

16) Candidates have to produce Original documents and other particulars on the day of verification date itself for verification or as and when required and called for. If candidate fails to produce the certificates at the time of verification, and the particulars furnished in the Application form do not tally with the Original documents produced by the candidate, the candidature will be rejected/disqualified without any further correspondence. As candidature for the recruitment is processed through Computer/Electronic devices based on the particulars furnished in the Application Form, the candidate is advised to fill in all the relevant particulars carefully.

17) **Selection Procedure/Scheme:** The Selection Procedure/Scheme of the Exam will be as follows:

A) Written Examination:

Candidates will be required to appear for a written examination for 120 marks. The Questions will be objective in nature and it is for two hours duration. The Question Paper will be in English language only for the post code nos. 11, 12 and 13. The syllabus is given in **Annexure-I**. The tentative date of written examination is **06-12-2020 from 11 AM to 1 PM.**

Post code	Subject	No. of questions	Max. Marks
11	Scientific Assistant (Physical)	120	120
12	Scientific Assistant (Chemical)	120	120
13	Scientific Assistant (Biology/Serology)	120	120

Note: Candidates will have to answer the questions on OMR answer sheet using **Blue / Black Ball Point pen** only. For this purpose the pens shall be provided at the examination centers / Halls. Candidates must note that the time of examination, following articles are prohibited to be brought in to exam centers / hall:-

- (1) Mobile
- (2) Calculator
- (3) Watches
- (4) Rings / Jewellery
- (5) Electronic gadgets
- (6) Water bottles
- (7) Books / News Papers / Note books / Bags etc.
- (8) Any article / object which may be prescribed as prohibited by examination Authority/SLPRB.
- (9) In addition to above, Covid-19 measures will be adopted to conduct the written examination and candidates shall comply with the preventive measures as per direction of examination Authority/SLPRB.

The minimum marks to be secured by the candidates in order to qualify in the Written examination is 40% for OCs; 35% for BCs; and 30% for SCs/STs/Ex-Servicemen.

Note: Mere securing of minimum qualifying marks does not confer any right to the candidate for being considered to the selection.

ANNEXURE - I

SYLLABUS FOR WRITTEN EXAMINATION

For post code no. 11 (Physical):-

Mechanics

Vector Analysis

Scalar and vector fields, gradient of a scalar field and its physical significance. Divergence and curl of a vector field with derivations and physical interpretation. Vector integration (line, surface and volume), Statement and proof of Gauss and Stokes theorems.

Mechanics of particles

Laws of motion, motion of variable mass system, Equation of motion of a rocket. Conservation of energy and momentum, Collisions in two and three dimensions, Concept of impact parameter, scattering cross-section, Rutherford scattering.

Mechanics of Rigid bodies

Definition of rigid body, rotational kinematic relations, equation of motion for a rotating body, angular momentum, Euler equations and its applications, precession of a top and Gyroscope

Central forces

Central forces, definition and examples, conservative nature of central forces, conservative force as a negative gradient of potential energy, equation of motion under a central force. Derivation of Kepler's laws.

Special theory of relativity

Galilean relativity, absolute frames. Michelson-Morley experiment, Postulates of special theory of relativity. Lorentz transformation, time dilation, length contraction, addition of velocities, mass-energy relation. Concept of four-vector formalism.

Waves & Oscillations

Simple Harmonic oscillations

Simple harmonic oscillator and solution of the differential equation-Physical characteristics of SHM, torsion pendulum-measurements of rigidity modulus, compound pendulum-measurement of 'g', Principle of superposition, combination of two mutually perpendicular simple harmonic vibrations of same frequency and different frequencies. Lissajous figures.

Damped and forced oscillations

Damped harmonic oscillator, solution of the differential equation of damped oscillator. Energy considerations, comparison with un-damped harmonic oscillator, logarithmic decrement, relaxation time, quality factor, differential equation of forced oscillator and its solution, amplitude resonance and velocity resonance.

Vibrating strings

Transverse wave propagation along a stretched string, general solution of wave equation and its significance, modes of vibration of stretched string clamped at ends, overtones and harmonics. Energy transport and transverse impedance.

Vibrations of bars

Longitudinal vibrations in bars-wave equation and its general solution. Special cases (i) bar fixed at both ends (ii) bar fixed at the midpoint (iii) bar fixed at one end. Tuning fork.

Wave Optics

Aberrations

Introduction - monochromatic aberrations, spherical aberration, methods of minimizing spherical aberration, coma, astigmatism and curvature of field, distortion. Chromatic aberration-the achromatic doublet. Achromatism for two lenses (i) in contact and (ii) separated by a distance.

Interference

Principle of superposition - coherence-temporal coherence and spatial coherence-conditions for interference of light. Fresnel's biprism-determination of wavelength of light -change of phase on reflection. Oblique incidence of a plane wave on a thin film due to reflected and transmitted lights (cosine law) -colors of thin films- Interference by a film with two non-parallel reflecting surfaces (Wedge shaped film). Determination of diameter of wire, Newton's rings in reflected light. Michelson interferometer, Determination of wavelength of monochromatic light using Newton's rings and Michelson Interferometer.

Diffraction

Introduction, Distinction between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction -Diffraction due to single slit - Fraunhofer diffraction due to double slit-Fraunhofer diffraction pattern with N slits (diffraction grating). Resolving power of grating, Determination of wavelength of light in normal incidence position using diffraction grating, Fresnel's half period zones - area of the half period zones - zone plate -comparison of zone plate with convex lens, differences between interference and diffraction.

Polarization

Polarized light: methods of polarization, polarization by reflection, refraction, double refraction, scattering of light-Brewster's law-Mauls law-Nicol prism polarizer and analyzer-Quarter wave plate, Half wave plate-optical activity, determination of specific rotation by Laurent's half shade polarimeter-Babinet's compensator - Linear, elliptical and circular polarization.

Fiber Optics

Introduction- different types of fibers, rays and modes in an optical fiber, fiber material, principles of fiber communication (qualitative treatment only), advantages of fiber optic communication.

Thermodynamics

Kinetic theory of gases

Introduction -Deduction of Maxwell's law of distribution of molecular speeds. Transport phenomena -Viscosity of gases-thermal conductivity-diffusion of gases.

Thermodynamics

Introduction- Second law of thermodynamics, Kelvin's and Clausius statements-Entropy, physical significance -Change in entropy in reversible and irreversible processes-Entropy and disorder-Entropy of Universe-Temperature-Entropy (T-S) diagram- Change of entropy of a perfect gas- change of entropy when ice changes into steam.

Thermodynamic potentials and Maxwell's equations

Thermodynamic potentials-Derivation of Maxwell's thermodynamic relations-Clausius-Clapeyron's equation- Derivation for ratio of specific heats-Derivation for difference of two specific heats for perfect gas. Joule Kelvin effect-expression for Joule Kelvin coefficient for perfect and van der Waal's gases.

Low temperature Physics

Joule Kelvin effect-Porous plug experiment - Joule expansion-Distinction between adiabatic and Joule Thomson expansion-Expression for Joule Thomson cooling-Liquefaction of helium, Kapitza's method- Adiabatic demagnetization, Production of low temperatures. Quantum theory of radiation

Blackbody-Ferry's black body-distribution of energy in the spectrum of black body-Wein's displacement law, Wein's law, Rayleigh-Jean's law-Quantum theory of radiation-Planck's law-Measurement of radiation-Types of pyrometers-Disappearing filament optical pyrometer-experimental determination - Angstrom pyrheliometer determination of solar constant, Temperature of Sun.

Electromagnetism & Modern Physics

Electric field intensity and potential

Gauss's law statement and its proof- Electric field intensity due to (1) Uniformly charged sphere and (2) an infinite conducting sheet of charge. Electrical potential - equipotential surfaces- potential due to i) a point charge, ii) charged spherical shell and uniformly charged sphere.

Electric and magnetic fields

Biot-Savart's law, explanation and calculation of B due to long straight wire, a circular current loop and solenoid - Lorentz force.

Electromagnetic Induction and Electromagnetic waves

Faraday's law - Lenz's law- Self and mutual inductance, displacement current - Maxwell's equations - Maxwell's plane wave equation, Transverse nature of electromagnetic waves.

Atomic Physics

Drawbacks/limitations of Bohr's atomic model- Sommerfeld's Modification of Bohr's Theory, Sommerfeld's elliptical orbits-relativistic correction.

Wave particle duality and concept of Matter waves, de Broglie's hypothesis - wavelength of matter waves, Davisson and Germer experiment. Heisenberg's uncertainty principle - Complementarity principle of Bohr, X-rays and Lasers Theory.

Nuclear Physics

Basic ideas of nucleus - size, mass, binding energy. Liquid drop model and Shell model (qualitative aspects only) - Magic numbers.

Radioactive decay, Alpha decay, β -decay, Energy kinematics for β -decay, neutrino hypothesis.

For post code no. 12 (Chemical):-

ORGANIC CHEMISTRY

Acyclic Hydrocarbons

Alkanes: preparation: Corey-House reaction, Wurtz reaction, Kolbe synthesis. Chemical reactivity - Halogenation.

Alkenes- Preparation of alkenes (a) by dehydration of alcohols (b) dehydrohalogenation of alkyl halides (c) by dehalogenation of 1,2 dihalides, Zaitsev's rule. Properties: Addition of HX, Markonikov's rule, addition of H₂O, HOX, H₂SO₄ with mechanism and addition of HBr in the presence of peroxide Oxidation (cis - additions) - hydroxylation by KMnO₄, OsO₄, trans addition- peracids, ozonolysis -location of double bond.

Alkynes- Preparation by dehydrohalogenation of vicinal dihalides, dehalogenation of tetrahalides. Physical Properties: Acidity of terminal alkynes. Chemical reactivity - electrophilic addition of X₂, HX, H₂O. Oxidation and reduction Alicyclic Hydrocarbons Nomenclature, preparation by Freund's method, Dickmann, heating dicarboxylic metal salts. Stability of cycloalkanes - Baeyer strain theory. Conformational structures of cyclohexane.

Aromatic Hydrocarbons

Aromaticity -definition, Huckel's rule - application Reactions - General mechanism of electrophilic substitution, mechanism of nitration, sulphonation, and halogenation, Friedel Craft's alkylation (polyalkylation) and acylation. Orientation of aromatic substitution.

Arenes

Preparation of alkyl benzenes by Friedel Craft's alkylation, Friedel Craft's acylation followed by reduction, Wurtz-Fittig reaction. Chemical reactivity: Ring substitution reactions, side chain substitution reactions and oxidation.

Halogen compounds

Nomenclature and classification. Chemical reactivity - reduction, formation of RMgX, Nucleophilic substitution reactions - classification into SN1 and SN2. Mechanism and energy profile diagrams of SN1 and SN2 reactions. Stereochemistry of SN2 (Walden Inversion) 2-bromobutane, SN1 (Racemisation) 1-bromo-1-phenylpropane explanation of both by taking the example of optically active alkyl halide

Alcohols

Preparation of alcohols using Grignard reagent, Ester hydrolysis, Reduction of Carbonyl compounds, carboxylic acids and esters. Physical properties: H-bonding, Boiling point and Solubility. Reactions with Sodium, HX/ZnCl₂ (Lucas reagent), esterification, oxidation with PCC, alk. KMnO₄, acidic dichromates.

Phenols:

Preparation: (i) from diazonium salts of anilines, (ii) from benzene sulphonic acids and (iii) Cumene hydroperoxide method. Properties: Acidic nature, formation of phenoxide and reaction with R-X, electrophilic substitution nitration, halogenation and sulphonation. Reimer Tiemann reaction, Gattermann-Koch reaction, Azo-coupling reaction, Schotten-Boumann reaction.

Ethers and epoxides

Nomenclature, preparation by (a) Williamson's synthesis. Physical properties, Chemical properties -action of conc. H₂SO₄ and HI

Carbonyl compounds

Nomenclature and isomerism. Preparation of aldehydes & ketones from acid chloride, nitriles, oxidation of arenes. Physical properties - absence of Hydrogen bonding. Keto-enol

tautomerism, polarisability of carbonyl groups, reactivity of the carbonyl groups in aldehydes and ketones. Chemical reactivity: Addition of [a] NaHSO_3 (b) HCN (c) RMgX (d) NH_3 (e) RNH_2 (f) NH_2OH (g) PhNHNH_2 (h) 2,4-DNP (Schiff bases). Addition of H_2O to form hydrate addition of alcohols. Base catalysed reactions - Aldol, Cannizzaro reaction, Perkin reaction, Benzoin condensation, haloform reaction, Knoevenagel condensation. Oxidation reactions - KMnO_4 oxidation, reduction - catalytic hydrogenation, Clemmenson's reduction, Wolf-kishner reduction, reduction with LAH, NaBH_4 . Analysis - 2,4 -DNP test, Tollen's test, Fehlings test, Schiff's test, haloform test.

Carboxylic acids

Nomenclature, classification. Preparation a) Hydrolysis of Nitriles, b) Carbonation of Grignard reagent. Oxidation of Arenes. Kolbe reaction. Physical properties- hydrogen bonding, dimeric association, acidity - strength of acids. Chemical properties - Reactions involving H, OH and COOH groups - salt formation, anhydride formation, Acid halide formation, Esterification & Amide formation. Reduction of acid to the corresponding primary alcohol - via ester or acid chloride. Degradation of carboxylic acids by Huns Diecker reaction, Schmidt reaction. Arndt - Eistert synthesis, Halogenation by Hell-Volhard - Zelensky reaction. Carboxylic acid Derivatives - Reactions of acid halides, Acid anhydrides, acid amides and esters

Nitrogen compounds

Nomenclature and classification of nitro hydrocarbons. Preparation, reactivity, Nef reaction, Mannich reaction, Michael addition, Reduction reaction of Nitrobenzenes in different media.

Amines: Nomenclature, classification. Preparation : Gabriel synthesis, Hoffman's bromamide reaction. Physical properties- basic character. Chemical Properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation, reaction with Nitrous acid. Aromatic amines - Bromination, diazotisation. Synthetic utility of diazonium salts.

Cyanides and isocyanides: Nomenclature and structure. Preparation of cyanides from a) Alkyl halides b) from amides c) from aldoximes. Preparation of isocyanides from Alkyl halides and Amines. 2. Properties of cyanides and isocyanides, a) hydrolysis b) addition of Grignard reagent iii) reduction.

Biomolecules

Carbohydrates : classification, monosaccharide, structures of pentose and hexose's. anomeric carbon, mutarotation, simple chemical reactions of glucose, disaccharides : reducing and non reducing sugars-sucrose, maltose and lactose, polysaccharides : elementary idea of structures of starch and cellulose;

Proteins : amino acids, peptide bond, polypeptides, proteins, structure of proteins - primary, secondary, tertiary structure and quaternary structures (qualitative idea only), denaturation of proteins; enzymes. Hormones - Elementary idea excluding structure.

Vitamins - Classification and functions.

Nucleic Acids: DNA and RNA.

Polymers: Classification of polymers, General method of polymerization addition and condensation, free radical, cationic and anionic polymerization, copolymerization, natural rubber, vulcanization of rubber, synthetic rubbers.

Basics of drugs and formulation analysis : Weights, balances, importance of analysis, quality control and quality assurance, analytical methods (classification, validation parameters), requirements - chemicals (types, purification, checking purity), glass wares (types, calibration, cleaning), sampling techniques, sampling error minimization. Units of concentrations. Errors science, errors minimization.

INORGANIC CHEMISTRY

Chemical bonding

Molecular orbital theory: Shapes and sign convention of atomic orbitals. Modes of overlapping. Concept of σ and π bonds. LCAO concept. Types of molecular orbitals- bonding, antibonding and non bonding. MOED of homo nuclear diatomics - H_2 , N_2 , O_2 , O_2^{2-} , O_2^{2-} , F_2 (unhybridized diagrams only) and hetero nuclear diatomics CO , CN , NO , NO^+ and HF . Bond order, stability and magnetic properties

s-block elements

General Characteristics of groups I and II elements, Diagonal relationship between Li and Mg, Be and Al.

p-block elements

Group-13: Synthesis and structure of diborane, Boron nitrogen compounds ($B_3N_3H_6$ and BN),
Group 14: Carbides-Classification - ionic, covalent, interstitial - synthesis. Industrial application. Silicones - Preparation - a) direct silicon process b) use of Grignard reagent
Classification - straight chain, cyclic and cross-linked.

Group-15: Synthesis of ammonia. Oxy acids of nitrogen and phosphorous

Group 16: Manufacture of H_2SO_4 , oxy acids of sulphur.

Group 17: Inter halogens-classification- general preparation- structures of AB , AB_3 , AB_5 and AB_7 type and reactivity. Comparison of Pseudo halogens with halogens. Chemistry of Zero group elements

General preparation, structure, bonding and reactivity of Xenon compounds - Oxides, Halides and Oxy-halides.

Chemistry of d-block elements

Characteristics of d-block elements with special reference to electronic configuration variable valence, ability to form complexes, magnetic properties & catalytic properties. Stability of various oxidation states and comparative treatment of second and third transition series with their 3d analogues.

Chemistry of Lanthanides:

Electronic structure, oxidation state, ionic and atomic radii- lanthanide contraction- cause and consequences, -complex formation. Magnetic properties-. Colour and spectra, Chemistry of actinides- electronic configuration, oxidation state, actinide contraction, colour and complex formation. Comparison with lanthanides

Theories of bonding in metals

Valence bond theory, Explanation of metallic properties and its limitations, Free electron theory, Band theory, formation of bands, explanation of conductors, semiconductors n-type and p-type, extrinsic & intrinsic semiconductors, and insulators

Coordination Compounds-

Coordination complexes. IUPAC Nomenclature Werner's theory, Sidgwick's EAN rule and limitations. Valence bond theory (VBT) - postulates and application to (a) tetrahedral complexes $[Ni(NH_3)_4]^{2+}$, $[NiCl_4]^{2-}$ and $[Ni(CO)_4]$ (b) octahedral complexes $[Fe(CN)_6]^{4-}$, $[Fe(CN)_6]^{3-}$, $[FeF_6]^{4-}$, $[Co(NH_3)_6]^{3+}$, $[CoF_6]^{3-}$. Limitations of VBT, Isomerism in coordination compounds, stereo isomerism -(a) geometrical isomerism in (i) square planar metal complexes of the type $[MA_2B_2]$, $[MA_2BC]$, $[M(AB)_2]$, $[MABCD]$. (ii) Octahedral metal complexes of the type $[MA_4B_2]$, $[M(AA)_2B_2]$, $[MA_3B_3]$ using suitable examples, (b) Optical isomerism in (i). tetrahedral complexes $[MABCD]$, (ii). Octahedral complexes $[M(AA)_2B_2]$, $[M(AA)_3]$ using suitable examples. Structural isomerism: ionization, linkage, coordination ligand isomerism using suitable examples.

Cements

Introduction, Classification of cement and properties, chemical composition of cement, Standards, Manufacturing of Portland cement, chemical constituents of Portland cement, Setting and hardening of cement, PCC & RCC.

PHYSICAL CHEMISTRY

Atomic structure and elementary quantum mechanics

Planck's radiation law, De Broglie's hypothesis. Heisenberg's uncertainty principle, Schrodinger's wave equation and its importance. Physical interpretation of the wave function, significance of Ψ and Ψ^2 . Schrodinger wave equation for H-atom. (no derivation)

Gaseous State

Deviation of real gases from ideal behavior. van der Waals equation of state. The van der Waal's equation and critical state. Relationship between critical constants and van der Waal's constants. The law of corresponding states, reduced equation of states. Joule Thomson effect and inversion temperature of a gas. Liquifaction of gases: i) Linde's method based on Joule Thomson effect ii) Claude's method based on adiabatic expansion of a gas

Dilute Solutions & Colligative Properties

Dilute Solutions, Colligative Properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis-determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point. Derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, Van't hoff factor, degree of dissociation and assocoation of solutes.

Solid state Chemistry

Symmetry elements in crystals , Law of rationality of indices. Definition of space lattice, unit cell. Bravais Lattices and Seven Crystal systems (a brief review). X-ray diffraction by crystals; Bragg's equation. Miller indices.

Symmetry of molecules

Symmetry operations and symmetry elements in molecules. Definition of Axis of symmetry types of C_n , Plane of symmetry (σ_h , σ_v , σ_d) Center of symmetry and improper rotational axis of symmetry (S_n).

Phase Rule

Meaning of the terms - Phase, Component and degrees of freedom, Gibb's Phase rule, phase equilibria of one component system - water system.

Colloids& surface chemistry

Definition of colloids. Classification of colloids. Solids in liquids (sols): preparations, Protective action. Hardy-Schultz law, Gold number. Liquids in liquids(emulsions): Types of emulsions, preparation and emusifier. Liquids in solids(gels); Classification, preparations and properties, General applications of colloids. Adsorption: Types of adsorption, Factors influencing adsorption. Freundlich adsorption isotherm. Langmuir theory of unilayer adsorption isotherm. Applications

Chemical Equilibrium:

Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of mass action, equilibrium constant, factors affecting equilibrium- Le Chatelier's principle, ionic equilibrium- ionization of acids and bases, strong and weak electrolytes, degree of ionization, ionization of poly basic acids, acid strength, concept of pH, Henderson

Equation, hydrolysis of salts (elementary idea), buffer solution, solubility product, common ion effect (with illustrative examples)

Electrochemistry & EMF

Electrical transport - conduction in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of specific and equivalent conductance with dilution. Migration of ions and Kohlrausch's law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, determination by Hittorf's method. Applications of conductivity measurements: Determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations. Nernst equation, cell EMF and single electrode potential, standard Hydrogen electrode - reference electrodes (calomel electrode) - standard electrode potential, sign conventions, electrochemical series and its significance. Applications of EMF measurements, Determination of pH quinhydrone electrode, Solubility product of AgCl. Potentiometric titrations.

Chemical Kinetics

Introduction, rate of reaction, variation of concentration with time, rate laws and rate constant. Specific reaction rate. Factors influencing reaction rates: effect of concentration of reactants, effect of temperature, effect of pressure, effect of catalyst with simple examples, order of reaction. First order reaction, derivation of equation for rate constant. Characteristics of first order reaction. Units for rate constant. Half-life period, graph of 1st order reaction, examples. Decomposition of H_2O_2 . Pseudo first order reaction, Hydrolysis of methyl acetate, Second order reaction, derivation of expression for 2nd order rate constant, examples-Saponification of ester, $2O_3 \rightarrow 3O_2$, $C_2H_4 + H_2 \rightarrow C_2H_6$. units for rate constants, half-life period and second order plots.

Thermodynamics

A brief review of -Energy, work and heat units, definition of system, surroundings. I law of thermodynamics statement, extensive properties and intensive properties, state function, path functions Work of expansion and heat absorbed as path function. Expression for work of expansion, Heat changes at constant pressure and heat changes at constant volume. Enthalpy. Heat capacities at constant pressure and constant volume. Derivation $C_p - C_v = R$. Isothermal adiabatic processes. Reversible and irreversible processes. Reversible change and maximum work. Derivation of expression for maximum work for isothermal reversible process. Internal energy of an ideal gas. Joules experiment and Joule-Thompson coefficient. Adiabatic changes in ideal gas P-V curves for isothermal and adiabatic processes. Kirchhoff's equation and problems. Limitations of I law and need for II law. Statement of II law of thermodynamics. Cyclic process. Heat engine, Carnot's theorem, Carnot's cycle.

Entropy: Definition from Carnot's cycle. Entropy as a state function. Entropy as a measure of disorder. Sign of entropy change for spontaneous and non-spontaneous processes & equilibrium processes. Entropy changes in i). Reversible isothermal process, ii). reversible adiabatic process, iii). phase change, iv). reversible change of state of an ideal gas. Entropy of mixing, inert perfect gases. Free energy Gibb's function (G) and Helmholtz's function (A) as thermodynamic quantities. Concept of maximum work and net work ΔG as criteria for spontaneity.

Analytical Chemistry:

Analytical Techniques: Introduction Types of analysis - Physical, Chemical and instrumentation. Physical analysis - Specific gravity, Melting point, Boiling point, Crystallization. Purification of compounds etc. Chemical analysis - Quantitative and Qualitative analysis of organic and inorganic compounds. Instrumental analysis - Spectroscopic, Chromatographic PH measurement, Conductivity, Turbidity etc

Volumetric analysis (Titrimetric analysis) :

Acid-base titrations: Relative strength and its effect on titration, common ion effect, pH, Henderson-Hasselbach equation, buffers, neutralization curve, acid bas indicators, theory of indicators, back titrations, biphasic titrations, pharmacopoeial applications, hydrolysis of salts, ionic products of water and law of mass action; Redox titrations : Theory of redox titrations, redox indicators, types of redox titrations, iodometry, cerrimetry, mercury metry, diazotization nitrite titrations, 2,6-dichlorophenol indophenol titrations, titration curve and calculations of potentials during course of titrations.; Argentometric or precipitation titrations : Mohrs, Fajans and Volhard methods; Nonaqueous titrations : Nonaqueous solvents, titrants and indicators. Differentiating and leveling solvents.; Complexometric titrations : Theory of the titrations, titrant, indicators and pharmacopoeial applications.; Miscellaneous titrations : Karl-Fischer titrations, Kjeldahl method.

Gravimetric analysis: Stability, solubility products, types of precipitations, precipitation techniques, pharmacopoeial applications

For post code no. 13 (Biology/Serology):-

Cell Biology

Ultrastructure of prokaryotic and eukaryotic cell, Structure and functions of cell organelles.

Cell division - Mitosis and Meiosis. Chromosomes - Structure, Karyotype.

Genetics

Mendelian principles, Gene Interaction, Linkage and Crossing over, Multiple alleles (Human blood groups), Sex determination, Sex linked inheritance, Mutations - Genetic and chromosomal (Structural and numerical); Chromosomal aberrations in humans. Recombination in prokaryotes - transformation, conjugation, transduction, sexduction. Extra genomic inheritance. DNA finger printing

Molecular Biology and Genetic Engineering

Structure of eukaryotic gene, Structure of DNA and RNA, DNA replication in prokaryotes and eukaryotes, Transcription and translation in prokaryotes and eukaryotes, Genetic code. Regulation of gene expression in prokaryotes, Principles of recombinant DNA technology. DNA vectors, Transgenesis. Applications of genetic engineering.

Bio molecules

Structure and functions of Carbohydrates, proteins and amino acids, lipids, vitamins and porphyrins. Enzymes - classification and mode of action, enzyme assay, enzyme units, enzyme inhibition, enzyme kinetics, Factors regulating enzyme action.

Techniques

Microscopy - Light and Electron, Centrifugation, Chromatography, Electrophoresis, Calorimetric and Spectrophotometric techniques for the quantification of DNA, RNA, and protein, Blotting techniques, PCR.

Microbiology

Introduction to microbiology, Sterilization techniques, Different methods for isolation of microorganisms.

Outlines of Structure, Nutrition and Reproduction of Eukaryotic microbes (Algae, Fungi, Mycoplasma) Prokaryotes (Bacteria, Cyanobacteria). Virus: Viral diseases - common cold, Typhoid, Cholera, Ring worm, Candidiasis.

Biotechnology

Plant and animal cell culture, cloning, Fermentors types and process, Biopesticides, Biofertilizers, Bioremediation, Renewable and non - renewable energy resources, Non-conventional fuels.

Nutrition

Biological values of carbohydrates, proteins and fats. Carbohydrate and protein malnutrition, disorders, Chemistry and physiological role of vitamins and minerals in living systems.

Metabolism

Metabolism of carbohydrates, lipids, proteins, amino acids and nucleic acids. Biological oxidation and bioenergetics.

Immunology

Types of immunity, cells and organs of immune system, Antigen - antibody reaction.

Immunotechniques, Hypersensitivity, Hepatitis B, AIDS. Vaccines.

Plant Science

Structure of root, stem and leaf of a flowering plant. Plant physiology Water relations, Mineral nutrition, Photosynthesis, Phytohormones.

Animal Science

Biology of Non chordates and chordates, Embryology of chordates, Parasites of human importance - Entamoeba histolytica, Plasmodium vivax, Taenia solium, Ascaris lumbricoides, Wuchereria bancrofti.

Physiology

Structure and functions of liver, lungs (exchange and transport of respiratory gases), heart and kidney. Composition of blood, blood coagulation, Biochemical tests for the identification of blood, Digestion and absorption, Endocrinology, Muscle - structure and contraction and Nervous system..

Environment and wild life

Ecological pyramids, Biogeochemical cycles - Nitrogen, Carbon and Phosphorus. Ecological adaptations - pelagic, volant, fossorial, cursorial, desert, parasitic. Climatic and edaphic and biotic factors. Ecological succession - Hydrosere and xerosere, Natural resources, Biodiversity, current environmental issues, Environmental pollution - air, water, soil, sound pollution, Global warming, depletion of ozone and climate change. Importance of wild life species in ecosystem, Endangered and rare species, Wild life Management, Different methods of killing and poaching of the wild life animals.

Evolution

Theories and evidences of organic evolution, Hardy - Weinberg law. Sympatric and allopatric speciation. Evolution of man.
