# Anthropology

**PAPER – I**

**Unit – I** - History and Development of Social and Cultural Anthropology. Basic Concepts: Simple Society, Complex Society, Community, Culture, Civilization, Primary and Secondary Groups, Cultural Relativism and Ethnocentrism, Ethnicity, Globalization, and Postmodern Anthropology. Social Organization, Social System, Social Structure, Social Process, Social Function, Values and World View. Types of Marriage: Monogamy, Polygamy, Preferential and Prescriptive, Endogamy, Exogamy, Parallel and Cross Cousin. Types and Functions of Family. Types of Kinship Terms, Types and Structure of Descent Groups. Types of Kin Group, Alliance Theory.

**Unit – II** - Definition, Nature and Characteristics of Culture. Paradoxes of Culture. Types of Culture Change: Innovation, Invention, Diffusion, Acculturation, Assimilation, Attenuation, Integration. Cultural Adaptation: Enculturation and Socialization. Concepts and Theories of Religion, Religion, Magic and Science, Religious Functionaries. Types of Political Organization, State and Stateless Societies. Forms and Agencies of Social Control, Social Sanction, Law and Justice, Concepts of Production, Consumption, Exchange and Distribution. Primitive And Peasant Economy, Reciprocity And Redistribution, Types And Technological Levels Of Economy: Foraging, Hunting, Pastoralism, Shifting Cultivation. Terrace Cultivation, Dry and Wet Cultivation, Horticulture and Industrial.

**Unit – III** - Methodological Perspectives in Anthropology. Field Work And Field Work Traditions In Anthropology, Methodological Approaches In Anthropology: Holistic, Emic And Etic, Synchronic And Diachronic, Testing Of Hypothesis. Types of Research Design. Techniques of Data Collection and Their Types: Observation, Interview, Case Study, Schedule and Questionnaire. Qualitative and Quantitative Methods. Types of Sampling and Their Application. Methods of Comparison, PRA And RRA Techniques, Sociogram, Projective Techniques, Type of Scaling Techniques, Methods of Visual Anthropology, Measurement of Central Tendencies, Frequency Distribution, Standard Deviation, Standard Error, Chi-Square Test, Coefficient of Co Variation And Co-Efficient of Correlation.

**Unit – IV** - Emergence Of Anthropology As An Empirical Discipline, Anthropology As Natural Science And Natural History, Classical Evolutionism, Diffusionism, Structuralism, Structural-Functionalism, Functionalism, Neo-Evolutionism, Configurational Approach And Culturological Approach To The Study of Culture, Post-Structuralism, Symbolic And Interpretive Anthropology, Postmodern Anthropology, Concepts of Culture And Personality. Individual, Culture and Society, Types of Personality Formation and Determinants, Types of Personality, Personality and Social Structure, Functions of Personality, Psychology of Culture Change, Diachronic And Synchronic Study of Culture and Personality. Relation between Language and Culture, Classification of Language, Functional Study of Language, Structural Analysis in Linguistics and Anthropology, Language and Communication.

**Unit – V** - Approaches to the Study of Indian Civilization. Concepts of Little Tradition and Great Tradition, Unity and Diversity, Universalization and Parochialisation. Relevance of Village Studies, Types of Village. Caste as a Concept and System, Origin of Caste, Jajmani System, Dominant Caste, Caste and Politics, Problems of Scheduled Caste. Folk-Urban and Tribe-Caste Contrast and Continuum. Sacred Complex Studies in India. Scheduled Tribes and Their Types, Distribution and Classification of Tribal Languages, Peasant Society and Culture. Problems of Minorities.

**Unit – VI** - Problems in Tribal Society: Land Alienation, Shifting Cultivation, Housing, Health, Nutrition and Sanitation, Indebtedness, Alcoholism, Bonded Labour, Child Labour, Education, Poverty and Gender Issues. Problems of Displacement and Rehabilitation. Development Strategies, Policies, Plans and Programmes of Tribal Development. Approaches to Tribal Development, Role of Anthropology in Tribal and Rural Development, Types of Tribal Movement in India. New Panchayati Raj System: PESA Act and Gram Sabha. Role of N.G.Os in Development.

**Unit – VII** – The New Development Paradigm: Anthropology of Development and Anthropology in Development. Applied and Action Anthropology. Meanings & Characteristics and Indices of Economic Development, Social and Cultural Dimensions of Economic Development, Development and Under-development. The Third World profile. Regional Imbalances and Regional Development in India. Poverty Alleviation Programmes in India, Agricultural and Industrial Development in Rural India. Regional Development in India. Quality of life and Collective Well being. Resources (Human and Natural) and their utilization in Odisha.

**Unit – VIII** – Problems of Development. Socio-cultural Barriers and Stimulants to Development. Economic Development and Social change, Modernization and Development. Culture of Development & Development of Culture. Planned Development in India, Planning in India: Centralised, De-centralised, Top-bottom, Bottom-top, Sectoral and Integrated. Constitutional safequards and protective legislations for SCs and STs in India. Gender and Development. Environment and Development, Health and Development, Education and Development. Theories of Economic Development (Adam Smith, Devis Richarod, Thomas Malthus, J.S. Mills Myrdal, Schumacher, Marx, Schumpteter and Amartya Sen) Globolization, Liberlisation and Development.

**PAPER-II**

**Unit – I** - Aims and scope of Biological Anthropology, History and development of Biological/Physical Anthropology, Application of biological anthropology, Recent trends in biological anthropology. Theories of organic evolution: Lamarckism, Darwinism, Synthetic theory, Origins of Man: "Out of Africa model" and "Multiregional Model", Principles of evolution: Convergence evolution and Divergent evolution. Evolution and adaptation

**Unit – II** - Man's place in Animal Kingdom, Characteristic features of living primates , Primate evolution with special reference to skull, law, limbs, dentition and brain, Primate fossils: Aegyptopithecus, Propliopithecus, Dryopithecus, Ramapithecus ; Primate social behavour; Erect posture and bipedalism , Stages of human evolution: Australopithecine stage, Homo-erectus stage, Neanderthal stage( Conservative and progressive variety )Homo-sapien-sapiens stage : (Cro-Magnon Man , Grimaldi Man & Chancelade Man )

**Unit – III** - Living Human variation: Concepts of race, Biological concept of race Racial classification of major races of world population, Racial Criteria: Metric, Non-metric, genetic, Racial Classification of Indian population (Risley, Guha and Sarkar), Distribution of Genetic variation: ABO Blood group, Rh Blood group, MN blood group; distribution of genetic disorders: sickle cell anaemia, Thalassemia, $G^6PD$ Deficiency.

**Unit – IV** - Human genetics: Scope and development, Mendel's Law and its application to human population, Inheritance of genetic traits in Man: Autosomal, Sex-linked characters, methods of studying Heredity: Twin method, Pedigree method, Hardy-Weinberg Law & its application in human population, Genetic polymorphism: Balanced & Transient, Chromosome Karyotypes in man, Chromosomal abnormality in man, Structure & function of DNA and RNA, Replication of DNA, Recombinant Technology, Application areas of human genetics: Pre-natal diagnosis, genetic counseling, paternity determination, DNA finger printing. Factors affecting genetic structure of human population: mutation, selection, drift and gene flow

**Unit – V** - Definition & Scope of prehistoric Archaeology, Geological frame work : An outline of Pleistocene epoch, Glacial and Interglacial period in Europe and India, Causes and consequences of glaciations; methods of dating: Relative dating – study of stratigraphy, Pollen Analysis, Paleontology; Absolute dating – Radio carbon dating, Potassium – Argon method;, Thermoluminiscence method; Concept of Three age system of cultural chronology; Prehistoric Technology & Tool types of Paleolithic, Mesolithic and Neolithic Cultures. History and development of museums in the world.

**Unit – VI** - Lower Paleolithic Cultures of Africa and South Asia (India): Pebble tool culture in Africa(evidence from Olduvai Gorge) and India (Sohan valley Culture), Achulian Culture of Africa and Achulian Cultural of peninsular India, Middle stone age cultures of Africa and Middle Palaeolithic culture of India, Late stone age culture of Africa, Upper Paleolithic culture in India, Mesolithic and Neolithic culture of Europe of India, Proto-historic culture of South Asia (India) – Chalcolithic culture of India , Indus Valley civilization: Salient features (Town planning, settlement, Agriculture, Art & Craft, Metal technology, Trade, religion, burials etc. Origins and causes of decline of the Indus civilization.

**Unit – VII** -Ecological anthropology :definition and scope ;Aspects of ecological anthropology :environmental determinism, environmental possiblism, cultural ecology, population ecology, system ecology, ethno-ecology, palaeoecology, social ecology, ;Eco-system: structure and function, major eco-systems of the world , Bio-cultural adaptation to cold, heat and high altitude, Energetic and human society, Ecological ethnology: ecological adaptation of hunter-gathers, Nomads , and Island communities ,carrying capacity of ecosystem, cultural component of eco-systems; culture as the master variable, environment and sustainable development, Environmental problems: causes and consequences of degradation of land ,water ,air. Global warming and Green house effect, Effects of environmental pollutants on human health Environmental policy in India

**Unit-VIII :** Medical anthropology : scope and application ; socio-cultural and bio-medical concept of health, disease and illness; Ethno-medicine; Symbolic aspects of sickness and healing, An outline of medical systems in India , Epidemiology of communicable and non-communicable diseases; Determinants of health: Socio-cultural, environmental and genetic; National health policy; Population policy in India ;Nutrition policy of India ,Factors affecting fertility and mortality in India ; Problems of food security and malnutrition in India ,Reproductive and child health problem in India , National Rural Health Mission : Objectives and perspectives ,Problems of aged in India , Gender and health

# Botany

## PAPER-I

**Unit-I -** **Algae -** General characteristics, Organization of thallus, Cell Structure, Reproduction,Alternation of generation, Economic importance; Structure, Reproduction and life cycle of *chlamydomonas* and Spirogyra.

**Cyanobacteria** – General characteristics, Cell structure, Heterocysts, Reproduction and Economic importance.

**Fungi -** General characteristics, organization of thallus, Reproduction, Alternation of generations, Economic importance; Structure, Reproduction and life cycle of Yeast, *Mucor* and *Rhizopus.*

**Lichens –** Thallus structure and Reproduction of Lichen.

**Plant Diseases –** Late blight of potato, Smut and rust of wheat, Citrus Canker, Mosaic Disease of tobacco.

**Unit-II -** **Bryophytes -** General characteristics, Alternation of generation, Economic significance;
Structure & Reproduction of *Riccia, Anthoceros* and *Sphagnum.*

**Pteridophytes -** General characteristics, Alternation of generation, Stelar structure, Heterospory and seed habit; General Morphology, Anatomy and Reproduction of *Psilotum, Sellaginella* and *Marsilea.*

**Gymnosperms -** General characteristics, Resemblances with and differences between Pteridophytes and Angiosperms; General Morphology, Anatomy and Reproduction of *Cycas.*

**Unit-III -** **Morphology of Angiosperms** - Root, Stem and their modifications; Leaves and their types, Venation and modifications; Phyllotaxy; Inflorescence; Structure of flower, Floral diagram and Floral Formula; Important features of the families; Cruciferae, Fabaceae, Malvaceae and Poaceae.

**Unit-IV -** **Anatomy -** Anatomy of typical dicot stems, root and leaf; Secondary growth and anomalous secondary growth of stems.

**Embryology of Angiosperms**- Microsporangium, Male gametophyte, Megasporangium, Female gametophyte, Pollination, Fertilization, Sexual incompatibility, Endosperm, Embryo, Seed development, Structure and types of seeds, Seed dispersal, Seed dormancy and germination.

**Unit-V -** **Ecology -** Ecological factors; Ecological adaptations - Hydrophytes, Xerophytes, Mesophytes; Plant succession; Bio-geochemical cycles, Ecosystem and their components, Major ecosystems, Environmental pollution- air, soil and water pollution and their control measures.

## PAPER-II

**Unit–I-** **Viruses**- General characteristics, size and shape, structure, viral multiplication.

**Bacteriophages-** Types, Multiplication, Lytic cycle, Lysogeny.

**Archaea –** General features, cell structure and types.

**Eubacteria** - Morphology, Internal structure, Transformation, Conjugation, Transduction.

**Unit– II - Cell Biology -** Cell structure, Cell wall, Cell membrane, Plastids, Mitochondria, Golgi bodies, Glyoxisomes, Perosisomes, Ribosomes, Nucleus and Nucleolus; Structure of Chromosomes; Cell cycle – Mitosis and Meisosi.

**Unit – III - Genetics -** Mendel's laws of Inheritance, Interaction of genes; Linkage, Recombination and Gene mapping; Extra-Nuclear inheritance; Mutation-Types and induction, DNA damage and repair; Types of polyploidy, Role of mutation and polyploidy in crop improvement.

**Unit – IV - Molecular Biology -** DNA is the genetic material, Structure and Replication of DNA, DNA polymerase; Structure and types of RNA; RNA polymerase and transcription, RNA processing; Translation; Regulation of gene action in prokaryotes with reference to lac-operon.

**Plant Biotechnology**- General idea about plant tissue culture, sterilization techniques, clonal propagation, somaclonal variation; Protoplast isolation and somatic hybridization.

**Transgenic plants**- *Agrobacterium*-mediated gene transfer, Direct gene transfer, Insect (Bt.) and herbicide(glyphosate) resistant transgenic plants.

**Unit – V - Plant Physiology –** Water relations of plant cells, absorption of water, ascent of sap, transpiration, mineral nutrition; Phloem transport.

**Plant Biochemistry –** enzymes; Photosynthesis and photorespiration, respiration, nitrogen metabolism.

**Plant growth regulators –** (auxins, gibberellin, cytokinin, abscisic acid, ethylene), Photoperiodism and venalization.

# Chemistry

## PAPER-I

## SECTION-A : PHYSICAL CHEMISTRY

**Unit-I:**

**Classical thermodynamics**

Brief resume of concepts of law of thermodynamics – free energy, chemical potential and entropies – Partial molar properties – partial molar free energy – partial molar volume and partial molar heat content and their significances – concept of fugacity and determination of fugacity – activity – activity coefficient – Third law of thermodynamics, excess functions for non ideal solutions

**Non-equilibrium thermodynamics**

Thermodynamic criteria – Entropy production and entropy balance equation – chemical equations and chemical affinity- generalized fluxes and forces – phenomenological equations – Onsager's reciprocity relations.

**Statistical thermodynamics**

Enscmble-phase space – Quantum statistics – partition functions – Statistical thermodynamics – Einstein and Debye specific heat equations.

**Unit-II:**

**Chemical dynamics**

Empirical rate laws – Theories of reaction rates – Determination of reaction mechanism – Reaction in solutions – catalysed reaction kinetics – Techniques for fast reactions viz. flow method, relaxation method, flash photolysis, NMR method.

**Electrochemistry**

Electrochemistry of solutions – Debye – Huckel – Onsager treatment and its extension, Ion association – Thermodynamics of electrified interfaces – Lipmann equation – Butler Volumer equation – theory of double layer at interfaces and semiconductor – corrosion and prevention methods.

**Unit-III:**

**Surface chemistry**

Adsorption – Surface tension, Capillary action – pressure difference across curved surface isotherm – BET equation – surface films on liquids.

**Micelles :** Surface active agents and their classifications – Structure of micelles – CMC – Thermodynamics of micellizations – Solubilization –micro emulsion – reverse micelle.

**Polymers :** Definition, type of polymers – kinetie of polymerization – mechanism of polymerization – Molecular mass and its determination (Osmometry, Viscometry, diffusion and light scattering methods).

**Solid state chemistry :** Structural classification of solids of binary and ternary compounds – defects in solids – Electrical properties : Metals, insulator, semiconductor, super conductors – band theory of solids.

**Phase equilibria** : Thermodynamic derivation of phase rule – Three component systems and their application.

**Unit-IV**

**Quantum Mechanics**

Postulates – Particle in box, rigid rotator – harmonic oscillator – variation principles, first order perturbation principle – angular momentum.

**Molecular orbital theory**

Huckel theor of conjugated systems – Free valence index, bond order and charge density calculations – application to ethylene – butadiene – cyclopropylene radical, cyclobutadiene

**Electronic structure of atoms**

Electronic configuration, L-S coupling – term separation of energies of $p^n$ and $d^n$ configurations – spin orbit coupling – Zeeman splitting.

## SECTION – B : INORGANIC CHEMISTRY

**Unit-I**

**Periodic properties and chemical bonding**

Chemical periodicity, VSEPR theory for different types of molecules, Walsh diagram (tri- and penta – atomic molecules), dπ-pπ bond, bent rule and energetic of hybridization some simple reactions of covalently bonded molecules.

**Acid-base concept and Non-aqueous solvents**

Hard-soft acid base concept – acid base strength – theoretical basis of hardness and softness. Non aqueous solvents: types and characteristics – reactions in non-aqueous solvents.

**Symmetry and Group Theory in Chemistry**

Symmetry elements and symmetry operations – definitions of group, subgroup, cosets relation between orders of a finite group and its subgroup – Conjugacy relation and classes. Point symmetry group – Stoneflies symbols – representations of groups by matrices (representation for the $C_n$, $C_{nv}$, $C_{nh}$, $D_{nh}$ groups) – Character of a representation – The great Orthogonality theorem (without proof) and its importance – Character tables and their use.

**Unit-II**

**Chemistry of transition and inner transition elements:**

General characteristics of 1st row transition elements and inner transition elements with special reference to electronic structure, ionic radii, oxidation states, complex formation, magnetic behaviour and spectral properties.

**Coordination compounds and Metal – Ligand Bonding**

Nomenclature and isomerism of coordination compounds – valence bond theory and its limitations – Crystal field theory and its applications to octahedral, tetrahedral and square planer complexes – Limitations of crystal field theory – Molecular orbital theory: sigma bonding and energy level diagram in octahedral, tetrahedral and square planar complexes: bonding and energy level diagram in octahedral complexes.

**Electronic spectra of transition metal complexes**

Types of electronic transitions, selection rule – Spectrochemical, series – Spectroscopic ground states, correlation – Orgel and Tanabe-Sugano diagrams for transition metals complexes ($d^1$ to $d^9$ states), calculations of Dq, B and b parameters – charge transfer spectra.

**Unit-III**

**Metal – Ligand Equilibria in Solution**

Stepwise and overall formation constants and their interrelation, factors affecting the stability of metal complexes – chelate effect and its thermodynamic origin – determination of binary formation constants by pH-metry and spectrophotometry, Job's method of continuous variation.

**Reaction mechanism of transition metal complexes**

Energy profile of a reaction – Thermodynamic and kinetic stability of metal complexes – Kinetic application of valence bond and crystal field theories.

**S**ubstitution reactions of octahedral complexes: acid hydrolysis – base hydrolysis: conjugate base mechanism and the direct/indirect evidences – Substitution reactions in square planar complexes: the trans effect and its application to synthesis of complexes – theories of trans effect – mechanism and factors affecting the substitution reactions.

Redox reactions: Outersphere reactions, Marcus theory for outerasphere reaction – inner sphere reactions.

**Nuclear chemistry**

Radioactive disintegrations, radio isotopes and their applications, nuclear reactions, fission and fusion, radio analytical techniques and activation analysis.

**Unit-IV**

**Metal л complexes**

Metal carbonyls: synthesis, structure and bonding – vibrational, spectra of metal carbonyls for bonding and structural elucidation – EAN concept and application to metal carbondyls – important reactions OF METAL CARBONYIS – Preparation, bonding, structure and important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes – tertiary phosphine as ligand.

**Organometallic Chemistry**

Preparation, properties and applications alkyl and aryls of group-I and II metal (Li, Mg, Zn) and transition metals (Ti, Ni,. Cu and Pd).

**Bioinorganic Chemistry**

Essential and trace metals in biological processes – role of alkali and alkaline earch metal jons - $Na^+$- $K^+$ Pump – metalloporphyrins with special reference to hemoglobin and myoglobin, Metal complexes in transmission of energy – chlorophylix, photosystem-I and photosystem-II in cleavage of water - ATP as energy currency in biological system.

Metalloenzymes: Carbonic anhydrase, carboxypetidase.

Structure and function of metalloproteins in electron transport processes – cytochromes and ferrodoxin.

Biological nitrogen fixation, molybdenum nitrogenase, spectroscopic and other evidences – Metal complexes in medicine.

**PAPER-II**

**SECTION-A : ORGANIC CHEMISTRY**

**Unit-I**

**Stereochemistry, structure and reactivity**

Conformational analysis of cycloalkanes, decalins, effect of conformation on reactivity, conformation of sugars, steric strain due to unavoidable crowding. Elements of symmetry, chirality, molecules with more than one chiral center, threo and erythro isomers, methods of resolution, optical purity, enantiopticand diasterotopic atoms, groups and faces, sterospecific and steroselective synthesis – Asymmetric synthesis – Optical activity in the absence of chiral carbon (biphenyls, allenes and spiranes), chirality due to helical shape.

Types of mechanisms, types of reactions, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Hammond's postulate, Curtin-Hammett principle. Potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotope effects.

**Aliphatic nucleophilic substitution**

The $S_N2$, $S_N1$, mixed $S_N1$ and $S_N2$ and $S_ET$ mechanisms. The neighbouring group mechanism, neighbouring group participation by p and s bonds, anchimeric assistance Classical and non-classical carbocations, phenonium ions, norbormy1 system, common carbocations rearrangements – Application of NMR spectroscopy in the detection of carbocations.

**The SN1 mechanism.**

Nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis and ultrasound, ambident nucleophile, leaving group and reaction medium, phase transfer catalysis and ultrasound, ambident nucleophile, regioselectivity.

**Aliphatic electrophilic substitution**

Bimolecular mechanisms – $S_E2$ and $S_{Ei}$. The $S_E1$ mechanism, electrophilic substitution accompanied by double bond shifts. Effect of substrates, leaving ground and the solvent polarity on the reactivity.

**Unit-II**

**Aromatic Electrophilic Substitution**

The arenium ion mechanism, orientation and reactivity, energy profile diagrams, the ortho/para ratio, ipso attach, orientation in other ring systems – Quantitative treatment of reactivity in substrates and electrophiles – Diazonium coupling – Vilsmeir reaction, Gattermann - Koch reaction.

**Aromatic Nucleophilic Sustitution**

The $S_NAr$, $S_N1$, benzyne and $S_{RN}1$ mechanisms. Reactivity – effect of substrate structure, leaving group and attacking nuleophile. The von Richter, Sommelet – Hauser, and Smiles rearrangements.

**Free Radical Reactions**

Types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance – Reactivity for aliphatic and aromatic sustrates at a bridgehead. Reactivity in the attacking radicals – The effect of solvents on ractivity. Allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids auto-oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts. Sandmeyer reaction. Free radical rearrangement. Hunsdiecker reaction.

**Addition to Carbon – Carbon Multiple Bonds**

Mechanism and stereochemical aspects of addition reactions involving electrophies, nucleophiles and free radicals, regio – and chemoselectivity, orientation and reactivity. Addition to cyclopropane ring – Hydrogenation of double andtriple bonds, hydrogenation of aromatic rings. Hydroboration – Michael reaction – Sharpless asymmetric epoxidation.

**Addition to Carbon – Hetero Multiple Bonds.**

Mechanism of metal Hydride reduction of saturated and unsaturated carbony1 compounds, acids, esters and nitriles. Addition of Grignard reagents,organozinc and organolithium reagents tocarbony1 and unsaturated carbony1 compounds. Witting reaction – Mechanism of condensation reactions involving enolates – Aldol, Knoevenagel, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions.

**Elimination Reactions**

The $E_2$, $E_1$ and $E_1CB$ mechanisms and their spectrum –Orientation of the double bond Reactivity – effect of substrate structures, attacking base, the leaving and the medium. Mechanism and orientation in pyrolytic elimination.

**Unit-III**

**Pericyclic Reactions**

Molecular orbital symmetry, frontier orbitals of ethylene, 1, 3- butadiene, 1,3,5 – hexatriene and ally1 system. Classification of pericyclic reactions. Woodward – Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reactions – conrotatory and disrotatory motions – antrafacial and suprafacial additions, 4n and 4n+2 systems, 2+2 addition of ketenes, 1,3 dipolar cycloadditions and chelotropic reactions.

Sigmatropic rearrangements – suprafacial and antrafacial shifts of H, Sigmatropic shifts involving carbon moieties, 3,3 – and 5,5 – Sigmatropic rearrangements, Claisen, Cope and aza- Cope rearrangements. Fluxional tautomerism. Ene reaction.

**Photochemical Reactions**

Interaction of electromagnetic radiation with matter, type of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, actinometry.

**Photochemistry of Alkenes :** Intramolecular reactions of the olefinic bond – geometrical isomerism, cyclisation reactions, rearrangement of 1,4- and 1.5- dienes.

**Photochemistry of Carbony1 Compounds :** Intramolecular reactions of carbony1 compounds – saturated, cyclic and acyclic, $\beta,\gamma$-unsaturated and $\alpha$, $\beta$- unsaturated compounds, cyclohexadienones.

**Photochemistry of Aromatic Compounds :** Isomerisations, additions and substitutions.

**Miscellaneous Photochemical Reactions:** Photo-Fries reactions of anilides. Photo-Fries rearrangement. Barton reaction. Singlet molecular oxygen reactions. Photochemical formation of smog.

**Unit-IV**

**Disconnection approach**

An introduction to synthons and synthetic equivalents, disconnection approach, functional group inter-conversion, the importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections, chemoselectivity, reversal of polarity, cyclisation reaction and amine synthesis.

**Protecting groups :** Principle of protection of alcohol, amine, carbony1 and carboxy1 groups.

**One group C-C disconnections**

Alcohols and carbony1 compounds, regioselectivity, Alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis.

**Two group C-C disconnection**

Diels – Alder reaction, 1.3 – difunctionalised compounds, α, β-unsaturated carbony1 compounds, control in carbony1 condensations, 1,5-difunctionalised compounds, Micheal addition and Robinson annelation.

**Ring synthesis:** Saturated heterocycles, synthesis of 3-, 4-, 5- and 6- membered rings, aromatic heterocycles in organic synthesis.

## SECTION-B: ANALYTICAL CHEMISTRY

**Unit-I**

**Introduction to analytical chemistry and data processing**

Role of analytical chemistry, classification of analytical methods, types of instrumental analysis – Errors of analysis, classification, source and minimization of errors, absolute and relative errors, accuracy and precision, significant figures, mean value and deviation, average and standard deviation, median value, range, confidence intervals. Sampling in analysis. Definition, theory of sampling, technique of sampling, statistical criteria of good sampling, stratified sampling, transmission and storage of samples.

**Environmental samples and their analyses**

Aquatic pollution: Inorganic, organic, pesticides, agricultural, industrial etc.-Water qualify parameters: dissolved oxygen, biochemical oxygen demand, solids, metals, content of chlorides, fluoride, sulfate, phosphate, nitrate.

Analytical methods for measuring BOD, DO, COD, fluoride, nitrate (As, Cd, Cr, Hg, Pb, Se etc.)

**Unit-II**

**Ultraviolet and Visible Spectroscopy**

Various electronic transitions, Beer-Lambert's Law, effect of solvent on electronic transitions, ultraviolet bands for carbony1 compounds, unsaturated carbony1 compoiunds, dienes, conjugated polyenes. Fieser – Woodward rules for conjugated dienes and carbony1 compounds, ultraviolet spectra of aromatic compounds.

**Infrared Spectroscopy**

Principles – Vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols, ary1 aminers. Detailed study of vibrational frequencies of carbony1 compounds (Ketones, aldehydes), esters, amides, acids, anhydrides, lactones, lactams and conjugated carbony1 compounds. H-bonding and solvent effect on vibrational frequencies, overtones, combination bands and Fermi resonance.

**Nuclear Magnetic Resonance Spectroscopy**

Principles, chemical shift, spin-spin interaction, shielding mechanism, chemical shift values and correlation for protons bonded to carbon (Aliphatic, olefinic, enols, carboxylic acids, amines, amides & mercapto) chemical exchange, effect of deuteration, complex spin-spin interaction between two, three, four and five nuclei (first order spectra), virtual coupling. Stereochemistry, hindred rotation, Karplus curve-variation of coupling constant with dihedral angle. Simplification of complex spectra nuclear magnetic double resonance, chemical shift reagents, solvent effects.

**Mass Spectrometry**

Principles, Ion production – EI, CI, FD and FAB – factors affecting fragmentation, ion analysis and abundance – Mass spectral fragmentation of organic compounds, common functional groups – Molecular ion peak – Metastable peak, Mc Lafferty rearrangement. Nitrogen rule – High resolution mass spectrometry – Examples of mass spectral fragmentation of simple organic compounds with respect to their structure determination.

Problems relating to elucidation of structure of simple organic molecules using UV-VIS, IR, NMR and Mass spectral data.

**Unit-III**

**Solvent Extraction and ion exchange**

Solvent Extraction: Principles, classification of extraction, mechanism of extraction, extraction equilibria, techniques of extraction, applications in analytical chemistry.

Ion exchange: Type of ion exchange resins, synthesis and characteristics of ion exchange resins, action of ion exchange resins, ion exchange equilibria, technique of ion exchange, application of ion exchange in analytical chemistry.

**Chromatographic methods**

Basic principles and applications of chromatographic techniques (Paper, TLC, Ion Exchange, HPLC, GLC).

**Spectroscopic methods**

Atomic adsorption spectroscopy : Principles and application of AAS in chemical analysis.

Flame photometric methods : Principles – Interference in flame photometry – Application in quantitative analysis.

Nephelometric method: Principle and applications in analysis.

**X-ray diffraction method :** Wiese indices, Miller indices, Laue method, Bragg's law and applications in determination of crystal structure.

**Unit-IV**

**Electron spin resonance**

Principles zero filed splitting and Kramer's degeneracy, factors affecting the g value, hyperfine splitting and applications to sample radicals.

**Thermal analytical methods**

Thermogravimetric analysis (TGA) – Derivative Thermogravimetric analysis (DTG) – Applications of theromogravimetry.

Differential Thermal Analysis (DTA) – Applications of differential thermal analysis in simultaneous TG-DTA curves.

Thermogravimetric titration: Principle and applications.

**Electroanalytical methods**

Classification of electro analytical methods – Principles and applications of voltammetry, cyclic voltammetry, anodic stripping voltammetry, Polarography, amperometry, coulometry, conductometry and ion selective electrodes.

# Commerce

## PAPER-I

**Unit I : Business Environment**

Meaning and Elements of Business Environment; Economic Environment; Economic Planning; Competition Policy; Consumer Protection; Environment Protection; Liberalization, Privatization and Globalization; Industrial Policy; Industrial Growth.

**Unit II : Financial Accounting**

Accounting and Financial Accounting, Generally Accepted Accounting Principles (GAAP); Accounting Standards; Accounting Equation and Financial Transactions; Books of Accounts; Bank Reconciliation Statement (BRS); Trial Balance & Errors; Financial Statements and their Analysis (Income Statement, Balance Sheet and Cash Flow Statement); Annual Financial Reports of a Company; Consignment and Joint Venture.

**Unit III : Cost and Management Accounting**

Cost Accounting and Management Accounting; Cost Classification, Analysis and Control; Statement of Costs; Methods of Costing (Job and Process Costing); Marginal Costing, Break-even Analysis and C-V-P Analysis; Activity Based Costing; Budgetary Control System and Variance Analysis; Responsibility Accounting and Segment Performance Analysis; Human Resources Accounting.

**Unit IV : Business Studies**

Forms of Business; Channels of Distribution; Business Risks and Insurance; Commercial Banks; Principles of Management, Scientific Management & Management Functions; Recruitment & Selection; Training & Development; Marketing Mix; Financial Planning; Fixed & Working Capital.

## PAPER II

**Unit I : Business Statistics**

Data Sources & Tabulation and Analysis; Sampling, Need, Errors & Methods of Sampling; Analysis & Interpretation of Data; Measures of Central Tendency; Measures of Dispersion; Correlation & Regression; Hypothesis Testing; T-Test, F-Test, Z-Test & Chi-Square Test.

**Unit II : Business Mathematics**

Stock & Shares; Profit & Loss; Invoicing & Discounting of Bills of Exchange; Logarithms; Annuities & Interest Rates; Simple & Compound Interest; Set Theory and Functions; Matrices & Determinants; Differentiation & Integration; Permutation and Combination.

**Unit III : Business Management & Entrepreneurship**

Planning – Objective, Strategies, Planning Process, Decision Making; Organizing; Organizational Structure; Formal & Informal Organizations; Staffing; Motivation; Leadership; Communication; Controlling.

Types of Entrepreneurs; Ownership Structure; Selection of an Appropriate Form of Ownership Structure; Factors affecting Entrepreneurial Growth; Institutional Support to Entrepreneur; Developing Entrepreneurial Competencies; Entrepreneurship Development Programmes; Venture Capital;

**Unit IV : Business Regulatory Framework & Financial Services**

Indian Contract Act, 1872; Sales of Goods Act, 1930; Special Contract Act – Indemnity & Guarantee, Bailment & Pledge, Contract of Agency; Partnership Act, 1932.

Importance of Banking in Business; Reserve Bank of India; NABARD & Rural Banking; E-banking; Development Banking; Financial System in India; Nature & Scope of Financial Services; Merchant Banking; Leasing & Hire Purchase; Credit Rating; Credit & Debit Cards.

## Economics

**PAPER – I**

UNIT-I : Microeconomics : A critic of the cardinal approach, Indifference Curve Approach, Revealed Preference Approach, Laws of returns and returns to scale, Cost curves, Duality in production, Value determination under Perfect Competition, Monopoly, Discriminating Monopoly, Monopolistic Competition, Non-collusive oligopoly, Collusive oligopoly-cartel and price leadership, Profit maximization hypothesis vs. sales maximization hypothesis. Full cost pricing, Bain's Limit Pricing Theory, Marginal Productivity Theory, Euler's theorem,. Theories of rent, wage, interest and profit, Macro theories of distribution, General equilibrium (2X2X2) model, Efficiency of general equilibrium, Pareto welfare optimality, New welfare economics, Social Welfare Function.

UNIT-II:Money, Banking and International Trade : Quantity Theories of Money, Components of money supply, High-powered Money and Money Multiplier, Demand for money-Classical, Keynesian, Friedman's, Baumol's, Tobin's approaches, Theories of Inflation-Demand-pull vs. Cost-push inflation, Trade-off and Non-Trade-off Phillips' curves, Structuralist approach, Rational expectations hypothesis, Structure of interest rates-team structure of interest rates, Changing theories of commercial banking, Functions of central bank, Instruments of monetary policy, Effectiveness of monetary policy, Non-banking financial intermediaries, Pure Theories of International Trade, Theories of international trade, Terms of trade, Gains from trade, Trade under imperfect competition and increasing returns to scale, Optimum tariff, Theory of Customs Union, Balance of payments, Disequilibrium in balance of payments and methods of its adjustment, market for foreign exchange-equilibrium rate of exchange, Fixed vs. flexible rates of exchange, Monetary approach to balance of payments, IMF, World Bank WTO.

UNIT-III-acroeconomics : National income and social accounting, Classical microeconomics, Keynesian macroeconomics, Theories of consumption functions, Marginal efficiency of investment, Accelerator theory of investment, static and dynamic multipliers-operation and policy implications, Keynesian theory of interest rate determination, Liquidity Trap and the policy implications, IS-LM model, Patinkin's real balance effect, Keyens and Pigou effects, Open economy macroeconomics- Mundell-Fleming model, Theories of trade cycles- Hawtrey, Hayek, Keynes, Schumpeter, Samuelson, Hicks, kaldor approaches, Control of business cycles-relative effective efficacy of monetary and fiscal policies.

UNIT-IV Public Economics : Normative approach to public finance, Optimal allocation of resources between public and private sectors, Private goods and Public goods, Externalities and market failure, merit goods, Downs' Economics Theory of Democracy and vote maximization, Optimum provision of public goods, Voluntary exchange models, Contributions of Pigou-Dalton, Samuelson, Musgrave, Arrow's impossibility theorem, Growth of public expenditure, Pure theory of public expenditure, Criteria for public investment-social cost-benefit analysis, Ability to pay approach, Theory of optimal taxation, Direct and indirect taxes, Excess burden of taxes, Neutrality and tax burden, Theory of tax incidence, Incidence of commodity and income taxes, Alternative concepts of incidence, A general theory of tax incidence, Burden of public debt Internal vs. external debt, Intergeneration equity, Public debt management, Debut redemption, Fiscal policy for stabilization, Built-in flexibility, Formula flexibility rules vs. discretionary stabilizers, Role of fiscal policy, Balanced budget multiplier and its policy implications.

UNIT-V: Economics of Development, Planning and Environment : Determinants of economic development, Indexes of development, Factors affecting economic development, Models of growth- Classical model, Harrod-Domar model, Solow model, Robinson's model, Kaldor's model, Endogenous growth models, Vicious circle of poverty, Stages of economic growth, Growth with surplus labour- Lewis model, Theory of big push, Balanced vs. unbalanced growth, Critical minimum effort thesis, Dualism, Ranis-Fei model, Dependency theory of development, Forward and backward linkage hypothesis, Terms of trade between agriculture and industry, International trade and development, Export led growth, Investment criteria and choice of techniques, Intermediate technique vs. appropriate technique, Planning in a liberalized regime, Planning and economic development, Plan models-Feldman-Mahalanobis models, Democratic decentralization and indicative planning, Micro level planning, Environment economy interaction, Managing exhaustible and renewable resources, Sustainable development, Common property resources, Environmental Kuznets curve, Optimal level of pollution, Marketable pollution permits, Market achievement and optimal pollution, Coasian bargaining problem, Pigovian tax, Measurement of environmental values, Global environmental externalities, Climatic change and carbon tax.

**PAPER-II**

UNIT-I : Features of Indian Economy: Demographic features, Poverty, inequality and unemployment- their measurements and facing their challenges, Planning- priorities of planning, Five-Year Plans, Planning and resource mobilization, Planning for inclusive growth, Environment-mechanism for environmental regulation in India, environmental laws and their implementation, controlling water and air pollution, environmental resource management in India, Reforms in Indian economy- New Economic Policy, structural changes in India economy, challenges and issues of globalization of the Indian economy, Indian Public Finance- fiscal reforms in India, fiscal federalism in India, Finance Commissions, theory of grants.

UNIT-II:Indian Agriculture and Industries: New Agricultural Strategy, Farm size and land productivity, Land reforms, Agricultural finance, Agricultural marketing, Pricing of farm products, Cooperatives, Agribusinesses, Growth and pattern of industrialization in India, Problems of large and small scale industries in India, Industrial Policy Resolutions of the Government of India, Industrial finance, Foreign capital, Public enterprises- privatization and disinvestment debates, Special Economic Zones-relevance, major issues and achievements.

UNIT-III-Banking and Service Sectors of India: Structure of Indian financial sector, Broad features of Indian banking system, Banking and financial sector reforms in India, Policy issues in banking sector-non-performing asset problems, Microfinance institutions in India, Problems and prospects of microfinance, Reserve Bank of India, Techniques of monetary control, Monetary policy, Indian stock market- Primary and secondary markets, markets for derivatives- futures, options and other forms of derivatives, SEBI, Components of service sector of India including information sector and their growth profile.

UNIT-IV : Economic and Social Infrastructure of India: Transport- growth of transport sector, institutional arrangement, development of its sub-sectors-surface transport, air transport and water transport, Communication- communication systems in India, Indian telecom industry-competition, FDI flow, regulatory framework, Energy-forms of energy, energy resources and conservation, government policy, Education- structure of education delivery, finance for education, Education policy, Health- health care structure, rural and urban health infrastructure, Inter-state variation in health infrastructure, National Health Policy, Housing- rural and urban housing schemes in India, Millennium Development Goals and social sector of India.

UNIT-V : Indian External Sector: Structure and features of India's foreign trade, Reforms in India's external sector, EXIM Policy and FEMA, Balance of payments of India, Efforts for external balance, Global financial situation and India's external sector, India and WTO.

# Education

## PAPER-I

Unit –I Relationship between Philosophy and Education, Western Schools of Philosophy and their educational implications – Existentialism, Perennialism and Reconstructionism, Contributions of Gandhi, Tagore, Sri Aurobindo, John Dewey and Rousseau to educational theory and practice; Indian Schools of Philosophy and their educational implications – Vedanta, Buddhisim and Jainism.

Unit-II Relationship between Sociology and Education, Concept of social change and factors influencing social change, Role of Education as an instrument of social change, Concept of Urbanization, Modernization and Westernization with reference to Indian society and their educational implications. Equalization of Educational opportunity; Education of social and economically disadvantaged sections of the society with reference to SC, ST and Women; Education and culture; Education and Values, Education and Democracy.

Unit-III Growth and Development – Concept and Difference between growth and Development, Principles of Development, Areas of development – Physical, Social and Emotional during childhood and adolescence; Piaget's theory of cognitive development; Theories of Learning – Skinner's operant condition, Bandura's observational learning, Bloom's Mastery Learning and Gagn's Hierarchy of Learning; Intelligence – its concept and measurement of intelligence; Personality – its theories and assessment.

Unit-IV Education in medieval India – Aims of Education, Curriculum, Methods of Teaching, System of Admission, Role of Teacher, Medium of Instruction, Types of Educational Institutions; Merits and demerits of Medieval Education, Education in British India – Charter Act of 1813; Macaulay's Minute – 1835; Wood's Despatch – 1854; Hunter Commission Report – 1882; Sadler Commission - 1917; Hartog Committee Report – 1929 and Sargent's Plan – 1944, National Policy on Education, 1986 and its Revised Policy, 1992.

Unit-V Meaning, Need, Scope and Purpose of Comparative Education; Basic factors of Comparative Education; Approaches to Comparative Education; Comparative study of Administration, Supervision and control of Education, Higher Education, Teacher Education and Distance and Continuing education with special reference to USA, UK and India.

Unit-VI Meaning, Nature and Scope of Educational Research; Need and purpose of Educational Research; Basic, Applied and Action Research, Formulation of Research problem – sources and criteria for identifying the problem; Review of related literature – Need, Source and Methods; Sampling – Meaning, Purpose and Methods of Selection – Random Sampling, Stratified Sampling, Cluster and Systematic Sampling; Major approaches to Research – Descriptive, Historical and Experimental.

Unit-VII Importance of Statistics in Educational Research; Descriptive and Inferential Statistics; Properties of Normal Probability Curve and its Applications; Significance of difference between means, 't' test for independent and non-independent samples; One-way ANOVA, Chi-Square, Pearson coefficient of correlation, Bi-serial and Point bi-serial correlation.

Unit-VIII Meaning and Scope of Teacher Education; Objectives of Teacher Education at elementary and secondary level; Development of Teacher Education in India, Pre-service Teacher Education – Aims, Objectives and Organizational structure, In-service Teacher Education – Need and agencies; Problems of Teacher Education, Qualitative Improvement of Teacher Education with reference to NCTE, Teacher Effectiveness – Meaning and Assessment.

## PAPER-II

Unit – I Measurement and Assessment Process – Concept, Scope and Need, Norm-referenced and criterion referenced measurement, Function of Assessment, Basic Principles of Assessment, Bloom's Taxonomy of Educational Objectives, Assessment, Principles of Test Construction and Standardization, Reliability, Validity and Objectivity, Trends in Assessment – Grading, Semester and Continuous Internal Assessment.

Unit – II Economics of Education – Concept, Scope and Significance, Education as Investment, Education and Economic Development, Cost-Benefit Analysis of Education, different types of costs of Education, Manpower Planning, Resources for Education – Role of Centre and State in financing education, Financing Education – theoretical conceptualization, Principles of Financing, Problems of financing education.

Unit-III Meaning, Nature, Scope and Significance of Educational Technology, Components of Educational Technology – Hardware and Software, Communication Process – Concept and components and theories of Communication Process, Programmed instruction, Computer assisted instruction, Personalised system of instruction, Micro Teaching, Team Teaching, System Approach in instructional process, Emerging trends in Educational Technology – Teleconference, CCTV, INSAT.

Unit-IV Concept and types of curriculum, Bases of curriculum – Philosophical, Sociological and Psychological, Factors affecting curriculum development, Conceptual framework for curriculum designing, representative curriculum design – Subject design, Discipline Design, Broad Fields Design – Learner centred Design, Experience Centre Design, Curriculum Evaluation – Meaning, Need and Importance, Models of Curriculum Evaluation.

Unit-V Educational Management – Meaning, Nature and Scope, Difference between Administration and Management, Leadership in Educational Management – Meaning, Nature and Styles of Leadership, Theories of Leadership, Measurement of leadership, Educational Planning – Meaning, Nature and Need, Approaches to Educational Planning, Types of Educational Planning, Problems of Educational Planning in India, Institutional Planning – Meaning, Nature, Scope and Steps.

Unit-VI Universalisation of Elementary Education – Problems and Issues, Alternatives to Formal Education – Sarva Shiksha Abhiyan, Rastriya Madhymik Siksha Abhijan, Right of children to free and compulsoty education, importance of Early Childhood Care and Education, Life-long Education, Distance Education, Environmental Education, Human Rights Education, Vocationalisation of Secondary Education, Family life Education and Adolescence Education – Approaches and Strategies, HIV and AIDS Education.

Unit-VII Meaning, Nature and Objectives of Guidance, Scope of Guidance, Types of Guidance – Educational, Vocational and Personal, Essentials of launching a guidance programme, Guidance services in Schools, Counseling – Meaning, nature and scope of counseling, Different types of counseling, Steps and Techniques of Counseling, Tools of Guidance – Interest Inventory, Attitude Scale and Intelligence Tests, Cumulative Record Card.

Unit-VIII Special Education – Concept, Nature, Objectives and types of Special Education, Education of Visually and Hearing Impaired, Characteristics, degree of impairment, Prevention and Educational Programmes, Mentally Retarded – Classification and remedial programmes, Learning Disable Children – characteristics, identification and educational programmes, Emotional Disturbances – meaning, classification, characteristics of emotionally disturbed children and role of education.

# English

**PAPER-I**

The candidate shall answer questions from each Unit which are compulsory.

**Unit-1** There shall be one question with a suitable alternative relating to major developments in English literature from Renaissance to the Age of Moderns from the following topics.

i) Elizabethan and Jacobean Drama
ii) Metaphysical Poetry
iii) Restoration Drama
iv) Augustan Satire
v) Rise of the Novel in the Eighteenth Century
vi) Romantic Poetry
vii) Victorian Crisis and Compromise
viii) Early and Later Victorian Novels
ix) The Modernist Movement
x) Modern Poetry
xi) Modern Drama
xii) Stream-of-Consciousness Novels

**Unit – 2** The candidate shall answer **four** short-answer-type questions out of six relating to forms of literature.

i) Lyric
ii) Ballad
iii) Ode
iv) Sonnet
v) Epic
vi) Elegy,
vii) Verse libre
viii) Tragedy
ix) Comedy
x) Romantic Comedy
xi) Revenge Tragedy
xii) Comedy of Humours
xiii) Comedy of Manners
xiv) Heroic Tragedy
xv) Thesis Play/Play of Ideas
xvi) Poetic Drama
xvii) Theatre of the Absurd
xviii) Epic Theatre
xix) Theatre of Cruelty
xx) Expressionist Drama

xxi) Picaresque Novel
xxii) Epistolary Novel
xxiii) Gothic Novel
xxiv) Historical Novel
xxv) Science Fiction
xxvi) Detective Fiction
xxvii) Autobiographical Novel
xxviii) Essay
xxix) Short Story
xxx) Travelogue

**Unit –3** The candidate shall answer **two** questions out of four relating to literary theory from the following topics.

i) Plato : Theory of Mimesis
ii) Aristotle : Definition of Tragedy
iii) Coleridge : Theory of Imagination
iv) Wordsworth : Theory of Poetry
v) Matthew Arnold : Touchstone Theory
vi) T.S. Eliot : Theory of Impersonality
vii) New Criticism
viii) Structuralism
ix) Deconstruction
x) Marxian Approaches to Literature
xi) New Historicism
xii) Feminism
xiii) Psycho-analytical Approaches to Literature
xiv) Post-Modernism
xv) Post-Colonialism

**Unit-4** The candidate shall attempt **four** short-answer-type questions out of six relating to the following basic concepts.

i) Allegory
ii) Anagnorisis
iii) Aporia
iv) Catharsis
v) Conceit
vi) Comic Relief
vii) Expressionism
viii) Epiphany
ix) Fancy
x) Hubris
xi) Imagery
xii) Irony
xiii) Metaphor
xiv) Myth
xv) Naturalism
xvi) Negative Capability
xvii) Objective Correlative
xviii) Peripeteia
xix) Paradox
xx) Pun

xxi) Personification
xxii) Pathetic Fallacy
xxiii) Poetic Justice
xxiv) Realism
xxv) Symbol
xxvi) Surrealism
xxvii) Three Dramatic Unities

**Unit – 5** The candidate shall attempt an appreciation of a poem commenting on aspects of its form content and style.

**PAPER-II**

The candidate shall answer questions from each Unit which are compulsory.

**Unit- 1** The candidate shall write an essay on a subject of general interest in not less than 1200 words choosing **one** out of five topics**.**

**Unit- 2** The candidate shall attempt a précis in 200-210 words of a given passage of about 600 words.

**Unit- 3** The candidate shall answer **five** questions relating to a comprehension passage. The answer to each question should not exceed 30 words.

**Unit- 4** The candidate shall be required to write a report on a given topic in not more than 300 words.

**Unit- 5** The candidate shall be required to prepare a brochure/pamphlet on a given theme.

**Unit- 6** The candidate shall answer objective type questions each carrying 1 mark relating to grammar in context. The following items are to be covered.

i) Tense and Aspects
ii) Prepositions
iii) Modals
iv) Phrasal Verbs
v) Linking Devices
vi) Direct and Indirect Speech
vii) Concord
viii) Conditional Sentences
ix) Correlatives
x) Complement and Adjuncts

# Geography

## PAPER – I

## General Geography

**Unit – I - Geomorphology & Soil Geography :**

- Origin of the Universe.
- Internal Structure of the Earth Isostasy.
- Continental Drift, Concept of Plate tectonics.
- Earthquake Volcanism : Concept cause, effect & distribution.
- Weathering and erosion.
- Cycle of Erosion (Davis and Perick).
- Land forms produced by running water,
- Groundwater, Wind, Wave and Glacier.
- Soil forming processes.
- Soil Profile, Structure and Texture.
- Classification of Soils.

**Unit – II – Climatology, Oceanography & Biogeography.**

- Elements and Factors of Climate.
- Temperature and its vertical and horizontal distribution.
- Pressure and winds.
- Hydrological Cycle, Humidity.
- Types and distribution of Rainfall.
- Atmospheric disturbances: Tropical and temperate Cyclone.
- Classification of World Climate (Koppen and Thernthwaite)
- Bottom relief of Pacific, Atlantic and Indian Ocean.
- Temperature and Salinity of the Ocean Water.
- Oceanic Circulation Tides and Currents of Pacific, Atlantic and Indian Ocean.
- Marine resources.
- Global distribution of forests.
- Man's response to the Global environment.

**Unit – III – Social Geography and Geographical Thought**

- Races of Mankind, Cultural Realms of the World,

  Man and Environment relation.
- Population: Growth and Distribution of Global Population, Urban Population and Trend of Urbanisation.
- Evolution of Settlement: Types and Pattern of Rural and Urban Settlement.
- Geographical Thought in (Ancient) India.
- Contribution of Humboldt, Karl Ritter, Blache and Peter Hagett to development of Geography.

**Unit – IV – Economic Geography and Political Geography**

- Resources: Meaning and its Classification, Resource Conservation and Management.
- Agriculture: its types, Agricultural location theory by Vonthunen.
- Industrial location theory by Weber and Smith.
- Concept of Regions, Regionalism, Delimitation of Regions.
- Concept of Nation and State.
- Frontiers, Boundaries & Buffer Zone.
- Political Geography of Middle East and South Asia.

**Unit - V - Applied Geography**

- Cartography: Cartographic techniques in Geography, Map and its design.
- Surveying: Land use, Socio-Economic and Instrument Survey.
- Use of Statistical Methods in Geography : Measures of Central Tendencies, Measures of Dispersion, Establishing Relationship.
- Geographical Information System : Concept & Components.
- Use of Areal Photography and Remote Sensing techniques in Geography.

## PAPER-II

### A – India

#### Unit-I ( Physical)

- Physiography and Relief of India.
- River system of India.
- Climate of India, Climatic regions, Mechanism of Indian Monsoon.
- Soils of India : Types and Distribution.
- Natural Vegetation and its Classification and distribution in India.

#### Unit-II (Human & Economic)

- Population its Structure and Composition, Population growth density and its distribution. Factors affecting Population distribution.
- Settlements: Rural and Urban.
- Resources and its Classification mode of occurrence and distribution of Iron Ore, Bauxite Coal and Petroleum.
- Agriculture and its types, Agricultural Problems and Prospects.
- Growth and development of Iron and Steel Industry, Aluminum and Cotton Textile Industry.
- Transport System in India : Road, Rail, Air and Water transport.

#### Unit-III (Geographical Regions)

- Geographical account of Lower Ganga Plain, Chhotanagpur Plateau, Kashmir Valley, West Coastal Plain.

### B – ODISHA

#### Unit – IV (Physical)

- Physiography and Relief of Odisha.
- Drainage System of Odisha.
- Climate of Odisha.
- Soils, its types and distribution.
- Natural Vegetation of Odisha.

**Unit – V (Human Economic & Regional)**

- Population : Factors responsible for the density and distribution of Population, Population growth and distribution.
- Mineral resources of Odisha (Iron Ore, Bauxite and Coal).
- Agriculture : its types and Problems.
- Indsutries ; Iron, Steel & Aluminum Industires.
- Transport System in Odisha (Road, Railway and Air Transport).
- Geographical account of Mahanadi Valley, Coastal Plain.

# Geology

## PAPER-I

**Unit – I Geomorphology and Remote Sensing**

Weathering and erosion, Geological action of River, wind and glacier. Physiography of India, Application of geomorphology.

Principles of aerial photography, photogrammetry and satellite remote sensing – data products, their interpretation and application. Geographic Information System (GIS) – Principles and application.

**Unit – II Mineralogy**

Physical, chemical and optical characteristics of common rock forming silicate mineral groups. Structural classification of silicates. Minerals of Carbonate, Phosphate and sulphide groups. Atomic substitution, isomorphism, polymorphism. Principles of X-Ray Diffraction.

**Unit –III Structural Geology**

Concept of stress, strain and rock deformation. Structural analysis of folds, joints and faults, Lineation and foliation. Unconformities and basement cover relation. Superposed deformations.

**Unit – IV Igneous and Metamorphic Petrology**

Form, texture and structure of igneous rocks. Silicate melt equilibria, binary and ternary phase diagrams, magmatic differentiation, assimilation. Petrology and geotectonic evolution of granites, basalts, anorthosites, ophiolite, kimberlite. Texture and structure of metamorphic rocks, regional and contact metamorphism. Characteristics of different grades and facies of metamorphism. Plate tectonics and metamorphic zones. Metasomatism, granitisation, migmatites and paired metamorphic belts.

**Unit – V Sedimentology and Geochemistry**

Sedimentary structures and textures. Provenance and diagenesis. Sedimentary environment and facies. Tectonics and sedimentation. Classification of sedimentary rocks. Sedimentary basins of India. Earth in relation to solar system, structure and composition of Earth. Geochemical cycle, meteorites. Concept and application of stable isotopes in sedimentology.

## PAPER-II

**Unit – I Palaeontology**

Morphology and time ranges of fossil groups. Evolutionary changes in mollusks and mammals in geological time. Siwalik vertebrate fauna, Gondwana flora. Evidence of life in Precambrians. Different microfossil groups and uses in biostratigraphic correlation.

**Unit – II Stratigraphy**

Stratigraphic code and nomenclature, Geological time scale, Stratigraphic correlation, Precambrian stratigraphy of India. Stratigraphy of the Palaeozoic, Mesozoic and Cenozoic formations of India, Gondwana system and Deccan traps. Palaeoclimate and palaeogeography. Concept of seismic and sequence stratigraphy.

**Unit – III Geophysics and Fuel Geology**

Geophysical techniques: gravity, electrical, magnetic and seismic.

Origin and classification of coal, Indian coal deposits: Gondwana, Tertiary and lignite.

Coal Bed Methane (CBM). Origin, migration and entrapment of natural hydrocarbons, structural, stratigraphic and mixed traps. Geographical and Geological distribution of onshore and offshore petroliferous basins of India.

**Unit – IV Economic Geology**

Process of mineralization: magmatic, hydrothermal, supergene, sedimentary exhalation (SEDEX).

Mineralogy, mode of occurrence and distribution of iron, manganese, aluminium, chromium, base metals and gold. Indian deposits of non-metals: mica, asbestos, graphite, placer deposits, gemstones, limestones, evaporites. Strategic, critical and essential minerals. Metallogenic epochs and provinces. Surface and subsurface exploration and prospecting.

**Unit – V Hydrogeology and Environmental Geology**

Natural hazards – preventive / precautionary measures of floods, landslides, earthquakes, tsunami, coastal erosion. Impact assessment of anthropogenic activities: opencast mining, river valley projects, solid and radioactive waste disposal, excess withdrawal of groundwater, oil spill. Concept of global warming, sea level rise.

Vertical distribution of groundwater, classification of aquifers, hydrologic cycle. Hydrological properties: porosity, permeability, Darcy's law and its application. Groundwater provinces of India. Groundwater quality and contamination, groundwater recharge, rainwater harvesting.

Engineering properties of rocks, geological investigation for dams and reservoirs.

Tunnels: type, method and problems.

# Hindi

**PAPER-I**

**Unit-I** **Hindi sahitya Ka Itihas**

(A) Adikal (Pramukha Kabi aur Kavya Prabritiyan)
(B) Bhaktikal & ritikal (Pramukha Kabi aur Kavya Prabritiyan)

**Unit-II** **Hindi sahitya Ka Itihas (Adhunik Kal)**

(A) Bharatendu Yug, Dwivedi Yug. Chayabad Yug,
(B) Pragatibad, Prayogbad & Nai Kabita (Pramukh Kavi aur Kavya Prabritiyan)

**Unit-III** **Madhyakalin Kavya**

(A) Kabirdas, Surdas, Tulsidas
(B) Biharilal, Raheem, Ghanananda.

**Unit-IV** **Hindi Gadya Sahitya** (Upanyas, Kahani, Natak, Ekanki)

**(A) Upanyas aur Kahani**
i) Godan, (Premchand), Maila anchal, (Renu), Ragdarbari (Shrilal Shukla)
ii) Kahani Sangrah – Edited by Bhishma Sahani (Sahitya Akademi, New Delhi.)

(B) **Hindi Natya – Sahitya**
i) Skandgupta – Jaishankar Prasad.
ii) Ashadh Ka ek Din – Mohan Rakesh
iii) Shrestha Hindi Ekanki – Edited by Prof. Bijoypal Singh Viswavidyalay Prakasan, Varanasi.

**Unit-V** **Hindi Nibandha – Alochana**

(A) (i) Acharya Ram Chandra Shukla (Chintamani, Part-I)
(ii) Hazari Prasad Dwivedi (Ashok Ke Phool)

(B) (i) Kavya Kala tatha anyanya Nibandh (Jai Shankar Prasad)
(ii) Dusri Parampara Ki Khoj (Prof. Namvar Singh.

## PAPER- II

**Unit-I** **Basha Vigyan**

(A) Bhasha (Paribhasha, Swaroop, Prakar, Bhasha Ke Vividh Roop)
Dhwani Vigyan (Vagyantra, Dhwaniyon Ka Vargikaran)

(B) Hindi Bhasha aur Boli
(i) Hindi Bhasa Ka Udbhab aur Vikas.
(ii) Hindi Ke Vividh Roop (Rajbhasha, Rastrabhasha, Sampark Bhasha, Sanchar Bhasha).

**Unit-II** **Rajbhasha Hindi**

(A) (i) Hindi Ki Sambaidhanik Sthiti.

(ii) Devanagari lipi

(B) (i) Paribhasik Sabdavali : Sidhant aur Prayog.

(ii) Sarkari Patrachar

**Unit-III** **Kavya Shastra**

(A) (i) Kavya: Paribhasha, Lakshna, Kavya Prayojan

(ii) Alankar Sidhant, Ras Sidhant, Dhwani Sidhant.

(C) Paschatya Kavya Sastra
(i) Plato, Aristotle
(ii) I.A. Richards, T.S. Iliot.

**Unit-IV** **Tulanatmak Sahita aur Anuvad**

(A) Tulanatmak Sahitya : Paribhasa, Swaroop, Kshetra aur Seemayen.
(B) Anuvad : Paribhasha, Prakar, Anuvadak Keg und-dosh.

**Unit-V** **Adhunik Vidhayen**

(A) Atmakatha, Rekhachitra, Sansmaran,
(B) Yatra-Katha, Sakshatkar, Reportaz, Vyangya.

# History

**PAPER– I**

**Unit – I** - 1. Nature and Meaning of History: Sources, Objectivity Interpretation, Scope of History; Historiographic tradition in India

2. Egyptian Civilization: Salient Features and its contributions to Human Civilisation
3. Mesopotamian Civilisation: Society, Economy, Polity, Governance and Law
4. Ancient Greece: Evolution of Athenian Democracy; Development of City-States
5. Rome: Republican Experiments; Development of Class Society, Art, Architecture and Literature
6. Chinese Civilisation: Society, Development of Science and Philosophy.

**Unit – II** - 1. Feudalism in Medieval Europe

2. Advent of Modernity: Renaissance, Enlightenment, Growth of Science and Technology
3. Industrial Revolution
4. French Revolution: 1789, 1830 & 1848
5. Triumph of Nationalism: Italian & German Unification
6. Growth of Parliamentary Democracy in Britain: Reforms of 1832, 1867 and 1911

**Unit – III** -1. Growth of Capitalism and Colonialism and the World Order

2. Word War I : Causes, Course and Effects
3. League of Nations : Achievements & Failures
4. Totalitarianism in Europe: Nazism, Fascism
5. Growth of Left Movement: Socialism & Communism
6. Word War II : Context & Implications for the Global Order

**Unit – IV** -1. UNO : Objectives, Structure and Achievements

2. Cold War and Emergence of USA as a World Power
3. Regional Security and Alliances: NATO, Warsaw Pact, CENTO, SEATO
4. Process of Decolonisation in Afro-Asian countries; NAM, ASEAN
5. Arab-Israel Conflict, PLO
6. Africa: *Apartheid* to Democracy

**Unit – V** - 1. Opium War and consequences

2. Sino-Japanese War, 1894-95 and Russo-Japanese War, 1904-05
3. Communist Revolution of China in 1949
4. October Revolution and Rise of Soviet Communism
5. Japan in the context of World War I & II
6. Emergence of New Global Order: Liberalisation and Globalisation – Economic & Political implications

History of India

**PAPER-II**

**Unit – I** - Sources of Indian History:

1. Archaeology, Inscriptions, Copper Plates, Numismatics and Literature; Archival and oral history
2. Harappan Civilisation: Origin, Extent, Nature & Decline
3. Vedic Civilisation: Origin and Migration of Aryans; Early and Later Phases: Religion, Society, Polity and Literature
4. Rise of Heterodox Religious Movements: Ideas and Spread of Buddhism & Jainism
5. Empire building: Mauryan Administration, Ashoka's Dhamma & Decline of Mauryas
6. Post-Mauryan Period in Northern, Eastern and Southern India: Satavahans, Chedis, Kushanas, Pallavas, Cholas and Pandyas

Evolution of Art and Architecture in Ancient India

**Unit – II** - 1. The Imperial Guptas : Society, Religion, Art, Literature, Trade and Commerce

2. Emergence of Turkish Rule in North India : Iltutmish & Balban
3. Consolidation of Internal Administration: Allauddin Khalji's Expansion, Market & Administrative Reforms
4. Muhammad-Bin-Tughluq's administrative experiments and Firoz Tughluq's public works
5. Economy, Society, Art and Architecture during the Sultanate period
6. Bhakti & Sufi Movements in Medieval India : Kabir, Nanak, Chaitanya

**Unit – III –**

1. Akbar : Rajput and Religious Policies; Assessment of Akbar as a Ruler
2. Aurangzeb : Deccan & Religious Policies and Decline of the Mughals
3. Rise of the Maratha State : Shivaji's Administration and Military Organisation
4. Mughal Art, Architecture and Culture
5. Economy during the 16th and 17th centuries: Agriculture, Craft production, Technology, Trade and Commerce
6. Society during the Mughal Rule : Conditions of Peasants, Famines, Position of Women

**Unit – IV -**

1. Mode of Expansion and Consolidation of British Colonial rule: Subsidiary Alliance, Doctrine of Lapse
2. Economic Impact of Colonial Rule in India : Stages of Colonialism, Drain of Wealth, 'De-Peasantisation', 'De-Industrialization'
3. Resistance to Colonial Rule : Early Uprisings of Peasants and Tribals; Revolt of 1857
4. Nature and Character of Socio-religious Reform Movements in the 19th century India
5. Rise and Growth of Indian Nationalism: Phases of Moderates and Extremists; Gandhian Movements : Non-Cooperation, Civil Disobedience and Quit India
6. Rise & Growth of Communalism: Partition, Transfer of Power and Independence

**Unit – V -**

1. Odisha in Ancient and Medieval times : Battle of Kalinga, Somavamsis, Gangas and Suryavamsis Society, Religion, Culture and Administration
2. Socio-economic Changes during the Mughal and Maratha periods.
3. Resistance Movements during Colonial Rule : Buxi Jagabandhu and Surendra Sai
4. Praja Mandal Movement in the Garjat States and Merger of Princely States
5. Language Movement and Creation of separate Province of Odisha
6. Nationalist Politics and Popular Struggles, 1920-1947

# Home Science

## PAPER-I

**Unit-I : (Food Science)**

Study of foods: Function of food, Importance, Composition and nutritive value of Cereals, Pulses, Vegetables and Fruits, fleshy foods (Meat, Fish Egg, Poultry) milk & milk products, oils & Fats. Food processing: methods of food preparation, changes in food during preparation, effect of preparation on nutritive value. Food preservation: Causes of food spoilage, Importance, principles and methods of food preservation Food spoilage: Causes of food spoilage and food contamination. Food adulteration and food poisoning, measuring quality of food, control of food quality.

**Unit-II : (Nutrition Science)**

Nutrients: classification, functions, Sources, requirements, and effect of deficiency of carbohydrates, Proteins, Fats, Vitamins, Minerals, Water and Roughages. Utilization of Food: Digestion, absorption and metabolism of Proteins, Fat and Carbohydrates. Basal metabolism, factors affecting Basal metabolism, total energy requirement, factors affecting energy requirement. Balanced diet: Basic food groups, planning of balanced diet on the basis of recommended dietary allowance (ICMR) for adult man and woman, Nutrition during pregnancy, lactation infancy, child hood adolescence and old age.

**Unit-III : (Community Nutrition )**

Nutritional problems of the Community, Assessment of nutritional status, concept of malnutrition, prevalence & ecology of malnutrition, prevalence, etiology, biochemical & clinical manifestation, preventive & therapeutic measures for the PEM, Vitamin A deficiency, Nutritional anemia, Iodine Deficiency Disorder, Ricket & Osteoporosis, Flurosis, Obesity & overweight, Diabetes mellitus, Tuberculosis, Chronic heart disorder, and Cancer. Measures to combat malnutrition: nutrition policy and programmes, supplementary feeding programmes, Role of ICDS, Role of National and International agencies in combating malnutrition (WHO, FAO, UNICEF, NIN, NFI, FNB, CFTRI, NNMB). Role of food technology in combating malnutrition (development of food mixture, food fortification, food preservation & new foods).

**Unit-IV : (Human Development)**

Basics of Human Development: Role of genetic and environmental factors affecting human growth and development. Prenatal growth and development: stages and factors affecting prenatal growth and development. Principles and stages of human development. Methods of studying and assessing Children: Cross-sectional, Longitudinal, Observation, Interview, Case study, Biographical, use of various Psychometric tests.

**Unit-V : (Child Development)**

Development of Children from Infancy to late Childhood Years: Physical, Motor, Cognitive, Speech, Emotional and Social development. Personality development of Children: Role of Family, school, community and mass media. Early Childhood care and Education: Concept of child rearing, its impact and factors affecting child rearing. Significance and objectives of early childhood education.

**Unit-VI : (Family Studies)**

Family: Meaning, types and functions. Contemporary changes in family system – functional and structural changes. Family Life Cycles: Significance, stages and developmental tasks associated with each stages of family life cycle. Contemporary Family Problems: Marital, financial, unemployment, dowry, unwed motherhood, divorce, accidents, prolonged sickness, double earner families, single parent families and old age problems.

## PAPER-II

**Unit-I : (Home Management)**

Importance of Home Management, family goals, values standards and decision making process. The qualities of a good home maker. Types of family resources: Management of time – methods & techniques of time management. Money management – Types of income, planning and steps in budget preparation, keeping financial records & accounts, Savings and Investments. Management of energy: Energy requirement of different tasks, fatigue – type and how to reduce fatigue, techniques of work simplification.

**Unit-II : (Interior decoration & Consumer Education)**

Interior decoration: Basic elements (Line, form, colour, texture) and principles (Balance, Rhythem, proportion, Harmony, Emphasis) of design and their application in interior decoration. Study of colour – importance, use and characteristics of various colour combinations and its application. Consumer Education: Strategies, Rights and responsibility of consumer, Consumer protection legislation and Consumer aids.

**Unit-III : (Extension Education)**

Extension Education: concept, philosophy, principles, objectives and scope of extension education. Uniqueness of the extension programme in India, Qualities of an extension worker, Extension worker as a communicator. Programme planning: meaning, nature, principles & scope of programme planning, steps for making a programme, role of officials, non-officials and agencies in programme implementation. Evaluation: meaning, scope & purpose of evaluation, elements of evaluation process, uses of evaluation, steps involved, types of evaluation, criteria for evaluation, tools in evaluation.

**Unit-IV : (Extension Communication)**

Communication: Definition, meaning, nature, types and importance of communication, elements of communication, communication process, and communication models. Communication Channels: Definition, dimensions, classification, and nature of channels, selection of communication channels. Communication Approaches: basic principles and steps in teaching & learning in extension education, extension teaching methods, classification & factors involved in selection of appropriate methods, feature, advantages & limitations of different method of teaching (mass, group, individual). Audio-visual aids in communication, choice, planning, selection & types of visual aids, Audio aids & audio-visual aids, other teaching aids, contribution of audio-visual aids in extension teaching.

**Unit-V : (Textiles)**

Textile fibers : Classification of textile fibers, according to sources and chemical composition, manufacturing process – Cotton, Wool Silk, Rayon, Acrylic, Polyester. Fiber to Fabric: Construction yarn making process, types of yarns, fabric construction techniques. Weaving, parts of loom, types of weave and process of weaving. Fabric finishes (textural finishes, Functional finishes). Different types of dyeing and printing methods.

**Unit-VI : (Research Methodology)**

Trends in Research in Home Science. Types of Social Science Research. Selecting and defining a research problem. Research Design: Concept, need and features of a research design. Sampling design: Probability and non-probability sampling. Methods of data collection: Primary and secondary data collections. Classification and tabulation of data. Diagrammatical and graphical presentation of data. Analysis of data through parametric and non-parametric statistics. Report writing – interpretation, steps followed and layout of report writing.

# Logic & Philosophy

**PAPER-I**

**Group-A : DEDUCTIVE LOGIC**

1. Truth and validity
2. Sentence and proposition
3. Classification of propositions
4. Seven-fold relation of proposition
5. Existential import of propositions
6. Immediate inference : conversion and obversion
7. Categorical syllogism: figure; mood; general syllogistic rules; special rules of different figures; Aristotle's dictum, direct and indirect reduction.
8. Mixed syllogism
9. Fallacies: logical and extra-logical

**Group-B: INDUCTIVE LOGIC**

1. Nature, problem and procedure of induction
2. Induction and probable inference
3. Formal and material grounds of induction
4. Hypothesis
5. Methods of experimental enquiry
6. Scientific order, system and explanation

**Group-C: SYMBOLIC LOGIC**

1. Logical form of arguments
2. The calculus of propositions
3. Predicate calculus
4. Algebra of classes
5. Logic of sets
6. Logic of relations

**Group-D: LOGIC AND LANGUAGE**

1. Sign and symbol
2. Ambiguity
3. Vagueness
4. Definition
5. Concept and image
6. What is knowledge?
7. Analytic truth and logical possibility
8. A priori and a posteriori
9. The principles of logic

**PAPER-II**

**Group-A: MODERN EUROPEAN PHILOSOPHY**

1. Bacon
2. Descartes
3. Spinoza
4. Leibnitz
5. Locke
6. Berkeley
7. Hume
8. Kant

**(Metaphysics and Epistemology only)**

**Group-B : INDIAN PHILOSOPHY**

1. Carvaka
2. Budhism
3. Jainism
4. Samkhya

5. Yoga
6. Nyaya
7. Vaisesika
8. Mimamsa
9. Samkara Vedanta
10. Ramanuja Vedanta

**(Metaphysics and Epistemology only of all except Mimamsa; Epistemology only of Mimamsa)**

**Group-C: MORAL PHILOSOPHY (WESTERN)**

1. Utilitarian theories
2. Deontological theories
3. Virtue Ethics
4. Bio-medical ethics
5. Environmental ethics
6. Business Ethics

**Group-D: MORAL PHILOSOPHY (INDIAN)**

1. Ethics of the Upanisads
2. Buddhist ethics
3. Jaina ethics
4. Purusarthas
5. Doctrine of karma
6. Karmayoga of the Bhagavadgita

# Mathematics

## PAPER – I

**UNIT – I** ALGEBRA AND NUMBER THEORY

Group Theory : Groups, Subgroups, Normal Subgroups and Quotient Groups, Homomorphisms and applications, Permutation groups, Conjugacy and Class equation, Simple group, Sylow Theorms.

Ring Theory : Rings, Special Classes of rings, Homomorphisms, Ideals and Quotient rings, Maximal and Prime ideals, Polynomial rings, Principal Ideal Domain, Unique Factorization Domain.

Field : Field of Quotients of an Integral Domain, Polynomials over the rational field, Algebraic Extension of Fields: Irreducible polynomials and Eisenstein: Criterion, roots of Polynomial, Splitting field and its degree of extension, Multiple roots, Ruler and Compass Constructions, Symmetric function of roots, Solution of Cubic and Biquadratic Equations.

Number Theory : Integers, g.c.d., Fundamental Theorem of Arithmetic, Euclidean Alogorithm, Arithmetical functions (Euler-function, Mobius function- ), Dirichlet multiplication, Linear Congruences, Euler-Fermat Theorem, Linear Diophantine Equations, Fermat's Theorem, Fermat Little Theorem, Polynomial Congruence, Lagrange's Theorem, Chinese Remainder Theorem, Wilson's Theorem and Applications.

**UNIT –II** ANALYSIS –I

Basic Topology : Finite, Countable and Uncountable sets, Metric Spaces, Topological Spaces, Basis, Closed sets, Open Sets, Limit Points, Properties of Connected Spaces and Compact Spaces, Heine Boril Theorem.

Sequence and Series : Convergent Sequences, Subsequences, Convergence of Monotone Sequences, Couchy Sequences, Upper and Lower limits of Sequences, Bolzano Weirstrass Theorem, Series of non-negative terms, Convergence tests, Power Series, Couchy Convergence Criterion, Absolute Convergence, Alternating Series.

Continuity and Differentiability : Properties of Continuous Function, Continuity and Compactness, Continuity and Connectedness, Discontinuity, Monotonic functions, Mean Value Theorem, Taylor Series.

Function of Several Variables : Continuity Differentiability, Extreme Values, Maxima and Minima, Line Integral, Surface Integral, Volume Integral, Applications of Green's Theorem, Stokes Theorem and Gauss Theorem.

**UNIT – III** COMPLEX ANALYSIS

Analytical Functions : Continuity, Differentiability, Couchy-Reimenn Equations, Analytic Functions, Harmonic Functions.

Bilinear Transformation : Elementary Transformations, Bilinear Transformation, Mapping by Elementary Functions.

Complex Integration : Couch's Theorem, Couchy's Integral Formula, Maximum Modulus Theorem, Liouville's Theorem, Morera's Theorem, Related Problems.

Singularities and Calculus of residues : Series Expansion, Taylor's Series, Laurent's Series, Zeros of Analytic Function, Singularities, Residues, Councy's Residue Theorem, Evaluation of Definite Integrals.

**UNIT – IV** OPERATIONS RESEARCH

Linear Programming : Simpler Method, Computational Procedure, Use of Artificial Variables.

Duality in Linear Programming : General Primal-dual pair, Duality Theorems, Complementary Slackness Theorem, Duality and Simplex Method, Dual Simplex Method.

Games and Strategies : Two-person-Zero Sum Games, Minimax-Maximin Principle, Games with Saddle Points, Mixed Strategies, Graphical Solutions, Dominance Property, Arithmetic Method of nxn Games, General Solution of nxn rectangular Games.

Transportation and Assignment : General Transportation Problem, Finding Initial Basic Feasible Solution, Test of Optionality, Transportation Algorithm, Transhipment Problems.

Mathematical Formulation of Assignment Problem, Method of Solution of Assignment Problem, Travelling Salesman Problem.

**UNIT – V** NUMERICAL ANALYSIS

Root Finding for Non-Linear Equations :Newton's Method, Secant Method, One-point Iteration Method, Multiple Roots, Newton Methods of Non-Linear Systems.

Interpolation Theory : Finite Differences, Newton's Forward and Backward differences, Newton's Divided differences, Lagrange's Interpolation, Errors in data and Forward differences, Hermite Interpolation, Piece-wise linear Interpolation.

Numerical Integration : Newton-cote integration formula, trapezoidal rule, Simpsons' rule, Gaussian quadrature, Asymptotic error formulas and their applications.

Numerical Methods for Ordinary Different Equations : Euler's Method, Multistep Methods, Midpoint Method, Trapezoidal Method, Single Step Method and Runge-Kutta Method.

## PAPER-II

UNIT-I ANALYSIS

Riemann stieltjes integral Existence of the integral, Properties of the integral, Fundamental theorem of calculus, change of variables in on integral, Differentiation of integral.

Sequence and series of functions

Uniform convergence of sequence of functions, Cauchy criterion for uniform convergence, weierstrass test for uniform convergence, uniform convergence and continuity, uniform convergence and differentiation, construction of continuous function on the real line which is nowhere differentiable.

Measure Theory Lebesgue outer measure , Properties of outer measure, Measurable sets, Cantor set, Borel set, and sets, Non measurable sets, Measurable functions, Properties of measurable functions.

Lebesgue integration and $l^p$ spaces comparison of Lebesgue and Riemann integral, Lebesgue integral of bounded measurable functions over sets of finite measure, Bounded convergence theorem, Lebesgue integral for nonnegative measurable function. Fatou's Lemma, Monotone convergence theorem, $l^p$ spaces, essential supremum of a function, Minkowski and Holder inequalities, Absolute summable and summable series in a normal linear space completeness in $l^p$.

UNIT-II FUNCTIONAL ANALYSIS

Normed Linear space Linear spaces, Subspaes, Quotient spaces, properties of norm, Riesz Lemma, Continuity of linear maps, Bounded linear operations, Equivalent norms, Hahn Banach theorem and its consequences.

Banach spaces Uniform boundedness principle, closed graph theorem and its consequences, open mapping theorem and its consequences.

Spaces of Bounded linear functional Duals and transposes, Duals of $l^p$, $L^p[a,b]$, C[a,b], Weak convergence, weak* convergence, Reflexivity.

Hilbert space Inner product spaces, Orthonormal sets, Gram Schmidt Orthonormalisation, Bessel's Inequality, Riesz. Fischer theorem, Projection theorem, Riesz representation theorem.

UNIT-III LINEAR ALGEBRA

Vectorspace, Subspace, Linear Dependence , Independence, Dimension and Basis , Linear Transformation, Range and Kernel, Rank and Nullity, Inverse of Linear Transformation, Linear Map associated with matrix.

Elementary Row Operations, Rank and Nullity of Matrix, Inverse of a Matr4ix, Determinants and product of Determinats, Eigen values, Eigen vectors, Characteristic roots.

Canonical forms, Tringular form, Nilpotent Transformations, Similarity of Matrices, Quadratic form.

Traces and Transpose, Hermitian, Unitary and Normal Transformation.

UNIT- IV DISCRETE MATHEMATICS-

Logic- Fundamentals of logic, Normal forms, Logical Inferences, Methods of proof, Mathematical Induction, Rules of Inferences for quantified propositions.

Lattice and Boolean Algebra – Binary relations, Equivalence relations, prset, Lattice, Hasse Diagram, Algebraic properties of Lattice, Paths and closures, Directed graphs and adjacency matrix, Boolean Algebra, Boolean functions, Minimization of Boolean functions.

Recurrence relation –

Generating functions of sequences, Calculating co-efficients of generating functions, Recurrence relation, solving recurrence relations by substitution and generating functions. Solution by the method of characteristic roots.

Graph Theory –

Trees and their properties, spanning trees, Binary trees, Euler's formula, Euler's circuits, Hamiltanian Graphs

UNIT – V DIFFERENTIAL EQUATIONS

Linear Differential Equations with constant coefficients and variable coefficients, system of Linear Differential Equations. Laplace Transformation : Linearity of the Laplace transformation. Laplace transforms of derivatives and integrals, shifting theorems. Differentiation and integration of transforms. Convolution theorem. Solution of integral equations and systems of differential equations using Laplace Transformation.

Series Solution of differential equations: Power series method, Bessel, Legendre and Hypergeometirc equations. Bessel, Legendre functions and their properties . Sturm-Liouville problem, Orthogonality of eigen functions. Orthogonality of Bessel fuctions and Legendre polynomials.

Partial Differential Equations of the 1st order. Lagrange's solution some special types of equations, their solution, Charpit's general method of solution. Partial Differential Equations of second and Higher orders. Classification of linear partial differential equations of second order. Homogeneous and non-homogeneous equations with constant colfficients, Monge's method.

Fourier Series and Fourier Transform, Convergence of Fourier series, Application of Fourier series and Fourier Transforms to Boundary value problems. Solution of Laplace equation, wave equation and heat conduction equations.

# Music

## "VOCAL MUSIC".

### PAPER-I

1. Theoretical description of the following Raagas:
   Nata, Shree, Suddhadeshi, Mukhari, Varadi, Sokavaradi, Debagandhari, Kiravani, Malavgouda.

   Yaman, Todi, Malkanunsh, Marubihag, Puriya Kalyan, Suddha Saranga, Jog, Hansadhawani, Bhimpalasi, Darbari Kanda.

2. Analytical and comparative study of the following Raagas:
   i) Kalyan – Jamunakalyan.
   ii) Kedar Kamodi – Kedargouda.
   iii) Gouda – Jhinjhoti,
   iv) Ahari – Ashabari
   v) Kalingagouda – Gouri.

   i) Puriya – Marwa

   ii) Alhaiya Bilawal – Devgiri Bilawal

   iii) Bilashkhani Todi – Komal rishav Ashawari

   iv) Nat Bhairav – Ahir Bhairav

   v) Meghmalhar – Surmalhar.

3. Knowledge about the following Compositions:

Champu (Ka, Kha, Ga and Gha), Chhanda (Chokhi,Ashadhasukla and Rasakulya Vaani ),Janana (one each of poet Banamali and Kavi Surya Baladev Rath).

Dhrupad, Dhamar Thumri, Kajri & Bhajan

4. Theoretical knowledge of the following Talas with different Layakriyas :

   Ektali, Rupak,Tripata, Jhampa, Matha, Kuduka, Yati, & Aditala.

   Ektal, Tilwada, Chautala, Jhumura, Dhamar, Roopak, Deepchandi, Teental, Kaharwa.

5. Knowledge of writing rotation of the following composition :

   Raganga Prabandha (from Unit 1), Champu (From Unit 3), Chhanda or Devotional Song (From Unit-3).

   Khayal(from Unit-I), Dhurap(From Unit 3), Dhamar (From Unit -3).

6. Comparative study on the presentation style of Odishi Music, Hindustani Music and Karnataka Music.

7. Ability to compose one song based on appropriate Raaga and Tala according to it's mood.

8. Knowledge about the essential qualities of a good performer.

## **PAPER-II**

1. Detailed knowledge on Naada.
2. Deep knowledge on shruti and swara.
3. Historical development on Raaga Bargikaran.
4. Rasa theory of Indian Music.
5. History of Odishi Music :
   a. Period of Kharavela and Natyasastra
   b. Charya sahitya and Jayadeva
   c. Period of Reetiyuga
   d. Development of Odishi Music in the present period.
6. History of Indian Music

   a. Time of vedic

   b. Moghul period

   c. Time of Bharat

   d. Time of Sarangadena

   e. Modern time

7. Study on the following musical treatises.

   Geeta Prakash, Sangeeta Kalpalatika, Sangeet Narayan, Natya Manorama.

   Natyasastra, Sangeet Ratnakar, Sangeet parijat, Swaramela kalanidhi.

8. Knowledge about the Guruparampara and their style in Odishi Music.

9. Study of different Gharanas and comparative study of different gharanas of Hindustani Music.

10. Knowledge about the following musical terms and phrases.

Sangeeta, Tala, Laya, Raagavistar, Vaadi- Sambadi-Anuvadi and Bivadi, Abirbhaba-Tirobhaba, Alptwa-Bahutwaa, Purbanga-Uttaranga.

# Odia

**PAPER-I**

## ଓଡିଆ ଭାଷାର ଇତିହାସ

## ଓ

## ଓଡିଆ ସାହିତ୍ୟର ଇତିହାସ

ୟୁନିଟ – I : ଓଡିଆ ଭାଷାର ଉତ୍ପତି ଓ କ୍ରମ ବିକାଶ (ଆଦିକାଳରୁ ଷୋଡଶ ଶତାବ୍ଦୀ ପର୍ଯ୍ୟନ୍ତ) ।

ୟୁନିଟ – II : ଓଡିଆ ଭାଷା ସହିତ ସଂସ୍କୃତ, ପାଲି ଓ ପ୍ରାକୃତ ଭାଷାର ସଂପର୍କ ।

ୟୁନିଟ – III : ଓଡିଆ ଶବ୍ଦ ଭଣ୍ଡାର (ତତ୍ସମ, ତଦ୍ଭବ, ଦେଶଜ ଓ ବୈଦେଶିକ)।

ୟୁନିଟ – IV : ଓଡିଆ ଭାଷା ଉପରେ ବୈଦେଶିକ ପ୍ରଭାବ ।

ୟୁନିଟ – V : ଓଡିଆ **ସାହିତ୍ୟର ଇତିହାସ (ଆଦି** ପର୍ଯ୍ୟାୟ)।

[ବୌଦ୍ଧଗାନ ଓ ଦୋହା, ପ୍ରାଚୀନ ଓଡିଆ ଗଦ୍ୟ ସାହିତ୍ୟ, ପ୍ରାଚୀନ ଓଡିଆ କବିତାର ସ୍ୱରୂପ]

ୟୁନିଟ –VI : ଓଡିଆ **ସାହିତ୍ୟର ଇତିହାସ (ମଧ୍ୟ** ପର୍ଯ୍ୟାୟ)।

[ଓଡିଆ ପୁରାଣ ଓ ସନ୍ଥ ସାହିତ୍ୟ, ପ୍ରାକ୍ ରୀତି କାବ୍ୟଧାରା]

ୟୁନିଟ –VII : ଓଡିଆ **ସାହିତ୍ୟର ଇତିହାସ (ଉତ୍ତର ମଧ୍ୟ** ପର୍ଯ୍ୟାୟ)।

[ଓଡିଆ ରୀତି ସାହିତ୍ୟ, ଓଡିଆ ପଦାବଳୀ ସାହିତ୍ୟ ]

ୟୁନିଟ –VIII : ଓଡିଆ **ସାହିତ୍ୟର ଇତିହାସ (ଆଧୁନିକ** ପର୍ଯ୍ୟାୟ)।

[ଓଡିଆ ସାହିତ୍ୟରେ ନବ ଜାଗରଣ, ପତ୍ର-ପତ୍ରିକା, ପ୍ରବଂଧ, ଗଳ୍ପ, ଉପନ୍ୟାସ, କବିତା ଓ ନାଟକର କ୍ରମ ବିକାଶ]

**PAPER-II**

## ଓଡିଆ ସାହିତ୍ୟର ବିଶେଷ ଅନୁଶୀଳନ

ୟୁନିଟ – I : ସାରଳା ଦାସ, ବଳରାମ ଦାସ, ଜଗନ୍ନାଥ ଦାସ, ଅଚ୍ୟୁତାନନ୍ଦ ଦାସ ।

ୟୁନିଟ – II : ବସ୍ତା ଦାସ, ନାରାୟଣାନନ୍ଦ ଅବଧୂତ ସ୍ୱାମୀ, ମାର୍କଣ୍ଡ ଦାସ, ଦେବଦୁର୍ଲ୍ଲଭ ଦାସ ।

ୟୁନିଟ – III : ଦୀନ କୃଷ୍ଣ ଦାସ, ଉପେନ୍ଦ୍ର ଭଞ୍ଜ, ଅଭିମନ୍ୟୁ ସାମନ୍ତସିଂହାର, ବଳଦେବ ରଥ ।

ୟୁନିଟ – IV : ବ୍ରଜନାଥ ବଦଜେନା, ଗୋପାଳ କୃଷ୍ଣ, ବନମାଳୀ, ଭୀମ ଭୋଇ ।

ୟୁନିଟ – V : ଫକୀର ମୋହନ, ରାଧାନାଥ ରାୟ, ମଧୁସୂଦନ ରାଓ, ରାମଶଙ୍କର ରାୟ ।

ୟୁନିଟ –VI : ଗଙ୍ଗାଧର ମେହେର, ବିଶ୍ୱନାଥ କର, ନନ୍ଦକିଶୋର ବଲ୍, ନୀଳକଣ୍ଠ ଦାସ ।

ୟୁନିଟ–VII: କାଳନ୍ଦୀ ଚରଣ ପାଣିଗ୍ରାହୀ, କାଳୀଚରଣ ପଟ୍ଟନାୟକ, ସଚ୍ଚି ରାଉତରାୟ, ଗୋଦାବରୀଶ ମହାପାତ୍ର ।

ୟୁନିଟ –VIII : ଗୋପୀନାଥ ମହାନ୍ତି, ସୁରେନ୍ଦ୍ର ମହାନ୍ତି, ବିନୋଦ ଚନ୍ଦ୍ର ନାୟକ, ଗୁରୁପ୍ରସାଦ ମହାନ୍ତି ।

# Physics

**PAPER– I**

**Unit-I : Mathematical Physics**

1. Complex variable :
   Cauchy's theorem, Cauchy's integral formula, classification of singularities, branch point and branch cut, Residue theorem, evaluation of integral using residue theorem.

2. Special functions :
   Basic properties and solutions (series expansion, recurrence and orthogonality relations) of Bessel, Legendre, Laguerre functions, Solution of inhomogeneous partial differential equation by method of Green's function.

3. Group theory :
   Definitions, isomorphism and homomorphism, point group, group representation, reducible and irreducible representation, Lie group and Lie algebra with SU(2) and 0(3).

4. Tensors:
   Cartesian tensors, covariant, contravariant and mixed tensor, tensor algebra, properties of symmetric and anti symmetric tensor Levi Civita and metric tensor.

**Unit-II: Classical Mechanics**

1. Hamilton's principle:
   Hamilton's principle, Lagrange's equation from Hamilton's principle,Solution of Lagrange equation of motion for Simple harmonic oscillator. Hamilton' equations of motion, canonical equations from variational principle, principle of least action
2. Canonical transformation:
   Generating function and Legendre transformation, Integral invariant of Poincare, Lagrange and Poisson's brackets, infinitesimal canonical transformation, conservation theorems in Poisson bracket formalism, Jacobi Identity.
3. Rigid body:
   Independent coordinates, orthogonal transformation and rotations (finite and infinitesimal), Euler's angles, Euler's theorem on the motion of rigid body, Inertia Tensor and principal axis transformation, angular momentum and kinetic energy of rotation in terms of Euler's angles. Euler's equation of motion, torque free motion of rigid body,heavy symmetrical top with one point fixed. , motion in a non inertial frame of reference, Coriolis force
4. Small oscillation:
   Theory of small oscillation, Normal modes and normal frequencies, application to tri atomic molecules.
5. Hamilton-Jacobi theory:
   Hamilton-Jacobi equation for Hamilton's principal function, Harmonic oscillator problem, Hamilton's Characteristic function, Action angle variable and its application to Kepler's problem.

**Unit-III: Classical Electrodynamics**

1. Electrostatics and Magnetostatics:
   Scalar and vector potential, Gauge transformation, multiple expansion of (i) scalar potential and electrostatic energy due to static charge distribution, (ii) vector potential due to stationary current distribution, Electrostatic and magnetostatic energy, Poynting 's theorem, Maxwell's stress tensor,
2. Relativistic electrodynamics:
   Equation of motion in an electromagnetic field, electromagnetic field tensor, covariance of Maxwell's equation, Maxwell's equations as equations of motion, Lorentz transformation laws for electromagnetic field, and the fields due to point charge in uniform motion, Field invariants , covariance of Lorentz force equation of motion, and equation of motion of a charged particle in an electromagnetic field, Energy momentum tensor and conservation laws for electromagnetic field, Relativistic Lagrangian and Hamiltonian of a charged particle in an electromagnetic field.
3. Dispersion:
   The oscillator model and dispersion in dielectric and conductors, anomalous dispersion and resonant absorption, Krammer- Kroning dispersion relation.

4. Radiation, scattering and Diffraction:
   Field due to localized oscillating source, electric dipole,magnetic diapole, electric quadrupole field radiation, centre-fed linear antenna with sinusoidal current,scattering by a small dielectric sphere in long wave length limit, Raleigh scattering,

5. Radiation from moving Charge:
   Lienard Wiechert potential, Field due to a charge moving with velocity, field due to accelerated charge, radiation at low velocities, total power radiated by the accelerated charge, Larmor 's formula and its relativistic generalization, angular distribution of radiation from an accelerated charge, Thomson scattering.

**Unit-IV: Quantum Mechanics-I**

1. Wave packet:
   Gaussian wave packet, spreading of wave packet, coordinate and momentum representation, **x** and **p** in these representation, Dirac delta function,
2. Operator method in Quantum Mechanics:
   Formulation of Quantum Mechanics in vector space language, uncertainty product of two arbitrary operators, one dimensional harmonic oscillator by operator method.
   Matrix representation of operators, Schrodinger, Heisenberg and interaction pictures. Dirac bracket notation.
3. Three dimensional potential well, Fermi energy, Radial solution of Hydrogen atom and its total wave function .
4. Symmetry , invariance principle and conservation Laws:
   Space translational invariance , time translational invariance and rotational invariance and conservation laws.
5. Angular momentum:
   Angular momentum algebra, addition of two angular momenta j_1=1/2, j_2=1/2. Clebsch–Gordon Coefficients, examples, matrix representation of j_1=1/2 and j_2=1. Spin angular momentum, Pauli spin matrices and their properties, eigen value and eigen function,
6. Approximation methods:
   Time independent perturbation theory, First and second order correction to energy and eigen functions, Degenerate perturbation theory, application to one electron system, relativistic mass correction, Spin-Orbit coupling, Zeeman effect, linear Stark effect. Fine structure of spectral line of H-like atom

**Unit-V: Statistical Mechanics**

1. Objectives of Classical Statistical Mechanics:
   Microstates, macro states, phase space, Liouville's theorem, concept of ensembles, Ergodic hypothesis, postulates of equal a priory probability, Boltzmann's postulates of entropy, micro canonical ensemble, entropy of ideal gas, Gibb's paradox, Sakur-Tetrode equation,
2. Canonical ensemble:
   Expression for entropy, canonical partition function, Helmholtz free energy, energy fluctuation,

3. Grand canonical ensemble:
   Grand canonical partition function, chemical potential, density fluctuation, chemical potential of an ideal gas,
4. Quantum Statistical Mechanics:
   Density matrices for micro canonical, canonical and grand canonical ensembles, B-E and F-D distribution. Equation of states for B-E system, Bose condensations, Planck's law of black body radiation, equation of state for ideal Fermi gas at low density-high temperature and at high density-low temperature, theory of white dwarf star, relation between chemical potential and Fermi energy,

5. Phase Transition:
   First and second order phase transition in matter, Landau theory of phase transition and its application to ferromagnetism.

**PAPER-II**

**Unit-I :Quantum Mechanics-II**

1. WKB Approximation:
   Connection formulae, Bohr quantization rule, barrier penetration and α-decay,
2. Variational method:
   He atom as an example, First order perturbation, exchange degeneracy.
3. Time dependant perturbation theory:
   Interaction picture, Transition probability, constant and harmonic perturbation, Fermi Golden Rule, electric dipole radiation, selection rule, Spontaneous emission, Einstein's A and B coefficients, Principle of Laser
4. Scattering theory:
   Laboratory and center of mass system, differential and total scattering cross section, scattering amplitude, scattering by spherically symmetric potential, Partial wave analysis and phase shift, scattering by rigid sphere and square well, Coulomb scattering, Formal theory of scattering, Green's function in scattering theory, Born approximation,
5. Symmetry and Conservation laws:
   space and time translational invariance, rotational invariance of the dynamical systems, Discrete symmetries- space reflection, charge conjugation and time reversal symmetries..
6. Identical Particles:
   Symmetric and anti-symmetric wave functions, Slater determinant, symmetric and anti-symmetric wave functions of two identical spin ½ particles.

**Unit-II: Relativistic Quantum Mechanics and Field theory**

1. Klein-Gordon Equation:
   Klein-Gordon equation and its drawback, need for a relativistic equation.
2. Dirac Equation:
   Dirac equation, properties of Dirac γ-matrices,Non-relativistic reduction of Dirac equation,magnetic moment of electron, Spin-Orbit coupling, Covariance of Dirac equation and bilinear covarints.

3. Solution of Dirac Equation:
   Free particle solution of Dirac equation and its physical interpretation, projection operator for spin and energy,Zitterbewegung, Hole theory.
4. Symmetry in Dirac equation:
   Charge conjugation, space reflection, time reversal symmetries of Dirac equation, Continous systems and fields, transition from discrete to continous systems, Lagrange and Hamiltonian formulation, Noether's theorem.
5. Quantization of Free field:
   Second quantization, covariant quantization of electromagnetic field, quantization of neutral scalar field and Dirac field.

**Unit-III : Electronics**

1. Amplifiers:
   Frequency response of linear amplifier, amplifier pass band, R-C, L-C and transformer coupled amplifier, feed back amplifier, book-strapping the FET, stability, noise
2. Operational amplifier: differential and integral amplifier,input and out put impendance, summing integrating and differentiating amplifier, comparators
3. Oscillators:
   Feedback criteria for oscillation, phase shift, Wien bridge, crystal controlled and Klystron oscillators, multi vibrators- astable, monostale and bistable
4. Digital Circuits:
   Logic fundamentals, Boolean theorem, Logic gates-RTL,DTL,TTL, RS flip-flop, JK flip-flops
5. Boolean algebra, De Morgan theorem, AND,NAND,NOT,NOR gates(CMOS,NMOS), MOS circuits, two phase inverter, dynamic MOS shift register.

**Unit-IV: Condensed Matter Physics**

1. Bragg-Laue formulation of X-ray diffraction, , atomic and crystal structure, Electron and neutron diffraction by crystal, binding in solids,inert gas solids,ionic crystals, covalent bond.
2. Lattice Dynamics:
   Classical theory of lattice vibration under harmonic approximation, vibration of linear mono atomic and diatomic lattices, acoustical and optical modes, optical properties of ionic crystal in the infrared region, normal modes and phonon, inelastic scattering of neutron by phonon, lattice heat capacity, models of Debye and Einstein, An-harmonic effects in crystals-thermal expansion and thermal conductivity.

3. Free Electron Theory:
   Free electron theory of metal,one dimensional infinite potential well. electron gas in three dimension, density of states, electronic specific heat, electrical conductivity and Wiedeman-Franz law, Hall effect, cyclotron resonance.
4. Band Theory of Solid:
   Bloch equation, empty lattice band, nearly free electron bands, no of states in band, tight binding method, effective mass of electron in the band, concept of holes, classification of metal, semiconductor and insulator, intrinsic and extrinsic semiconductors, intrinsic carrier concentration,

5. Dielectric Properties of solids:
   Electronic and ionic polarization of molecules, static dielectric constants of gases, Lorentz internal fields, static dielectric constant of solids, classical theory of electronic polarization and optical absorption, Clausius-Mossotti equation, elementary idea of ferroelectricity.
6. Magnetic Properties of Solids:
   Origin of Magnetism, quantum theory of diamagnetism, paramagnetism, Pauli Paramagnetism, Ferromagnetism, Curie-Weiss law, ferromagnetic domain , ferri and anti ferromagnetism,

7. Superconductivity:
   Phenomenological description of superconductivity, Meissner effect, Type-I and type-II superconductors, London's equation, outlines of BCS theory, High T_c superconductor.

**Unit-V: Nuclear and Particle Physics**.

1. Nuclear Properties:
   Basic nuclear properties: nuclear size, nuclear radius and charge distribution, nuclear form factor, mass and binding energy, Angular momentum, parity and symmetry, Magneticdipole moment and electric quadrupole moment,
2. Two body bound state;
   Properties of deuteron, Schrodinger equation and its solution for ground state of deuteron, rms radius, spin dependence of nuclear forces, electromagnetic moment and magnetic dipole moment of deuteron and the necessity of tensor forces.
3. Two-body scattering:
   Partial wave analysis and phase shifts, scattering length,
   magnitude of scattering length and strength of scattering, Significance of the sign of scattering length; Eeffective range theory, low energy p-p scattering, Nature of nuclear forces, charge independence, charge symmetry and iso-spin invariance of nuclear forces.
4. β-decay :
   β- emission and electron capture, Fermi's theory of allowed β-decay, Selection rules for Fermi and Gamow-Teller transitions, Parity non-conservation and Wu's experiment.
5. Nuclear Structure:
   Liquid drop model, Bethe-Weizsacker binding energy/mass formula, Fermi model, Shell model and Collective model.
6. Nuclear Reactions and Fission.
   Different types of reactions, Quantum mechanical theory, Resonance scattering and reactions, Breit-Wigner dispersion relation; Compound nucleus formation and break-up Optical model; Principle of detailed balance, Transfer reactions. Nuclear fission: Experimental features, spontaneous fission, liquid drop model, barrier penetration, statistical model, Super-heavy nuclei.

7. Particle Physics:
Basic forces, classification of elementary particle, Gellmann-Nishijima scheme,meson and Baryon octet, isospin, strangeness, spin ,parity, Lepton and baryon number. conservation, parity conservation and non conservation , time reversal and consequence of time time reversal invariance, charge conjugation, G-parity, Statement of CPT theorem and its consequences, Hadron classification by isospin and hypercharge, SU(2) and SU(3) Groups, algebras and generators;Elementary idea of SU(3) symmetry and Quarks model, need for Color; Elementary ideas of electroweak interactions and standard model.

# Political Science

**PAPER-I**

**Unit – I** : **Political Theory:**

Nature of Political Theory, Evolution and Growth, Behaviouralism, Decline and Resurgence, Contemporary Trends.

State : Its Origin, Functions and Role.

Law, Liberty, Equality, Justice and Rights.

Political Ideology : Liberalism, Socialism, Communism and Feminism.

Democracy : Perspective and Prospects.

**Unit-II : Political Thought** :

Plato: Ideal State, Justice, Communism.

Aristotle : State and Revolution .

Machiavelli : State, Religion and Morality.

Social Contractualists : Hobbes, Locke, Rousseau.

Karl Marx: Dialectical Materialism, Class Struggle, Surplus Value.

John Rawls & Robert Nozick.

**Unit-III** : **Public Administration :**

Nature, Scope and Significance of Public Administration and New Public Administration.

Theories and Principles of Organisation.

Personnel Administration : Recruitment, Training, Promotion, Morale, Employer-Employee Relations.

Public Policy : Policy Formulation and Implementation.

Relationship between Permanent and Political Executive.

**Unit-IV** : **Political Sociology :**

Nature and Scope.

Structural Functional Analysis, Systems Analysis.

Authority & Legitimacy.

Social Stratification: Bases of Stratification; Caste, Class and Status.

Political Culture, Political Socialisation, Political Modernisation and Political Participation.

**Unit-V : International Relations :**

Approaches to the Study of International Politics : Idealism and Realism, System Theory, Decision—Making and Game Theory.

National Power, Balance of Power and Collective Security, Disarmament, Human Rights, International Terrorism, Gender in I.R.

Non-Alignment : Evolution, Achievements and Contemporary Relevance.

India's Role in World Affairs.

India's Foreign Policy: Determinants, Continuity and Change.

**PAPER-II**

**Unit-I** : **Indian Government and Politics :**

Ideological Bases of the Indian Constitution, Preamble, Fundamental Rights and Directive Principles of State Policy.

Structure and Process : President, Prime Minister, Parliament and the Working of the Parliamentary System.

Theory and Practice of Federalism in India.

Supreme Court, Judicial Review and Judicial Activism.

Political Parties and Pressure Groups.

Issues and Trends : Regionalism, Secularism, Caste & Politics.

Elections and Electoral Reforms.

**Unit-II: Comparative Government and Politics:**

Comparative Politics: Nature and Scope.

Issues in Comparative Politics: Parliamentary and Presidential, Unitary & Federal.

Constitutionalism: Meaning and Challenges.

British Political System: Conventions and Rule of Law.

Parliamentary Government: Crown, Parliament and Cabinet.

U.S. Political System: Separation of Powers, Checks and Balance.

President, Congress-Senate and House of Representatives, Supreme Court and Judicial Review.

Swiss Political System : Direct Democracy, Federal Council, Federal Assembly and Federal Tribunal.

Chinese Political System : Democratic Centralism, National People's Congress, President of People's Republic of China, State Council.

Party System in the U.K., U.S.A. and China.

**Unit-III** : **State and Local Government in Odisha :**

Emergence of Odisha as a Separate State.

Government and Politics in Odisha from 1936 to 1950.

Government and Politics since 1950.

Governor, Council of Ministers, State Legislative Assembly, High Court and Subordinate Courts.

Politics of Defection and Coalition in Odisha.

Elections and Voting Behaviour in Odisha since 1952.

Rural Local Government and Urban Local Government in Odisha.

**Unit-IV** : **Indian Political Tradition :**

Indian Political Tradition: Foundation & Features.

Kautilya : Arthasastra, Theory of Government and Statecraft.

Raja Rammohun Roy : The Indian Renaissance and Nationalism.

Swami Vivekananda : Nationalism, Internationalism and Enlightened Humanism.

G.K. Gokhale : Idealism and Swadeshi.

B.G. Tilak : Swaraj & Education.

Aurobindo : Political Techniques, Spiritual Nationalism and Universalism.

Gandhi : Satyagraha, Trusteeship and Sarvodaya.

B.R. Ambedkar: Equity and Social Justice.

**Unit-V:** Development Administration in India :

Development Administration : Meaning, Scope and Significance.

Evolution of Development Administration in India.

Planning: Machinery, Process and Limitations.

Development Goals: Self-reliance, Industrialisation, Modernisation, Social Justice, Poverty Alleviation.

Planning Commission, National Development Council.

State Planning Board.

District Planning Machinery.

Bureaucracy and Development Administration in India.

Development Administration: Problems & Prospects.

Good Governance.

# Psychology

## PAPER-I

### Advances General psychology

**UNIT-I**

Current definition of psychology – Different approaches : Biological, Behavioural, cognitive, Humanistic, Socio-cultural, Modern perspective in psychology.

The Biological Bases of Human Behaviour:

a) Central Nervous System – (Central processing unit) Brain & Spinal cord.
b) Peripheral nervous system: somatic nervous system & A.N.S.
c) Chemical connection: the endocrine glands.

**UNIT-II**

Principles of Learning:

Classical Conditioning, Operant Conditioning and its application, Cognitive learning – Tolman's sign learning theory, Kohler's Insightful learning and Bandura's observational learning and applications.

Human Memory : Two influential models, Kinds of Information stored in Memory, Forgetting – Theories of forgetting, Memory and the Brain – Amnesia and other memory disorder.

**UNIT-III**

Sensory Process and Perception : Sensory Processes : Perception : Form Perception – Perceptual Constancy – Movement Perception – Role of Motivation and Learning in Perception. Plasticity of perception – Extra Sensory perception.

Cognition : Thinking, decision – making & communication

a) Basic elements of thought : concepts, propositions & images; reasoning: transformation of information to conclusion. b) Decision making & communication.

**UNIT-IV**

Motivation : - Theories of Motivation – Some major perspectives, Types of Motives.

**Emotions:** Nature of Emotion : Some contrasting views, Biological basis of emotion, External expression of emotion, emotion and cognition. Subjective Wellbeing.

**UNIT-V**

Personality : Meaning and Definition – Approaches to Personality: Psychodynamic, Humanistic theories, type, trait & Learning approaches. Personality Assessment – Modern research on personality: Applications to personal health and behavior in work settings.

**PAPER-II**

**Applied Psychology**

**UNIT-I**

The FIELD OF SOCIAL PSYCHOLOGY HOW WE THIN ABOUT AND INTERACT WITH OTHERS.

A working Definition of Social Psychology – Social Psychology Focuses on the Behaviour of individuals - : Research Methods in Social Psychology:

SOCIAL IDENTITY – SELF AND GENDER

The Self, Self Concept, Self Esteem, Self-efficacy, Self Monitoring Behavior, Self Focusing Gender – maleness of Femaleness as a Crucial Aspect of identify.

ATTITUDES : EVALUATING THE SOCIAL WORLD

Formation of Attitudes – Social Learning, Direct Experience and Genetic Factors – Aattitudes and Behavior. The Essential Link – Specificity, Components, Strength, Vested interest, the Role of Self-awareness, accessibility Persuasion: the Traditional and Cognitive Approaches – Resistance to persuasion – cognitive Dissonance.

**Unit-II**

**Nature and Scope of Counseling Psychology**

Definition meaning and goals of counseling, Work settings and activities of the counselors. Training of counselors, Characteristics of effective counselors.

Ethical and legal guidelines for counselors, Contemporary trends and issues in counseling.

**Family Counseling**

Premarital and marital counseling, Counseling for women – family violence, women abuse. Women in career, Dual career couple, The elderly people : Psychosocial perspective for active aging.

**Counseling at Work Place**

Work and mental health, Occupational stress and counseling, Development of soft skills, Pre-retirement and retirement counseling, Burnout: Prevention and intervention.

**Group counseling**

Group guidance activities, Multicultural counseling, Self-help groups, Crisis intervention, counseling for disaster victims, Steps in crisis intervention.

**UNIT-III**

**HEALTH PSYCHOLOGY AND COMMUNITY INTERVENTION**

Concept of health, Role of psychology in health, Current perspectives in health and illness; Prevention: Primary, secondary, tertiary etc.

**Life styles to enhance health and prevent illness:**

Health related behavior and health promotion, developmental, gender, and socio-cultural factors in health. Programmes for health promotion.

**Community Interventions:**

Meaning, nature, and scope of community psychology. Psychological Interventions : Nature, goals and common features of interventions. Approaches of interventions.

**Programmes for social problems**

Programmes for special populations :

a) For mentally, socially, physically handicapped, deprived, severally impaired.
b) For juvenile offenders,
c) For women and elderly

**Unit-IV:**

**HRD;** Meaning, Objectives, Mechanisms, Assumption, need & significance of HRD, Principles. HRD vs. HRM,. Nature and Scope of human resources management; meaning, characteristic, objective, importance, history, function and scope of HRM.

Strategic HRM: Meaning, steps, types, challenges and role implementation. Policies and practices of HRM.

Work Stress and its Management: Concept of stress, types, forms sources and consequences. Copies with stress and stress management.

**Unit-V:**

**LIFESPAN DEVELOPMENT**

**The study of human development –** the life span perspectives, the transitions of life., Developmental study as a science. Research methods – Observation, Experimental, Other research methods – survey, case study, longitudinal and cross sectional methods.

**Adolescence :** Bio-social, Cognitive and Psycho-social development,. Problems in Adolescence.

**Adulthood;** Early, Middle & late Adulthood – Problems in Adulthood.

**Aging:** primary aging, secondary aging, problems of old age.

Characteristics and Development Tasks of Old Age, Adjustment to Physical Changes, Motor Abilities Mental Abilities & interest, Hazards to personal and Social Adjustments in Old Age.

# Sanskrit

## PAPER-I

### LITERATURE

1.1. History of Vedic Literature (Samhitas, Brahmanas, Aranyakas, Upanishads)

1.2. Vedangas & Ancillary Literature.
1.3. Epics & Puranas.
1.4. Origin & Development of Sanskrit Dramas.
1.5. Prose Literature (Prose Romances, Fables & Fairy Tales.
1.6. Mahakavyas
1.7. Lyrics & Chamu Literature
1.8. Contribution of odisha to Sanskrit Literature (Murarimishra, Visvanathakaviraja, Krsnananda, Jayadeva, Jivadevacharya & Divakaramishra)

## PAPER-II

### TEXTUAL AND SASTRIC STUDIES

2.1. Comparative Philology (2.1.1) Indo-European Language, (2.1.2) Comparison between Vedic and Classical Sanskrit Languages, (2.1.3) Phonetic Changes in Sanskrit, (2.1.4) Causes of Semantic changes, (2.1.5) Comparative study of the Vedic Language with Avesta.

2.2. Grammar : Sandhi, Karaka & Samasa.

2.3. Indian Philosophy : Samkhya, Vedanta, Nyaya-Vaisesika systems and the Philosophy of the Bhagavadgita.

2.4. Poetics[Part-I]
(2.4.1. Definition of Kavya, 2.4.2. Schools of Indian Poetics & 2.4.3. Sabdasaktis).

2.5. Poetics[Part-II]
(2.5.1. Kavyabhedas, 2.5.2. Natyatattva).

2.6. Poetics[Part-III]
(Definition and Types of Rasa).

2.7. Indian Culture (2.7.1. Samskaras, 2.7.2 : Varnasramadharma, 2.7.3. Status of Women in Ancient India, 2.7.4. State Administration according to Manu and Kautilya)

2.8. One Essay in Sanskrit language covering (i) textual or (ii) critical themes or (iii) on issues of contemporary relevance (out of these three options are from each item).

# Sociology

## PAPER– I

**Unit-1**: Sociological Concepts :- Society, Community, Associations, Institutions, Groups,

Status and Role, Religion, Culture, Norms and Values, Social control, Socialization, Social Stratification and Social change.

**Unit-II**:Sociological Perspectives :- Historical and Social Context of the emergence and Growth of Sociology, Significance of Sociology, Structural-Functional perspective, Conflict perspective, Humanistic perspective.

**Unit-III**:Relation between Theory and Emipirical Research, Theory and facts, Concepts, Reliability and validity, Research Design- Exploratory, Descriptive, Diagnostic and Experimental Objectivity, Value-neutrality, Hypothesis, Sampling, Quantitative methods, Qualitative Research Techniques. Scaling Techniques: Thurstone, Likert, Bagardus, Sociometry.

**Unit-IV**:Classical Sociological Tradition. Emile Durkheim: Rules of Sociological method, Division of Labour, Theory of Suicide, Theory of Religion.

**Karl Marx_**: Dialectical Materialism, Historical Materialism, Materialistic Interpretation of History, Theory of Alienation and Theory of Class struggle. Neo-Marxism and its relevance in the present context.

**Unit-V**: Modern Sociological Foundations of Sociology :

Functional Theory : R.K.Merton,

Talcott Parsons,

Tumin,Davis and Moore

Conflict Theory : G.Simmel, L.Coser,

Ralph Dahrendorf

World System Theory : Immanuel Wallerstein.

- Phenomenology
- Ethnomethodology
- Exchange Theory
- Post-Modernism,
- Critical Sociology

## PAPER – II

**Unit-I :** Perspectives on Indian Society :

* Indological/Textual perspective :
  G.S. Ghurye,

  L. Dumont

* Structural- functional perspective :

  M. N. Srinivas,

  S. C. Dube

* Marxian Perspective :

  D. P. Mukherjee,

  A.R.Desai, &

  R. K. Mukherjee.

* Subaltern Perspective :

  David Hardiman

  B. R. Ambedkar

**Unit-II** : Composition of Indian Society : Linguistic groups, Religious groups, Ethnic groups, Cultural groups.

Pluralism in Indian Society

Society : Continuity and change

Challenges to National Integration: Communalism, Linguism, Regionalism, Terrorism.

**Unit-III**: Rural Sociology: Emergence & Development, Importance of Rural Sociology in the Indian context.

Rural and Agrarian Social structure

Village Community : Rural Urban contrast and continuum, Village studies- Andre Beteille, Yogendra Singh, M.N.Srinivas, McKim Marriot, Robert Redfield.

Major Rural Institutions: Caste, Kinship, Family, Religion in Persistence and change Agrarian Social structure, Peasant movements, Legislations and emerging trends.

**Unit-IV** :Social Change : Theories : Linear Theory, Cyclical Theory, Conflict Theory & Functionalist Theory.

Concept of Development:

Nature of Social and Human Development, Changing Paradigms of Development, Sustainable Development.

Perspectives on Development: Ecological, Liberal, Marxian, Environment and Development Debate.

**Univ– V:** Globalisation and Society:

Globalisation: The Historical context, Dimensions of Globalisation: Economic, Technological, Social and Cultural.

Global Institutions and Actors:

World Bank, IMF, WTO

Globalisation and Nation States

Social Impact of Globalisation in the Indian context.

Liberalisation, Privatisation and New Economic order.

# Statistics

## PAPER-I

**UNIT-I (Probability Theory)**

Classical definition and axiomatic approach. Sample space. Laws of total and compound probability. Probability of m events out of n. Conditional probability. Bayes' theorem. Random variable – discrete and continuous. Distribution function. Mathematical expectation, moments and cumulants, Characteristic function and probability generating function. Inversion, uniqueness and continuity theorems. Markov, Holder, Jenson, Liapnov and Chebyshev's inequalities.

**UNIT-II (Probability Theory and Distributions)**

Standard probability distributions – Bernoulli, uniform, binomial, Poisson, geometric, rectangular, Exponential, normal, Cauchy, hyper-geometric, multinomial, negative binomial, beta, gamma and lognormal, Convergence in distribution, in probability, in r-th mean, and almost surely, and their relationships. Laws of large numbers and central limit theorems for i.i.d. random variables.

**UNIT-III (Statistical Methods)**

Collection, compilation and presentation of data, charts, diagrams and histogram. Frequency distribution. Measures of location, dispersion land skewness. Bivariate and multivariate data. Association and contingency. Curve fitting and orthogonal polynomials. Bivariate distributions. Bivariate normal distribution. Bivariate normal distribution. Simple correlation and regression. Distribution of the sample correlation coefficient.

**UNIT-IV (Statistical Methods)**

Partial and multiple correlations and regressions. Intraclass correlation. Correlation ratio. Standard errors, and large sample and small sample tests. Sampling distributions of sample mean, sample variance, t, F and chi-square; and tests of significance bases on them.

**UNIT-V (Theory of Estimation)**

Characteristics of a good estimator, Estimations based on the method of maximum likelihood, minimum chi-square, moments, and least squares. Optimal properties of maximum likelihood estimators. Minimum variance unbiased and minimum variance bound estimators, Cramer-Rao inequality. Bhattacharya bounds. Sufficient estimator. Factorization theorem. Complete statistics. Rao-Blackwell theorem. Confidence interval estimation.

**UNIT-VI (Hypothesis Testing)**

Simple and composite hypothesis, kinds of error. Critical region. Different types of critical regions and similar regions. Power function. Most powerful and uniformly most powerful tets. Neyman-Pearson fundamental lemma. Unbiased tests. Likelihood ratio test. Non-parametric tests- sign, median, run, Wilcoxon, Mann-Whitney, Wald-Wolfowitz.

## PAPER-II

**UNIT-I (Multivariate Analysis)**

Multivariate normal distribution – marginal and conditional distributions, distribution of quadratic forms. Maximum likelihood estimators of parameters, distributions of sample mean vector and matrix of corrected sum of squares and cross products. Sampling distributions of sample partial and multiple correlation coefficients (null case only). Hotelling's $T^2$ statistic – properties, distribution and uses, Mahalanobis- $D^2$ statistic and its use. The problem of discrimination, Fisher's dicsriminant function.

**UNIT-II (Sampling Techniques)**

Census versus sample survey. Pilot and large-sale sample surveys. Simple random sampling with and without replacement. Stratified sampling and sample allocations, Cost and variance functions. Ratio and regression methods of estimation. Sampling with probability proportional to size. Cluster, multi-phase, multi-stage and systematic sampling.

**UNIT-III (Demography and Vital Statistics)**

The life table, its constitution and properties. Makehams and Gompertz curves. Abridged life table. U.N. model life tables. Stable and stationary populations. Different birth rates. Total fertility rate. Gross and net reproduction rates. Different mortality rates. Standardized death rate. Internal and international migration: net migration. International and post censual estimates. Projection methods including logistic curve fitting. Decennial population census in India.

**UNIT-IV (Time Series Analysis and Econometrics)**

Time series – components and methods of their determination, variate difference method, Yule-Slutsky effect. Correlogram. Autoregressive models of first and second order. Periodogram analysis. Two variable and k-variable linear models – assumptions, OLS estimators and their properties. Multicollinearity – detection, consequences and remedial measures. Heteroscedasticity – nature, OLS estimators in the presence of heteroscedasticity, detection, consequences and remedial measures. Generalized least squares GLS estimators.

**UNIT-V (Design and Analysis of Experiments )**

Principles of designs of experiments. Layout and analysis of completely randomized, randomized block and Latin square designs. Factorial experiments and confounding in $2^\eta$, $3^2$ and $3^3$ experiments. Split plot and strip-plot designs. Construction and analysis of balanced and partially balanced incomplete block designs. Analysis of covariance. Analysis of non-orthogonal data. Analysis of missing plot data.

**UNIT-VI (Statistical Quality Control and Operations Research)**

Different types of control charts for variables and attributes. Acceptance sampling by attributes-single, double, multiple and sequential sampling plans. OC and ASN

functions. Concepts of AOQL and ATL. Acceptance sampling by variables, use of Dodge-Romig and other tables.

Operations Research – approach, elements of linear programming. Simplex procedure. Transportation and assignment problems. Principle of duality. Single and multi-period inventory control models, ABC analysis. Characteristics of a waiting line model. M/M/I, M/M/C modes. General simulation problems. Replacement models for items that fail and of items that deteriorates.

# Telugu

## PAPER-I

**UNIT-I. STUDY OF TELUGU LANGUAGE**

Study of History and Evolution of Telugu language – From the early period to Modern period- The place of Telugu among the language families of India in general and the Dravidian family in particular.

**UNIT-II. HISTORY OF TELUGU LITERATURE**.

Study of evolution of Telugu literature from the early period to king poets of Tanjavore.

Study of classical poets-their age and works-particular selections from Nannaya, Tikkana, Errapragada, Saiva Poets, Srinatha, Potana, Krishna Devaraya poets and king poets of Tanjavore.

**UNIT-III. STUDY OF MODERN POETS.**

Modern Trends, their works Gurajada, Rayaprolu, Veeresalingam, Viswanadha, Devulapalli, Jashuva, Sri Sri and leading Modern poets, Trends-Romantic movement, progressive movement.

**UNIT-IV. STUDY OF LITERARY TRENDS.**

Salient features of the ages,forms etc,Itihasa, Purana, Prabandha, Sataka, Yakshagana, Samkertana Literature, Historical Poem, Prose works classical and Modern-Novel, Short story, Eassay, one-act play etc.

**UNIT-V. GRAMMAR.**

Study of Telugu Grammar BalavyaKaranam by Chinnayasuri.

## PAPER-II

**UNIT-I. Modern Drama and Folk Poetry**

Sakshi- Kanya sulkamu- Janapada geya vakmayam.

**UNIT-II. Sahitya Vimarsa ( LITERARY CRITICISM).**

Sahitya swarupa swabhavamulu- Sravya Kavyamulu, Nirvachanam-Kavyahetuvulu-Dwani-Rasa siddhamtamu-Kavyabhedamulu-Drusyakavyam-Swarupa swabharamulu-praschya-paschatya Natakotpathi.

**UNIT-III. Comparative study of Telugu and Odiya literature and culture.**

Various literary movements in Andhra and Odisha (Sahitya Udyamaly)-Matamu-Sampradayamulu-Kalalu in Odiya and Telugu.

**UNIT-IV. Prosody and Poetics.**

Chandassu- Akankaras.

**UNIT-V. Sanskrit.**

Study of Sanskrit Grammar and Kavyas.

Elementary knowledge of Sanskrit Grammer. Prose and poetry-Hitopadesa and Kalidasa works.

## Urdu

**PAPER-I**

**Unit – I - History of Urdu Language and literature with special reference to cultural development.**

(a) Coming of Aryans in India

(b) Development of Indo-Aryan culture through different stages i.e. old Indo-Aryan, Middle Indo-Aryan and Modern or New Indo-Aryan

(c) New Indo-Aryan Languages: Hindi in Western region of Uttar Pradesh, Haryani, Brij Bhasha and Khadiboli and their relations with Urdu.

(d) Impact of Khariboli, Persian and Arabic on Urdu.

(e) Development of Urdu in North India and South India.

***Books for Reference :***

1. Tarikh-e-Adab-i-Urdu – Rambabu Saxena
2. Muqaddama-i-Tarikh-e- Zaban-e-Urdu – Masud Husain Khan
3. Tarikh-e-Zaban-e-Urdu – Azimul Haque Junaidi
4. Punjab Men Urdu – Mehmood Shirani
5. Daccan Men Urdu – Nasiruddin Hashmi

**Unit – II – Novels, Short Stories and Dramas.**

***Books Prescribed :***

1. Godan – Premchand
2. Umrao-Jan-Ada – Ruswa
3. Urdu ke-Tera Afsane – Athar Parwez
4. Naqsh-i-Akhir – Ishteyaq Husain Qureshi
5. Anarkali – Imtiyaz Ali Taj.

**Unit – III – Poetry.**

***Books Prescribed :***

1. Intekhab-e-kalam-e-Meer – Abdul Haque
2. Majmua-e-Nazme-Hali – Hali
3. Bal-e-Jibreel – Iqbal
4. Kalam-e-Shaad – Shaad Azimabadi
5. Kulliat-e-Akber – Akber Ilahabadi

**Unit – IV – Prose**

***Books Prescribed :***

1. Sabras – Mulla Wajhi
2. Rasail-e-Shibli – Shibli
3. Ab-e-Hayat – Mohammed Husain Azad
4. Ghubar-e-Khatir – Moulana Abul Kalam Azad
5. Mazamin-e-Sir-Sayed – Sir Sayed Ahmed.

**PAPER-II**

**Unit – I - Philolgy, Rhetoric & Prosody in Urdu**

***Books Prescribed :***

1. Hindustani Lesaniyat – Dr. Mohiuddin Quadri Zor.
2. Zaban-o-Ilm-e-Zaban - Dr. Abdul Quadir Sarwari.
3. Jadid Ilmul-Balaghat – Prof. Abdul Majeed.
4. Jadid Ilmul-Urooz – Prof. Abdul Majeed.

**Unit – II - Poetry & Criticism**

***Books Prescribed:***

1. Qasaid-i-Zauque – S. Suleman.
2. Sehrul-Bayan – Mir Hasan.
3. Marsiya-e-Anees – Masud Husain
4. Moqaddama-e-Sher-o-Shaeri – Hali

5. Tanquidi-Nazariye - Ihtesham Husain.
6. Tanquid Kya Hai – Aale Ahmed Suroor.
7. Urdu Shairi-per-ek-Nazar – Kalimuddin Ahmed.

**Unit – III – Ghalib – His prose and poetry**

***Books Prescribed:***

1. Diwan-e-Ghalib – Abdur Rahman Bijnori
2. Ghalib – Nama – S.M. Ikram.
3. Khutoot-e-Ghalib – Mahesh Prasad.

**Unit – IV - Dr. Nazir Ahmed and his Novels**

***Books Prescribed:***

1. Miratul-Uroos – Dr. Nazir Ahmed
2. Banatun-Nas - -do-
3. Taubatan-Nasuh - -do-
4. Ayyama - -do-
5. Ibnul-Waqt -do-

# Zoology

**PAPER-I**

**UNIT-I BIOLOGY OF NON-CHORDATES**

Protozoan parasites of man; Reproduction in sponges; Polymorphism in coelenterates; Helminth parasites of man and parasitic adaptations; Coelom in annelids; Vision in insects; Horseshoe crab and its importance; Locomotory organs and locomotion in molluscs; Larval forms in echinoderms and origin of chordates; Comparative study of the excretory organs and excretion in invertebrates.

**UNIT-II BIOLOGY OF CHORDATES**

Origin of chordates; Biology and affinity of protochordates; Biology and affinities of Cyclostomes and Dipnoi; Migration in fishers; Metamorphosis in amphibians; Poisonous and non-poisonous snakes of India; Flight adaptation in birds; Adaptive radiation in mammals; Aquatic mammals and their adaptations; Dentition in mammals.

**UNIT-III ECOLOGY, BIOSTATISTICS, ANIMAL TAXONOMY**

Population and its characteristics; Biotic community; Environmental pollution, Green house effect, Acid rain; Wildlife of India and their conservation; Probability and probability distribution (Normal, Binomial and Poisson); Tests of significance (t- and $x^2$ tests); Simple correlation; Regression and Analysis of variance; Speciation and species concept; Modern trends in taxonomy; Collection, preservation and curetting of animals of taxonomic importance.

**UNIT-IV EVOLUTION, ETHOLOGY**

Variation and natural selection as underlying mechanisms of evolution; Isolation and isolating mechanisms in relation to origin of species; Patterns of evolution (micro, Macro and Mega); Hardy-Weinberg principle in relation to population genetics; Molecular and genomic evolution; Ancestry of man; Pheromones and behaviour; Social organization in primates; Courtship and mating behaviour in mammals; Biological clock and circadian rhythm.

**UNIT-V ECONOMIC ZOOLOGY, MICROBIOLOGY**

Biology of silk moth and sericulture; Apiculture; Earthworm and vermicomposting; Induced breeding in fishes; Pearl culture; Transgenic animals and their importance; Structure of bacteria and bacteriophage; Isolation, screening and culture of bacteria related to production of antibiotics and enzymes; Lytic and lysogenic cycles; Transduction, transformation and conjugation in bacteria.

## PAPER-II

**UNIT-I CELL BIOLOGY AND GENETICS**

Structure, composition and arrangement of biological membranes; Transport across cell membrane; Cytoskeleton- structure and dynamics; Cell cycle and cell signaling; Cell division – Mitosis and Meiosis; Cell necrosis and apoptosis; Linkage, Crossing over and Gene mapping; Gene interaction; Penetrance and expressivity; Human genome project; Chromosomal aberrations and their genetic consequences;

**UNIT-II PHYSIOLOGY AND ENDOCRINOLOGY**

Blood groups and blood coagulation; structure of hemoglobin and transport of gases of respiratory importance; Ultra filtration in the mammalian kidney and mechanism of urine formation; Osmoregulation in aquatic animals; Cellular organization of neuron and synaptic transmission; Chemistry and biological action of pituitary hormones; Neurosecretion and hypothalamic control of adenohypophysial function; Mechanism of hormone action; Testicular events and biosynthesis of testosterone; Endocrinology of implantation, parturition and lactation; Role of hormones during pregnancy.

**UNIT-III BIOCHEMISTRY AND MOLECULAR BIOLOGY**

Electron transport chain and ATP synthesis; Carbohydrate metabolism and its regulation; Protein synthesis, three dimensional structure of protein and protein folding; Kinetics and mechanism of enzyme action; Metabolism of amino acids-transamination, oxidative deamination; Oxidation of fatty acids; DNA structure, types and its organization in the chromatin; Synthesis and processing of mRNA; Regulation of gene expression in prokaryotes; Blotting techniques – Southern, Northern and Western; Gene, genome and genetic code.

**UNIT-IV IMMUNOLOGY AND DEVELOPMENTAL BIOLOGY**

Antigen, antibody and antigen-antibody reactions; Immunoglobulin – structure and function; Humoral and cell mediated immunity; Immunological aspects of transplantation, autoimmunity and immunotolerance; Hypersensitivity, Vaccines, interferon, episomes and toxins; Biochemical aspects of fertilization, Organizer concept and embryonic induction; Differential gene expression during development; In vitro fertilization and embryo transfer; Regeneration in vertebrates; Stem cell biology.

**UNIT-V INSTRUMENTATION AND TEHNIQUES**

Microscopy – light, fluorescent, electron (Scanning & Transmission) microscopy; Ultra centrifugation (Differential and Density gradient); Electrophoresis (Agarose and PAGE); UV and visible spectrophotometry; Chromatography – Paper, Gas and Liquid chromatography; Principles and technique of PCR; Radioisotopic techniques and scintillation counting; Karyotyping and chromosomal analysis; Tissue fixation and microtomy; Histochemical methods for the demonstration of carbohydrate, protein, lipid and nucleic acids.

# IRPM/PMIR

Principles and Practices of Management, Industrial Relations-I (Employment Relations & Unionism), Human Resource Management, Labour Legislations and Case Laws-I, Social Research and Statistics (SRS- I), General, Labour and Industrial Economics, Organizational Behaviour –I, Industrial Psychology.

Organizational Behaviour -II, Industrial Relations-II (Contemporary Issues in IR), Labour Legislations and Case Laws-II, Performance Management, Learning and Development, Social Security and Unorganized Sector, Quantitative Methods & Statistics (SRS-II).

Human Resource Development, Productivity Management & TQM, Organization Change & Development, Financial & Marketing Management, MIS & HRIS, Corporate Social Responsibility.

Compensation Management, Strategic HRM, International HRM, Labour Administration, Talent & Knowledge Management, Ethics & Management.

AUDIT COURSE: Indian Polity, Environmental Law, Disaster Management, Entrepreneur Development