

KLUEEE SYLLABUS

Physics Syllabus

Unit 1. Units and dimensions

Fundamental units in the CGS & SI systems - Definitions of SI Units - Supplementary and derived units - Dimensions of Physical quantities - Application of Dimensional Analysis - uses - examples - Limitations of dimensional analysis.

Errors in measurements - variation and average values - Number of observations - Ideas of standard deviation and mean deviation- Systematic and random errors - Significant figures and rounding off - Evaluation of percentage of errors.

Unit 2. Elements of vectors

Addition and subtraction of Vectors - Laws of addition of vectors - Equal and null vectors - Unit vectors - Unit vectors in Cartesian co-ordinate system - Position vector and its magnitude - Parallelogram law of vectors - Expression for the resultant vector.

Triangle law and polygon law of vectors - Application to relative motion of a boat in a river - Multiplication of a vector with scalar. Scalar product with Examples of work and energy. Vector product with examples of torque and angular momentum.

Vector and Scalar products of unit vectors.

Unit 3. Kinematics-Dynamics

Equations of motion in a straight line under uniform acceleration - Equation of motion of freely falling body, vertically projected body from ground and from a height - Two dimensional motion - Projectiles with examples - Path of a projectile - maximum height, time of flight and range.

Newton's Laws of motion - Concepts of inertia, momentum force, impulse and types of forces - Collision of two bodies in one dimension - one body at rest - two bodies moving in the same and opposite directions - Elastic and inelastic collisions - Coefficient of restitution.

Unit 4. Work, Power, and Energy

Definition and units - Expressions for P.E. & K.E. - Work-energy theorem - Law of conservation of energy.

Unit 5. Centre of Mass

Definition - Co-ordinates of center of mass - Velocity, Acceleration - Characteristics of center of mass - Examples in the case of two dimensional motions - Laws of motion of center of mass - Explosion.

Unit 6. Friction

Causes of friction - Static, Kinetic and rolling friction - laws of friction - expressions for acceleration of a body on smooth and rough inclined planes (without rolling).

Unit 7. Rotatory motion

Rotatory motion - Relationships between quantities in rotatory and linear motions - Centripetal and centrifugal forces - Concepts of torque and couple - Relation between angular momentum and torque - Moment of inertia - Rotational kinetic energy - Parallel and perpendicular axes theorems - Expressions for the Moment of inertia of a thin rod, sphere, circular ring, uniform disc., cylinder and rectangular lamina - Conservation of angular momentum with examples - Motion in a vertical circle.

Unit 8. Gravitation

Kepler's laws of planetary motion - Newton's universal law of gravitation - Expression for the relation between g & G - Variation of ' g ' with height, depth, latitude and local conditions. Inertial and gravitational masses - Escape velocity and orbital velocity - geo-stationary satellites and their uses.

Unit 9. Simple Harmonic motion

Definitions and examples - Expressions for displacement, velocity, acceleration, time period and frequency - Expressions for the period of a simple pendulum and loaded spring - Force constant - Expressions for the KE & PE of a body in SHM.

Unit 10. Elasticity

Elasticity & plasticity - Stress - Strain, Hookes law - Moduli of elasticity (Y, n, K) - Poisson's ratio (s) - Relation between Y, n, K and s - Behaviour of wire under gradually increasing load - elastic fatigue - expression for strain energy - experimental determination of Y by Searle's apparatus.

Unit 11. Surface Tension

Surface tension - Definition and examples - Molecular Phenomenon - Angle of contact - Capillarity with examples in nature - Experimental determination of Surface Tension by capillary rise method with necessary theory - variation of Surface Tension with temperature - Expressions for excess pressure inside a drop and a bubble.

Unit 12. Hydrodynamics

Principle of Buoyancy - Pressure in a fluid - Bernoulli's theorem - Aerodynamic lift and motion of spinning ball.

Unit 13. Viscosity

Stream line flow - Explanation of viscosity - Poiseuille's equation - determination of co-efficient of Viscosity - Variation with temperature.

Unit 14. Expansion of Solids- Liquids-Gases

Three coefficients of expansion of solids their inter relationship - Determination of coefficient of linear expansion by mechanical lever method - Application to Bimetallic thermostat.

Coefficients of real and apparent expansion of liquids and the relation between them - Variation of density with temperature - Anomalous expansion of water and its effects - Experimental determination of real and apparent coefficients by Regnault's method and specific gravity bottle.

Volume and pressure coefficients of expansion of gases - Experimental determination of volume and pressure coefficients by Regnault's & Jolly's bulb apparatus - Absolute zero - Kelvin's scale of temperature - Boyle's law and Charle's law - Ideal gas equation.

Unit 15. Thermodynamics

Definition of calorie, thermal capacity, specific heat and latent heats - Law of mixtures - Problems relating to specific heats and latent heats and law of mixtures - Joule's law and Mechanical equivalent of Heat (J). Three phases of matter and Triple point of water - Definition of specific heats of gases C_p & C_v - Isothermal and Adiabatic processes - Relationships between P,V & T - External work done by an ideal gas during expansion - Internal energy - Statements and explanation of Zeroeth law, First and Second laws of thermodynamics - Relation $C_p - C_v = R$.

Unit 16. Thermal Radiations

Nature and properties of thermal Radiation - Prevost's theory of heat exchanges - Emissive and absorptive powers - Black body radiation - Kirchoff's law and its application - Newton's law of cooling - Laws of Black body radiation - Stefan's law, Weien's displacement law and Planck's formula (qualitative treatment only)

Unit 17. Sound

Propagation of sound - Wave equation - Velocity of sound in solids, liquids and gases - Variation of velocity of sound in gases with temperature, pressure, density and humidity. Natural and Forced vibrations - Resonance with examples - Formation of stationary waves in stretched strings - Laws of transverse waves along stretched strings - Experimental verification by sonometer - Beats - Definition and explanation (Theory only) - Doppler effect - Formulae for apparent frequency in specific cases - Applications and limitations of Doppler effect.

Unit 18. Geometrical Optics

Determination of velocity of light by Foucault's rotating mirror method - Its significance - Critical angle - Total internal reflection - Application to optical fibres.

Lens maker's formula $1/f = (m - 1) (1/R_1 + 1/R_2)$ - Defects of images - Spherical and Chromatic aberrations and their elimination (Qualitative treatment) - Construction of Ramsden's and Huygens eye pieces. Dispersion of light - Formula for refractive index of prism - Pure and impure spectra - arrangement to obtain pure spectrum -

Description and working of spectrometer - Determination of angle of a prism - Angle of minimum deviation and Refractive index - Dispersive power of a prism.

Different kinds of spectra - Emission spectra-Line, Band and Continuous spectra- Absorption spectra - their significance - Fraunhofer lines and their significance.

Unit 19. Physical Optics

Nature of light - Newton's corpuscular theory - Huygen's wave theory - Electromagnetic theory Quantum Theory (Elementary ideas only) - Interference - Coherent sources - Young's double slit experiment - Phenomenon of diffraction - Fresnel and Fraunhofer diffraction - Diffraction at straight edge (qualitative treatment) - Polarization - Concepts of polarization - Production of **plane polarized light by reflection and double refraction (Polaroids).**

Unit 20. Magnetism

Magnetic pole strength - Inverse square law - Magnetic induction B - Formulae for magnetic induction on axial and equatorial line of a bar magnet and a very short bar magnet - Couple acting on a bar magnet placed in a uniform magnetic field - Magnetic moment of a magnet - Tangent law - Deflection magnetometer - Comparison of magnetic moments in Tan A and Tan B positions by equal distance method and null method - Verification of Inverse square law - vibration magnetometer - Experimental determination of M and BH.

Magnetic materials Dia, Para, Ferro, Antiferro and Ferrimagnetism - their properties - Electron theory of magnetism (qualitative treatment) - Permeability and Susceptibility (concepts only).

Unit 21. Electro Statics

Coulomb's law - permittivity- Concept of electric field - Electric lines of force.

Force on a charge in an electric field ($F=Eq$) - Electric potential - Potential due to a point charge - Potential energy of a point charge in a uniform electric field - Electron volt - Relation between E and V ($E =v/d$) Capacitance, Dielectric constant - Parallel plate capacitor - Formula for Capacitance - Effect of dielectric on capacity (expressions only) - Formulae for resultant capacitance when capacitors are connected in series and parallel - Energy stored in a capacitor - Effect of dielectric on the energy - Types of capacitors and their uses.

Unit 22. Current Electricity

Ohm's law - Specific resistance - Conductance - Temperature dependence of resistivity - Thermistor - Emf of a cell - Internal resistance and back emf.

Kirchoff's laws - Statement and explanation - Application to Wheatstone's bridge for its balance condition - Metre bridge - Principle of potentiometer - Comparison of emf's of cells. Determination of internal resistance of a primary cell.

Unit 23. Thermo Electricity

Seebeck effect - Peltier and Thomson effects and their coefficients - Variation of thermo emf with temperature - Neutral and Inversion temperatures. Application of thermo couples.

Unit 24. Electro Magnetism

Oersted's experiment - Biot Savart law - The Tesla Ampere law - Magnetic field near a long straight wire and at the center of a circular coil carrying current (expressions only) - Force on a moving charge in a magnetic field ($F = Q V \times B$) - Force on a current carrying conductor in a magnetic field - Force between two straight parallel conductors

carrying current - Definition of Ampere - Fleming's left hand rule - Force and Torque on current loop in a magnetic field - Tangent Galvanometer expression for the current construction and working of a moving coil galvanometer - Shunt and its uses - Conversion of moving coil galvanometer into ammeter and voltmeter. Comparison of Moving Coil Galvanometer with Tangent Galvanometer - Electro magnetic induction - magnetic flux and induced emf. - Faraday and Lenz laws - Fleming's right hand rule - Self and Mutual inductances - Henry.

Unit 25. Atomic Physics

Discovery of electron - e/m electron by Thomson's method - Charge of an electron by Millikan's oil drop method (Principle only) Photo electric effect - Laws of photoelectric emission - Einstein's photo electric equation and its experimental verification by Millikan's method - Photoelectric cells and their uses.

X-ray spectra - Mosley's law and its importance - Compton effect - Dual nature of matter - De Broglie's hypothesis (concepts only)

Unit 26. Nuclear Physics

Composition of nucleus - Nuclear forces - Mass defect and binding energy - Explanations with examples - Discovery of neutron - Nuclear fission - Chain reaction - Principle and working of a Nuclear reactor - Nuclear fusion - Energy of sun and stars (Carbon - Nitrogen cycle and Proton- Proton cycle) -Elementary particles.

Unit 27. Semi conductor Devices

Junction Diode - Depletion layer - Barrier potential- Forward bias and Reverse bias - Current - Voltage characteristics - Junction diode as half wave and full wave rectifiers - Zener diode as voltage regulator - Transistors - pnp and non transistors - Transistor characteristics - Transistor as common emitter amplifier (Block diagram and qualitative treatment only).

Mathematics Syllabus

Unit1. Algebra

Functions - Types of functions - Algebra of real valued functions, Surds and Logarithms, Mathematical Induction and its applications, Permutations and combinations - Linear and Circular Permutations – Combinations, Binomial Theorem - for a positive integral index - for any rational index - applications - Binomial coefficients - Partial Fractions Exponential and Logarithmic Series - Quadratic Expressions - Quadratic inequations, Theory of Equations - Relations between the roots and coefficients in any equation - Transformation of equations - reciprocal equations - cubic equations - Cardan's solution - Biquadratic equations - Ferrari and Decarte's solutions. Matrices and Determinants - Definition - Types of Matrices - Algebra of Matrices - Properties of determinants of 2X2 and 3X3 order matrices - Simultaneous Linear equations in two and three variables – Rank of matrix. Complex numbers - their properties - Demoivre's Theorem - Applications - Expansions of Trigonometric functions.

Unit 2. Trigonometry

Trigonometric functions - Graphs – Periodicity, trigonometric ratios of compound angles, multiple and sub-multiple angles, Transformations, Trigonometric Equations, Inverse Trigonometric functions, Hyperbolic and inverse hyperbolic functions, Properties of Triangles, Heights and Distances (in two dimensional plane)

Unit 3. Vector Algebra

Scalar Product – Angle between two vectors, properties of scalar product, applications of dot products. Vector Product – Right handed and left handed systems, properties of vector product, applications of cross product. Product of three vectors – Scalar triple product, properties of scalar triple product, vector triple product, vector product of four vectors, scalar product of four vectors. Lines – Equation of a straight line passing through a given point and parallel to a given vector, passing through two given points, angle between two lines. Skew lines – Shortest distance between two lines, condition for two lines to intersect, point of intersection, collinearity of three points. Planes – Equation of a plane, passing through a given point and perpendicular to a vector, given the distance from the origin and unit normal, passing through a given point and parallel to two given vectors, passing through two given points and parallel to a given vector, passing through three given non-collinear points, passing through the line of intersection of two given planes, the distance between a point and a plane, the plane which contains two given lines, angle between two given planes, angle between a line and a plane. Sphere – Equation of the sphere whose centre and radius are given, equation of a sphere when the extremities of the diameter are given.

Unit 4. Probability

Addition and multiplication theorems of probability - their applications - conditional probability and Baye's Theorem, . Mean and Variance of a random variable - Binomial and Poisson, normal distributions.

Unit 5. Coordinate Geometry

Locus - Translation and Rotation of Axes, The Straight Line, The Pair of Straight Lines, Coordinate planes in three dimensions - distance between two points - section formula and their applications, Direction cosines and direction ratios of a line - angle between two lines - projection of a line, The plane and its general equation - Equation of the plane in different forms, Circles and system of Circles, Conics - Parabola - Ellipse - Hyperbola - their applications -

Equations of Tangent, Normal, Polar and Pole to these conics, Polar Coordinates.

Unit 6. Calculus

Functions - Limits – Continuity, Differentiation - Different Methods, Successive Differentiation including Leibnitz's Theorem, Applications of Differentiation, Partial Differentiation including Euler's Theorem on homogeneous functions, Different methods of Integration, Definite integrals and their applications to areas - reduction formulae. Numerical Integration - Trapezoidal and Simpson's Rules, Differential equations - Formation and solution of first order, first degree differential equations, Second order linear homogenous equations with constant coefficients.

Chemistry Syllabus-1

Unit 1. Atomic Structure

Electromagnetic Radiation: Wave nature - Wave Characteristics: Wave length - frequency - Wave number - units to express these quantities - relationship between them, Atomic Spectrum of Hydrogen - different regions of the spectrum - wave number of the spectral lines in these regions (Rydberg's equation), Lyman, Balmer, Paschen, Brackett and Pfund series. Atomic Models: Rutherford's model, merits and demerits, Bohr's Model: Postulates - formulation of the model - Expressions for the energy and radius of the Hydrogen Atomic orbits with derivations - limitations. Zeeman, Stark effects - Sommerfeld's modifications. Quantum Numbers: Significance - writing quantum numbers for differentiating electrons in atoms - Pauli's exclusion principle. Wave nature of electron: De-Broglie wave equation - Heisenberg's uncertainty principle, (Cartesian coordinates equation only). Orbitals: Shapes of s, p, d orbitals - orbitals energy sequence - aufbau principle - Hund's rule. Electronic configuration of elements (from atomic no: 1 to 30 by n+l method) Stability and magnetic behaviour of atoms based on concepts of electronic configuration.

Unit 2. Nuclear Chemistry

Nuclear particles: (Protons, Neutrons) - isotopes, isobars, isotones and Isodiapheres. Nucleus: Relative dimensions of atom and nucleus - nuclear mass defect - mass - energy relation - binding energy - n/p ratio - magic numbers. Nuclear reactions: Writing nuclear reactions in the shortest form of $(M(a,b)M')$ notation, balancing - typical examples of nuclear reactions - nuclear fusion (proton) reactions - nuclear fission (uranium - 235) - Differences between nuclear and Chemical reactions. Radioactivity: Units of radioactivity (Curie, Rutherford and Becquerel) - natural and artificial radioactivity - disintegration series - Group displacement law. Radioactive disintegration: Rate equation (no derivation) - decay constant - half-life period - numerical problems on radioactive disintegrations - Radioactive isotopes (O^{18} , P^{32} , U^{238} , C^{14} , I^{131}) and their applications

Unit 3. Periodic Classification of Elements

Periodic Laws and Periodic Table: Periodic laws based on atomic number and electron configuration - Structure of the long form of the periodic table - s, p, d, f blocks - outer electronic configuration of elements of s, p, d and f blocks. Periodic trends: Trends down the group and across the period in respect of atomic size, ionic radius, Oxidation State, ionization potential, electron affinity and electronegativity - reasons for the trends

Unit 4. Chemical Bonding

Ionic Bonding: Nature, factors favourable for the bond formation - Effect of ionization potential, electron affinity and electro negativity - Born - Haber cycle for sodium chloride crystal formation - Face centered cubic lattice structure of sodium chloride - Body centered cubic lattice structure of cesium chloride (diagramatic illustrations only) - coordination number of metal ions in the crystals of sodium chloride and cesium chloride. Properties of ionic substances, Covalent Bond: Nature - octet rule and electron dot formula of simple molecules ($BeCl_2$, BF_3 , CO_2 , NH_3 , H_2O , PCl_5 , SF_6 , CH_4 , C_2H_4 , C_2H_6) - postulates of valence bond theory (qualitative treatment) - overlapping of orbitals - sigma and pi bonds - dipole moment (qualitative aspect) of simple molecules. (HCl , H_2O , SO_2 , NH_3 , CH_4 , CCl_4) - properties of covalent substances. Hybridization of Orbitals: sp, sp^2 , sp^3 , dsp^3 , d^2sp^3 hybridizations - shapes of simple molecules ($BeCl_2$, BCl_3 , CH_4 , C_2H_6 , C_2H_4 , C_2H_2 , NH_3 , H_2O , PCl_5 , SF_6) Bond Lengths - bond angles and bond energies - postulates of valence shell electron pair repulsion (VSEPR) theory - application to geometry of covalent molecules (beryllium chloride, boron tri-chloride, water and ammonia) Hydrogen Bond: Concept - inter and intra molecular Hydrogen bonds - typical examples.

Unit 5. Stoichiometry

Definition : Stoichiometry, Stoichiometric Equation, Stoichiometric amounts – Examples, Mole Concept: Gram atom, Gram molecule, Definition of mole, mass, formula weight - Calculations. Chemical reactions and Numerical calculations based on weight - weight, weight - volume, volume - volume relationships, Calculation of empirical and molecular formulae of Carbon compounds - oxidation number - Redox reactions - Calculation of oxidation number - Balancing of redox reactions by ion - electron (half reaction) method and oxidation number method.

Unit 6. Gaseous State

Gas laws - Boyle's law, Charles's law, Avogadro's law - statement and numerical problems, Ideal gas equation: $PV=nRT$, values of R - numerical problems based on gas equation. Graham's law of diffusion - Statement - numerical problems. Dalton's law of partial pressures: Statement - numerical problems. Kinetic theory of Gases: Postulates - derivation of $PV = \frac{1}{3} mnc^2$ - Deducing gas laws from kinetic gas laws (Boyle's law, Charles law, Dalton's law, Graham's law) from kinetic gas equation - RMS velocity - most probable velocity - Mathematical relationship between the three. Average kinetic energy of the molecules.

Unit 7. Solutions

Definition of solution: Solvent - solute, methods of expressing concentrations of solutions - molarity, molality, normality - mole fraction methods - Numerical problems. Vapour Pressure: Definition - effect of temperature - Raoult's law - Numerical problems.

Unit 8. Acids and Bases

Theories of Acids and Bases - Arrhenius acid - base concept, limitations, Lowry - Bronsted concept - examples - limitations - Lewis Theory - examples. Ionic Product of Water: pH of aqueous solutions - (include both strong and weak acids and bases) - buffer solutions - types of buffers, buffer action - calculation of pH of acid buffers. Indicators: Acid -base indicators - pH range - selection of indicators for acid - base titrations. Hydrolysis of Salts: Definition - examples of different salts.

Unit 9. Electro Chemistry

Metallic Conductors - Electrolytes - Non-electrolytes - Arrhenius theory of ionization - Faraday's laws - Numerical problems. Galvanic Cells : Definition - examples - cell notation - writing of cells and cell reactions. Nernst Equation - e.m.f. calculation

Unit 10. Chemical Equilibrium and chemical Kinetics

Chemical Equilibrium: Reversible reactions - chemical equilibrium - dynamic nature - examples of chemical equilibrium, law of mass action - equilibrium constant - characteristics of equilibrium constant - factors affecting equilibrium - application of law of mass action to Haber's process (for Ammonia). Le Chatelier's Principle: Statement and applications to Haber's process (for Ammonia). Chemical Kinetics: Rate of reaction (elementary treatment) factors (concentration - temperature, catalyst) affecting rate of reaction, rate law, rate constant and its units Order and Molecularity - First order Rate equation and half life - collision theory of reaction rates (elementary treatment)

Unit 11. Chemical Energetics

Chemical energetics: Internal energy - enthalpy - exothermic and endothermic reactions - heats of reaction; formation, combustion, neutralization - Hess Law - Numerical problems.

Unit 12. Surface chemistry

Adsorption and absorption - Physical and Chemical adsorption - distinguishing properties - Adsorption of Gases on Metals - Adsorption from solutions (Elementary treatment). Colloidal State: True and Colloidal solutions - explanation of terms - Dispersion medium, Dispersed phase, lyophilic and lyophobic sols using the examples - smoke, cloud, blood, milk, starch solution and gold sol. Micelles - cleaning action of soap Emulsions: emulsifying agent and emulsification - its applications Catalysts: Explanation of terms - Homogeneous and Heterogeneous catalysis, Distinction with suitable examples - auto catalysis with one example.

Unit 13. Hydrogen and its Compounds

Water: Hardness of Water and its removal Heavy Water: Isotopes of hydrogen - heavy water - electrolytic preparation - properties and uses of heavy Water. Hydrogen Peroxide: Preparation (laboratory, electrolytic and auto oxidation) and concentration, properties of H_2O_2 as oxidizing agent and reducing agent, structure and uses of H_2O_2

Unit 14. Alkali and Alkaline Earth Metals

General Characteristics: Electronic configuration - position in the long form of the periodic table - trends in physical properties, chemical properties with reference to oxides, halides and carbonates. Sodium and Magnesium: Occurrence - extraction of sodium (Castner and Down process) - extraction of Magnesium (from Carnalite and Magnesite) - Typical physical and chemical properties - Uses. Alloys of magnesium (Magnalium and Electron) preparation, properties and uses of the following compounds sodium hydroxide, sodium bicarbonate, magnesium - sulphate, Plaster of Paris, Lime Mortar and Gypsum.

Unit 15. Group elements

General Characteristics: Electronic configuration - position in the long form of the periodic table - trends in physical properties - Chemical properties with reference to oxides, halides and hydroxides. Aluminium: Occurrence - extraction - purification (electrolytic) - typical physical and chemical properties - uses including aluminothermic process - Preparation, properties and uses of Potash Alum. Electron deficient compounds: Concept and examples, Diborane: Preparation, properties and structure

Unit 16. IV Group elements

General Characteristics: Electronic configuration - position in the long form of the periodic table - trends in physical properties of carbon and silicon. Physical forms of Carbon: Allotropy of carbon - structure of diamond and graphite. Preparation - properties - structure and uses of Silicon and SiO_2 . Comparison of SiO_2 with CO_2 . Fuel gases: Producer gas and water gas - preparation - calorific values and uses.

Unit 17. V Group Elements

General Characteristics: Electronic configuration - position in the long form of the period table - trends in physical properties. Chemical Properties of Compounds of Nitrogen & Phosphorous: Hydrides, Oxides, Halides and structural aspects of Oxy - acids. Industrial Preparation and Uses of : Ammonia, and Super phosphate of lime.

Unit 18. VI Group Elements

General Characteristics: Electronic configuration - position in the long form of the periodic table - trends in physical properties - allotropy of elements. Chemical Properties of Compounds of Oxygen and Sulphur: Hydrides, oxides, halides and structural aspects of Oxy acids. Preparation, properties and uses of Ozone, Sodium thiosulphate.

Unit 19. VII Group Elements

General Characteristics: Electronic configuration - position in the long form of the periodic table - trends in physical properties. Fluorine and Chlorine: Preparation, properties and uses. Structure and oxidation states of Oxides and oxyacids of chlorine. Bleaching Powder: Preparation, properties and uses.

Unit 20. Noble Gases

Discovery, Occurrence and isolation. Chemistry of Noble Gases and their uses.

Unit 21. Transition Elements (dBlock)

General characteristics of: Electronic configuration - position in the long form of the periodic table. Properties : Oxidation states - colour forming ability - alloy formation - magnetic properties Coordination complexes: Werner's notations (elementary account)

Unit 22. Environmental Chemistry

Terminology: Environment, pollutant, contaminant, receptor, sink, speciation, dissolved oxygen, threshold limit.
Air Pollution: Common air pollutants - CO and oxides of Nitrogen and Sulphur - acid rains and green house effect
Water pollution: Common Water pollutants. Organic Pollutants, Biological Oxygen Demand (BOD), Inorganic pollutants - Water treatment with respect to fluorine content Ozone layer and effect of freons (CFC).

Unit 23. Hydrocarbons-I (Alkanes and Alkenes)

Classification - Formation of sigma and pi bonds. Homologous series - concept and its significance. Isomerism: Concept, Structural isomerism (chain, position, functional isomerism). Nomenclature of Aliphatic Hydro Carbons : IUPAC system Methane and Ethane: Preparation by reduction of alkyl halides, Wurtz method, Grignard method, decarboxylation, Kolbe's/electrolysis, Sabtier - Senderen's reaction. Chemical Properties: Halogenation, Nitration, Pyrolysis, Oxidation - Uses Ethylene: Methods of preparation: dehydration of alcohols - dehydrohalogenation of alkylhalides - dehalogenation of dihalides. Properties of Ethylene: Addition of hydrogen - halogens - hydrogen halides - water - hypohalous acids -mineral acids - polymerisation - oxidation (with Beayers reagent) - ozonolysis - Uses.

Unit 24. Hydrocarbons II

Acetylene: preparation - Dehydrohalogenation of 1,2 - dihalides - hydrolysis of CaC_2 dehalogenation - Kolbe's electrolysis Properties: Oxidation, addition of hydrogen, halogens, hydrogen halides and water, trimerization, salt formation, decolorization of Br_2/CCl_4 - uses Benzene: Preparation from acetylene, coal tar distillation, structure of benzene, resonance - aromatic property. Properties: Friedel - Craft's reaction, halogenation, nitration, sulphonation - Uses.

Unit 25. Alkyl Halides

Nomenclature and classification to Primary, Secondary & Tertiary Alkyl halides Ethyl Chloride: Preparation - from alcohols using Lucas reagent, PCl_3 , PCl_5 and SOCl_2 . Properties: Reduction, hydrolysis, dehydrohalogenation, Wurtz reaction, reactions with KNO_2 , AgNO_2 , KCN , AgCN , Mg and sodium ethoxide. Chloroform: Preparation from ethanol using bleaching powder & water and chloralhydrate. Properties: Oxidation, isocyanide formation - hydrolysis - uses.

Units 26. Alcohols

Nomenclature and classification to Primary, Secondary & Tertiary Alcohols Ethanol: Preparation - Hydrolysis of alkyl halides, hydration of alkenes, fermentation of molasses & starch, Properties: Hydrogen bonding - Reaction with Sodium, esterification, action with conc H_2SO_4 , reaction with Lucas reagent, PBr_3 , PCl_5 , oxidation with Potassium dichromate and $\text{Cu} / 300^\circ\text{C}$. Combustion, chloroform formation. Differentiation with Lucas reagent - Uses.

Unit 27. Ethers

Nomenclature - Diethyl ether - Preparation from alcohols-Williamson synthesis - Properties - Reaction with HI-Uses.

Unit 28. Aldehydes and Ketones

Nomenclature - Acetaldehyde & Acetone: Preparations - Oxidation of Alcohols, heating calcium salts. Properties: oxidation, reduction with H_2 / Ni and LiAlH_4 , addition of NaHSO_3 , HCN , NH_3 , hydroxylamine, phenylhydrazine, 2,4 - DNP, aldol condensation, oxidation with Tollen's and Fehlings reagents.

Unit 29. Carboxylic Acids

Nomenclature - Acetic Acid - Preparations - Oxidation of alcohols, aldehydes, hydrolysis of cyanides. Properties: Acidity - reactions with Na , NaOH , NaHCO_3 , esterification - acid chlorides, anhydrides, amides formation, halogenation - Uses.

Unit 30. Nitrogen Compounds

Nomenclature - Nitro-Benzene - Preparation - nitration of Benzene. Properties: Reduction in acidic, basic, neutral media and with LiAlH_4 - Uses Aniline: Classification of amines - Preparation: reduction of nitro benzene. Properties: basic nature - salt formation with HCl , alkylation, N - acetylation, N- benzoylation, diazotisation - carbylamine reaction - Uses.

Unit 31. Chemistry in Biology and Medicine

Importance of Metals in the bio molecules viz., Haemoglobin, Cyanocobalamine (Vitamin B12) and chlorophyll (Elementary treatment) Common Drugs used in Medicine: Acetyl Salicylic acid (Aspirin) - Paracetamol (Elementary treatment of these two only).

Botany Syllabus

Unit 1. World of Plant Life

A. Science of Botany: Its Origin, Some important landmarks in the development of Botany, uses of plants in daily life. Differences between plants and animals.

B. (i) Diversity in habitats - Mesophytes, Xerophytes, Hydrophytes, Halophytes, Epiphytes, Mangroves

(ii) Diversity in forms - Herbs, Shrubs, Trees, Twiners, Lianas

(iii) Diversity in life span - Ephemerals, Annuals, Biennials, Perennials

(iv) Diversity in nutritional Methods - Parasites, Saprophytes, Symbionts, Autotrophs

C. Branches of Botany and applied Botany - Phycology, Mycology, Lichenology, Bacteriology, Virology, Microbiology, Bryology, Pteridology, Morphology, Embryology, Palynology, Anatomy, Cytology, Taxonomy, Ecology, Genetics, Paleo-botany, Agriculture, Horticulture, Forestry, Pharmacology, Plant breeding, Plant pathology, Biotechnology

Unit 2. Institutes & Botanists of India

A. Contributions of the following institutes - BSI, NBRI, CIMAP, IARI, ICRISAT, FRI, ICAR.

B. Contributions of the following botanists - Birbal Sahni, P. Maheswari, M.O.P. Iyengar, M.S. Swaminathan and K.C. Mehta

Unit 3. Vegetative Morphology

A. Root: Characteristics of roots, types of root system, Regions of root, Modifications of root

B. Stem: Characteristics and functions of stem, Types of stems, Types of buds, Types of branching, modifications of stem

C. Leaf: Leaf base, stipules, petioles. (Note: Lamina, Margins, apex, surface, texture OMITTED), Venation, phyllotaxy, types of leaves (simple & compound), leaf modifications.

Unit 4. Reproductive Morphology

A. Inflorescence: Racemose & cymose inflorescences, mixed and special inflorescences, Terminal inflorescence, Axillary inflorescence & intercalary inflorescence, cauliflory

B. Flower:- Structure of flower, sex distribution, symmetry of flower (based on the arrangement), merosity, structural symmetry, position of gynoecium on the thalamus, types of bracts & bracteoles, various types of thalamus, perianth, aestivation, calyx, corolla, Androecium, Gynoecium

C. Pollination: Types of pollination, contrivances of self and cross pollination, agents of pollination.

D. Embryology: Structure of anther and ovule, types of ovules, structure and development of Embryo sac, Fertilization and post fertilization changes.

E. Fruit: Types of fruits - simple, aggregate and multiple, True and false fruits

F. Dispersal of seeds and fruits: Agents of dispersal

Unit 5. Clasification of Flowering Plants

- A. Principles of clasification and nomenclature, Bentham & Hookers system of clasification
- B. Study of the following families:- Malvaceae, Fabaceae, Caesalpiniaceae, Asteraceae, Solanaceae, Liliaceae

Unit 6. Economic Botany

Botanical name, family, morphology of useful part, varieties, economic importance of the following - Paddy, Wheat, Jowar, Bajra, Red gram, Bengal gram, Groundnut, Coconut, Cotton, Jute, Mango, Banana, Neem and Amla

Unit 7. Cell Biology

Ultra structure of Eukaryotic cell, differences between plant and animal cells, Chromosomes and Nucleic acids.

Unit 8. Cell Division: Mitosis and meiosis

Unit 9. Internal Organisation of Plants

- A. Tissues: Meristems, Simple, complex and secretory tissues
- B. Tissue systems: Epidermal, Ground and vascular tissue systems.
- C. Root apex and stem apex
- D. Anatomy of dicot and monocot roots
- E. Anatomy of dicot and monocot stems
- F. Anatomy of dicot & monocot leaves
- G. Normal secondary growth in dicot stem

Unit 10. Biotechnology

- A. Scope and applications of biotechnology, aspects of biotechnology
- B. Genetic engineering
- C. Tissue culture and singe cell protein, somatic hybridization
- D. Mushroom cultivation (White button mushrooms)

Unit 11. Plant Kingdom

- A. Broad outlines of the clasifications (cryptogams & phanerogams)
- B. Salient features of the major groups - Thallophyta (Algae & Fungi), Bryophyta, Pteridophyta, Spermatophyta (Gymnosperms & angiosperms)
- C. Study of the structure and life history of the following forms:- Spirogyra, Rhizopus, Funaria, Pteris, & Cycas

Unit 12. Microbiology

- A. Branches of applied Microbiology and their Importance
- B. Bacteria: Introduction, distribution, habitat, Structure, Nutrition, reproduction and economic importance
- C. Viruses: Introduction, structure of TMV & bacteriophage, Multiplication, transmission, symptoms of viral diseases on plants and their control measures.

Unit 13. Plant Pathology

- A. Introduction, brief historical account of plant pathology, clasification of plant diseases, general control measures.
- B. Symptoms, causative organism and control measures of the following diseases -
 1. Blast of paddy (Rice)
 2. Red rot of sugar cane
 3. Grain smut of sorghum
 - 4 . Citrus canker

Unit14.PlantsandEnvironment

- A. Introduction, scope of ecology, levels of organization, basic concepts of ecology
- B. Plant communities - Hydrophytes, Mesophytes, Xerophytes
- C. Soil - Soil formation, soil profile, components of soil, plant groups in relation to soil characteristics, soil erosion, soil conservation (Note: Vegetation of AP and forests of AP - OMITTED)

Unit15.CroplImprovement

Introduction, Aims & Objectives of plant breeding, organizations of crop improvement research, methods of plant breeding - Introduction, selection, hybridization, Hybrid vigour, Polyploidy breeding, Mutation breeding

Unit16.PlantPhysiology

A. Water relations of plants: Importance of water, availability of water, bulk flow, diffusion, Water potential, Osmosis, Plasmolysis, Imbibition - Absorption of water by plants - (Active and pasive absorption). Ascent of sap - (root pressure theory, cohesion - tension theory) Transpiration - Definition, types of transpiration, Structure of stomata, Mechanism of stomatal opening and closing, factors affecting transpiration, importance of transpiration.

B. Mineral Nutrition: Introduction, Macro and Microelements, criteria of essentiality, role of NPK in plant nutrition, Absorption of ions, (Active and pasive absorption). Carrier theory (cytochrome pump theory, Lecithin carrier theory) Fertilisers - (Inorganic, Organic, Bio-Fertilizers) - Importance of bio fertilizers.

C. Enzymes: Definition, Historical account, Properties, components of enzyme nomenclature and clasification of enzymes. Mode of enzyme action

D. Photosynthesis: Introduction, historical account, structure of chloroplast, Photosynthetic pigments (Chlorophylls, Carotenoids & Phycobilins), Hills reaction, Emerson enhancement effect, photosystems, Photolysis of water, photophosphorylation, C3 pathway, C4 pathway, CAM pathway, Photorespiration, factors affecting photosynthesis, Importance of photosynthesis.

E. Translocation of Organic solutes: Munch's Hypothesis.

F. Respiration: Introduction, Types of respiration, differences between aerobic & anaerobic respiration - Glycolysis, Krebs Cycle, Electron Transport System, mechanism of anaerobic respiration, alcoholic fermentation, respiratory quotient (RQ)

G. Nitrogen Metabolism: Forms of Nitrogen, biological nitrogen fixation, (Symbiotic & non symbiotic) Bio-synthesis of proteins (Transcription and Translation), Genetic code and its properties.

H. Plant Growth Regulators And Seed Germination: Introduction, Discovery & Physiological effects of auxins, gibberellins, cytokinins, abscisic acid and ethylene, Role of hormones in agriculture and horticulture, Photoperiodism, Seed germination - Physiological changes during germination, conditions required for germination, seed vigour, and seed dormancy.

Zoology Syllabus

Unit 1. Zoology, the Basics

Nature and Scope of Zoology, Relation between Zoology and Other Sciences, Basic principles of clasification

- a) Need for clasification
- b) Five Kingdom clasification, viz., Monera, Protista, Plantae, fungi and Animalia.
- c) Concept of species - levels of clasification - Binomial nomenclature
- d) Kingdom Protista - Prokaryotic and Lukaryotic unicellular organisms.

Unit 2. Characters and Classification of Invertebrate Phyla upto the Level of Classes with Examples

- i) Phylum : Protozoa ii) Phylum : Porifera iii) Phylum : Coelenterata (Cnidaria) iv) Phylum : Platyhelminthes
- v) Phylum : Nematelminthes vi) Phylum : Annelida vii) Phylum : Arthropoda viii) Phylum : Mollusca
- ix) Phylum : Echinodermata

Unit 3. Animal Organisation

- i) Symmetry - Types and characteristic features of each symmetry, giving an example for each type from the representative Phyla - Asymmetry, Radial Symmetry, Biradial symmetry and Bilateral symmetry ii) Coelom:
- a) Formation of coelom b) Schizocoelic and Enterocoelic coelom c) Definition of Acoelom, Pseudo-coelom & Coelom - Examples from major Phyla. iii) Animal tissues

Unit 4. Locomotion and Reproduction in Protozoa

- i) Types and Structure of locomotory organelles - Pseudopodia, Cilia & flagellae giving examples. ii) Amoeboid movement (Pseudopodial movement) - Sol-gel theory only iii) Ciliary and flagellar movements - Synchronal and Metachronal movements (eg. Paramecium) Effective stroke and recovery stroke (eg. Euglena) iv) Types of Reproduction: a) Encystment (eg. Amoeba and Euglena) - Process and its significance (Dissemination and Multiplication). b) Asexual reproduction - Binary Fission - (types, transverse and longitudinal). c) Sexual reproduction - conjugation as exemplified by Paramecium - its significance

Unit 5. Animal Associations

- i) Definition and 1 or 2 examples of the following associations a) Mutualism / Symbiosis b) Commensalism c) Parasitism ii) Structure and life cycle of the following parasites a) Entamoeba histolytica b) Plasmodium Vivax c) Taenia Solium d) Wuchereria bancrofti iii) List of following Parasites giving scientific name, common name, vector, stage of infection, mode of transmission, affected systems and name of the diseases caused. Entamoeba gingivalis - Opalina - Balantidium - Giardia - Monocystis - Plasmodium ovale - Plasmodium malariae - Plasmodium falcifarum Eimeria - Trypanosoma gambiense - Trypanosoma rhodesiense - Trypanosoma cruzi, Leishmania donovani, Leishmania tropica - Taenia saginata - Echinococcus granulosus - Hymenolepis nana - Ascaris lumbricoides - Schistosoma haematobium - Paragonimus - Ancylostoma duodenale - Enterobius and Loa loa.

Unit 6. Phylum

Annelida - Pheretima - Type study in detail

Unit 7. Phylum-Arthropoda

- i) Cockroach - Periplaneta Americana - External characters digestive, respiratory and nervous systems only.
- ii) Life cycle and economic importance of silk worm iii) Insect mouth parts of the following types: a) Biting chewing type, eg. Cockroach b) Piercing and sucking type, eg. Mosquito c) Sponging and sucking type, eg. Housefly
- d) Siphoning type, eg. Butterfly iv) Economic importance of insects: a) Useful insects, viz., Honey bee, Lac insect - their produce and general features. b) Harmful insects viz., Bed bug, Head Louse. Mosquito and Housefly - their harmful effects and diseases spread by them.

Unit 8. Man and Biosphere

A. Elementary aspects of the following:

- i. Abiotic factors - Light, temperature and water - their effects on organisms. ii. Biotic Factors - producers, consumers

and decomposers iii. Pond Ecosystem - Littoral Zone, Limnetic Zone and profundal zone - Ecological pyramids and energy flow iv. Population ecology : Population density, growth, age distribution and population regulation.

B. Environmental Pollution:

i) Air Pollution - Primary and Secondary Pollutants - Sulphur dioxide, Nitrous oxide, Particulates, aerosols, carbon monoxide and noise ii) Water pollution - pollutants - pesticide, industrial effluents, sewage, heavy metals, radio - active substances iii) Land pollution - Fertilizers, pesticides & Solid waste iv) Preventive measures of Environmental pollution v) Wild life conservation vi) Legislation on environment protection with reference to Indian context.

C. Application Biology:

Biotechnology involved in Alcohol, Enzymes, Antibiotics, monoclonal antibodies, Vaccines and hormones.

Unit 9. Phylum-Chordata

A. General characters and out line clasification of Chordata upto clases with typical examples.
B. i) Pisces : Distinctive features of cartilaginous and Bony fishes, typical Examples ii) Amphibia: Distinctive features of Urodela, Anura and Apoda. Typical Examples. C. i) Reptilia: Distinctive characters of Squamata, Rhynchocephalia, Crocodilia and Chelonia with typical Examples. ii) Identification of Poisonous and Non-Poisonous Snakes, Poison apparatus, Toxicity of snake venom and treatment of snake bite including first aid. iii) Aves: Distincive features of Carinatae and Ratitae with typical examples. iv) Mammalia: Distinctive features of Prototheria, Metatheria and Eutheria.

Unit 10. Functional anatomy of Rabbit-Digestive, Respiratory and Circulatory systems

A. Digestive System of Rabbit - Comparison with that of Frog:

Nutrition & Digestion

1. Nutrition - Chemistry of food stuffs (Carbohydrates, Proteins and lipids) Role of Vitamins and Minerals in nutrition.
2. Digestion: Digestive enzymes and their mechanism of action - the sequence of digestion and absorption

B. Respiratory system of Rabbit - Mechanism of Respiration and Transport of respiratory gases.

C. Circulatory system of Rabbit

- i) Structure of Heart, Arterial and venous systems - comparison with those of Frog
- ii) Working of the heart of Rabbit
- iii) Coagulation of blood

Unit 11. Functional Anatomy of rabbit-Excretory, Musculoskeletal and Reproductive Systems

A. Excretory system of Rabbit - Comparison with that of Frog

- i) Structure and function of Nephron.
- ii) Urine formation and its composition

B. Musculo - Skeletal System:

- i) Ultra structure and contraction of muscle sliding filament theory system
- ii) Types of Joints

C. Reproductive system of Rabbit - Comparison with that of Frog - Structure

- i) Fertilization
- ii) Development of Rabbit upto gastrulation, gestation and viviparity

D. Central Peripheral and autonomous Nervous systems in brief . Name and Roman

E. Endocrine system - Endocrine glands [Pituitary, thyroid, parathyroid, adrenal (midula and cortex), Pancreas, Ovary & Testes] and the role of their hormones .

Unit 12. Genetics

A. Mendel's Laws

B. Sex determination

C. i) Sex determination X0, ZZ, ZW to Honey bee methods, Secondary sx differences - role of Hormones

ii) Sex linked inheritance X, Y, XY, incomplete, sx limited and sx influenced inheritance

D. Gene expression and gene regulation

E. Blood groups - Their inheritance (ABO & Rh) -Rh factors, significance in pregnancy and transfusion

Unit 13. Organic evolution

A. i) Origin of life

ii) Theories of Organic evolution - Lamarck, Darwin, Devries

B. Modern Concepts - Variations - Hardy Weinberg equilibrium, Natural selection -

Gene pool speciation - macro and micro evolution - drift

C. Evidence of organic evolution

Unit 14. Applied Zoology

A i) Poultry Layers and Broilers Poultry diseases (Bacterial, Viral and fungal)

ii) Animal breeding in Dairy and Poultry - Cloning

B. Immunity disorders - AIDS, Hepatitis and Allergic reactions