nutrients for plants – Role of various elements in plant growth – natural and chemical fertilizers – classification of chemical fertilizers – Urea, super phosphate and potassium nitrate – Mixed fertilizer – Fertilizer Industry in India.
- B. Match Industry, pyrotechny and explosives: Raw materials needed for match industry – manufacturing process – pyrotechnics – coloured smokes – Explosives; Definition – classification – Nitroglycerine, dynamite, cordite, TNT and picric acid.

UNIT – II

- A. Silicate Industry: Cement, Glass and ceramics. Raw materials and manufacture of cement, Glass and ceramics.
- B. Petrochemicals: Elementary study – Definition – origin – composition – chemicals from natural gas, petroleum, Light Naphtha and Kerosene – synthetic gas.

UNIT –III

- A. Corrosion of metals: Definition – various methods of preventing corrosion – coating with other metals (galvanizing, lining, and electroplating) – cathodic protection and painting – corrosion inhibitors.
- B. Photography: Colour photography

UNIT – IV

Chemistry of paper Industry: Raw materials manufacturing process – bleaching and colorings.

UNIT – V PAINTS:

Manufacture – setting – characteristics of good paint, failure, varnish – types.

References:

- 1) Industrial Chemistry by R.K.Das
- 2) Industrial chemistry by B.K.Sharma
- 3) Industrial Chemistry by S.S Dara

VI SEMESTER – Paper - XVI

PRACTICAL PAPER –III

GRAVIMETRIC ANALYSIS AND ORGANIC PREPARATION

Gravimetric Analysis:

Estimation of Ca as calcium oxalate monohydrate

Estimation of Ba as chromate

Estimation of Lead as Chromate

Organic preparation:

Preparation involving

Hydrolysis – Ester hydrolysis

Amide hydrolysis

Benzoylation of beta naphthol amines

Acetylation of an amine

Nitration of acetanilide

Oxidation: Benzoic acid from benzaldehyde

VI SEMESTER
PRACTICAL PAPER – IV
ORGANIC ESTIMATION AND ORGANIC ANALYSIS

Organic estimation:

Estimation of aniline

Estimation of phenol

Organic analysis:

Analysis of the organic substance containing the following functional groups:

Acids, phenols, aldehydes, ketones, esters, nitro compounds, amines, amides, anilides and halogenated hydrocarbons (side chain and nucleus). Monosaccharide – glucose and fructose. Report should contain aromatic or aliphatic, saturated or unsaturated and a solid derivative or a colour reaction should be exhibited.

SEMESTER VI
SKILL BASED SUBJECT PAPER – IV
TEXTILE CHEMISTRY

UNIT – I

Natural Fibre: properties of textile fibres – classification of fibres. Natural fibres of vegetables origin – chemical and physical properties of cotton, jute. Natural fibres of animal origin: chemical and physical properties of wool and silk – natural mineral fibres: chemical and physical properties of asbestos and glass.

UNIT – II

Man made fibre: mode of production – types of spinning – wet dry and melt spinning.

- a. viscose rayon: Raw material, method of conversion to fibre and filament form. Physical and chemical properties and uses.
- b. Cuprammonium rayon and cellulose acetate: raw materials, method of conversion to fibre and filament form. Physical and chemical properties and uses.
- c. Synthetic organic fibre: polyamide and polyester fibre – raw materials, method of production, physical and chemical properties fibre structure.

UNIT – III

Pre – treatment process for dyeing: Study of operation, principles and different agent for singeing, desizing, scouring and bleaching.

UNIT – IV

Dyeing: classification of dyes – theories of dyeing

Direct dye: properties, method of application to cotton – assistants used and their functions.

Sulphur dye: properties, method of application to cotton. Acid dye: properties, method of application to cotton.

Vat dye: properties, method of application to cotton.

UNIT – V

Printing: different methods of printing like hand block printing, stencil printing, wax printing, screen printing, roller printing etc.

References:

1. Textile Science, E.P.G Gohl and D. Vilensky
2. Textile scouring and bleaching, E.R. Trotman
3. Technology of Dyeing, Dr. V.A Shenai
4. Textile fibre for dyeing, Bernard P.Carbman.

REFERENCE BOOKS

ORGANIC CHEMISTRY

1. I.L. Finar, Organic Chemistry Vol.I
2. I.L. Finar, Organic Chemistry Vol.II
3. R.T. Morrison and R.W.Boyd, Organic chemistry
4. Jerry March, reaction Mechanism of Organic Compounds
5. P.L.Soni, Organic Chemistry
6. B.S. Bahl and Arun Bahl, Akvanced Organic Chemistry

INORGANIC CHEMISTRY

1. Arthur I. Vogel, A Text Book of quantitative Inorganic Analysis
2. F.A. Cotton and Wilkinson, Basic Inorganic Chemistry
3. R.D. Madan, Advanced Inorganic Chemistry
4. H.Sister, Non-aqueous solvents
5. Douglas A.Skoog and Donald M.West, Principles of Instrumental Analysis
6. J.D. Lee, Concise Inorganic Cheimstry
7. Gilreath, Fundamentals of Inorganic Chemistry
8. James E.Huheey, Inorganic Chemistry
9. P.L. Soni, Inorganic Chemistry

PHYSICAL CHEMISTRY

1. S. Glasstone, Text book of Physical Chemistry
2. N.Kundu and S.N. Jain, Physical Chemistry
3. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry
4. F. Daniel and R.A Alberty, Physical Chemistry
5. G.M. Barrow, Physical Chemistry
6. R.A. Alberty, Physical Chemistry
7. S. Glasstone, Introduction to Electrochemistry
8. C.N. Banwell, Fundamentals of Molecular Spectroscopy
9. RT. Chang, Basic Principles of Spectroscopy
10. P.W. Atkins, Physical Chemistry
11. K.J. Laidler, Chemical Kinetics
12. K.K. Rohatgi – Mukherjee, Fundamental Photochemistry
13. V. Ramakrishnan and M.S. Gopinathan, Group theory in Chemistry
14. George Davidson, Introductory Group theory for Chemists.

APPLIED CHEMISTRY & INDUSTRIAL CHEMISTRY

1. P.C. Jain and Monica Jain, Engineering Chemistry
2. P.L. Soni, Organic Chemistry
3. P.L. Soni, Inorganic Chemistry
4. P.L. Soni, Physical Chemistry

B.Sc. ANCILLARY CHEMISTRY
III SEMESTER – Paper I
ORGANIC, INORGANIC & PHYSICAL CHEMISTRY

UNIT – I

Bonding:

- i. V.B.Theory: Postulates of V.B.Theory – Applications to the formation of simple molecules like H₂ and O₂. Overlap of atomic orbitals –S-S, S-P and P-P Overlap – principles of hybridization.
- ii. M.O.Theory: Formation of M.O's – bonding and antibonding and non-bonding M.O's – M.O diagram for Hydrogen, Helium F₂.

UNIT –II

Chemical Kinetics: Rate of reaction- Rate law and rate constant – order and molecularity of reactions. – derivation of first order rate constant – half life period – examples of second order and third order reaction – enzyme kinetics.

UNIT – III

Electrochemistry.

A. Arrhenius theory of electrolytes strong electrolytes – weak electrolytes
ostwald's dilution of law and its applications – Ionic product of water and its applications
– solubility product and its determination.

pH – definition – simple calculation of pH from molarity of acids and bases –
common ion effect and its application in analytical chemistry – buffer solution –
definition – theory of buffer action – application.

B. Acid – base indicators – working range of indicators- Choice of indicators –
commercial cells – primary and secondary cells – Weston – cadmium cell – lead storage
cell.

UNIT – IV

Corrosion Principle and methods – corrosion and passivity rusting of iron – preventive
methods from rusting – Electroplating.

UNIT – V

Carbohydrates – definition and classification;

- a) Monosaccharide: preparation properties and uses of glucose and fructose.
Configuration of glucose, and fructose – Haworth's structure.
- b) Disaccharides: Sucrose – Manufacture, properties and uses of sucrose – structure.
Only (No elucidation) Distinction between glucose – fructose and sucrose.

c) Polysaccharides: Starch and cellulose (A general study).

VOLUMETRIC ANALYSIS:

I. Acidimetry and alkalimetry:

- e. Titration between a strong acid against NaOH
- f. Titration between a strong acid against Na_2CO_3
- g. Titration between sodium hydroxide against oxalic acid.

II. Permanganometry:

- a) Titration between KMnO_4 against oxalic acid.
- b) Titration between KMnO_4 against ferrous Sulphate
- c) Titration between KMnO_4 against Mohr's salt (Ferrous ammonium Sulphate)

III. Iodometry:

- a) Titration between sodium thiosulphate and potassium dichromate.
- b) Titration between sodium thiosulphate and copper Sulphate.
