

Syllabi for the
Orissa Civil Services
(Preliminary) Examination
(Subject-wise)

SYLLABUS FOR ORISSA CIVIL SERVICES (PRELIMINARY) EXAMINATION

GENERAL STUDIES

The nature and standard of questions in this paper will be such that a well-educated person will be able to answer them without any specialized study. The questions will be such as to test a candidate's general awareness of a variety of subjects, which will have relevance for a career in Civil Services.

General Science

Current events and developments of national and international importance.

History of India and Indian National Movement.

Indian and World Geography

Indian Polity and Economy.

General Mental Ability

General Science

1. Questions on General Science will cover general appreciation and understanding of science including matters of everyday observation and experience, as may be expected of a well educated person who has not made a special study of any particular scientific discipline.
2. Questions also may be set covering facts relating to modern important scientific discoveries and prominent Indian Scientists and their contributions.

Current events and Developments of national and international importance.

In current events knowledge of significant state, national and international events will be tested.

History of India and Indian National Movement

1. In History of India emphasis will be on;
 - a) General understanding on social, economic and political history of India.
 - b) General understanding of socio-cultural and political history of Orissa.

2. Indian National Movement.

- a) Nature and character of the 19th century resurgence, growth of nationalism and attainment of independence.
- b) Freedom movement in Orissa, Oriya nationalism and Formation of Orissa Province.

Indian and World Geography –

Emphasis will be on Geography of India and Orissa. Questions are to be set on the following;

1. Physical, Social and Economic Geography of India.
2. Main features of Indian agriculture and natural resources.
3. Natural resources of Orissa – Water, Forest and Minerals.
4. Natural disasters in Orissa, - Flood and Cyclone.

Indian Polity and Economy –

Questions on Indian polity and economy will test the candidate's knowledge on the following;

1. Indian Political system and Constitution of India.
2. Social system and economic development in India.
3. Local self Government – Urban and Rural Bodies in Orissa.
4. Orissa's economic development during the Plan periods;
Agriculture, Industry, Social Sector.

General Mental Ability

The candidates will be tested on reasoning and analytical abilities.

AGRICULTURE

Agriculture, its importance in national economy. Factors determining agroecological zones and geographic distribution of crop plants. Importance of crop plants, cultural practices for cereal, pulses, oilseed, fibre, sugar, tuber and fodder crops. Crop rotation, multiple and relay cropping, intercropping and mixed cropping. Dryfarming techniques. Organic farming. Soil as a medium of plant growth and its composition, mineral and organic constituents of the soil and their role in crop production; chemical, physical and biological properties of soils. Essential plant nutrients - their functions, occurrence, cycling in soils. Soil fertility and its evaluation for judicious fertilizer use. Organic manures and bio-fertilizers, inorganic fertilizers, integrated nutrient management.

Principles of plant physiology - plant nutrition, absorption, translocation and metabolism of nutrients. Diagnosis of nutrient deficiencies and their amelioration, photosynthesis, respiration, growth and development. Plant growth regulators. Cell and cell organelles. Cell division and reproductive cycle. Principles of genetics, gene-interaction, sex determination, linkage and recombination, mutation, extra chromosomal inheritance, polyploidy. Origin and domestication of crop plants. Biodiversity - genetic resources conservation and utilization. Genetic basis of plant breeding - pureline selection, mass selection, male sterility and incompatibility and their use in plant breeding. Pedigree and back-cross methods of selection. Heterosis and its exploitation. Genetic engineering. Development of hybrids, composites and synthetics. Important varieties, hybrids, composites and synthetics of major crops. Seeds and seed-production techniques.

Important fruit and vegetable crops of India. Method of propagation—sexual and asexual. Package and practices of fruits and vegetables. Crop rotation, intercropping, companion crops, role of fruits and vegetables in human nutrition. Post-harvest handling and processing of fruits and vegetables. Landscaping and ornamental horticulture, commercial floriculture. Medicinal and aromatic plants. High-tech horticulture.

Pests and diseases affecting major crops. Principles of control of crop pests and diseases. Integrated pest management. Use and maintenance of plant protection equipments. Mushroom cultivation and bee keeping.

Principles of economics as applied to agriculture. Farm planning and optimum resource—use efficiency and maximization of income and employment. Farm systems and their spatial distribution, their significant role in regional economic development. Intellectual property right in agriculture.

AGRICULTURAL ENGINEERING

Part – A

1. **Surveying:** Chain survey, compass survey, plane table survey, contour survey, estimation of area and volume of earth work.
2. **Fluid mechanics:** Fluid properties, types of flow and their properties, forces on plane and curved surfaces, stability of floating and submerged bodies, importance of Reynold's number, Froude number in fluid flow phenomena, Chezy's and Manning formula in design of flow channels.
3. **Irrigation:** Importance of irrigation in agriculture, soil-water-plant relationship, estimation of irrigation requirement of crops, irrigation efficiencies, types of irrigation, irrigation scheduling and on-farm-water management, types of pumps for irrigation and their criteria for selection, concept of participatory irrigation management and its advantages over traditional system.
4. **Drainage:** Drainage needs for crop production, types of drainage systems – surface drainage, subsurface drainage, vertical drainage and bio-drainage, laying of drainage system in cropped field, hydraulic conductivity and its measurement for drainage planning.
5. **Surface hydrology :** Hydrologic cycle, measurements of rainfall, evaporation and infiltration, estimation of runoff and factors affecting runoff. Basic, unit and complex hydrograph and their properties.
6. **Ground water Hydrology:** Occurrence of ground water and its movement, geologic formations and their properties in relation to availability of ground water, ground water investigation, ground water estimation and artificial recharge, types of wells and their hydraulics, method of construction of different types of wells including well development, augmentation of well yield, factors affecting drawdown in wells, quality of ground water for irrigation.
7. **Soil erosion and biological control measures:** Importance of soil conservation in crop production, problems of soil erosion in Orissa, types of soil erosion and their control – biological control like contour farming, strip cropping, buffer strip cropping, inter cropping, mulching.
8. **Soil erosion by mechanical control measures:** Mechanical control measures like contour bunding, graded bunding, bench terracing under different land situation. Gully control measures, vegetated water ways.

9. **Watershed management:** Importance of watershed management in rainfed and dry land areas, prioritization of watershed for treatment, land capability classification and crop planning in watersheds, water harvesting and recycling for crop production.

10. **Farm structures :** Planning of farmstead, farm house, farm road, farm fencing, farm gate, dairy farm, poultry house.

Part - B

1. **Different sources of Farm power:-** Human and Animal power, Mechanical power, Electrical power, power from water. Different types of engines and engine parts.

2. **Renewable sources of energy:-** Energy from biomass, wind energy, types of wind mills & rotors, solar energy, geothermal, ocean thermal, tidal and wave energy, photovoltaic cells, Solar cookers, solar collectors and solar dryers.

3. **Non renewable sources of energy :-** Energy from petroleum fuels, coal, natural gas etc.

4. **Land preparation equipments :-** Tillage & tilth, Primary tillage and primary tillage tools, secondary, tillage and secondary tillage tools, land levellers and graders, earth moving equipment and bulldozers.

5. **Puddling :-** Definition of puddling, objectives of puddling, puddling index, methods of puddling and types of puddlers.

6. **Seed drills and planters :-** Difference between broad casting, seed drilling and planting types of seed drills and planters. Planting methods, calibration of seed drills and planters. Types of metering devices.

7. **Manure and fertilizer application:** Types and methods of application of manures and fertilizers. Types of manure and fertilizer application, metering devices.

8. **Plant protection equipments :** Different types of sprayers and dusters, spray pattern, MMD and VMD. Different types of dusters.

9. **Harvesting :** Different types of sickles, mowers, reapers and combines, different losses in combine, root crop and fruit crop harvesting equipments, threshing and winnowing methods, different types of threshers and winnowers.

10. **Grading and transportation :** Purpose of grading, different types of graders, grading methods, value addition, bullock cart, tractor and power tillers with trolley.

Part - C

1. **Psychometrics** : Different terminology in psychometrics and its relevance to agricultural products and its processing.
2. **Moisture Content**: Importance of moisture content. Various methods of determination of moisture contents in cereals, pulses, oil seeds.
3. **Drying** : Drying of cereals, pulses, oil seeds, methods of drying and types of dryers and fuels used for dryers. Design of dryer.
4. **Grain Processing**: Unit operations, processing of cereals, oil seeds and pulses, working principles of equipments for milling, mixing, cleaning and grading.
5. **Storage of Grains**: Storage parameters for grains. Different types of storage structures and material used for same.
6. **Processing of fruits & vegetables**: Properties of fruits and vegetables, process parameters and equipments for sorting, washing, handling, peeling, slicing, blanching, mixing and handling, chilling, packaging, transportation, storage and preservation.
7. **Dairy Engineering** : Various dairy and food processing systems, working principle of equipments for receiving milk, pasteurization, sterilization, homogenization, bottle filling, butter manufacturing. Evaporation, drying, freezing.
8. **By-product utilization** : Properties of husk from rice and its utilization for fuel and manufacturing of other items. Utilization of other by-products from coconut, groundnut, cashew nut, sugarcane and fruits and vegetables etc.
9. **Process equipment Design** : Design parameters, codes and material selection. Design of handling and milling equipments, dryers, heat exchangers, pressure vessels.
- 10 **Food science**: Major nutrients serving as food for living cells, Biochemical changes during ripening and storage of fruits, grains, milk and milk products. Types of micro organisms – Algae, fungi, bacteria and viruses. Multiplication of bacteria, control of bacterial growth, pathogenic bacteria, food contaminations.

ANIMAL HUSBANDRY AND VETERINARY SCIENCE

Animal Husbandry

1. **General** : Role of Livestock in Indian Economy with special reference to Orissa, and human health. Mixed farming. Climatic zones and livestock distribution. Socio-economic aspects of livestock enterprise with special reference to women.

2. **Genetics and Breeding** : Principles of genetics, chemical nature of DNA and RNA and their models and functions. Recombinant DNA technology, transgenic animals, multiple ovulation and embryo-transfer. Cytogenetics, immunogenetics and biochemical polymorphism and their application in animal improvement. Gene actions. Systems and strategies for improvement of livestock for egg, milk, meat and wool production. Breeding strategies for improving drought animals. Breeding of animals for disease resistance. Breeds of livestock, poultry and rabbits. Conservation of breeds.

3. **Nutrition** : Role of nutrition in animal health and production. Classification of feeds, Proximate composition of feeds, feeding standards, computation of rations. Ruminant and non-ruminant nutrition. Concepts of total digestible nutrients and starch equivalent systems. Significance of energy determinations. Conservation of feeds and fodder and utilization of agro by-products. Feed supplements and additives. Nutritional deficiencies and their management.

4. **Management** : Systems of housing and management of livestock, poultry and rabbits. Farm records. Economics of livestock, poultry and rabbit farming. Clean milk production. Veterinary hygiene with reference to water, air and habitation. Sources of water and standards of potable water. Purification of water. Air changes and thermal comfort. Drainage systems and effluent disposal. Biogas.

5. **Animal Production** : (a) Artificial insemination, fertility and sterility. Reproductive physiology, semen characteristics and preservation. Sterility, its causes and remedies. (b) Meat, egg and wool production. Methods of slaughter of meat animals, meat inspection, judgment, carcass characteristics, adulteration and its detection, processing and preservation.; Meat products, quality control and nutritive value. By-products. Physiology of egg production, nutritive value, grading of eggs, preservation, packaging, transportation and marketing.

6. **Veterinary Science** : (i) Major contagious diseases affecting cattle, buffaloes, horses, sheep and goats, pigs, poultry, rabbits and pet animals. Etiology, symptoms,

pathogenesis, diagnosis, treatment and control of major bacterial, viral, rickettsial and parasitic infections.

(ii) Description, symptoms, diagnosis and treatment of the following :

- (a) Production diseases of milch animals, pig and poultry.
- (b) Deficiency diseases of livestock and birds.
- (c) Poisonings due to infected/contaminated foods and feeds, chemicals and drugs.

7. Principles of immunization and vaccination : Different types of immunity, antigens and antibodies. Methods of immunization. Breakdown of immunity, vaccines and their use in animals. Zoonoses, Food borne infections and intoxications, occupation hazards

- 8.**
- (a) Poisons used for killing animals. Euthanasia.
 - (b) Drugs used for increasing production/performance efficiency, and their adverse effects.
 - (c) Drugs used to tranquilize wild animals as well as animals in captivity.
 - (d) Quarantine measures in India and abroad. Act, Rules and Regulations.

9. Dairy Science : Physicochemical and nutritional properties of milk. Quality assessment of milk and milk products, Common tests and legal standards. Cleaning and sanitation of dairy equipment. Milk collections, chilling, transportation, processing, packaging, storage and distribution. Manufacture of cream, butter, cheese, ice-cream, condensed and dried milk, by products and Indian milk products. Unit operations in dairy plant. Role of micro organism in quality of milk and milk products. Physiology of milk secretion.

ANTHROPOLOGY

- I. **BASIC CONCEPTS:** Biological/Physical Anthropology, Social/Cultural Anthropology, Prehistoric Archaeology/Palaeo Anthropology, Economic Anthropology, Visual Anthropology, Medical Anthropology, Forensic Anthropology, Cognitive Anthropology.
- II. **KEY TERMINOLOGIES AND DEFINITIONS:** Culture, Culture Trait, Culture Complex, Culture Pattern, Culture Area, Acculturation, Enculturation, Society, Community, Group, Institution, Association, Band, Tribe, Caste, Animism, Shamanism,
- III. **SOCIAL INSTITUTIONS:** Marriage, Family, Kinship, Clan, Moiety, Phratry, Lineage, Dormitory. Society, Culture and personality; Status and Role; Mechanical Solidarity and Organic Solidarity, Anthropology of Religion, Science of Mythology, Applied Anthropology, Social Stratification.
- IV. **PLEISTOCENE PERIOD AND PREHISTORIC CULTURE:** Geological and Archaeological Time Scale, Ice Age (causes & effects). Paleolithic, Mesolithic and Neolithic Cultures. Tool Types and Techniques.
- V. **EVOLUTION:** Organic Evolution: Lamarckism, Darwinism, Neo Darwinism and Synthetic Theory. Human Evolution: Palaeontological Evidences - Australopithecinae, Homo Erectus, Neanderthal Man, Cro Magnon, Chancelade, Grimaldi.
- VI. **MAN'S PHYLOGENETIC POSITION:** Man as a Primate, Anthropoidea, Hominoidea, Hominidae and Homo sapiens.
- VII. **HUMAN VARIATION:** Concept of Race; Major Races, their characteristic features and distribution. Causes of variation.
- VIII. **ANTHROPOLOGICAL GENETICS:** Concept of Gene, Chromosome, Hereditary Trait & their transmission, Genetic Variation in population.

- IX. CONSTITUTIONAL PROVISIONS AND PROTECTIVE LEGISLATION FOR STs AND SCs Definition of Tribe, Caste, their Characteristic features, constitutional safeguard. MADA, Cluster Approach, Tribal Sub Plan, ITDA, Primitive Tribe. Problems of the Tribals and Welfare Measures for them.
- X. ANTHROPOLOGICAL THOUGHT Natural Science Ideals in Anthropology; Humanistic Tradition in Anthropology; Anthropology, History and Natural history.
- XI. THEORIES IN ANTHROPOLOGY: Evolutionism, Diffusionism, Neo Evolutionism, Functionalism,; Structural – Functionalism, Structuralism.
- XII. METHODOLOGY IN ANTHROPOLOGY: Cultural Relativism, Methods of Comparison of Anthropology, Emic and Etic approaches, Holistic Approaches in Anthropology, Unity and Diversity in Indian Society, Social Mobility and Social Change.

BOTANY

1. Cell Biology : Structure and function of cell wall and extra-cellular matrix, Cell membrane, Cytoplasmic organelles, Nucleus, Nucleolus, Chromosomes, Cell cycle, Mitosis and Meiosis, Regulation of cell cycle.

2. Genetics, Molecular Biology and Evolution : Laws of inheritance, Linkage and crossing over, Genetic mapping, Structural and numerical changes in chromosomes, Gene mutation and its molecular basis, Sex-determination, Sex-linked inheritance, Structure of nucleic acids, DNA replication, Gene expression - Transcription, Translation, Regulation of gene expression in prokaryotes.

Origin of earth and origin of life, Theories of organic evolution, Molecular basis of evolution.

3. Biotechnology : Plant cell, tissue and organ culture, Protoplast culture and somatic hybridization, Genetic engineering - Restriction enzymes and recombinant DNA technology, Biotechnology in agri-horticulture (Role of genetic engineering in crop improvement), Medicine and industry, Biofertilizer and biopesticides.

4. Plant Diversity : Classical, Five-kingdom and Three-domain, classification, General characteristic features of Viruses, Bacteria, Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms, Nomenclature and classification of flowering plants, Modern approaches in plant taxonomy.

5. Plant Physiology: Concept of water potential, Diffusion, Osmosis, Absorption of water, Ascent of sap, Transpiration; Ion uptake, Active and passive uptake of solutes; Phloem transport; Nitrogen metabolism - Biological nitrogen fixation, Assimilation of nitrate and ammonia.

6. Plant Biochemistry : Enzymes – Nature, Classification, Properties, Kinetics, Mode of action, Allosteric enzymes; Photosynthesis – Light and Dark reaction (C₃, C₄ and CAM cycles), Photophosphorylation; Respiration – Glycolysis, Fermentation, Oxidative phosphorylation; Photorespiration; Role of isotopes in biochemical studies.

7. Growth, Reproduction and Seed Biology : Dynamics of growth, Growth movements, Growth substances, Photomorphogenesis, Physiology of flowering - photoperiodism and vernalization.

Vegetative, asexual and sexual methods of reproduction, Pollination and fertilization, Sexual incompatibility, Development, structure, dormancy and germination of seeds.

8. Plant Pathology : Diseases of rice, wheat, sugarcane, potato, mustard, groundnut and cotton crops. Factors affecting infection (host factors, pathogen factors, biotic factors like rhizosphere and phyllosphere organisms); Chemical, biological and genetic methods of disease control.

9. Plant and Environment : Biotic and abiotic components, Ecological adaptations, Types of vegetational zones and forests of India. Deforestation, afforestation, social forestry and plant introduction; Soil erosion, wasteland reclamation; Environmental pollution and its control (including phytoremediation); Bioindicators, Global warming.

10. Biodiversity, Plant Genetic Resources: Methods of conservation of plant genetic resources and its importance, Convention of Biological Diversity (CBD), Endangered, threatened and endemic taxa. Role of cell/tissue culture in propagation and enrichment of genetic diversity, Plants as sources of food, fodder, forage, fibres, oils, drugs, wood and timber, paper, rubber, beverages, spices, essential oils and resins, gums, dyes, insecticides, pesticides and ornamentation; Biomass as a source of energy.

CHEMISTRY

Section-A (Inorganic Chemistry)

1.1 Atomic structure : Schrodinger wave equation, significance of n and l Quantum numbers and their significance, radial and angular probability, shapes of orbitals, relative energies of atomic orbitals as a function of atomic number. Electronic configurations of elements; Aufbau principle, Hund's multiplicity rule, Pauli's exclusion principle.

1.2 Chemical periodicity : Periodic classification of elements, salient characteristics of s,p,d and f block elements. Periodic trends of atomic radii, ionic radii, ionisation potential, electron affinity and electronegativity in the periodic table.

1.3 Chemical bonding : Types of bonding, overlap of atomic orbitals, sigma and pi bonds, hydrogen and metallic bonds. Shapes of molecules, bond order, bond length, V.S.E.P.R. theory and bond angles. The concept of hybridization and shapes of molecules and ions.

1.4 Oxidation states and oxidation number : Oxidation and reduction, oxidation numbers, common redox reactions, ionic equations. Balancing of equations for oxidation and reduction reactions.

1.5 Acids and bases : Bronsted and Lewis theories of acids and bases. Hard and soft acids and bases. HSAB principle, relative strengths of acids and bases and the effect of substituents and solvents on their strength.

1.6 Chemistry of elements :

(i) **Hydrogen**: Its unique position in the periodic table, isotopes, ortho and para hydrogen, industrial production, heavy water.

(ii) **Chemistry of s and p block elements**: electronic configuration, general characteristics properties, inert pair effect, allotropy and catenation. Special emphasis on solutions of alkali and alkaline earth metals in liquid ammonia. Preparation, properties and structures of boric acid, borates, boron nitrides, borohydride (diborane), carboranes, oxides and oxyacids of nitrogen, phosphorous, sulfur and chlorine; interhalogen compounds, polyhalide ions, pseudohalogens, fluorocarbons and basic properties of halogens. Chemical reactivity of noble gases, preparation, structure and bonding of noble gas compounds.

(iii) **Chemistry of d block elements**: Transition metals including lanthanides, general characteristic properties, oxidation states, magnetic behaviour, colour. First row transition metals and general properties of their compounds (oxides, halides and sulfides) lanthanide contraction.

1.7 Extraction of metals : Principles of extraction of metals as illustrated by sodium, magnesium, aluminium, iron, nickel, copper, silver and gold.

1.8 Nuclear Chemistry : Nuclear reactions; mass defect and binding energy, nuclear fission and fusion. Nuclear reactors; radioisotopes and their applications.

1.9 Coordination compounds : IUPAC Nomenclature, isomerism and theories of coordination compounds and their role in nature and medicine.

1.10 Pollution and its control : Air pollution, types of air pollutants; control of air and water pollution; radioactive pollution.

Section-B **(Organic Chemistry)**

2.1 Bonding and shapes of organic molecules : Electronegativity, electron displacements, inductive, mesomeric and hyperconjugative effects; bond polarity and bond polarizability, dipole moments of organic molecules; hydrogen bond; effects of solvent and structure on dissociation constants of acids and bases; bond formation, fission of covalent bonds : homolysis and heterolysis; reaction intermediates-carbocations, carbanions, Benzyne, Arynes, Enamines, free radicals and carbenes; generation, geometry and stability; nucleophiles and electrophiles.

2.2 Chemistry of aliphatic compounds: Nomenclature; alkenes-synthesis, reactions (free radical halogenation)-- reactivity and selectivity, sulfonation, detergents; cycloalkanes, Baeyer's strain theory; alkenes and alkynes, synthesis, electrohilic addition reactions, Markownikov's rule, peroxide effects, 1-3-dipolar addition; nucleophilic addition to electron-deficient alkenes; polymerisation; relative acidity; synthesis and reactions of alkyl halides, alkanols, alkanals, alkanones, alkanolic acids, esters, amides, nitriles, amines, acid anhydrides, α -unsaturated ketones, ethers and nitro compounds.

2.3 Stereochemistry of carbon compounds : Elements of symmetry, chiral and achiral compounds. Fischer projection formulae; optical isomerism of lactic and tartaric acids, enantiomerism and diastereoisomerism; configuration (relative and absolute); conformations of alkanes upto four carbons, cyclohexane and dimethylcyclohexanes-their potential energy. **D**, **L**-and **R**, **S**-notations of compounds containing chiral centres; projection formulae-Fischer, Newman and sawhorse of compounds containing two adjacent chiral centres; meso and dl-isomers, erythro and threo isomers; racemization and resolution; examples of homotopic, enantiotopic and diastereotopic atoms and groups in organic compounds, geometrical isomers; **E** and **Z** notations. Stereochemistry of SN1, SN2, E1 and E2 reactions.

2.4 Organometallic compounds : Preparation and synthetic uses of Grignard reagents, organo lithium compounds.

2.5 Active methylene compounds : Diethyl malonate, ethylacetoacetate, ethylcyanoacetate, applications in organic synthesis; tautomerism (keto-enol).

2.6 Chemistry of aromatic compounds : Aromaticity; Huckel's rule; electrophilic aromatic substitution : nitration, sulfonation, halogenation (nuclear and side chain), Friedel-Crafts alkylation and acylation, substituents effect; chemistry and reactivity of aromatic halides, phenols, nitro-, diazo-, diazonium-and sulfonic acid derivatives, benzyne reactions.

2.7 Chemistry of biomolecules : (i) Carbohydrates : Classification, reactions, structure of glucose, D, L-configuration, osazone formation; fructose and sucrose; step-up and step-down of aldoses and ketoses, and their interconversions, (ii) **Amino acids** : Essential amino acids; zwitterions, isoelectric point, polypeptides; proteins; methods of synthesis of amino acids. (iii) Elementary idea of oils, fats, soaps and detergents.

2.8 Basic principles and applications of UV, visible, IR and NMR spectroscopy of simple organic molecules.

Section-C **(Physical Chemistry)**

3.1 Gaseous state : Deviation of real gases from the equation of state for an ideal gas, van der Waals and Virial equation of state, critical phenomena, principle of corresponding states, equation for reduced state. Liquefaction of gases, distribution of molecular speed, collisions between molecules in a gas; mean free path, specific heat of gases

3.2 Thermodynamics : (i) **First law and its applications**: Thermodynamic systems, states and processes, work, heat and internal energy, zeroth law of thermodynamics, various types of work done on a system in reversible and irreversible processes. Calorimetry and thermochemistry, enthalpy and enthalpy changes in various physical and chemical processes, Joule-Thomson effect, inversion temperature. Heat capacities and temperature dependence of enthalpy and energy changes.

(ii) **Second law and its applications** : Spontaneity of a process, entropy and entropy changes in various processes, free energy functions, criteria for equilibrium, relation between equilibrium constant and thermodynamic quantities.

3.3 Phase rule and its applications : Equilibrium between liquid, solid and vapours of a pure substance, Clausius-Clapeyron equation and its applications. Number of components, phases and degrees of freedom; phase rule and its applications; simple systems with one (water and sulfur) and two components (lead-silver, salt hydrates). Distribution law, its modifications, limitations and applications.

3.4 Solutions : Solubility and its temperature dependence, partially miscible liquids, upper and lower critical solution temperatures, vapour pressures of liquids over their mixtures, Raoult's and Henry's laws, fractional and steam distillations.

3.5 Colligative Properties : Dilute solutions and colligative properties, determination of molecular weights using colligative properties.

3.6 Electrochemistry : Ions in solutions, ionic equilibria, dissociation constants of acids and bases, hydrolysis, pH and buffers, theory of indicators and acid-base titrations. Conductivity of ionic solutions, its variation with concentration, Ostwald's dilution law, Kohlrausch's law and its application. Transport number and its determination. Faraday's laws of electrolysis, galvanic cells and measurements of their e.m.f., cell reactions, standard cell, standard reduction potential, Nernst equation, relation between thermodynamic quantities and cell e.m.f., fuel cells, potentiometric titrations.

3.7 Chemical kinetics : Rate of chemical reaction and its dependence on concentrations of the reactants, rate constant and order of reaction and their experimental determination; differential and integral rate equations for first and second order reaction, half-life periods; temperature dependence of rate constant and Arrhenius parameters; elementary ideas regarding collision and transition state theory.

3.8 Photochemistry : Absorption of light, laws of photochemistry, quantum yield, the excited state and its decay by radiative, nonradiative and chemical pathways; simple photochemical reactions.

3.9 Catalysis : Homogeneous and heterogeneous catalysis and their characteristics, mechanism of heterogeneous catalysis; enzyme-catalysed reactions (Michaelis-Menten mechanism).

3.10 Colloids : The colloidal state, preparation and purification of colloids and their characteristics properties; lyophilic and lyophobic colloids and coagulation; protection of colloids; gels, emulsions, surfactants and micelles.

CIVIL ENGINEERING

Part-A

1. Engineering Mechanics : Units and Dimensions, SI Units, Vectors, Concept of Force, Concept of particle and rigid body. Concurrent, nonconcurrent and parallel forces in a plane, moment of force and Varignon's theorem, free body diagram, conditions of equilibrium, Principle of virtual work, equivalent force system.

First and Second Moments of area, Mass moment of Inertia.

Static Friction Inclined plane and bearings.

Kinematics and Kinetics : Kinematics in cartesian and polar co-ordinates, motion under uniform and nonuniform acceleration, motion under gravity. Kinetics of particle : Momentum and Energy principles, D'Alembert's Principle, Collision of elastic bodies, rotation of rigid bodies, simple harmonic motion.

2. Strength of Materials : Simple Stress and Strain, Elastic constants, axially loaded compression members, Shear force and bending moment, theory of simple bending, Shear Stress distribution across cross sections, Beams of uniform strength, Leaf spring, Strain Energy in direct stress, bending and shear.

Deflection of beams : Macaulay's method, Mohr's moment area method, Conjugate beam method, unit load method. Torsion of Shafts, Transmission of power, closecoiled helical springs, Elastic stability of columns : Euler's, Rankine's and Secant formulae. Principal Stresses and Strains in two dimensions, Mohr's Circle. Theories of Elastic Failure, Thin and Thick cylinders : Stresses due to internal and external pressures-Lame's equation.

3. Structural Analysis : Analysis of pin jointed plane trusses, deflection in trusses. Three hinged and two hinged arches, rib shortening, temperature effects, influence lines in arches. Analysis of propped cantilevers, fixed beams, continuous beams and rigid frames. Slope deflection, moment distribution, Kani's method and Matrix method : Force and Displacement methods. Rolling loads and influence lines for determinate beams and pin jointed trusses.

Part-B

Geotechnical Engineering: Types of soil, field identification and classification, phase relationships, consistency limits, particle size distribution, classification of soil, structure and clay mineralogy.

Capillary water and structural water, effective stress and pore water pressure, Darcy's Law, factors affecting permeability, determination of permeability, permeability of stratified soil deposits.

Seepage pressure, quick sand condition, compressibility and consolidation, Terzaghi's theory of one dimensional consolidation, consolidation test. Compaction of soil, optimum moisture content, Proctor Density.

Subsurface exploration, methods of boring, sampling, types of sampler, field tests.

Shear strength of soils, Mohr-Coulomb failure theory, shear tests Earth pressure at rest, active and passive pressures, Rankine's theory, Coulomb's wedge theory, earth pressure on retaining wall.

Bearing capacity, Terzaghi and other important theories, net and gross bearing pressure, Immediate and consolidation settlement.

Load carrying capacity of pile groups.

Stability of slope-Conventional method of slices, stability numbers.

Transportation Engineering : Highway alignment, choice of layout and capacity of highways, location survey, geometric design of highways-various elements, curves, sight distance, grade separation and segregation of traffic, intersection design, highway materials and testing, subgrade and pavement components, types of pavements, road drainage.

Railway engineering-elements of permanent track-rails, sleepers, ballast and rail fastenings, tractive resistance, elements of geometric design-gradients and grade compensation on curves, cant, transition curves and vertical curves, stresses in railway tracks, points and crossings, signalling and interlocking, maintenance of railway track. Elements of Culverts and small bridges.

Airport Engineering - Classification of airports, selection of site, airport planning and control, airport marking and lighting systems.

Part-C

Fluid Mechanics: fluid properties, fluid statics, forces on plane and curved surfaces, stability of floating and submerged bodies.

Kinematics: Velocity, streamlines, continuity equation, accelerations, irrotational and rotational flow, velocity potential and stream functions, flownet, flow separation.

Dynamics: Euler's equation along streamline, control volume equation, continuity, momentum, energy and moment of momentum equation from control volume equation, applications to pipe flow, moving vanes, moment of momentum, Dimensional analysis.

Boundary layer on a flat plate, drag and lift on bodies. Laminar and Turbulent Flows. Laminar and turbulent flow through pipes, variation of friction factors, pipe networks, water hammer, and surge tanks.

Open Channel Flow: Energy and momentum correction factors, uniform and non-uniform flows, specific energy and specific force, critical depth, Friction factors and roughness coefficients, flow in transitions, free overfall, weirs, hydraulic jump, surges, gradually varied flow equations, surface profiles, moving hydraulic jump.

Part-D

Environmental Engineering

Water Supply: Estimation of surface and subsurface water resources, predicting demand for water, impurities of water and their significance, physical, chemical and bacteriological analysis, water borne diseases, standards for potable water.

Intake of water: Types of intake structures, pumping and gravity schemes, water treatment: principles of coagulation, flocculation and sedimentation; slow, rapid, pressure, filters; chlorination, softening, removal of taste, odour and salinity.

Water storage and distribution: storage and balancing reservoir types, location and capacity. Distribution systems: layout, hydraulics of pipe lines, pipe fittings, valves including check and pressure reducing valves, meters, analysis of distribution systems, leak detection, maintenance of distribution systems, pumping stations and their operations.

Sewerage systems: Domestic and industrial wastes, storm sewage-separate and combined systems, flow through sewers, design of sewers, sewer appurtenances, manholes, inlets, junctions, siphon. Plumbing in buildings.

Sewage characterisation: BOD, COD, solids, dissolved oxygen, nitrogen and TOC. Standards of disposal in normal water course and on land.

Sewage treatment: Working principles, units, grit chamber, sedimentation tank, trickling filters, oxidation ponds, activated sludge process, septic tank, disposal of sludge, recycling of waste water.

Construction Management : Elements and principles of Activity on Arrow (AOA) and Activity on Node (AON) networks and work breakdown structure. Interfaces. Ladder networks. Activity time. Time computations and floats. ATC and PTC trade-off. Work study and sampling. Scheduling principles-material schedules. ABC and EOQ analysis of inventory. Budgeting with barcharts. Working capital, CPM and PERT, probability of completion.

Elements of Engineering Economics, methods of appraisal, present worth, annual cost, benefit-cost, incremental analysis. Economy of scale and size. Choosing between alternatives including levels of investments. Project profitability.

COMMERCE & ACCOUNTANCY

PART – I

Accounting and Auditing

Unit-I - Conceptual Analysis

Nature, Scope and objective of accounting - Accounting as an information system, Users of Accounting Information. Generally Accepted Principles of Accounting – The Accounting Equation, Accrual concept – Other concepts and conventions.

Unit-II - Capital and Revenue :

Classification of receipts, Classification of payments, Classification of Incomes, Classification of expenditure as capital and Revenue.

Unit-III - Accounting Standards :

Accounting standards relating to Fixed Assets, Accounting standards relating to Depreciation, Accounting standard relating to Inventory and relating to Recognition of Revenue.

Unit-IV - Accounting for Finalisation of Accounts :

Final Accounts of sole proprietors, Final accounts of partnership firms, Final accounts of limited companies (statutory provisions)

Unit-V - Provisions and Reserves :

Nature & Types of Reserves, Provisions and Funds.

Unit-VI - Accounting for Non-Profit Making Organizations :

Accounting for non-profit making organizations such as Clubs, Educational Institutions, Hospitals, Charitable Institutions.

Unit-VII- Accounting for Partnership Firms :

Accounting problems relating to Admission and Retirement of a partner and Dissolution of firms.

Unit-VIII - Accounting for Shares and Debentures :

Issues and Forfeiture of Shares, Issue of Debentures, Treatment of Convertible Debentures. Redemption of Debentures.

Unit-IX - Financial Statement Analysis.

Ratio Analysis relating to liquidity, solvency and profitability, Importance of Return On Investment (ROI) ratio in evaluating the performance of business entity.

Unit – X - Funds Analysis :

Statement of sources and application of funds and cash flow statement.

Unit – XI - Auditing :

Nature, objective, principles and techniques, planning an audit,(Audit programme, working papers and audit process), Evaluation of Internal Controls, Internal and management audit.

Unit-XII - Cost Accounting :

Cost concepts and classification, Elements of cost and Computation of total cost.

PART – II

Business Organization and Management

Unit – I - Forms of Organisation :

Distinctive features of different forms of business organizations, sole proprietorship, partnership – Characteristics, Registration, Partnership deed, Rights and Duties, Retirement, Dissolution.

Unit – II - Corporate and other forms of Organisation :

Joint Stock Company - Concept, Characteristics, Types Co-operative and State ownership forms of organization.

Unit – III - Securities :

Types of securities (Equity shares, Preference shares, Debentures/Bonds) Methods of issue of equity shares - Public Issue, Private Placement, Right Issue, Bonus Issue.

Unit – IV - Capital Market :

Economic functions of the capital market (Stock Exchange), Concept and functions of Mutual Funds, Control and regulation of capital market (SEBI).

Unit – V - Business Combinations :

Nature and Types of Combinations, Reasons of Combinations, Pools, Cartels, Trade Associations, Chambers of Commerce. Problems of modernization of Industrial Enterprises, Social responsibility of business.

Unit – VI - Foreign Trade :

Procedure of Import and Export, Financing of Import and Export, Incentives for export promotion.

Unit – VII- Insurance :

Principles and Practice of Life, Fire, Marine and General Insurance.

Unit-VIII - Management Function :

Planning – Strategies; Organising, levels of authority, staffing, line and staff function, Organization structure - centralization and decentralization, Delegation of Authority, Span of Control, Management by Objective (MBO), Management by Exception (MBE).

Co-ordination – Concepts, Types and Methods. Leadership. Communication. Motivation.

Direction – Principles and Strategies.

Control – Principles, Performance standards, Corrective action.

Unit – IX - Office Management and Management of Change :

Office Management – Scope and principles, systems and routines Handling of records, modern aids to office management, office equipment and machines Automation and personal computers, Impact of Organization and Methods (O & M). Crisis Management

Unit – X - Company Law :

Joint Stock Companies - Incorporation, documents and formalities, Doctrine of Indoor Management and Constructive Notice. Duties and powers of the Board of Directors of a Company.

Unit – XI - Accounts and Audit :

Law relating to Accounts and Audit of Companies.

Unit – XII - Company Secretary :

Role, functions, qualifications and appointment of Company Secretary.

ECONOMICS

Part-I

General Economics

1) **Micro-economics** : (a) Production Function : laws of returns and returns to scale Isoquants, Costs and Supply; (b) Consumption and Demand : Elasticity concepts (c) Market Structure and conditions of equilibrium; (d) Determination of prices under Perfect Competition, Monopoly and Monopolistic Competition ; (e) Theory of Distribution : Marginal Productivity Theory (f) Elementary concepts of Welfare Economics : Consumer's Surplus, Private and Social Products; Pareto-optimality.

2) **Macro-economics** : (a) National Income Concepts; (b) Determinants of National Income and Employment (c) Determinants of Consumption, Savings and Investment (d) Rate of Interest and its determination

3) **Money, Banking and Public Finance** : (a) Concepts of Money and measures of money supply; (b) Banks and credit creation; Banks and portfolio management. (c) Central Bank and control over money supply (d) Inflation, its causes and remedies. (e) Public Finance: Budget, Taxes and non-tax revenues-Types of Budget deficits.

4) **International Economics** : (a) Theories of International Trade-comparative costs-Heckscher-Ohlin; Gains from Trade and Terms of Trade.

(b) Free Trade and Protection.

(c) Balance of Payments accounts.

(d) Exchange rate under free exchange markets.

(e) Evolution of the International Monetary System and World Trading order- The Brettonwoods system, IMF and the World Bank and their associates.

Floating rates-GATT and WTO

(5) Growth and Development : (a) Meaning and measurement of growth; growth, distribution and Welfare; (b) Characteristics of underdevelopment; (c) Stages of Development; (d) Sources of growth-capital, human capital, population, productivity, Trade and aid, non-economic factors; growth strategies – balanced and un-balanced.

(6) Economic Statistics : Types of averages-measures of dispersion-correlation-Index numbers; types, uses and limitations.

Part-II

Indian Economics

1. Main features; Geographic size-Endowment of natural resources, Population; size, composition quality and growth trend-Occupational distribution
2. Major problems, their dimensions, nature and broad causes; Mass poverty-Unemployment and its types-Economic effects of population pressure-Inequality and types thereof-Low productivity and low per capita income, Rural-urban disparities-Foreign Trade and payments imbalances. Balance of Payments and External Debt- Inflation, and parallel economy and its effects-Fiscal deficit.
3. Growth in income and employment since Independence-Rate, Pattern, Sectoral trends-Distributional Changes-Regional disparities.
4. Economic Planning in India : goals, achievements and shortfalls; planning and market.
5. Broad fiscal, monetary, industrial, trade and agricultural policies-objectives, rationale, constraints and effects.

EDUCATION

Unit – I: Education & its Role :

Education – Meaning, Nature and scope.

Education as a process

Education and Schooling

Education for National Development and International Understanding.

Education and Society

Education and Culture

Education and Politics

Education and religion.

Unit – II : Development of Education after independence

Recommendations of Secondary Education Commission, 1952-53.

Indian Education Commission, 1964-66

National Education Policy 1968

National Policy on Education, 1986

Programme of Action, 1992.

Unit – III : Trends in Education.

Constitutional provisions for Education

State, Centre relationship for development of Education

Education for the socially and economically disadvantaged sections of the society- S.C., S.T. & Women.

Unit – IV : Psychological Foundations of Education .

Growth and Development, principles

Factors affecting growth and development

Dimensions of development – Physical, Mental, Social, Emotional, Moral.

Intelligence : Nature, SI Model, Multiple intelligences.

Personality : Approaches to personality study; Trait, Type and Psychodynamic.

Creativity : Nature, Characteristics, Measurement.

Unit – V : Learning Theories and Principles.

Learning – Concept and principles

Theories of learning – Conditioning, Trial and Error,

Gagnes’s Hierarchical learning, Blooms Mastery Learning Constructivism.

Motivation – Concept, Types and Techniques for motivating the learners.

Transfer of learning – Theories, Role of teacher in maximum transfer.

Role of Technology in learning.

Unit – VI : Issues in Education.

Concept, need, process of the followings :-

Population Education: Adolescent Education, Family life and sex
Education

Health and Nutrition Education

Environmental Education

Value and Peace oriented Education.

Adult and Non-formal Education.

Unit – VII : Trends in Education.

Distance Education

Life long and continuing Education

Vocational Education

Education for All

Programmes of TIC, NLM, PLC, JSN, NFE & AE, DPEP & S.S.A.

Work Experience /SUPW.

Information and communication Technology – Meaning, Nature & Scope.

Unit – VIII : Evaluation in Education

Educational Evaluation – Meaning & Scope

Types of Evaluation – Placement, Formative, Diagnostic & Summative.

Continuous and comprehensive Evaluation.

New Trends in Evaluation – Grading, Semester system, Question Bank.

Use of computer in Evaluation,

Orissa Examination Act, 1988

Problems of Present Evaluation system.

Unit – IX : Administration, Management and Supervision in Education.

Concept of Administration, Management and Supervision.

Structure and Functions of UGC, NAAC, NCERT, NCTE, NIEPA, CBSE, CAGE, AICT, ICSSR.

SCERT, SRC for A.E., SIET, BSE, CHSE of Orissa.

Sources of Financing at different levels of Education.

Unit – X : Educational Statistics.

Need of Statistics for a Teacher

Measures of Central Tendencies - Mean, Median & Mode

Measures of Variability

Standard scores – Properties and uses.

Normal probability curve – Properties and applications.

ELECTRICAL ENGINEERING

Electrical Circuits-Theory and Applications

Circuit components, network graphs, circuit analysis methods : nodal analysis, mesh analysis; basic network theorems and applications; transient analysis : circuits with a.c. and d.c. inputs; sinusoidal steady state analysis; resonant circuits and applications; coupled circuits and applications; balanced 3-phase circuits. Two port networks, driving point and transfer functions; poles and zeros of network functions.

Signals & Systems

Representation of continuous-time and discrete-time signals; LTI systems; convolution; impulse response; time-domain analysis of LTI systems based on convolution and differential/difference equations. Fourier transform, Laplace transform, Z-transform, Transfer function. Sampling and recovery of signals.

Control Systems

Elements of control systems; block-diagram representations; open-loop & closed-loop systems; LTI systems : time domain and frequency domain analysis. Stability : Routh Hurwitz criterion, root-loci, Nyquist's criterion. Bode-plots, Design of lead-lag compensators; Proportional, PI, PID controllers.

E.M. Theory

Electro-static and magneto-static fields; Maxwell's equations; electromagnetic waves and wave equations; wave propagation and antennas; transmission lines; micro-wave resonators, cavities and wave guides.

Electrical Engineering Materials

Electrical/electronic behaviour of materials : conductivity; free-electrons and band-theory; intrinsic and extrinsic semi-conductor, p-n junction; super-conductivity. Dielectric behaviour of materials : polarization phenomena; piezo-electric phenomena. Magnetic materials: behaviour and application.

Analog Electronics

Diode circuits: rectifiers, filters, clipping and clamping, zener diode and voltage regulation. Bipolar and field effect transistors: Characteristics, biasing and small signal equivalent circuits. Basic amplifier circuits; differential amplifier circuits. Principles of feedback; OPAMP circuits; filters; oscillators.

Digital Electronics

Boolean algebra; minimisation of Boolean function; logic gates, digital IC families (DTL, TTL, ECL, MOS, CMOS). Combinational circuits : arithmetic circuits, code converters, multiplexers and decoder's. Sequential circuits : latches and flip-flops, counters and shift-registers. Comparators, timers, multivibrators. Sample and hold circuits; ADCs and DACs. Semiconductor memories.

Communication Systems

Fourier analysis of signals : amplitude, phase and power spectrum, auto-correlation and cross-correlation and their Fourier transforms. Analog modulation systems : amplitude and angle modulation and demodulation systems, spectral analysis; superheterodyne receivers. Pulse code modulation (PCM), differential PCM, delta modulation. Digital modulation schemes : amplitude, phase and frequency shift keying schemes (ASK, PSK, FSK). Multiplexing : time-division, frequency-division. Additive Gaussian noise : characterization using correlation, probability density function, power spectral density, Signal-to-noise ratio calculations for AM and FM. Elements of digital communication systems : source coding, channel coding; digital modulation & demodulation. Elements of Information theory, channel capacity. Elements of satellite and mobile communication; principles of television engineering; radar engineering and radio aids to navigation.

Computers and Microprocessors

Computer organization : number representation and arithmetic, functional organization, machine instructions, addressing modes, ALU, hardwired and microprogrammed control, memory organization. Elements of microprocessors : 8-bit microprocessors -architecture, instruction set, assembly level programming, memory, I/O interfacing, microcontrollers and applications.

Measurement and Instrumentation

Error analysis; measurement of current voltage, power, energy, power-factor, resistance, inductance, capacitance and frequency. Electronic measuring instruments: multimeter, CRO, digital voltmeter, frequency counter, Q-meter, spectrum-analyser, distortion-meter. Transducers: thermocouple, thermistor, LVDT, strain-gauges, piezo-electric crystal. Use of transducers in measurement of non-electrical quantities. Data-acquisition systems.

Energy Conversion

Single-phase transformer : equivalent circuit, phasor-diagram, tests, regulation and efficiency; three-phase transformer; auto transformer. Principles of energy conversion-d.c. generators and motors: Performance characteristics, starting and speed control, armature reaction and commutation; three-phase induction motor; performance characteristics, starting and speed control. Single-phase induction motor. Synchronous generators: performance characteristics, regulation, parallel operation. Synchronous motors: starting characteristics, applications; universal motor. FHP motors, permanent magnet and stepper motors, brushless d.c. motors, single-phase motors.

Power Systems

Electric power generation : thermal, hydro, nuclear. Transmission line parameters: steady-state performance of overhead transmission lines and cables. Distribution systems, Insulators, bundle conductors, corona and radio interference effects; per-unit quantities; bus admittance and impedance matrices; load flow; active and reactive power control. Economic operation. Principles of overcurrent, differential and distance protection; solid state relays, circuit breakers, Grounding Concept of system stability. HVDC transmission.

Power Electronics and Electric Drives

Semiconductor power devices : diode, transistor, thyristor, triac, GTO, IGBT and MOSFET, static characteristics, principles of operation; triggering circuits; bridge converters-fully controlled and half controlled; principles of chopper and inverter. Basic concept of speed control of DC and AC motor drives.

Elements of IC Fabrication Technology

Overview of IC Technology. Unit steps used in IC fabrication : wafer cleaning, photo-lithography, wet and dry etching, oxidation, diffusion, ion-implantation, CVD and LPCVD techniques for deposition of poly-silicon, silicon, silicon-nitride and silicon dioxide; metallisation and passivation.

FISHERY SCIENCE

1. General Fisheries: Role of fisheries and aquaculture in Indian economy and human health. Fisheries resources of India. Utilization of different aquatic resources for fish production. Geographical distribution of fishes in India. Fisheries education and research in India. Organisational setups in fisheries development at national and international context. Frontier research and global scenario in fisheries and aquaculture. Growth and development of fisheries and aquaculture during different plan periods in India; Fisheries and Aquaculture Regulatory Acts. Disaster awareness related to fisheries and aquaculture.

2. Fishery Resource Management : Inland, marine and estuarine capture fishery resources of India. Catch statistics; Major Indian river systems, reservoirs and lacustrine fisheries. Conservation and management of inland, marine and reservoir fisheries. Fishery resources of exclusive economic zone. Maximum sustainable yield; Maximum economic yield; Catch per unit effort; Mortality, Exploitation rate and ratio; Fisheries regulation; Potential fishing zone, major exploited marine fisheries of India and their present status. Survey and evaluation system of aquatic resources. Fisheries legislation-International, National and State.

3. Fishery Biology. Systematics of commercially important finfishes and shellfishes with particular reference to east coast of India. Anatomy and physiology of cartilaginous fish (*scoliodon*), bony fishes (Carp, Murrels, Catfish, Seabass), and shell fishes (prawn, shrimp, crab, squids, cuttlefish, *lamellidens*, mussels) with particular reference to their skeletal, digestive, circulatory, respiratory, excretory, reproductive and nervous system. Osmoregulation, Migration, Energetic and Environmental effects. Food and feeding habits of cultivable fishes and shellfishes. Breeding habits, Gonochorism, secondary sexual characters and parental care. Maturity stages and Gametogenesis. Embryology of finfishes and shellfishes. Different endocrine glands viz., pituitary, thyroid, interrenal, corpuscles of stanius, hypothalamo-hypophysial complex, ovary, testis X and Y organs.

4. Aquacultural Principles and Practices: Principles, definition and scope of aquaculture. History of aquaculture and present global scenario. Construction and design of fish farms hatcheries and aquaria. Soil and water quality management in pond ecosystem - manuring, liming, fertilisation and aeration of culture ponds. Types of aquaculture-extensive, semi intensive, intensive. Diversification in aquaculture – cage, pen, bheri & bheel and waste water culture. Mono culture and composite culture. Integrated aquaculture, ornamental fish breeding and culture, pearl culture. Coastal aquaculture and mariculture (finfish, edible oyster, sea weed, pearl, mussels). Nutritional requirements of cultivable finfishes and shellfishes; Probiotics, essential amino acids, antinutritional factor, feed conversion; Nutritional bioenergetics of fish; Fish feed technology, culture of fish food organisms. Common Parasitic,(protozoa, helminth and crustacean) bacterial, fungal, viral and environmental diseases in finfish and shellfish and their management.

5. Fish seed production and management: Bundh and happa breeding, hypophysation techniques, synthetic agents and their principles in induced breeding. Types of hatcheries. Seed production and hatchery management of Indian major carps, exotic carps, air breathing fishes, common ornamental fishes, mahaseer, trouts, seabass, mullets, milkfish, groupers, fresh water prawns, shrimps and crabs. Brood stock management of fishes, prawn and shrimp. Nursery management for seed raising in carps, prawns and shrimps.

6. Aquatic Environment: Fresh water, marine and brackish water ecosystem – Physico – Chemical parameters; Biological communities-plankton, benthos and macrophytes; Productivity; Food chain and food web; Nutrient cycles; Waves, tides, currents, upwelling, mudflats, beach profile. Meteorological parameters and their effect on fisheries. Classification of ponds, lakes, rivers, reservoir and estuaries. Important aquatic biodiversity zones. Conservation and management of coral reefs, endangered fishes, turtles and aquatic mammals. Aquatic pollution-types of pollutants and their control, effect of pollution on fish and other aquatic organisms. Oceanography equipments.

7. Genetics, Biotechnology and Biochemistry : Karyology, Genetic characterization , genome manipulation and selective breeding. Aquaculture and marine biotechnology. Structure of protein, lipid, carbohydrates, nucleic acids, enzymes, vitamins and coenzymes. Metabolism of protein, carbohydrate and lipids. Estimation of protein, carbohydrate, lipid and their derivatives. Buffers.

8. Aquatic Microbiology : Microscopes and microscopy; Staining techniques, Wet mount and hanging drop preparation. General organization and reproduction of bacteria, fungi, virus; host-microbe interaction, Antibiotics. Immunology – definition and scope. Role of microbes in nutrient cycles. Microbiological media and culture characteristics. Biochemical, serological and molecular tests for identification of bacteria.

9. Harvest and Post Harvest Technology: Classification of fishing methods. Crafts and gear used in India. Design, construction and maintenance of fishing crafts and gear. Navigational aids used in fishing. Seamanship. Operation of fishing gears. Nutritional importance of fish as food. Post mortem changes. Handling of fresh fish. Methods of chilling-icing, refrigerated sea water and chilled sea water stowage. Transport of fresh fish. Principles of fish preservation. Methods of fish preservation-freezing, canning, curing, value added products. Fish byproducts. Micro organisms in fish and fishery products. Quality control, Quality assurance, Quality standards. Plant sanitation. Export of fishery products and byproducts.

10. Social Sciences: Sampling methods; Measures of central tendency; Probability; Distribution, Correlation and regression; Testing of hypothesis; Design of experiments. Definition, theories and laws of economics. Economic structure of capture and culture fisheries. Fish marketing in India. International trade and exchange. Employment generation in fisheries and aquaculture. Nutritional security. Role of Cooperatives and financial institutions in fisheries. Concepts, principles, scope and objectives of extension. Extension teaching methods. Modes of technology transfer—training, demonstration, trials. Extension education aids. Extension functionaries (FFDA, BFDA, NATP, ATMA).

FORESTRY

- 1. Forest :** Its role in Natural Ecosystem Management, Land use and extent of Forests in India, Need for conservation of existing forests and scope of Extension Forestry in India.
- 2. Effect of Locality Factors on Vegetation :** Climatic (light, Temperature, Precipitation and wind) Edaphic (Soil and Geology, soil conditions influencing plant growth) and Biotic factor (Man, Animal, Bird and Micro organisms).
- 3. Forest Classification and Distribution :** Basis for classification of Indian Forest, Forest Types in India and Orissa, Phytogeographic regions of India.
- 4. Forest Management :** Objective & principles of Management, Sustained yield : Principles, scope and limitation. Normal Forest : Factors of normality, normality in even aged and uneven aged forest. Growing stock : Determination of actual and normal growing stock in different systems, relationship between growing stock and yield. Yield and its regulation : kinds of yield, yield in even aged and uneven aged stand, Yield regulation in regular and irregular stand.
- 5. Silvicultural System :** Basis for classification of Silvicultural System. Clear Felling System, Uniform System, Selection System, Coppice Forest System and Conversion. Role of different forest systems in Working Plan preparation.
- 6. Forest Regeneration :** Natural Regeneration : by seeds , by vegetative parts. Stages of natural regeneration and different operations carried out for obtaining natural regeneration. Artificial Regeneration : Factors deciding success of artificial regeneration. Introduction of exotics : Scope and limitations. Tending : Different types of tending and factors affecting tending operations.

7. Extension Forestry : Agroforestry : Concept, Classification, Scope and Management. Farm Forestry, Social Forestry : Objectives, scope and benefits. Joint Forest Management.

8. Forest Policy and legislation : Indian Forest Policy 1952, 1988, 1994. National Commission on Agriculture (1976) report on Forestry. Constitution of Waste land Development Board. Indian Forest Act. 1927, Forest Conservation Act. 1972, Orissa Timber and Other Forest Produce Transit Rules 1980, Orissa Forest Rules 1980.

9. Forest Utilization : Sustainable forest harvesting techniques. Principles and Techniques of Logging and Wood Extraction. Non-Timber Forest Produces : Gums, resins, dye tannin, fibres & flosses, oil seed, cane, bamboos, medicinal plants, lac, tasser, honey Katha , bidi leaves, paper & pulp.

10. Forest Ecology and Environment : Biotic and Abiotic component, Forest Community Concept. Ecosystem : Components, energy flow in ecosystem. Ecological succession. Watershed concept : role of wood lots in sustainable resource management.

11. Wildlife Management : Role of Wildlife in forest management, Wildlife management : Principles, Wildlife management in Zoo, Sanctuary and National Park. Biosphere : Concept and need for conservation. Scope of Eco tourism in Biosphere Reserve.

12. Forest Genetics and Tree Improvement : Nature and Scope of tree breeding, Sexual & Asexual reproduction. Pollination and Mode of pollination, sterility & Incompatibility. Variation : Phenotypes and genotypes. Methods of Breeding Trees and other forest plants : Introduction, Selection, Hybridization, Heterosis, Polyploidy and Mutation. Principles and Practices of Plant Breeding : Progeny testing, provenance trial. Breeding of trees for higher productivity, desirable quality. Tree Breeding strategies for Forest Plants Improvement.

GEOGRAPHY

Section-A Physical Geography

i) **Geomorphology** : Origin of the earth; Interior of the earth; Types and characteristics of Rocks & Soils; Folding and Faulting; Volcanoes; Earthquakes; Landforms caused by fluvial, aeolian and glacial actions.

ii) **Climatology** : Structure and composition of atmosphere; Temperature; Pressure belts and Wind systems; Clouds and rainfall types; Cyclones and anti-cyclones; Major climatic regions.

iii) **Oceanography** : Ocean relief; Temperature; Salinity; Ocean deposits; Ocean currents, Waves and Tides.

iv) **Biogeography** : Major biomes of the world; Ecosystem and food chain; Environmental degradation and conservation. Disaster management.

Section-B Human Geography

i) Man and Environment Relationship

Concepts of Determinism and Possibilism. Major cultural realms of the world.

ii) Population

Races of mankind and tribes; growth and distribution of world population; migration; population problems of developed and developing countries.

iii) Economic Activities

Food gathering and hunting; pastoral herding; fishing and forestry; Types of agriculture - shifting, subsistence, commercial and plantation; Mining, Power; Manufacturing - locational factors of textile, iron and steel, sugar and fertilizer industries; Trade, transport, communication and services.

iv) Settlements

Origin, types and patterns of rural and urban settlements; Processes of urbanisation; Morphology and functional classification of towns;

Section-C - Geography of the World

- i) Major Natural Regions : Characteristics, economic base and human adaptation.
- ii) Regional Geography of Developed Countries : U.S.A., Japan, Australia
- iii) Regional Geography of Developing Countries : China, Brazil and Egypt.

Section-D - Geography of India

- i) **Physical Setting** : Landforms, drainage, climate, soils and natural vegetation.
- ii) **Economic Base** : Minerals – Iron ore, Bauxite, Limestone & Gypsum, Energy resources- Coal, Petroleum, Hydel Atomic, Aquatic resources, Forest resources; Irrigation, Agriculture and Industries; (Textile, Iron & Steel, Paper and Fertilizer), Trade and commerce.
- iii) **Population** : Growth, distribution and density; demographic characteristics.
- iv) **Environment & Development** : Environmental Problems, Issues, Regional Development and Planning.

Section-E - Geographical Thought

- i) **Ancient Period** : Contributions of Indians, Greeks, Romans and Arabs.
- ii) **Pre-Modern Period** : Contribution of Kant, Humboldt and Ritter.
- iii) **Modern Period** : Dichotomy of determinism and possibilism; contributions of Ratzel, Huntington and La Blache.
- iv) **Recent Period** : Quantitative Revolution; Radicalism, Behaviouralism and Humanism.

Section-F - Techniques of Geographical Analysis

- i) **Maps** : Scale and types, uses.
- ii) **Diagrams** : Types and uses'
- iii) **Projections** : Types, characteristics and uses.
- iv) **Remote sensing and Geographical Information System (GIS)** : Aerial photographs and imagery, GIS.

GEOLOGY

Part-I

(a) **General Geology** : Solar System. The Earth : its origin, age and internal constitution. Volcanoes - cause, types, distribution, geological effects and products. Earthquakes - intensity, distribution, causes and effects. Geosynclines. Mountain building. Continental drift. Sea floor spreading. Plate tectonics.

(b) **Geomorphology** : Basic concepts. External and internal processes. Rock weathering. Fluvial landforms and drainage patterns. Landforms of aeolian, marine, glacial and Karst landscapes. Study of aerial photographs and satellite imagery. Application of remote sensing in geology.

(c) **Structural and field Geology** : Primary and secondary structures. Dip and strike of beds. Unconformities. Study of folds, joints, faults, foliation and lineations. Stages of rock deformation. Stress and strain ellipsoid. Stereographic projection.

Topographic maps and their interpretation. Use of clinometer compass in the field. Measurements of bed, foliation, folds, joints, faults and lineations in the field. Principles of geological mapping. Effects of topography on outcrops. Drawing of sections.

Part-II

(a) **Crystallography** : Laws of crystallography. Symmetry elements and forms of normal classes of seven crystal systems. Twinning.

Polarisation, Double refraction & optic axis. Petrological microscope and accessories. Construction and use of Nicol prism. Pleochroism, extinction angle, birefringence. Behaviour of light in uniaxial and biaxial minerals.

(b) **Mineralogy** : Physical, chemical and optical properties of the following common rock forming minerals: quartz, feldspar, mica, pyroxene, amphibole, olivine, garnet, carbonates, aluminosilicates. Structure of silicates. Crystal chemistry of minerals-Polymorphism, Isomorphism.

(c) **Economic Geology** : Ore mineral and gangue. Classification of mineral deposits. Processes of formation. Occurrence, origin and distribution in India of the ores of aluminium, chromium, copper, gold, lead, zinc, iron, manganese and radioactive elements. Deposits of minerals used as abrasives, refractories and in ceramics. Deposits of coal and petroleum. Prospecting for mineral deposits.

Part -III

(a) **Igneous Petrology** : Origin of magma and formation of igneous rocks. Bowen's reaction principle. Crystallisation of binary systems. Classification of igneous rocks. Textures and structures of igneous rocks. Composition, origin and mode of occurrence of granite, syenite, diorite, mafic and ultramafic rocks, anorthosites and alkaline rocks.

(b) **Sedimentary Petrology** : Sedimentary processes and products. Classification of sedimentary rocks. Sedimentary structures. Clastic deposits- their classification, mineral composition and texture. Elementary ideas about the origin and characteristics of quartz arenites, arkoses and graywackes. Siliceous and calcareous deposits of chemical and organic origin.

(c) **Metamorphic Petrology** : Types and factors of metamorphism. Zones, grades and facies of metamorphism. Regional and contact metamorphism. Textures and structures of metamorphic rocks. Metamorphism of argillaceous, arenaceous, calcareous and basic rocks. Metasomatism.

Part-IV

(a) **Paleontology** : Fossils and fossilization. Modes of preservation of fossils. Uses of fossils. Study of morphology and geological history of Foraminifers, Brachipoda, Pelecypoda, Gastropoda, Cephalopoda, Trilobita, Echinoidea and Anthozoa. Mammals of Siwalik Group. A brief study of Gondwana flora.

(b) **Stratigraphy and Geology of India** : Fundamental laws of stratigraphy. Stratigraphic correlation - lithostratigraphic, biostratigraphic and chronostratigraphic. Geological time scale. Physiographic divisions and outline of stratigraphy of India. Brief study of Dharwar, Vindhyan and Gondwana Supergroups and Siwalik Group with reference to their major subdivisions, lithology, fossils, areal distribution and economic importance. Geology of Orissa.

HISTORY

Section-A

1. Prehistoric cultures: Old Stone Age, New Stone Age.
2. Indus Civilization. Origins. The Mature Phase: extent, society, economy and culture. Contacts with other cultures, Decline.
3. Vedic society. The Vedic texts; change from Rig Vedic to later Vedic phases. Religion; Upanishadic thought. Political and Social organisation; evolutions of monarchy and Varna system.
4. State formation and urbanization, from the mahajanapadas to the Nandas. Jainism and Buddhism. Factors for the spread of Buddhism.
5. The Mauryan Empire: Chandragupta; Megasthenes' Account Asoka and his inscriptions; his dhamma, administration, culture and art. The Arthasastra.
6. Post-Mauryan India, BC 200- AD 300: Society: Evolution of jatis; The Satavahanas and state formation in Peninsula. Sangam texts and society. Indo-Greeks, Sakas, Kushanas; Kanishka. Contacts with the outside world. Religion : Saivism, Bhagavatism, Hinayana and Mahayana Buddhism; Svetambar & Digambar Jainism, Culture; and art.
7. The Guptas and their successors (to c. 750 AD): Changes in political organisation of empire. Economy and society. Literature, Science and Arts.
8. Orissa (C-3rd centry B.C. – 700 A.D.): Kaling War, Kharavela – achievements; Cave architecture – Khandagiri & Udayagiri, Sailod bhavas.

Section-B

9. Early Medieval India. Major dynasties; the Chola Empire. Agrarian and political structures. The Rajaputs. Postition of women. Invasions of the Arabs and Ghaznavides.
10. Cultural trends, (750-1200) : Religious conditions : importance of temples and monastic institutions; Sankaracharya; Islam; Sufism. Literature and Science. Alberuni's "India". Art and architecture.
11. Thirteenth and fourteenth Centuries: Ghorian invasions causes and consequences. Delhi Sultanate under the "Slave" Rulers. Alauddin Khalji : Conquests; administrative, agrarian and economic measures. Muhammad Tughluq's innovations. Firuz Tughluq and the decline of the Delhi Sultanate. Growth of commerce and urbanization.

12. The fifteenth and early 16th Century : Provincial dynasties: Vijayanagara Empire. The Lodis, First phase of the Mughal Empire: Babur, Humayun. The Sur empire and administration.

Bhakti movement: Kabir, Nanak, Chaitanya.

13. The Mughal Empire , 1556-1707. Akbar: conquests, administrative measures, **jagir** and **mansab** systems; policy of **sulh-i-kul**. Jahangir, Shahjahan and Aurangzeb : expansion in the Deccan; religious policies. Shivaji.

14. Culture: Art & Architecture, Painting. Society & Economy: conditions of peasants and artisans, growth in trade; commerce with Europe. Social stratification and status of women.

15. Decline of Mughal Empire, (1707-1761): Causes of decline. Maratha power under the Peshwas. Sawai Jai Singh, (astronomer).

16. Medieval Orissa : The Imperial Gangas and Suryavamsi Gajapatis ;Cult of Jagannath; Sarala Das and Panchasakha in Oriya literature, Temples of Orissa : Lingaraj, Jagannath and Konarka .

Section-C

17. British expansion : The Carnatic Wars, Conquest of Bengal. Mysore and its resistance to British expansion: The three Anglo-Maratha Wars. Early structure of British Raj: Regulating and Pitt's India Acts.

18. Economic Impact of the British Raj : Drain of Wealth land revenue settlements (zamindari, ryotwari, mahalwari); Deindustrialisation; Railways and commercialisation of agriculture; Growth of landless labour.

19. Cultural encounter and social changes: Introduction of western education and modern ideas. Indian Renaissance, social and religious reform movements; growth of Indian middle class; The press and its impact: Social reforms measures before 1857.

Resistance to British rule : The 1857 Revolt- causes, nature, course and consequences.

20. Indian Freedom struggle-the first phase: Growth of national consciousness; Formation of Associations; Establishment of the Indian National Congress and its Moderate phase;- Economic Nationalism; Swadeshi Movement; The growth of "Extremism" and the 1907 split in Congress; The Act of 1909 - the policy of Divide and Rule; Congress-League Pact of 1916.

- 21.** Gandhi and his thought; Gandhian techniques of mass mobilisation- Khilafat and Non Cooperation Movement, Civil Disobedience and Quit India Movement; Other strands in the National Movement- Revolutionaries, the Left, Subhas Chandra Bose and the Indian National Army.
- 22.** Growth of Communalism: The Muslim League and the Hindu Mahasabha; The post -1945 developments; Partition and Independence.
- 23.** India; Independence to 1964. A parliamentary, secular, democratic republic (the 1950 Constitution). Planning and state-controlled industrialization. Agrarian reforms. Policy of Non-alignment.
- 24.** Orissa under Colonial rule and after : British conquest of Orissa- Khurda Rebellion (1817)- Kandha Rebellions under Dora Bisoyee and Chakra Bisoyee – Resistance movement under Surendra Sai- Oriya Movement- Nationalist Movement –Merger of States.

HOME SCIENCE

Section – A Food & Nutrition

1. Study of foods : Composition and nutritive value of Cereals, Pulses, Vegetables and Fruits, fleshy foods (Meat, Fish, Egg, Poultry) milk & milk products, oils & Fats.
2. Nutrients : Properties, functions, requirements, sources and effect of deficiency of carbohydrates, Proteins, Fats, vitamins, minerals and water.
3. Balanced diet, Basic food groups (Basic five, basic seven) planning of balanced diet on the basis of recommended dietary allowance (ICMR) for adult man and woman on the basis of activities; (Sedentary, Moderate & Heavy).
4. Nutrition during pregnancy, lactation, infancy, child hood, adolescence and oldage.
5. Meal planning : Significance and factors considered in meal planning. Food processing : methods of food preparation changes in food during preparation, effect of preparation on nutritive value.
6. Food preservation : Causes of food spoilage, Importance and principles of food preservation, house hold and commercial methods of food preservation.

Section – B Child Development & Family studies.

1. Meaning & principles of growth and development prenatal growth and development : conception, stages of prenatal growth and development, factors affecting prenatal growth and development.
2. Developmental milestones from birth to Two years physical development – growth cycle, body size, body proportion, bones, muscles & teeth development, motor development – principles and sequence of motor development & motor skills.
3. Emotional development – pattern & characteristic of children's emotion, common child hood emotional patterns. Social development – socialization and social expectation, importance of early social experiences. The pattern of social development.

4. Cognitive Development in children – Stages of cognitive development according to Jean Piaget.
5. Marriage; definition, function, types of marriages, (arranged and love) with their advantages and disadvantages factors to be considered in the selection of marriage partner.
6. Family : structure, characteristic and function of family, types of family (joint, nuclear and extended) - their advantages and disadvantages, changes in family system, causes, features and factors contributing to change.

Section C – Family Resource Management.

1. Concept of Home Management – Importance of Home Management, family goals, values standards and decision making process. The qualities of a good home maker.
2. Types of family resources and their management : Management of time – methods & techniques of time management, money management – Types of income, planning and steps in budget preparation, Engel’s law of consumption, keeping financial records & accounts, savings and investments.
3. Management of energy : Energy requirement of different tasks, fatigue – type and how to reduce fatigue, techniques of work simplification.
4. Housing : Selection of sites, principles of house planning Different types of building components and materials. Housing problems and housing schemes.
5. Interior decoration : Basic elements (line, form, colour, texture) and principles (Balance, Rhythm, Proportion, harmony, emphasis) of design and their application in interior decoration.
6. Consumer Education : Consumer education, strategies, rights and responsibility of consumer, Consumer protection legislation and consumer aids.

Section D – Textile & Clothing.

1. Textile fibers : Classification of textile fibers, according sources and chemical composition, manufacturing process, physical and chemical properties of cotton, wool, silk.
2. Construction of fabric : Yarn making process and different types of yarns, weav, description of the loom & its parts. Principles of weaving, other method of fabric construction (knitting, Felting, Braiding, Bonding and plaiting).

3. Finishing : Objectives and types of different finishes (Calendering, Mercerizing Sanforizing, Tetering, Weighting, Napping, Glazing Sizing, Bleaching, Embossing, Moiring,).
4. Dyeing & Printing : Importance of dyeing & printing, different methods of dyeing and printing used in textile.
5. Care of clothing : Methods laundering and their principles laundry reagents and their function. Care of clothing-cotton, silk and wool, storage of clothes.
6. Apparel Designing : Role of clothing in personality development. Factors influencing choice of clothing for different age group. Elements (Line, Form Texture, Colour) and principles (Balance, Proportion, Emphasis, Rhythm and proportion).

Section E Home Science Extension Education.

1. Extension Education : Concept, philosophy, objectives and scope of extension education. Role and qualities of extension worker. Need for Home-Science Extension Education.
2. Communication in Extension : Principles of learning and teaching process, steps in extension teaching. Extension teaching methods (individual, group & Mass) factors involved in the selection of appropriate method.
3. Audio-visual aids : Meaning & types of audio aids, visual aids and audio-visual aids in extension teaching. Other teaching aids. Puppet show, Dramatization, Folk songs, Dances, Charts, Posters).
4. Community Development : Concept, principles and objectives of community development. Subject matter of community development, Major elements involved in India's community development and extension process.
5. Extension programmes : Role of formal and informal institutions and agencies in Extension education and community Development. (CDP, IRDP, ICDS, DWACRA, ICAR, DRDA, NABARD, KBKs, ATMA, SHGs).
6. Community Developmental Programmes : Objectives, philosophy, principles and types of community development programmes, Impact of community development programmes in rural life in India.

I Jurisprudence

1. Nature and scope of Jurisprudence.
2. Schools of Jurisprudence:
 - i) Natural law
 - ii) Analytical
 - iii) Historical
 - iv) Sociological
 - v) Realist.
3. Theories of punishment.
4. Sources of Law:
 - (i) Custom, (ii) Legislation and (iii) Precedent.
5. Legal concepts:
 - (i) Rights and duties
 - (ii) Ownership and Possession
 - (iii) Legal personality.

II Constitutional Law of India

1. Preamble and nature of Indian Constitution
2. Fundamental Rights
3. Directive Principles and Fundamental Duties
4. Constitutional position and powers of President and Governors
5. Supreme Court and High Courts: Jurisdiction, powers, appointment and transfer of Judges
6. Union Public Service Commission and State Public Service Commissions
7. Emergency Provisions
8. Amendment of the Constitution

III International Law :

1. Nature and definition of International Law
2. Sources: Treaty, Custom, General Principles of Law recognised by civilised nations and subsidiary means of determination of law
3. State Recognition and State Succession
4. The United Nations, its objective, purpose and principal organs:
General Assembly & Security Council
5. Protection of Human Rights:
 - (i) Provisions in the UN Charter
 - (ii) Universal Declaration of Human Rights, 1948
 - (iii) Convention on Elimination of All Forms of Discriminate Against Women (CEDAW)

IV Torts :

1. Nature and Definition of Tort
2. Liability based on fault and strict liability
3. Vicarious Liability including State Liability
4. Joint Tort feasons
5. Negligence
6. Defamation
7. Conspiracy
8. Nuisance
9. False imprisonment
10. Malicious Prosecution.

V Criminal Law :

1. General Principles of criminal liability: Mens rea and actus reus
2. Stages of Crime :Preparation and criminal attempts
3. General Exceptions
4. Joint and constructive liability
5. Abetment
6. Criminal Conspiracy
7. Sedition
8. Murder and culpable homicide
9. Theft, extortion, robbery and dacoity

10. Misappropriation and Criminal Breach of Trust.

VI Law of Contract :

1. Definition of contract
2. Basic elements of contract: Offer, acceptance, consideration, contractual capacity
3. Factors vitiating consent
4. Void, Voidable, illegal and unenforceable agreements
5. Wagering agreements
6. Contingent contracts
7. Performance of contracts and Impossibility of performance
8. Discharge of contractual obligations
9. Quasi-contracts
10. Remedies for breach of contract.

MANAGEMENT

1. **Managerial Function** : Evolution of management thought – From classical to modern school, Formulation of organizational vision, Mission and objectives, Managerial functions – Planning, Organising, Coordination, Motivation, Staffing, Directing and Control, Formulating Strategies, Generic strategies.
2. **Organizational Behaviour and Design** : Theories of motivation, Hierarchy of need model, Factor theory, sources of motivation – achievement, power, money, affiliation, Communication : Barriers and gateways, Leadership - Characteristics, transformational leader and transactional leader, Leader as change agents, Understanding group behavior and dynamics - behaviour in small groups.
3. **Quantitative Techniques in Decision making** : Averages, dispersion, skewness, Product moment, Correlation, Rank correlation, Regression, Time Series Analysis, Forecasting techniques, qualitative techniques, Linear Programming – problem formulation, Product-mix, product composition, warehousing and transportation problems, simplex and graphic method, PERT and CPM – determination of critical path, Crashing.
4. **Management Control System** : Basic concepts of management control system, Responsibility centres : cost centres, profit centres and investment centres, managing discretionary costs, transfer pricing, basis for fixing transfer pricing.
5. **Strategic Cost Management** : Concepts and classification of costs, Cost-Volume-Profit Analysis, Activity-based costing, Standard Costing and Variance Analysis, Zero base budgeting Divisional performance vs. Managerial performance.
6. **Business Environment** : Rationale for international trade, Industrial policy, trade policy, WTO, Patents, Intellectual property rights.
7. **Financial Management** : Goals of finance function, ratio analysis, break even analysis, funds flow analysis, financial and operating leverage, management of working capital : overview and estimation, time value of money, NPV and IRR methods of capital budgeting.
8. **Marketing Management** : Marketing-mix - Product management, segmentation, targeting, positioning, marketing communication, pricing

decisions, distribution channels and logistics, ethics in marketing – consumer protection.

9. **Corporate Governance** : Corporate Governance, Social responsibility of business, Code of Conduct, Social cost-benefit analysis - different approaches to SCBA, Corporate Communication.
10. **Operation and Materials Management** : Supply chain management – vendor evaluation and audit, make or buy decisions, inventory control – EOQ model, ABC analysis, Valuation of inventories - different methods.
11. **Management Information System** : Conceptual foundations of information systems, overview of systems analysis and design, system development, management of software development life cycle.
12. **Human Resource Development** : Manpower planning, recruitment, selection, training, development, promotion and transfer, performance measurement, balanced score card and other methods, job evaluation and enrichment.

MATHEMATICS

1. **Logic :**

Statements, Truth values, Connectives, Tautology, Inferences, Methods of Proof.

2. **Set Theory :**

Set operations, Algebra of sets, D' Morgan's laws, Sub set, Power set, Product of sets, Principles of Mutual inclusion and exclusion.

3. **Relation and function :**

- (i) Relation, Binary, Domain, Range, Properties of relation, Equivalence relation, Partial order relation, Poset, Lattice
- (ii) Function, One-one, Onto functions, Bijective, Inverse, Composite functions, Absolute value function, Step function, Exponential, Trigonometric, Logarithmic functions.

4. **Real and complex numbers :**

- (i) Real numbers : Natural numbers, Integers, Rational, Irrational, Real numbers, Algebra of Real numbers, Order relation in real numbers, Countability, Uncountability, Real sequences, Series, their Convergence.
- (ii) Complex numbers : Algebra of complex numbers, Argument, Modulus, Inverse, Demoiivre's Theorem and Applications.

5. **Matrices :**

Algebra of Matrices, Determinant of Matrices, Inverse of Matrix, Transpose, Solution of Linear equations, Symmetric Matrices, Skew-Symmetric Matrices, Hermitian Matrices, Skew-hermitian Matrices, Rank of a matrix.

6. **Combinatrics and probability :**

- (i) Counting Principles, Permutations, Different type of Permutations, Combinations, Binomial Theorem.
- (ii) Definition, Axioms of probability, Independent events, Baye's law.

7. **Differential calculus :**

Limit, Continuity, Derivatives, Higher order derivatives, Tangent, Normal, Increasing, Decreasing functions, Maxima, Minima, Rolle's Theorem, Mean value Theorems, Taylor's Theorem, Partial Differentiation, Euler's Theorem.

8. **Integral calculus :**

Integration as reverse process of differentiation, Definite Integral, Methods of integration, Area under plane curves.

9. **Differential Equation :**

Order, Degree of O.D.E., First order Differential equation, Their solutions, Higher order differential equation with constant coefficients, Their solutions.

10. **2-Dimensional Geometry :**

Preliminaries, Straight lines, Circles, Pair of lines, Parabola, Ellipse, Hyperbola.

11. **3-Dimensional Geometry and vectors:**

- (i) Preliminaries, Direction cosines, Planes, Lines, Sphere, Tangent plane to spheres.
- (ii) Algebra of vectors, Linear Dependence and Independence, Scalar and vector product of vectors, Scalar and vector triple products.

12. **Mechanics :**

- (i) Statics : Force, Parallelogram law of Forces, Equilibrium of forces, Moments, Couples, Friction, Centre of Mass.
- (ii) Dynamics : Laws of Motion, Kinematics, D' Alemberts principle, Motion of a particle in Plane, Projectile, Moment of Inertia of plane bodies.

13. **Group :**

Properties of groups, Permutation group, Cyclic group, Sub-group, Lagrange's Theorem, Counting principles, Normal sub-groups, Homomorphism and Isomorphism.

14. **Rings and Fields and Vector spaces :**

- (i) Definitions, Ring, Division Ring, Integral domain, Fields, Sub-ring, Ideals, Homomorphism and Isomorphism.
- (ii) Vector space, Subspace, Linear dependence, Independence, Basis, Dimension.

15. **Numerical Methods :**

Numbers in Binary, Octal and Hexadecimal systems, Errors, Solution of algebraic and transcendental equations by Bisection, Secant, Newton-Raphson method, Interpolation, Lagrange and Newton's Methods, Quadrature, Trapezoidal and Simpson's $1/3^{\text{rd}}$ rule. Numerical solution of I.V.P., Euler's Method, Second order Runge-Kutta Method.

MECHANICAL ENGINEERING

1. Statics and Dynamics

(a) Statics :

Simple applications of equilibrium equations. Friction. Trusses.

(b) Dynamics :

Simple applications of equations of motion, work, energy and power.

Conservation of momentum and impact.

2. Theory of Machines :

Simple examples of kinematic chains and their inversions.

Different types of gears, bearings, governors, flywheels and their functions.

Static and dynamic balancing of rigid rotors.

Simple vibration analysis of bars and shafts.

Linear automatic control systems.

3. Mechanics of Solids :

Stress, strain and Hookes Law. Shear and bending moments in beams. Simple bending and torsion of beams, springs and thin walled cylinders. Elementary concepts of elastic stability, mechanical properties and material testing.

4. Manufacturing Science :

Equilibrium phase diagram, Iron carbon equilibrium diagram, Transformation curves, Heat treatment of steel, case hardening. Sand casting, gates and risers, defects in casting. Inspection. Special casting processes. Metal working process :- Rolling. Forging, Extrusion, powder metallurgy. Gas welding, Arc welding, Resistance welding, Advanced welding processes :- Geometry of cutting tool in ASA, ORS and NRS, Merchant's theory, tool material, cutting fluid, Tool wear, Taylor's tool life equation, chatter in machining, Economics of machining, CNC,

DNC, Advanced Machining process :- EDM, ECM, AJM, USM, EBM, LBM. Thermoplastics, Thermosets, coating technology (PVD, CVD.)

5. Manufacturing Management :

Operation Research, formulation of LP problem, solution by graphical method, simplex method. Transportation problem, Assignment problem, theory of games, waiting line, statistical quality control, production control, quality engineering concepts of Taguchi, Total quality management, ISO 9000/ISO 14000. Methods and time study, motion economy and work space design, operation and flow process charts, break-even analysis.

6. Thermodynamics :

Basic concepts, definitions and laws, heat, work and temperature, Zeroth law, First Law, second law and its corollaries, Temperature scales, Behaviour of pure substances, equations of state. Reciprocating air compressors : Work required for single and multistage air compressors, Effect of intercooling, optimum inter-stage pressure, Effect of clearance and volumetric efficiency. Analysis of air standard power cycles, Carnot, Otto, Diesel, Brayton cycles, vapour power cycles, Rankine reheat and regenerative cycles, Open and closed cycles gas turbine with intercooling and reheating.

7. Energy Conversion :

Flow of steam through nozzles, critical pressure ratio, shock formation and its effect. Steam Generators, mountings and accessories. Impulse and reaction turbines, elements and layout of thermal power plants.

Hydraulic turbines and pumps, specific speed, layout of hydraulic power plants.

Introduction to nuclear reactors and nuclear power plants, handling of nuclear waste.

8. Refrigeration and Air Conditioning :

Unit of refrigeration, Maximum COP, Bell Coleman, vapour absorption and vapour compression cycles, Refrigeration equipment, operation and maintenance, refrigerants, principles of air conditioning, psychometric chart, comfort zones, humidification and dehumidification. Ozone friendly refrigerants.

9. Fluid Mechanics :

Hydrostatics, continuity equation, Bernoulli's theorem, flow through pipes, discharge measurement, laminar and turbulent flow, boundary layer concept.

PHILOSOPHY

Section-A

Problems of Philosophy

1. Substance : Aristotle, Descartes, Locke Berkeley's immaterialism, Hume, Nyaya Vaisesika and Jaina.
2. Universals : Realism and Nominalism (Plato, Aristotle, Berkeley's Criticism of Abstract ideas) Nyaya – Vaisesika, Buddhism.
3. Method of knowledge : Empiricism, Rationalism, Pramana Vada - Carvaka, Nyaya – Vaisesika.
4. Theories of Truth : Correspondence theory, Coherence theory, Pragmatic theory.
5. Khyati Vada : Anyatha khyati, Akhyati, Anirvacaniya khyati, Viparita khyati.
6. Body and Mind : Descartes (Interactionism), Spinoza (Parallelism), Leibnitz (Pre-established theory), Epiphenomenalism.

Section-B

Logic

1. Truth and validity, Principles of Logic.
2. Problem and Procedure of Induction : Scientific induction, Unscientific induction, Analogy.
3. Syllogism : Figures and Moods, Rules of syllogism (general and special) Valid moods, Direct and indirect reduction, Venn Diagrams.
4. Grounds of Induction : Formal grounds and material grounds.

5. Propositional calculus : Truth functions (negation, conjunction, disjunction, implication, alternation, equivalence, stroke), Truth table, Testing validity of arguments, Direct truth-table, Indirect truth-table method.
6. Algebra of classes : Null class, Class inclusion, Class-membership, Reduction to normal forms.

Section-C

Ethics

1. Statement of fact and statement of value, Right and Good - Teleology and de-ontology.
2. Moral standards : Psychological Hedonism, Utilitarianism (Bentham and J.S. Mill), Rigorism (Kant).
3. Problem of freedom of will.
4. Moral Judgements : Descriptivism, Prescriptivism, Emotivism.
5. Gandhian Ethics : Truth, Non-violence, Satyagraha, Ends and Means.
6. Niskama Karma, Purusartha.
7. Jaina Ethics : Triratna.
8. Buddhist Ethics : Four Noble truths, Eight fold paths.

PHYSICS

1. Mechanics, Properties of matter, Special Relativity and Waves

Dimensional analysis. Newton's laws of motion and applications, variable mass systems, projectiles. Rotational dynamics-kinetic energy, angular momentum, theorems of moment of inertia and calculations in simple cases. Conservative forces, frictional forces. Gravitational potential and intensity due to spherical objects. Central forces, Kepler's problem, escape velocity, artificial and Geo-stationary satellites. Streamline motion, Viscosity, Poiseuille's equation. Applications of Bernoulli's equation and Stokes' law.

Michelson Morley experiment, Postulates of Relativity, Lorentz transformation, addition of velocities, length contraction, time dilation, mass-energy relation.

Simple harmonic motion, Lissajous figures. Damped oscillation, forced oscillation and resonance. Beats, Phase and group velocities. Stationary waves, vibration of strings and air columns, longitudinal waves in solids. Doppler effect. Ultrasonics and applications.

2. Geometrical and Physical Optics.

Laws of reflection and refraction from Fermat's principle. Matrix method in paraxial optics- thin lens formula, nodal planes, system of two thin lenses. Chromatic and spherical aberrations. Simple optical instruments-magnifier, eyepieces, telescopes and microscopes.

Huygens' principle-reflection and refraction of waves. Interference of light-Young's experiment, Newton's rings, interference by thin films, Michelson interferometer. Fraunhofer diffraction-single slit, double slit, diffraction grating, resolving power. Fresnel diffraction-half-period zones and zone plate. Production and detection of linearly, circularly and elliptically polarised light. Double refraction, quarter-wave plates and half-wave plates. Polarizing sheets. Optical activity and applications. Rayleigh scattering and applications.

Lasers, characteristics of laser light-spatial and temporal coherence, Focussing of laser beams and applications.

3. Heat and Thermodynamics

Thermal equilibrium and temperature. The zeroth law of thermodynamics. Heat and the first law of thermodynamics. Efficiency of Carnot engines. Entropy and the second law of thermodynamics. Kinetic theory and the equation of state of an ideal gas. Mean free path, distribution of molecular speeds and energies. Transport phenomena. Andrew's experiments-Van der Waals equation and applications. Joule-Kelvin effect and applications. Brownian motion. Thermodynamic potentials-Maxwell relations and Phase transitions. Kirchhoff's laws. Black-body radiation-Stefan-Boltzmann law, spectral radiance, Wien displacement law, Planck radiation law.

4. Electricity and Magnetism

Electric charge, Coulomb's law, electric field, Gauss' law. Electric potential, Van de Graff accelerator. Capacitors, dielectrics and polarization. Ohm's law, Kirchhoff's first and second rules, resistors in series and parallel, applications to two-loop circuits. Magnetic field-Gauss' law for magnetism, magnetic susceptibility, classification of magnetic materials. Circulating charges, cyclotron, synchrotron. Hall effect. Biot-Savart law, Ampere's law, Faraday's law of induction. Lenz's law. Inductance. Alternating current circuits-RC, LR, single-loop LRC circuits, impedance, resonance, power in AC circuits. Displacement current, Maxwell's equations (MKS units), electromagnetic waves, energy transport and Poynting vector.

5. Atomic and Nuclear Physics

Photoelectric effect, Einstein's photon theory. Bohr's theory of hydrogen atom. Stern-Gerlach experiment, quantisation of angular momentum, electron spin. Pauli exclusion principle and applications. Zeeman effect. X-ray spectrum, Bohr's theory of the Mosley plot. Compton effect, Compton wavelength. Wave nature of matter, de Broglie wavelength, wave-particle duality. Heisenberg's uncertainty relationships. Schrodinger's equation-eigenvalues and eigenfunctions of (i) particle in a box, (ii) simple harmonic oscillator and (iii) hydrogen atom. Potential step and barrier penetration. Natural and artificial radioactivity. Binding energy of nuclei, nuclear fission and fusion. Classification of elementary particles and their interactions.

6. Solid State Physics and Electronics

Crystal structure, Bravais Lattices, Miller indices, X-ray diffraction, Bragg's Law.

Vacuum diodes in half-wave and full-wave rectification, qualitative ideas of semiconductors, p-type and n-type semiconductors, junction diode, Zener diode, transistors, binary numbers, Logic gates and truth tables, Basic parts of digital computers.

POLITICAL SCIENCE & INTERNATIONAL RELATIONS

Section-A

1. **Political Science** : Nature & scope and approaches to the study of Political Science
2. **Concepts** : State, Sovereignty, Power, Nationalism, Civil Society
3. **Political Ideas** : Rights, Liberty, Equality, Justice.
4. **Democracy** : Meaning and Theories of Democracy.
5. **Political Ideologies** : Liberalism, Marxism, Socialism, Fascism, Gandhism.
6. **Party System and Political Process** : Therories of Party System, National and regional parties, Patterns of coalition politics, interest and pressure groups.
7. **Forms of Government** : Parliamentary and Presidential. Federal & unitary
8. Regionalism and Decentralization
9. **Theories of Development and Underdevelopment: Role of Bureaucracy;**
10. **Social Movements** : Peasant & workers , Tribal, Feminist Environmental Movements and Role of Non Government organisation.
11. **Major theories of International relations** : Idealist, Realist, Systems Decision making; .

12. **State & the Global order** : Nature and Impact of globalization; Regional Economic Cooperation .

Section-B

Government and Politics with Special reference to India

1. Approaches to the study of Governments
2. **Constitutions and Basic features:** U.K., USA.and China,.
3. **Constitutional Development** in British India; The Constituent Assembly and salient features of the Indian Constitution .
4. **Nature of Indian federalism** : Centre-state relations, legislative, administrative, financial and political
5. **Fundamental Rights and Directive Principles of State Policy,** Fundamental Duties;
6. **The Union Executive** : President, Prime Minister and the Council of Ministers
7. **Parliament** : Powers and functions of the Lok Sabha & Rajya Sabha; Parliamentary Committees;
8. **The Judiciary** : The Supreme Court , Judicial Review; Judicial Activism.
9. **The State Executive** : Governor, Chief Minister and the Council of Ministers;
10. **Indian Party System** : Evolution and Contemporay trends; coalition government at the Centre and States, pressure groups in Indian politics.
11. **Local Government & Politics** : Panchayti Raj and Municipal Government; Role of women in Panchayats.
12. **Challenges to Indian Political System:**

a) Communalism Regionalism, terrorism, casteism, criminalisation and corruption.

b) Regional disparities, socio economic inequality Poverty, Illiteracy, Population, growth, impact of globalization.

PSYCHOLOGY

1. Introduction to psychology :

Concept and definition of psychology. Branches of psychology. Application of psychology to society and social problems.

2. Methods in Psychology :

Characteristics and Application of methods; Introspection, Clinical, case study, Experimental.

3. Quantitative Analysis :

Measures of central tendency and dispersion. Correlation. Levels of measurement. Reliability and validity and their application in test construction.

4. Physiological Psychology :

Structure of neuron, nerve impulses, synapse and neurotransmitters. Central and peripheral nervous system-structure and neural control of behaviour. Endocrine system and hormonal control of behaviour. Methods of studying brain function.

5. Development of human behaviour :

Individual Differences : Heredity and environment. Developmental issues – Role of early experience, Adolescence, Problems of aging.

6. Perception :

Perceptual processes; Perceptual organisation, Perception of form, colour, depth and time; Perceptual readiness and constancy; Role of motivation, social and cultural factors in perception; Application of knowledge of perception to skill development (e.g. for certain jobs like that of driving, airline pilots etc.).

7. Learning :

Classical conditioning and operant conditioning. Modeling and observational learning. Learning and motivation. Application of Learning principles in behaviour modification.

8. Memory :

Physiological basis of memory, Remembering and forgetting, Measurement of Remembering (Recall, Recognition, Relearning). Short term and long term memory, Theories of forgetting (Decay and Interference theories and Repressive forgetting). Application of Mnemonic devices etc, to improving memory.

9. Cognition and Language :

Concept formation, Nature and development of thinking, Language and thought, acquisition of language, Problem solving, Creative thinking and its application.

10. Intelligence and Aptitude :

Definition and concepts, Theories and models of Intelligence, Measurement of intelligence and aptitude, Exceptional intelligence, multiple intelligence, emotional intelligence, artificial intelligence.

11. Motivation and Emotion :

Definition and concept of imprinting, needs, drives and motives; Theories of motivation and their application (drive reduction theory, Maslow's motivational hierarchy). Social motivation: Achievement, power, affiliation motives and influence of early experiences. Physiological basis of emotion. Theories of emotion (James-Lange and Cannon-Brad theories, cognitive theories).

12. Personality :

Concepts and Definition of personality. Study of personality (Trait, type and eclectic approaches) Development of personality (Freud, Erikson, Biological and socio-cultural determinants). Measurement of Personality (Self-report measures, projective tests). Application of personality profiles in fitting a person to a job.

13. Adjustment and Stress :

Concept and definition. Factors affecting adjustment (frustration and conflict). Sources of stress and reactions to stress. Coping with stress. Application of stress management techniques.

14. Social Behaviour :

Socio-cultural factors and behaviour. Development of attitudes, stereotypes and prejudice. Strategies for reducing prejudice and changing attitude. Person perception, implicit personality theory and integrating impressions. Application of person perception to impression management.

15. Application of Psychology :

Health and mental health (yoga, meditation and relaxation therapies). Education (Programmed learning, self instructional learning and learning styles). Community (self help through group cohesiveness and leadership). Industry (Assessment centre approach in selection, recruitment and training). Environment (man-nature interaction), pollution reduction. Information technology (Application to commercial, educational and health areas).

PUBLIC ADMINISTRATION

1. **Basic concepts** : Meaning, Scope and Significance; Public and Private Administration; Evolution of the Discipline; Comparative Public Administration; Development Administration; New Public Administration; New Public Management Perspective.
2. **Principles of Organisation** : Hierarchy, Unity of Command, Span of Control, Authority and Responsibility, Coordination, Supervision, Centralisation and Decentralisation, Delegation.
3. **Theories of Organisation** : Classical Theory, Scientific Management Theory, Bureaucratic Theory, Human Relations Theory, Behavioural Approach, Systems Approach.
4. **Administrative Behaviour** : Leadership, Policy Formulation, Decision Making, Communication, Motivation, Morale.
5. **Accountability and Control** : Concepts; Legislative, Executive and Judicial Control over Administration; Citizen and Administration; Civil Society, People's Participation, Right to Information.
6. **Comparative Administrative Systems** : USA, UK, France: Features, Recruitment, Training, Promotion.
7. **Personnel Administration in India**: Recruitment to all India and Central Services, Training, Promotion; Union Public Service Commission.
8. **Financial Administration**: Budget – Concept, Formulation, Execution; Accounts; Audit; Comptroller and Auditor General of India.
9. **Central and State Administration in India**: Features of Indian Constitution; President, Prime Minister and Council of Ministers, Central Secretariat, Cabinet Secretariat, Prime Minister's Office, Planning Commission, Finance Commission, Election Commission; Governor, Chief Minister, State Secretariat, Directorate, District Administration.

- 10. Local Government:** Evolution; 73rd and 74th Constitutional Amendment Acts., Rural and Urban Local Governments in Orissa – Structures, Functions, Finances, Problems and Prospects.

SOCIOLOGY

Unit I : Basic Concepts :

Society, community, association, institution, culture, culture change, diffusion, Cultural lag, ethnocentrism, acculturation.

Social Groups-primary, secondary and reference groups.

Little Tradition and Great tradition,

Status and role, role conflict, role set, social control.

Norms and values-conformity and deviance,

Law and customs.

Socio-cultural processes :

socialization, assimilation, integration, cooperation, competition, conflict, accommodation, universalization and parochialization.

Unit II : Marriage, Family and Kinship :

Marriage : types and forms, marriage as contract, and as a sacrament.

Family : types, functions and changes.

Kinships : terms and usages.

Unit III : Social Stratification :

Forms and functions; Caste, Class and gender, Jajmani system, purity and pollution, dominant caste, sanskritisation.

Unit IV : Types of Society :

Tribal, agrarian, industrial and post-industrial, society.

Unit V : Economy and Society :

Economic systems of simple and complex societies, non-economic determinants of economic behaviour, market (free) economy and controlled (planned) economy.

Unit VI : Industrial and Urban Society :

Rural-Urban Continuum and contrast, urban growth and urbanization, town, city and metropolis; urban slums; impact of automation on society; industrialisation and environment.

Unit VII : Social Demography :

Population size, growth, composition, and distribution in India; components of population growth-births, deaths and migration; population policy.

Unit VIII : Political Processes :

Power, authority and legitimacy; political socialisation; political modernisation, pressure groups; caste and politics, Religion and politics.

Unit IX : Weaker Sections-and Minorities :

Protective discrimination; Constitutional safeguards.

Unit X : Social Change :

Theories of change; factors of change; science, technology and change. Social movements-Peasant Movement, Women's Movement, Backward Caste Movement, Dalit Movement.

STATISTICS

Group-A: Probability & Probability Distributions

Unit-I

Random experiment, sample space, event, algebra of events, probability on a discrete sample space, basic theorems of probability and simple examples based thereon, conditional probability, independent events, Bayes' theorem and its applications, discrete and continuous random variables and their distributions, expectation, moments, moment generating function, joint distribution of two random variables, marginal and conditional distributions, independence of random variables, covariance. Chebyshev's inequality, weak law of large numbers and central limit theorem for independently and identically distributed random variables with finite variance and their simple applications.

Unit-II

Distribution function of random variables, Bernoulli, Binomial, Geometric, Negative binomial, Hypergeometric, Poisson, Uniform, Beta, Exponential, Gamma, Cauchy, Normal, Lognormal and Bivariate normal distributions, real-life situations where these distributions provide appropriate models. Derivation of mgf and characteristic function of the distributions, computation of their moments and Pearsonian co-efficients.

Group-B: Statistical Methods

Unit-I

Concept of a statistical population and sample, types of data, presentation and summarization of data, measures of central tendency, dispersion, moments, skewness and kurtosis, measures of association and contingency, correlation, rank correlation, intraclass correlation, correlation ratio, simple and multiple linear regression, multiple and partial correlations (involving three variables only)

Unit-II

Curve-fitting and principle of least squares, concepts of parameter and statistic, Z, χ^2 , t and F- statistics and their distributions, properties and applications, distributions of sample range and median (for continuous distributions only).

Group-C: Statistical Inference

Unit-I

Properties of a good estimator : Unbiasedness, consistency, efficiency, sufficiency, completeness; minimum variance unbiased estimation, Rao-Blackwell theorem, Cramer-Rao inequality and minimum variance bound estimator, Methods of estimation : moments, maximum likelihood, least squares and minimum chi-square; properties of maximum likelihood estimator, idea of a random interval, confidence intervals for the parameters of standard distributions, shortest confidence intervals, large-sample confidence intervals.

Unit-II

Simple and composite hypotheses, two kinds of errors, level of significance, size and power of a test, desirable properties of a good test, most powerful test, Neyman-Pearson lemma and its application for testing simple hypothesis, uniformly most powerful test, likelihood ratio test and its properties and applications. Chi-square test, sign test, Wald-Wolfowitz run test, run test for randomness, median test, Wilcoxon test and Wilcoxon-Mann-Whitney U-test. Wald's sequential probability ratio test, OC and ASN functions, application to binomial and normal distributions.

Group-D : Sampling Theory and Design of Experiments

Unit-I

Complete enumeration vs sampling, need for sampling, basic concepts of sampling and sampling design, large-scale sample surveys, sampling and non-sampling errors, simple random sampling, estimation of sample size, stratified random sampling, systematic sampling, cluster sampling, ratio, product and regression methods of estimation under simple and stratified random sampling, double sampling for ratio and regression methods of estimation, two-stage sampling with equal size first-stage units.

Unit-II

Analysis of variance with equal number of observations per cell in one, two and three-way classifications, analysis of covariance in one and two-way classifications, basic principles of experimental designs, completely randomized design, randomized block

design, Latin square design, missing plot technique, 2^n factorial experiment, total and partial confounding, 3^2 factorial experiments, split-plot design and balanced incomplete block design.

Each group should have equal weight

ZOOLOGY

I. (a) Taxonomy

Nomenclature and classification of animals up to orders; Taxonomic principles- species, ranking and phylogenetic divisions.

(b). Non-chordata

Structure, reproduction and life history of the following:

Amoeba, Plasmodium, Hydra, Fasciola, Taenia, Pheretima, Palaemon, Periplaneta, Pila and Asterias.

II. Chordata

General features and phylogeny of protochordates; General characters and phylogeny of cyclostomes, pisces, amphibians, reptiles, aves and mammals; Type studies : *Scoliodon, Rana, Calotes, Columba and Oryctolagus.*

III. Comparative anatomy

Comparative functional anatomy of vertebrate systems : integument, digestive, brain, kidney, circulatory and endocrine.

IV. (a). Ecology and Wildlife

Concept and components of ecosystem (energy flow, food chain, food web, ecological pyramids, bio-geochemical cycles such as carbon, nitrogen and sulphur; Biotic community; Concept of population; Animal adaptations; Biodiversity- principles and types (, and diversity); Conservation; Wildlife of Orissa; Concept of wildlife management and endangered species.

(b). Evolution and Economic Zoology

Principles, theories and evidences of evolution; Palaeozoology; Zoological eras; Zoogeographical distribution of animals; Beneficial insects and their culture; Protozoan and helminth parasites of man; Poisonous and non-poisonous snakes.

V. (a) Cell Biology and Microbiology

Structure of animal cell; Cell organelles and their functions; Cell division- mitosis and meiosis; Prokaryotes and eukaryotes; Bacterial cell structure; Viruses and their types; Bacterial and viral diseases.

(b). Genetics

Concept of genes and heredity; Mendelian and non-Mendelian inheritance; Linkage and crossing-over; Mutation and recombination; Sex determination; Sex-linked inheritance.

(c). Immunology

Innate vs acquired immunity; Antigen and antibody; B and T cells; organ and tissue transplantation; Immune response and AIDS.

VI. (a). Biochemistry

Structure and organization of biomolecules- carbohydrates, lipids, proteins and nucleic acids; Glycolysis; TCA cycle; Glycogen metabolism; Gluconeogenesis; β -oxidation of fatty acids; Electron transport and oxidative phosphorylation; Hormones; Vitamins; Enzymes; Coenzymes; pH and buffers.

(b). Molecular Biology

Structural organization of DNA and RNA; Types of RNA; DNA replication; Transcription and translation; Genetic code; Protein synthesis.

VII. (a). Physiology and Endocrinology

Physiology of digestion, excretion and respiration; Muscles and their contraction; Neuron and nerve conduction; Hormone action; Second messenger concept; Physiology of reproduction; Hypothalamic regulation and endocrine functions.

(b). Ethology

Neural and hormonal control of behaviour; Mechanism of learning and memory; Biological rhythms.

(c) Embryology

Gametes and gametogenesis; Fertilization; Cleavage and gastrulation in frog and chick; Metamorphosis; Placenta and placentation in mammals.

VIII. (a). Biotechnology

Recombinant DNA; Restriction enzymes; Gene cloning and vectors; c-DNA; Gene library; Animal cloning and GM animals; Application of biotechnology in health care, waste management and food production.

(b). Instrumentation

Microscopy (compound, electron and phase-contrast); pH-metry; Colorimetry; Chromatography; Centrifugation; Electrophoresis; ELISA.

(c). Biostatistics

Measurement of central tendency- mean, mode and median; Tests of significance (χ^2 , t and F).

