CIPET IPT BHUBANESWAR JEE 2021

SYLLABUS

B.Tech. (Plastic Engineering/Manufacturing & Engineering Technology)

90 questions, 3 hours duration, (Mathematics - 30, Physics -30, Chemistry -30 questions)

A. MATHEMATICS

UNIT 1:

SETS, RELATIONS AND FUNCTIONS: Sets and their representation: Union, intersection and complement of sets and their algebraic properties; Power set; Relation, Type of relations, equivalence relations, functions; one-one, into and onto functions, the composition of functions.

UNIT 2:

COMPLEX NUMBERS AND QUADRATIC EQUATIONS: Complex numbers as ordered pairs of reals, Representation of complex numbers in the form a + ib and their representation in a plane, Argand diagram, algebra of complex number, modulus and argument (or amplitude) of a complex number, square root of a complex number, triangle inequality, Quadratic equations in real and complex number system and their solutions Relations between roots and coefficient, nature of roots, the formation of quadratic equations with given roots.

UNIT 3:

MATRICES AND DETERMINANTS: Matrices, algebra of matrices, type of matrices, determinants and matrices of order two and three, properties of determinants, evaluation of determinants, area of triangles using determinants, Adjoint and evaluation of inverse of a square matrix using determinants and elementary transformations, Test of consistency and solution of simultaneous linear equations in two or three variables using determinants and matrices.

UNIT 4:

PERMUTATIONS AND COMBINATIONS: The fundamental principle of counting, permutation as an arrangement and combination as section, Meaning of P (n,r) and C (n,r), simple applications.

UNIT 5:

MATHEMATICAL INDUCTIONS: Principle of Mathematical Induction and its simple applications.

UNIT 6:

BINOMIAL THEOREM AND ITS SIMPLE APPLICATIONS: Binomial theorem for a positive integral index, general term and middle term, properties of Binomial coefficients and simple applications.

UNIT 7:

SEQUENCE AND SERIES: Arithmetic and Geometric progressions, insertion of arithmetic, geometric means between two given numbers, Relation between A.M and G.M sum up to n terms of special series; Sn, Sn2, Sn3. Arithmetico-Geometric progression.

UNIT 8:

LIMIT, CONTINUITY AND DIFFERENTIABILITY: Real – valued functions, algebra of functions, polynomials, rational, trigonometric, logarithmic and exponential functions, inverse function. Graphs of simple functions. Limits, continuity and differentiability. Differentiation of the sum, difference, product and quotient of two functions. Differentiation of trigonometric, inverse trigonometric, logarithmic, exponential, composite and implicit functions; derivatives of order up to two, Rolle's and Lagrange's Mean value Theorems, Applications of derivatives: Rate of change of quantities, monotonic Increasing and decreasing functions, Maxima and minima of functions of one variable, tangents and normal.

UNIT 9:

INTEGRAL CALCULAS: Integral as an anti-derivative, Fundamental Integrals involving algebraic, trigonometric, exponential and logarithms functions. Integrations by substitution, by parts and by partial functions. Integration using trigonometric identities. Evaluation of simple integrals of the type $\int dx/x$ 2+a2 , $\int dx/$ √x 2 ± a2 , $\int dx/a$2− x 2 , $\int dx$ √a2− x 2 , $\int dx/ax$2+bx+c ,$\int dx/$ √ax2+ bx+c , $\int (px+q)dx$ $/ax$2+bx+c , $\int (px+q)dx$ √ax2+ bx+c $\int$ √a 2 ± x 2 dx , $\int$√x 2 − a 2 dx Integral as limit of a sum. The fundamental theorem of calculus, properties of definite integrals. Evaluation of definite integrals, determining areas of the regions bounded by simple curves in standard form.

UNIT 10:

DIFFRENTIAL EQUATIONS Ordinary differential equations, their order and degree, the formation of differential equations, solution of differential equation by the method of separation of variables, solution of a homogeneous and linear differential equation of the type $dy/dx + p(x)y = q(x)$

UNIT 11: CO-ORDINATE GEOMETRY

Cartesian system of rectangular coordinates in a plane, distance formula, sections formula, locus and its equation, translation of axes, the slope of a line, parallel and perpendicular lines, intercepts of a line on the co-ordinate axis. Straight line Various forms of equations of a line, intersection of lines, angles between two lines, conditions for concurrence of three lines, the distance of a point form a line, equations of internal and external by sectors of angles between two lines coordinate of the centroid, orthocentre and circumcentre of a triangle, equation of the family of lines passing through the point of intersection of two lines. Circle, conic sections A standard form of equations of a circle, the general form

of the equation of a circle, its radius and central, equation of a circle when the endpoints of a diameter are given, points of intersection of a line and a circle with the centre at the origin and condition for a line to be tangent to a circle, equation of the tangent, sections of conics, equations of conic sections (parabola, ellipse and hyperbola) in standard forms, condition for Y = mx +c to be a tangent and point (s) of tangency.

UNIT 12:

THREE DIMENSIONAL GEOMETRY Coordinates of a point in space, the distance between two points, section formula, directions ratios and direction cosines, the angle between two intersecting lines. Skew lines, the shortest distance between them and its equation. Equations of a line and a plane in different forms, the intersection of a line and a plane, coplanar lines.

UNIT 13:VECTOR ALGEBRA Vectors and scalars, the addition of vectors, components of a vector in two dimensions and three-dimensional space, scalar and vector products, scalar and vector triple product.

UNIT 14:

STATISTICS AND PROBABILITY Measures of discretion; calculation of mean, median, mode of grouped and ungrouped data calculation of standard deviation, variance and mean deviation for grouped and ungrouped data. Probability: Probability of an event, addition and multiplication theorems of probability, Baye's theorem, probability distribution of a random variate, Bernoulli trials and binomial distribution.

UNIT 15:

TRIGONOMETRY Trigonometrical identities and equations, trigonometrical functions, inverse trigonometrical functions and their properties, heights and distance.

UNIT 16:

MATHEMATICAL REASONING Statement logical operations and, or, implies, implied by, if and only if, understanding of tautology, contradiction, converse and contrapositive.

B. PHYSICS

The syllabus contains two Section- A and B, Section – A pertains to the Theory Part having 80% weightage, while Sections – B contains practical component (Experimental Skills) having 20 % Weightage.

UNIT 1: PHYSICS AND MEASUREMENT

Physics, technology and society, S I Units, fundamental and derived units, least count, accuracy and precision of measuring instruments, Errors in measurement, Dimensions of Physics quantities, dimensional analysis and its applications.

UNIT 2: KINEMATICS

The frame of reference, motion in a straight line, Position- time graph, speed and velocity; Uniform and non-uniform motion, average speed and instantaneous velocity, uniformly accelerated motion, velocity-time, position-time graph, relations for uniformly accelerated motion, Scalars and Vectors, Vector.

Addition and subtraction, zero vector, scalar and vector products, Unit Vector, Resolution of a Vector. Relative Velocity, Motion in a plane, Projectile Motion, Uniform Circular Motion.

UNIT 3: LAWS OF MOTION

Force and inertia, Newton's First law of motion; Momentum, Newton's Second Law of motion, Impulses; Newton's Third Law of motion. Law of conservation of linear momentum and its applications. Equilibrium of concurrent forces. Static and Kinetic friction, laws of friction, rolling friction. Dynamics of uniform circular motion: centripetal force and its applications.

UNIT 4: WORK, ENERGY AND POWER Work done by a content force and a variable force; kinetic and potential energies, work-energy theorem, power. The potential energy of spring conservation of mechanical energy, conservative and neoconservative forces; Elastic and inelastic collisions in one and two dimensions.

UNIT5: ROTATIONAL MOTION Centre of the mass of a two-particle system, Centre of the mass of a rigid body; Basic concepts of rotational motion; a moment of a force; torque, angular momentum, conservation of angular momentum and its applications; the moment of inertia, the radius of gyration. Values of moments of inertia for simple geometrical objects, parallel and perpendicular axes theorems and their applications. Rigid body rotation equations of rotational motion.

UNIT 6: GRAVITATION The universal law of gravitation. Acceleration due to gravity and its variation with altitude and depth. Kepler's law of planetary motion. Gravitational potential energy; gravitational potential. Escape velocity, Orbital velocity of a satellite. Geo stationary satellites.

UNIT 7: PROPERTIES OF SOLIDS AND LIQUIDS Elastic behaviour, Stress-strain relationship, Hooke's Law. Young's modulus, bulk modulus, modulus of rigidity. Pressure due to a fluid column; Pascal's law and its applications. Viscosity. Stokes' law. terminal velocity, streamline and turbulent flow. Reynolds number. Bernoulli's principle and its applications. Surface energy and surface tension, angle of contact, application of surface tension - drops, bubbles and capillary rise. Heat, temperature, thermal expansion; specific heat capacity, calorimetry; change of state, latent heat. Heat transfer-conduction, convection and radiation. Newton's law of cooling.

UNIT 8: THERMODYNAMICS Thermal equilibrium, zeroth law of thermodynamics, the concept of temperature. Heat, work and internal energy. The first law of thermodynamics. The second law of thermodynamics: reversible and irreversible processes. Carnot engine and its efficiency.

UNIT 9: KINETIC THEORY OF GASES Equation of state of a perfect gas, work done on compressing a gas, Kinetic theory of gases - assumptions, the concept of pressure. Kinetic energy and temperature: RMS speed of gas molecules: Degrees of freedom. Law of equipartition of energy, applications to specific heat capacities of gases; Mean free path. Avogadro's number.

UNIT 10: OSCILLATIONS AND WAVES Periodic motion - period, frequency, displacement as a function of time. Periodic functions. Simple harmonic motion (S.H.M.) and its equation; phase: oscillations of a spring -restoring force and force constant: energy in S.H.M. - Kinetic and potential energies; Simple pendulum - derivation of expression for its time period: Free, forced and damped oscillations, resonance. Wave motion. Longitudinal and transverse waves, speed of a wave. Displacement relation

for a progressive wave. Principle of superposition of waves, a reflection of waves. Standing waves in strings and organ pipes, fundamental mode and harmonics. Beats. Doppler Effect in sound.

UNIT 11: ELECTROSTATICS Electric charges: Conservation of charge. Coulomb's law-forces between two point charges, forces between multiple charges: superposition principle and continuous charge distribution. Electric field: Electric field due to a point charge, Electric field lines. Electric dipole, Electric field due to a dipole. Torque on a dipole in a uniform electric field. Electric flux. Gauss's law and its applications to find field due to infinitely long uniformly charged straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell. Electric potential and its calculation for a point charge, electric dipole and system of charges; Equipotential surfaces, Electrical potential energy of a system of two point charges in an electrostatic field. Conductors and insulators. Dielectrics and electric polarization, capacitor, the combination of capacitors in series and parallel, capacitance of a parallel plate capacitor with and without dielectric medium between the plates. Energy stored in a capacitor.

UNIT 12: CURRENT ELECTRICITY Electric current. Drift velocity. Ohm's law. Electrical resistance. Resistances of different materials. V-I characteristics of Ohmic and non-ohmic conductors. Electrical energy and power. Electrical resistivity. Colour code for resistors; Series and parallel combinations of resistors; Temperature dependence of resistance. Electric Cell and its Internal resistance, potential difference and emf of a cell, a combination of cells in series and parallel. Kirchhoff’s laws and their applications. Wheatstone bridge. Metre Bridge. Potentiometer - principle and its applications.

UNIT 13: MAGNETIC EFFECTS OF CURRENT AND MAGNETISM Biot - Savart law and its application to current carrying circular loop. Ampere's law and its applications to infinitely long current carrying straight wire and solenoid. Force on a moving charge in uniform magnetic and electric fields. Cyclotron. Force on a current-carrying conductor in a uniform magnetic field. The force between two parallel current carrying conductors definition of ampere. Torque experienced by a current loop in a uniform magnetic field: Moving coil galvanometer, its current sensitivity and conversion to ammeter and voltmeter. Current loop as a magnetic dipole and its magnetic dipole moment. Bar magnet as an equivalent solenoid, magnetic field lines; Earth's magnetic field and magnetic elements. Para-, dia- and ferromagnetic substances. Magnetic susceptibility and permeability. Hysteresis. Electromagnets and permanent magnets.

UNIT 14: ELECTROMAGNETIC INDUCTION AND ALTERNATING CURRENTS Electromagnetic induction: Faraday's law. Induced emf and current: Lenz’s Law, Eddy currents. Self and mutual inductance. Alternating currents, peak and RMS value of alternating current/ voltage: reactance and impedance: LCR series circuit, resonance: Quality factor, power in AC circuits, wattless current. AC generator and transformer.

UNIT 15: ELECTROMAGNETIC WAVES Electromagnetic waves and their characteristics, Transverse nature of electromagnetic waves, Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet. X-rays. Gamma rays), Applications of e.m. waves.

UNIT 16: OPTICS Reflection and refraction of light at plane and spherical surfaces, mirror formula. Total internal reflection and its applications. Deviation and Dispersion of light by a; prism; Lens Formula. Magnification. Power of a Lens. Combination of thin lenses in contact. Microscope and Astronomical Telescope (reflecting and refracting) and their magnifying powers. Wave optics: wave front and Huygens' principle. Laws of reflection and refraction using Huygens principle. Interference, Young's

double-slit experiment and expression for fringe width, coherent sources and sustained interference of light. Diffraction due to a single slit, width of central maximum. Resolving power of microscopes and astronomical telescopes. Polarization, plane-polarized light: Brewster's law, uses of plane-polarized light and Polaroid.

UNIT 17: DUAL NATURE OF MATTER AND RADIATION Dual nature of radiation. Photoelectric effect. Hertz and Lenard's observations; Einstein's photoelectric equation: particle nature of light. Matter waves-wave nature of particle, de Broglie relation. DavissonGermer experiment.

UNIT 18: ATOMS AND NUCLEI Alpha-particle scattering experiment; Rutherford's model of atom; Bohr model, energy levels, hydrogen spectrum. Composition and size of nucleus, atomic masses, isotopes, isobars: isotones. Radioactivity- alpha. beta and gamma particles/rays and their properties; radioactive decay law. Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number, nuclear fission and fusion.

UNIT 19: ELECTRONIC DEVICES Semiconductors; semiconductor diode: 1- V characteristics in forward and reverse bias; diode as a rectifier; I-V characteristics of LED. the photodiode, solar cell and Zener diode; Zener diode as a voltage regulator. Junction transistor, transistor action, characteristics of a transistor: transistor as an amplifier (common emitter configuration) and oscillator. Logic gates (OR. AND. NOT. NAND and NOR). Transistor as a switch.

UNIT 20: COMMUNICATION SYSTEMS Propagation of electromagnetic waves in the atmosphere; Sky and space wave propagation. Need for modulation. Amplitude and Frequency Modulation, Bandwidth of signals. the bandwidth of Transmission medium, Basic Elements of a Communication System (Block Diagram only).

C. CHEMISTRY

a)PHYSICAL CHEMISTRY

UNIT I: SOME BASIC CONCEPTS IN CHEMISTRY Matter and its nature, Dalton's atomic theory: Concept of atom, molecule, element and compound: Physical quantities and their measurements in Chemistry, precision and accuracy, significant figures. S.I.Units, dimensional analysis: Laws of chemical combination; Atomic and molecular masses, mole concept, molar mass, percentage composition, empirical and molecular formulae: Chemical equations and stoichiometry.

UNIT 2: STATES OF MATTER Classification of matter into solid, liquid and gaseous states. Gaseous State: Measurable properties of gases: Gas laws - Boyle's law, Charle’s law. Graham's law of diffusion. Avogadro's law, Dalton's law of partial pressure; Concept of Absolute scale of temperature; Ideal gas equation; Kinetic theory of gases (only postulates); Concept of average, root mean square and most probable velocities; Real gases, deviation from Ideal behaviour, compressibility factor and van der Waals equation. Liquid State: Properties of liquids - vapour pressure, viscosity and surface tension and effect of temperature on them (qualitative treatment only). Solid State: Classification of solids: molecular, ionic, covalent and metallic solids, amorphous and crystalline solids (elementary idea); Bragg's Law and its applications: Unit cell and lattices, packing in solids (fcc, bcc and hcp lattices), voids, calculations involving unit cell parameters, an imperfection in solids; Electrical and magnetic properties.

UNIT 3: ATOMIC STRUCTURE Thomson and Rutherford atomic models and their limitations; Nature of electromagnetic radiation, photoelectric effect; Spectrum of the hydrogen atom. Bohr model of a hydrogen atom - its postulates, derivation of the relations for the energy of the electron and radii of the different orbits, limitations of Bohr's model; Dual nature of matter, de Broglie's relationship. Heisenberg uncertainty principle. Elementary ideas of quantum mechanics, quantum mechanics, the quantum mechanical model of the atom, its important features. Concept of atomic orbitals as one-electron wave functions: Variation of Ψ and $\Psi 2$ with r for 1s and 2s orbitals; various quantum numbers (principal, angular momentum and magnetic quantum numbers) and their significance; shapes of s, p and d - orbitals, electron spin and spin quantum number: Rules for filling electrons in orbitals – Aufbau principle. Pauli's exclusion principle and Hund's rule, electronic configuration of elements, extra stability of half-filled and completely filled orbitals.

UNIT 4: CHEMICAL BONDING AND MOLECULAR STRUCTURE Kossel - Lewis approach to chemical bond formation, the concept of ionic and covalent bonds. Ionic Bonding: Formation of ionic bonds, factors affecting the formation of ionic bonds; calculation of lattice enthalpy. Covalent Bonding: Concept of electronegativity. Fajan's rule, dipole moment: Valence Shell Electron Pair Repulsion (VSEPR) theory and shapes of simple molecules. Quantum mechanical approach to covalent bonding: Valence bond theory - its important features, the concept of hybridization involving s, p and d orbitals; Resonance. Molecular Orbital Theory - Its important features. LCAOs, types of molecular orbitals (bonding, antibonding), sigma and pi-bonds, molecular orbital electronic configurations of homonuclear diatomic molecules, the concept of bond order, bond length and bond energy. Elementary idea of metallic bonding. Hydrogen bonding and its applications.

UNIT 5: CHEMICAL THERMODYNAMICS Fundamentals of thermodynamics: System and surroundings, extensive and intensive properties, state functions, types of processes. The first law of thermodynamics - Concept of work, heat internal energy and enthalpy, heat capacity, molar heat capacity; Hess's law of constant heat summation; Enthalpies of bond dissociation, combustion, formation, atomization, sublimation, phase transition, hydration, ionization and solution. The second law of thermodynamics - Spontaneity of processes; ΔS of the universe and ΔG of the system as criteria for spontaneity. ΔG° (Standard Gibbs energy change) and equilibrium constant.

UNIT 6: SOLUTIONS Different methods for expressing the concentration of solution - molality, molarity, mole fraction, percentage (by volume and mass both), the vapour pressure of solutions and Raoult's Law - Ideal and non-ideal solutions, vapour pressure - composition, plots for ideal and non-ideal solutions; Colligative properties of dilute solutions - a relative lowering of vapour pressure, depression of freezing point, the elevation of boiling point and osmotic pressure; Determination of molecular mass using colligative properties; Abnormal value of molar mass, van't Hoff factor and its significance.

UNIT 7: EQUILIBRIUM Meaning of equilibrium, the concept of dynamic equilibrium. Equilibria involving physical processes: Solid-liquid, liquid - gas and solid-gas equilibria, Henry's law. General characteristics of equilibrium involving physical processes. Equilibrium involving chemical processes: Law of chemical equilibrium, equilibrium constants (Kp and Kc) and their significance, the significance of ΔG and ΔG° in chemical equilibrium, factors affecting equilibrium concentration, pressure, temperature, the effect of catalyst; Le Chatelier's principle. Ionic equilibrium: Weak and strong electrolytes, ionization of electrolytes, various concepts of acids and bases (Arrhenius. Bronsted - Lowry and Lewis) and their ionization, acid-base equilibria (including multistage ionization) and ionization constants, ionization of

water. pH scale, common ion effect, hydrolysis of salts and pH of their solutions, the solubility of sparingly soluble salts and solubility products, buffer solutions.

UNIT 8: REDOX REACTIONS AND ELECTROCHEMISTRY Electronic concepts of oxidation and reduction, redox reactions, oxidation number, rules for assigning oxidation number, balancing of redox reactions. Electrolytic and metallic conduction, conductance in electrolytic solutions, molar conductivities and their variation with concentration: Kohlrausch's law and its applications. Electrochemical cells - Electrolytic and Galvanic cells, different types of electrodes, electrode potentials including standard electrode potential, half - cell and cell reactions, emf of a Galvanic cell and its measurement: Nernst equation and its applications; Relationship between cell potential and Gibbs' energy change: Dry cell and lead accumulator; Fuel cells.

UNIT 9: CHEMICAL KINETICS Rate of a chemical reaction, factors affecting the rate of reactions: concentration, temperature, pressure and catalyst; elementary and complex reactions, order and molecularity of reactions, rate law, rate constant and its units, differential and integral forms of zero and first-order reactions, their characteristics and half-lives, the effect of temperature on the rate of reactions, Arrhenius theory, activation energy and its calculation, collision theory of bimolecular gaseous reactions (no derivation). UNIT 10: SURFACE CHEMISTRY Adsorption- Physisorption and chemisorption and their characteristics, factors affecting adsorption of gases on solids - Freundlich and Langmuir adsorption isotherms, adsorption from solutions. Catalysis - Homogeneous and heterogeneous, activity and selectivity of solid catalysts, enzyme catalysis and its mechanism. Colloidal state- distinction among true solutions, colloids and suspensions, classification of colloids - lyophilic. lyophobic; multimolecular. macromolecular and associated colloids (micelles), preparation and properties of colloids - Tyndall effect. Brownian movement, electrophoresis, dialysis, coagulation and flocculation: Emulsions and their characteristics.

b) INORGANIC CHEMISTRY

UNIT 11: CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES Modem periodic law and present form of the periodic table, s, p. d and f block elements, periodic trends in properties of elements atomic and ionic radii, ionization enthalpy, electron gain enthalpy, valence, oxidation states and chemical reactivity.

UNIT 12: GENERAL PRINCIPLES AND PROCESSES OF ISOLATION OF METALS Modes of occurrence of elements in nature, minerals, ores; Steps involved in the extraction of metals - concentration, reduction (chemical and electrolytic methods) and refining with special reference to the extraction of Al. Cu, Zn,and Fe; Thermodynamic and electrochemical principles involved in the extraction of metals.

UNIT 13: HYDROGEN Position of hydrogen in periodic table, isotopes, preparation, properties and uses of hydrogen; Physical and chemical properties of water and heavy water; Structure, preparation, reactions and uses of hydrogen peroxide; Classification of hydrides - ionic, covalent and interstitial; Hydrogen as a fuel.

UNIT 14: S -BLOCK ELEMENTS (ALKALI AND ALKALINE EARTH METALS) Group -1 and 2 Elements General introduction, electronic configuration and general trends in physical and chemical properties of elements, anomalous properties of the first element of each group, diagonal relationships. Preparation and properties of some important compounds - sodium carbonate and sodium hydroxide and sodium

hydrogen carbonate; Industrial uses of lime, limestone. Plaster of Paris and cement: Biological significance of Na, K. Mg and Ca.

UNIT 15: P- BLOCK ELEMENTS Group -13 to Group 18 Elements General Introduction: Electronic configuration and general trends in physical and chemical properties of elements across the periods and down the groups; unique behaviour of the first element in each group. Groupwise study of the p - block elements Group -13 Preparation, properties and uses of boron and aluminium; Structure, properties and uses of borax, boric acid, diborane, boron trifluoride, aluminium chloride and alums. Group -14 The tendency for catenation; Structure, properties and uses of Allotropes and oxides of carbon, silicon tetrachloride, silicates, zeolites and silicones. Group -15 Properties and uses of nitrogen and phosphorus; Allotrophic forms of phosphorus; Preparation, properties, structure and uses of ammonia, nitric acid, phosphine and phosphorus halides, (PCl3. PCl5); Structures of oxides and oxoacids of nitrogen and phosphorus. Group -16 Preparation, properties, structures and uses of ozone: Allotropic forms of sulphur; Preparation, properties, structures and uses of sulphuric acid (including its industrial preparation); Structures of oxoacids of sulphur. Group-17 Preparation, properties and uses of hydrochloric acid; Trends in the acidic nature of hydrogen halides; Structures of Interhalogen compounds and oxides and oxoacids of halogens. Group-18 Occurrence and uses of noble gases; Structures of fluorides and oxides of xenon.

UNIT 16: d - and f- BLOCK ELEMENTS Transition Elements General introduction, electronic configuration, occurrence and characteristics, general trends in properties of the first-row transition elements - physical properties, ionization enthalpy, oxidation states, atomic radii, colour, catalytic behaviour, magnetic properties, complex formation, interstitial compounds, alloy formation; Preparation, properties and uses of K2Cr2O7, and KMnO4. Inner Transition Elements Lanthanoids - Electronic configuration, oxidation states and lanthanoid contraction.Actinoids - Electronic configuration and oxidation states.

UNIT 17: CO-ORDINATION COMPOUNDS Introduction to co-ordination compounds. Werner's theory; ligands, co-ordination number, denticity. chelation; IUPAC nomenclature of mononuclear co-- ordination compounds, isomerism; Bonding-Valence bond approach and basic ideas of Crystal field theory, colour and magnetic properties; Importance of co-- ordination compounds (in qualitative analysis, extraction of metals and in biological systems).

UNIT 18: ENVIRONMENTAL CHEMISTRY Environmental pollution - Atmospheric, water and soil. Atmospheric pollution - Tropospheric and Stratospheric Tropospheric pollutants - Gaseous pollutants: Oxides of carbon, nitrogen and sulphur, hydrocarbons; their sources, harmful effects and prevention; Greenhouse effect and Global warming: Acid rain; Particulate pollutants: Smoke, dust, smog, fumes, mist; their sources, harmful effects and prevention. Stratospheric pollution- Formation and breakdown of ozone, depletion of the ozone layer - its mechanism and effects. Water Pollution - Major pollutants such as. pathogens, organic wastes and chemical pollutants; their harmful effects and prevention. Soil pollution - Major pollutants such as; Pesticides (insecticides. herbicides and fungicides), their harmful effects and prevention. Strategies to control environmental pollution.

c)**ORGANIC CHEMISTRY**

UNIT 19: PURIFICATION AND CHARACTERISATION OF ORGANIC COMPOUNDS Purification - Crystallization, sublimation, distillation, differential extraction and chromatography - principles and their

applications. Qualitative analysis - Detection of nitrogen, sulphur, phosphorus and halogens. Quantitative analysis (basic principles only) - Estimation of carbon, hydrogen, nitrogen, halogens, sulphur, phosphorus. Calculations of empirical formulae and molecular formulae: Numerical problems in organic quantitative analysis.

UNIT 20:SOME BASIC PRINCIPLES OF ORGANIC CHEMISTRY Tetravalency of carbon: Shapes of simple molecules - hybridization (s and p): Classification of organic compounds based on functional groups: and those containing halogens, oxygen, nitrogen and sulphur; Homologous series: Isomerism - structural and stereoisomerism. Nomenclature (Trivial and IUPAC) Covalent bond fission - Homolytic and heterolytic: free radicals, carbocations and carbanions; stability of carbocations and free radicals, electrophiles and nucleophiles. Electronic displacement in a covalent bond - Inductive effect, electromeric effect, resonance and hyperconjugation. Common types of organic reactionsSubstitution, addition, elimination and rearrangement.

UNITS 21: HYDROCARBONS Classification, isomerism, IUPAC nomenclature, general methods of preparation, properties and reactions. Alkanes - Conformations: Sawhorse and Newman projections (of ethane): Mechanism of halogenation of alkanes. Alkenes - Geometrical isomerism: Mechanism of electrophilic addition: addition of hydrogen, halogens, water, hydrogen halides (Markownikoffs and peroxide effect): Ozonolysis and polymerization. Alkynes - Acidic character: Addition of hydrogen, halogens, water and hydrogen halides: Polymerization. Aromatic hydrocarbons - Nomenclature, benzene - structure and aromaticity: Mechanism of electrophilic substitution: halogenation, nitration. Friedel - Craft's alkylation and acylation, directive influence of the functional group in mono-substituted benzene.

UNIT 22: ORGANIC COMPOUNDS CONTAINING HALOGENS General methods of preparation, properties and reactions; Nature of C-X bond; Mechanisms of substitution reactions. Uses; Environmental effects of chloroform, iodoform freons and DDT.

UNIT 23: ORGANIC COMPOUNDS CONTAINING OXYGEN General methods of preparation, properties, reactions and uses. ALCOHOLS, PHENOLS AND ETHERS Alcohols: Identification of primary, secondary and tertiary alcohols: mechanism of dehydration. Phenols: Acidic nature, electrophilic substitution reactions: halogenation. nitration and sulphonation. Reimer - Tiemann reaction. Ethers: Structure.Aldehyde and Ketones: Nature of carbonyl group; Nucleophilic addition to >C=O group, relative reactivities of aldehydes and ketones; Important reactions such as - Nucleophilic addition reactions (addition of HCN. NH3, and its derivatives), Grignard reagent; oxidation: reduction (Wolf Kishner and Clemmensen); the acidity of α-hydrogen. aldol condensation, Cannizzaro reaction. Haloform reaction, Chemical tests to distinguish between aldehydes and Ketones. Carboxylic Acids Acidic strength and factors affecting it,

UNIT 24: ORGANIC COMPOUNDS CONTAINING NITROGEN General methods of preparation. Properties, reactions and uses. Amines: Nomenclature, classification structure, basic character and identification of primary, secondary and tertiary amines and their basic character. Diazonium Salts: Importance in synthetic organic chemistry.

UNIT 25: POLYMERS General introduction and classification of polymers, general methods of polymerization, - Addition and condensation, copolymerization. Natural and synthetic, rubber and vulcanization, some important polymers with emphasis on their monomers and uses – polythene, nylon, polyester and bakelite.

UNIT 26: BIOMOLECULES General introduction and importance of biomolecules. CARBOHYDRATES - Classification; aldoses and ketoses: monosaccharides (glucose and fructose) and constituent monosaccharides of oligosaccharides (sucrose, lactose and maltose).

PROTEINS - Elementary Idea of α-amino acids, peptide bond, polypeptides. Proteins: primary, secondary, tertiary and quaternary structure (qualitative idea only), denaturation of proteins, enzymes. VITAMINS – Classification and functions. NUCLEIC ACIDS – Chemical constitution of DNA and RNA. Biological functions of nucleic acids.

UNIT 27: CHEMISTRY IN EVERYDAY LIFE Chemicals in Medicines - Analgesics, tranquillizers, antiseptics, disinfectants, antimicrobials, anti-fertility drugs, antibiotics, antacids. Anti-histamines - their meaning and common examples. Chemicals in food - Preservatives, artificial sweetening agents - common examples. Cleansing Agents - Soaps and detergents, cleansing action

UNIT 28: PRINCIPLES RELATED TO PRACTICAL CHEMISTRY Detection of extra elements (Nitrogen, Sulphur, halogens) in organic compounds; Detection of the following functional groups; hydroxyl (alcoholic and phenolic), carbonyl (aldehyde and ketones) carboxyl and amino groups in organic compounds. • The chemistry involved in the preparation of the following: Inorganic compounds; Mohr's salt, potash alum. Organic compounds: Acetanilide, p-nitro acetanilide, aniline yellow, iodoform. • The chemistry involved in the titrimetric exercises – Acids, bases and the use of indicators, oxalic-acid vs KMnO4, Mohr's salt vs KMnO4 • Chemical principles involved in the qualitative salt analysts: Cations – Pb2+, Cu2+, Al3+, Fe3+, Zn2+, Ni2+ , Ca2+, Ba2+, Mg2+ , NH4 +Anions- CO3 2−, S 2- ,SO4 2−, NO3- , NO2- , Cl- , Br- , I- (Insoluble salts excluded). Chemical principles involved in the following experiments: 1. Enthalpy of solution of CuSO4 2. Enthalpy of neutralization of strong acid and strong base 3. Preparation of lyophilic and lyophobic sols. 4. Kinetic study of the reaction of iodide ion with hydrogen peroxide at room temperature

B.Tech (Lateral Entry for B.Sc. students)

60 questions, 1 hour duration, (Mathematics - 30, Physics -15, Chemistry -15 questions)

A. MATHEMATICS (+ 2 Level) - (30 Questions)

Logic : Statement, Negation, Implication, Converse, Contrapositive, Conjuction, Disjunction, tautology, Truth Table, Principle of Mathematical induction.

Sets, Relation and Function : Union, Intersection, Difference, Symmetric difference and Complement of sets , De Morgan's laws,Venn diagram, Cartesian product of sets, Power Set, Relation and function : domain , codomain and range of a relation, types of relations, Equivalence relation, Representation of three dimensional space by RxRxR, types of functions and their domain and range such as: Constant function, identity function, modulus function, logarithm function, exponntial function, greatest integer function. surjective, injective and bijective functions, sum , difference and quotient of functions and their range, Composite function, Inverse of a function. Number system : Real numbers (algebraic and order properties, rational and irrational numbers), Absolute value, Triangle inequality, AM ≥ GM, Inequalities(simple cases), Complex numbers as ordered pairs of reals, representation of a complex number in the form a +ib and their representation in a plane, Argand diagram, Algebra of complex

numbers, modulus and argument of complex numbers, Conjugate a complex number, Quadratic equation in real numbers, and their solution, Relation between roots and coefficients, nature of roots, formation of quadratic equation with roots. Permutations and Combinations, fundamental principle of counting, permutation as an arrangement and combination as a selection, meaning of P(n,r) and C(n,r), simple applications, Binomial theorem for positive integral index, general term and middle term, properties of Binomial coefficient and their applications, Identities involving binomial co-efficients. Determinants and matrices : Determinants and matrices up to third order, Minors and cofactors, Properties of determinants, Matrices upto third order, Types of matrices, algebra of matrices, properties of determinant, evaluation of determinants, Adjoint and inverse of matrix, Application of determinants and matrices to the solution of linear equations (in three unknowns). Trigonometry : Compound angles, Multiple and Submultiple angles, Trigonometric identities , Solution of trigonometric equations, trigonometric functions, Properties of triangles, Inverse trigonometric function and their properties Co-ordinate geometry of two dimensions : Cartesian system of rectangular co-ordinates in a plane, distance formula, section formula, locus and its equation, translation of axes, slope of a line, parallel and perpendicular lines, intercepts of a line on the coordinate axes. Various forms of equations of a line, intersection of lines, angles between two lines, conditions for concurrence of three lines, distance of a point from a line equations of internal and external bisectors of angles between two lines, coordinates of centroid, orthocentre and circumcentre of a triangle, equation of family of lines satisfying various conditions,. Pairs of straight lines, Standard form of equation of a circle, general form of the equation of a circle, radius and centre of a circle, equation of a circle when the end points of a diameter are given, points of intersection of a line and a circle and condition for a line to be tangent to a circle, Equations of tangents to a circle, Equations of parabola, Ellipse and hyperbola in simple forms, their tangents in standard form. Condition of tangency. Coordinate geometry of three dimensions : Coordinates of a point in space, distance between two points, section formula, Direction cosines and direction ratios, Projection, angle between two intersecting lines. Angle between two planes, Angle between a line and a plane. Distance of a point from a line and a plane. Equations of a line and a plane in different forms, intersection of a line and a plane, coplanar lines. Sequence and Series : Definition, Infinite geometric series, Arithmetico-geometric series, Exponential and Logarithmic series, Geometric mean between two given numbers, Relation between AM and GM Vectors : Vectors and scalars, addition of vectors, components of a vector in two dimensions and three dimensional space, scalar and vector products, scalar and vector triple product. Differential calculus: Concept of limit, limits of polynomial functions, rational functions, trigonometric functions, exponential and logarithmic functions, Continuity of functions, Contuinity and differentiability, Derivative of standard Algebraic and Transcendental functions, Differentiation of trigonometric, inverse trigonometric, logarithmic and exponential functions, Derivative of composite functions, functions in parametric form, Implicit differentiation, Differentiation of the sum, difference, product and quotient of two functions, derivatives of order upto two, Rolle's and Lagrange's Mean Value Theorems, Applications of derivatives: Rate of change of quantities, monotonic – increasing and decreasing functions, Maxima and minima of functions of one variable, tangents and normals, Geometrical application of derivatives such as finding tangents and normals to plane curves. Integral calculus: Standard methods of integration (substitution, by parts, by partial fraction, etc), Integration of rational, irrational functions and trigonometric functions. Definite integrals and properties of definite integrals, Fundamental Theorem of Calculus, Evaluation of definite integrals, determining areas of the regions bounded by simple curves in standard form. Differential equations : Definition, order, degree of a differential equation, General and particular solution of a differential equation,

Formation of a differential equation, Solution oof a differential equations by method of separation of variables, Homogeneous differential equations of first order and first degree, Linear differential equations of the form dy/dx +p(x)y = q(x), Probability and statistics: Measures of Dispersion: Calculation of mean, median, mode of grouped and ungrouped data, calculation of standard deviation, variance and mean deviation for grouped and ungrouped data, Probability: Probability of an event, addition and multiplication theorems of probability, Mutually exclusive events, Independent events, Compound events, Conditional probability, Addition theorem, Baye's theorem, random variables, probability distribution of a random variate (Binomial distribution only

B. PHYSICS- (15 Questions)

Mechanics: Vector algebra, gradient, divergence, curl and their significance. Ordinary differential equation:1st order and 2nd order homogenous differential equation laws of motion, motion in a uniform field, components of velocity and acceleration in different coordinate systems. Motion under a central force, Kepler's law, Gravitational law and field. Potential due to a spherical body, Gauss and Poisson equations for gravitational self-energy. System of particles, center of mass, equation of motion, conservation of linear and angular momenta, conservation of energy, elastic and inelastic collisions. Rigid body motion, rotational motion, moment of inertia and their products. Special theory of relativity: Postulates of special theory of relativity, length contraction, time dilation, relativistic addition of velocities. Oscillations: Harmonic oscillations, kinetic and potential energy, examples of simple harmonic oscillations, spring and mass system, simple and compound pendulum, torsional pendulum. Superposition of two simple harmonic motions of the same frequency along the same line, interference, superposition of two mutually perpendicular simple harmonic vibrations of the same frequency, Lissajous figures, case of different frequencies. Forced and damped oscillations. Motion of charged particles in electric and magnetic fields: E as an accelerating field, electron gun, case of discharge tube, linear accelerator, E as deflecting field-CRO, sensitivity. Properties of Matter: Elasticity, small deformations, Hooke's law, elastic constants for an isotropic solid, beams supported at both the ends, cantilever, torsion of a cylinder, bending moments and shearing forces. Bernoulli's theorem, viscous fluids, streamline and turbulent flow. Poiseulle's law. Capillarity, tube of flow, Reynolds's number, Stokes law. Surface tension and surface energy, molecular interpretation of surface tension, pressure across a curved liquid surface, angle of contact and wetting. Electrostatics: Coulomb's law (in vacuum) expressed in vector forms, calculation of E for simple distributions of charge at rest, dipole and quadruple fields Work done on a charge in an electrostatic field expressed as a line integral, conservative nature of the electrostatic field. Electric potential , E = -dV/dx, Torque on a dipole in a uniform electric field and its energy, flux of the electric field, Gauss' law and its application for finding E for symmetric charge distributions, Gaussian pillbox, fields at the surface of a conductor. Screening of electric field by a conductor. Capacitors, electrostatic energy, force per unit area of the surface of a conductor in an electric field .Capacitance of an isolated spherical conductor, parallel plate ,spherical and cylindrical condenser. Gauss law in dielectrics. Electric Currents: Steady current, Current density vector J, non-steady currents and continuity equation, Kirchhoff's law and analysis of multi-loop circuits, rise and decay of current in LR and CR circuits, decay constants, transients in LCR circuits, AC circuits, Complex numbers and their applications in solving AC circuit problems, complex impedance and reactance, series and parallel resonance, Q factor, power consumed by an AC circuit, power factor. Magneto statics: Force on a moving charge, Lorentz force equation and definition of B, force on a straight conductor carrying current in a uniform magnetic field, torque on a current loop, magnetic

dipole moment, Biot and Savart's law, calculation of B in simple geometric situations, Ampere's law ∇∇.B=0, ∇×B,= μ0J, field due to a magnetic dipole. Time Varying Fields: Electromagnetic induction, Faraday's law, electromotive force e=σ.E.dr, Integral and differential forms of Faraday's law, mutual and self inductance, transformers, energy in a static magnetic field, Maxwell's displacement current, Maxwell's equations, electromagnetic field, energy density. Electromagnetic Waves: The wave equation satisfied by E and B, plane electromagnetic waves in vacuum, Poynting's vector. Kinetic theory of Matter: Real gas: Van der Waals gas, equation of state, nature of Van der Waals forces, comparison with experimental P-V curves. The critical constants, distinction between gaseous and vapour state, Joule expansion of ideal gas, and of a Vander Waals gas, Joule coefficient, estimates of J-T cooling. Thermodynamics: Blackbody radiation: energy distribution in blackbody spectrum. Planck's quantum postulates, Planck's law. Interpretation of behaviour of specific heats of gases at low temperature. Kinetic Theory of Gases: Maxwellian distribution of speeds in an ideal gas: distribution of speeds and of velocities, distinction between mean, rms and most probable speed values. Law of equipartition of energy and its applications to specific heat of gases. Physical Optics: The principle of superposition , Interference of a light, double-slit interference, coherence requirement for the sources, optical path retardation, lateral shift of fringes, Localized fringes: thin films, Michelson interferometer, Fresnel diffraction: Fresnel half-period zones, plates, straight edge, rectilinear propagation. Fraunhofer diffraction : Diffraction of a single slit, the intensity distribution, diffraction at a circular aperture and a circular disc. Diffraction gratings: Diffraction at N parallel slits, intensity distribution, plane diffraction grating, polarization of transverse waves, plane, circular and elliptically polarized light. Polarization by reflection and refraction. Double reflection and optical rotation: Refraction, in uniaxial crystals, its electromagnetic theory. Phase retardation plates, double image prism, rotation of plane of polarized light, origin of optical rotation in liquids and in crystals. Quantum Mechanics: Origin of the quantum theory: failure of classical physics to explain the phenomena such as blackbody spectrum, photoelectric effect, Ritz combination principle in spectra, stability of an atom, Planck's radiation law, Einstein's explanation of photoelectric effect, Bohr's quantization of angular momentum and its applications to hydrogen atom, limitations of Bohr's theory. Wave particle duality and uncertainty principle: de Broglie's hypothesis for matter waves, the concept of wave and group velocities, evidence for diffraction and interference of particles, experimental demonstration of matter waves. Consequence of de Broglie's concepts; quantization in hydrogen atom; quantized energy levels of a particle in a box, wave packets, Heisenberg's uncertainty relation for p and x, its extension to energy and time. Consequence of the uncertainty relation: gamma ray microscope, diffraction at a slit, particle in a box, position of electron in a Bohr orbit. Quantum Mechanics: Schrodinger's equation. Postulatory basis of quantum mechanics, operators, expectation values, transition probabilities, applications to particle in a one dimensional box, harmonic oscillator, reflection at a step potential, transmission across a potential barrier. Week spectra: continuous X-ray spectrum and its dependence on voltage, Characteristics X-rays. Moseley's law, Raman effect, Stokes and anti-Stocks lines, fission and fusion (concepts), energy production in stars by p-p and carbon cycles (concepts). Cyclotron. Solid State Physics: X-ray diffraction, Bragg's law, Magnetism: Atomic magnetic moment, magnetic susceptibility, Dia-Para-, and Ferromagnetism, Ferromagnetic domains, Hysteresis. Band Structure: Energy bands, energy gap, metals, insulators, semiconductors. Solid State Devices: Semiconductors - Intrinsic semiconductors, electrons and hole s, Fermi level. Temperature dependence of electron and hole concentrations. Doping: impurity states, n and p type semiconductors. Semiconductor devices: p-n junction, majority and minority charge carriers, junction diode, Zener diode. Electronics: Power supply: diode as a circuit element, load line concept, rectification,

ripple factor, Zener diode, voltage stabilization, IC voltage regulation, characteristics of a transistor in CB, CE and CC mode. Field effect transistors: JFET volt-ampere curves, biasing JFET, RC coupled amplifier, gain, frequency response, input and output impedance. Digital electronics: Decimal to binary and binary to decimal conversion. AND, OR, NOT NOR, XOR, XNOR, NAND gates. NAND, NOR gates as universal gates. C. CHEMISTRY (+ 3 Level) - (15 Questions) Kinetic Theory of Gases : Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation. Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena, critical constants and their calculation from van der Waals equation. Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation derivation not required) and their importance. Liquids : Surface tension, Viscosity, coefficient of viscosity of liquid using Effect of temperature on surface tension and coefficient of viscosity of a liquid. Solids : Symmetry elements, unit cells, crystal systems, Bravais lattice types Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices. XRay diffraction by crystals, Braggs law. Defects in crystals. Chemical Kinetics : Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Halflife of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory. Solutions : Thermodynamics of ideal solutions: Ideal solutions and Raoults law, deviations from Raoults law non-ideal solutions. Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes

Thermodynamics: Definition of thermodynamic terms, systems, surroundings etc. Types of systems, intensive and extensive properties, state and path functions and their differentials, thermodynamic processes, concept of heat and work. First law of thermodynamics, statement, definition of internal energy, enthalpy, heat capacity, heat capacity at constant volume, constant pressure and their relation, calculation of w, q, U, H, for the expansion of ideal gases under isothermal and adiabatic conditions for reversible processes, Work done in irreversible process. Thermochemistry : Standard state, standard enthalpy of formation, Hess's law of heat of summation and its application, heat of reaction at constant pressure and constant volume, enthalpy of neutralization, bond dissociation energy and its calculation from thermochemical data, temperature dependence of enthalpy. Kirchoff's equation. Third law of Thermodynamics. Chemical equilibrium : Equilibrium constant and free energy. Relationship between Kp, Kc, Kx. Derivation of law of mass action (Study of homogeneous and heterogeneous equilibria). Le chaterlier's principle. Ionic equilibria : Degree of ionization of weak electrolytes, ionic product of water, salt hydrolysis, solubility product and its applications, Buffer solutions. Phase equilibrium: Statement and meaning of the terms - phase, component and degree of freedom, derivation of Gibbs phase rule, Clausius-clapeyron equation, phase equilibrium of one component system - water and sulphur system. Two component systems including eutectics, congruent and incongruent melting points, (Pb- Ag system). Electrochemistry-I: Specific conductance and equivalent and molar conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution, migration of ions and Kohlrausch law, transport number Arrhenius theory of electrolytic dissociation and its limitations, weak and strong electrolytes, Ostawald's dilution law, its uses and limitations. Application of conductivity measurements, determination of degree of dissociation of weak electrolytes Determination of solubility product of a sparingly soluble salt, conductometric titration(acid-base). Electrochemistry-II: Types of reversible electrodes- gas metal ion, meta-metal ion, metalinsoluble salt-anion and redox

electrodes. Electrode reactions, Nernst equation, derivation of cell EMF and single electrode potential, standard hydrogen electrodes-reference electrodes, standard electrode potentials, sign conventions, electrochemical series and its significant, EMF of a cell and its measurements. Computation of cell EMF, concentration of cell with and without transport, liquid junction potential, definition of pH. Determination of pH using hydrogen electrode, quinehydrone electrode, buffers-mechanism of buffer action, Henderson equation. Hydrolysis of salts (quantitative treatment). Atomic Structure: Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation (Mathematical derivations excluded) significance of quantum numbers, shapes of s,p,d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements. Anomalous electronic configuration. Periodic Properties: Atomic and ionic radii, ionization enthalpy and electron – gain enthalpy, electronegativity-definition, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behaviour. Chemical Bonding: Covalent Bond - valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion, (VSEPR) theory of NH3 , H3O+, SF4, CIF3, ICl2 and H2O. MO theory, homonuclear and heteronuclear (CO and NO) diatomic molecules. S & P Block Elements: Allotropy in C, S and P, Inertpiar effect. Diagonal relationship anomalous behavior of first member of each group. Hydrides and their classification. Structure and properties of hydrids of p block elements. Structure of diborane, oxoacids of P S and Cl, halides and oxohalides: PCl3, PCl5, SOCl2. General Principles of Metallurgy: chief modes of occurrence of metal based on standard electrode potentials. Ellingham diagram for reduction of metal oxide using carbon as reducing agent. Hydro metallurgy. Purification of metals (Al,Pb,Fe,Cu,Ni,Zn) electrolytic and oxidative refining , Parting process , van Arkel - de Boer process and Mond process. Fundamentals of organic chemistry: Inductive effect, resonance, hyper conjugation. Strength of organic acids & bases. Reactive intermediate- carbocations, carbanions, free-radicals and carbenes - formation, stability and structure, types and mechanism of organic reactions- SN1 , SN2, SE1, SE2 , E1, E2, AdE, AdN, Stereochemistry of Organic compounds: Conformations with respect to ethane, butane & cyclohexane. Concept of chirality, configuration. Geometrical and optical isomerism. Enatiomerism, diastereomerism and meso compounds. D-L, cis-trans nomenclature,CIP rule, R/S (for one chiral carbon atom) and E/Z nomenclature. Aliphatic Hydrocarbons : Alkanes: (Upto 5 Carbons). Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbes synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogena- tion. Alkenes: (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydro- halogenation of alkyl halides (Saytzeffs rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. KMnO4) and trans-addition (bromine), Addition of HX (Markownikoffs and anti-Markownikoffs addition), Hydration, Ozonolysis, Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC2 and conversion into higher alkynes; by de- halogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. Reactions: formation of metal acetylides, addition of bromine and alkaline KMnO4,ozonolysis. Aromatic hydrocarbons: Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. Reactions: (Case benzene): Elec- trophilic substitution: nitration, halogenation and sulphonation. Friedel-Crafts reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (up to 4 carbons on benzene). Alkyl and Aryl Halides Alkyl Halides (Up to 5 Carbons) Types of Nucleophilic Substitution (SN1, SN2 and SNi) reac- tions. Preparations & Reactions of Alkyl Halides. Aryl Halides Preparation: from phenol, Sandmeyer & Gattermann reactions. Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replace- ment by OH group) and effect

of nitro substituent. Benzyne Mechanism: KNH2/NH3 (or NaNH2/NH3). Alcohols, Phenols and Ethers (Upto 5 Carbons)Alcohols: Preparation: Preparation of 1, 2 and 3 alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes and ketones, carboxylic acid and esters. Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. KMnO4, acidic dichromate, conc. HNO3). Oppeneauer oxidation Diols: (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement. Phenols: (Phenol case) Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. ReimerTiemann Reaction, Gattermann-Koch Reaction, Ethers (aliphatic and aromatic): Cleavage of ethers with HI. Aldehydes and ketones (aliphatic and aromatic): Formaldehye, acetaldehyde, acetone and benzalde- hyde Preparation: from acid chlorides and from nitriles. Reactions Reaction with HCN, ROH, NaHSO3, NH2 − G derivatives. Iodoform test. Aldol Con- densation, Cannizzaros reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Carboxylic acids and their derivatives. Carboxylic acids (aliphatic and aromatic) Preparation: Acidic and Alkaline hydrolysis of esters. Reactions: Hell Vohlard - Zelinsky Reaction. Amines and Diazonium Salts Amines (Aliphatic and Aromatic): (Upto 5 carbons) Preparation: from alkyl halides, Gabriels Ph- thalimide synthesis, Hofmann bromamide reaction. Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO2, Schotten Baumann Reaction. Electrophilic substi- tution (case aniline): nitration, bromination, sulphonation. Diazonium salts: Preparation: from aromatic amines. Reactions: conversion to benzene, phenol, dyes. Amino Acids: Preparation of Amino Acids: Strecker synthesis using Gabriels phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis. Reactions of Amino acids: ester of COOH group, acetylation of NH2 group, complexation with Cu2+ ions, ninhydrin test.

B.Tech (Lateral Entry for diploma holders)

120 questions, 2 hours duration (Engg Math - 40, Engg Mechanics - 40, Basic Electrical and Electronics Engg. - 40 questions)

A. ENGINEERING MATHEMATICS – 40

Algebra: Definition of complex number, Conjugate of complex number, Modulus and amplitude of a complex number. Algebra of complex numbers. Cube root of unity and their properties, De'Moivre's theorem and its application, Permutation, Combination, Binomial Theorem for any rational index, Relationship between Binomial coefficients. Determinant and Matrices: Properties of determinants. Crammer's Rule, Types of matrices, Transpose, Adjoint and inverse of a matrix upto third order. Solution of simultaneous equation by matrix method. Trigonometry: Trigonometrical ratios, multiple and submultiple angles, solution of trigonometrical equations, Properties of triangles, Inverse circular function and its properties. Analytical Geometry: Distance formula, Division formula, Area of trapezium, Area of Triangle, Equation of straight lines in different form, Distance of a point from a line, Equation of circle in different forms. Vector Algebra: Definition, Algebra of vectors, Position Vector, Resolution of vector into components, normal vector, unit vector, Scalar and Vector product of two vectors and their application, scalar triple product and its application. Calculus: Limit and continuity of function, Derivative of standard functions, Derivative of composite functions. Differentiation of implicit functions, Differentiation of function in parametric form, Differentiation using logarithm, Differentiation of a function with respect to another function, Successive differentiation in simple cases, Maxima, minima

and point of inflection, Partial derivative, Euler's theorem for homogeneous functions. Standard methods of integration (by parts, by substitution, by partial fraction etc.). Definite integrals and their properties. Area bounded by curves. Ordinary Differential Equation: Order and degree of differential equation, formation of differential equation. Solution of first order and first degree differential equation. (Linear and homogeneous) Coordinate Geometry of three Dimension: Distance and Division formulae, Direction cosine and direction ratio of a line, condition of perpendicularity and parallelism, Equation of plane under different conditions, angle between two planes, Distance of a point from a plane, General equation of a sphere, Equation of a sphere with given diameter. Probability and Statistics: Measures of central tendency (Mean, Median, Mode), Measures of dispersion (Mean Deviation, Standard Deviation and Variance), Definition of probability, equally likely, Mutually exclusive and independent events. Addition theorem of probability.

B. ENGINEERING MECHANICS – 40 Questions

Force and Moments Force and its effects, Classification of forces, Principle of Transmissibility, Principle of Superposition, Action and Reaction, Tension and Compression, Free Body Diagram. Co-planer concurrent forces: Resultant of forces, Equilibrium of forces and equilibrant, Parallelogram law of forces and determination of the resultant of two concurrent forces, Components and resolve parts of a force, Principle of resolution of a force and any number of forces, Analytical determination of resultant of number of concurrent forces, Lami's Theorem, Triangle law of forces and polygon law of forces. Coplanar non-concurrent forces: Moment of a force, Statement and proof of Varignon's theorem, Conditions of equilibrium, Determination of resultant of two like and unlike parallel forces, Couple and its moment, Various types of supports with their reactions, Simple problems on coplanar non concurrent forces with the help of free body diagram. Center of Gravity and Moment of Inertia Centroid and Center of Gravity(C.G.), Expression for C.G. of straight line (uniform rod),triangle, rectangle, circular, semicircular lamina. Expression for C.G. of solids like hemisphere and cone (Expression only). Different types of engineering sections (symmetrical and non-symmetrical built up sections). Location of the C.G. of the above sections. Definition of Moment of Inertia (M.I.) of plain figure as second moment of area. Perpendicular axes theorem, parallel axis theorem. M.I. of plane lamina like rectangle, triangle, circle, and semicircle (from 1st principle) M.I. of different engineering sections. Friction Frictional force, angle of friction, limiting friction, co-efficient of friction, Laws of Static Friction. Simple problems on ladder, Body on Inclined planes with applied force parallel to the plane and horizontal, Screw Jack. Gear Drive Various types of gears, Gear terminology, Velocity ratio and expression for the velocity ratio for simple gears. Types of gear trains (simple and compound gear trains) Simple Lifting Machine Definition of a machine. Simple and compound lifting machines. Mechanical Advantage (MA), Velocity Ratio (VR) and efficiency of lifting machine. Relationship between MA, VR and efficiency. Laws of machine, Friction in machines, Friction in terms of load and friction in terms of effort. Reversible machine and self-locking machine. Condition of reversibility of a machine. Velocity Ratio and efficiency of 1st, 2nd & 3rd system of pulleys; Simple and differential wheel & axle, Screw jack. Simple Stress and Strain Stress, strain, tensile, compressive and shear types of stress and strain, Hooke's Law of elasticity, Poisson's ratio, Elastic limit, Elastics Constants (E, G &K) relationship between E,G &K, Stress-strain curve and salient points on stress-strain curve for ductile material. Simple problems on stress and strain in case of material with uniform cross section. Dynamics Kinematics and kinetics of a particle, Principle of Dynamics:-Newton's laws of motion, D'Alembert's Principle and its application. Motion of particle acted upon by a constant force. Engineering Application of Work, Power and Energy: Work done, force-

displacement diagram, Work done in stretching a spring, Power, Indicated Power, Brake Power and efficiency. Kinetic and potential energy & its application, Force, Momentum and Impulse, Conservation of energy and linear momentum, Collision of elastic bodies, Co-efficient of restitution (e), Velocity after impact. Impact of body with a fixed plane.

C. BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (40 Questions)

C 1. BASIC ELECTRICAL ENGINEERING (20 Questions)

Fundamentals and AC Theory: Concept of Source and Load, Ohm's Law, Concept of resistance, Series and Parallel DC circuits, Kirchhoff's Laws, Faraday's Laws of Electromagnetic Induction, Fleming's Left 7 Hand Rule and Right Hand Rule. Generation of alternating emf, Difference between DC and AC, Amplitude, Cycle, Time period, Frequency, Phase, Phase Angle, Phase Difference, Instantaneous value, RMS value, Average value, Amplitude factor and Form factor, Phasor diagram representation of AC values, AC through pure resistance, inductance and capacitance, AC through RL, RC and RLC circuits, Impedance Triangle and Power Triangle. Conversion of Electrical Energy:. DC machine and its main parts. DC generators: Principle of operation and emf equation. DC motors: Principle of operation, classification, torque equation and applied voltage V-back emf Eb relation. Starters used for DC motors, Use of different types of DC generators and motors, Concept of single phase Transformer and its application, Principle of operation of Three-phase and Single-phase Induction Motors. Power Billing: Calculation of Power used in small electrical appliances and installation, Calculation of Energy consumption in small electrical installations, Earthing installation, types (Pipe and Plate earthing) and uses. Measuring Instruments and Storage Devices: Introduction to measuring instruments, Expression for Torque in measuring instruments, Use of PMMC and MI type of instruments(Ammeters and Voltmeters). Connection diagram of AC/DC ammeter, voltmeter, energy meter and wattmeter for single phase electrical system only, Introduction to storage devices and their types. Charging, Discharging and Maintenance of Lead Acid battery. C 2. BASIC ELECTRONICS ENGINEERING (20 Questions) Electronic Devices: Classification of material according to electrical conductivity (Conductor, Semiconductor & Insulator) with respect to energy band diagram only. Principle of working and use of PN junction diode, Zener diode and Light Emitting Diode (LED), Integrated circuits (I.C) & its advantages. Electronic Circuits: Principles of working of different types of Rectifiers with their merits and demerits, Transistor, Different types of Transistor Configuration and state output and input current gain relationship in CE, CB and CC configuration (No mathematical derivation), Need of biasing and explain different types of biasing with circuit diagram (only CE configuration), Amplifiers (concept), Working principles of single phase CE amplifier. Communication System: Basic communication system (concept & explanation with help of Block diagram), Concept of Modulation and Demodulation, Difference between them, Different types of Modulations (AM, FM and PM) based on signal, carrier and modulated wave (Only Concept, No Mathematical Derivations). Transducers And Measuring Instruments: Concept of Transducer and sensor with their differences, Working principle of photo emissive, photoconductive, photovoltaic transducer and its application, Multimeter and its applications.

M. Tech.(PLASTIC ENGINEERING / POLYMER NANOTECHNOLOGY) / MS by Research (Polymer Science and Engg)

90 questions, 2 hour duration, Plastic Engg questions - 60, Engineering Mathematics – 20, Analytical & Logical reasoning – 10

A. ENGINEERING MATHEMATICS

Ordinary Differential Equations – Solution of first order , second order and higher order differential equations(separable equation, exact differential equation, homogeneous equation with constant co efficient, Euler Cauchy equations ,solution by undetermined coefficients and variation of parameters) Linear Algebra – Matrices ,Vectors, Determinants and linear system of equations ,Eigen value problems, symmetric, skew symmetric ,orthogonal matrices .Complex matrices ,Hermitian , Skew Hermitian and Unitary matrices, Similarity of matrices. Fourier series - Fourier series and expansion of functions of any period, odd and even functions, half range expansion. Laplace Transform – Use of Laplace transform for solving differential equations, Convolution and Integral equations. Complex Analysis – Analytic functions, Cauchy-Riemann equations, Laurent's series, singularities and zeros. Numerical Methods – Interpolation, numerical integration, solution of first order ordinary differential equations. Probability and Statistics- Probability distribution (discrete and continuous) , sampling distribution, correlation and regression analysis.

B. PLASTIC ENGINEERING

Polymer Science and Engineering: Natural Polymers, Synthetic polymers –homo polymers, co-polymers, cross linked polymers, polymerisation- Addition Polymerization, step growth polymerisation, Degree of polymerisation, polydispersity, molecular weight of polymers, molecular weight distribution.

Polymerisation techniques, Analysis and characterisation of polymers, melt flow index, Polymer processing: injection moulding, blow moulding, extrusion, compression moulding, polymer additives, polymer blends and alloys. Engineering plastics, commodity plastics, high performance plastics. Application of polymers.

Chemistry: Chemical bonding atomic structure, organic chemistry, name reaction, physical chemistry Chemical kinetics –Spectroscopy.

Material Science: Mechanical properties of material - Magnetic and Dielectric materials – Conductor and Semi conductor materials.

Applied Mechanics: Law of Mechanics – Lame's theorem – Forces, Moments and Couples – Displacement, velocity and Acceleration – Friction – Moment of Inertia.

M.Sc (Polymer Science)

100 Questions, 2 hours duration, Core Subjects- 70 Questions, English Grmmar-10 Questions, Mathematics -10 Questions, General Knowledge and Current Affairs -10 Questions

A. CORE SUBJECTS

Organic Chemistry • Name Reactions • Polymer Chemistry • Chemical Kinetics and Photochemistry • Functional Groups • Spectroscopy. • Hydrocarbons and their Halogen Derivatives. • Atomic Structure, Chemical Bonding, & Periodic Properties. • Bio-molecules. • Qualitative and Quantitative Analyses • Physical Chemistry and Analytical Chemistry B] ENGLISH • Grammar Verbal Reasoning • Synonyms • Antonyms • Plurals • Sentence Completion C] MATHEMATICS • Numerical Aptitude • Menstruation • Ratios and Proportion • Average and Percentages • Profit and loss

Integrated M.Sc.(Polymer Science / Material Science & Engineering)

90 questions, 3 hours duration, (Mathematics - 30, Physics -30, Chemistry -30 questions)

A.MATHEMATICS

UNIT - I

Relations and Functions 1. Relations and Functions Types of relations; reflexive, symmetric, transitive and equivalence relations. One to one and onto functions, composite functions, inverse of function. Binary operations. 2. Inverse Trigonometric Functions Definition, range, domain, principle value branch. 3. Linear Programming Introduction, related terminology such as constraints, objective function, optimization, different types of linear programming (L.P.) problems, mathematical formulation of L.P. problems, graphical method of solution for problems in two variables

UNIT - II

Algebra 1. Matrices Concept, notation, order, equality, types of matrices, zero and identity matrix, transpose of a matrix, symmetric and skew symmetric matrices. Operation on matrices; Addition and multiplication and multiplication with a scalar. Simple properties of addition, multiplication and scalar multiplication. Non commutativity of multiplication of matrices and existence of non-zero matrices whose product is the zero matrix (restrict to square matrices of order 2). concept of elementary row and column operations 2. Determinants Determinant of a square matrix (up to 3 × 3 matrices), properties of determinants, minors, co-factors and applications of determinants in finding the area of a triangle, Adjoint and inverse of a square matrix. solving system of linear equations in two or three variables (having unique solution) using inverse of a matrix.

UNIT-III

Differential Calculus 1. Continuity and Differentiability Continuity and differentiability, derivative of composite functions, chain rule, derivatives of inverse trigonometric functions, derivative of implicit functions. Concept of exponential and logarithmic functions. Derivatives of logarithmic and exponential functions. Logarithmic differentiation, derivative of functions expressed in parametric forms. Second order derivatives No problems on Mean Value Theorems.2. Applications of Derivatives Applications of derivatives, increasing and decreasing functions, tangents and normals, maxima and minima (first derivative test motivate geometrically and second derivative test given as a provable tool). Simple problems (that illustrate basic principles and understanding of the subject as well as real life situations).

UNIT-IV

Integral Calculus

Integrals: Integration as inverse process of differentiation. Integration of a variety of functions by substitution, by partial fractions and by parts, Evaluation of simple integrals of the following types and problems based on them. Fundamental Theorem of Calculus (without proof). Basic properties of definite integrals and evaluation of definite integrals. 2. Applications of the Integrals Applications in finding the area under simple curves, especially lines, circles/parabolas/ ellipses (in standard form only). Area between any of the two above said curves (the region should be clearly identifiable). 3. Differential Equations. Definition, order and degree, general and particular solutions of a differential equation. Formation of differential equation whose general solution is given. Solution of differential equations by method of separation of variables, solutions of homogeneous differential equations of first order and first degree. Solutions of linear differential equation of the type :

UNIT - V

Vectors: Vectors and scalars, magnitude and direction of a vector. Direction cosines and direction ratios of a vector. Types of vectors (equal, unit, zero, parallel and collinear vectors), position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, position vector of a point dividing a line segment in a given ratio. Definition, Geometrical Interpretation, properties and application of scalar (dot) product of vectors, vector (cross) product of vectors . 2. Three - dimensional Geometry Direction cosines and direction ratios of a line joining two points. Cartesian equation and vector equation of a line, coplanar and skew lines, shortest distance between two lines. Cartesian and vector equation of a plane. Distance of a point from a plane.

B.PHYSICS

Unit-I

Electrostatics

Electric charges and fields: Electric charge and its quantization, conservation of charge, Coulomb's law, force between two point charges, force between multiple charges, superposition principle, Continuous change distribution. Electric field due to a point charge, electric field lines, electric field due to a dipole at any point, torque on a dipole in uniform electric field. Electric flux, Gauss's theorem (statement only) and its applications to find field due to uniformly charged infinite plane sheet, infinitely long straight wire. 2. Electrostatic potential and capacitance: Electric potential, potential difference, electric potential due to a point charge, potential due to a dipole, potential due to a system of charges. Equipotential

surfaces, electrical potential energy of a system of two point charges and of electric dipole in an electrostatic field. Conductors, insulators, free charges and bound charges inside a conductor, Dielectrics and electric polarization, capacitors and capacitance, capacitance of Page 4 of 8 a parallel plate capacitor with and without dielectric medium between the plates, combination of capacitors in series and in parallel, energy stored in a capacitor.

Unit- II

Current Electricity:

Electric current, drift velocity, mobility and their relation with electric current, Ohm's law, electrical resistance, conductance, resistivity, conductivity, effect of temperature on resistance, V – I characteristics (linear and non-linear), electrical energy and power. EMF and potential difference, internal resistance of a cell, combination of cells in series and parallel, Kirchhoff's laws and simple applications. Wheatstone bridge and Meter Bridge. Potentiometer-Principle and its applications to measure potential difference and for comparing EMF of two cells; measurement of internal resistance of a cell.

Unit-III

Magnetic effect of Current and magnetism

Moving charges and magnetism: Concept of magnetic field, Biot-Savart law and its application to find magnetic field on the axis and at the centre of a current carrying circular loop, Ampere's law and its application to infinitely long straight wire. Straight and toroidal solenoid (qualitative treatment only); Force on a moving charge in uniform magnetic and electric fields. Force on a current carrying conductor in a uniform magnetic field, force between two parallel current carrying conductors- definition of ampere, torque experienced by a current loop in uniform magnetic field, moving coil galvanometer- its current sensitivity and conversion to ammeter and voltmeter. 2. Magnetism and matter: Current loop as a magnetic dipole and its magnetic dipole moment, magnetic dipole moment of a revolving electron, magnetic field lines, earth's magnetic field and magnetic elements. Para-, dia- and ferro- magnetic substances with examples.

Unit-IV

Electromagnetic induction and Alternating current: Electromagnetic induction: Faraday' laws of electromagnetic induction, motional EMF and current induced due to it, Lenz's law, Eddy currents, self and mutual induction. 2. Alternating Current: Page 5 of 8 Alternating currents, peak and RMS value of alternating current / voltage, reactance and impedance, LC oscillation (qualitative idea only), LCR series circuit (qualitative idea using impedance triangle), resonance, power in AC circuits, wattles current, Transformer (Principle of working & efficiency).

Unit-V

Electromagnetic waves: Electromagnetic spectrum (radio waves, microwaves, infrared, visible, Ultra violet, X-ray and gamma rays), including elementary ideas about their uses.

Unit-VI

Optics Ray optics and optical instruments: Refraction of light, refractive index, its relation with velocity of light (formula only) total internal reflection and its applications, Refraction at spherical surfaces, thin lens formula, lens makers formula, magnification, power of lenses, combination of two thin lenses in contact, combination of a lens and a mirror, refraction and dispersion of light through prism. Optical instruments: microscopes and telescopes (reflecting) and their magnifying powers. 2. Waves Optics: Wave front, Huygen's principle, Interference, Young's double slit experiment and expression for fringe width, coherent sources, sustained interference of light, diffraction due to a single slit, width of a central maximum, polarization, plane polarized light, Brewster's law.

Unit-VII

Dual nature of Radiation and matter: Dual nature of radiation, Photoelectric effect, Einstein's photoelectric equation, particle nature of light. Matter waves- wave nature of particles, de-Broglie relation.

Unit-VIII

Atoms and Nuclei Atoms: Alpha- particle scattering experiment, Rutherford's model of atom, its limitations, Bohr model, energy levels, hydrogen spectrum. 2. Nuclei: Atomic nucleus, its composition, size, nuclear mass, nature of nuclear force, mass defect, binding energy per nucleon and its variation with mass number, nuclear fission, fusion, Radioactivity, alpha, beta and gamma particles/ rays and their properties, radioactive decay law, half life and decay constant.

Unit-IX

Semiconductor electronics Energy bands in conductors, semiconductors and insulators (qualitative idea only), p-type, n-type semiconductors, semiconductor diode, V-I characteristics in forward and reverse bias, diode as a half and full wave rectifier (centre tap), efficiency (no derivation). Junction transistor, transistor action, Characteristics of transistor, transistor as an amplifier (CE configuration), basic idea of analog and digital signals, Logic gates (OR, AND, NOT, NAND, and NOR).

Unit-X

Communication System: Propagation of electromagnetic waves in the atmosphere, sky and space wave propagation, satellite communication, Need for-modulation, qualitative idea about amplitude modulation and frequency modulation, advantages of frequency modulation over amplitude modulation,

C. CHEMISTRY

Unit I: Solid State Classification of solids based on different binding forces: molecular, ionic, covalent and metallic solids, amorphous and crystalline solids (elementary idea). Unit cell in two dimensional and three dimensional lattices, calculation of density of unit cell, packing in solids, packing efficiency, voids, number of atoms per unit cell in a cubic unit cell, point defects.

Unit II: Solutions Types of solutions, solubility of gases in liquids, solid solutions, colligative properties, relative lowering of vapour pressure, Raoult's law, elevation of boiling point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, Abnormal colligative properties (Preliminary idea only).

Unit III: Electrochemistry Electrolytes and non-electrolyte conductor, conductance in electrolytic solutions, specific and molar conductivity, variation of conductivity with concentration, Kohlrausch's law, electrolysis and laws of electrolysis (elementary idea), dry cell electrolytic cells and Galvanic cells, EMF of a cell, standard electrode potential, Nernst equation and its application to chemical cells, Relation between Gibbs energy change and emf of a cell.

Unit IV: Chemical Kinetics Rate of a reaction (Average and instantaneous), factors affecting rate of reaction: concentration, temperature, catalyst, order and molecularity of a reaction, rate law and specific rate constant, integrated rate equations and half life (only for zero and first order reactions), concept of collision theory (elementary idea, no mathematical treatment), Activation energy, Arrhenius equation.

Unit V: Surface Chemistry Adsorption - physisorption and chemisorption, factors affecting adsorption of gases on solids, catalysts, colloidal state distinction between true solutions, colloids and suspension; lyophilic, lyophobic, multimolecular and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation, emulsion - types of emulsions.

Unit VI: General Principles and Processes of Isolation of Elements Principles and methods of extraction - concentration, oxidation, reduction - electrolytic method and refining.

Unit VII: P- Block Elements Group15 Elements: General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; nitrogen preparation properties & uses; compounds of nitrogen, preparation and properties of ammonia, oxides of nitrogen (Structure only); Phosphorus – allotropic forms. Group 16 Elements: General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties, dioxygen: Preparation, Properties and uses, classification of oxides, Ozone, Sulphur allotropic forms; compounds of sulphur: Preparation properties and uses of sulphur dioxide, sulphuric acid, properties and uses; oxoacids of sulphur (Structures only). Group 17 Elements: General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; compounds of halogens, Preparation properties and uses of chlorine and hydrochloric acid, interhalogen compounds, oxoacids of halogens (structure only). Group 18 Elements: General introduction, electronic configuration, occurrence, trends in physical and chemical properties, uses.

Unit VIII: d and f Block Elements General introduction, electronic configuration, occurrence and characteristics of transition metals, general trends in properties of the first row transition metals - metallic character, ionization enthalpy, oxidation states, ionic radii, colour, catalytic property, magnetic properties, interstitial compounds, alloy formation.

Unit IX: Coordination Compounds - Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds. Bonding, Werner's theory, VBT and CFT.

Haloalkanes: Nomenclature, nature of C-X bond, preparation from alcohols, halogenations of alkanes, alkenes, Sandmeyer's reaction, halogen exchange reaction, physical properties and chemical properties, nucleophilic substitution reactions (unimolecular and bimolecular), stereochemical effect of substitution reaction, elimination reaction, Electrophilic substitution reactions (halogenations, nitration, sulphonation), Friedel-Crafts reaction, reaction with metals (Wurtz Fittig and Fittig reaction), optical

rotation. Haloarenes: Nature of C - X bond, substitution reactions (Directive influence of halogen in monosubstituted compounds only.

Unit XI: Alcohols, Phenols and Ethers Alcohols: Nomenclature, methods of preparation, from alkenes, carbonyl compounds, Grignard reagent, physical properties and chemical properties (of primary alcohols only),esterification, reaction with (hydrogen halide, phosphorus trihalide Oxidation (identification of primary, secondary and tertiary alcohols mechanism of dehydration). Phenols: Nomenclature, methods of preparation from haloarenes, benzene sulphonic acid, diazonium salt, cumene, physical properties and chemical properties, acidic nature of phenol, esterification, Electrophilic aromatic substitution (halogenations, nitration) ReimerTiemann reaction, reaction with Zn dust, oxidation. Eithers :Nomenclature, methods of preparation dehydration of alcohols, Williamson synthesis, physical properties and chemical properties, formation of alcohols, Electrophilic substitution (halogenations, nitration, Friedel-Craft reaction.

Unit XII : Aldehydes, Ketones and Carboxylic Acids Aldehydes and Ketones : Nomenclature nature of carbonyl group methods of preparation, from alcohols (oxidation and dehydrogenation), ozonolysis of alkenes, hydration of alkynes, preparation of ketones from acyl chlorides and nitriles, preparation of acetone by FriedelCraft acylation reaction, physical properties and chemical properties, nucleophillic addition reaction with hydrogen cyanide, sodiumhydrogen sulphite, reaction with NH3 and NH2-G compounds (Hydrazine, hydroxyl amine, semicarbazide, phenyl hydrazine, 2,4-dinitro phenylhydrazine), alcohol, Grignard reagent, Clemmensen reaction, Wolff-Kishner reduction, Fehling's Test, Tollen's Test, haloform reaction, Aldol condensation, Cannizzaro's reaction, special reaction of (formaldehyde with ammonia and acetone with concentrated sulphuric acid), Electrophilic substitution reactions of aromatic aldehydes and ketones. Carboxylic Acids : Nomenclature, acidic nature, methods of preparation, from primary alcohols, aldehydes, anhydrides, esters, nitriles and Grignard reagent, preparation of benzoic acid from toluene and benzanilide, physical properties, chemical properties, reaction with (metals, alkalies, PCl3, PCl5, SOCl2, NH3), formation of anhydride, esterification, reduction, decarboxylation, Hell-Volhard-Zelinsky reaction. Substitution reaction of benzoic acid (nitration, bromination) uses.

Unit XIII : Organic compunds containing Nitrogen Amines : Nomenclature classification, structure, methods of preparation, reduction of (nitrocompounds, nitriles, amides) amonolysis of alkyl halides, Hoffmann bromamide degradation, Gabriel phthalamide synthesis. Physical properties and chemical proporties, basic character of amines, alkylation, acylation, carbylamines reaction, identification of primary, secondary and teritary amines (reaction with nitrous acid and arylsulphonyl chloride). Electrophilic substitution reactions of aniline (nitration, sulphonation, bromination). Cyanide and Isocyanides-will be mentioned at relevant places in context.

Unit XIV: Polymers Classification-Natural and synthetic methods of polymerization(addition and condensation)co polymerization, some important polymers, natural and synthetic like polythene, nylon, polyester, bakelite, rubber, Biodegradable and non-biodegradable polymers.

Unit XV : Chemistry in Everyday life Chemical in Medicines- Angesics, traqulizers antiseptics, disinfectants, antimicrobials, antifungal, drugs, antibiotics, antacids, antihistamines. Cleansing agents – Soap & detergents, cleansing action.