SYLLABUS FOR APEd.CET-2023:

COVERING THE DEGREE SUBJECTS (B.A., B.Com. B.Sc.) CBCS
Syllabus for the subjects under Part-A, Part-B and Part-C of APEd.CET-2023:
PART-A: GENERAL ENGLISH

1. Reading Comprehension.
2. Correction of Sentences, Articles, Prepositions, Tenses, Spelling.
3. Vocabulary, Synonyms, Antonyms.
4. Transformation of Sentences - Simple, Compound and Complex. Voices, Direct Speech and Indirect Speech.

PART-B: GENERAL KNOWLEDGE & TEACHING APTITUDE

1. Questions will be designed to test the ability of the candidate's general knowledge of the environment around him and its application to society.
2. Questions will also be designed to test knowledge of current events and of such matters of every day observation and experience in their scientific outlook as is expected of an educated person.
3. The test will also include questions relating to India and its neighbouring Countries especially pertaining to History, Culture, Geography, Ecology, Economics, General Policy and Scientific Research.
4. Teaching requires certain characteristics like ability to communicate, ability to deal with Children, ability to recognize individual differences etc., apart from analytical thinking and general intelligence. One who has these characteristics will be able to become a good teacher after training. Questions relating to these aspects will be included to test one's teaching aptitude.

PART-C: One of the following subjects to be opted:

1. Mathematics (MS)

DIFFERENTIAL EQUATIONS:

Differential Equations of first order and first degree: Linear Differential Equations; Differential equations reducible to linear form; Exact differential equations; Integrating factors; Change of variables. Orthogonal Trajectories.

Differential Equations of first order but not of the first degree: Equations solvable for p; Equations solvable for y; Equations solvable for x; Equations that do not contain x (or y); Equations homogeneous in x and y; Equations of the first degree in x and y – Clairaut's Equation.

Higher order linear differential equations: Solution of homogeneous linear differential equations of order n with constant coefficients; Solution of the non-homogeneous linear differential equations with constant coefficients by means of polynomial operators. General Solution of $f(D)y = 0$. General Solution of $f(D)y = Q$ when Q is a function of x, $\frac{1}{f(D)}$ is expressed as partial fractions.

P.I of $f(D)y = Q$ when $Q = be^{ax}$.
P.I. of $f(D)y = Q$ when Q is $b\sin ax$ or $b\cos ax$.
P.I. of $f(D)y = Q$ when $Q = bx^k$.
P.I. of $f(D)y = Q$ when $Q = e^{ax}V$, where V is a function of x.
P.I. of $f(D)y = Q$ when $Q = xV$, where V is a function of x.
P.I. of $f(D)y = Q$ when $Q = x^m V$, where V is a function of x.

Higher order linear differential equations: Method of variation of parameters; Linear differential Equations with non-constant coefficients; The Cauchy-Euler Equation, Legendre's linear equations, miscellaneous differential equations.

THREE-DIMENSIONAL ANALYTICAL SOLID GEOMETRY:

The Plane: Equation of plane in terms of its intercepts on the axis, Equations of the plane through the given points, Length of the perpendicular from a given point to a given plane, Bisectors of angles between two planes, Combined equation of two planes, Orthogonal projection on a plane.

The Line: Equation of a line; Angle between a line and a plane; The condition that a given line may lie in a given plane; The condition that two given lines are coplanar; Number of arbitrary constants in the equations of straight line; Sets of conditions which determine a line; The shortest distance between two lines; The length and equations of the line of shortest distance between two straight lines; Length of the perpendicular from a given point to a given line.

The Sphere: Definition and equation of the sphere; Equation of the sphere through four given points; Plane sections of a sphere; Intersection of two spheres; Equation of a circle; Sphere through a given circle; Intersection of a sphere and a line; Power of a point; Tangent plane; Plane of contact; Polar plane; Pole of a Plane; Conjugate points; Conjugate planes;Angle of intersection of two spheres; Conditions for two spheres to be orthogonal; Radical plane; Coaxial system of spheres; Simplified from of the equation of two spheres.

Cones: Definitions of a cone; vertex; guiding curve; generators; Equation of the cone with a given vertex and guiding curve; equations of cones with vertex at origin are homogenous; Condition that the general equation of the second degree should represent a cone;Enveloping cone of a sphere; right circular cone: equation of the right circular cone with a given vertex, axis and semi vertical angle: Condition that a cone may have three mutually perpendicular generators; intersection of a line and a quadric cone; Tangent lines and tangent plane at a point; Condition that a plane may touch a cone; Reciprocal cones; Intersection of two cones with a common vertex.

ABSTRACT ALGEBRA:

Groups: Binary Operation – Algebraic structure – semi group-monoid – Group definition and elementary properties Finite and Infinite groups – examples – order of a group, Composition tables with examples.

Subgroups: Complex Definition – Multiplication of two complexes Inverse of a complex-Subgroup definition- examples-criterion for a complex to be a subgroups. Criterion for the product of two subgroups to be a subgroup-union and Intersection of subgroups.

Co-sets and Lagrange's Theorem: Cosets Definition – properties of Cosets–Index of a subgroups of a finite groups–Lagrange's Theorem.

Normal subgroups: Definition of normal subgroup – proper and improper normal subgroup– Hamilton group – criterion for a subgroup to be a normal subgroup – intersection of two normal subgroups – Sub group of index 2 is a normal sub group –quotient group – criteria for the existence of a quotient group.

Homomorphism: Definition of homomorphism – Image of homomorphism elementary properties of homomorphism – Isomorphism – automorphism definitions and elementary properties–kernel of a homomorphism – fundamental theorem on Homomorphism and applications.

Permutations and Cyclic groups: Definition of permutation – permutation multiplication – Inverse of a permutation – cyclic permutations – transposition – even and odd permutations – Cayley's theorem. Definition of cyclic group – elementary properties – classification of cyclic groups.

Rings: Definition of Ring and basic properties, Boolean Rings, divisors of zero andcancellation laws Rings, Integral Domains, Division Ring and Fields, The characteristic of a ring - The characteristic of an Integral Domain, The characteristic of a Field. Sub Rings, Ideals

REAL ANALYSIS:

Real Numbers: The algebraic and order properties of R, Absolute value and Real line, Completeness property of R, Applications of supremum property; intervals.

Real Sequences: Sequences and their limits, Range and Boundedness of Sequences, Limit of a sequence and Convergent sequence. The Cauchy's criterion, properly divergent sequences, Monotone sequences, Necessary and Sufficient condition for Convergence of Monotone Sequence, Limit Point of Sequence, Subsequence's and the Bolzano-weierstrass theorem – Cauchy Sequences – Cauchy's general principle of convergence theorem.

Infinitie Series: Series: Introduction to series, convergence of series. Cauchy's general principle of convergence for series tests for convergence of series, Series of Non-Negative Terms. P-test, Cauchy's nth root test or Root Test, D'-Alembert's' Test or Ratio Test, Alternating Series – Leibnitz Test. Absolute convergence and conditional convergence.

Continuity: Limits: Real valued Functions, Boundedness of a function, Limits of functions. Some extensions of the limit concept, Infinite Limits. Limits at infinity. (No question is to be set from this portion).

Continuous functions: Continuous functions, Combinations of continuous functions, Continuous Functions on intervals, uniform continuity.

Differentiation and Mean Value Theorems: The derivability of a function, on an interval, at a point, Derivability and continuity of a function, Graphical meaning of the Derivative, Mean value Theorems; Rolle's Theorem, Lagrange's Theorem, Cauchy's Mean value Theorem.

Riemann Integration: Riemann Integral, Riemann integral functions, Darboux theorem. Necessary and sufficient condition for R – integrability, Properties of integrable functions, Fundamental theorem of integral calculus, integral as the limit of a sum, Mean value Theorems.

LINEAR ALGEBRA:

Vector Spaces: Vector Spaces, General properties of vector spaces, n-dimensional Vectors, addition and scalar multiplication of Vectors, internal and external composition, Null space, Vector subspaces, Algebra of subspaces, Linear Sum of two subspaces, linear combination of Vectors, Linear span Linear independence and Linear dependence of Vectors.Basis of Vector space, Finite dimensional Vector spaces, basis extension, co-ordinates, Dimension of a Vector space, Dimension of a subspace, Quotient space and Dimension of Quotient space.

Linear Transformations: Linear transformations, linear operators, Properties of L.T, sum and product of LTs, Algebra of Linear Operators, Range and null space of linear transformation, Rank and Nullity of linear transformations – Rank – Nullity Theorem.

Matrix: Matrices, Elementary Properties of Matrices, Inverse Matrices, Rank of Matrix, Linear Equations, Characteristic equations, Characteristic Values & Vectors of square matrix, Cayley – Hamilton Theorem.

Inner product space: Inner product spaces, Euclidean and unitary spaces, Norm or length of a Vector, Schwartz inequality, Triangle Inequality, Parallelogram law, Orthogonality, Orthonormal set, complete orthonormal set, Gram – Schmidt orthogonalisation process. Bessel's inequality and Parseval's Identity.

2. Physical Sciences (Physics and Chemistry) (PS)

PHYSICS:

MECHANICS, WAVES AND OSCILLATIONS:

Mechanics of Particles: Review of Newton's Laws of Motion, Motion of variable mass system, Motion of a rocket, Multistage rocket, Concept of impact parameter, scattering cross-section, Rutherford scattering-Derivation.

Mechanics of Rigid bodies: Rigid body, rotational kinematic relations, Equation of motion for a rotating body, Angular momentum and Moment of inertia tensor, Euler equations, Precession of a spinning top, Gyroscope, Precession of atom and nucleus in magnetic field, Precession of the equinoxes.

Motion in a Central Force Field: Central forces, definition and examples, characteristics of central forces, conservative nature of central forces, Equation of motion under a central force, Kepler's laws of planetary motion- Proofs, Motion of satellites, Basic idea of Global Positioning System (GPS), weightlessness, Physiological effects of astronauts.

Relativistic Mechanics: Introduction to relativity, Frames of reference, Galilean transformations, absolute frames, Michelson-Morley experiment, negative result, Postulates of Special theory of relativity, Lorentz transformation, time dilation, length contraction, variation of mass with velocity, Einstein's mass-energy relation.

Undamped, Damped and Forced oscillations: Simple harmonic oscillator and solution of the differential equation, Damped harmonic oscillator, Forced harmonic oscillator – Their differential equations and solutions, Resonance, Logarithmic decrement, Relaxation time and Quality factor.

Coupled oscillations: Coupled Oscillators-Introduction, Two coupled oscillators, Normal coordinates and Normal modes- N-coupled oscillators and wave equation.

Vibrating Strings: Transverse wave propagation along a stretched string, General solution of wave equation and its significance, Modes of vibration of stretched string clamped at ends, Overtones and Harmonics, Melde's strings.

Ultrasonics: Ultrasonics, General Properties of ultrasonic waves, Production of ultrasonics by piezoelectric and magnetostriction methods, Detection of ultrasonics, Applications of ultrasonic waves, SONAR.

WAVE OPTICS:

Interference of light: Introduction, Conditions for interference of light, Interference of light by division of wave front and amplitude, Phase change on reflection-Stokes' treatment, Lloyd's single mirror, Interference in thin films: Plane parallel and wedge-shaped films, colours in thin films, Newton's rings in reflected light-Theory and experiment, Determination of wavelength of monochromatic light, Michelson interferometer and determination of wavelength.

Diffraction of light: Introduction, Types of diffraction: Fresnel and Fraunhoffer diffractions, Distinction between Fresnel and Fraunhoffer diffraction, Fraunhoffer diffraction at a single slit, Plane diffraction grating, Determination of wavelength of light using diffraction grating, Resolving power of grating, Fresnel's half period zones, Explanation of rectilinear propagation of light, Zone plate, comparison of zone plate with convex lens.

Polarisation of light: Polarized light: Methods of production of plane polarized light, Double refraction, Brewster's law, Malus law, Nicol prism, Nicol prism as polarizer and analyzer, Quarter wave plate, Half wave plate, Plane, Circularly and Elliptically polarized light-Production and

detection, Optical activity, Laurent's half shade polarimeter: determination of specific rotation, Basic principle of LCDs.

Aberrations and Fibre Optics: Monochromatic aberrations, Spherical aberration, Methods of minimizing spherical aberration, Coma, Astigmatism and Curvature of field, Distortion; Chromatic aberration-the achromatic doublet; Achromatism for two lenses (i) in contact and (ii) separated by a distance.

Introduction to Fibers, different types of fibers, rays and modes in an optical fiber, Principles of fiber communication (qualitative treatment only), Advantages of fiber optic communication.

Lasers and Holography: Lasers: Introduction, Spontaneous emission, stimulated emission, Population Inversion, Laser principle, Einstein coefficients, Types of lasers-He-Ne laser, Ruby laser, Applications of lasers; Holography: Basic principle of holography, Applications of holography.

HEAT AND THERMODYNAMICS:

Kinetic Theory of gases: Kinetic Theory of gases-Introduction, Maxwell's law of distribution of molecular velocities (qualitative treatment only) and its experimental verification, Mean free path, Degrees of freedom, Principle of equipartition of energy (Qualitative ideas only), Transport phenomenon in ideal gases: viscosity, Thermal conductivity and diffusion of gases.

Thermodynamics: Introduction- Isothermal and Adiabatic processes, Reversible and irreversible processes, Carnot's engine and its efficiency, Carnot's theorem, Thermodynamic scale of temperature and its identity with perfect gas scale, Second law of thermodynamics: Kelvin's and Clausius statements, Principle of refrigeration, Entropy, Physical significance, Change in entropy in reversible and irreversible processes; Entropy and disorder-Entropy of Universe; Temperature-Entropy (T-S) diagram and its uses ; change of entropy when ice changes into steam.

Thermodynamic Potentials and Maxwell's equations: Thermodynamic Potentials-Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy and their significance, Derivation of Maxwell's thermodynamic relations from thermodynamic potentials, Applications to (i) Clausius-Clayperon's equation (ii) Value of CP-CV (iii) Value of CP/CV (iv) Joule-Kelvin coefficient for ideal and Van der Waals' gases.

Low temperature Physics: Methods for producing very low temperatures, Joule Kelvin effect, Porous plug experiment, Joule expansion, Distinction between adiabatic and Joule Thomson expansion, Expression for Joule Thomson cooling, Liquefaction of air by Linde's method, Production of low temperatures by adiabatic demagnetization (qualitative), Practical applications of substances at low temperatures.

Quantum theory of radiation: Blackbody and its spectral energy distribution of black body radiation, Kirchoff's law, Wein's displacement law, Stefan-Boltzmann's law and Rayleigh-Jean's law (No derivations), Planck's law of black body radiation-Derivation, Deduction of Wein's law and Rayleigh-Jean's law from Planck's law, Solar constant and its determination using Angstrom pyroheliometer, Estimation of surface temperature of Sun.

ELECTRICITY, MAGNETISM AND ELECTRONICS:

Electrostatics: Gauss's Law-Statement and its proof, Electric field intensity due to (i) uniformly charged solid sphere and (ii) an infinite conducting sheet of charge, Deduction of Coulomb's law from Gauss law, Electrical potential–Equipotential surfaces, Potential due to a (i) dipole (ii)uniformly charged sphere.

Dielectrics: Dielectrics-Polar and Non-polar dielectrics- Effect of electric field on dielectrics, Dielectric strength, Capacitance of a parallel plate condenser with dielectric slab between the plates,

Electric displacement D, electric polarization P, Relation between D, E and P, Dielectric constant and electric susceptibility.

Magnetostatics: Biot-Savart's law and its applications: (i) circular loop and (ii) solenoid, Divergence and curl of magnetic field, Ampere's Circuital Law and its application to Solenoid, Hall effect, determination of Hall coefficient and applications.

Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, Self-induction and Mutual induction, Self-inductance of a long solenoid, Mutual inductance of two coils, Energy stored in magnetic field, Eddy currents and Electromagnetic damping.

Alternating currents: Alternating current - Relation between current and voltage in LR and CR circuits, Phasor and Vector diagrams, LCR series and parallel resonant circuit, Q –factor, Power in ac circuits, Power factor.

Electromagnetic waves-Maxwell's equations: Idea of displacement current, Maxwell's Equations-Derivation, Maxwell's wave equation (with derivation), Transverse nature of electromagnetic waves, Poynting theorem (Statement and proof).

Basic Electronic devices: PN junction diode, Zener diode and Light Emitting Diode (LED) and their I-V characteristics, Zener diode as a regulator- Transistors and its operation, CB, CE and CC configurations, Input and output characteristics of a transistor in CE mode, Relation between alpha, beta and gamma; Hybrid parameters, Determination of hybrid parameters from transistor characteristics; Transistor as an amplifier.

Digital Electronics: Number systems, Conversion of binary to decimal system and vice versa, Binary addition & Binary subtraction (1's and 2's complement methods), Laws of Boolean algebra, DeMorgan's Laws-Statements and Proofs, Basic logic gates, NAND and NOR as universal gates, Exclusive-OR gate, Half adder and Full adder circuits.

MODERN PHYSICS:

Atomic and Molecular Physics: Vector atom model and Stern-Gerlach experiment, Quantum numbers associated with it, Angular momentum of the atom, Coupling schemes, Spectral terms and spectral notations, Selection rules, Intensity rules, Fine structure of Sodium D-lines, Zeeman effect, Experimental arrangement to study Zeeman effect; Raman effect, Characteristics of Raman effect, Experimental arrangement to study Raman effect, Quantum theory of Raman effect, Applications of Raman effect.

Matter waves &Uncertainty Principle: Matter waves, de Broglie's hypothesis, Wave length of matter waves, Properties of matter waves, Davisson and Germer's experiment, Phase and group velocities, Heisenberg's uncertainty principle for position and momentum& energy and time, Illustration of uncertainty principle using diffraction of beam of electrons (Diffraction by a single slit) and photons (Gamma ray microscope), Bohr's principle of complementarity.

Quantum (Wave) Mechanics: Basic postulates of quantum mechanics, Schrodinger time independent and time dependent wave equations-Derivations, Physical interpretation of wave function, Eigen functions, Eigen values, Application of Schrodinger wave equation to (i) one dimensional potential box of infinite height (Infinite Potential Well) and (ii) one dimensional harmonic oscillator.

Nuclear Physics:

Nuclear Structure: General Properties of Nuclei, Mass defect, Binding energy; *Nuclear forces*: Characteristics of nuclear forces- Yukawa's meson theory; *Nuclear Models*: Liquid drop model, The Shell model, Magic numbers; *Nuclear Radiation detectors*: G.M. Counter, Cloud chamber, Solid State detector; *Elementary Particles*: Elementary Particles and their classification.

Nano materials: Nanomaterials – Introduction, Electron confinement, Size effect, Surface to volume ratio, Classification of nano materials– (0D, 1D, 2D); Quantum dots, Nano wires, Fullerene, CNT, Graphene (Mention of structures and properties), Distinct properties of nano materials (Mention-*mechanical, optical, electrical, and magnetic properties*); Mention of applications of nano materials: (*Fuel cells, Phosphors for HD TV, Next Generation Computer chips, elimination of pollutants, sensors*).

Superconductivity: Introduction to Superconductivity, Experimental results-critical temperature, critical magnetic field, Meissner effect, Isotope effect, Type I and Type II superconductors, BCS theory (elementary ideas only), Applications of superconductors.

CHEMISTRY:

INORGANIC AND PHYSICAL CHEMISTRY:

INORGANIC CHEMISTRY: Chemistry of p-block elements

Group 13: Preparation & structure of Diborane, Borazine

Group 14: Preparation, classification and uses of silicones

Group 15: Preparation & structures of Phosphonitrilic halides {(PNCl2)n where n=3, 4

Group 16: Oxides and Oxoacids of Sulphur (structures only)

Group 17: Pseudohalogens, Structures of Interhalogen compounds.

Chemistry of d-block elements: Characteristics of d-block elements with special reference to electronic configuration, variable valence, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states.

Chemistry of f-block elements: Chemistry of lanthanides - electronic structure, oxidation states, lanthanide contraction, consequences of lanthanide contraction, magnetic properties. Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides.

Theories of bonding in metals: Valence bond theory and Free electron theory, explanation of thermal and electrical conductivity of metals based on these theories, Band theory- formation of bands, explanation of conductors, semiconductors and insulators.

PHYSICAL CHEMISTRY

Solid state: Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. The law of symmetry. Miller indices, Definition of lattice point, space lattice, unit cell. Bravais lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law. Powder method. Defects in crystals. Stoichiometric and non-stoichiometric defects.

Gaseous state: van der Waal's equation of state. Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. Relationship between critical constants and vander Waal's constants. Lawof corresponding states. Joule- Thomson effect. Inversion temperature.

Liquid state: Liquid crystals, mesomorphic state. Differences between liquid crystal and solid/liquid. Classification of liquid crystals into Smectic and Nematic. Application of liquid crystals as LCD devices.

SOLUTIONS, IONIC EQUILIBRIUM & DILUTE SOLUTIONS

Solutions: Azeotropes- HCl-H2O system and ethanol-water system. Partially miscible liquids-phenol-water system. Critical solution temperature (CST), Effect of impurity on consulate temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

Ionic equilibrium: Ionic product, common ion effect, solubility and solubility product. Calculations based on solubility product.

Dilute solutions: Colligative properties- RLVP, Osmotic pressure, Elevation in boing point and depression in freezing point. Experimental methods for the determination of molar mass of a non-volatile solute using osmotic pressure, Elevation in boiling point and depression in freezing point. Abnormal colligative properties. Van't Hoff factor.

ORGANIC & GENERAL CHEMISTRY:

ORGANIC CHEMISTRY

Recapitulation of Basics of Organic Chemistry

Carbon-Carbon sigma bonds (Alkanes and Cycloalkanes): General methods of preparation of alkanes- Wurtz and Wurtz-Fittig reaction, Corey House synthesis, physical and chemical properties of alkanes, Isomerism and its effect on properties, Free radical substitutions; Halogenations, concept of relative reactivity v/s selectivity. Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of Ethane, Propane and butane) General molecular formulae of cycloalkanes and relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram, Conformations of monosubstituted cyclohexane.

Carbon-Carbon pi Bonds (Alkenes and Alkynes): General methods of preparation, physical and chemical properties. Mechanism of E1, E2, E1 cb reactions, Saytzeff and Hofmann eliminations, Electrophilic Additions, mechanism (Markovnikov/Anti Markovnikov addition) with suitable examples, *syn and anti-addition*; additionofH2,X2, HX. Oxymercuration, demercuration, hydroboration-oxidation, ozonolysis, hydroxylation, Diels Alderreaction,1,2- and1,4-addition reactions in conjugated dienes. Reactions of alkynes; acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, Alkylation of terminal alkynes.

Benzene and its reactivity: Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation) Reactions - General mechanism of electrophilic aromatic substitution, mechanism of nitration, Friedel- Craft's alkylation and acylation. Orientation of aromatic substitution - ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO2 and Phenolic).

Orientation of

i. Amino, methoxy and methyl groups

ii. Carboxy, nitro, nitrile, carbonyl and sulfonic acid groups

iii. Halogens (Explanation by taking minimum of one example from each type)

GENERAL CHEMISTRY

Surface chemistry and chemical bonding Surface chemistry

Colloids- Coagulation of colloids- Hardy-Schulze rule. Stability of colloids, Protection of Colloids, Gold number.

Adsorption-Physical and chemical adsorption, Langmuir adsorption isotherm, applications of adsorption.

Chemical Bonding: Valence bond theory, hybridization, VB theory as applied to ClF3**,** Ni(CO**)4,** Molecular orbital theory -LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules(N2,O2,CO and NO).

HSAB: Pearson’s concept, HSAB principle & its importance, bonding in Hard-Hard and Soft-Soft combinations.

Stereochemistry of carbon compounds

Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae. **Optical isomerism**: Optical activity- wave nature of light, plane polarised light, optical rotation and specific rotation. Chiral molecules- definition and criteria (Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples- Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane. D,L, R,S and E,Z- configuration with examples. Definition of Racemic mixture – Resolution of racemic mixtures (any 3 techniques)

ORGANIC CHEMISTRY & SPECTROSCOPY:

ORGANIC CHEMISTRY

Chemistry of Halogenated Hydrocarbons: Alkyl Halides: Methods of preparation and properties, nucleophilic substitution reactions– SN1, SN2 and SNi mechanisms with stereo chemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination, Williamson's synthesis. Aryl Halides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; SN Ar, Benzyne mechanism. Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

Alcohols & Phenols: Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvet Blanc Reduction; Oxidation Of Diols By Periodic Acid Andlead Tetraacetate, Pinacol-Pinacolone Rearrangement;

Phenols: Preparation And Properties; Acidity And Factors Affecting It, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen Rearrangement with mechanism;

Carbonyl Compounds: Structure, reactivity, preparation and properties; Nucleophilic Addition, Nucleophilic Addition-elimination reactions with ammonia derivatives Mechanisms of Aldol and Benzoin Condensation, Claisan-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann Haloform Reaction And Baeyer Villiger oxidation, α- substitution reactions, oxidations and reductions (Clemmensen, wolf –kishner, with LiAlH4 &NaBH4). Addition Reactions Of α, β-unsaturated carbonyl compounds: Michael Addition. Active Methylene Compounds: Keto-enol tautomerism. Preparation And Synthetic Applications Diethyl malonate and ethyl acetoacetate.

Carboxylic Acids and their Derivatives: General methods of preparation, physical properties and reactions of monocarboxylic acids, effect of substituent acidic strength. Typical reactions of icarboxylic acids, hydroxy acids and unsaturated acids. Preparation And Reactions Of Acid Chlorides, anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl group-Mechanism of acidic and alkaline hydrolysis of esters, Claisen Condensation, Reformatsky reactions and Curtius Rearrangement Reactions involving H, OH and COOH groups- salt formation, anhydride formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Huns-Diecker reaction, decarboxylation by Schimdt reaction, Arndt- Eistert synthesis, halogenation by Hell- Volhard- Zelinsky reaction.

SPECTROSCOPY

Molecular Spectroscopy: Interaction of electromagneticradiation with molecules and various types of spectra;

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational Spectroscopy: Classical Equation Of Vibration, computation of force constant, Harmonic and anharmonic oscillator, Morse Potential curve, vibrational degrees of freedom for polyatomic molecules, modes of vibration. Selection rules for vibrational transitions, Fundamental Frequencies, overtones and hot bands.

Electronic spectroscopy: Energy levels of molecular orbitals (σ, π, n). Selection rules for electronic spectra. Types of electronic transitions in molecules, effect of conjugation. Concept of chromophore. bathochromic and hypsochromic shifts. Beer-Lambert's law and its limitations.

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants. Applications of NMR with suitable examples - ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone.

Application of Spectroscopy to Simple Organic Molecules

Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Application of electronic spectroscopy and Woodward rules for calculating λmax of conjugated dienes and α,β – unsaturated compounds.

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).

INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY:

Organ metallic Compounds: Definition and classification of organometallic compounds on the basis of bond type, Concept of hapticity of organic ligands. Metal Carbonyls:18electronrule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation of mono and binuclear carbonyls of 3d series. P-acceptor behaviour of carbon monoxide. Synergic effects (VB approach) - (MO diagram of CO can be referred to for synergic effect to IR frequencies).

Carbohydrates: Occurrence, classification and their biological importance, Monosaccharides: Constitution and absolute configuration glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth Projection And Conformational Structures; Interconversions of aldoses and ketoses; Kiliani-Fischer synthesis and Ruff degradation; Disaccharides– Elementary Treatment Of Maltose, lactose and sucrose. Polysaccharides–Elementary Treatment Of starch.

Amino acids and proteins: Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Gabriel Phthalimide synthesis c) strecker's synthesis.

Physical properties: Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point.

Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating- peptide bond (amide linkage). Structure and nomenclature of peptides and proteins.

Heterocyclic Compounds: Introduction and definition: Simple five membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1, 4, -

dicarbonyl compounds, Paul-Knorr synthesis. Properties: Acidic character of pyrrole - electrophilic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction in furan. Pyridine – Structure - Basicity - Aromaticity- Comparison with pyrrole- one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction.

Nitrogen Containing Functional Groups: Preparation, properties and important reactions of nitro compounds, amines and diazonium salts.

Nitro hydrocarbons:

Nomenclature and classification-nitro hydrocarbons, structure -Tautomerism of nitroalkanes leading to aci and keto form, Preparation of Nitroalkanes, reactivity -halogenation, reaction with HONO (Nitrous acid), Nef reaction and Mannich reaction leading to Micheal addition and reduction.

Amines: Introduction, classification, chirality in amines (pyramidal inversion), importance and general methods of preparation.

Properties: Physical properties, Basicity of amines: Effect of substituent, solvent and steric effects. Distinction between Primary, secondary and tertiary amines using Hinsberg's Method And Nitrous Acid. Discussion of the following reactions with emphasis on the mechanistic pathway: Gabriel Phthalimide synthesis, Hoffmann- Bromamide Reaction, Carbylamine Reaction, Mannich reaction, Hoffmann’s exhaustive methylation, Hofmann-elimination reaction and Cope elimination.

Diazonium Salts: Preparation and synthetic applications of diazonium salts including preparation of arenes, haloarenes, phenols, amino and nitro compounds. Coupling Reactions Of Diazonium Salts (preparation of azo dyes).

Photochemistry: Difference between thermal and photochemical processes, Laws of photochemistry- Grothus- Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield- Photochemical reaction mechanism- hydrogen- chlorine and hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Jablonski diagram, Photosensitized reactions- energy transfer processes (simple example).

Thermodynamics: The first law of thermodynamics-statement, definition of internal energy and enthalpy, Heat capacities and their relationship, Joule-Thomson effect- coefficient, Calculation of work for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes, State function. Temperature dependence of enthalpy of formation- Kirchoff s equation, Second law of thermodynamics Different Statements of the law, Carnot cycle and its efficiency, Carnot theorem, Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes. Third law of thermodynamics, Nernst heat theorem, Spontaneous and non- spontaneous processes, Helmholtz and Gibbs energies-Criteria for spontaneity.

INORGANIC &PHYSICAL CHEMISTRY:

INORGANIC CHEMISTRY

Coordinator Chemistry: IUPAC nomenclature of coordination compounds, Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory (VBT): Inner and outer orbital complexes. Limitations of VBT, Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry, Factors affecting the magnitude of crystal field splitting energy, Spectrochemical series, Comparison of CFSE for Octahedral and Tetrahedral complexes, Tetragonal distortion of octahedral geometry, Jahn-Teller distortion, square planar coordination.

Inorganic Reaction Mechanism:

Introduction to inorganic reaction mechanisms. Concept of reaction pathways, transition state, intermediate and activated complex. Labile and inert complexes, ligand substitution reactions -SN1 and SN2, Substitution reactions in square planar complexes, Trans-effect, theories of trans effect and its applications

Stability of metal complexes:

Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method and mole ratio method.

Bioinorganic Chemistry:

Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals, Sodium / K - pump, carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine, Cis-platin as an anti-cancer drug. Iron and its application in bio-systems, Haemoglobin, Myoglobin. Storage and transfer of iron.

PHYSICAL CHEMISTRY

Phase rule: Concept of phase, components, degrees of freedom. Thermodynamic derivation of Gibbs phase rule. Phase diagram of one component system - water system, Study of Phase diagrams of Simple eutectic systems i) Pb-Ag system, desilverisation of lead ii) NaCl-Water system, Congruent and incongruent melting point- Definition and examples for systems having congruent and incongruent melting point, freezing mixtures.

Electrochemistry: Specific conductance, equivalent conductance and molar conductance- Definition and effect of dilution. Cell constant. Strong and weak electrolytes, Kohlrausch's law and its applications, Definition of transport number, determination of transport number by Hittorf's method. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only), Application of conductivity measurements- conduct metric titrations. Electrochemical Cells- Single electrode potential, Types of electrodes with examples: Metal- metal ion, Gas electrode, Inert electrode, Redox electrode, Metal-metal insoluble salt- salt anion. Determination of EMF of a cell, Nernst equation, Applications of EMF measurements - Potentiometric titrations. Fuel cells- Basic concepts, examples and applications.

Chemical Kinetics:

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction, Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only). Enzyme catalysis- Specificity, factors affecting enzyme catalysis, Inhibitors and Lock & key model. Michaels- Menten equation- derivation, significance of Michaelis-Menten constant.

3. Biological Sciences (Botany and Zoology) (BS)

BOTANY:

FUNDAMENTALS OF MICROBES AND NON-VASCULAR PLANTS:

Origin of life and Viruses: Origin of life, concept of primary Abiogenesis; Miller and Urey experiment. Five kingdom classification of R.H. Whittaker. Discovery of microorganisms, Pasteur experiments, germ theory of diseases. Shape and symmetry of viruses; structure of TMV and Gemini virus; multiplication of TMV; A brief account of Prions and Viroids. A general account on symptoms

of plant diseases caused by Viruses. Transmission of plant viruses and their control. Significance of viruses in vaccine production, bio-pesticides and as cloning vectors.

Special groups of Bacteria and Eubacteria: Brief account of Archaebacteria, Actinomycetes and Cyanobacteria. Cell structure and nutrition of Eubacteria. Reproduction- Asexual (Binary fission and end oospores) and bacterial recombination (Conjugation, Transformation, Transduction). Economic importance of Bacteria with reference to their role in Agriculture and industry (fermentation and medicine). A general account on symptoms of plant diseases caused by Bacteria; Citrus canker.

Fungi & Lichens: General characteristics of fungi and Ainsworth classification (upto classes). Structure, reproduction and life history of(a)*Rhizopus* (Zygomycota)and (b)*Puccinia* (Basidiomycota). Economic uses of fungi in food industry, pharmacy and agriculture. A general account on symptoms of plant diseases caused by Fungi; Blast of Rice. Lichens- structure and reproduction; ecological and economic importance.

Algae: General characteristics of Algae (pigments, flagella and reserve food material); Fritsch classification (upto classes). Thallus organization and life cycles in Algae. Occurrence, structure, reproduction and life cycle of (a) *Spirogyra* (Chlorophyceae) and (b) *Polysiphonia*(Rhodophyceae). Economic importance of Algae.

Bryophytes: General characteristics of Bryophytes; classification upto classes. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life cycle of (a) *Marchantia* (Hepaticopsida) and (b) *Funaria* (Bryopsida). General account on evolution of sporophytes in Bryophyta.

BASICS OF VASCULAR PLANTS AND PHYTOGEOGRAPHY:

Pteridophytes: General characteristics of Pteridophyta; classification of Smith (1955) up to divisions. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of (a) *Lycopodium* (Lycopsida) and (b) *Marsilea* (Filicopsida).

Stelar evolution in Pteridophytes; Heterospory and seed habit.

Gymnosperms: General characteristics of Gymnosperms; Sporne classification up to classes.

Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of (a) *Cycas* (Cycadopsida) and (b) *Gnetum*(Gnetopsida). Outlines of geological time scale. A brief account on *Cycadeoidea.*

Basic aspects of Taxonomy: Aim and scope of taxonomy; Species concept: Taxonomic hierarchy, species, genus and family. Plant nomenclature: Binomial system, ICBN- rules for nomenclature. Herbarium and its techniques, BSI herbarium and Kew herbarium; concept of digital herbaria. Bentham and Hooker system of classification; Systematic description and economic importance of the following families: (a) Annonaceae (b) Curcurbitaceae

Systematic Taxonomy: Systematic description and economic importance of the following families: (a) Asteraceae (b) Asclepiadaceae (c)Amaranthaceae (d) Euphorbiaceae

(e) Arecaceae and (f) Poaceae. Outlines of Angiosperm Phylogeny Group (APG IV).

Phytogeography: Principles of Phytogeography, Distribution (wides, endemic, discontinuous species). Endemism – types and causes. Phytogeographic regions of World. Phytogeographic regions of India. Vegetation types in Andhra Pradesh.

ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS, PLANT ECOLOGY AND BIODIVERSITY:

Anatomy of Angiosperms: Organization of apical meristems: Tunica-carpus theory and Histogen theory. Tissue systems–Epidermal, ground and vascular. Anomalous secondary growth in

*Boerhaavia*and *Dracaena.*Study of timbers of economic importance - Teak, Red sanders and Rosewood.

Embryology of Angiosperms: Structure of anther, anther wall, types of tapetum. Microsporogenesis and development of male gametophyte. Structure of ovule, megasporogenesis; monosporic (*Polygonum*), bisporic (*Allium*) and tetrasporic (*Peperomia*) types of embryo sacs.Outlines of pollination, pollen – pistil interaction and fertilization. Endosperm - Types and biological importance - Free nuclear, cellular, helobial and ruminate. Development of Dicot (*Capsella bursa-pastoris*) embryo.

Basics of Ecology: Ecology: definition, branches and significance of ecology. Ecosystem: Concept and components, energy flow, food chain, food web, ecologicalpyramids. Plants and environment: Climatic (light and temperature), edaphic and biotic factors. Ecological succession: Hydrosere and Xerosere.

Population, Community and Production Ecology

Population ecology: Natality, mortality, growth curves, ecotypes, ecads. Community ecology: Frequency, density, cover, life forms, biological spectrum. Concepts of productivity: GPP, NPP and Community Respiration. Secondary production, P/R ratio and Ecosystems.

Basics of Biodiversity

Biodiversity: Basic concepts, Convention on Biodiversity - Earth Summit. Value of Biodiversity; types and levels of biodiversity and Threats to biodiversity. Biodiversity Hot spots in India. Biodiversity in North Eastern Himalayas and Western Ghats. Principles of conservation: IUCN threat-categories, RED data book. Role of NBPGR and NBA in the conservation of Biodiversity.

PLANT PHYSIOLOGY AND METABOLISM:

Plant-Water relations: Importance of water to plant life, physical properties of water, diffusion, imbibition, osmosis. water potential, osmotic potential, pressure potential. Absorption and lateral transport of water; Ascent of sap. Transpiration: stomata structure and mechanism of stomatal movements (K+ ion flux). Mechanism of phloem transport; source-sink relationships.

Mineral nutrition, Enzymes and Respiration:

Essential macro and micro mineral nutrients and their role in plants; symptoms of mineral deficiency. Absorption of mineral ions; passive and active processes. Characteristics, nomenclature and classification of Enzymes. Mechanism of enzyme action, enzyme kinetics.

Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle; electron transport system, mechanism of oxidative phosphorylation, Pentose Phosphate Pathway (HMP shunt).

Photosynthesis and Photorespiration: Photosynthesis: Photosynthetic pigments, absorption and action spectra; Red drop and Emerson enhancement effect. Concept of two photo systems; mechanism of photosynthetic electron transport and evolution of oxygen; photophosphorylation

Carbon assimilation pathways (C3, C4 and CAM); Photorespiration - C2 pathway

Nitrogen and lipid metabolism: Nitrogen metabolism: Biological nitrogen fixation – asymbiotic and symbiotic nitrogen fixing organisms. Nitrogenase enzyme system. Lipid metabolism: Classification of Plant lipids, saturated and unsaturated fatty acids. Anabolism of triglycerides, β-oxidation of fatty acids, Glyoxylate cycle.

Plant growth - development and stress physiology: Growth and Development: Definition, phases and kinetics of growth. Physiological effects of Plant Growth Regulators (PGRs) - auxins, gibberellins, cytokinins, ABA, ethylene and brassinosteroids. Physiology of flowering: Photoperiodism, role of phytochrome in flowering. Seed germination and senescence.Physiological changes during water stress.

CELL BIOLOGY, GENETICS AND PLANT BREEDING:

The Cell: Cell theory; prokaryotic vs eukaryotic cell; animal vs plant cell; a brief account on ultra-structure of a plant cell. Ultra-structure of cell wall. Ultra-structure of plasma membrane and various theories on its organization. Polymorphic cell organelles (Plastids); ultrastructure of chloroplast. Plastid DNA.

Chromosomes: Prokaryotic vs eukaryotic chromosome. Morphology of a eukayotic chromosome. Euchromatin and Heterochromatin; Karyotype and ideogram. Brief account of chromosomal aberrations - structural and numerical changes. Organization of DNA in a chromosome (solenoid and nucleosome models).

Mendelian and Non-Mendelian genetics: Mendel's laws of inheritance. Incomplete dominance and co-dominance; Multiple allelism. Complementary, supplementary and duplicate gene interactions (plant based examples are to be dealt). A brief account of linkage and crossing over; Chromosomal mapping - 2 point and 3 point test cross. Concept of maternal inheritance (Corren's experiment on *Mirabilis jalapa*); Mitochondrial DNA.

Structure and functions of DNA: Watson and Crick model of DNA. Brief account on DNA Replication (Semi- conservative method). Brief account on Transcription, types and functions of RNA. Gene concept and genetic code and Translation. Regulation of gene expression in prokaryotes - Lac Operon.

Plant Breeding: Plant Breeding and its scope; Genetic basis for plant breeding. Plant Introduction and acclimatization. Definition, procedure; applications and uses; advantages and limitations of :(a) Mass selection, (b) Pure line selection and (c) Clonal selection. Hybridization – schemes, and technique; Heterosis (hybrid vigour). Brief account on Molecular breeding – DNA markers in plant breeding. RAPD, RFLP.

ZOOLOGY:

ANIMAL DIVERSITY – BIOLOGY OF NONCHORDATES :

Principles of Taxonomy – Binomial nomenclature – Rules of nomenclature Whittaker's five kingdom concept and classification of Animal Kingdom.

Phylum Protozoa: General Characters and classification of protozoa up to species level with suitable examples Locomotion, nutrition and reproduction in Protozoan's *Elphidium (typestudy)*

Phylum Porifera: General characters and classification up to species level with suitable examples Skelton in Sponges Canal system in sponges

Phylum Coelenterate: General characters and classification up to species level with suitable examples Mutagenesis in *Obelia*, Polymorphism in coelenterates, Corals and coral reefs formation

Phylum Ctenophore: General Characters and Evolutionary significance (affinities)

Phylum Platy helminthes: General characters and classification up to species level with suitable examples Life cycle and pathogen city of *Fasciolahepatica*Parasitic Adaptations in helminthes

Phylum Nemathelminthes: General characters and classification up to species level with suitable examples Life cycle and pathogen city of *Ascaris lumbricoides*

Phylum Annelida: General characters and classification up to species level with suitable examples *Hirudinaria granulosa*- External characters, digestive system, excretory system and reproductive system, Evolution of Coelom and Coelomoducts, Vermiculture - Scope, significance, earthworm species, processing, Vermicompost, economic importance of vermin compost

Phylum Arthropoda : General characters and classification up to species level with suitable examples Prawn- External characters, appendages, respiratory system and circulatory system Vision and

respiration in Arthropoda, Metamorphosis in Insects *Peripatus*- Structure and affinities Social Life in Bees and Termites

Phylum Mollusca: General characters and classification up to species level with suitable examples, Pearl formation in Pelecypoda, Sense organs in Mollusca, Torsion in gastropods

Phylum Echinodermata: General characters and classification up to species level with suitable examples, Water vascular system in starfish, Larval forms of Echinodermata

Phylum Hemichordate: General characters and classification up to species level with suitable examples,

Balanoglossus - Structure and affinitie

ANIMAL DIVERSITY – BIOLOGY OF CHORDATES :

General characters and classification of Chordata upto species level Protochordata- Salient features of Cephalochordate, Structure of *Branchiostoma*Affinities of Cephalochordate. Salient features of Urochordata Structure and life history of *Herdmania*Retrogressive metamorphosis –Process and Significance.

Cyclostomata, General characters, Comparison of *Petromyzon* and *Myxine* Pisces: General characters and classification of Fishes upto species level ***Scoliodon*:** External features, Digestive system, Respiratory system, Structure and function of Heart, Structure and functions of the Brain. Migration in Fishes Types of Scales Dipnoi.

General characters of Amphibian Classification of Amphibian upto species level with examples. ***Ranahexadactyla*:** External features, Digestive system, Respiratory system, Structure and function of Heart, structure and functions of the Brain

Reptilia: General characters of Reptilia, Classification of Reptilia upto species level with examples

Calotes: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and function of Brain Identification of Poisonous and non-poisonous snakes and Skull in reptiles.

Aves: General characters and classification of Aves upto species level *Columba livia*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and function of Brain Migration in Birds Flight adaptation in birds.

General characters of Mammalian Classification of Mammalian upto species level with examples Comparison of Prototherians, Metatherians and Eutherians Dentition in mammals.

CELL BIOLOGY, GENETICS, MOLECULAR BIOLOGY AND EVOLUTION:

Cell Biology: Definition, history, prokaryotic and eukaryotic cells, virus, viroids, mycoplasma Electron microscopic structure of animal cell. Plasma membrane –Models and transport functions of plasma membrane. Structure and functions of Golgi complex, Endoplasmic Reticulum and Lysosomes Structure and functions of Ribosomes, Mitochondria, Nucleus, Chromosomes

Genetics-I: Mendel's work on transmission of traits Gene Interaction – Incomplete Dominance, Codominance, Lethal Genes Polygene's (General Characteristics & examples); Multiple Alleles (General Characteristics and Blood group inheritance Sex determination (Chromosomal, Genic Balance, Hormonal, Environmental and Haplo- diploidy types of sex determination) Sex linked inheritance (X-linked, Y-linked & XY-linked inheritance)

Genetics - II: Mutations &Mutagenesis, Chromosomal Disorders (Autosomal and Allosomal) Human Genetics – Karyo typing, Pedigree Analysis(basics)Basics on Genomics and Proteomics

Molecular Biology: Central Dogma of Molecular Biology Basic concepts of-

i. DNA replication – Overview (Semi-conservative mechanism, Semi- discontinuous mode, Origin & Propagation of replication fork)

ii. Transcription in prokaryotes – Initiation, Elongation and Termination, Post-transcriptional modifications(basics)

iii. Translation – Initiation, Elongation and Termination Gene Expression in prokaryotes (Lac Operon); Gene Expression in eukaryotes.

Origin of life Theories of Evolution: Lamarckism, Darwinism, Germ Plasm Theory, Mutation Theory Neo- Darwinism: Modern Synthetic, Theory of Evolution, Hardy-Weinberg Equilibrium Forces of Evolution: Isolating mechanisms, Genetic Drift, Natural Selection, Speciation

ANIMAL PHYSIOLOGY, CELLULAR METABOLISM ANDEMBRYOLOGY :

Animal Physiology -I: Process of digestion and assimilation, Respiration - Pulmonary ventilation, transport of oxygen and CO2, (Note: Need not study cellular respiration here), Circulation - Structure and functioning of heart, Cardiac cycle, Excretion - Structure and functions of kidney urine formation, counter current Mechanism

Animal Physiology -II: Nerve impulse transmission - Resting membrane potential, origin and propagation of action potentials along myelinated and non-myelinated nerve fibers. Muscle contraction - Ultra structure of muscle, molecular and chemical basis of muscle contraction. Endocrine glands - Structure, functions of hormones of pituitary, thyroid, parathyroid, adrenal glands and pancreas, Hormonal control of reproduction in a mammal

Cellular Metabolism – I(Biomolecules) Carbohydrates - Classification of carbohydrates. Structure of glucose Proteins - Classification of proteins. General properties of amino acids Lipids - Classification of lipids. Enzymes: Classification and Mechanism of Action

Cellular Metabolism –II: Carbohydrate Metabolism - Glycolysis, Krebs cycle, Electron Transport Chain, Glycogen metabolism, Gluconeogenesis, Lipid Metabolism – Synthesis of fatty acids, β-oxidation of palmitic acid Protein metabolism - Transamination, Deamination and Urea Cycle

Embryology: Gametogenesis Fertilization, Types of eggs Types of cleavages, Development of Frog upto formation of primary germ layers.

IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY:

Immunology – I (Overview of Immune system): Introduction to basic concepts in Immunology, Innate and adaptive immunity, Vaccines and Immunization programme, Cells of immune system, Organs of immune system

Immunology – II (Antigens, Antibodies, MHC and Hypersensitivity)

Antigens: Basic properties of antigens, B and T cell epitomes, happens and adjuvant; Factors influencing immunogenicity

Antibodies: Structure of antibody, Classes and functions of antibodies Structure and functions of major his to compatibility complexes, Exogenous and Endogenous pathways of antigen presentation and processing Hypersensitivity – Classification and Types

Techniques: Animal Cell, Tissue and Organ culture media: Natural and Synthetic media, Cell cultures: Establishment of cell culture (primary culture, secondary culture, types of cell lines; Protocols for Primary Cell Culture); Established Cell lines (common examples such as MRC, HeLa, CHO, BHK, Vero); Organ culture; Cryopreservation of cultures

Stem cells: Types of stem cells and applications, Hybridoma Technology: Production & applications of Monoclonal antibodies (mAb)

Applications of Animal Biotechnology: Genetic Engineering: Basic concept, Vectors, Restriction Endo nucleases and Recombinant DNA technology

Gene delivery: Microinjection, electroportion, biolistic method (gene gun), liposome and viral-mediated gene delivery

Transgenic Animals: Strategies of Gene transfer; Transgenic - sheep, fish; applications Manipulation of reproduction in animals: Artificial Insemination, *Invitro* fertilization, super ovulation, Embryo transfer, Embryo cloning

PCR: Basics of PCR.

DNA Sequencing: Sanger's method of DNA sequencing- traditional and automated sequencing.**Hybridization techniques**: Southern, Northern and Western blotting DNA fingerprinting: Procedure and applications.

Applications in Industry and Agriculture: Fermentation: Different types of Fermentation and Downstream processing;

Agriculture: Monoculture in fishes, polyploidy in fishes.

4. Social Studies (Geography, History, Civics and Economics) (SS)

GEOGRAPHY:

PHYSICAL GEOGRAPHY:

Definition, Nature, scope of Physical Geography, Classification of rocks. Earth Movements; organic, epeirogenic, earth quakes and volcanoes. Wegner 's theory of continental drift and plate tectonic theory. Weathering: causes and its types. Mass – movements; causes, its types and impacts. Concept of cycle of erosion; cycle of erosion by W.M. Davis. Process of Wind, River, Underground water, Glaciers and Sea waves. Weather and Climate; Origin, composition and structure of atmosphere. Insolation, Horizontal and vertical distribution of temperature, inversion of temperature. Atmospheric pressure- measurement and distribution, pressure belts, planetary winds, Monsoon and Local winds. Humidity- measurement and variables, evaporation, condensation, precipitation forms and types and distribution. Climate classification by Koppen.

Configuration of oceanic floors, Temperature and Salinity of ocean, Land and water distribution. Tides, waves and ocean currents.

HUMAN GEOGRAPHY:

Nature scope and Historical development of Human Geography. Division of Mankind: Spatial distribution of race and tribes of India. Human adaptation to the environment (i) Cold region — Eskimo (ii) Hot region- Bushman (iii) Plateau — Gonds (iv) Mountains — Gujjars.

Meaning, nature and components of resources; Classification of resources — renewal and non-renewable; biotic and abiotic, recyclable and non recyclable. Distribution and density of world population, population growth, fertility and mortality patterns. Concept of over, under and optimum population; Population theories: Malthus. Rural settlements: Meaning, classification and types. Urban settlements: Origin, classification. Population pressure, resource use and environment degradation;

ECONOMIC GEOGRAPHY:

Nature, scope and relationship of economic geography with economics and other branches of social sciences. Classification of economic activities. Factors affecting location of economic activity with special reference to agriculture Vonthunen Theory. We bar's industrial theory.

Spatial distribution of food (rice and wheat), commercial (cotton and sugarcane) and plantation crops (tea, rubber and coffee). Ferrous and non-ferrous resources, distribution and production of coal, iron ore, petroleum and natural gas. Classification of Industries, world distribution and production of iron and steel and textile industry. Transport, communication and trade: Land and air transport, recent trends in international trade.

GEOGRAPHY OF INDIA:

India: Location, relief structure and drainage systems. Climate, Soils, natural vegetation.

Population: distribution, density, growth and composition. Migration, human settlement types and urbanization. Land resources, irrigation, Green revolution and problems of Indian agriculture. Energy and mineral resources: coal, petroleum, hydroelectricity and nuclear energy, iron ore, manganese and mica. Industries- iron and steel, cotton textile, sugar and petrochemical industries; and industrial regions of India. Modes of transport and communication, international trade changing pattern of export and import.

INTRODUCTION TO REMOTE SENSING & GEOGRAPHICAL INFORMATION SYSTEM:

Introduction to Remote Sensing, Definition, Basis of remote sending. Electromagnetic spectrum, stages in remote sensing. Platforms of Remote Sensing, types of satellites. Types of Sensors

Introduction to Aerial Photographs: their advantages and types. Remote sensing in India Development. Applications of Remote sensing techniques in Geographical aspects. Introduction to Geographical Information Systems: Definition, Purpose, Advantages. History of GIS. Software and hardware requirements. Classification of Software and Hardware. GIS data types: Spatial and attribute data-Raster and Vector data structure. GPS/DGPS, Definition, GNSS and GPS applications. Remote sensing and GIS integration. Application of GIS in various fields of geography.

HISTORY:

ANCIENT INDIAN HISTORY & CULTURE (FROM INDUS VALLEY CIVIL. TO 13 CENTURY A.D):

Ancient Indian Civilization (from Circa 3000 BC to 6th BC): Indus Valley Civilization - Salient Features; Vedic Age - Society, Polity, Economy, Culture during early and later Vedic period.

Ancient Indian History & Culture (6th Century BC to 2rd Century AD): Doctrines and Impact of Jainism and Buddhism; Mauryan Administration, Society, Economy & Culture - Ashoka's Dhamma; Kanishka's Contribution to Indian Culture. History & Culture of South India (2nd Century BC to 8th Century AD): Sangam Literature; Administration, Society, Economy and Culture under Satavahanas; Cultural contribution of Pallavas. India from 3rd century AD to 8th century AD: Administration, Society, Economy, Religion, Art, Literature and Science & Technology under Guptas – Samudragupta; Cultural contribution of Harsha: Arab Conquest of Sind and its Impact. History and Culture of South India (9th century AD to 13th century AD): Local Self Government of Cholas; Administration, Society, Economy and Culture under Kakatiyas – Rudram Dev.

MEDIEVAL INDIAN HISTORY & CULTURE (1206 A.D TO 1764 A.D):

Impact of Turkish Invasions – Balban, AllauddhinKhilji, Md. Bin Tughlaq - Administration, Society, Economy, Religion and Cultural developments under Delhi Sultanate (from 1206 to 1526 AD). Impact of Islam on Indian Society and Culture – Bhakti Movement; Administration, Society, Economy, Religion and Cultural developments under Vijayanagara Rulers. Emergence of Mughal Empire – Babur – Sur Interregnum - Expansion & Consolidation of Mughal Empire – Akbar, Jahangir, Shah Jahan, Aurangazeb. Administration, Economy, Society and Cultural Developments under the Mughals – Disintegration of Mughal Empire - Rise of Marathas under Shivaji. India under Colonial Hegemony: Beginning of European Settlements - Anglo-French Struggle – Conquest of Bengal by EIC.

MODERN INDIAN HISTORY & CULTURE (1764-1947 A. D):

Policies of Expansion –Warren Hastings, Cornwallis - Subsidiary Alliance & Doctrine of Lapse – Causes & Results of 1857 Revolt – Lytton, Rippon, Curzon. Social, Religious & Self-Respect Movements – Raja Rammohan Roy, DayanandaSaraswathi, Swami Vivekananda, JyotibaPhule, Narayana Guru, Periyar, Dr. B. R. Ambedkar. Causes for the growth of Nationalism - Freedom Struggle from 1885 to 1920, Moderate Phase — Militant Phase: Vandemataram Movement - Home Rule Movement. Freedom Struggle from 1920 to 1947: Gandhiji's Role in the National Movement –

Revolutionary Movement – Subhas Chandra Bose. Muslim League & the Growth of Communalism – Partition of India – Advent of Freedom - Integration of Princely States into Indian Union – Sardar Vallabhai Patel.

HISTORY & CULTURE OF ANDHRA (FROM 1512 TO 1956 AD):

Andhra through 16th & 19th Centuries AD: Evolution of Composite culture- the Quatbshahi of Golkonda - Administration, Society &Economy - Literature & architecture: Advent of European and settlements in Andhra - Occupation of NorthrenCricars and Ceeded Districts - Early revolts again the British. Andhra Under British ruel: Administration - Land revenue settlements -Society - Education - Religion - Impact of Industrial revolution on economy- peasantry &famines - contribution of sir thomasmunroe& C.P. Brown - impact of 1857 revolts in Andhra. Social Reforms &New literary Movements :KandukuriVereeshalingam, RagupathiVenkatarathnam Naidu, GuruzadaAppaRao,Kommarraju Venkata Laxman Rao ; New literacy movements :RayaproluSubbaRao, Viswanath Satyanarayana, GurramJashua , BoyiBhimanna, Sri Sri.

Freedom Movement in Andhra (1885-1947): Vandemataram Movement– Home Rule Movement in Andhra - Non-Cooperation Movement - AlluriSeetarama Raju &Rampa Revolt (1922-24) - Civil Disobedience Movement – Quit India Movement. Movement for separate Andhra State (1953) and AP (1956): Causes – Andhra Maha Sabha –Conflict between Coastal Andhra &Rayalaseema – Sri Bagh Pact – work of various Committees – Martyrdom of PottiSriramulu – Formation of separate Andhra State (1953); Movement for formation of Andhra Pradesh (1956): VisalandhraMahasabha – Role of Communists – States Reorganization Committee – Gentlemen's Agreement – Formation of Andhra Pradesh.

HISTORY OF MODERN WORLD (FROM 15TH CENT. AD TO 1945 AD):

Transformation from Medieval to Modern Era – Chief Characteristics; Glorious Revolution (1688) Origin of Parliament Bill of Rights – Results. American Revolution (1776); French Revolution (1789) – Causes, Course and Results. Unification of Italy; Unification of Germany.

Communist Revolution in Russia; World War I: Causes – Results of the War – Paris Peace Conference; League of Nations. World War II: Causes, Fascism & Nazism – Results; The United Nations Organization: Structure, Functions and Challenges.

CIVICS:

Introduction to political science:

Introduction: Definition, Nature, Scope and Importance of Political Science – Relations with allied disciplines (History, Economics, Philosophy and Sociology). Approaches to the study of Political Science: Traditional Approaches-Philosophical, Historical. Modern Approaches-Behavioral and System Approach.

State: Definition of the State, Elements of the State, Theories of Origin of the State-(Divine Origin, Force, Evolutionary and Social Contract). Concepts of Modern State and Welfare State.

Concepts of political science: Law, Liberty, Equality. Power, Authority and Legitimacy.

Theories of rights: Meaning, Nature and Classification of Rights**.** Theories of Rights.

Political ideologies: Liberalism, Individualism, Anarchism. Socialism, Marxism and Multiculturalism

BASIC ORGANS OF THE GOVERNMENT:

Constitution: Meaning, Definition, Origin and Evolution of Constitution. Classification of the Constitutions-Written and Unwritten; Rigid and Flexible.

Organs of the government: Theory of Separation of Powers-B.D.Montesquieu.

Legislature-Unicameral and Bicameral-Power and Functions, Executive-Types, Powers and Functions. Judiciary-Powers and Functions.

Forms of government: Unitary and Federal forms of Governments-Merits and Demerits. Parliamentary and Presidential forms of Governments- Merits and Demerits.

Democracy: Meaning, Definition, Significance, Theories and Principles of Democracy.Types of Democracy: Direct and Indirect Democracy-Methods, Merits and Demerits-Essential Conditions for Success of Democracy.

Political parties, pressure groups and public opinion: Meaning, Definition and Classification of Political Parties: National and Regional-Functions of Political Parties. Pressure Groups (Interest Groups)- Meaning, Definition, Types, Functions and Significance of Public Opinion.

INDIAN GOVERNMENT AND POLITICS:

Social and ideological base of the indian constitution: Constitutional Development in India during British Rule-A Historical Perspective with reference to Government of India Acts, 1909,1919 and 1935. Constituent Assembly-Nature, Composition, Socio-Economic, Philosophical Dimensions and Salient Features of the Indian Constitution.

Individual and state: Fundamental Rights, Directive Principles of State Policy and Fundamental Duties-Differences between Fundamental Rights and Directive Principles of State Policy. The 'Doctrine of Basic Structure of the Constitution' with reference to Judicial Interpretations and Socio-Political Realities.

Union executive: President of India-Mode of Election, Powers and Functions.

Parliament-Composition, Powers and Functions, Legislative Committees, Prime Minister and Council of Ministers-Powers and Functions, Role in Coalition Politics

State executive: Governor-Mode of Appointment, Powers and Functions. Legislature-Composition, Powers and Functions, Chief Minister and Council of Ministers-Powers and Functions.

The indian judiciary: Supreme Court-Composition and Appointments, Powers and Functions or Jurisdiction of the Supreme Court, Judicial Review, Judicial Activism. High Court-Composition, Powers and Functions, Debates on the mode of appointment of Judges-National Judicial Appointments Commission and Judicial Reforms.

INDIAN POLITICAL PROCESS:

Federal processes: Features of Indian Federal System- Centre-State Relations-Legislative, Administrative and Financial. Emerging Trends in Centre-State Relations-Restructuring Centre- State Relations-Recommendations of Sarkaria Commission, M.M.Punchi Commission.

Electoral processes: The Election Commission of India, Powers and Functions.

Issues of Electoral Reforms, Voting Behaviour-Determinants and Problems of Defections.

Grossroot democracy-decentralisation: Panchayat Raj system-Local and Urban Governments-Structure, Powers and Functions. Democratic Decentralization-Rural Development and Poverty alleviation with reference to 73rd and 74th Constitutional Amendment Acts, Challenges and Prospects.

SOCIAL DYNAMICS AND EMERGING CHALLENGES TO INDIAN POLITICAL system: Role of Caste, Religion, Language and Regionalism in India. Politics of Reservation, Criminalization of Politics and Internal threats to Security.

Regulatory and governance institutions: NITI Ayog, Finance Commission, Comptroller and Auditor General of India. Central Vigilance Commission, Central Information Commission, Lokpal and Lokayukta.

WESTERN POLITICAL THOUGHT:

Ancient greek political thought: Plato-Rule of Philosopher Kings-Theory of Justice-Ideal State and Education. Aristotle-Theory of State-Classification of Governments-Citizenship, Slavery and Theory of Revolutions.

Medieval and modern political thought: St.Augustine-Theory of Two Cities.

Niccolo Machiavelli-State and Statecraft.

Contractual political thought: Thomas Hobbes- Social Contract and Absolute Sovereignty. John Locke- Human Nature, State of Nature, Social Contract, Natural Rights and Limited Government. Jean Jacques Rousseau- Human Nature, State of Nature, Social Contract, General Will and Popular Sovereignty.

Utilitarian political thought: Jermy Bentham-Theory of Utility, Law and Reforms. J.S.Mill-Theory of Liberty and Representative Government.

Marxist political thought: Karl Marx-Dialectical Materialism, Theory of Surplus Value and Class Struggle. Antonio Gramsci-Hegemony and Civil Society.

ECONOMICS:

MICROECONOMIC ANALYSIS:

Economic Analysis and Methodology: Meaning and Definitions of Economics- Scarcity and Choice as fundamental problems of economics - Scope and Importance of Micro economic analysis - Micro and Macro economic Analysis –Inductive and Deductive methods – partial and general equilibrium – Principles of Micro economics.

Theory of Consumption: Concept of Demand -Factors determining demand - Law of Demand - reasons and exceptions - Elasticity of Demand –Cardinal utility; Diminishing Marginal Utility and Equi Marginal Utility - Ordinal utility: Indifference Curve analysis: Properties of Indifference curves, Indifference Curve Map -Marginal Rate of Substitution - Budget Line - Changes -Consumer Equilibrium under Indifference Curve Analysis – Consumers' Surplus.

Theory of Production: Concept and Objectives of Firm - Production Function: Cobb- Douglas Production Function-Law of Variable Proportions -Laws of Returns to Scale - Economies of large scale - Concepts of Cost - Total, Average and Marginal Costs - Law of Supply - Concept of Revenue : Total, Average and Marginal Revenues - Relation between Average and Marginal Revenues and elasticity of Supply.

Theory of Exchange: Concepts of Market: Criteria for Classification of Markets - Perfect Competition– Conditions, Price and Output determinations; Monopoly : Conditions, Price and Output Determination - Price Discrimination; Monopolistic Competition - Assumptions - Price and output determination - Selling Costs ; Oligopoly -Types- Kinky demand curve and Price rigidity.

Theory of Distribution: The concepts of Functional and Personal Distribution of Income - Marginal Productivity Theory of Distribution - Modern Theory of Distribution -Concept of Rent - Ricordian Theory of Rent – Marshall's concepts of Economic Rent and Quasi Rent; Theories of Wage Determination: Subsistence Theory and Standard of Living Theory - Modern Theory of Wages; Classical Theory of Interest -Liquidity Preference Theory of Interest; Theories of Profit: Risk and Uncertainty, Dynamic and Innovations Theories.

MACRO ECONOMIC ANALYSIS:

National Income: Macroeconomics - Definition, Scope and Importance - Difference between Micro economic and Macro economic Analyses – Circular Flow of Income -National Income: Definitions, Concepts, Measurement of National Income - Difficulties - Importance - Concept of Green Accounting.

Theory of Employment: Classical Theory of Employment - Say's Law of Markets - Criticism - Keynesian Theory of Employment - Consumption Function - Keynes' Psychological Law of Consumption - Average and Marginal Propensity to Consume - Factors determining Consumption Function- Investment Function: Marginal Efficiency of Capital -Multiplier and Accelerator - Keynesian Theory of Employment.

Money and Banking: Definitions of Money - Concepts of Money, Liquidity and Finance - Gresham's Law - RBI classification of Money - Theories of Money: Fisher and Cambridge (Marshall, Pigou, Robertson and Keynes equations) - Banking - Definition and types of Banking - Commercial Banks - Functions -Recent Trends in Banking - Mergers and Acquisitions - Central Bank - Functions - Control of Credit by Central Bank - NBFCs- Factors contributing to their Growth and their Role.

Inflation and Trade Cycles: Inflation: Concepts of Inflation, deflation and stagflation - Phillip's Curve - Measurement of Inflation - CPI and WPI -Types of Inflation - Causes and Consequences of Inflation -Measures to Control Inflation. Trade Cycles: Phases of Trade Cycle -Causes and Measures to control Trade Cycles.

Finance and Insurance: Financial Assets and Financial Instruments - Financial Markets - Functions of Money Market - Functions of Capital Market - Stock Market - Exchanges – Index: Sensex and Nifty – Concept of Insurance -Types and Importance of Insurance

DEVELOPMENT ECONOMICS:

Economic Growth and Development: Economic Development as a Branch of Study of Economics – Scope and Importance - Distinction between Economic Growth and Economic Development - Measures of Economic Development and their limitations - Relevance of Herd (Group) Immunity in the context of COVID 19 - three core values of economic development: Sustainability, Self-esteem and Freedom – Economy and Environment: Concepts of sustainable development and inclusive growth**.**

Modern Economic Growth: Characteristics of Underdeveloped Countries - World Bank and IMF Classification of countries - Modern economic growth – Kuznets' Six Characteristics -Obstacles to economic development - Vicious Circle of Poverty and cumulative causation -Factors of economic growth: Economic and Non-economic - Capital Formation – Foreign and Domestic capital, Debt and Disinvestment.

Theories of Development and Underdevelopment: Classical Theory: Adam Smith, Ricardo and Malthus -Marxian Theory - Schumpeter Theory -Rostow's Stages of Economic Growth -Harrod-Domar two sector model -Solow's Model and Robinson's Golden Age.

Strategies of Economic Development: Strategies of Economic Development – Big Push -Balanced Growth -Unbalanced Growth - Mahalanobis Model - Agriculture vs Industry -Capital Intensive Technology vs Labour Intensive Technology -Role of Infrastructure in Economic Development.

Institutions and Economic Development: Role of State in Economic Development -Role of Markets - Market Failure and Regulation by State -Public sector vs Private sector -Economic Planning – concept, objectives and types -NITI Ayog - Economic Federalism -Financial Institutions and Economic Development -Role of International Institutions-IDBI, ADB, IMF -Foreign Trade - FIIs and FDIs.

ECONOMIC DEVELOPMENT- INDIA AND ANDHRA PRADESH:

Basic Features: Basic characteristics of Indian Economy as a developing economy – Economic development since independence - Objectives and achievements of planning – Planning Commission/NITI Ayog and their approaches to economic development - India's Rank in Global Human Development Index.

National Income and Demography: Trends in National income - Demographic trends - Poverty and Inequalities – Occupational Structure and Unemployment - Various Schemes of employment generation and eradication of poverty – Issues in Rural Development and Urban Development –Intra-state and Inter-state Labour Migration and unorganized sector Problems of Migrant Labour.

Agricultural and Industrial Developments: Indian Agriculture – Agricultural Strategy and Agricultural Policy – Agrarian Crisis and land reforms – Agricultural credit – Minimum Support Prices -Malnutrition and Food Security - Indian Industry - Recent Industrial Policy – Make-in India – Start-up and Stand-up programmes – SEZs and Industrial Corridors - Economic Reforms and their impact - Economic initiatives by government of India during COVID - Atmanirbhar Bharat package.

Indian Public Finance: Fiscal policy- Indian Tax System and Recent changes – GST and its impact on Commerce and Industry – Centre, States financial relations- Recommendations of Recent Finance Commission – Public Expenditure and Public Debt –Concepts of Budget.

Andhra Pradesh Economy: The basic characteristics of Andhra Pradesh economy after bifurcation in 2014 – Impact of bifurcation on the endowment of natural resources and state revenue – new challenges to industry and commerce - the new initiatives to develop infrastructure – Power and Transport –Health and Education- Information Technology and e-governance – Urbanization and smart cities – Skill development and employment –Recent Social welfare programmes.

STATISTICAL METHODS FOR ECONOMICS:

Nature and Definition of Statistics: Introduction to Statistics – Definition, scope, importance and limitations of Statistics – Primary and Secondary data- Census and Sampling techniques and their merits and demerits.

Diagrammatic Analysis: Collection of data - Schedule and questionnaire – Frequency distribution – Tabulation – diagram and graphic presentation of data – Histogram, Frequency Polygon, Cumulative Frequency Curves - Bar Diagrams and Pie Diagram.

Measures of Central Tendency and Dispersion: Measures of Central Tendency and Dispersion - Types of averages- Arithmetic Mean, Geometric Mean, Harmonic Mean – Median – Mode – Dispersion - Range, Quartile Deviation, Mean Deviation, Standard Deviation- Coefficient of Variation.

Correlation and Regression: Correlation and Regression - Meaning, Definition and uses of Correlation- Types of Correlation- Karl Pearson's Correlation coefficient - Spearman's Rank Correlation- Regression Equations - utility of regression analysis – Demand forecasting.

Time Series and Index Numbers: Time Series and Index Numbers: Definition and components of Time Series – Measurement of Time Series – Moving Average and the Least Squares Method – Index Numbers - Concepts of Price and Quantity Relatives – Laspeyer's, Paasche's and Fisher's Ideal Index Numbers – Uses and Limitations of Index Numbers.

(For these four subjects Syllabus shall be of graduation level (revised syllabus under CBCS)

5. English [Special English in B.A.]

The Syllabus for Part C for Subject: English shall cover

a) Syllabus pertaining to English for Classes VIII, IX and X and that for the Two-Year Intermediate course of A.P-50 Questions (50 Marks)

Topics

i) Language functions ii) Elements of Phonetics iii) Grammar

iv) Phrasal Verbs (idioms) v) Writing skills vi) Study skills vii) Reference skills

b) Syllabus prescribed for Optional English at B.A. Degree Level (B.A. Special English)/ Modern Literature Syllabus in English-50 Questions (50 marks)

AN INTRODUCTION TO THE ENGLISH LITERATURE (600-1500):

History of English Literature: Old English, Middle English and Renaissance Periods

Introduction to the Genres, Literary Forms and Terms: Poetry, drama, criticism, Ballad, Epic, romance, lyric, ode, elegy, pastoral elegy, sonnet, mystery / miracle plays, morality play, rhyme, meter, metaphysical conceit

Poetry: Chaucer: *Controlling the Tongue* Edmund
Spenser: *One day I Wrote Her Name*

Drama: Marlowe: Dr. Faustus

Literary Criticism: Sir Philip Sidney: Apologie for Poetry

AN INTRODUCTION TO ELIZABETHAN AND JACOBEAN LITERATURES (1500-1660):

History of English Literature Genre, Literary Forms: Elizabethan and Jacobean (16th and 17th Century) Simile, metaphor, personification, alliteration, apostrophe, hyperbole, allegory, allusion, anti-climax, irony, blank verse, tragedy, comedy, tragic-comedy, romantic comedy, chronicle play, masque, comedy of humours, farce

Drama (Romantic Comedy): William Shakespeare: *Twelfth Night*

Poetry: John Donne: *For whom the Bell Tolls*
Ben Jonson: *It is not Growing Like a Tree*

Prose: Francis Bacon: Of Superstition, Of Parents and Children

Literary Criticism: Aristotle's *Poetics* – Section I

AN INTRODUCTION TO RESTORATION AND AUGUSTAN LITERATURE (1660-1750):

History of English Literature Literary Forms and Terms: Restoration and Augustan Periods (17th and 18th Centuries). Satire, mock-epic, heroic couplet, epistle, heroic tragedy, comedy of manners, genteel comedy, sentimental comedy, periodical essay.

Poetry: Jonathan Swift: *The Place of the*
Damned John Bunyan: *Upon the Disobedient Child*

Drama: William Congreve: *The Way of the World*

Prose: *Addison and Steele: A Lady's Diary, Advice in Love*

Literary Criticism: Samuel Johnson: Preface to Shakespeare

AN INTRODUCTION TO ROMANTIC AND VICTORIAN (1757-1901):

History of English Literature Literary Forms and Terms: Romantic and Victorian Periods biography, autobiography, melodrama, historical novel, sentimental novel, gothic novel, regional novel, flat character, round character, protagonist, antagonist

Poetry: Wordsworth: Tintern Abbey Christina Rosetti: A Birthday
Elizabeth Barret Browning: The Lady's Yes.

Drama: Oliver Goldsmith: She Stoops to Conquer

Fiction: Jane Austen: *Pride and Prejudice*

Literary Criticism: Matthew Arnold: The Study of Poetry

GLIMPSES OF WORLD LITERATURE:

Poetry: *1.* Anna Akhmatova: *How I Taught Myself to live simple*
2. A.D. Hope: *The Sacred Way*
*3.*Maya Angelou: *Caged Bird*

Drama: Vijay Tendulkar: *Silence! The Court is in Session*

Fiction: Nadine Gordimer*: July's People*

Short Story: Tillie Olsen*: I Stand Here Ironing*
Glenda Adams*: Lies*