

NEET SYLLABUS

Physics, Chemistry, and Biology (Higher Secondary Stage)

For National Eligibility-cum-Entrance Test NEET (UG)-2021, the National Medical Commission of India (NMC) recommends the following syllabus for admission to MBBS/BDS/BAMS/BSMS/BUMS/BHMS courses across the country, after review of various State syllabi as well as those prepared by CBSE, NCERT, and COBSE. This is to establish uniformity across the country, keeping in view the relevance of different areas in medical education.

Physics syllabus of class 11th		Physics syllabus of Class 12th	
Sr. No.	Topics	Sr. No.	Topics
1	Physical-world and measurement	1	Electrostatics
2	Kinematics	2	Current Electricity
3	Laws of Motion	3	Magnetic Effects of Current and Magnetism
4	Work, Energy and Power	4	Electromagnetic Induction and Alternating Currents
5	Motion of System of Particles and Rigid Body	5	Electromagnetic Waves
6	Gravitation	6	Optics
7	Properties of Bulk Matter	7	Dual Nature of Matter and Radiation
8	Thermodynamics	8	Atoms and Nuclei
9	Behaviour of Perfect Gas and Kinetic Theory	9	Electronic Devices
10	Oscillations and Waves		
Chemistry syllabus of class 11th		Chemistry syllabus of class 12th	
Sr. No	Topics	Sr. No.	Topics
1	Some Basic Concepts of Chemistry	1	Solid State
2	Structure of Atom	2	Solutions
3	Classification of Elements and Periodicity in Properties	3	Electrochemistry
4	Chemical Bonding and Molecular Structure	4	Chemical Kinetics
5	States of Matter: Gases and Liquids	5	Surface Chemistry
6	Thermodynamics	6	General Principles and Processes of Isolation of Elements
7	Equilibrium	7	<i>p</i> -Block Elements
8	Redox Reactions	8	<i>d</i> and <i>f</i> Block Elements
9	Hydrogen	9	Coordination Compounds
10	s-Block Element (Alkali and Alkaline earth metals)	10	Haloalkanes and Haloarenes
11	Some p-Block Elements	11	Alcohols, Phenols and Ethers
12	Organic Chemistry- Some Basic Principles and Techniques	12	Aldehydes, Ketones and Carboxylic Acids

13	Hydrocarbons	13	Organic Compounds Containing Nitrogen
14	Environmental Chemistry	14	Biomolecules
		15	Polymers
		16	Chemistry in Everyday Life

Biology syllabus of class 11th		Biology syllabus of class 12th	
Sr. No.	Topics	Sr. No	Topics
1	Diversity in Living World	1	Reproduction
2	Structural Organisation in Animals and Plants	2	Genetics and Evolution
3	Cell Structure and Function	3	Biology and Human Welfare
4	Plant Physiology	4	Biotechnology and Its Applications
5	Human physiology	5	Ecology and environment

PHYSICS: CONTENTS OF CLASS XI SYLLABUS

UNIT I: Physical World and Measurement

- **Physics:** Scope and excitement; nature of physical laws; Physics, technology, and society.
- **Need for measurement:** Units of measurement; systems of units; SI units, fundamental and derived units. Length, mass, and time measurements; accuracy and precision of measuring instruments; errors in measurement; significant figures.
- Dimensions of physical quantities, dimensional analysis, and its applications.

UNIT II: Kinematics

- A 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, and position-time graphs, for uniformly accelerated motion (graphical treatment).
- Elementary concepts of differentiation and integration for describing motion. *Scalar and vector quantities*. Position and displacement vectors, general vectors, general vectors and notation, equality of vectors, multiplication of vectors by a real number; addition and subtraction of vectors. Relative velocity.
- Unit vectors. Resolution of a vector in a plane-rectangular component.
- Scalar and Vector products of Vectors. Motion in a plane. Cases of uniform velocity and uniform acceleration- projectile motion. Uniform circular motion.

UNIT III: Laws of Motion

- Intuitive concept of force. Inertia, Newton's first law of motion; momentum and Newton's second law of motion; impulse; 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, lubrication.

- *Dynamics of uniform circular motion.* Centripetal force, examples of circular motion (vehicle on level circular road, vehicle on banked road).

UNIT IV: Work, Energy, and Power

- Work done by a constant force and variable force; kinetic energy, work-energy theorem, power.
- Notion of potential energy, the potential energy of a spring, conservative forces; conservation of mechanical energy (kinetic and potential energies); nonconservative forces; motion in a vertical circle, elastic and inelastic collisions in one and two dimensions.

UNIT V: Motion of System of Particles and Rigid Body

- Centre of mass of a two-particle system, momentum conservation, and centre of mass motion. Centre of mass of a rigid body; centre of mass of uniform rod.
- Moment of a force, -torque, angular momentum, conservation of angular momentum with some examples.
- Equilibrium of rigid bodies, rigid body rotation, and equation of rotational motion, comparison of linear and rotational motions; the moment of inertia, the radius of gyration. Values of M.I. for simple geometrical objects (no derivation). Statement of parallel and perpendicular axes theorems and their applications.

UNIT VI: Gravitation

- Kepler's laws of planetary motion. The universal law of gravitation. Acceleration due to gravity and its variation with altitude and depth.
- Gravitational potential energy; gravitational potential. Escape velocity, orbital velocity of a satellite. Geostationary satellites.

UNIT VII: Properties of Bulk Matter

- Elastic behavior, Stress-strain relationship. Hooke's law, Young's modulus, bulk modulus, shear modulus of rigidity, poisson's ratio; elastic energy.
- Viscosity, Stokes' law, terminal velocity, Reynold's number, streamline and turbulent flow. Critical velocity, Bernoulli's theorem and its applications.
- Surface energy and surface tension, angle of contact, excess of pressure, application of surface tension ideas to drops, bubbles and capillary rise.
- Heat, temperature, thermal expansion; thermal expansion of solids, liquids, and gases. Anomalous expansion. Specific heat capacity: C_p , C_v - calorimetry; change of state – latent heat.
- Heat transfer- conduction and thermal conductivity, convection and radiation. Qualitative ideas of Black Body Radiation, Wein's displacement law, and Green House effect.
- Newton's law of cooling and Stefan's law.

UNIT VIII: Thermodynamics

- Thermal equilibrium and definition of temperature (zeroth law of Thermodynamics). Heat, work and internal energy. First law of thermodynamics. Isothermal and adiabatic processes.
- *Second law of the thermodynamics*: Reversible and irreversible processes. Heat engines and refrigerators.

UNIT IX: Behaviour of Perfect Gas and Kinetic Theory

- Equation of state of a perfect gas, work done on compressing a gas.
- *Kinetic theory of gases*: Assumptions, concept of pressure. Kinetic energy and temperature; degrees of freedom, law of equipartition of energy (statement only) and application to specific heat capacities of gases; concept of mean free path.

UNIT X: Oscillations and Waves

- Periodic motion-period, frequency, displacement as a function of time. Periodic functions. Simple harmonic motion(SHM) and its equation; phase; oscillations of a spring-restoring force and force constant; energy in SHM –Kinetic and potential energies; simple pendulum-derivation of expression for its time period; free, forced and damped oscillations (qualitative ideas only), resonance.
- Wave motion. Longitudinal and transverse waves, speed of wave motion. Displacement relation for a progressive wave. Principle of superposition of waves, reflection of waves, standing waves in strings and organ pipes, fundamental mode and harmonics. Beats. Doppler effect.

PHYSICS: CONTENTS OF CLASS XII SYLLABUS

UNIT I: Electrostatics

- Electric charges and their conservation. Coulomb's law-force 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, statement of Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell (field inside and outside)
- Electric potential, potential difference, electric potential due to a point charge, a dipole and system of charges: equipotential surfaces, electrical potential energy of a system of two point charges and of electric dipoles in an electrostatic field.
- Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarization, capacitors and capacitance, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor with and without dielectric medium between the plates, energy stored in a capacitor, Van de Graaff generator.

UNIT II: Current Electricity

- Electric current, the flow of electric charges in a metallic conductor, drift velocity and mobility, and their relation with electric current; Ohm's law, electrical resistance, $V-I$ characteristics (linear and non-linear), electrical energy and power, electrical resistivity, and conductivity.
- Carbon resistors, color code for carbon resistors; series and parallel combinations of resistors; temperature dependence of resistance.
- Internal resistance of a cell, potential difference and emf of a cell, combination of cells in series and in parallel.
- Kirchhoff's laws and simple applications. Wheatstone bridge, metre bridge.
- Potentiometer-principle and applications to measure potential difference, and for comparing emf of two cells; measurement of internal resistance of a cell.

UNIT III: Magnetic Effects of Current and Magnetism

- Concept of magnetic field, Oersted's experiment. Biot-Savart law and its application to current carrying circular loop.
- Ampere's law and its applications to infinitely long straight wire, straight and toroidal solenoids. Force on a moving charge in uniform magnetic and electric fields. Cyclotron.
- 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 a 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. Magnetic dipole moment of a revolving electron. Magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to its axis. Torque on a magnetic dipole (bar magnet) in a uniform magnetic field; bar magnet as an equivalent solenoid, magnetic field lines; Earth's magnetic field and magnetic elements.
- Para-, dia-and ferro-magnetic substances, with examples.
- Electromagnetic and factors affecting their strengths. Permanent magnets.

UNIT IV: 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; LC oscillations (qualitative treatment only), LCR series circuit, resonance; power in AC circuits, wattless current.
- AC generator and transformer.

UNIT V: Electromagnetic Waves

- Need for displacement current.
- Electromagnetic waves and their characteristics (qualitative ideas only). Transverse nature of electromagnetic waves.

- Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, x-rays, gamma rays) including elementary facts about their uses.

UNIT VI: Optics

- Reflection of light, spherical mirrors, mirror formula. Refraction of light, total internal reflection and its applications optical fibres, refraction at spherical surfaces, lenses, thin lens formula, lens-maker's formula. Magnification, power of a lens, combination of thin lenses in contact combination of a lens and a mirror. Refraction and dispersion of light through a prism.
- Scattering of light- blue colour of the sky and reddish appearance of the sun at sunrise and sunset.
- *Optical instruments*: Human eye, image formation and accommodation, correction of eye defects (myopia and hypermetropia) using lenses.
- Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers.
- *Wave optics*: Wavefront and Huygens' principle, reflection and refraction of plane wave at a plane surface using wavefronts.
- Proof of laws of reflection and refraction using Huygens' principle.
- Interference, Young's double hole 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. Polarisation, plane polarized light; Brewster's law, uses of plane polarized light and Polaroids.

UNIT VII: Dual Nature of Matter and Radiation

- Photoelectric effect, Hertz and Lenard's observations; Einstein's photoelectric equation- particle nature of light.
- Matter waves- wave nature of particles, de Broglie relation. Davisson-Germer experiment (experimental details should be omitted; only conclusion should be explained).

UNIT VIII: Atoms and Nuclei

- Alpha- particle scattering experiments; 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 decay law. Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number, nuclear fission and fusion.

UNIT IX: Electronic Devices

- Energy bands in solids (qualitative ideas only), conductors, insulators and semiconductors; semiconductor diode- I - V characteristics in forward and reverse bias, diode as a rectifier; I - V characteristics of LED, diode, 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.

CHEMISTRY: CONTENTS OF CLASS XI SYLLABUS

UNIT I: Some Basic Concepts of Chemistry

- *General Introduction*: Important and scope of chemistry.
- Laws of chemical combination, *Dalton's atomic theory*: concept of elements, atoms and molecules.
- Atomic and molecular masses. Mole concept and molar mass; percentage composition and empirical and molecular formula; chemical reactions, stoichiometry and calculations based on stoichiometry.

UNIT II: Structure of Atom

- Atomic number, isotopes and isobars. Concept of shells and subshells, dual nature of matter and light, de Broglie's relationship, Heisenberg uncertainty principle, concept of orbital, quantum numbers, shapes of s, p and d orbitals, rules for filling electrons in orbitals- Aufbau principle, Pauli exclusion principles and Hund's rule, electronic configuration of atoms, stability of half-filled and completely filled orbitals.

UNIT III: Classification of Elements and Periodicity in Properties

- Modern periodic law and long form of periodic table, periodic trends in properties of elements- atomic radii, ionic radii, ionization enthalpy, electron gain enthalpy, electronegativity, valence.

UNIT IV: Chemical Bonding and Molecular Structure

- Valence electrons, ionic bond, covalent bond, bond parameters, Lewis structure, polar character of covalent bond, valence bond theory, resonance, geometry of molecules, VSEPR theory, concept of hybridization involving s, p and d orbitals and shapes of some simple molecules, molecular orbital theory of homonuclear diatomic molecules (qualitative idea only). Hydrogen bond.

UNIT V: States of Matter: Gases and Liquids

- Three states of matter, intermolecular interactions, types of bonding, melting and boiling points, role of gas laws of elucidating the concept of the molecule, Boyle's law, Charles's law, Gay Lussac's law, Avogadro's law, ideal behaviour of gases, empirical derivation of gas equation. Avogadro number, ideal gas equation. Kinetic energy and molecular speeds (elementary idea), deviation from ideal behaviour, liquefaction of gases, critical temperature.
- Liquid State- Vapour pressure, viscosity and surface tension (qualitative idea only, no mathematical derivations).

UNIT VI: Thermodynamics

- First law of thermodynamics-internal energy and enthalpy, heat capacity and specific heat, measurement of U and H, Hess's law of constant heat summation, enthalpy of : bond dissociation, combustion, formation, atomization, sublimation, phase transition, ionization, solution and dilution.
- Introduction of entropy as state function, Second law of thermodynamics, Gibbs energy change for spontaneous and non-spontaneous process, criteria for equilibrium and spontaneity.
- Third law of thermodynamics- Brief introduction.

UNIT VII: Equilibrium

- Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of chemical equilibrium, 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 polybasic acids, acid strength, concept of pH., Hydrolysis of salts (elementary idea), buffer solutions, Henderson equation, solubility product, common ion effect (with illustrative examples).

UNIT VIII: Redox Reactions

- Concept of oxidation and reduction, redox reactions oxidation number, balancing redox reactions in terms of loss and gain of electron and change in oxidation numbers.

UNIT IX: Hydrogen

- Occurrence, isotopes, preparation, properties and uses of hydrogen; hydrides ionic, covalent and interstitial; physical and chemical properties of water, heavy water; hydrogen peroxide-preparation, reactions, uses and structure;

UNIT X: s-Block Elements (Alkali and Alkaline earth metals)

- *Group 1 and group 2 elements:*
- General introduction, electronic configuration, occurrence, anomalous properties of the first element of each group, diagonal relationship, trends in the variation of properties (such as ionization enthalpy, atomic and ionic radii), trends in chemical reactivity with oxygen, water, hydrogen and halogens; uses.
- Preparation and Properties of Some important Compounds:
- Sodium carbonate, sodium chloride, sodium hydroxide and sodium hydrogencarbonate, biological importance of sodium and potassium.
- Industrial use of lime and limestone, biological importance of Mg and Ca.

UNIT XI: Some p-Block Elements

- General Introduction to p-Block Elements.
- *Group 13 elements:* General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous properties of first element of the group; Boron, some important compounds: borax, boric acids, boron hydrides. Aluminium: uses, reactions with acids and alkalis.
- *General 14 elements:* General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous behaviour of first element. Carbon, allotropic forms, physical and chemical properties: uses of some important compounds: oxides.
- Important compounds of silicon and a few uses: silicon tetrachloride, silicones, silicates and zeolites, their uses.

UNIT XII: Organic Chemistry- Some Basic Principles and Techniques

- General introduction, methods of purification qualitative and quantitative analysis, classification and IUPAC nomenclature of organic compounds.
- Electronic displacements in a covalent bond: inductive effect, electromeric effect, resonance and hyper conjugation.

- Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbanions; electrophiles and nucleophiles, types of organic reactions.

UNIT XIII: Hydrocarbons

- *Alkanes*- Nomenclature, isomerism, conformations (ethane only), physical properties, chemical reactions including free radical mechanism of halogenation, combustion and pyrolysis.
- *Alkenes*-Nomenclature, structure of double bond (ethene), geometrical isomerism, physical properties, methods of preparation: chemical reactions: addition of hydrogen, halogen, water, hydrogen halides (Markovnikov's addition and peroxide effect), ozonolysis, oxidation, mechanism of electrophilic addition.
- *Alkynes*-Nomenclature, structure of triple bond (ethyne), physical properties, methods of preparation, chemical reactions: acidic character of alkynes, addition reaction of- hydrogen, halogens, hydrogen halides and water.
- *Aromatic hydrocarbons*- Introduction, IUPAC nomenclature; Benzene; resonance, aromaticity; chemical properties: mechanism of electrophilic substitution-Nitration sulphonation, halogenation, Friedel Craft's alkylation and acylation; directive influence of functional group in mono-substituted benzene; carcinogenicity and toxicity.

UNIT XIV: Environmental Chemistry

- *Environmental pollution*: Air, water and soil pollution, chemical reactions in atmosphere, smogs, major atmospheric pollutants; acid rain ozone and its reactions, effects of depletion of ozone layer, greenhouse effect and global warming-pollution due to industrial wastes; green chemistry as an alternative tool for reducing pollution, strategy for control of environmental pollution.

CHEMISTRY: CONTENTS OF CLASS XII SYLLABUS

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, electrical and magnetic properties, Band theory of metals, conductors, semiconductors and insulators.

UNIT II: Solutions

- Types of solutions, expression of concentration of solutions of solids in liquids, 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 molecular mass. Van Hoff factor.

UNIT III: Electrochemistry

- Redox reactions, 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; lead accumulator, EMF of a cell, standard electrode potential, Relation between Gibbs energy change and EMF of a cell, fuel cells; corrosion.

UNIT IV: Chemical Kinetics

- Rate of a reaction (average and instantaneous), factors affecting rates 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, catalysis homogeneous and heterogeneous, activity and selectivity: enzyme catalysis; colloidal state: distinction between true solutions, colloids and suspensions; lyophilic, lyophobic multimolecular and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation; emulsions- 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; occurrence and principles of extraction of aluminium, copper, zinc and iron.

UNIT VII: *p*- Block Elements

- *Group 15 elements*: General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; preparation and properties of ammonia and nitric acid, oxides of nitrogen (structure only); Phosphorous- allotropic forms; compounds of phosphorous: preparation and properties of phosphine, halides (PCl₃, PCl₅) and oxoacids (elementary idea only).
- *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, preparation, properties and uses of sulphur dioxide; sulphuric acid: industrial process of manufacture, 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 (structures 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, 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. Preparation and properties of K₂Cr₂O₇ and KMnO₄.
- *Lanthanoids*- electronic configuration, oxidation states, chemical reactivity, and lanthanoid contraction and its consequences.
- *Actinoids*: Electronic configuration, oxidation states and comparison with lanthanoids.

UNIT IX: Coordination Compounds

- *Coordination compounds*: Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds, isomerism (structural and stereo) bonding, Werner's theory VBT,CFT; importance of coordination compounds (in qualitative analysis, biological systems).

UNIT X: Haloalkanes and Haloarenes

- *Haloalkanes*: Nomenclature, nature of C –X bond, physical and chemical properties, mechanism of substitution reactions. Optical rotation.
- *Haloarenes*: Nature of C-X bond, substitution reactions (directive influence of halogen for monosubstituted compounds only).
- Uses and environment effects of – dichloromethane, trichloromethane, tetrachloromethane, iodoform, freons, DDT.

UNIT XI: Alcohols, Phenols and Ethers

- *Alcohols*: Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only); identification of primary, secondary and tertiary alcohols; mechanism of dehydration, uses with special reference to methanol and ethanol.
- *Phenols*: Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophilic substitution reactions, uses of phenols.
- *Ethers*: Nomenclature, methods of preparation, physical and chemical properties uses.

UNIT XII: Aldehydes, Ketones and Carboxylic Acids

- *Aldehydes and Ketones*: Nomenclature, nature of carbonyl group, methods of preparation, physical and chemical properties; and mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes; uses.
- *Carboxylic Acids*: Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses.

UNIT XIII: Organic Compounds Containing Nitrogen

- *Amines*: Nomenclature, classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary secondary and tertiary amines.
- *Cyanides and Isocyanides*- will be mentioned at relevant places.
- *Diazonium salts*: Preparation, chemical reactions and importance in synthetic organic chemistry.

UNIT XIV: Biomolecules

- *Carbohydrates*- Classification (aldoses and ketoses), monosaccharide (glucose and fructose), D.L. configuration, oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen): importance.
- *Proteins*- Elementary idea of – amino acids, peptide bond, polypeptides, proteins, primary structure, secondary structure, tertiary structure and quaternary structure (qualitative idea only), denaturation of proteins; enzymes.

- **Hormones- Elementary idea (excluding structure).**
- *Vitamins*- Classification and function.
- *Nucleic Acids*: DNA and RNA

UNIT XV: Polymers

- *Classification*- Natural and synthetic, methods of polymerization (addition and condensation), copolymerization. Some important polymers: natural and synthetic like polyesters, bakelite; rubber, Biodegradable and non-biodegradable polymers.

UNIT XVI: Chemistry in Everyday Life

- Chemicals in medicines- analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.
- Chemicals in food- preservatives, artificial sweetening agents, **elementary idea of antioxidants.**
- Cleansing agents- soaps and detergents, cleansing action.

BIOLOGY: CONTENTS OF CLASS XI SYLLABUS

UNIT I: Diversity in Living World

- What is living? ; Biodiversity; Need for classification; Three domains of life; Taxonomy & Systematics; Concept of species and taxonomical hierarchy; Binomial nomenclature; Tools for study of Taxonomy – Museums, Zoos, Herbaria, Botanical gardens.
- Five kingdom classification; salient features and classification of Monera; Protista and Fungi into major groups; Lichens; Viruses and Viroids.
- Salient features and classification of plants into major groups-Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms (three to five salient and distinguishing features and at least two examples of each category); Angiosperms classification up to class, characteristic features and examples).
- Salient features and classification of animals-nonchordate up to phyla level and chordate up to classes level (three to five salient features and at least two examples).

UNIT II: Structural Organisation in Animals and Plants

- Morphology and modifications; Tissues; Anatomy and functions of different parts of flowering plants: Root, stem, leaf, inflorescence- cymose and racemose, flower, fruit and seed (To be dealt along with the relevant practical of the Practical Syllabus).
- Animal tissues; Morphology, anatomy and functions of different systems (digestive, circulatory, respiratory, nervous and reproductive) of an insect (cockroach). (Brief account only)

UNIT III: Cell Structure and Function

- Cell theory and cell as the basic unit of life; Structure of prokaryotic and eukaryotic cell; Plant cell and animal cell; Cell envelope, cell membrane, cell wall; Cell organelles-structure and function; Endomembrane system-endoplasmic reticulum, Golgi bodies, lysosomes, vacuoles; mitochondria, ribosomes, plastids, micro bodies; Cytoskeleton, cilia, flagella, centrioles (ultra structure and function); Nucleus-nuclear membrane, chromatin, nucleolus.

- Chemical constituents of living cells: Biomolecules-structure and function of proteins, carbohydrates, lipids, nucleic acids; Enzymes-types, properties, enzyme action.
- B Cell division: Cell cycle, mitosis, meiosis and their significance.

UNIT IV: Plant Physiology

- Transport in plants: Movement of water, gases and nutrients; Cell to cell transport-Diffusion, facilitated diffusion, active transport; Plant – water relations – Imbibition, water potential, osmosis, plasmolysis; Long distance transport of water – Absorption, apoplast, symplast, transpiration pull, root pressure and guttation; Transpiration-Opening and closing of stomata; Uptake and translocation of mineral nutrients-Transport of food, phloem transport, Mass flow hypothesis; Diffusion of gases (brief mention).
- Mineral nutrition: Essential minerals, macro and micronutrients and their role; Deficiency symptoms; Mineral toxicity; Elementary idea of Hydroponics as a method to study mineral nutrition; Nitrogen metabolism-Nitrogen cycle, biological nitrogen fixation.
- Photosynthesis: Photosynthesis as a means of Autotrophic nutrition; Site of photosynthesis take place; pigments involved in Photosynthesis (Elementary idea); Photochemical and biosynthetic phases of photosynthesis; Cyclic and non cyclic and photophosphorylation; Chemiosmotic hypothesis; Photorespiration C3 and C4 pathways; Factors affecting photosynthesis.
- Respiration: Exchange gases; Cellular respiration-glycolysis, fermentation (anaerobic), TCA cycle and electron transport system (aerobic); Energy relations- Number of ATP molecules generated; Amphibolic pathways; Respiratory quotient.
- Plant growth and development: Seed germination; Phases of Plant growth and plant growth rate; Conditions of growth; Differentiation, dedifferentiation and redifferentiation; Sequence of developmental process in a plant cell; Growth regulators-auxin, gibberellin, cytokinin, ethylene, ABA; Seed dormancy; Vernalisation; Photoperiodism.

UNIT V: Human Physiology

- Digestion and absorption; Alimentary canal and digestive glands; Role of digestive enzymes and gastrointestinal hormones; Peristalsis, digestion, absorption and assimilation of proteins, carbohydrates and fats; Caloric value of proteins, carbohydrates and fats; Egestion; Nutritional and digestive disorders – PEM, indigestion, constipation, vomiting, jaundice, diarrhea.
- Breathing and Respiration: Respiratory organs in animals (recall only); Respiratory system in humans; Mechanism of breathing and its regulation in humans-Exchange of gases, transport of gases and regulation of respiration Respiratory volumes; Disorders related to respiration-Asthma, Emphysema, Occupational respiratory disorders.
- Body fluids and circulation: Composition of blood, blood groups, coagulation of blood; Composition of lymph and its function; Human circulatory system-Structure of human heart and blood vessels; Cardiac cycle, cardiac output, ECG, Double circulation; Regulation of cardiac activity; Disorders of circulatory system-Hypertension, Coronary artery disease, Angina pectoris, Heart failure.
- Excretory products and their elimination: Modes of excretion- Ammonotelism, ureotelism, uricotelism; Human excretory system-structure and fuction; Urine formation, Osmoregulation; Regulation of kidney function-Renin-angiotensin, Atrial Natriuretic Factor, ADH and Diabetes insipidus; Role of other organs in excretion; Disorders; Uraemia, Renal failure, Renal calculi, Nephritis; Dialysis and artificial kidney.

- Locomotion and Movement: Types of movement- ciliary, flagellar, muscular; Skeletal muscle-contractile proteins and muscle contraction; Skeletal system and its functions (To be dealt with the relevant practical of Practical syllabus); Joints; Disorders of muscular and skeletal system-Myasthenia gravis, Tetany, Muscular dystrophy, Arthritis, Osteoporosis, Gout.
- Neural control and coordination: Neuron and nerves; Nervous system in humans-central nervous system, peripheral nervous system and visceral nervous system; Generation and conduction of nerve impulse; Reflex action; Sense organs; Elementary structure and function of eye and ear.
- Chemical coordination and regulation: Endocrine glands and hormones; Human endocrine system- Hypothalamus, Pituitary, Pineal, Thyroid, Parathyroid, Adrenal, Pancreas, Gonads; Mechanism of hormone action (Elementary Idea); Role of hormones as messengers and regulators, Hypo- and hyperactivity and related disorders (Common disorders e.g. Dwarfism, Acromegaly, Cretinism, goiter, exophthalmic goiter, diabetes, Addison's disease).

(Imp: Diseases and disorders mentioned above to be dealt in brief.)

BIOLOGY: CONTENTS OF CLASS XII SYLLABUS

UNIT I: Reproduction

- Reproduction in organisms: Reproduction, a characteristic feature of all organisms for continuation of species; Modes of reproduction – Asexual and sexual; Asexual reproduction; Modes-Binary fission, sporulation, budding, gemmule, fragmentation; vegetative propagation in plants.
- Sexual reproduction in flowering plants: Flower structure; Development of male and female gametophytes; Pollination-types, agencies and examples; Outbreeding devices; Pollen-Pistil interaction; Double fertilization; Post fertilization events- Development of endosperm and embryo, Development of seed and formation of fruit; Special modes-apomixis, parthenocarpy, polyembryony; Significance of seed and fruit formation.
- Human Reproduction: Male and female reproductive systems; Microscopic anatomy of testis and ovary; Gametogenesis-spermatogenesis & oogenesis; Menstrual cycle; Fertilisation, embryo development upto blastocyst formation, implantation; Pregnancy and placenta formation (Elementary idea); Parturition (Elementary idea); Lactation (Elementary idea).
- Reproductive health: Need for reproductive health and prevention of sexually transmitted diseases (STD); Birth control-Need and Methods, Contraception and Medical Termination of Pregnancy (MTP); Amniocentesis; Infertility and assisted reproductive technologies – IVF, ZIFT, GIFT (Elementary idea for general awareness).

UNIT II: Genetics and Evolution

- Heredity and variation: Mendelian Inheritance; Deviations from Mendelism- Incomplete dominance, Co-dominance, Multiple alleles and Inheritance of blood groups, Pleiotropy; Elementary idea of polygenic inheritance; Chromosome theory of inheritance; Chromosomes and genes; Sex determination-In humans, birds, honey bee; Linkage and crossing over; Sex linked inheritance- Haemophilia, Colour blindness; Mendelian disorders in humans-Thalassemia; Chromosomal disorders in humans; Down's syndrome, Turner's and Klinefelter's syndromes.
- Molecular basis of Inheritance: Search for genetic material and DNA as genetic material; Structure of DNA and RNA; DNA packaging; DNA replication; Central dogma; Transcription, genetic code, translation; Gene expression and regulation- Lac Operon; Genome and human genome project; DNA finger printing.

- Evolution: Origin of life; Biological evolution and evidences for biological evolution from Paleontology, comparative anatomy, embryology and molecular evidence); Darwin's contribution, Modern Synthetic theory of Evolution; Mechanism of evolution-Variation (Mutation and Recombination) and Natural Selection with examples, types of natural selection; Gene flow and genetic drift; Hardy-Weinberg's principle; Adaptive Radiation; Human evolution.

UNIT III: Biology and Human Welfare

- Health and Disease; Pathogens; parasites causing human diseases (Malaria, Filariasis, Ascariasis, Typhoid, Pneumonia, common cold, amoebiasis, ring worm); Basic concepts of immunology-vaccines; Cancer, HIV and AIDS; Adolescence, drug and alcohol abuse.
- Improvement in food production; Plant breeding, tissue culture, single cell protein, Biofortification; Apiculture and Animal husbandry.
- Microbes in human welfare: In household food processing, industrial production, sewage treatment, energy generation and as biocontrol agents and biofertilizers.

UNIT IV: Biotechnology and Its Applications

- Principles and process of Biotechnology: Genetic engineering (Recombinant DNA technology).
- Application of Biotechnology in health and agriculture: Human insulin and vaccine production, gene therapy; Genetically modified organisms-Bt crops; Transgenic Animals; Biosafety issues-Biopiracy and patents.

UNIT V: Ecology and environment

- Organisms and environment: Habitat and niche; Population and ecological adaptations; Population interactions-mutualism, competition, predation, parasitism; Population attributes-growth, birth rate and death rate, age distribution.
- Ecosystem: Patterns, components; productivity and decomposition; Energy flow; Pyramids of number, biomass, energy; Nutrient cycling (carbon and phosphorous); Ecological succession; Ecological Services-Carbon fixation, pollination, oxygen release.
- Biodiversity and its conservation: Concept of Biodiversity; Patterns of Biodiversity; Importance of Biodiversity; Loss of Biodiversity; Biodiversity conservation; Hotspots, endangered organisms, extinction, Red Data Book, biosphere reserves, National parks and sanctuaries.
- Environmental issues: Air pollution and its control; Water pollution and its control; Agrochemicals and their effects; Solid waste management; Radioactive waste management; Greenhouse effect and global warming; Ozone depletion; Deforestation; Any three case studies as success stories addressing environmental issues.

SYLLABUS for JEE (Main)

Syllabus for Paper-1 (B.E./B.Tech.)- Mathematics, Physics and Chemistry

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; S_n , S_{n^2} , S_{n^3} . 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

$$\int \frac{dx}{x^2+a^2}, \quad \int \frac{dx}{\sqrt{x^2 \pm a^2}}, \quad \int \frac{dx}{a^2-x^2},$$
$$\int \frac{dx}{\sqrt{a^2-x^2}}, \quad \int \frac{dx}{ax^2+bx+c}, \quad \int \frac{dx}{\sqrt{ax^2+bx+c}},$$
$$\int \frac{(px+q)dx}{ax^2+bx+c},$$
$$\int \frac{(px+q)dx}{\sqrt{ax^2+bx+c}}, \quad \int \sqrt{a^2 \pm x^2} dx,$$
$$\int \sqrt{x^2 - a^2} dx$$

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: DIFFERENTIAL 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

$$\frac{dy}{dx} + p(x)y = q(x)$$

UNIT 11: CO-ORDINATE GEOMETRY

Cartesian system of rectangular co-ordinates 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 from a line, equations of internal and external bisectors of angles between two lines co-

ordinate 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, direction 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 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, 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.

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.

Section- A

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 constant force and a variable force; kinetic and potential energies, work-energy theorem, power.

The potential energy of spring conservation of mechanical energy, conservative and non-conservative forces; Elastic and inelastic collisions in one and two dimensions.

UNIT 5: 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. Kirchoff'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: wavefront 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. Davisson-Germer 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).

SECTION-B

UNIT 21: EXPERIMENTAL SKILLS

Familiarity with the basic approach and observations of the experiments and activities:

1. Vernier callipers-its use to measure the internal and external diameter and depth of a vessel.
2. Screw gauge-its use to determine thickness/ diameter of thin sheet/wire.
3. Simple Pendulum-dissipation of energy by plotting a graph between the square of amplitude and time.
4. Metre Scale - the mass of a given object by principle of moments.
5. Young's modulus of elasticity of the material of a metallic wire.
6. Surface tension of water by capillary rise and effect of detergents,
7. Co-efficient of Viscosity of a given viscous liquid by measuring terminal velocity of a given spherical body,
8. Plotting a cooling curve for the relationship between the temperature of a hot body and time.
9. Speed of sound in air at room temperature using a resonance tube,
10. Specific heat capacity of a given (i) solid and (ii) liquid by method of mixtures.
11. The resistivity of the material of a given wire using metre bridge.

12. The resistance of a given wire using Ohm's law.
13. Potentiometer-
 - i. Comparison of emf of two primary cells.
 - ii. Determination of internal resistance of a cell.
14. Resistance and figure of merit of a galvanometer by half deflection method.
15. The focal length of;
 - (i) Convex mirror
 - (ii) Concave mirror, and
 - (ii) Convex lens, using the parallax method.
16. The plot of the angle of deviation vs angle of incidence for a triangular prism.
17. Refractive index of a glass slab using a travelling microscope.
18. Characteristic curves of a p-n junction diode in forward and reverse bias.
19. Characteristic curves of a Zener diode and finding reverse break down voltage.
20. Characteristic curves of a transistor and finding current gain and voltage gain.
21. Identification of Diode, LED, Transistor, IC, Resistor, A capacitor from a mixed collection of such items.
22. Using a multimeter to:
 - (i) Identify the base of a transistor
 - (ii) Distinguish between NPN and PNP type transistor
 - (iii) See the unidirectional of current in case of a diode and an LED.
 - (iv) Check the correctness or otherwise of a given electronic component (diode, transistor or IC).

CHEMISTRY

SECTION – A

PHYSICAL CHEMISTRY

UNIT 1: 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, Charles'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 Ψ^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 (K_p and K_c) 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.

SECTION-B

INORGANIC CHEMISTRY

UNIT 11: CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES

Modern 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; Allotropic forms of phosphorus; Preparation, properties, structure and uses of ammonia, nitric acid, phosphine and phosphorus halides, (PCl_3 , PCl_5); 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 $\text{K}_2\text{Cr}_2\text{O}_7$, and KMnO_4 .

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.

SECTION-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 reactions- Substitution, 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, NH_3 , 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, tranquilizers, 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 $KMnO_4$, Mohr's salt vs $KMnO_4$
- Chemical principles involved in the qualitative salt analysts:

Cations – Pb^{2+} , Cu^{2+} , Al^{3+} , Fe^{3+} , Zn^{2+} , Ni^{2+} , Ca^{2+} , Ba^{2+} , Mg^{2+} , NH_4^+

Anions- CO_3^{2-} , S^{2-} , SO_4^{2-} , NO_3^- , NO_2^- , Cl^- , Br^- , I^- (Insoluble salts excluded).

Chemical principles involved in the following experiments:

1. Enthalpy of solution of CuSO_4
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.

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SYLLABUS FOR JEE (Main)-2021

Syllabus for Paper-2A (B.Arch)

Part –I 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, triangle inequality, Quadratic equations in real and complex number system and their solutions Relations between roots and co-efficient, 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; S_n , S_{n^2} , S_{n^3} . 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

$$\int \frac{dx}{x^2+a^2}, \int \frac{dx}{\sqrt{x^2 \pm a^2}}, \int \frac{dx}{a^2-x^2}, \int \frac{dx}{\sqrt{a^2-x^2}}, \\ \int \frac{dx}{ax^2+bx+c}, \int \frac{dx}{\sqrt{ax^2+bx+c}}, \int \frac{(px+q)dx}{ax^2+bx+c}, \\ \int \frac{(px+q)dx}{\sqrt{ax^2+bx+c}}, \int \sqrt{a^2 \pm x^2} dx, \\ \int \sqrt{x^2 - a^2} dx$$

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: DIFFERENTIAL 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

$$\frac{dy}{dx} + p(x)y = q(x)$$

UNIT 11: CO-ORDINATE GEOMETRY

Cartesian system of rectangular co-ordinates in a plane, distance formula, sections formula, locus and its equation, translation of axis, slope of a line, parallel and perpendicular lines, intercept of a line on the co-ordinate axes.

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 from a line, equations of internal and external bisectors of angles between two lines co-ordinate 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, direction 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 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, 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.

Part –II APTITUDE

UNIT - 1 Awareness of persons. Buildings, Materials.

Objects, Texture related to Architecture and Build-environment Visualising three dimensional objects from two-dimensional drawings. Visualising. Different sides of three-dimensional objects. Analytical Reasoning Mental Ability (Visual. Numerical and Verbal)

UNIT – 2 Three dimensional- perception: Understanding and appreciation of scale and proportions of objects, building forms and elements, colour texture harmony and contrast Design and drawing of geometrical or abstract shapes and patterns in pencil. Transformation of forms both 2D and 3D union, subtraction rotation, development of surfaces and volumes, Generation of Plan, elevations and 3D views of objects, Creating two dimensional and three-dimensional compositions using given shapes and forms.

Part – III DRAWING

Sketching of scenes and activities from memory of urbanscape (public space, market, festivals, street scenes, monuments, recreational spaces etc). landscape (riverfronts. Jungles. Gardens, trees. Plants etc.) and rural life.

To be conducted in a Drawing sheet.

Note: Candidates are advised to bring pencils. Own geometry box set, crasets and colour pencils and crayons for the Drawing Test.

Syllabus for Paper-2B (B.Planning)

Part – I MATHEMATICS

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Part – III PLANNING

UNIT-1 GENERAL AWARENESS

General knowledge questions and knowledge about prominent cities, development issues, government programmes etc.

UNIT-2 SOCIAL SCIENCES

The idea of nationalism, nationalism in India, pre-modern world, 19th-century global economy, colonialism and colonial cities, industrialisation, resources and development, types of resources, agriculture, water, mineral resources, industries, national economy; Human Settlements

Power-sharing, federalism, political parties, democracy, the constitution of India

Economic development- economic sectors, globalisation, the concept of development, poverty; Population structure, social exclusion and inequality, urbanisation, rural development, colonial cities,

UNIT-3 THINKING SKILLS

Comprehension (unseen passage); map reading skills, scale, distance, direction, area etc.; critical reasoning; understanding of charts, graphs and tables; basic concepts of statistics and quantitative reasoning.

NOTE:-

*The NTA has decided to provide choices in one section (**Section B**) to cater to the decision of different Boards across the country regarding the reduction of the syllabus. However, the total number of questions to be attempted will remain the same (Physics – 25, Chemistry – 25 and Mathematics – 25), wherever applicable.*