

Written Examination Syllabus for the post of Degree College Lecturers in Residential Educational Institutions Societies

Syllabus

Paper - I

Section-I: General Studies

1. Current Affairs - Regional, National & International.
2. Indian Constitution; Indian Political System; Governance and Public Policy.
3. Social Exclusion; Rights issues such as Gender, Caste, Tribe, Disability etc. and inclusive policies.
4. Society Culture, Civilization Heritage, Arts and Literature of India and Telangana
5. General Science; India's Achievements in Science and Technology
6. Environmental Issues; Disaster Management- Prevention and Mitigation Strategies and Sustainable Development.
7. Economic and Social Development of India and Telangana.
8. Socio-economic, Political and Cultural History of Telangana with special emphasis on Telangana Statehood Movement and formation of Telangana state.

Section-II: General Abilities

9. Analytical Abilities: Logical Reasoning and Data Interpretation.
10. Moral Values and Professional Ethics in Education.
11. Teaching Aptitude

Section - III: Basic Proficiency in English

i) School Level English Grammar:

Articles; Tense; Noun & Pronouns; Adjectives; Adverbs; Verbs; Modals; Subject-Verb Agreement; Non-Finites; Reported Speech; Degrees of Comparison; Active and Passive Voice; Prepositions; Conjunctions; Conditionals.

ii) Vocabulary:

Synonyms and Antonyms; Phrasal Verbs; Related Pair of Words; Idioms and Phrases; Proverbs.

iii) Words and Sentences:

Use of Words; Choosing Appropriate words and Words often Confused; Sentence Arrangement, Completion, Fillers and Improvement; Transformation of Sentences; Comprehension; Punctuation; Spelling Test; Spotting of Errors.

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Paper - II: English

I. Genres, Movements, Schools, Concepts:

- Renaissance-Reformation, Metaphysical poetry, Neo-classicism, Puritanism, Restoration, Romanticism, Victorian Age, Realism-Naturalism, Expressionism, Symbolism, Modernism, Postmodernism.
- Structuralism, Poststructuralism, Feminism, Postcolonialism, Diaspora, Race Gender and Caste.
- English Literary Criticism from Philip Sydney to Matthew Arnold
- New Criticism, Formalism, Archetypal criticism, New Historicism, Psychoanalytical criticism, Reader response criticism.
- Literary Genres: Poetry, Fiction, Prose, Drama (origins and development, elements, forms, types)

II. Writers and Texts:

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|-----------------------|--|
| • Christopher Marlowe | Doctor Faustus |
| • William Shakespeare | Hamlet |
| • John Milton | Paradise Lost-Book 1 |
| • William Wordsworth | “Immortality Ode”, Tintern Abbey |
| • Robert Browning | “My Last Duchess”, “Andrea del Sarto” |
| • Thomas Hardy | Tess of the d’ Urbervilles |
| • TS Eliot | The Waste Land |
| • G.B. Shaw | Saint Joan |
| • Virginia Woolf | “A Room of One’s Own” |
| • William Golding | Lord of the Flies |
| • Walt Whitman | “When Lilacs Last in the Dooryard Bloomd”, “Crossing Brooklyn Ferry” |
| • Arthur Miller | Death of a Salesman |
| • Toni Morrison | Beloved |
| • Mulk Raj Anand | Untouchable |
| • Kamala Das | “An Introduction”, “The Old Playhouse” |
| • Girish Karnad | Hayavadana |
| • Salman Rushdie | Midnight’s Children |
| • Chinua Achebe | Things Fall Apart |
| • Margaret Atwood | Edible Woman |
| • Derek Walcott | Dream on Monkey Mountain |

III. English Language Teaching:

1. ELT in India : (History and status of English in India; English as Second Language, English as Foreign Language, and English as Global Language).
2. Methods and Approaches: (Grammar Translation method, Direct method, Audio-Lingual method; Structural approach, Communicative language teaching)
3. Teaching of Language Skills : (Teaching of Listening, Speaking, Reading, and Writing Skills; Teaching of Grammar and Functional English; Teaching of Vocabulary; Classroom techniques; Use of authentic materials) Teaching literature.
4. Testing and Evaluation: (Principles, Types, Objectives of testing and evaluation)
5. Phonetics and Phonology; Syntax and Structure.

IV. Literary comprehension - (Excerpts from poetry and prose for comprehension)

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Paper - II: Telugu

(ఎ) సంప్రదాయ సాహిత్యకవుల అధ్యయనం - కాలం - రచనలు

నన్నయ, తిక్కన, ఎర్రన, శివకవులు (నన్నెచోడుడు, మల్లికార్జున పండితారాధ్యుడు, పాల్కురికి సోమనాథుడు), నాచనసోమన - భాస్కర రామాయణ కావులు, రంగనాథ రామాయణ కవి - శ్రీనాథుడు - పోతన - పిల్లలమర్రి పినవీరభద్రుడు - గౌరన - అనంతామాత్యుడు - కొరవి గోపరాజు - నంది మల్లన, ఘంట సింగన - అష్టదిగ్గజ కవులు - తాళ్ళపాక కవులు - పొన్నగంటి తెలగన్న - చేమకూర వెంకటకవి - తంజావూరు రాజకవులు కవయిత్రులు - కందుకూరి రుద్రకవి, మడికి సింగన

(బి) వేమన తాత్త్వికత - సమకాలిక పరిశీలన, దృక్పథం - సమాజంపై వేమన కవిత్వ ప్రభావం.

సాహిత్య ధోరణుల అధ్యయనం - యుగప్రభావం - రూపాలు - మొదలైనవి. ఇతిహాసం - పురాణం ప్రబంధం - శతకం - సంకీర్తన సాహిత్యం - చారిత్రక కావ్యం - సంప్రదాయ, ఆధునిక గద్య రచనలు - నవల - కథానిక - వ్యాసం - ఏకాంకిక మొదలైనవి - వాదాలు (దళిత, హేతు, స్త్రీ, మైనారిటీ , బి.సి. ప్రాంతీయ)

జానపద విజ్ఞానం - గేయాలు - కతాగేయాలు - గద్యాభ్యాసాలు - (పురాణగాథలు - ఐతిహ్యాలు - కథలు), సామెతలు - పొడుపుకథలు - జానపద కళలు - (వీధి నాటకాలు, యక్షగానాలు, బొమ్మలాటలు,, పగటి వేషాలు, చిందు, ఒగ్గు, జాతర కళారూపాలు.

ఆధునిక కవులు అధ్యయనం - ఆధునిక ధోరణులు వారి రచనలు - గురజాడ - రాయప్రోలు - విరేశలింగం - విశ్వనాథ - దేవులపల్లి - బసవరాజు - పింగళి - కాటూరి - దువ్వూరి - పుట్టపర్తి - శ్రీశ్రీ - కాళోజి, దాశరథి, సి. నారాయణ రెడ్డి , ఎన్. గోపి - ప్రసిద్ధ ఆధునిక కవులు - భావ, అభ్యుదయ, విప్లవ, - దిగంబర, చేతనావర్తన కవులు.

తెలుగు వ్యాకరణ, ఛందస్సు అధ్యయనం:

వ్యాకరణం - బాల వ్యాకరణం (సంజ్ఞ, సంధి, క్రియా, తత్సమ, ఆచ్ఛిక ప్రకరణాలు ఛందస్సు - వృత్తాలు, జాతులు, ఉపజాతులు (ఉత్పలమాల, చంపకమాల, శార్దూలం, మత్తేభం, ద్విపద, తరువోజ , సీసం, కందం, స్రగ్ధర , పంచచామరం) అలంకారాలు - అర్థాలంకారాలు, శబ్దాలంకారాలు తెలుగు భాషా చరిత్ర పరిణామం - (ప్రాజ్ఞాస్మయ యుగం నుండి నేటి వరకు) - ద్రావిడ భాషా కుటుంబాలలో తెలుగు స్థానం - భౌగోళిక విభజన - మాండలికాలు.

భాషా విజ్ఞాన అధ్యయనం - భాషా శాస్త్రం, అర్థ విపరిణామం - ఆధునిక కాలం,: శాసన భాష నుండి సాహిత్య భాష వరకు (వ్యావహారిక భాష ఉద్యమం వంటివి

తెలుగు సాహిత్య పరిణామం (ప్రాజ్ఞాస్మయ యుగం నుండి నేటి వరకు) సాందర్య, సాహిత్య విమర్శ అధ్యయనం (ఫ్రాక్, పల్లీమ) ఆధునిక తెలుగు సాహిత్య విమర్శ. సంస్కృత వ్యాకరణం - కావ్యాలు - సంస్కృత వ్యాకరణం ప్రాథమిక విజ్ఞానం, సామాన్య ప్రామాణిక గద్య, పద్య పాఠ్యాంశాలు - హితోపదేశం, కాళిదాసుని కృతులు, సంస్కృత పంచకావ్యాల పరిచయం.

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Paper - II: Mathematics

I. Real Analysis

Finite, Countable and Uncountable sets - Real Number system \mathbb{R} - Infimum and Supremum of a subset of \mathbb{R} - Bolzano- Weierstrass Theorem- Sequences- Convergence- Limit Superior and Limit Inferior of a Sequence- Sub sequences- Heine- Borel Theorem- Infinite Series - Tests of Convergence-Continuity and Uniform continuity of a real valued function of a real variable- Monotonic Functions- Functions of Bounded Variation- Differentiability and Mean Value Theorems- Riemann Integrability-Sequences and Series of Functions

II. Metric Spaces

Metric spaces - Completeness- Compactness- Connectedness - Continuity and Uniform continuity of a function from one metric space into another-Topological Spaces - Bases and Subbases - Continuous functions

III. Elementary Number Theory

Primes and Composite numbers - Fundamental Theorem of Arithmetic - Divisibility - Congruences- Fermat's theorem - Wilson's Theorem - Euler's Phi - Function

IV. Group Theory

Groups- Subgroups- Normal Subgroups- Quotient groups- Homomorphisms- Isomorphism Theorems-Permutation groups- Cyclic groups- Cayley's theorem. Sylow's theorems - Their applications

V. Rings and Fields

Rings- Integral domain- Fields- Subrings - Ideals - Quotient rings - Homomorphisms - Prime ideals-Maximal ideals - Polynomial rings - Irreducibility of polynomials - Euclidean domains- Principal ideal domains-Algebraic, Normal, Separable extensions of fields- Galois Theory

VI. Vector Spaces

Vector Spaces, Subspaces - Linear dependence and independence of vectors - basis and dimension -Quotient spaces - Inner product spaces - Orthonormal basis - Gram- Schmidt process.

VII. Functional Analysis

Normed Linear Spaces- Banach Spaces -Inner Product Spaces- Hilbert Spaces-Linear Operators- Linear Functionals- Open Mapping Theorem- Closed Graph Theorem- Uniform Boundedness theorem- Hahn- Banach Theorem

VIII. Theory of Matrices

Linear Transformations - Rank and nullity - Change of bases- Matrix of a Linear Transformation -Singular and Non-singular matrices - Inverse of a matrix - Eigenvalues and Eigenvectors of a matrix and of a Linear Transformation - Cayley- Hamilton's theorem- Quadratic forms- Signature and Index

IX. Complex Analysis

Algebra of Complex Numbers - The Complex Plane - Complex Functions and Their Analyticity - Cauchy-Riemann equations - Mobius transformations- Power Series-Complex Integration - Cauchy's Theorem - Morera's Theorem - Cauchy's Integral Formula - Liouville's Theorem - Maximum Modulus Principle - Schwarz's Lemma - Taylor's Series - Laurent's Series-Calculus of Residues - Evaluation of Integrals

X. Ordinary Differential Equations

Ordinary Differential Equations (ODE) of First order and First degree - Different methods of solving them - Exact Differential equations and Integrating factors ODE of First order and Higher degree - Equations solvable for p , x and y - Clairaut's equations -Singular Solutions- Linear Differential Equations with Constant Coefficients and Variable Coefficients- Variation of Parameters

XI. Partial Differential Equations

Formation of Partial Differential Equations (PDE) - Lagrange and Charpit's methods for Solving first order PDEs - Cauchy problem for first order PDEs- Classification of Second Order PDE's - General Solution of Higher Order PDEs with Constant Coefficients

XII. Solid Geometry

The Plane- Right line- Sphere- Cones and Cylinders

Main Examination Syllabus for the post of Degree Lecturers in Residential Educational Institutions Societies

Paper - II: Physics

I. Mathematical Methods of Physics

Dimensional analysis, vector algebra and vector calculus. Linear algebra, matrices, Cayley-Hamilton Theorem. Eigenvalues and eigenvectors. Linear ordinary differential equations of first & second order, special functions (Hermite, Bessel, Laguerre and Legendre functions). Fourier series, Fourier and Laplace transforms. Elements of complex analysis, analytic functions; Taylor & Laurent series: poles, residues and evaluation of integrals. Elementary probability theory, random variables, binomial, Poisson and normal distributions. Central limit theorem.

II. Classical Mechanics

Newton's laws. Dynamical systems, Phase space dynamics, stability analysis. Central force motions. Two body collisions-scattering in laboratory and centre of mass frames. Rigid body dynamics-moment of inertia tensor. Non-inertial frames and pseudo forces. Variational principle. Generalized coordinates. Lagrangian and Hamiltonian formalisms and equations of motion. Conservation laws and cyclic coordinates. Periodic motion: small oscillations, normal modes. Special theory of relativity-Lorentz transformations, relativistic kinematics and mass-energy equivalence.

III. Electromagnetic Theory

Electrostatics: Gauss's law and its applications, Laplace and Poisson equations, boundary value problems. Magneto statics: Biot-savart law, Ampere's theorem. Electromagnetic induction. Maxwell's equations in free space and linear isotropic media; boundary conditions on the fields at interfaces. Scalar and vector potentials, gauge invariance. Electromagnetic waves in free space. Dielectrics and conductors. Reflection and refraction, polarization, Fresnel's law, interference, coherence and diffraction. Dynamics of charged particles in static and uniform electromagnetic fields. Charges particles in inhomogeneous fields.

IV. Quantum mechanics

Wave-particle duality. Schrodinger equation (time-dependent and time-independent). Eigenvalue problems (particle in a box, harmonic oscillator, etc.). Tunnelling through a barrier. Wave function in coordinate and momentum representations. Commutators and Heisenberg uncertainty principle. Dirac notation for state vectors. Motion in a central potential: Orbital angular momentum, angular momentum algebra, spin, addition of angular momenta; Hydrogen atom. Stern-Gerlach experiment. Time independent perturbation theory and applications. Variational method. Time dependent perturbation theory and Fermi's golden rule. Selection rules. Identical particles. Pauli exclusion principle. Spin-statistics connection.

V. Thermodynamics and statistical Physics

Laws of thermodynamics and their significance. Thermodynamic potentials, Maxwell relations, chemical potential, Phase equilibria. Phase space. Micro and macro- states. Micro-canonical, canonical and grand-canonical ensembles and partition functions. Free energy and its connection with thermodynamic quantities. Classical and quantum statistics. Bose and Fermi gases. Principle of detailed balance. Black body radiation and Planck's distribution law

VI. Electronics

Semiconductor devices (diodes, junctions, transistors, field effect devices, homo- and hetero junction devices), device structure, device characteristics, frequency dependence and applications. Optoelectronic devices (solar cells, photo detectors, LEDs). Rectifiers and power supplies. Feedback amplifiers and their frequency response. Oscillators, Multivibrators. Operational amplifiers and their applications, Digital techniques and applications (Logic circuits, registers, counters and Comparators). A/D and D/A converters. Microprocessors, micro controller basics. Fundamentals of AM communication, FM communication and Fibre optic communication and their techniques.

VII. Atomic & Molecular Physics

Quantum States of an electron in an atom. Electron spin. Spectrum of Helium and alkali atom. Relativistic corrections for energy levels of hydrogen atom, hyper fine structure

and isotopic shift, width of spectrum lines, LS & JJ couplings. Zeeman, Paschen-Bach & Stark effects. Frank-Condon principle. Electronic rotational, vibrational and Raman spectra of diatomic molecules. Selection rules. Lasers: spontaneous and stimulated emission, Einstein A & B coefficients. Optical pumping, Population inversion, rate equation. Modes of resonators and coherence length.

VIII. Condensed Matter Physics

Bravais lattice. Reciprocal lattice. Diffraction and the structure factor. Bonding of solids. Elastic properties, Phonons, lattice specific heat. Free electron theory and electronic specific heat. Response and Relaxation phenomena. Drude model of electrical and thermal conductivity. Hall Effect and thermoelectric power. Electron motion in a periodic potential, band theory of solids; metals, insulators and semiconductors. Superconductivity: Type-I and type-II superconductors. Josephson junctions. Superfluidity. Defects and dislocations. Ordered phases of matter: translational and orientation order, kinds of liquid crystalline order. Quasi crystals.

IX. Nuclear and Particle Physics

Basics of radio activity. Basic nuclear properties; size, shape and charge distribution, spin and parity. Binding energy, Semi-empirical mass formula, liquid drop model. Nature of the nuclear force, form of nucleon-nucleon potential, charge independence and charge symmetry of nuclear forces. Deuteron problem. Evidence of shell structure, single-particle shell model, its validity and limitations. Elementary ideas of alpha, beta and gamma decays and their selection rules. Fission and fusion. Nuclear reactions. Reaction mechanism, compound nuclei and direct reactions.

X. Mathematical Methods of Physics

Green's function. Partial differential equations (Laplace, wave and heat equations in two and three dimensions). Elements of computational techniques: root of functions, interpolation, and extrapolation, integration by trapezoid and Simpson's rule, solution of first order differential equation using Runge-Kutta method. Finite difference methods. Tensors. Introductory group theory.

XI. Classical Mechanics

Basic concepts of Dynamical systems, Poisson brackets and canonical transformations. Symmetry, invariance and Noether's theorem. Hamilton-Jacobi theory.

XII. Electromagnetic Theory

Dispersion relations in Plasma. Lorentz invariance of Maxwell's equation. Transmission lines and wave guides. Radiation from moving charges and dipoles and retarded potentials.

XIII. Quantum Mechanics

Spin-Orbit coupling, fine structure. WKB approximation. Elementary theory of scattering: Phase shifts, partial waves, Born approximation. Relativistic quantum mechanics: Klein-Gordon and Dirac equations. Semi-classical theory of radiation.

XIV. Thermodynamics and Statistical Physics

First- and second-order phase transitions. Diamagnetism, paramagnetism and ferromagnetism. Ising model. Bose-Einstein condensation. Diffusion equation. Random walk and Brownian motion. Introduction to non equilibrium processes.

XV. Condensed Matter Physics

Phase contrast microscopy, Thermo gravimetric analysis. Differential scanning calorimetry. Theory and applications of Mossbauer effect. Electron Spin Resonance (ESR), Nuclear Magnetic Resonance (NMR), Chemical shift and applications. X-ray diffraction technique, scanning electron microscopy and transmission electron microscopy and their applications.

XVI. Nuclear and Particle Physics

Classification of fundamental forces. Elementary particles and their quantum numbers (charge, spin, parity, isospin, strangeness, etc.). Quark model, baryons and mesons. C, P, and T invariance. Applications of symmetry arguments to particle reactions. Parity non-conservation in weak interaction. Relativistic kinematics.

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Paper - II: Chemistry

Inorganic chemistry:

- I. Atomic structure and chemical bonding - structure and bonding in homo and hetero nuclear molecules. Application of VSEPR, Valence Bond and Molecular orbital theories in explaining the structures of simple molecules.
- II. Chemistry of main group (I to VII & Nobel gases) elements.
- III. Chemistry of transition elements and inner transition elements.
- IV. General principles of metallurgy: Occurrence of metals, Concentration of ores - levigation, magnetic separation, froth floatation, leaching, Extraction of crude metal from concentrated ore - conversion to oxide, reduction of oxide to the metal, Thermodynamic principles of metallurgy - Ellingham diagram limitations, applications. Extraction of iron, copper and zinc from their oxides, Electrochemical principles of metallurgy, Oxidation and reduction, Refining of crude metal - distillation, liquation, poling, electrolysis, zone refining and vapour phase refining, Uses of aluminium, copper, zinc and iron. Alloys: Inter-metallic compounds
- V. Concept of Symmetry in Molecules - Symmetry Operations - Symmetry Elements : Rotational Axis of Symmetry and Types of Rotational Axes, Plane of Symmetry and types of Planes, Improper Rotational Axis of Symmetry, Inversion Center and Identity Element. Molecular Point Groups: Definition and Notation of Point Groups, Classification of Molecules into C_1 , C_s , C_i , C_n , C_{nv} , C_{nh} , D_n , D_{nh} , D_{nd} , S_n , T_d , O_h & I_h .
- VI. Coordination Chemistry - IUPAC nomenclature, bonding theories - Werner's theory, EAN rule, VBT, Crystal Field Theory - Crystal Field splitting patterns in various geometries, Factors affecting $CFSE$. Calculation of $CFSE$ - Jahn Teller effect - Isomerism in complexes. Spectral and magnetic properties of Coordination complexes - Russell Sanders coupling - term symbols - charge transfer spectra of complexes.
- VII. Stability of metal complexes - Stepwise and overall stability constants - Factors affecting the stability of metal complexes - Chelate effect. Pearson's theory of hard and soft acids and bases (HSAB).
- VIII. Reaction mechanism of metal complexes - Inert and labile complexes - Ligand substitution reaction of octahedral complexes - Acid hydrolysis, Base hydrolysis - Conjugate base mechanism - Anation reactions - Substitution reactions of square planar complexes - Trans effect - Electron transfer reactions - Inner and outer sphere mechanisms.
- IX. Metal carbonyls, Nitrosyls and Metallocenes - Structure and bonding.
- X. Bio-inorganic chemistry - Metal complexes as oxygen carriers - Hemoglobin and myoglobin - Oxygen transport - Non heme proteins - Hemerythrin and hemocyanin.
- XI. Analytical chemistry - Chromatography - General principles involved in separations by Paper, Thin layer, Column Chromatography, GC and HPLC.

Physical Chemistry:

- I. Solutions and colligative properties: Types of solutions, Expressing concentration of solutions mass percentage, volume percentage, mass by volume percentage, parts per million, mole fraction, molarity and molality, Solubility: Solubility of a solid in a liquid, solubility of a gas in a liquid, Henry's law, Vapour pressure of liquid solutions: vapour pressure of liquid- liquid solutions. Raoult's law as a special case of Henry's law - vapour pressure of solutions of solids in liquids, Ideal and non-ideal solutions, Colligative properties and determination of molar mass - Relative lowering of vapour pressure, elevation of boiling point, Depression of freezing point, Osmosis and osmotic pressure - reverse osmosis and water purification. Abnormal molar masses - van't Hoff factor. Phase equilibria - Phase rule and its application to one component and two component systems

- II. Acids and bases: Acids, bases and salts- Arrhenius, Bronsted-Lowry and Lewis concepts of acids and bases. Ionisation of Acids and Bases - Ionisation constant of water and its ionic product- pH scale ionisation constant of weak acids and weak bases- relation between K_a and K_b . Di and poly basic acids and di and poly acidic Bases- Factors affecting acid strength- Common ion effect in the ionization of acids and bases- Hydrolysis of salts and pH of their solutions. Buffer solutions.
- III. Thermodynamics: Brief review of concepts of I and II laws of thermodynamics. Concept of entropy. Entropy as a state function. Calculation of entropy changes in various processes. Entropy changes in an ideal gas. Entropy changes on mixing of ideal gases. Entropy as a function of V and T. Entropy as a function of P and T. Entropy change in isolated systems- Clausius inequality. Entropy change as a criterion for spontaneity and equilibrium. Third law of thermodynamics. Evaluation of absolute entropies from heat capacity data for solids, liquids and gases. Standard entropies and entropy changes of chemical reactions. Helmholtz and Gibbs free energies (A and G). A and G as criteria for equilibrium and spontaneity. Physical significance of A and G. Driving force for chemical reactions- relative signs of ΔH and ΔS . Thermodynamic relations. Gibbs equations. Maxwell relations. Temperature dependence of G. Gibbs- Helmholtz equation. Pressure dependence of G. Chemical potential: Gibbs equations for non-equilibrium systems. Material equilibrium. Phase equilibrium. Clapeyron equation and Clausius-Clapeyron equation. Conditions for equilibrium in a closed system. Chemical potential of ideal gases. Ideal-gas reaction equilibrium- derivation of equilibrium constant. Temperature dependence of equilibrium constant - The Van't Hoff equation.
- IV. Electrochemistry: Conductance and its applications, Derivation of Nernst equation. Chemical and concentration cells (with and without transference). Liquid junction potential - derivation of the expression for L J P - its determination and elimination. Applications of EMF measurements: Solubility product, potentiometric titrations, determination of transport numbers, equilibrium constant measurements. Decomposition potential and its significance. Electrode polarization - its causes and elimination. Concentration over potential. Concept of activity and activity coefficients in electrolytic solutions. The mean ionic activity coefficient. Debye-Huckel theory of electrolytic solutions. Debye-Huckel limiting law. Calculation of mean ionic activity coefficient. Limitations of Debye-Huckel theory. Extended Debye-Huckel law. Theory of electrolytic conductance. Derivation of Debye-Huckel-Onsager equation - its validity and limitations. Concept of ion association - Bjerrum theory of ion association (elementary treatment) - ion association constant - Debye-Huckel-Bjerrum equation.
- V. Quantum chemistry: Black body radiation- Planck's concept of quantization- Planck's equation, average energy of an oscillator. Wave particle duality and uncertainty principle - significance for microscopic entities. Emergence of quantum mechanics. Wave mechanics and Schrödinger wave equation. Operators - operator algebra: Commutation of operators, linear operators, Complex functions, Hermitian operators. Operators and Eigen functions and Eigen values. Degeneracy. Linear combination of Eigen functions of an operator. Well behaved functions. Normalized and orthogonal functions. Postulates of quantum mechanics. Physical interpretation of wave function. Observables and operators. Measurability of operators. Average values of observables. The time dependent Schrodinger equation. Separation of variables and the time-independent Schrodinger equation. Theorems of quantum mechanics: Real nature of the Eigen values of a Hermitian operator - significance. Orthogonal nature of the Eigen values of a Hermitian operator- significance of orthogonality. Expansion of a function in terms of Eigen values. Eigen functions of commuting operators - significance. Simultaneous measurement of properties and the uncertainty principle. Particle in a box- Particle in one and three dimensional box. Plots of ψ and ψ^2 discussion, Degeneracy of energy levels. Comparison of classical and quantum mechanical particles. Calculations using wavefunctions of the particle in a box- orthogonality, measurability of energy, position and momentum, average values and probabilities.
- VI. Chemical kinetics: Theories of reaction rates - Collision theory, Transition state theory, Reaction coordinate, activated complex and the transition state. Thermodynamic formulation of transition state theory. Unimolecular reactions and Lindeman's theory.

- VII. Complex reactions - Opposing reactions, parallel reactions and consecutive reactions. Chain reactions- general characteristics, steady state treatment - H₂ - Br₂ reaction. Derivation of rate law. Effect of structure on reactivity- Linear free energy relationships. Hammett and Taft equations - substituent (ρ and ρ^*) and reaction constant (ρ and ρ^*) with examples. Michaelis-Menten mechanism of enzyme catalyzed reactions - derivation of kinetic equation and its applications.
- VIII. Photochemistry: Electronic transitions in molecules - The Franck Condon principle. Electronically excited molecules- singlet and triplet states. Radiative life times of excited states-theoretical treatment. Measured lifetimes. Quantum yield and its determination. Actinometry - ferrioxalate and uranyl oxalate actinometers. Derivation of fluorescence and phosphorescence quantum yields. E-type delayed fluorescence- evaluation of triplet energy splitting (ρ_{EST}). Laws of photo chemistry, Photo physical processes, photo physical kinetics of unimolecular reactions. Calculation of rate constants of various photo physical processes, State diagrams, photochemical primary processes. Types of photochemical reactions- electron transfer, photo dissociation, addition, abstraction, oxidation and isomerisation reactions with examples. Effect of light intensity on the rates of photochemical reactions. Photosensitization. Quenching- Stern Volmer equation. Experimental set up of a photochemical reaction. Introduction to fast reactions- Principles of flash photolysis.
- IX. Solid state chemistry: General characteristics of solid state. Classification of crystalline solids based on different binding forces, probing the structure of solids: X-ray crystallography, Crystal lattices and unit cells. Bravais lattices- primitive and centred unit cells, Number of atoms in a unit cell (primitive, body centred and face centred cubic unit cell), Close packed structures: Close packing in one dimension, in two dimensions and in three dimensions- tetrahedral and octahedral voids- formula of a compound and number of voids filled- locating tetrahedral and octahedral voids, Packing efficiency in simple cubic, bcc and in hcp, ccp lattice. Calculations involving unit cell dimensions density of the unit cell. Imperfections in solids- types of point defects- stoichiometric and non-stoichiometric defects. Magnetic properties of solids- classification of magnetic materials, Magnetic susceptibility, Langevin diamagnetism, Weiss theory of para magnetism. Magnetic properties of solids - classification of magnetic materials, Magnetic susceptibility, Langevin diamagnetism, Weiss theory of para magnetism
- X. Electronic properties of metals, insulators and semi conductors: Electronic structure of solids, Band theory, band structure of metals, insulators and semiconductors. Electrons holes and excitons. The temperature dependence of conductivity of extrinsic semi conductors. Photoconductivity and photovoltaic effect.
- XI. Superconductivity. Occurrence of superconductivity. Destruction of superconductivity by magnetic fields- Meissner effect. Types of superconductors. Theories of super conductivity- BCS theory.

Organic Chemistry:

- I. IUPAC nomenclature of organic molecules. Isomerism - classification of isomers.
- II. Classification, preparations and properties of alkane, alkenes, alkynes, cyclo alkanes, aromatic hydrocarbons, halogen compounds, hydroxy compounds, carbonyl compounds, carboxylic acids and its derivatives.
- III. Stereo chemistry: Molecular representations (Wedge, Fisher, Newman and Saw-horse projection formula) their description and interconversions. Stereoisomers - classification- configuration- R,S Nomenclature, criteria for chirality, Axial chirality of allenes, spiranes, alkylidenes, Cycloalkanes, chiral biaryls - Atropisomerism. Planar chirality of ansa compounds and trans- cyclooctene. Helical chiral compounds. Determination of absolute configuration by chemical correlation methods. Determination of configuration in E,Z- nomenclature. Spectral and chemical methods for determination of E, Z- configuration, including aldoxime and ketoximes. Asymmetric synthesis: Topicity, pro-chirality, stereoselectivity, enantioselectivity and diastereoselectivity. Asymmetric aldol reaction and Diel's alder reaction.
- IV. Introduction to conformational isomerism, Klyne - Prelog terminology for conformers and torsion angles, dihedral angle, Steric strain and the concept of dynamic

stereoisomerism. Study of conformations of acyclic compounds like ethane, butane, dihalobutanes, halohydrin, ethylene glycol, butane-2, 3-diol, amino alcohols and 1,1,2,2-tetrahalobutanes. Study of conformations of cyclic compounds -cyclo pentane, cyclohexane, cyclohexanone, and its derivatives.

- V. Nature of bonding in organic molecules and aromaticity, delocalized chemical bonding, conjugation, cross conjugation, resonance, hyperconjugation, tautomerism, Huckel's Rule and the concept of aromaticity- Aromaticity, non-aromaticity and anti aromaticity. Aromaticity of benzenoid and nonbenzenoid compounds, alternant and non-alternant hydrocarbons, Azulenes, Fulvenes and Annulenes. Metallocenes- Ferrocene.
- VI. Reactive intermediate: Generation, detection, structure, stability and reactivity of carbocation, carbanion, free radical, carbene and nitrene. Molecular rearrangements: definition and classification, molecular rearrangements involving 1). Electron deficient carbon: Wagner - Meerwein, Pinacol-Pinacolone, allylic and Wolf rearrangement. 2). Electron deficient Nitrogen: Hofmann, Lossen, Curtius, Schmidt and Beckmann rearrangements. 3) Electron deficient Oxygen: Baeyer-Villiger oxidation. 4). Base catalysed rearrangements: Benzylic acid, Favorski, Tran annular, Sommelet-Hauser and Smiles rearrangement.
- VII. Organic reaction mechanism: Mechanism, stereochemistry and energy profile diagram of Addition reactions to polar and non polar double bonds. Substitution reactions: Mechanism, rate law, stereochemistry and factors affecting on aliphatic and aromatic reactions. Elimination reactions- mechanism, rate law, stereochemistry, orientation and factors affecting on E1, E2, E1cB, pyrolytic syn elimination and a-elimination, elimination vs substitution. Detection of reaction mechanism by product isolation, isotopic labelling, chemical trapping and crossover experiments.
- VIII. Oxidation- Swern, Cr (VI) oxidants, Oxidative cleavage of 1,2-diols - Periodic acid and Lead tetraacetate.
- IX. Reductions - Wilkinson's catalytic hydrogenation, LiAlH₄, NaBH₄, BH₃, AlH₃ and DIBAL.
- X. Synthetic strategies: Target selection, terminology, disconnection approach, C-C bond disconnections.
- XI. Heterocyclic chemistry: importance as drugs, nomenclature, classification based on size of the ring, number and nature of hetero atoms. Synthesis and reactivity of Pyrrole, furan, Thiophene, pyridine, Indole, Benzothiophene, Quinoline, Isoquinolines.
- XII. Alkaloids and Terpenoids- importance as drugs, isolation of natural products by steam distillation, solvent extraction and chemical methods. Structure determination and synthesis of papaverine, nicotine and quinine. General methods in the structure determination of Terpenes, isoprene rule, special isoprene rule, structure determination of a-Terpenol and camphor.
- XIII. Organic photochemistry: photochemical energy, Frank-Condon principle, Jablonski diagram, Electronic transitions, photosensitization, quenching, quantum efficiency, quantum yield, photochemistry of carbonyl compounds n π * and p π * transitions. Norrish type-I and Norrish type-II cleavages. Paterno-Buchi reactions, Photoreduction, photochemistry of enones- hydrogen abstraction, rearrangements of α,β -unsaturated ketones and cyclohexadienones, photochemistry of p-benzoquinones, Dienes - photochemistry of 1,3-butadiene, (2+2) additions, Di-p-methane rearrangement, photochemistry of aromatic compounds, excited states of benzene and its 1,2-, 1,4-additions.
- XIV. Pericyclic reactions: Classification, Stereochemistry of pericyclic reactions, Molecular Orbitals and Symmetry of ethylene, 1,3-butadiene, 1,3,5-hexatriene, allylic, 1,3-pentadienyl and 1,3,5-heptatrienyl p- systems. Analysis of pericyclic reactions by PMO, FMO and orbital correlation methods.
- XV. Basic principles, concepts of UV, IR, ¹H NMR, ¹³C NMR and Mass spectroscopic methods - structure determination of organic compounds by UV, IR, ¹H NMR, ¹³C NMR and Mass spectroscopic methods.
- XVI. Green chemistry: Principles of Green chemistry, and its approaches.

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Paper - II: Statistics

1. **Probability:** Sample space, events, relations among events, classical and relative frequency definitions of probability, probability as a measure. Basic results on probability of events. Conditional probability and Baye's theorem. Independence of events.

Random variables (discrete and continuous). Distribution function and its properties. Joint distribution of two and more random variables. Marginal, conditional distributions and densities. Expectation of random variables, moments and generating functions. Conditional expectation. Characteristics function and its properties. Inversion theorem. Statement of continuity theorem.

Convergence of a sequence of events. Borel - Cantelli lemma, Borel 0-1 law and statement of Kolmogorov 0-1 law with applications. Convergence of a sequence of random variables. Convergence in law, in probability, with probability one and in quadratic mean and other inter-relationships. Convergence in law of $X_n + Y_n$, $X_n Y_n$ and X_n / Y_n . Definition and examples of weak law of large numbers. Khintchine's theorem and strong law of large numbers.

Statement of CLT. Lindberg-Levy and Liapunov forms of central limit theorems, statement of Lindberg - Feller form of CLT with simple illustrations.

Stochastic processes with examples. Markov Chains transition probability matrix and classification of states of a Markov chain with examples.

2. **Distribution Theory :** Theoretical distribution - Binomial, Poisson, negative binomial, geometric, hypergeometric, multinomial, rectangular, normal, lognormal, exponential, gamma, beta, Cauchy, weibull and Pareto distributions with properties.

Transformation of random variables. Distribution of Chi - squares, t and F distributions and their properties. Distribution of \bar{X} and s^2 for samples coming from normal population. Distribution of order statistics and range. Joint and marginal distribution of order statistics. Distribution of sample quantiles.

Multivariate normal distribution and its marginal and conditional distribution with examples. Simple correlation and lines of regression.

3. **Estimation:** Unbiasedness, sufficiency, consistency and efficiency of a point estimate with examples. Statement of Neyman's factorization criterion with applications. Minimum variance unbiased estimation, Crammer - Rao lower bound and its applications. Rao - Blackwell theorem, completeness and Lehman - Scheffe theorem. Estimation by method of maximum likelihood, moments and statement of its properties. Confidence intervals for the parameters of normal, exponential, binomial and Poisson distribution.

4. **Testing of Hypotheses:** Concepts of tests of statistical hypothesis, types of error, level of significances, power, critical region and test function. Concepts of MP and UMP tests. Neyman - Pearson lemma and its applications, one parameter exponential family of distributions. Concepts of unbiased and consistent tests. Likelihood ratio (LR) criterion with simple applications (including homogeneity of variances). Statements of asymptotic properties of LR tests. Large sample tests of population means, proportions and correlation coefficients. Relation between confidence intervals, and hypothesis testing. Wald's SPRT for testing a simple null hypothesis against simple alternative hypothesis and its OC and ASN functions. SPRT procedure for binomial, Poisson, normal and exponential distributions.

5. **Non - Parametric Tests :** Non - parametric tests for (i) one sample case: sign test, Wilcoxon signed rank test for symmetry, runs test for randomness, Kolmogorov - Smirnov (k-s) test for goodness of fit (ii) two sample case: sign and Wilcoxon tests for paired

comparisons. Wilcoxon - Mann Whitney test and K -S test and test for independence based on spearman's rank correlation. Kruskal-Wallis test and Friedman's test.

6. Multivariate Tests: Principal Component Analysis, Factor analysis, Canonical Correlation, Cluster analysis. Multivariate tests based on Hotelling's T^2 and Mahalanobis D^2 statistics for one sample problem, two sample problem and classificatory problems between two normal populations based on Fisher's discriminant function.

7. Sampling Techniques: Estimation of population mean, population total and variance of the estimator in the following sampling methods: simple random sampling with and without replacements and equal and unequal probabilities. Horwitz Thompson and Yates and Grundy estimators. Selection of sample and determination of sample size. Stratified random sampling, proportional and optimum allocations and comparisons. Systematic sampling with $N=nk$ and comparisons in populations with linear trend. Cluster sampling with clusters of equal and unequal sizes. Two stage sampling with equal and unequal first stage units. Ratio and regression estimation in case of simple random sampling and stratified random sampling. Non - sampling errors.

8. Linear Models and Analysis of Experimental Designs: Gauss - Markov linear model, BLUE for linear functions of parameters Gauss - Markov theorem, analysis of multiple regression models, multiple and partial correlations. Tests of hypothesis on regression and correlation parameters, tests of sub - hypothesis. Aitken's generalized least squares. Concept of multicollinearity.

Introduction of selecting the best regression equation, all possible regressions: backward, stepwise regression procedures. Variations on these methods. Probit and logit analysis, Introduction to non-linear regression model building, least squares in non-linear case, estimating the parameters, non-linear growth models.

Statement of Cochran's theorem for quadratic forms, analysis of variance one - way classification model, two - way classification model with one - observation per cell with more than one (equal) observations per cell with interaction. Fisher's least significance difference (LSD) method. Analysis of covariance one-way and two - way classification. Fundamental principles of experimental designs. Analysis of completely randomized design (CRD), Randomized Block Design (RBD), and Latin Square design (LSD). Analysis of RBD and LSD with one and more than one observation missing.

Estimation of main effects, interactions and analysis of 2^2 , 2^3 , 2^4 , 2^n and 3^2 factorial experiments. Total and partial confounding of 2^2 , 2^3 , 2^4 and 3^2 factorial designs. Concept of balanced partial confounding. Fractional factorial designs. Split plot design and its analysis.

Balanced incomplete block design (BIBD) - parametric relations, Intra - block analysis and recovery of inter block information. Partially balanced incomplete block design with two associate classes (PBIBD (2)) - parametric relations and intra -block analysis. Youden Square design, Lattice design and intra - block analysis of simple lattice design.

9. Optimization Techniques - I : Meaning and scope of Operations research, formulation of Linear programming problem (LPP), rule of steepest ascent, and θ -rule, optimum solution for Linear programming problem by graphical method and simplex algorithm using artificial variables (Big M/penalty method and two phase simplex methods). Dual of a symmetric Linear programming problem and reading the optimal solution to the dual from the optimum simplex table of primal. Complementary slackness theorem, dual simplex algorithm.

Definition of transportation problem, initial basic feasible solution by North West, matrix minimum methods and VAM. Optimal solution through MODI tableau for balanced and unbalanced transportation problem, degeneracy in transportation problem, transportation problems as a special case of linear programming problem. Assignment problem as a special case of transportation problem and LPP. Optimal solution using Hungarian method.

Sequencing: Optimal sequence of 'n' jobs on two and three machines without passing.

10. Optimization Techniques - II :Non-linear programming problem - Formulation, generalized Lagrange multiplier technique, Kuhn - Tucker necessary and sufficient conditions for optimality of an NLPP.

Game theory: 2 person zero sum game, pure strategies with saddle point, principles of dominance and games without saddle point.

Introduction to simulation, generation of random numbers for uniform, Normal, Exponential, Cauchy and Poisson distributions. Estimating the reliability of the random numbers, simulation to queuing and inventory problem.

Queuing Theory: Introduction, essential features of Queuing system, operating Characteristics of Queuing system (transient and steady states). Queue length, General relationships among characteristics. Probability distribution in queuing systems, distribution of Arrival and inter arrival. Distribution of death (departure) process, service time .Classification of Queuing models and solution of Queuing models; $M/M/1: \infty/FIFO$ and $M/M/1: N/FIFO$.

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Paper - II: Computer Science

1. **Computer Organization:** Memory Organizations, CPU Organisation, Assembly Language, Microprogramming, Input-Output Organization, Intel 8086 Computer.
2. **Programming:** Programming in C, Object oriented programming concepts including classes, Polymorphism, Inheritance, and Programming in C++, Java and Python.
3. **Data Structures:** Arrays, Records, Linked Lists, Trees, Binary Tree Traversal, Binary Search Trees, and Graphs.
4. **Design and Analysis of Algorithms:** Algorithm complexity, Algorithms Design Techniques - Divide and Conquer, Greedy Method, Dynamic Programming, Backtracking, Branch and Bound, NP-Hard and NP-Complete Problems.
5. **Principles of Programming Languages:** BNF, Variables, Data Types, Control Structures, Scope and Extent, Data Abstraction, Concurrency concepts, Exception Handling, Functional Programming, and Logic Programming.
6. **Compiler Design:** Types of grammar, Phases of compiler, Lexical Analysis, Parsing Techniques, Code generation and Optimization.
7. **Operating Systems:** Introduction, Process and CPU Scheduling, Process Synchronization, Deadlocks, Disk and Memory Management, Virtual Memory, File System Interface and Implementation, Protection and Security.
8. **Database Management Systems:** Introduction, Relational Model and Languages, Data Modeling, Database Design Theory and Methodology, SQL/ PLSQL, Transaction Processing & Concurrency control and Database Recovery & Security.
9. **Computer Graphics:** Line Drawing, Graphic Primitives and Polygons, 2D Transformations, Windows and Clipping, 3-D Graphics, Curves and Surfaces.
10. **Computer Networks:** Introduction, Seven Layers in OSI Model, Network Protocols, Internetworking, and TCP/IP Model.
11. **Distributed Operating Systems:** Goals, Client-Server Model, Synchronization in distributed systems, Distributed Process Management and File Systems, Distributed Shared Memory.
12. **Software Engineering:** Software Characteristics, Software Process Models, Analysis, Design, Coding, Testing, and Software Quality Assurance.
13. **Object oriented Analysis and Design:** Introduction to UML, Basic Structural Modeling, Classes and Object Diagrams, Behaviour Modeling and Architecture Modeling.
14. **Network Security:** Data Encryption and Decryption, Symmetric Key algorithms like DES, IDEA and AES, Public Key Cryptography, RSA algorithm, Digital Signatures & Authentication, Firewalls and VPN.

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Paper - II: Botany

I. Phycology, Mycology, Bacteria and Viruses

Phycology : Thallus organization ; cell ultra structure ; reproduction (vegetative, sexual, asexual) ; criteria for classification of algae : pigments, reserve food, flagella ; classification, salient features of Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Phaeophyta and Rhodophyta ; algal blooms and toxic algae, algal biofertilizers ; algae as food, and feed and role of algae in industry.

Mycology : General characters of fungi ; substrate relationship in fungi ; cell ultrastructure ; unicellular and multicellular organization ; cell wall composition ; nutrition (saprobic, biotrophic, symbiotic) ; reproduction (vegetative, asexual, sexual) ; heterothallism ; heterokaryosis parasexuality ; Molecular aspects in classification.

General account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina ; fungi in industry, medicine and as food ; fungal diseases in plants and humans ; Mycorrhizae ; fungi as biocontrol agents.

Bacteria- ultrastructure and biochemistry of cell wall, nutritional types, reproduction, Plasmids.

Viruses- Characters and ultrastructure of virions and symptomatology and transmission of plant viruses. Mollicutes general characters of spiroplasmas and phytoplasmas Importance of microorganisms : Microbes in medicine, agriculture and environment.

II. Bryophyta, Pteridophyta and Gymnosperms

Bryophyta : Morphology, structure, reproduction and life history ; distribution ; classification., of Marchantiales, Jungermaniales, Anthocerotales, Sphagnales, Funariales and Polytrichales ; economic and ecological importance.

Pteridophyta : Morphology, anatomy and reproduction ; classification of Psilopsida, Lycopsidea, Sphenopsida and Pteropsida ; evolution of stele ; heterospory and origin of seed habit ; general account of fossil pteridophytes.

Gymnosperms- Introduction and classification, Structure and reproduction of Cycadales, Ginkgoales, Coniferales, Ephedrales, Welwitschiales and Gnetales.

III. Taxonomy Of Angiosperms

The species concept : Taxonomic hierarchy, species, genus, family and other categories ; principles used in assessing relationship, delimitation of taxa and attribution of rank.

Salient features of the International Code of Botanical nomenclature.

Taxonomic tools : Herbarium ; floras ; histological, cytological, phytochemical, serological, biochemical and molecular techniques ; computers and GIS.

Systems of angiosperm classification : Phenetic versus phylogenetic systems ; cladistics in taxonomy ; relative merits and demerits of major systems of classification.

Study of the following families- Magnoliaceae, Malvaceae, Rutaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Amaranthaceae and Poaceae.

IV. Plant Anatomy And Embryology

Shoot development: Organization of the shoot apical meristem (SAM); control of cell division and cell to cell communication; control of tissue differentiation especially xylem and phloem ; secretory ducts and laticifers.

Phyllotaxy and leaf differentiation

Root Development: Organization of root apical meristem (RAM); vascular tissue differentiation; homeotic mutants in *Arabidopsis* and *Antirrhinum*,

Male gametophyte: Structure of anthers; microsporogenesis, role of tapetum; pollen development and gene expression; male sterility; sperm dimorphism and hybrid seed production; pollen germination, pollen tube growth and guidance ; pollen storage ; pollen allergy, pollen embryos.

Female gametophyte: Ovule development; megasporogenesis; organization of the embryo sac, structure of the embryo sac cells.

Pollination, pollen - pistil interaction and fertilization : Floral characteristics, pollination mechanisms and vectors; self-incompatibility; double fertilization.

Seed development and fruit growth: Endosperm development during early, maturation and desiccation stages; embryogenesis, cell lineages during late embryo development; storage proteins of endosperm and embryo; polyembryony; apomixis; embryo culture; fruit maturation.

Dormancy: Seed dormancy; overcoming seed dormancy; bud dormancy.

Senescence and programmed cell death (PCD): Types of cell death, PCD in the life cycle of plants, metabolic changes associated with senescence and its regulation; influence of hormones and environmental factors on senescence. Embryology related to taxonomy.

V. Plant Resource Utilisation and Conservation

Origin, evolution, botany, cultivation and uses of (i) Food forage and fodder crops (ii) fibre crops (iii) medicinal and aromatic plants and (iv) vegetable oil-yielding crops. Ethnobotany - Scope and objectives of ethnobotany.

Important fire-wood and timber - yielding plants and non-wood forest products (NWFPs) such as bamboos, rattans, raw materials for paper-making, gums, tannins, dyes, resins and fruits.

Role of plants in Medicine- morphology, active principles and medicinal value of the following plants- *Andrographis*, *Asparagus*, *Phyllanthus*, *Gymnema*.

Principles of conservation; extinctions; environmental status of plants based on International Union for Conservation of Nature.

Strategies for conservation - in situ conservation : International efforts and Indian initiatives ; protected areas in India - sanctuaries, national parks, biosphere reserves, wetlands, mangroves and coral reefs for conservation of wild biodiversity.

Strategies for conservation - ex situ conservation : Principles and practices; botanical gardens, field genebanks, seed banks, in vitro repositories, cryobanks; general account of the activities of Botanical Survey of India (BSI), National Bureau of Plant Genetic Resources (NBPGR), Indian Council of Agricultural Research (ICAR), Council of Scientific and Industrial Research (CSIR) and the Department of Biotechnology (DBT) for conservation, non-formal conservation efforts.

VI. -Plant Ecology

Climate, soil and vegetation patterns of the world: Life zones; major biomes and major vegetation and soil types of the world.

Vegetation organization: Concepts of community; analytical and synthetic characters of community.

Population characters, interactions of species- positive and negative interactions of species.

Ecological succession: types, changes involved in succession, concept of climax.

Biotic and abiotic interactions, habitat and niche, allopatric and sympatric speciation.

Ecosystem organization: Structure and functions; primary production methods of measurement of primary production, ; energy dynamics (trophic organization, energy flow pathways, ecological efficiencies); food chains, food web and ecological pyramids, global biogeochemical cycles of C, N, in terrestrial and aquatic ecosystems.

Biological diversity: Concept and levels; speciation and extinction; IUCN categories of threat; distribution and global patterns, hot spots; endemism, inventory.

Air, water and soil pollution: Kinds, sources, effects on plants and ecosystems.

Climate change: Green house gases (CO₂, CH₄, N₂O, CFCs: sources, trends and role); ozone layer and ozone depletion ; consequences of climate change (CO₂ fertilization, global warming, sea level rise, UV radiation).

Ecosystem stability : Concept (resistance and resilience); ecological perturbations (natural and anthropogenic) and their impact on plants and ecosystems ; ecology of plant invasion ; Biogeographical zones of India, Flora of Telangana - vegetational types.

VII. -Cell Biology

Ultrastructure and functions of cell organelles. Cell wall, Plasma membrane Plasmodesmata, Chloroplast, Mitochondria, Plant Vacuoles, Nucleus, Ribosomes, Cell cycle and apoptosis : Control mechanisms; role of cyclins and cyclin dependent kinases; retinoblastoma and E2F proteins; cytokinesis and cell plate formation; mechanisms of programmed cell death. Mitosis and meiosis its significance

Other cellular organelles: Structure and functions of microbodies, Golgi apparatus, lysosomes, endoplasmic reticulum.

Techniques in cell biology: Immuno techniques; in situ hybridization, FISH, GISH; Electron microscopy.

VIII. Cytogenetics

Chromatin organization : Chromosome structure and Packaging of DNA, molecular organization of centromere and telomere; nucleolus and ribosomal RNA genes ; euchromatin and heterochromatin ; karyotype analysis ; banding patterns ; specialized types of chromosomes ; polytene, lampbrush, B-chromosomes and sex chromosomes ; molecular basis of chromosome pairing.

Structural and numerical alterations in chromosomes : Duplication, deficiency, inversion and translocation; autopolyploids ; allopolyploids ; evolution of major crop plants.

Genetics of prokaryotes and eukaryotic organelles : genetic recombination in phage ; genetic transformation, conjugation and transduction in bacteria ; genetics of mitochondria and chloroplasts cytoplasmic male sterility.

Gene structure and expression : Genetic fine structure ; cis - trans test ; Benzer's experiment; introns and their significance ; RNA splicing ; regulation of gene expression in prokaryotes and eukaryotes.

Mutations : Spontaneous and induced mutations ; physical and chemical mutagens ; molecular basis of gene mutations ; transposable elements in prokaryotes and eukaryotes ; mutations induced transposons ; site-directed mutagenesis ; DNA damage and repair mechanisms.

Plant Breeding: Principles and methods of plant breeding ; Marker assisted breeding.

Biostatistics : Mean, Variance, Standard deviation, Standard error, Student's 't' test, chi-square and ANOVA.

Molecular cytogenetics : Nuclear DNA content; C-value paradox; cot curve and its significance; restriction mapping - concept and techniques ; multigene families and their evolution.

IX. Plant Physiology

Energy flow : Principles of thermodynamics, free energy and chemical potential, redox reactions, structure and functions of ATP.

Fundamentals of enzymology : General aspects, allosteric mechanism, regulatory and active sites, isoenzymes, kinetics of enzymatic catalysis, Michaelis - Menton equation and its significance.

Membrane transport and translocation of water and solutes: Plant water relations, mechanism of water transport through xylem, passive and active solute transport, membrane transport proteins.

Signal transduction: Receptors and G-proteins, phospholipid signaling, role of cyclic nucleotides, calcium-calmodulin cascade, diversity in protein kinases and phosphatases.

Photochemistry and photosynthesis: Photosynthetic pigments and light harvesting complexes, photo oxidation of water, mechanisms of electron and proton transport, carbon assimilation - the Calvin cycle, photorespiration and its significance, the C4 cycle, the CAM pathway, biosynthesis of starch and sucrose.

Respiration and lipid metabolism : Glycolysis, the TCA cycle, electron transport and ATP synthesis, pentose phosphate pathway, glyoxylate cycle, alternative oxidase system, structure and function of lipids, fatty acid biosynthesis, synthesis of membrane lipids, structural lipids and storage lipids and their catabolism.

Nitrogen fixation and metabolism : Biological nitrogen fixation, nodule formation and nod factors, mechanism of nitrate uptake and reduction, ammonium assimilation.

Photobiology : Photochromes and cryptochromes, photophysiology of light - induce responses, cellular localization.

Plant growth regulators and elicitors : Physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid and salicylic acid.

The flowering process : Photoperiodism, endogenous clock and its regulation, floral induction and development - genetic and molecular analysis, role of vernalization.

Stress physiology : Plant responses to biotic and abiotic stress; mechanisms of biotic and abiotic stress tolerance, HR and SAR, water deficit and drought resistance, salinity stress, metal toxicity, freezing and heat stress, oxidative stress.

Coping with biotic stress: Chemical control, Biological control, IPM

X. Biotechnology and Genetic Engineering

Plant Biotechnology - Principles, scope and applications.

Plant cell and tissue culture : General introduction, scope, cellular differentiation, and totipotency.

Organogenesis and adventitious embryogenesis : Morphogenesis; somatic embryogenesis.

Somatic hybridization : Protoplast isolation, fusion and culture.

Applications of plant tissue culture : Clonal propagation, artificial seed, production of hybrids and somaclones, production of secondary metabolites / natural products, cryopreservation and germplasm storage.

Recombinant DNA technology : Gene cloning principles and techniques, genomic / c DNA libraries, vectors, DNA synthesis and sequencing, polymerase chain reaction, DNA fingerprinting and DNA markers.

Genetic engineering of plants: Transgenic plants, Methods of gene transfer - Agrobacterium - mediated and microprojectile, chloroplast transformation, intellectual property rights, ecological risks and ethical concerns.

Microbial genetic manipulation : Bacterial transformation, selection of recombinants and transformants, genetic improvement of industrial microbes.

Genomics and proteomics : High throughput sequencing, genome projects, bioinformatics, functional genomics, microarrays.

Written Examination Syllabus for the post of Degree College Lecturers in Residential Educational Institutions Societies

Paper - II: Zoology

I. General Concepts:

1. Levels of structural organization - Unicellular, multi cellular and colonial forms, Prokaryotic and Eukaryotic cells, Levels of organization of tissues, Organs & systems.
2. Acoelomata, Pseudocoelomata, Coelomata, Proterostomia and Deuterostomia.
3. Concepts of species and hierarchical taxa, Biological nomenclature, Classical methods of taxonomy of animals.

II. Non-Chordata:

1. General characters and classification of invertebrates up to order level.
2. Protozoa - Locomotion, Nutrition and reproduction in protozoa, Protozoan diseases of man- Kalaazar, Amoebiasis, Malaria, Trypanosomiasis.
3. Porifera - Canal system in Porifera, Skeleton in Porifera, Reproduction in sponges.
4. Coelenterata - Polymorphism, Metagenesis, Coral formation, Obelia.
5. Helminthes - Common Helminthic parasites of Man - Fasciola hepatica, Schistosoma, Taenia solium, Echinococcus granulosus, Ascaris, Ancylostoma, Trichinella - their life cycles, Pathogenesis and clinical significance. Parasitic adaptations in Helminths.
6. Annelida - Excretory system in Annelida, Coelom formation, Coelom and coelomoducts, Metamerism.
7. Arthropoda - Mouthparts of insects, Ommatidium, Useful and harmful insects, Metamorphosis in insects, Apiculture and Sericulture in India, Crustacean larvae, Peripatus.
8. Mollusca - Respiration, Torsion and Detorsion, Pearl formation.
9. Echinodermata - Echinoderm larvae, Water vascular system.

III. Chordata:

1. General characters and classification of chordates up to order level, Origin of chordates, Phylogeny and affinities of Hemichordata, Retrogressive metamorphosis.
2. Vertebrate integument and its derivatives, Comparative account of Digestive, Respiratory, Circulatory, Excretory and Reproductive systems of vertebrates.
3. Pisciculture in India, Common edible fishes.
4. Origin and evolution of Amphibia, Neoteny or Paedogenesis.
5. Important snakes of India, Identification of Poisonous and non- Poisonous Snakes, Poisonous Apparatus, Dinosaurs.
6. Flight adaptations and Migration in birds. Archeopteryx, Poultry.
7. Adaptive radiation in Mammals, Dentition in Mammals.

IV. Cell Biology:

1. Prokaryotic and Eukaryotic cell, Plasma membrane - Ultra structure & function.
2. Structure and function of intracellular organelles - Nucleus, Mitochondria, Golgi bodies, Lysosomes, Endoplasmic reticulum, Peroxisomes, Vacuoles, Cytoskeleton and its role in motility.
3. Organization of genes and chromosomes - Operon concept, unique and repetitive DNA, structure of chromatin and chromosomes, Heterochromatin, Euchromatin, transposons.
4. Cell division - Mitosis and meiosis, Cell cycle & its regulation.
5. DNA replication, Repair and Recombination - Unit of replication, Replication origin and Replication fork, DNA damage and Repair mechanism, Recombinant DNA technology, Transgenesis & Cloning.
6. Protein synthesis - Genetic code, Initiation, Elongation and termination.
7. Regulation of gene expression - Lac operon.

V. Genetics:

1. Mendel's law of inheritance - Gene interactions, Epistasis and Linkage.
2. Gene mapping methods - Linkage-Complete and Incomplete linkage, Linkage maps, Recombination, Mapping with molecular markers, Somatic cell hybrids.
3. Crossing over - Types (Somatic or mitotic crossing over and Germinal or meiotic crossing over) theories about the mechanism of crossing over, Tetrad analysis and cytological detection of crossing over.
4. Mutations - Types (Spontaneous and Induced), Causes and detection, Mutant types (Lethal, Conditional/biochemical, Loss of function, Gain of function, Germinal versus somatic mutants), Molecular basis of mutations.
5. Chromosomal aberrations (Deletion, Duplication, Inversion and Translocation, Ploidy and their genetic implications), Autosomal abnormalities (Down's syndrome, Trisomy-13, -18), Sex anomalies (Turner's syndrome, Klinefelter's syndrome, Hermaphroditism).
6. Human genetics - Human karyotyping, Genetic disorders due to mutant genes (Huntington's chorea), Sickle-cell anaemia (SCA), Inborn errors of metabolism- Phenylketonuria, Alkaptonuria .

VI. System and Cell physiology:

1. Blood and Circulation - Blood corpuscles, Haemopoiesis, Plasma function, Blood groups, Haemoglobin, Haemostasis.
2. Cardiovascular system - Neurogenic, Myogenic heart, Cardiac cycle, Tachycardia and Bradycardia.
3. Respiratory system - Transport of gases, Exchange of gases, Mechanism of respiration.
4. Nervous system - Neuron, Conduction of nerve impulse, Synaptic transmission, Neurotransmitters.
5. Muscle - Ultra structure of skeletal muscle, Mechanism of muscle contraction.
6. Sense organs- Eye and Ear.
7. Excretory system - Structure & function of mammalian Kidney and Nephron, Micturition.
8. Osmoregulation - Osmoregulation in Aquatic & Terrestrial animals, Hormonal control of Osmoregulation.
9. Digestive system - Digestion, Absorption, Assimilation and Egestion.
10. Endocrinology and Reproduction - Endocrine glands, Types of hormones & Mechanism of hormonal action, Hormonal regulation of reproduction in mammals.
11. Outline classification of organic compounds (Carbohydrates, Proteins and Lipids).
12. Order of protein structure - Primary, Secondary, Tertiary and Quaternary; Ramachandran plot.
13. Glycolysis (EMP), Krebs's cycle (TCA CYCLE), Electron transport system (Oxidative phosphorylation), Pentose phosphate pathway, Gluconeogenesis.

VII. Evolution:

1. Origin of life - Theories and Evidences of organic evolution, The modern synthetic theory.
2. Population genetics (Gene pool, Gene frequency), Hardy weinberg's law.
3. Genetic drift and Convergent evolution, Adaptive radiation.
4. Isolation and Speciation.
5. Evolution of Horse and Man.
6. Zoogeographical realms of the world.

VIII. Developmental biology:

1. Spermatogenesis and Oogenesis.
2. Fertilization, Cleavage, Gastrulation, Formation of germ layers, Parthenogenesis.

3. Formation and Function of Foetal membranes.
4. Placenta - Definition and Function.
5. Types of Placenta.
6. Development of Frog and chick.

IX. Histology:

1. Histology of mammalian Tissues and Organs -Epithelial, connective, blood, bone, cartilage, skin, stomach, intestine, liver, pancreas, kidney, testis and ovary.

X. Ecology:

1. Concepts of Ecosystem.
2. Biogeochemical cycles (Carbon, Nitrogen and Phosphorous).
3. Influence of environmental factors on animals, Energy flow in Ecosystem, Food chains, food web and trophic levels.
4. Animal Associations (Neutralism, Mutualism, Symbiosis, Commensalism, Parasitism, Predation and Competition).
5. Ecological succession.
6. Environmental pollution- Air, water, land, noise, radioactive, thermal. Effects of pollution on ecosystem, Prevention of pollution
7. Wildlife in India- Conservation, Chipco movement.
8. Biodiversity- Economic significance, Conservation, Hot spots of India.

XI. Immunology:

1. Cells of the immune system- Lymphoid cells, Mono nuclear cells, Granulocytic cells, Mast cells.
2. Organs of the immune system- Primary and secondary lymphoid organs, Lymphatic system.
3. Antigens- Antigenic determinants or epitopes, immunogenicity, Haptens.
4. Humoral immunity -immunoglobulin (fine structure of immunoglobulin and immunoglobulin classes), The complement system, Classical and alternate pathway, Inflammation.
5. Innate (Non-specific immunity) - Anatomical barriers, Phagocytosis, Natural killer cells (NK cells), Interferons.
6. Cell mediated immunity- Mechanism of cell mediated immunity, Brief account on Antigen presentation, Major Histocompatibility complex.
7. Antigen-Antibody interactions- Affinity, Avidity, Cross-reactivity, Precipitation reactions, Agglutination reactions and ELISA.
8. Brief account on Immunological Hypersensitivity disorders:
 - a) Tolerance and Autoimmunity
 - b) Transplantation
 - c) Immunodeficiency diseases - HIV.
 - d) Immunization (Active and Passive immunity)

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Paper - II: Microbiology

I. General Microbiology

History of Microbiology. Contributions of Scientists. Types, application and importance of microscopy. Structure of microbial cells. Methods of sterilization: Physical methods - chemical methods and their application. Pure culture techniques. Preservation methods and Maintenance of Microbial cultures. Microbiological media and cultivation of microorganisms. Microbial identification methods. Principles of bacterial taxonomy and classification. Microbial growth curve. Measurement of Growth. Synchronous cultures- methods of synchronous culturing. Continuous culturing methods, factors effecting growth. Phenomenon of bacterial sporulation. Microbial nutrition, respiration and fermentation. Distribution, characteristics and reproduction of algae and fungi.

II. Virology

Structure and Classification of bacterial, plant and animal viruses, Methods of cultivation, detection, Propagation and maintenance of viruses. Some important viruses: Influenza virus, Adeno virus, HBV, HIV, T2 phase, TMV, Replication of viruses, Tumor viruses, Interferons and viral interference.

III. Molecular Biology and Microbial Genetics

DNA structure and replication. Transcription and translation. Concept of ribozyme. Genetic code and Wobble hypothesis, Gene regulation. Cloning and expression vectors. Construction and screening of genomic and cDNA libraries. PCR, Gene chips and Microarray. DNA markers, fingerprinting and gene therapy. DNA sequencing. Expression of recombinant proteins Protein-protein and protein-DNA interaction. Applications of recombinant DNA technology. Types of mutagens, molecular basis and analysis of mutations, site directed mutagenesis. DNA damage and repair mechanisms. Recombination in bacteria by Transformation, Conjugation, Transduction. Transposable elements. Cell cycle and programmed cell death. Signal transduction, Protein folding & roles of Molecular chaperones. Databases, Sequence and structure analysis of DNA and Proteins. Primer design. Protein engineering and drug designing.

IV. Biochemistry and Techniques

pH and its biological relevance. Redox potentials, Electron transport, oxidative phosphorylation. Classification, chemical structure of important carbohydrates. Properties of amino acids, structure, confirmation and properties of proteins. Enzyme nomenclature, classification, Enzyme activity and inhibition. Enzyme kinetics - Michelis-Menton kinetics. Optical methods - colourimetry and spectrophotometry, fluorimetry, optical rotation, Circular dichroism, NMR, ESR spectroscopy, X-ray diffraction, types of mass spectrometry. Chromatographic techniques, diffusion, dialysis, cell disruption methods, centrifugation techniques, electrophoreses and blotting techniques. Radio isotopes - detection and measurement.

V. Immunology and chemotherapy

Types of Immunity, primary and secondary organs of immune system, cells of immune system. Types, structure, properties and functions of antigens and antibodies, antigen antibody reactions. Major Histocompatibility Complex (MHC) and transplantation. Polyclonal and monoclonal antibodies. Hypersensitivity, Autoimmunity. Tumor immunology, Immunological tolerance and immuno-suppression, Immune deficiency diseases. Immunotherapy of infectious diseases, immunization. Types of antimicrobial agents and mode of action. Therapeutic agents, Chemical, non-medicinal antimicrobials- sanitizers, disinfectants, antiseptics. Antibiotics. . Antiviral agents. Microbiological assays.

VI. Industrial Microbiology

Exploitation of microbes in industry. Screening, strain development. Types of fermentations processes, scaleup of fermentations. Up and Down stream process. Fermentation productions- Ethanol, Beer, Wine and other alcoholic drinks, amino acids, antibiotics, organic acids, vitamins, enzymes, probiotics, solvents and vaccine. Microbial products from genetically modified (cloned) organisms. QA, QC, GLP, GMP, Patents & IPR

VII. Food Microbiology

Dairy Microbiology and microbial products of milk, Fermented foods, Bacteriological examination of milk, fresh foods and canned foods, Food preservation methods and spoilage. Current and future implications concerning food safety, hazards and risks. Probiotics, Prebiotics and their significance in human beings and animals.

VIII. Environmental and Agriculture Microbiology

Ecological significance. Microbiology of water and sewage treatment. Role of microorganisms in nutrient cycling, Mineralization, Soil humus formation, Nitrogen metabolism, Phosphate solubilization. Biofertilizers, Biopesticides, Biodegradation of pollutants. Plant microbe interactions, Animal-microbe interactions: Rumen microbiology, termite microbial communities, Microbes in the production of energy from agricultural and domestic wastes.

IX. Medical Microbiology

Principles of Medical Microbiology, Normal flora of human body. Properties of pathogenic microorganisms, Principles of diagnostic microbiology, Use of lab animals in diagnostic microbiology. Bacterial and viral infections (Air born, water born, food born, insect born, zoonotic and direct contact), Mycosis, Toxins.

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Paper - II: Electronics

I- Mathematical Physics and Classical Mechanics

Vector algebra and vector calculus- Linear algebra, matrices, Linear ordinary differential equations of first & second order,

Special Functions: Legendre's polynomials, Bessel functions, Hermite polynomials.. Laplace equation and wave equation

Integral Transforms: Fourier Transforms and applications, Laplace transforms and applications.

Tensor Analysis: Tensor Algebra, Metric Tensor & Christoffel Symbols

Mechanics of a system of particles: Lagrangian Mechanics, Lagrange's equations, Hamilton's principle, Hamiltonian Mechanics, canonical Transformations and Hamilton-Jacobi Theory, and Poisson's Brackets.

Numerical Methods: Numerical Interpolation, Numerical Differentiation, Numerical Integration, Solutions of Equations and Numerical solutions of Ordinary Differential Equations.

II- Statistical Mechanics and Quantum Mechanics

Introduction to Statistical Mechanics: Statistical Mechanics- Thermodynamics, Ensembles, Density distribution- Liouville's theorem, Postulates of classical statistical Mechanics, Micro canonical Ensemble, Maxwell-Boltzmann Statistics, Canonical and grand canonical ensembles.

Quantum Statistics: Postulates of Quantum Statistical Mechanics, Quantum Statistics- Bose and Fermi-Dirac Statistics

Principles Of Quantum Mechanics: Birth of Quantum Mechanics, Eigen values and Eigen functions Dirac's Bra and ket vectors Eigen functions and uncertainty principle.

Schrodinger Equations and Angular Momentum Theory: Schrodinger wave equation, Applications of Schrodinger's equation to one dimensional problems, Angular momentum, Application of Schrodinger's equation to three dimensional problems, Hydrogen atom, spin and angular momentum, Addition of angular momenta, Clebsch-Gordan coefficients

Approximation Methods: Time independent perturbation theory, variation method, Time dependent perturbation theory

Relativistic Quantum Mechanics: Klein Gordon relativistic equation and applications, Dirac's relativistic equation and applications

III-Solid State Physics

Crystalline State and Crystal Structure: Crystalline State and Crystal Structure, non crystalline state, elements of X-ray diffraction, experimental techniques for structure determination.

Imperfection in Crystals: Imperfection in Crystals, diffusion, dislocations.

Free electron theory and band theory of solids: Free electron theory, band theory of solids, semiconductors, solid state lasers.

Lattice vibrations and thermal properties: Elastic waves in solids, Infra red absorption ionic crystals, and lattice heat capacity.

Dielectrics and ferroelectrics: Macroscopic descriptions of dielectrics, measurement of dielectric constant, ferroelectrics.

Magnetism and Super conductivity: Magnetism, spontaneous magnetization, occurrence of superconductivity, super conductivity-theoretical explanations.

IV - Semiconductor Devices- Analog and Digital Electronics

Semiconductor Diodes, Transistors and Amplifiers: Semiconductor diodes, Transistors, Power supplies, Feedback amplifiers, RC coupled amplifiers and its frequency response, Oscillators and Multivibrators

Operational Amplifiers: Operational Amplifier, its characteristics, and its parameters, Operational Amplifier-configurations, Operational Amplifier-Frequency response, Operational Amplifier-Linear applications, Operational Amplifier- non linear applications, Operational Amplifier- Wave form generators.

Digital Electronics: Introduction to Digital electronics and logic gates, Applications of EX-OR gate, De-Morgan's Theorems and Fundamental products, Karnaugh map, Flip-flops, Shift Registers, Counters, Multiplexer and De-multiplexer.

Converters: Digital to Analog Converters, Analog to Digital Converters

V- Nuclear Physics and Analytical Techniques

Nuclear decay process: Alpha Spectrum, Gamow's theory of α -decay. β - Spectrum, Neutrino hypothesis, Fermi theory of Alpha-decay, Fermi-Kurie Plots, selection rules for β -decay. Γ -emission - Multiple radiation - selection rules for γ -decay. Classification of elementary particles - Fundamental interactions - Conservation laws. Interaction of charged particles and Gamma radiation with matter, Radiation detectors.

Nuclear forces and Nuclear Models: Properties of Nucleus-nuclear radius, nuclear mass and binding energy, Angular momentum, nuclear statistics, parity and Symmetry, Magnetic dipole moment, electric quadrupole moment, Nature of nuclear forces, two body problem, bound and spin states of two nucleons, Theory of deuteron, Tensor forces, exchange forces, meson theory of nuclear forces, Nuclear models, liquid drop model, formula for total binding energy of the nucleus, Weizsacher's semi empirical mass formula, values of the empirical coefficients, Shell model-Experimental Evidence, predictions, spin orbit coupling and achievements of the shell-model.

Nuclear Reactions

Types of nuclear reactions, conservation laws, Kinematics of nuclear reactions, Q-value, Nuclear cross section, compound nucleus, Discrete energy levels of nucleus, Breit-Wigner formula, Basic properties of neutrons, classification of neutrons, slowing down of neutrons, logarithmic decrement in energy, moderating ratio, neutron diffusion-neutron current density, neutron leakage current, Fermi age equation, Bohr and Wheeler theory of fission, four-factor formula

Materials Characterization Techniques: Phase contrast microscopy, Principle, theory, instrumentation Applications, Electron microscopy, principle, scanning electron microscope, instrumentation, Transmission electron microscope, instrumentation, applications of electron microscopes, advantages of SEM over TEM. Thermo gravimetric analyser, principle, instrument control, Applications, Differential scanning calorimetry, principle, instrumentation, Power compensated DSC, Heat flux DSC, Temperature control methods, the average temperature control, Differential temperature control. Theory of Mossbauer effect, Recoil-less emission and absorption of gamma rays-nuclear, resonance experimental technique to observe Mossbauer effect, Mossbauer nuclides, Mossbauer parameters-Isomer shift, Quadrupole splitting, magnetic hyperfine splitting, simple applications

Resonance Spectroscopy: NMR theory-simple and classical, Relaxation mechanisms-spin-spin and spin-lattice. Bloch equations, complex susceptibility, NMR instrumentation related to absorption and induction techniques, chemical shift, spin-spin coupling, ethyl and methyl alcohol NMR spectra, Major areas of NMR. Principles of ESR, conditions for resonance, ESR spectrometer, interpretation of spectra, Hyperfine interactions, applications of ESR. Nuclear quadrupole Moment, electric field gradients, Nuclear quadrupole resonance, energy levels in different FG symmetries, NQR spectrometer, Applications, review on NMR, ESR and NQR.

VI- Electromagnetic Theory and Spectroscopy

Electromagnetic Theory: Electrostatic field, Magneto statics, Electro dynamics, EM waves in matter, Electromagnetic radiation, Lienard-Wiechert Potentials, Radiated power

Atomic Spectra: Fine structure, Zeeman, Paschen-back and Stark Effects, vector atom model L-s and jj coupling of two electron states, two electron system, Lande 'G' factor

Molecular spectra: Rotational Spectra of Diatomic molecules, vibrational spectra, Electron spectra, Frank-Condon principle, Dissociation energies, Frank Condon Principle

VII- Memory Devices and Microprocessors

Logic Families: Logic families and their performance characteristics, Emitter Coupled Logic (ECL, PMOs, CMOs Logic and Tri state Logic), Comparisons of Logic families

Semiconductor memories: Classification and Characteristics of Memories, Memory organization and expression.

INTEL 8085 Microprocessor Organization and Architecture: Microprocessor Organization and Architecture, Pin Configuration of Intel 8085 Micro Processor, Timing diagrams.

Addressing Modes and Programming of 8085 Microprocessors: Addressing modes and instruction set of Intel 8085, Programming of Micro Processor Intel 8085, Assembly Language Programming using Loops.

Peripheral Devices and Interfacing : I/O Interfacing & Data Transfer Schemes, Intel 8053 Programmable interval Timer, Programmable Peripheral Interface (8255), Priority Interrupt Controller (8259).

INTEL 8086 Microprocessor: Intel 8086 Micro Processor, Addressing Modes and Instruction set of Intel 8086 Micro Processor, Pin Configuration of Intel 8086 Micro Processor.

Advanced Microprocessors: Architecture of Micro Processors 80286, 80386, 80486, the Pentium Microprocessor

VIII- Communication Systems

Analog Communication: Need for modulation, Amplitude modulation, Frequency spectrum for sinusoidal A.M, Average power for sinusoidal and non-sinusoidal A.M, Generation of A.M. waves- Collector modulator, Balanced modulator, A.M transmitter

(Block diagram approach), Detection of A.M waves - Square law detector, Frequency and Phase modulation, Frequency spectrum for sinusoidal F.M, Average power for sinusoidal F.M, Varactor diode F.M modulator, Balanced slope F.M detector, Ratio F.M detectors.

Digital Communication: Sampling theorem, Pulse amplitude modulation (PAM), Natural sampling, Flat-top sampling, Signal recovery through holding, Quantization of signals, Quantization error, Pulse Code Modulation (PCM), Companding, Multiplexing PCM signals, Differential PCM. Digital modulation techniques: Amplitude Shift Keying (ASK), Phase Shift Keying (PSK), Frequency Shift Keying (FSK) and Differential Phase Shift Keying (DPSK) and their generation and detection (qualitative).

Transmission lines: Introduction, Primary line constants, Phase velocity and line

wavelength, Characteristic impedance, Propagation coefficient, Phase and group velocities, Standing waves, Lossless line at radio frequencies, VSWR, Slotted-line measurements at radio frequencies, Transmission lines as circuit elements, Smith chart.

Microwave devices: Introduction to rectangular and circular wave guides, Solution of wave equations in cylindrical coordinates, TE and TM modes, Power transmission and loss in circular wave guides, Excitation of modes in circular wave guide, Microwave tunnel diode, Gun effect diode (GaAs), Microwave generation and amplification.

Written Examination Syllabus for the post of Degree College Lecturers in Residential Educational Institutions Societies

Paper - II: History

I. Ancient India:

1. History; Definition, Scope, Nature, Sources and Methods.
2. Pre and Proto History - Stone ages and Chalcolithic Cultures.
3. Harappan Civilization - Characteristic features, Major cities - socio-economic conditions, Harappan Script, Religious practices - Decline.
4. Iron Age - Aryan Migrations - Second Urbanization.
5. India in 6th Century BC; Early States, Sixteen Mahajanapadas, Rise and Growth of Magadha - Society, Economy - Jainism, Buddhism, Ajivikas and Lokayatas.
6. Mouryan Age: Chandragupta Mourya and Ashoka, Mouryan Polity, Administration, Dhamma, Socio-Economic conditions - Decline.
7. Pre Satavahanas: Sangam Age and Satavahana Age; Political history, Administration, Society, Economy and Culture- Post Satavahana period - Chedi (Kharavela) Ikshvakus, Vakatakas, Abiras, Kshatrapas and Vishnukundis, Kushans (Kanishka).
8. Gupta Age: Political History, Administration, Socio-Economic conditions, Growth of Culture, Art and Architecture, Literature - Decline.
9. India in the Seventh Century A.D.; Pushyabhutis (Harsha), Pallavas, Chalukyas and Rashtrakutas - Political History, Society, Economy and Culture.

II. Medieval India:

10. India between 650 A.D. to 1200 A.D.- Rajputs, Arab and Turkish Invasions - Later Pallavas, Chalukyas, Chola Art, Architecture and Chola Administration - Society, Economy and Culture.
11. Age of Delhi Sultanate 1206 A.D. - 1526 A.D. - Political History, Administrative System, Changes in Society and Economy- Bhakti and Sufi Movements
12. Age of Vijayanagara - Origin, Political History, Krishnadevaraya, Socio and Economic conditions, Culture, Art, Architecture, Decline - Bahamanis.
13. Moghul Age (1526-1707) - Political History, She Shah, Akbar, Administration, Society, Economy, Culture- Decline - Marathas and Shivaji.

III. Modern India

14. Establishment of British Power in India - Early resistance - Hyder Ali, Tipu Sultan.
15. British paramountcy in India - Policies of Governor Generals, Impact of British policy on Indian Agriculture and Economy.
16. Socio - Religious Reforms Movements - Brahma Samaj - Arya Samaj, Satyashodhak Samaj and others- Educational policies of the British and their Impact.
17. 1857 Revolt; Causes Results and Significance.
18. Rise and Growth of Indian National Movement - Nationalist Movement I Phase from 1885 A.D. - 1905 A.D. - Indian National Congress; Moderates, Extremists and Early Revolutionaries II phase at 1905-1920 - Vande Mataram Movement Home Rule - Role of Tilak and Anie Beasant- Later phase of Revolutionary Movement. III Phase 1920-1947 - Non Co-operation Movement, Emergence of Gandhi, Civil Disobedience, Salt Satyagraha, Quit India Movement- Subhash Chandra Bose - Constitutional Reforms- Dr. B. R. Ambedkar - Declaration of Independence - Role of Women in Indian National Movement.

IV. Modern World:

19. Industrial Revolution- Significance and Results.
20. American War of Independence - Causes, Results, Significance.
21. French Revolution - Causes, Effects, Significance.
22. National Liberation Movements in Italy and Germany in the 19th Century - Mazzini, Cavour, Garibaldi, Bismarck.
23. World War-I - Causes and Effects - League of Nations.

24. The Russian Revolution of 1917 - Causes, Results and Significance.
25. The world between the Two World Wars - Nazism in Germany, Fascism in Italy, Turkey under MustafaKamal Pasha.
26. Developments in China 1911-1949 - Nationalist Revolution of 1911 - Communist Revolution of 1948 - Japan under Meiji Era -Vietnam Revolution.
27. World War-II - Causes and Effects - United Nations Organisation.

V. History of Telangana

28. Pre History
29. Pre Satavahana, Satavahana, Post Satavahana - Ikshvakus, Vakatakas, Abiras and Vishnukundis.
30. Telangana from 7th Century to 11th Century- Chalukyas of Badami, Vemulavada, Mudigondi andKalyana.
31. Age of Kakatiya's; Origin, Political History, Administration, Socio Economic, Religious conditions, Art and Architecture and Literature and their Subordinates.
32. Padma Nayaka's and Musunoori.
33. Qutubshahis - Administration, Religion, Art, Architecture and Literature.
34. Asafjahis - Administration, Economy, Culture and Society, British Paramountcy on Hyderabad State.
35. Freedom Movement in Telangana, Telangana Armed Struggle.

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Paper - II: Economics

I . Micro Economics

1. Demand Analysis

Definitions, Nature and Scope of Economics - Micro and Macro Economic Analyses - Concepts of Demand and Law of Demand - Determinants and Types of Demand - Demand Function - Shifts in Demand - Concepts of Supply and Law of Supply - Market Equilibrium - Elasticity of Demand: Concept and Types- Price, Income and Cross Elasticities of Demand - Measurement Methods of Price Elasticity of Demand

2. Utility Analysis

Cardinal and Ordinal Utility Approaches - Law of Diminishing Marginal Utility - Law of Equi-Marginal Utility - Consumer Surplus - Indifference Curve Analysis: Assumptions, Properties, Budget Line and Consumer's Equilibrium - Derivation of Demand Curve with the help of Indifference Curves - Price, Income and Substitution Effects - Hicks and Slutsky Versions - Revealed Preference Theory

3. Production Analysis

Production, Production Function and Factors of Production - Law of Variable Proportions - Isoquant, Isocost Curves and Producer's Equilibrium - Laws of Returns to Scale - Economies and Diseconomies of Scale - Cost Analysis: Cost Curves in Short Run and Long Run - Revenue Analysis - Relationship among Average Revenue, Marginal Revenue and Elasticity of Demand

4. Market Structure Analysis

Concepts of Firm, Industry and Market - Classification of Markets - Objectives of the Firm - Equilibrium of a Firm - Shut-Down Point - Perfect Competition: Concept, Characteristics, Equilibrium of Firm and Industry - Optimum Firm - Monopoly: Concept, Types, Characteristics and Equilibrium of the Firm - Price Discrimination - Bilateral Monopoly - Monopolistic Competition: Concept, Characteristics, Equilibrium

of the Firm and Selling Costs

5. Oligopoly, Duopoly and Factor Pricing Analysis

Oligopoly: Concept, Characteristics and Price Rigidity - Oligopoly Models - Duopoly: Concept and Characteristics - Duopoly Models - Marginal Productivity Theory of Distribution - Distribution Theories of Rent, Wages, Profit and Interest

II . Macro Economics

1. National Income Analysis

Concept, Nature & Scope and Importance of Macro Economics - Concept of Circular Flow of Incomes- National Income Analysis: Concepts and Components - Methods of Measurement of National Income- Importance of and Difficulties in the Estimation of National Income - Limitations of National Income as a Measure of Welfare - Social Accounting

2. Theories of Income and Employment

Classical Theory of Employment: Say's Law of Markets and Pigou's Wage Cut Policy - Keynesian Theory of Income and Employment: Effective Demand, Aggregate Demand Function and Aggregate Supply Function - Consumption Function: Average Propensity to Consume and Marginal Propensity of Consume - Factors Determining Consumption Function - Savings Function: Average Propensity to Save and Marginal Propensity to Save - Concepts of Multiplier, Accelerator and Super-Multiplier

3. Theories of Investment and Interest Rate

Capital and Investment - Types and Determinants of Investment - Marginal Efficiency of Capital - Ex-Post and Ex- Ante Investment and Savings - Classical, Neo-Classical and Keynesian

Theories of Interest - Simultaneous Determination of Interest and Real Income through IS-LM Framework

4. Supply of Money and Demand for Money

Meaning, Functions and Classification of Money - Measures of Money Supply - Demand for Money - Classical Theories of Money: Fisher's and Cambridge Versions of Quantity Theory of Money - Keynesian, Baumol and Milton Friedman Approaches to Demand for Money

5. Inflation and Trade Cycles

Inflation: Concept and Types - Causes and Measurements of Inflation - Effects (Consequences) of Inflation - Measures to Control Inflation - Phillips Curve, Deflation and Stagflation - Trade Cycles: Concept, Nature and Causes - Phases and Remedial Measures of Trade Cycles - Models of Business Cycles : Samuelson, Hicks and Kaldor

III . Public Finance

1. Introduction to Public Finance

Role of State in Economic Activities, Planning and Development - Nature, Scope and Evolution of Public Finance - Public, Private and Merit Goods - Multiple Theory of Public Household - Principle of Maximum Social Advantage

2. Public Revenue and Taxation

Public Revenue: Sources and Classification - Direct and Indirect Taxes - Progressive, Proportional and Regressive Taxes - Canons of Taxation - Characteristics of a Good Tax System - Impact and Incidence of Taxation - Effects of Taxation - Approaches to Taxation

3. Public Expenditure and Public Debt

Public Expenditure: Classification and Principles - Determinants of Public Expenditure - Theories of Public Expenditure: Wagner and Peacock-Wiseman - Effects of Public Expenditure - Public Debt: Nature, Sources and Classification - Effects and Redemption of Public Debt - Debt Trap

4. Fiscal Policy and Federal Finance

Fiscal Policy: Concept, Objectives and Tools - Fiscal Policy and Monetary Policy - Federal Finance: Concept and Features - Centre-State Financial Relations - Transfer of Resources from Centre to State and Local Bodies - Functions of Finance Commission - Current Finance Commission's Recommendations

5. Budget

Budget: Concepts, Classification and Types - Revenue Account and Capital Account - Budget Deficits: Concepts, Types and Implications - Fiscal Responsibility and Budget Management (FRBM) - Budgeting in India

IV. International Economics

1. Theories of International Trade

International Trade and Inter-Regional Trade - Inter-Industry Trade - Gains from Trade - Trade as an Engine of Economic Growth - Role of International Trade in Economic Development - Classical and Neo-Classical Theories of International Trade - Theory of Factor Price Equalisation - Heckscher-Ohlin Theory of International Trade

2. Terms of Trade and Barriers to Trade

Concepts of Terms of Trade - Factors Affecting Terms of Trade - Uses and Limitations of Terms of Trade - Secular Deterioration Hypothesis of Terms of Trade: Singer and Prebisch - Gunnar Myrdal Views on Terms of Trade - Tariffs, Quotas and Subsidies: Their Effects - Impact of Tariffs on Partial and General Equilibrium Analyses - Political Economy of Non-Tariff Barriers and Their Implication

3. Balance of Payments

Concepts of Balance of Trade and Balance of Payments - Factors Affecting Balance of Trade - Differences Between Balance of Trade and Balance of Payments - Components of Balance of

Payments- Equilibrium and Disequilibrium in Balance of Payments - Types of Disequilibrium - Causes and Consequences of Disequilibrium in Balance of Payments - Remedial Measures for Correcting Disequilibrium in Balance of Payments - Devaluation - Recent Trends in India's Balance of Payments

4. Exchange Rates

Foreign Exchange Market - Exchange Rates: Concept and Types - Relative Merits and Demerits of Fixed and Flexible Exchange Rates - Theories of Exchange Rates Determination: Mint Parity and Purchasing Power Parity (PPP) - An Overview of Different Methods of Exchange Rate Determination in India

5. International Monetary System and International Finance

International Liquidity - Lending Operations of International Financial Institutions: IMF, World Bank (IBRD), IDA, IFC, ADB and BRICS - Euro-Dollar and Euro-Currency Markets - International Trade Institutions: GATT and WTO - Impact of WTO on Indian Economy

V. Economics Of Development And Growth

1. Socio-Economic and Institutional Aspects of Economic Development

Concepts of Economic Growth, Development, Underdevelopment and Deprivation - Distinction Between Growth and Development - Objectives of Economic Development - Sustainable Development and Inclusive Growth - Indicators (Measures) of Economic Development

2. Factors of Economic Development

Factors Hindering Economic Development - Factors Promoting Economic Development - Population and Economic Development - Population Explosion - Theories of Demographic Transition - Malthusian Population Theory - Optimum Theory of Population - Human Resource Development and Economic Development - Natural Resources and Economic Development - International Aspects of Economic Development

3. Theories of Growth and Development

Classical Theories of Economic Growth: Adam Smith, Ricardo and J. S. Mill - Karl Marx Theory of Economic Development - Schumpeter's Theory of Economic Development - Rostow's Theory of Economic Growth - Hansen's Theory of Secular Stagnation

4. Strategies of Economic Development and Growth

Big Push Theory - Balanced Growth Strategies of Rodan, Nurkse and Lewis - Unbalanced Growth Strategy of Hirschman - Critical Minimum Effort Thesis - Low Level Equilibrium Trap - Theories of Social and Technological Dualism

5. Growth Models

Harrod-Domar Growth Model - Kaldor's Growth Model - Joan Robinson's Growth Model - Gunnar Myrdal's Model - Choice of Techniques: AK Sen - Technical Progress: Hicks and Harrod

VI. Indian Economy

1. Basic Structure and Demographic Features of Indian Economy

Basic Features of Indian Economy: Growth, Trends and Structural Changes in Indian Economy - Demographic Features of Indian Population - Size, Growth and Composition of Population and Their Implications on Indian Economy - Concepts of Demographic Transition and Demographic Dividend - Secular and Occupational Distribution of Population in India - Population Policy of India - Human Resource Development: Education and Health - Human Development Index

2. National Income, Income Inequalities, Poverty and Unemployment

Estimation of National Income in India - Trends and Composition of National Income in India - Income Inequalities in India: Magnitude, Causes, Consequences and Remedial Measures - Poverty in India: Concept, Types, Trends, Causes and Consequences - Unemployment in India: Concept, Types, Trends, Causes and Consequences - Poverty Alleviation and Employment Generation Programmes in India.

3. Planning and Public Policy

Concept, Types and Importance of Planning - Major Objectives of Five Year Plans in India - Review of Five Year Plans : Achievements and Failures - Current Five Year Plan - NITI Aayog - Economic Reforms: Liberalisation, Privatisation and Globalisation - A Critical Evaluation of Economic Reforms- Regional Imbalances: Causes, Consequences and Remedial Measures - Rural-Urban Disparities: Migration

4. Agricultural Sector

Nature and Importance of Agriculture in Indian Economic Development - Trends in Agricultural Production and Productivity - Agricultural System in India and Land Reforms - Green Revolution - Cropping Pattern - Agricultural Finance - Agricultural Marketing - Agricultural Pricing - Food Security in India

5. Industrial and Service Sectors

Structure, Growth, Trends and Importance of Indian Industry - Problems of Indian Industry - Medium, Small Scale and Micro Enterprises (MSME) : Growth, Role and Problems (Including Sickness Problem)- Industrial Policies of 1948, 1956 and 1991 - FEMA and Competition Commission of India - Disinvestment Policy - Foreign Direct Investment - Concept and Components of Service Sector - Infrastructural Development: Transport, Energy, Communication and Information Technology

VII . Telangana Economy

1. Telangana Economy: Human Resources

Economic History of Telangana - Economic Features of Telangana - Demographic Features of Telangana - Occupational Distribution of Population in Telangana - Sectoral Distribution of Population- Migration - Human Resource Development: Education and Health

2. Gross State Domestic Product, Poverty and Unemployment

Growth and Trends in Gross State Domestic Product and Per Capita Income in Telangana: Districtwise Analysis - Sectoral Contribution to Gross State Domestic Product - Inequalities in the Distribution of Income and Wealth - Poverty in Telangana: Trends, Causes and Consequences - Unemployment in Telangana: Trends, Causes and Consequences - Poverty Alleviation and Employment Generation Programmes in Telangana - Other Welfare Programmes in Telangana

3. Agricultural Sector

Growth of Agriculture in Telangana Economy - Trends in Agricultural Production and Productivity - Determinants of Agricultural Productivity - Cropping Pattern - Agrarian Structure and Land Reforms- Irrigation: Sources and Trends - Mission Kakatiya - Agricultural Credit and Rural Indebtedness - Agricultural Marketing - Food Security in Telangana

4. Industrial Sector

Structure of Telangana Industry - Growth and Pattern of Industrial Development in Telangana - Industrial Policy of Telangana State - Special Economic Zones (SEZ) - Role of Small Scale Industries in Telangana Economy - Problems & Remedial Measures of Small Scale Industries: Issue of Sickness- Industrial Finance in Telangana

5. Service and Infrastructural Sectors

Growth and Trends in Tertiary Sector in Telangana - Growth and Pattern of Development of Service Sector in Telangana - Infrastructural Development in Telangana: Transport, Energy, Communication & Information Technology and Tourism - Regional Imbalances: Causes, Consequences & Remedial Measures

VIII. Quantitative Methods For Economic Analysis

1. Mathematical Foundations of Economic Analysis

Need and Importance of Quantitative Methods in Economics - Meaning and Basic Concepts of Mathematics: Constants and Variables - Functions: Linear, Non-Linear Functions - Equations and Graphs of Linear, Quadratic and Cubic Functions - Concept of Derivative -- Rules of Differentiation with respect to Cost, Revenue, Price and Demand Functions - Application of Maxima and Minima in Economic Analysis

2. Introduction to Statistics

Meaning, Basic Concepts and Uses of Statistics - Population and Sample - Frequency Distribution, Cumulative Frequency - Graphic and Diagrammatic Representation of Data - Types of Data: Primary and Secondary Data - Methods of Collecting Data: Census and Sampling Methods (Random and Non-Random Sampling Methods)

3. Measures of Central Tendency and Dispersion

Measures of Central Tendency: Mean, Median, Mode, Geometric Mean and Harmonic Mean - Properties of Good Average - Comparison of Different Averages - Measures of Dispersion - Absolute and Relative Measures of Dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Coefficient of Variation and Variance

4. Correlation and Regression

Correlation: Meaning and Types - Karl Pearson's Correlation Co-efficient - Spearman's Rank Correlation - Regression: Meaning and Uses of Regression - Estimation and Interpretation of Regression Line

5. Index Numbers and Time Series Analysis

Index Numbers: Meaning and Uses - Types of Index Numbers - Methods of Index Numbers: Laspeyres, Paasche and Fisher - Analysis of Time-Series: Meaning and Uses - Components of Time Series Analysis: Secular, Seasonal, Cyclical and Irregular Variations - Methods of Measurement of Secular Trends: Graphic, Semi-Averages, Moving Averages and Least Squares Methods

IX . Banking And Economics Of Infrastructure

1. Commercial and Central Banking

Commercial Banks: Concept and Types - Functions and Principles of Commercial Banks - Balance Sheet of Commercial Banks - Process of Credit Creation - Social Responsibility, Importance and Growth of Commercial Banks in India - Central Banking - Functions of Reserve Bank of India - Concept and Objectives of the Monetary Policy - Instruments of Monetary Policy - Financial Sector Reforms in India

2. Financial and Investment Banking

Concept, Types, Functions and Growth of Non-Banking Financial Intermediaries - Their Impact on Indian Economy - Measures Taken to Control Their Operations - Development Bank: Concept, Functions and Importance - Functioning of Different Development Banks - Investment Banking - Merchant Banking

3. Money Market and Capital Market (Financial Markets)

Money Market: Concept and Characteristics - Components and Sub-Markets of Money Market - Functions of Money Market - Recent Trends and Importance of Money Market in India - Capital Market: Concept, Functions and Importance - Components of Capital Market: Primary and Secondary Markets - Stock Exchange: Concept and Functions - SEBI and Its Functions

4. Infrastructure and Economic Development

Concept of Infrastructure - Infrastructure as a Public Good - Special Characteristics of Public Utilities - Importance of Infrastructure in Economic Development - Trends in the Growth of Infrastructure in India - Classification of Infrastructure: Social and Physical Infrastructure - Social Infrastructure: Education, Health and Hygiene - Human Resource Development: Concept, Scope and Importance - Education in India: Planning, Policies and Financing - Trends in the Growth of Education in India - Health in India: Planning, Programmes and Importance

5. Physical Infrastructure

Types of Physical Infrastructure - Concept of Energy - Sources of Energy: Renewable & Non-Renewable and Conventional & Non-Conventional Energy - Sources of Commercial Energy: Coal, Oil & Gas and Electric Power - Transport - Modes / Categories of Transport: Roadways, Railways, Airways and Waterways - Role of Transportation in Economic Development - Information and Communication Technology (ICT): Concept, Growth, Trends and Importance

X . Economics Of Environment

1. Introduction to Environmental Economics

Concepts of Ecology and Environment - Interaction Among Ecology, Environment and Economy - Micro Economic Theory of Environment - The Pricing of the Environmental Variables - Pareto Optimality and Market Failure in the Presence of Externalities - Bio-Diversity: Meaning, Uses, Effects and Conservation

2. Resource Allocation

Natural Resources: Meaning, Features, Classification and Importance - Economics of Exhaustible, Non-Exhaustible Resources - Problems of Resource Allocation - Natural Resources Depletion: Optimal Rate of Depletion - Common Property Resources: Problems - Conservation of Resources - Implications of Ecological Imbalances

3. Environmental Valuation

Valuation of Non-Market Goods and Services: Measurement Methods - Environmental Degradation: Concept and Causes - Valuation of Environmental Degradation - Direct and Indirect Methods - Degradation of Land (Soil), Forest and Natural Resources: Causes and Effects - Cost-Benefit Analysis of Environmental Policies and Regulations

4. Sustainable Development

Impact of Environment on GNP - Limits to Growth - Sustainable Development: Concept and Rules - Modern and Neo-Classical Views on Sustainable Development - Peoples Movement for Sustainable Development - Development vs Sustainable Development

5. Environmental Pollution and Policies

Environment and Economy Interaction - Industrial and Agricultural Technology: Its Impact on Environment - Different Types of Pollution: Their Causes and Effects - Environmental Policy and Conservation and Protection of Eco-System - Implementation of Environmental Policies in India - Global Environmental Issues.

Written Examination Syllabus for the post of Degree College Lecturers in Residential Educational Institutions Societies

Paper - II: Political Science

I. Political Science - Basic Concepts

- Political Science: Nature and Scope - Inter disciplinary Character.
- Key Concepts: State, Sovereignty, Power, Nation.
- Political Ideas: Rights, Liberty, Equality, Law and Justice.
- Democracy: Meaning and Theories and Democracy, Electoral System.
- Forms of Government: Unitary and Federal, Parliamentary and Presidential.

II. Political Theory

- Political Ideologies: Liberalism, Neoliberalism, Marxism, Socialism and Fascism.
- Role of Ideology and end of Ideology.
- Nationalism and Internationalism.
- Theories of Development: Marxian, Liberal and Gandhian

III. Political Thought

- Greek Political Thought: Plato and Aristotle.
- Medieval Political Thought: Aquinas and St. Augustine.
- Modern Political Thought: Machiavelli and Bodin.
- Contractual Political Thought: Hobbes, Locke and Rousseau
- Indian Political Thought: Manu, Kautilya, Buddha, Gandhi, Phule and Ambedkar

IV. Comparative Politics

- Comparative Politics: Nature, Scope and Approaches.
- Constitutionalism: Western and Non- Western.
- Organs of Government: Legislature, Executive and Judiciary.
- Party Systems and Pressure Groups
- Power, Authority and legitimacy.

V. Political Sociology

- Political Socialization and Political Culture
- Political Development and Political Modernization.
- Political Elite and Theories.
- Political Communication: Changing Role of Media.
- Political Stratification: Caste, Class and Gender.

VI. Indian Government and Politics

- Nationalist Movement and Making of the Constitution.
- Salient Features and Ideological foundations of Indian Constitution.
- Federalism and Centre - State Relations.
- Development Strategies in India: Planning
- Union Executive, Legislature and Judiciary: President, Prime Minister, ^/ Council of Ministers, Lok Sabha and Rajya Sabha, Supreme Court and Judicial Review
- Contemporary Socio- Political Movements: Peasant, Dalit, Tribal Backward, Environmental, Regional and Sub: Regional Movements. Statehood Movements

VII. State and Local Governments

- Frame work for the study of State Politics.
- State Executive & Legislature: Governor, Chief Minister and State Legislature

- Panchayati Raj: Genesis and Development - Structure and Functions, 73rd Amendment of Indian Constitution
- Urban Local Government: Structure and functions, 74th Amendment of Indian Constitution

VIII. Public Policy and Political Analysis

- Public Policy: Nature, Scope and Importance - Public Policy as a Policy Science.
- Theories of Public Policy: Group theory, Incrementalism, Elite theory, Decision-making theory.
- Policy making Institutions: Legislature, Executive and Judiciary - Planning Commission
- Policy Process: Role of Media, Political Parties and Pressure Groups.
- Policy Evaluation.

IX. International Relations

- Approaches to the study of International Relations.
- Colonization and Decolonization: Rise of Third world, Problems & Prospects
- Elements of National Power.
- International Security: Disarmament, Arms control, Diplomacy, Cold War, war and Conflict Resolution.
- International Organization

A. UNO: Aims, objectives, structure and its changing role in the contemporary world.

B. SAARC, ASEAN and EU

- Indian Foreign Policy: Non-Alignment, Relations with neighbors and security concerns and Globalization.
- Contemporary issues in International Relations: Human Rights, Environmental Issues, climate Change and Terrorism
- International Financial Institutional: World Bank, IMG & WTO.

Written Examination Syllabus for the post of Degree College Lecturers in Residential Educational Institutions Societies

Paper - II: Commerce

I. Financial Management: Meaning, Nature, Objectives and Scope of Financial Management - Capital Budgeting, Process, Techniques - Sources of Finance, Cost of Capital - Cost of various sources of finance - Leverages: Operating and Financial leverages - Capital Structure Theories - Dividend decisions - Working Capital Management - Cash, Receivables and Inventory Management.

II. Financial and Management Accounting: Accounting Standards - Corporate Reporting - Accounting for price level changes - Human Resource Accounting - Responsibility Accounting - Analysis of Financial Statements - Techniques: Comparative and Common Size statements, Trend analysis, Ratio analysis, Funds Flow and Cash Flow analysis - Marginal Costing and Decision Making.

III. Cost Accounting and Control: Cost concepts and Classification - Installation of costing system - Elements of Cost: Material, Labour and Overheads - Methods of Costing - Techniques of costing: CVP, Standard Costing and Budgetary control - Uniform costing - Inter-firm comparisons and Activity Based costing - Cost Control, Cost Reduction and Cost Audit.

IV. Managerial Economics: Meaning, Nature and Scope of Managerial Economics - Demand Analysis, Production and Cost Analysis - Market Structure: Perfect and Imperfect Markets.

V. Organisation Theory and Behaviour: Organisation concept and theories - Individual vs. Group Behaviour - Motivation and Morale - Communication: Types and Barriers - Leadership: Styles and Theories.

VI. Marketing Management: Meaning, Concepts, Nature and Scope - Marketing Environment - Consumer Behaviour and Market Segmentation - Product, Price, Promotion and Channel management.

VII. Human Resource Management: HR Functions - HR Planning - Job analysis - Recruitment and Job Evaluation - Training and Development methods - Performance Appraisal Methods - Trade Unions and Collective Bargaining.

VIII. Business Environment: Meaning and Components of Business Environment - Industrial Policies (including Telangana State Industrial Policy) - Liberalisation, Privatisation and Globalisation - Indian Capital and Markets - Foreign Direct Investment - FEMA and WTO.

IX. Quantitative Techniques: Correlation and Regression - Sampling and Sampling methods - Probability and Probability Distributions - Hypothesis Testing - Parametric Tests (Z, t-test and ANOVA) and Non-parametric Tests (Chi-square test).

X. IT and e-Commerce: e-Commerce business models - Internet and web technologies - e-payment methods, e-cash, e-cheques, credit cards, smart cards and debit cards.

Written Examination Syllabus for the post of Degree College Lecturers in Residential Educational Institutions Societies

Paper - II: Business Administration

UNIT - 1: MANAGEMENT: Meaning - Role & Importance - Functions of Management - Planning & Types of Plans - Decision Making - Organizing - Formal and Informal Organization Structure - Span of Management - Delegation of Authority - Centralization and Decentralization - Communication - Process, Channels & Barriers - Leadership - Styles & Theories - Coordination - Controlling.

UNIT - 2: ORGANIZATIONAL BEHAVIOUR (OB): Concept & Significance - OB Models - Understanding and Managing Individual Behaviour - Perception - Values - Attitudes - Learning - Understanding and Managing Group Behaviour - Interpersonal Relations - Group Dynamics & Team Building - Organization Culture - Concept & Determinants - Managing Change - Conflict Management - Stress Management.

UNIT - 3: MANAGERIAL ECONOMICS: Fundamental Concepts - Law of Demand - Demand Analysis - Demand Forecasting - Production Function - Cost Function - Market Structure and Pricing - Perfect Market, Imperfect Market, Monopoly & Oligopoly - Pricing Policies and Methods - Profit Concepts & Measurement - Break Even Point.

UNIT - 4: BUSINESS ENVIRONMENT: Meaning - Constituents of Internal & External Environment - Liberalization - Privatization - Globalization - Foreign Trade and EXIM Policy - Foreign Capital & Collaborations - Monetary & Fiscal Policies - Free Trade Vs Protectionism - Cartelization - WTO.

UNIT - 5: HUMAN RESOURCE MANAGEMENT: Meaning - HRM Vs HRD - Human Resource Planning - Job Analysis - Job Description - Recruitment and Selection - Induction - Training and Development - Job Evaluation - Concept & Methods - Performance Appraisal - Meaning & Methods - Motivation - Concept, Theories, & Techniques - Compensation Management.

UNIT - 6: STRATEGIC MANAGEMENT: Meaning & Importance - Mc Kinsey 7S Framework - Corporate Governance - Strategy Analysis & Strategy Formulation - Business Portfolio Analysis - Strategic Control & Evaluation - Strategic Alliances.

UNIT - 7: MARKETING MANAGEMENT: Concepts of Market & Marketing - Marketing Environment - Marketing Mix - Consumer Behaviour - Determinants & Models - Market Segmentation - Targeting & Positioning - Branding - Product Life Cycle - Promotion Mix - Services Marketing - Marketing Research - New Trends in Marketing.

UNIT - 8: PRODUCTION MANAGEMENT: Role & Scope of Production Management - Product Selection - Process Selection - Facilities Location - Lay out Planning - Work and Job Design - Operation Planning and Control - Mass Production - Batch Production and Job Shop Production - Planning and Control Process - Network Analysis - PERT & CPM - Value Engineering - Business Process Re-engineering - Quality Assurance - Supply Chain Management-Concept.

UNIT - 9: QUANTITATIVE TECHNIQUES: Relevance of QT in Decision-Making - Research Process - Central Tendency - Dispersion - Data Collection (including Sampling Methods) - Probability Distributions - Concepts; Discrete Probability Distributions; & Continuous Probability Distributions -- Test of Hypothesis - Chi-square Test & ANOVA - Business Forecasting Methods - Correlation, Regression, & Time Series Analysis - Report Writing.

UNIT - 10: OPERATIONS RESEARCH: Meaning - Importance - Role - Linear Programming - Minimization and Maximization Methods - Graphic Method - Transportation and Assignment Problems - Goal Programming - Dynamic Programming - Inventory Control Models - Queuing Models - Decision Theory - Game Theory - Simulation.

UNIT - 11: FINANCIAL, COST & MANAGEMENT ACCOUNTING: Accounting Concepts - Principles - Conventions - Accounting Standards - Indian Accounting Standards (IND AS)- Cost Accounting - Classification of Cost - Cost Sheet - Standard Costing - Process Costing - Job & Batch Costing - Preparation and Analysis of Financial Statements - Inflation Accounting - Cost-Volume-Profit Analysis.

UNIT - 12: FINANCIAL MANAGEMENT: Meaning & Importance - Objectives - Sources of Finance - Investment Decisions - Financing Decisions - Dividend Decisions - Ratio Analysis - Working Capital Management - Cash Management - Receivables Management - Inventory Management.

UNIT - 13: INFORMATION TECHNOLOGY FOR MANAGERS: Hardware & Software - Operating Systems - Functions & Types - DBMS - Network Topologies - Types of Networks - Management Information System - SDLC - Data Analytics.