A Syllabus

HARYANA GOVERNMENT

PERSONNEL DEPARTMENT

Notification

The 6th November, 2008

No. 42/1/95-5SII.—In pursuance of the Rule 11 (1) of the Haryana Civil Services (Executive Branch) Rules, 2008 and in supersession of Notification No. 42/1/95-5SII, dated 31st March, 2008, the Governor of Haryana is pleased to order that the syllabi for the Preliminary Examination as well as Main Written Examination for the posts of Haryana Civil Service (Executive Branch) and Allied Services shall be as under :—

SYLLABI FOR THE PRELIMINARY EXAMINATION

COMPULSORY SUBJECT

GENERAL STUDIES

General Science.

Current events of national and international importance.

History of India and Indian National Movement.

Indian and World Geography.

Indian Culture, Indian Polity and Indian Economy.

General Mental Ability.

Haryana-Economy and people. Social, economic and cultural institutions and language of Haryana .

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. In current events, knowledge of significant national and international events will be tested. In History of India, emphasis will be on broad general understanding of the subject in its social, economic and political aspects. Questions on the Indian National Movement will relate to the nature and character of the nineteenth century resurgence, growth of nationalism and attainment of Independence. In Geography, emphasis will be on Geography of India. Questions on the Geography of India will relate to physical, social and economic Geography of the country, including the main features of Indian agricultural and natural resources. Questions on Indian Polity and Economy will test knowledge on the country's political system and Constitution of India, Panchayati Raj, social systems and economic developments in India. On general mental ability, the candidates will be tested on reasoning and analytical abilities.

OPTIONAL SUBJECTS FOR PRELIMINARY EXAMINATION

1. AGRICULTURE

Importance of agriculture in national economy. Impact of high yielding varieties and short duration varieties on shifts in cropping pattern. Important crops of India. Cultural practices for cereal, pluses, oilseed, fibre, sugar, tuber and fodder crops and scientific basis for their crop rotations. Concepts and principles of multiple and relay cropping, intercropping and mixed cropping. Weeds, their characteristics, dissemination and association with various crops; their multiplications; cultural, biological, chemical and integrated control of weeds. Sustainable agriculture and crop diversification.

Soil as medium of plant growth and its composition. Mineral and organic constituents of the soil and their role in maintaining soil productivity. Chemical, physical and microbiolgical properties of soil. Soil colloids. Essential plant nutrients (macro and micro)–their functions. Problem soils, extent & distribution in India and their reclamation. Principles of soil fertility and its evaluation for judicious fertilizer use. Organic manures and bio-fertilizers. Inorganic fertilizers (straight, complex and mixed). Integrated nutrient management.

Principles of plant physiology with reference to plant nutrition, absorption, translocation and metabolism of nutrients. Diagnosis of nutrient deficiencies and their amelioration. Photosynthesis and respiration. Growth and development. Auxins and hormones in plant growth and importance in agriculture.

Elements of genetics and plant breeding as applied to improvement of crops. Development of plant hybrids and composites. Important varieties, hybrids and composites of major crops.

Important fruit and vegetable crops of India, their methods of propagation (sexual and asexual), their package and practices with scientific basis, crop rotation, intercropping and companion crops. Role of fruits and vegetables in human nutrition, post-harvest handling and processing of fruits and vegetables.

Serious pests and diseases affecting major crops. Principles of control of crop pests and diseases, integrated management. Proper use and maintenance of plant protection equipments.

Principles of economics as applied to agriculture. Farm management-scope, importance, characteristics. Farm planning and budgeting. Types and systems of farming and factors effecting them. Farm mechanization. Social marketing.

Philosophy, objectives, scope and principles of extension. Early extension efforts in India. Methods of communication. Evaluation of extension programmes. CD programmes. On farm testing and frontline demonstration.

2. ANIMAL HUSBANDRY AND VETERINARY SCIENCE

1. General

Role of Livestock in Indian Economy and human health. Mixed farming. Socio-economic aspects of livestock enterprise with special reference to women.

2. Genetics and Breeding

Principle 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 polymorhism and their application in animal improvement. Gene actions. Systems and strategies for improvement of livestock for milk, meat and draught and poultry for eggs and meat. Breeding animals for disease resistance. Breeds of livestock and poultry.

3. Nutrition

Role of nutrition in animal health and production. Classification of feeds. Proximate composition of feeds. Feeding standards. Computation of rations. Ruminant-nutrition. Concept of total digestible nutrients and starch equivalent systems. Significance of energy determinations. Conservation of feeds and fodder and utilization of agro byproducts. Feed supplements and additives. Nutrition deficiencies and their management.

4. Management

System of housing and management of livestock, poultry. Farm records. Economics of livestock, poultry 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. Biogas.

5. Animal Production

(a) Artificial insemination, fertility and sterility. Reproductive physiology, Semen-characteristics and preservation. Sterility–its causes and remedies. (b) Methods of slaughter of meat animals, meat inspection, judgement, 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 and marketing.

6. Veterinary Science

(i) Major contagious diseases affecting cattle, buffaloes, horses, sheep and goats, pig, poultry-etiology, symptoms, pathogenicity 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 domestic 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, Foodborne infections and intoxications. Occupation hazards.

8. Pharmacology

Poisons used for killing animals-euthanasia. Drugs used for increasing production/performance efficiency and their adverse effects. Drugs used to tranquilize wild animals as well as animals in captivity. Quarantine measures in India and abroad. Act, Rules and Regulations.

9. Dairy Science

Physico-chemical and nutritional properties of milk. Quality assessment of milk and milk products. Common tests and legal standards. Cleaning and sanitization of dairy equipment. Milk collection, chilling, transportation processing, packaging, storage and distribution. Role of microorganisms in quality of milk products. Physiology of milk secretion.

3. BOTANY

1. Cell Biology

Structure and function of nucleus and cell organelles. Mitosis and meiosis, process and significance. Cell cycle, phases and genetic control.

2. Genetics, Molecular Biology and Biotechnology

Mendelian laws of inheritance. Gene concept and structure. A brief idea about linkage, crossing over and their role in gene-mapping. Major structural and numerical changes in chromosomes. Gene mutations and their genetic significance. Sex determination in plants. Nucleic acids-types and their role in gene action. Genetic code and its characteristic features. Genetic engineering and its utility in crop improvement. A brief idea about cell, tissue and organ culture. Biotechnology–concept and role in agrohorticulture, medicine and industry.

3. Plant Diversity

Structure and function of various plant forms from microbes to higher plants. Major classification of living forms into archaea, bacteria and eukaryotes. Basis of this new classification and main features of the three groups.

4. Plant Physiology

Process and mechanisms of photosynthesis, nitrogen metabolism and respiration in higher plants. Micronutrients and their role in plant growth. Use of isotopes in physiological studies. Physiology of flowering and fruiting.

5. Reproductive Methods and Seed Biology

Asexual and sexual modes of reproduction in higher plants. Male sterility and its utility in hybrid seed production. Seed dormancy and germination.

6. Plant Pathology

Major diseases of rice, wheat, sugarcane and potato. Chemical, biological and genetical methods of disease control.

7. Plants and Environment

Biotic and abiotic components of environment that influence plant growth and reproduction. Vegetation types and forest types of India. A brief account of deforestation and reforestation. Pollution and its impact on plants. A brief account of global warming and acid rain.

8. Biodiversity

Concept, depletion and conservation of biodiversity. A brief idea about rare, endangered and threatened plants.

9. Plant-Genetic Resources

Methods of conservation of plant-genetic resources and rare plants. Role of plant cell, tissue and organ culture in plant propagation and enrichment of genetic diversity.

10. Economic Plants

Plants as source of food, fibre, fodder, oils, drugs, wood, timber, paper, rubber, beverages (non-alcoholic), spices and dyes. Examples for each with their botanical name.

4. CHEMISTRY

1. Inorganic Chemistry

1. Atomic structure :– Schrodinger wave equation, significance of wave function, quantum numbers and their significance, 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 exclusion principle.

2. Chemical Periodicity:– Periodic classification of elements, salient characteristics of s,p,d and f block elements. Periodic trends of atomic randii, ionic radii, ionisation potenial, electron affinity and electronegativity in the periodic table.

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.

4. Oxidation States and Oxidation Number:– Oxidation and reduction, oxidation numbers, common redox reactions, ionic equations. Balancing of equations for oxidation and reduction reactions.

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.

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 characteristic properties, inert pair effect, allotropy and catenation. Special emphasis on solutions of alkali and alkaline earth metals in liquid ammonia. Interhalogen compounds, pseudohalogens 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. Lanthanide contraction.

7. Nuclear chemistry :–Nuclear reactions; mass defect and binding energy, nuclear fission and fusion. Nuclear reactors; radioisotopes and their applications.

8. Coordination compounds :–Nomenclature, isomerism and Wener's theory of coordination compounds and their role in nature and medicine.

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

2. Organic Chemistry

1. Bonding and shapes of organic molecules :–Elecgtronegativity, electron displacements-inductive, mesomeric and hyperconjugative effects; bond polarity and bond polarizability, dipole moments of organic molecules; hydrogen bond; bond formation, fission of covalent bonds; homolysis and heterolysis, Reaction intermediates-generation, geometry and stability of carbonations, carbanions, free radicals and carbenes. Nucleophiles and electrophiles.

2. Chemistry of Aliphatic Compounds :—Nomenclaute; Alkanes—synthesis, reactions (free radical, halogenation)—reactivity and selectivity, sulphonation; alkenes and alkynes—synthesis, electrohilic addition reactions, Markownikov's rule, peroxide affect, nucleophilic addition to electron—deficient alkenes; polymerisation; relative acidity; syntheses and reactions of alkylhalides, alkanols, alkanals, alkanones, alkanoic acids, esters, amiders, nitriles, amines, acid anhydrides, eithers and nitro compounds.

3. Stereochemistry of carbon compounds :—Elements of symmetry, chiral and achiral compounds. Fischer projection formulae; optical isomerism of tartaric acids, enationmerism and diastereoisomerism, configuration (relative and absolute); conformations of ethane, cyclohexane and their potential energy. D.L. and R.S.-notations of compounds containing chiral centres. Projection formulae—Fischer, Newman and Sawhorse—of compounds like ethane and cyclohoxane. Meso and dl-isomers, racemization and resolution, geometrical isomers; E and Z notations. Stereochemistry of SN 1 and SN 2 reactions.

4. Organometallic compounds :—Preparation and synthetic uses of Grignard reagents, alkyl lithium compounds.

5. Chemistry of Biomolecules :—(i) Carbohydrates Classification, structure of glucose, D, L–Configuration, osazone formation, fructose and sucrose. (ii) Amino Acids; Essentials amino acids; zwitterions, polyppetides; proteins (primary, secondary and tertiary structure of proteins). (iii) Elementary idea of oils, fats, soaps and detergents.

6. Basic Principles and Applications :—Principles and applications of UV, visible IR and NMR spectroscopy of simple organic molecules.

3. Physical Chemistry

1. Gaseous State :—Deviation of real gases from the equation of state for an ideal gas and Vander Waals equation of state, distribution of molecular speed, mean free path; specific heat of gases relation between Cp and Cv.

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, Hess's Law, enthalpy and enthalpy changes in various physical and chemical processes. Gibb's helm holtr equation. Heat capacities.

(ii) Second law and its applications :— Spontaneity of a process, entropy and entropy changes in various process, free energy functions, criteria for spontaneity, relation between equilibrium constant and thermodynamic quantities like ΔG^0

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 sulphur) component.

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

5. Electrochemistry :—Ions in solutions, ionic equilibria, dissociation constants of acids and bases, pH and buffers. Ostwald's dilution law, Kohlrausch law and its application. Faraday's laws of electrolysis, dry cells and measurements of e.m.f. using N.H.E.

6. Chemical Kinetics :—Rate of chemical reaction and its dependence on concentration of the reactents, rate constant and order of reaction and their experimental determination; integral rate equations for first order reaction, half-life periods; temperature dependence of rate constant and Arrhenius parameters; elementary ideas regarding collision and transition state theory.

7. Photochemistry :—Absorption of light, laws of photochemistry, quantum yield, the excited state and its decay by radiative, pathways; Fluorescence and phosphorescence.

8. Catalysis :—Homogeneous and heterogeneous catalysis and their examples; enzyme catalysed reactions (Michaelis-Menten mechansim).

9. Colloids :—The colloidal state and purification of colloids and their characteristic properties; lyophilic and lyophobic collids and coagulation; Floculation value protection of Gold number colloids. Peptisation electrophoresis Tyndal effect.

5. CIVIL ENGINEERING

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. Free body diagram. Conditions of equilibrium. Equivalent force system. First and Second Moments of area. Mass moment of inertia.

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 section. Beams of uniform strength.

Deflection of beams : Macaulay's method, Mohr's moment area method, conjugate beam method, unit load method. Torsion of shafts. Elastic stability of columns : Rankine's and Secant formulae, Principal; stresses and strains into dimensions, Mohr's Circle.

3. Structural Analysis

Analysis of pin jointed plane trusses, deflection in trusses. Three hinged arches. Analysis of Propped cantilevers, fixed beams, continous beams and rigid frames. Slope-deflection, moment distribution. Force and displacement methods.

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

5. Transportation Engineering

Highway alignment, choice of layout and capacity of highways, location survey, geometric design of highways-various elements, curves, grade separation, highway materials and testing subgrade and pavement components, types of pavements.

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, points and crossings.

6. Fluid Mechanics, Kinematics, Dynamics and Open Channel Flow

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, separation.

Dynamics : Euler's equation along streamline, control volume equation, continuity, momentum, energy and moment

rement of momentum equation from control volume equation, applications to pipe flow, dimensional analysis. Boundary layer on a flat late, Laminar and Turbulent Flows. Laminar and trubulent flow through pipes, friction factor variation, 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, hydraulic jump, surges.

7. 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, standards for potable water. Water treatment; principles of coagulation, flocculation and sedimenation; slow-rapid-pressure-filters; chlorination, softening, removal of taste, odour and salinity. Analysis of distribution systems.

Sewerage systems: Domestic and industrial wastes, storm sewage- separate and combined systems, flow through sewers, design of sewers.

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

Sewage treatment: Working principles, units, chambers, sedimentation tank, trickling filters, oxidation ponds, activated sludge process, septic tank, disposal of sludge.

8. Construction Management

Elements and principles of Activity on Arrow (AOA) and Activity on Node (AON) network and work breakdown structure. Activity time. Time computations and Floats. Scheduling principles. PERT, probability of completion. Critical path, CPM, floats, numbering of network, crashing of activity.

6. COMMERCE & ACCOUNTANCY

1. Accounting

Nature, scope and objectives 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. Distribution between capital and revenue expenditure. Accounting standards and their application. Accounting standards relating to fixed assets, depreciation, inventory, recognition of revenue. Final accounts of sole proprietors, partnership firms and limited companies. Statutory provisions. Reserves, provisions and funds. Final Accounts of not-for profit organisations. Accounting problems related to admission and retirement of a partner and dissolution of a firm. Accounting for shares and debentures. Accounting treatment of convertible debentures. Analysis and interpretation of financial statements. Ratio analysis and interpretation. Ratios relating to short term liquidity, long term solvency and profitability. Importance of the rate of return on investment (ROI) in evaluating the overall performance of a business entity. Cash-flow statement and statement of source and application of funds. Societal obligations of accounting.

2. Auditing

Nature, objectives and basic principles of auditing. Techniques of auditing- physical verification, examination of documents and vouching direct confirmation, analytical review. Planning an audit, audit programmes, working paper, audit process. Evaluation of internal controls. Test checking and sampling. Broad outlines of company audit. Audit of non-corporate enterprises. Internal and management audit.

3. Business Organisation

Distinctive features of different forms of business organisation. Sole proprietor. Partnership-characteristic registration, partnership deed, rights and duties, retirement, dissolution. Concept, characteristic and types of joint stock company. Cooperative and state ownership forms of organisations. Types of securities and methods of their issue. Economic functions of the capital market, stock exchanges. Mutual funds. Controls and regulations of capital market. Business combination. Control of monopolies. Problems of modernisation of industrial enterprises. Social responsibility of business. Procedure and financing of import and export trade. Incentives for export promotion. Financing of foreign trade. Principles and practice of life, fire, marine and general insurance.

4. Management

Management functions-Planning, strategies, organising, levels of authority, staffing, line function and staff function, leadership, communication, motivation. Directing-Principles, strategies Coordination-Concept, types, methods. Control Principles, performance standards, corrective action. Salary and wage administration. Job evaluation. Organisation structure. Centralisation and decentralisation. Delegation of authority. Span of control. Management by objectives and management by exception. Management of change. Crisis management. 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 organisation and methods (O & M).

5. Company Law

Joint stock companies. Incorporation, documents and formalities of joint stock companies. Doctrine of indoor management and constructive notice. Duties and powers of the board of directors of a company. Accounts and audit of companies. Role and functions of a company secretary. Qualifications for appointment of a company secretary.

7. ECONOMICS

1. General Economics

(1) Micro-Economics:—(a) Production - Agents of production. Costs and supply. Isoquants. (b) Consumption and demand - Elasticity concept. (c) Market structures and concepts of equilibrium. (d) Determination of prices. (e) Components and theories of distribution. (f) Elementary concepts of welfare economics. Parcto-optimality. Private and social products. Consumers surplus.

(2) Macro-economics :—(a) National Income concepts. (b) Determinants of National Income Employment. (c) Determinants of consumption, savings and investment. (d) Rate of interest and its determination. (e) Interest and profit.

(3) Money, Banking and Public Finance :—(a) Concepts of money and measures of money supply. Velocity of money. (b) Banks and credit creation. (c) Central bank and control over money supply. (d) Determination of the price level. (e) inflation, its causes and remedies. (f) 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. Terms of trade. (b) Free trade and protection. (c) Balance of payments accounts and adjustment. (d) Exchange rate under free exchange markets. (e) Gold standard. The Bretton Woods 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.

(6) Economic Statistics :—Types of average Measures of dispersion. Correlation. Index number, types, uses and limitations.

2. 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. Low productivity and low per capita income Rural-urban disparities. Foreign trade and payments imbalances. Balance of payments and external debt. Inflation. Parallel economy and its effects. Fiscal deficits.

(3) Growth in income and employment since independence. Rate, pattern, sectoral trends. Distributional change. Regional disparities.

(4) Economic Planning in India. Major controversies on planning in India. Alternative strategies. Goals and achievements. Shortfalls of different plans. Planning and the market.

(5) Broad fiscal monetary, industrial policies. Objectives, rationale, constraints and effects thereof.

8. ELECTRICAL ENGINEERING

1. Electrical Circuits - Theory and Applications

Circuit components, network graphs, KCL, KVL; circuit analysis methods; nodal analysis, mesh analysis; basic network theorems and applications transient analysis; RL, RC and RLC circuit; sinusodial 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.

2. Signals and Systems

Representation of continuous-time and discrete-time signals & systems; 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.

3. Control Systems

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

4. E-M Theroy

Electro-static and magneto-static fields; Maxwell's equations; e.m. waves and wave equations; wave propagation and antennas; transmission lines.

5. Electrical Engineering Materials

Electrical/electronic behaviour of materials; conductivity; free-electrons and band-theory; intrinsic and extrinsic and extrinsic semiconductor, p-n junction; solar cells, super-conductivity. Dielectric behaviour. Polarization phenomena. Magentic materials behaviour and application.

6. Analog Electronics

Diode circuits: Rectifiers, filters, clipping and clamping. Zener diode and voltage regulation. Bipolar and field effect transistors (BJT, JFET and MOSFET) ; Characteristics, biasing and small signal equivalent circuits. Basic amplifier circuits, differential amplifier circuits. Amplifiers: analysis, frequency response. Principles of feedback: oscillators.

7. Digital Electronics

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

8. Communication Systems

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. Signal-to-noise ratio calculations for AM and EM .

9. Computers and Microprocessors

Computer organization:-number representation and arithmetic, functional organization, machine instructions, addressing modes, ALU. Elements of microprocessors: 8-bit microprocessors-architecture, instruction set, memory, I/O interfacing.

10. Measurement and Instrumentation

Error analysis :— measurement of current voltage, power, energy, power-factor, resistance, inductance, capacitance and frequency; bridge measurements. Electronic measuring instruments: multi meter, CRO, digital voltmeter, frequency counter, Q-meter, spectrum-analyser, disortion-meter. Transducers: thermocouple, thermistor, LVDT, strain-guages, piezo-electric crystal. Data acquisition systems.

11. Energy Conversion

Single-phase transformer :- equivalent circuit, phasordiagram, tests, regulation and efficiency; three-phase transformer; auto transformer. Principles of energy conversion-d.c.generators and motors; perfonnance 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; synchronous condensor. FHP motors, permanent magnet and stepper motors, brushless d.c. single-phase motors.

12. 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; voltage control and power factor correction. Economic operation. Principles of overcurrent, differential and distance protection; circuit breakers, concept of system stability. HVDC transmission.

13. Power Electronics and Electric Drives

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

9. GEOGRAPHY

1. Physical Geography

(i) Geomorphology: Origin of the earth. Interior of the earth. Types and characteristics of rocks. Folding and Faulting. Continental drifts. Isostasy. Plate tectonics. Volcanoes. Earthquakes, Weathering. Landforms caused by fluvial, aeolian and glacial actions. Cycle of erosion .

(ii) Climatology: Structure and composition of atmosphere. Temperature. Pressure belts and wind systems. Clouds and rainfall types. Cyclones and anti-cyclones. Koppen's and Thornthwaite's classification of world climate.

(iii) Oceanography: Ocean relief. Temperature. Salinity. Ocean deposits. Ocean currents, El Nino and La Nino. Waves and tides. Marine resources. Coral reefs and atolls.

(iv) Biogeography: Origin and types of soils. Soil profile. Soil erosion and conservation. Major biomes of the world, Ecosystem and food chain. Environmental degradation and conservation.

2. Human Geography

(i) Man and Environment Relationship. Growth and development of human geography.

(ii) Population: 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. Tertiary activities-trade, transport, communication and services. Weber' s theory of industrial location.

(iv) Settlements: Origin, types and patterns of rural settlements. Urban settlements. Concept of primate city and rank size rule. Rural urban fringe. Processes of urbanization. Morphology and functional classification of towns. Million-cities and mega-cities. Charistaller's central place theory.

3. Geography of the World

(i) Major Natural Regions: Characteristics, economic base and human adaptation.

(ii) Regional Geography of Developed Countries: Canada, U.S.A., Western Europe, Russia, Japan; Australia and New Zealand.

(iii) Regional Geography of Developing Countries: S.E. Asia, S.W. Asia, China, Southern Africa and Brazil.

(iv) Regional Geography of South Asia.

4. Geography of India

(i) Physical Setting of India: Landforms, drainage, climate, soils and natural vegetation.

(ii) Economical Geography of India: Minerals and energy resources, aquatic resources, forest resources, irrigation, agriculture and industries. Trade and commerce. Industries and industrial development. Transport and trade.

(iii) Population: Population growth, distribution and density. Demographic characteristics.

(iv) Environmental problems, developmental issues and regional planning.

(v) Contemporary Issues: International boundaries issues. Disputes on sharing of water resources. Geopolitics of Indian Ocean. Environmental hazards. Environmental pollution. Problems of agrarian and industrial unrest. Regional disparities in economical development.

10. INDIAN HISTORY

1. Foundation of Indian Culture and Civilisation. Indus Civilisation. Vedic Culture. Sangam Age.
2. Religious Movements - Buddhism, Jainism, Bhagavatism and Brahmanism.
3. The Maurya Empire.
4. Trade and Commerce in the pre-Gupta and Gupta period.
5. Agrarian structure in the post-Gupta period.
6. Changes in the social structure of ancient India.
7. Political and social condition (800A.D.-1200 A.D.). The Cholas.
8. The Delhi Sultanate -Administration. Agrarian conditions.
9. The Provincial Dynasties. Vijaynagar Empire. Society and Administration.
10. The Indo-Islamic culture. Religious movements (15th and 16th centuries).
11. The Mughal Empire (1526A.D.-1707 A.D.) Mughal Polity Agrarian relations. Art, architecture and culture.
12. Beginning of European commerce.
13. The Maratha Kingdom and Confederacy.
14. The Decline of the Mughal Empire. The autonomous states with special reference to Bengal, Mysore and Punjab.

15. The East Indian Company and the Bengal Nawabs.
16. British economic impact in India.
17. The Revolt of 1857 and other popular movements against British rule in the 19th century.
18. Social and cultural awakening the lower castes. Trade unions and the peasant movements.
19. The freedom struggle.

11. LAW

I. Jurisprudence

1. Schools of Jurisprudence : Analytical, historical, philosophical and sociological.
2. Sources of Law: Custom, precedent and legislation.
3. Rights and Duties.
4. Legal Personality.
5. Ownership and Possession.

II. Constitutional Law of India

1. Salient features of the Indian Constitution.
2. Preamble.
3. Fundamental Rights, Directive Principles and Fundamental Duties.
4. Constitutional position of the President and Governors and their powers.
5. Supreme Court and High Courts, their powers and jurisdiction
6. Union Public Service Commission and State Public Service Commissions. Their powers and functions.
7. Distribution of Legislative powers between the Union and the States.
8. Emergency provisions.
9. Amendment of the Constitution.

III. International Law

1. Nature of Intenational law.
2. Sources: Treaty, custom, general principles of law recognized by civilized nations and subsidiary means for the determination of law.
3. State Recognition and State Succession.
4. The United Nations : Objectives, principal organs, the constitution; role and jurisdiction of the International Court of Justice.

IV. Torts

1. Nature and definition of tort.
2. Liability based on fault and strict liability.
3. Vicarious liability.
4. Joint tort-feasors.
5. Negligence
6. Defamation.

7. Conspiracy.
8. Nuisance.
9. False imprisonment and malicious prosecution.

V. Criminal Law and IPC

1. General principles of criminal liability.
2. Mens rea.
3. General exceptions.
4. Abetment and conspiracy.
5. Joint and constructive liability.
6. Criminal attempts.
7. Murder and culpable homocide.
8. Sedition.
9. Theft: extortion, robbery and dacoity.
10. Misappropriation and criminal breach of trust.

VI. Law of Contract and Indian Contract Act, 1872

1. Basic elements of contract, offer, acceptance, consideration, contractual capacity.
2. Factors vitiating consent.
3. Void, voidable, illegal and unenforceable agreements.
4. Performance of contracts.
5. Dissolution of contractural obligations, frustration of contracts.
6. Quasi-contracts.
7. Remedies for breach of contract.

VII. Law of Evidence and Indian Evidence Act.

12. MATHEMATICS

1. Algebra

Elements of Set Theory. Algebra of Real and Complex numbers including DeMoivre's Theorem. Polynomials and Polynomial Equations. Relations between Co-efficients and Roots, Symmetric functions of roots. Elements of Group Theory. Sub-groups, permutation groups and their elementary properties.

2. Matrices

Addition, Multiplication, Determinants of a Matrix, Properties of Determinants of order, Inverse of a Matrix, Cramer's rule.

3. Geometry and Vector

Analytic Geometry of straight lines and conics in Cartesian and Polar coordinates. Three Dimensional geometry for planes, straight lines, sphere, cone and cylinder. Addition, Substraction and Products of Vectors and Simple applications to geometry.

4. Calculus

Functions, Sequences, Series, Limits, Continuity, Derivatives. Application of Derivatives. Rates of change. Tangents, Normals, Maxima, Minima Rolle's Theorem, Mean Value Theorems of Lagrange and Cauchy, Asymptotes, Curvature, methods of finding indefinite integrals. Definite Integrals, Fundamental Theorem of Integral Calculus. Application of definite integrals to area, Length of a plane curve, Volume and Surfaces of revolution.

5. Ordinary Differential Equations

Order and Degree of a Differential Equation, First order differential Equations, Singular solution, Geometrical interpretation, Second order equations with constant co-efficients.

6. Mechanics

Concepts of particles, Lamina, Rigid Body, Displacement, Force, Mass, Weight, Motion, Velocity, Speed. Acceleration. Parallelogram of forces. Parallelogram of velocity, acceleration, resultant, equilibrium of coplanar forces. Moments, Couple, Friction, Centre of mass, Gravity. Laws of motion. Motion under conservative forces. Motion under gravity. Projectile, Escape velocity; Motion of artificial satellites.

7. Probability

Sample space, Events, Algebra of events, Probability-Classical, Statistical and Axiomatic Approaches. Conditional Probability and Baye's Theorem Random Variables and Probability. Distributions-Discrete and Continuous. Mathematical Expectations. Binomial, Poisson and Normal Distributions.

8. Statistical Methods

Collection, Classification, tabulation and presentation of data. Measures of central value. Measures of dispersion Skewness, moments and Kurtosis. Correlation and regression.

13. MECHANICAL ENGINEERING

1. Statics

Simple application of equilibrium equations.

2. Dynamics

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

3. Theory of Machines

Simple examples of kinematics chains and their inversions. Different types of gears, bearings, governors, flywheels and their functions. Static and dynamic balancing of grid rotors. Simple vibrations analysis of bars and shafts.

4. Mechanics of Solids

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

5. Manufacturing Science

Mechanics of metal cutting, tool life, economics of machining, cutting tool materials. Basic types of machine tool and their processes. Metal forming processes and machines—shearing, drawing, spinning, rolling, forging, extrusion. Types of casting and welding methods. Powder metallurgy and processing of plastics. Corrosion control methods. Types of corrosion.

6. Manufacturing Management

Methods and time study, motion economy and work space design, operation and flow process charts. Cost estimation, break-even analysis. Location and layout of plants, material handing. Capital budgeting. Job shop and mass production, scheduling, despatching, routing inventory. Basic concepts of quality control.

7. Thermodynamics

Basic concepts, definitions and laws, heat, work and temperature scales, first law, second law and its corollaries. Analysis of air standard power cycles, carnot, otto, diesel, dual brayton cycle, refrigeration cycle-Bel/coleman. Vapour absorption and vapour compression cycle analysis, open and closed cycle gas turbine with intercooling.

reheating, energy conversion. Flow of steam through nozzles, critical pressure ratio, 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 power plants handling of nuclear waste.

8. Refrigeration and Air Conditioning

Refrigeration system, properties of an ideal refrigerant; domestic refrigerator, COP. Principles of air conditioning, psychrometric chart, comfort zones, humidification and dehumidification.

14. PHYSICS

1. Mechanics

Units and dimensions. S.I. units. Motion in one and two dimensions. Newton's laws of motion with applications. Variable mass systems, Frictional forces. Work, power and energy. Conservative and non-conservative systems. Collisions, conservation of energy. Linear and angular momenta . Rotational Kinematics. Rotational dynamics. Equilibrium or rigid bodies. Gravitation, planetary motion, artificial satellites. Surface tension and Viscosity. Fluid dynamics, streamline adturbulent motion. Bernonlli's equation with applications. Stoke's law and its application. Special theory of relativity. Lorentz transformation. Mass energy equivalence.

2. Waves and Oscillations

Simple harmonic motion. Travelling and stationary waves. Superposition of waves. Forced oscillations. Damped oscillation. Resonance, sound waves. Vibrations of air columns, strings and rods. Ultrasonic waves and their application. Doppler effect.

3. Optics

Matrix methods in paraxial optics. Thin lens formulae. Nodal planes. Systems of two thin lenses. Chromatic and Spherical averration. Optical instruments. Eyepieces. Nature and propagation of light. Interference. Division of wavefront. Division of amplitude. Simple interferometers. Diffraction-Fraunhoffer and Fresnel, Gratings, Resolving power of optical instruments. Rayleigh criterion. Polarization. Production and detection of polarised light. Rayleigh scattering. Raman scattering. Lasers and their applications.

4. Thermal Physics

Thermometry. Laws of thermodynamics. Heat. engines. Entrophy. Thermodynamic potentials and Maxwell's relations. Van derwaals' equation of State. Critical constants. Joule-Thomson effect. Phase transition. Transport phenomenon heat conduction and specific heat in solids. Kinetic Theory of Gases. Ideal Gas equation. Maxwell's velocity distribution. Equipartition of Energy. Mean free path. Brownian Motion. Black-body radition. Planck's Law.

5. Electricity and Magnetism

Electric charge Fields and potentials. Coulmob's law. Gauss Law. Capacitance. Dielectrics. Ohm's Law. Kirchoff's Laws. Magnetic field. Ampere's Law. Faraday's Law of electromagnetic induction. Lenz's Law. Alternating Currents. LCR Circuits. Series and parallel resonance. Q-factor Thermoelectric efforts and their applications. Electromagnetic waves. Motion of charged particle in electric and magnetic fields. Particle accelerators. Ved de Fraff generator. Cyclotron Betatron. Mass spectrometer. Hall effect. Dia Para and ferro magnetism.

6. Modern Physics

Bohr's Theory of Hydrogen atom Optical and X-ray spectra. Photoelectric effect. Compton effect. Wave nature of matter and wave-particle quality. Natural and artificial radioactivity, alpha, beta and gamma radiation, chain decay, nuclear fission and fusion. Elementary particles and their classification.

7. Electronics

Vacuum tubes—diode and triode, p-and n-type materials, p-n diodes and transistors. Cicuits for rectification, amplification and oscilliations. Logic gates (AND, OR, NOT).

15. POLITICAL SCIENCE & INTERNATIONAL RELATIONS

Section A (Theory and International Relations)

1. (a) The State-Sovereignty. Theories of Sovereignty.
   (b) Theories of the origin of the State (social/contract historical—evolutionary and Marxist.
   (c) Theories of the functions of the State (liberal, welfare and socialist)
   (d) Social Movements : Backward classes movement, Feminist and peasant movement, Concerns for environment.
2. (a) Concepts—Rights, Property, Liberty, Equality, Justice and Human Rights.
   (b) Democracy—Electoral process. Theories of representations. Public opinion. Freedom of speech and the role of the press. Parties and Pressure groups.
   (c) Political Theories—Liberalism. Early Socialism. Marxian Socialism, Facism and Gandhism.
   (d) Theories of development and under-devlopment. Liberal and Marxist.
3. (a) Nature, Scope and Changes : phases and structures of International Relations.
   (b) Theories of International Relations : Realism and Neo-Realism, Systems, Marxist and Critical theories.
   (c) India's Role in International Order, Non-alignment its role and relevance.
   (d) Changed contours of India's foreign policy, relations with neigbhours.

Section B (Government)

1. Constitution and constitutional government. Parliamentary and Presidential government. Federal and Unitary government. State, Local government. Cabinet Government. Bureaucracy.
2. India—
   (a) Colonialism and nationalism in India. The national liberation movement and Constitutional development.
   (b) The Indian Constitution, Fundamental Rights, Directive Principles of State Policy, Legislature, Executive, Judiciary including Judicial Review, the Rule of Law.
   (c) Federalism including Centre—State relations-its comparison with the Federalism of USA, Canada and Australia Parliamentary system in India.
   (d) Panchayati Raj and Municipal Government changing structure and role of women.
3. Challenges for Indian Political System-Communalism, regionalism, terrorism, casteism, poverty, illiteracy, population, criminalization, corruption and development.

16. PSYCHOLOGY

1. Scope of psychology.
2. Methods : Observation and sociometrics experimental methods. Fields studies. Clinical and case methods. Characteristics of method of psychology.
3. Physiological Basis : Structure and functions of the nervous system. Structure and functions of brain. Structure and functions of the endocrine system.
4. Development of Behaviour : Genetic mechanism. Environmental factors. Growth and maturation. Relevant experimental studies.
5. Perception: Meaning and nature of perception. Perceptual organisation. Perception of form, colour, depth and time. Perceptual constancy. Role of motivation, social and cultural factors in perception.

6. Learning : Meaning and nature of learning. Learning theories. Classical conditioning. Operant conditioning. Cognitive learning. Perceptual learning. Learning and maturation. Laws of learning.

7. Memory : Nature of memory, Measurement of memory. Short-term memory. Long-term memory. Forgetting, Theories of forgetting.

8. Thinking : Language and thinking. Development of thinking. Creative thinking. Language and Thought. Images. Concept formation. Problem solving. Deductive and inductive reasoning.

9. Intelligence : Nature and meaning of intelligence. Theories of intelligence. Intelligence and creativity.

10. Motivation : Needs, drives and motives. Classification of motives. Measurement of motives. Theories of motivation. Characteristics of motivated behaviour. Frustration and conflict of motives-source of frustration and types of conficts.

11. Emotion : Characteristics of emotional behaviour, Expressions of emotions. Physiological correlates of emotions. Role of nervous system and endocrine glands in emotions. Theories of emotions : James Lange, Cannon Bard and Schachter. Stress-stressors, coping with stress.

12. Personality : Nature of personality. Development of self, culture and personality. Trait and type approaches. Biological and socio-cultural determinants of personality. Personality assessment techniques and tests.

13. Attitudes : Nature of attitudes. Theories of attitudes. Measurement of attitudes. Change of attitudes, factors in attitude change.

14. Classification of Psychological Disorders. Classifying psychological disorders. Emperical approaches to classification: DSM system of classification. Recurring issues in classification.

15. Abnormal behaviour

Psychological Disorders. Concept of normalcy and abnormalcy. Causes of abnormal behaviour-biological psychological and socio-cultural. Structural aspect of Freudian theory and defence mechanism. Neurosis-symptoms, aetiology and treatment. Phobic disorder, Obsessive compulsive disorder, Anxiety disorder, Conversion disorder, Disossiative disorder. Psychosomatic disorders-hypertension and peptic ulcers. Psychotic disorders—symptoms, aetiology and treatment. Functional Psychosis-depressive disorders, manic depressive psychosis, schizophrenia. Drug abuse — alchohal, narcotics, stimulants (amphetamines), hallucinogens (LSD), marijuana (hashish). Methods of assessing abnormal behaviour.

16. Treatment of abnormalcy — psychotherapies (psychoanalysis and behaviour therapy; physical and chemotherapies). ECT Anti-psychotic drugs. Antianxiety drugs. Antidepressant drugs.

17. Miscllaneous : Applications of psychology in industry, education and community. Characteristics of leadership. Leadership training. Juvenile delinquency and criminal behaviour-causes and prevention techniques.

17. PUBLIC ANMINISTRATION

1. Introduction : Meaning, scope and significance of Public Administration; Private and Public Administration, Evolution of Public Administration as a discipline.

2. Theories and Principles of Administration : Scientific Management; Bureaucratic Model; Classical Theory; Human Relations Theory; Behavioural approach; Systems approach; The principle of Hiearchy; Unity of Command Span of Control; Authority and Responsibility; Coordination; Delegation, Supervision; Line and Staff.

3. Administrative Behaviour : Decision Making Leadership theories; Communication; Motivation.

4. Personnel Administrntion Role of Civil Service in developing society ; Position Classification Recruitment; Training; Promotion; Pay and Service condition; Neutrality and Anonymity.

5. Financial Administration : concept of Budget, Formation and execution of budget; Accounts and Audit.

6. Control over Administration : Legislative, Executive and Judicial Control, Citizen and Administration.

7. Comparative Administration : Salient Features of administrative systems in U.S.A., USSR, Great Britain and France.

The President; The Prime Minister as Real executive; Central Secretariat; Cabinet Secretariat; Planning Commission; Finance Commission; Comptroller and Auditor General of India; Major patterns of Public Enterprises.

9. Civil Service in India : Recruitment of All India and Central Service Union Public Service Comrnission; Training of IAS and IPS, Generalists and Specialist; Relations with the Polilical Executive.

10. State, District and Local Administration : Governor, Chief Minister, Secretariat; Chief Secretary; Directorates. Role of District Collector in revenue, law and order and development administration; Panchayati Raj Urban local Government; Main features Structure and problems areas.

18. SOCIOLOGY

1. Basic Concepts

Society, community, association, institution. Culture—culture change, cultural lag cultural relativism, ethnocentrism. Social Groups—primary, secondary and reference groups. Social structure, social system, social action. Status and role, role conflict role set. Norms and values—conformity and deviance. Socio-cultural processes : socialisation, assimilation integration, cooperation, competition, conflict, accommodation, relative deprivation.

2. Marriage, Family and Kinship.

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

Family : types, functions and changes.

Kinship : terms and usages, rules of residence, descent, inheritance.

3. Social Stratification.

Forms and functions. Caste and class. Jajmani system. Dominant caste. Sanskritisation.

4. Types of Society.

Tribal, agrarian, industrial and post-industrial.

5. Industrial and Urban Society

Rural -Urban Continuum Urban growth and urbanisation-town, city and metropolis. Basic features of industrial society. Impact of automation of society. Industrialisation and environment.

6. Social Demography

Population size, growth, composition and distribution in India. Components of population growth-births, deaths and migration, Causes and consequences of population growth. Population and social developmenl. Population policy.

7 Political Processes

Power, authority and legitimacy. Political socialisation. Political modernisation. Pressure groups. Caste and politics.

8. Weaker Sections and Minorities.

Social justice-equal opportunity and special opportunity. Protective discrimination Constitutional safeguards.

9. Social Change.

Theories of change. Factors of change. Science, technology and change. Social movements-peasant movement, women's movement, backward caste movement, dalit movement.

19. ZOOLOGY

1. Cell structure and function : Structure of an animal cell, nature and function of sell organelles, mitosis and meiosis, chromosomes and genes, laws of inheritance, mutation.

2. General survey and classification of non-chordates, and chordates (upto classes) of following : Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthes Annelida, Arthropoda, mollusca, Echnodermata and Chordata.

3. Structure, reproduction and life history of following types : Amoeba, Plasmodium, Paramecium, Sycon, Hydra, Obelia, Fasciola, Taenia, Ascaris, Pheretima, Cockroach, a snail Balanoglossus, an Ascidia, Amphioxus.

4. Comparative anatomy of vertebrates; Integument endoskeleton, locomotory organs, digesitive system, respiratory system, heart and circulatory system, urinogenital system and sense organs.

5. Physiology : Chemical composition of protoplasm, nature and function of enzymes, colloids and hydrogenion concentration, biological oxidation. Elementary physiology of digestion, excretion, respiration, blood, mechanism of circulation with special reference to man, nerve impulse, conduction and transmission across synaptic junction.

6. Embryology : Gametogenesis, fertilization, c1evage, gastrulation, early development and metamorphogenesis of frog. Ascidian and retrogressive metamorphosis, Neoteny development of foetal membrance in chick and mammals.

7. Evolution : Origin of life:, principles and evidences of evolution, speciation, mutation and isolation.

8. Ecology : Biotic and abiotic factors, concept of eco-system, food chain and energy flow, adaptation of aquatic and desert fauna, interspecific interaction. Factors causing environmental pollution and its prevention endangered species.

9. Economic Zoology: Beneficial and harmful insects.

SYLLABI FOR THE MAIN WRITTEN EXAMINATION

COMPULSORY SUBJECTS

1. ENGLISH AND ENGLISH ESSAY

The aim of the paper is to test the candidate's ability to read and understand serious discursive prose, and to express his ideas : clearly and correctly in English.

The pattern of questions would be broadly as follows :

English—

(i) Precis Writing

(ii) Comprehension of given passages

(iii) Essay

(iv) Usage and Vocabulary

(v) General Grammar /Composition

Essay—

Candidates will be required to write an essay on a specific topic. The choice of subjects will be given. They will be expected to keep closely to the subject of the essay to arrange their ideas in orderly fashion and to write concisely. Credit will be given for effective, and exact expression.

2. HINDI AND HINDI ESSAY

(in Devnagri script)

(i) Translation of an English passage into Hindi.

(ii) Letter/Precis writing.

(iii) Explanation of Hindi passage (prose and poetry) in the same language.

(iv) Composition (idioms, corrections etc.).

(v) Essay on a specific topic. The choice of subjects will be given.

3. GENERAL STUDIES

The nature and standard questions in these papers will be such that a well-educated person will be able to answer them withot any specialized study. The questions will be such as to test a candidate's general awareness of a variety of subject which will have relevance for a career in Civil Services.

Part-I

(a) History of Modern India and Indian Culture

The History of Modern India' will cover history of the country from about the middle of the nineteenth century and would also include questions on important personalities who shaped the freedom movement and social reforms. The part relating to 'Indian Culture' will cover all aspects of Indian culture from the ancient to modern times.

(b) Geography of India

In this part, questions will be on the physical, economic and social geography of India.

(c) Indian Polity

This part will include questions on the Constitution of India, Political system and related matters.

(d) Current National issues and topics of social relevance.

This part is intended to test the Candidate's awareness of current national issues and topics of social relevance in the present-day India, such as the following : Demography and Human Resources and related issues. Behavioural and social issues and social welfare problems, such as child labour, gender equality, adult literacy, rehabilitation of the handicapped and other deprived segments of the society, drug abuse, public health etc. Law enforcement issues, human rights, corruption in public life, communal harmony etc. Internal Security and related issues. Environmental issues, ecological preservation, conservation of natural resources and national heritage. The role of national institutions, their relevance and need for change.

Part-II

(a) India and the World

This part is intended to test candidate's awareness of India's relationship with the world in various spheres, such as the following:—

Foreign Affairs External Security and related matters. Nuclear Policy. Indian abroad

(b) Indian Economy

In this part, questions will be on the planning and economic development in India, economic and trade issues foreign trade, the role and functions of I. M. F., World Bank, W. T. O. etc.

(c) International Affairs and Institutions.

This part will include question on important events in world affairs and on international institutions.

(d) Developments in the field of science and technology, communications and space.

In this part, questions will test the candidate's awareness of the developments in the field of science and technology, communications and space and also basic ideas of computers.

(e) Statistical analysis, graphs and diagrams.

This part will include exercises to test the candidate's ability to draw common sense conclusions from information presented in statistical, graphical or diagrammatical form and to point out deficiencies, limitations or inconsistencies therein.

OPTIONAL SUBJECTS FOR MAIN WRITTEN EXAMINATION

1. AGRICULTURE

Part-I

Concepts of multiple cropping, multistorey, relay and inter-cropping, and their importance in relation to food production. Package of practices for production of important cereals, pulses, oil seeds, fibres sugar, commercial and fodder crops grown during Kharif and rabi seasons in different regions of the country. Extension, social forestry and agro-forestry. Second generation problems of green revolution and apporaches to solve these problems. Diversification and value addition in agricultural crops. W. T. O. and its impact on Indian agriculture. Sustainable agriculture.

Weeds, their characteristics, dissemination and association with various crops; their multiplications; cultural., biological and chemical control of weed. Zero tillage.

Dryland agriculture and its problems. Technology for stabilising agriculture production in rainfed agriculture area. Water-use efficiency in relation to crop production, criteria for scheduling irrigations, ways and means of reducing run-off losses of irrigation water. Methods of irrigation and drainage. Drip and sprinkler irrigation. Drainage of water-logged soils. Soil-water-plant relationship.

Types of soils in India. Soil as medium of plant growth and its composition. Mineral and organic constituents of the soil and their role in maintaining soil productivity. Chemical, physical and microbiological properties of soil. Soil colloids. Essential plant nutrients (macro and micro) and their functions. Deficiency symptoms of plant nutrients Mechanism of nutrient absorption. Problem soils-distribution and their reclamation. Principles of soil fertility. Organic manures and bio-fertilizers. Inorganic fertilizers (straight, complex and mixed). Integrated nutrient management Losses of nitrogen in soil, nitrogen-use efficiency in submerged rice soils, nitrogen fixation in soils. Fixation of P and K in soil and scope for their efficient use.

Principles of economics as applied to agriculture. Farm management-scope, importance, characteristics. Farm planning and budgeting. Types and systems of farming and factors effecting them Farm mechanization Social marketing.

Philosophy, objectives, scope and principles of extension. Early extension efforts in India. Methods of communication. Evaluation of extension programmes. CD programmes. On farm testing and frontline, demonstration.

Part-II

Cell division. Nucleic acids-structure and function, Gene and chromosome. Laws of heredity, their significance in plant breeding. Chromosomal theory of inheritance. Cytoplasmic inheritance. Qualitative and quantitative characters.

Modes of reproduction. Selfing and crossing techniques. Application of principles of plant breeding to the improvement of major field crops. Methods of breeding of self and cross pollinated crops and vegetatively propagated crops. Plant introduction. Pureline selection and mass selection. Handling of hybrid populations-bulk, pedigree, backcross and single seed descent method. Hybrid vigour and its exploitation. Heterosis breeding. Male sterility and sell incompatibility. Composites, synthetics and multiline varieties. Top cross and polycross. Apomixis. Clonal selections. Tissue culture. Interspecific and intergeneric hybridization. Breeding for disease resistance. Role of mutation and polyploidy in plant breeding. Seed production and certification.

Physiology and its significance in agriculture. Absorption and translocation of water, transpiration Photosynthesis-modem concepts and factors affecting the process. Aerobic and anaerobic respiration. C_3, C_4 and CAM mechanisms. Photoperiodism and vernalization. Auxins, hormones and other plant regulators and importance in agriculture. Dormancy.

Climatic requirements and cultivation of major fruits plants, vegetable crops and flower plants; their package of practices with scientific basis. Post harvest handling and marketing problems of fruits, flowers and vegetables. Preservation of important fruits and vegetable products. Role of fruits and vegetables in human nutrition.

Diseases and pests of fields, vegetables and fruit crops of India and measures to control them. Causes and classification of plant diseases. Principles of plant disease control. Biological control of pests and diseases. Integrated pest and disease management. Storage pests of cereals and pulses, and their management.

2. ANIMAL HUSBANDRY AND VETERINARY SCIENCE

Part-I

1. Animal Nutrition

Energy sources, energy metabolism and requirements for maintenance and production of milk, meat, eggs. Evaluation of feeds as sources of energy. Sources of protein metabolism and synthesis, protein quantity and quality in relation to requirements. Energy protein ratios in ration. Sources, functions and requirements of minerals in animal diet. Inter relationship of the basic mineral nutrients including trace elements. Vitamins, hormones and growth stimulating substances. Their sources, functions, requirements and inter relationship with minerals.

Advances in Ruminant Nutrition (Dairy Cattle) - Nutrients and their metabolism with reference to milk production and its composition. Nutrient requirements for calves, heifers, dry and milking cows and buffaloes. Limitations of various feeding systems.

Advance in Non-Ruminant Nutrition (Poultry)-Nutrients and their metabolism with reference to poultry, meat and egg production. Nutrients requirements and feed formulation and broilers at different ages.

Advances in Applied Animal Nutrition-A critical review and evaluation of feeding experiments, digestibility and balance studies. Feeding standards and measures of feed energy. Nutrition requirements for growth, maintenance and production. Balanced rations.

2. Animal Physiology

Prenatal and postnatal growth, maturation, growth curves measures of growth, factors affecting growth, conformation, body composition, meat quality.

Current status of hormonal control of mammary development, milk secretion and milk ejection. Male and female reproduction organs, their components and functions. Digestive organs and their functions.

Physiological relations and their regulation; mechanisms of adaption, environmental factors and regulatory mechanism involved in animal behaviour, methods of controlling climatic stress.

Components of semen, composition of spermatozoae, chemical and physical properties of ejaculated semen, factors affecting semen in vivo and in vitro. Factors affecting semen production and quality preservation. Detection of oestrus and time of insemination for better conception.

3. Livestock Production and Management

Comparison of dairy farming in India with advanced countries. Dairying under mixed farming and as a specialised farming, economic dairy farming. Starting of a dairy farm and factors for success of a dairy entrepreneur. Capital and land requirement, organisation of the dairy farm. Procurement of goods, opportunities in dairy farming, factors determining the efficiency of dairy animal. Herd recording, budgeting, cost of milk production, pricing policy. Personnel management. Feeding and management of animals under drought, flood and other natural calamities

4. Genetics and Animal Breeding

Mitosis and Meiosis. Mendelian inheritance. Deviations to Mendelian genetics. Expression of genes. Linkage and crossing over. Sex determination, sex influenced and sex limited characters. Blood groups and polymorphism Chromosome abberations. Gene and its structure. DNA as a genetic material. Genetic code and protein synthesis. Recombinant DNA technology. Mutations, types of mutations, methods for detecting mutations and mutation rate.

Population genetics as applied to animal breeding. Quantitative Vs. qualitative traits. Hardy Weinberg Law. Population Vs. individual. Gene and genotypic frequency. Forces changing gene frequency. Random drift and small population. Theory of path coefficient. In breeding, methods of estimating inbreeding coefficient, systems of inbreeding. Effective population size. Breeding value, estimation of breeding value, dominance and epistatic deviation. Partitioning of variation. Genotype × environment correlation and genotype × environment interaction.

Heritability, repeatability and genetic and phenotypic correlations, their methods of estimation and precision of estimates. Aids to selection and their relative merits. Individual pedigree, family and within family selection. Progeny testing. Methods of selection. Construction of selection indices and their uses. Comparative evaluation of genetic gains through various selection methods. Indirect selection and Correlated response. Inbreeding, upgrading cross-breeding and synthesis of breeds. Crossing of inbred lines for commercial production. Selection for general and specific combining ability.

Part-II

1. Health and Hygiene

Structure of cell, organells and inclusions. Cell division. Cell types. Tissues and their classification. Embryonic and adult tissues. Embryology of vertebrates with special reference to aves and domestic mammals. Gametogenesis, fertilization, germ layers, foetal membranes and placentation; types of placenta in domestic mammals.

Physiology of blood and its circulation blood constituents; properties and functions; coagulation of blood; haemorrhagic disorders; anticoagulants; blood groups; circulation; physiology of heart. Respiration-mechanism of respiration; transport and exchange of gases; neural control of respiration. Exeretion-structure and function of kidney; formation of urine. Endocrine glands-functional disorders; their symptoms and diagnosis; synthesis of hormonies, mechanism and control of secretion.

General knowledge of pharmacology and therapeutics durgs. Celluar level pharmacodynamics and phatmacokinetice. Modem concepts of anaesthesia and dissociative anaesthetics. Autocoide. Antimicrobials and principles of chemotherapy in microbial injections. Use of hormones in therapeutics. Chemotherapy of parasitic infections.

Veterinary hygiene with reference to water, air and habitation. Assessment of pollution of water, air and soil. Importance of climate in animal health. Effect of environment on animal function and performance. Housing requirements for specific categories of domestic animals viz. pregnant cows and sows, milking cows, broiler birds. Stress, strain and productivity in relation to animal habitation.

2. Animal Diseases

Pathogenesis, symptoms, post mortem lesions, diagnosis, and control of infection diseases of cattle, pigs and poultry, horses, sheep and goats. Etiology, symptoms, diagnosis, treatment of production of cattle, pig and poultry. Deficiency diseases of domestic animals and birds. Diagnosis and treatment of non-specific condition like impaction, bloat, diarrhoea, indigestion, dehydration, stroke, poisioning. Diagnosis and treatment of neurological disorders. Principles and methods of immunisation of animals against specific diseases-hard immunity, disease free zones-'zero' disease concept- chemoprophylaxis. Immunity and immunoregulation in animals - role of cytokines in protection of animals from diseases as well as role of immune response in allergic and auto immune diseases. Diagnosis and treatment of immunological of disorders and diseases of animals. Anaesthesia-local, regional and general. Pre-anesthetic medication.

3. Veterinary Public Health

Zoonoses-classification, definition, role of animals and birds in prevalence and transmission of zoonotic diseases, occupational zoonotic diseases.

Epidemiology-principle, definition of epidemiological terms, application of epidemiological measures in the study of diseases and disease control. Epidemiological features of air, water and food borne infections.

Veterinary Jurisprudence-rules and regulations for improvement of animal quality and prevention of animal diseases. State and control rules for prevention of animal and animal product borne diseases, S.P.C.A., veterolegal cases, certificates. Duties and role of veterinarian in slaughter house to provide meat that is product under ideal hygienic conditions. By-products from a slaughter houses and their economic utilization.

4. Milk and Milk Products Technology

Milk Technology-Organization of rural milk procurement collection and transport of raw milk. Quality, testing and grading raw milk. Quality storage grades of whole milk. Skimmed milk and cream. Processing, packaging, storing, distributing, marketing defects and their control and nutritive properties of the following milks: pasteurized, standardized, toned, double toned, sterilized, homogenized, reconstituted, recombined and favoured milks. Preparation of cultured milks, cultures and their management, yoghurt. Dahi, Lassi and Srikhand. Preparation of flavoured and sterilized milks. Legal standards. Sanitation requirement for clean and safe milk and for the milk plant equipment.

Milk Products Technology-Selection of raw materials, assembling, production, processing, storing, distributing and marketing of milk products.

5. Meat Hygiene

Ante mortem care and management of food animals, stunning, slaughter and dressing operations. Battoir requirements and designs. Meat inspection procedures and judgement of carcass meat cuts. Grading of carcass meat cuts. Duties and functions of veterinarians in wholesome meat production.

6. Extension

Basic philosophy, objectives, concept and principles of extension. Different methods adopted to educate farmers under rural conditions. Generation of technology, its transfer and feedbac. Problems of constraints in transfer of technology. Animal Husbandry programmes for rural development.

3. BOTANY

Part-I

1. Microbiology and Plant Pathology

Main features that characterize microbes, Bacteria: Structure and modes of nutrition and reproduction. Role of bacteria in agriculture, forestry, industry and medicine. Applications of microbiology in agriculture, industry and medicine. Nature, structure of TMV and bacteriophage. Classification of plant diseases on the basis of causal organisms and symptoms. Modes of infection and dissemination. Symptoms, causal organisms and control of late-blight of potato, black-stem rust of wheat, red-rot of sugarcane, citrus canker and Bhindi MosaicVirus.

2. Cryptogams

Algae: Economic importance of algae. Vegetative and reproductive features of *Nostoc, Volvox, Ulothrix* and *Batrachospermum*. Fungi : Economic importance of fungi. Vegetative and reproductive features of *Phytophthora, Penicillium, Agaricus, Puccinia* and *Collectorichum*. General account of Lichens.

3. Bryophytes

Main morphological features (excluding developmental details) of *Marchantia* and *Funaria*.

4. Pteriodophytes

Morphological features (excluding developmental details) of *Selaginella* and *Pteris*. Heterospory, seed habit and its significance in Selaginells.

5. Gymnosperms

Characteristic features of sporophytes and gametophytes of *Cycas* and *Pinus*.

6. Phytogeography

Concept and significance of various floristic regions of India. Endernism and endemic plants of India

7. Systematics

Concept and basis of species, genera and families. Bentham and Hooker's classification-its basis, merits and demerits. Diagnostic floral features of Compositae, Cruciferae, Graminae, Leguminosae, Malvaceae and Solanaceae

8. Anatomy

Anatomical features of monocot and dicot roots and shoots. Secondary growth in roots and shoots. Anonmalous secondary growth in Boerhaavia and Dracaena.

9. Embryology

Structure and morphology of anther, pollen and embryo sac (polygonum type). Structure of mature monocot and dieot embryo and seed.

10. Economic Botany

Morphological and economic utility of the edible parts of wheat, rice, maize, sugar-cane, groundnut, gram beans, potato, tomato, onion, banana, apple, fig and mango. Morphological nature and economic utility of coriandrum, turmeric, ginger, cardamom & cinchona. Medicinal utility of opium, *Atropa, Azadirachta, Rauwolfia* and *Cannabis*.

Part-II

1. Cytogenetics

Basic differences between prokaryotic and eukaryotic cells. Physical and chemical structure of higher plant chromosomes. Mendelism and principles of segregation and independent assortment. Gene interactions—complementary, supplementary, inhibitory, epistasis. Sex linked genes and their inheritance pattern. Sex determination in lower and higher plants. Male sterility - concept, gene-control and use. Extra chromosomal inheritance. Mutations-Concept, types (spontaneous and induced, macro and micro-mutations) and their role in evolution and crop improvement Polyploidy-concept, types (Allo- auto- eu- and aneuploidy) and role in plant evolution. Mechanism of DNA transcription and RNA translation. Gene regulation as revealed by Lac-operon Modern concept about gene structure and function.

2. Plant Breeding and Biostatistics

Methods of breeding-introduction, selection, hybridization and backcrossing. Heterosis and use in crop breeding. Malesterility. Use of apomixis in plant breeding. Transgenic crops. Brief idea about mean, mode median, standard deviation, standard error and correlations (bivariate only). Coefficient of variation (CV). Test of significance (t, chi square)

3. Physiology and Biochemistry

Ascent of sap. Transpiration. Role of light in carbon fixation and photosynthesis. Carbon fixation in C_3, C_4 CAM plants. Photorespiration. Mechanism and significance of respiration (aerobic and anaerobic). Nitrogen fixation and its genetic control. Role of micro-nutrients in plant nutrition. Role of growth regulators (auxins, gibberellins, cytokinins) in plant development, differentiation and development. Physiology of dormancy and seed germination, Photoperiodism and vernalization.

4. Plant Ecology

Environment and its factors (biotic, climatic, edaphic and physiographic) which influence plant growth and development. Ecosystem- Structure and function. A brief account of food chain, ecological pyramids, energy flow, pollution, acid-rain, global-warming. Biodiversity--concept, definition, depletion and conservation. Endangered and the threatened plants, extinction and biosphere reserves.

5. Applied Botany

Cell, organ and tissue culture- procedure and utility. Protoplast-isolation and culture (a brief account). Recombinant DNA technology- methods to produce DNA and its utility in plants. In-vitro gene transfer-agrobacterium mediated gene transfer, directgene transfer by electroporation, microinjection and biolistic methods brief accounts only). Utility of transgenic plants in agriculture, horticulture and forestery.

4. CHEMISTRY

Part-I

1. Atomic Structure : Heisenberg's uncertainty principle, Schrodinger wave equation (time independent). Particle in one-dimensional box, quantum numbers. Shapes of s,p and d orbitals.

2. Chemical bonding : Ionic bond, characteristics of ionic compounds, factors affecting stability of ionic compounds, covalent bond and its general characteristics, polarities of bonds in molecules and their dipole moments. Valence bond theory, concept of resonance and resonance energy. Molecular or bital theory (LCAO method); bonding inhomonuclear molecules; H_2, H_2 to Ne_2, Comparison of valence. bond and molecular orbital theories, bond order, bond strength and bond length.

3. Solid State: Bragg's law. X-ray diffraction by crystals. Close packing, radius ratio rules, Structures of NaCI, ZnS, CSCI,. Imperfections in crystals, Schottky and Frenkel defects, impurity defects, semi-conductors.

4. The Gaseous State : Equation of state for real gases, Maxwell's distribution of speeds.

5. Thermodynamics and Statistical Thermodynamics : Thermodynamics systems, states and processes, work, heat and internal energy first law of thermodynamics, work done in isothermal and adiabatic expanson and enthalpy changes in various processes.Hess' s Law. Second law of Thermodynamics; Entropy of perfect gas in terms of volume, temperature and pressure. Nernst Heat theorem, Third law of Thermodynamics-its purpose, Plank's formulation, Statement of Lewis and Randall. Micro and macro states; canonical ensemble and canonical partition function; electronic, rotational and vibrational partition functions.

6. Clausius-Clapeyron equation, partial molar quantities, chemical potential and Gibbs–Duham equation, variation of chemical potential with temperature and pressure.

7. Electrode potential, Standard hydrogen electrode, Electoro-chemical series and its application in determining E.M.F. of cell and feasibility of a reaction, Nernst Equation.

8. Chemical Kinetics : Concentration dependence of rate of reaction -law of mass action and rate law expression; order of reaction, integrated rate equations for first order reactions; effect of temperature on rate constant. Elementary idea about collisions and transition state theories and their comparison.

9. Photochemistry: Absorption of light; laws of photochemistry, quantum yield, decay of excited state by different routes; Fluorescence and phosphorescene.

10. Surface Phenomena and Catalysis : Adsorption from and solutions on solid adsorbents, adsorption isotherms-Langmuir and B.E. T. isotherms; determination of surface area by B .E.T.

11. Coordination Chemistry : IUPAC nomenclature, Isomerism and sterio-chemistry of complexes with coordination numbers four and six. Crystal field Theory-Factors effecting Crystal field splitting, John Teller effect .

12. Chemistry of d block elements : Transition metals including Lanthanides - General characteristic properties oxidation states, magnetic behaviour, colour etc. Lanthanide contractions, its cause and consequences.

Part-II

1. (a) Reaction mechanisms : Kinetic versus Thermodynamic control, Hammond's Postulate, Method of determining reaction mechanism- isotope effect, solvent effect, catalysis and steric effect, Potential energy diagram transition state and Intermediates.

(b) Reactive intermediates : Strutcture and stability of carbocations, carbanians, carbenes and free radicals. 2. Substitution reactions: Nucleophilic substitution first order and second order (SNI and SN2) reactions, stereochemistry of these reactions and their comparision. Mechanism of Rearrangements: Pinacol-pinacolone, Beckmann, Claisen, Cope and fries rearrangement.

3. Chemistry and mechanism of reactions : Aldol condesation, Claisen condensation, Perkin, Knoevenagel, Wittig. Canizzaro and bonzoin condensations, Sandmeyer, Reimer-Tiemann and Reformatsky reactions.

4. Polymeric Systems: (a) Physical chemistry of polymers :- number and weight average molecular weights of polymers. Determination of molecular weights by sedimentation, osmotic presure, viscosity. (b)Preparation and properties of polymers: Organic polymers-polythylene, polystyrene, polyvinyl chloride, Teflon, nylon, terylene, synthetic and natural rubber.

5. Principles of spectroscopy and applications in structure elucidation : (a) Rotational spectra-diatomic molecules; isotopic substitution and rotational constants. (b) Vibrational spectra-diatomic molecule; linear triatornic molecules. (c) Electronic spectra:- Singlet and triplet states, $n \rightarrow \pi$ and $\pi \rightarrow \pi$ transitions; application to conjugated double bonds and conjugated carbonyls- Woodward-Fieser rules. (d) Nuclear magnetic resonance: chemical shift and coupling constants; Application of H NMR to simple organic molecules.

5. CIVIL ENGINEERING

Part-I

1. Engineering Mechanics

Units and dimensions, SI Units. Vectors.concept of force. Concept of particle and rigid body. Concurrent, Non Concurrent and parallel forces in a plane. Moment of force, Free body diagram. Conditions of equilibrium. Principle of virtual work. Equivalent force system. First and Second Moment of area. Mass moment of inertia. Static Friction, Inclined Plane and bearings, Kinematics and Kinetics. Motion under uniform and non-uniform acceleration, motion under gravity. Kinetics of partice : momentum and energy principles, collision of elastic bodies, rotation of rigid bodies.

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, Strain Energy in direct stress, bending and shear.

Deflection of beams: Mecaulay's method, Mohr's Moment area method. Conjugate beam method, unit load method. Torsion of shafts, 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.

3. Structural Analysis

Castiglianio's theorems I and II. Unit load method, method of consistent deformation applied to beams and pin Jointed trusses, Slope-deflection, moment distribution, indeterminate beams and rigid frames.

Rolling loads and Influences lines : Influences lines for shear force and bending moment at a section of a beam criteria for maximum shear force and bending moment in beams traversed by a system of moving loads. Influences lines for simply supported plane pin jointed trusses. Arches: Three hinged; rib shortening and temperature effects, influence lines in arches.

Force method and displacement method of analysis of indeterminate beams and rigid frames.

Plastic Analysis of beams and frames : Theory of plastic bending, plastic analysis, statical method, Mechanism method. Unsymmetrical bending: Moment of inertia, product of inertia, position of Neutral Axis and Principal Axes, calculation of bending stresses.

4. Design of Structures

Structural steel : Factors of safety and load factors. Rivetted, bolted and welded joints and connections. Design of tension and compression members, beams of built up section, rivetted and welded plate girders, stancheons with battens and lacings.

Design of concrete and masonry structures. Concept of mix design. Reinforced Concrete: Working Stress and Limit State method of design - Recommendations of I.S. codes, design of one way and two way slabs, simple and continuous beams of rectangular, T and L sections. Compression members under direct load with or without eccentricity, Isolated and combined footings. Cantilever and Counterfort type retaining walls.

Prestressed Concrete: Methods and systems of prestressing, anchorages, Analysis and design of sections for flexure based on working stress, loss of prestress.

5. Fluid Mechanics

Fluid properties and their role fluid motion, fluid statics including forces acting on plane and curve surfaces.

Kinematics and Dynamics of Fluid flow; Velocity and accelerations, stream lines, equation of continuity, irrotational and rotational flow, velocity potential and stream functions, flownet, methods of drawing flow net, flow separation, free and forced votices. Control volume equation, continuity, momentum, energy and moment of momentum equations from control volume equation, Navier·Stokes equation, Euler's equation of motion, application to fluid flow problems, pipe flow, plane, curved, stationary and moving vanes, orifice meters and Venturi meters. Dimensional Analysis and Similitudes; Buckingham's Pi-theorem, dimensionless parameters, similitude theory.

Laminar Flow: Laminar flow between parallel, plates, flow through tube.

Boundary layer: Laminar and turbulent boundary layer on a flat plate, laminar sublayer, smooth and rough boundaries.

Turbulent flow through pipes; Characteristics of turbulent flow, velocity distribution and variation of pipe friction factor, hydraulic grade line and total energy line.

6. Open Channel flow

Uniform and non-uniform flows, momentum and energy correction factors, specific energy and specific force critical depth, flow in contractions, flow at sudden drop, hydraulic jump and its applications surges and waves; gradually varied flow, classification surface profiles, control section.

7. Geo-technical Engineering

Types of soil, 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, Darey's Law, factors affecting permeability, determination of permeability, permeability of stratified soil deposits. Seepage pressure, quick sand condition, compressibility and consolidation. Terzaghi's theory one dimensional consolidation, consolidation test. Compaction of soil, field control of composition, Total stress and effective stress parameters, pore pressure coefficients. Shear strength of soils, Mohr Coulomb failure theory, Shear tests. Earth pressure at rest, active and passive pressures, Rankine's theory, Coulomb'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. Stability of slope, Total Stress and Effective Stress methods, Conventional methods of slices, stability number. Subsurface exploration, methods of boring, sampling, penetration tests. Essential features of foundation, types of foundation, design criteria, choice of type of foundation, stress distribution in soils, Boussinessq's theory, Newmarks' chart, pressure bulb, contact pressure, applicability of different bearing capacity theories, evaluation of bearing capacity from field tests, allowable bearing capacity, Settlement analysis, allowable steelement. Proportioning of footing, isolated and combined footings, rafts footing, Pile foundation, types of piles, pile capacity, static and dynamic analysis, design of pile groups, pile load test, settlement of piles, lateral capacity. Ground improvement techniques-preloading, sand drains, stone column, grouting, soil stabilisation.

Part-II

1. Construction technology

Engineering Materials

Physical properties of construction materials : Stones, Bricks and Tiles; Lime, cement and Surkhi Mortars; Lime Concrete and Cement Concrete. Properties of freshly mixed and hardened concrete, Flooring Tiles, use of ferrocement, fibre-reinforced and polymer concrete, high strength concrete and light weight concrete. Timber; Properties and uses; defects in timber, seasoning and preservation of timber. Plastics, rubber and damp-proofing materials, termite profiting, Materials for Low cost housing.

Construction : Building components and their functions; brick masonry; bonds; jointing; stone masonry. Design of brick masonry walls as per I.S. codes, factors of safety, plastering, pointing, Types of floors and roofs.

2. Construction Equipment

Factors affecting the selection of equipment, study, capital and maintenance cost. Concreting equipments:

Weigh batcher, mixer, vibration, batching plant, concrete pump. Earth-work equipments: Power shovel, hoe, bulldozer, dumper, trailors and tractors, rollers, sheep foot roller.

3. Construction Planning and Management

Construction activity, schedules, job layout, bar charts, organization of contracting firms, newwork analysis; CPM and PERT analysis, Float Time, crashing of activities, contraction of network for cost optimization, cost analysis, floats, slack time, numbering of network, probability of completing the project.

4. Survey

Common methods of distance and angle measurements, compass traversing, plane table survey, levelling. travelling, traverse survey, triangulation survey, balancing of traverse, contouring, topographical map. Technometry. Circular and transition curves.

5. Transportation Engineering

Railways: Permanent way, sleepers, rail fastenings, ballast, points and crossings, design of turn outs, stations and yards, signals and interlocking, levelcrossing. Construction and maintenance of permanent ways; Superelevation, creep of rail, ruling gradient, track resistance, tractive effort.

Highway Engineering: Principles of highway planning, Highway alignments, Geometrical design: Cross section, camber, superelevation, horizontal and vertical curves. Classification of roads; low cost roads flexible pavements, rigid pavements. Design of pavements and their construction, Drainage of roads: Surface and sub-surface drainage. Traffic Engineering: Forecasting techniques, origin and destination survey, highway capacity. Channelised and unchannelised intersections, rotary design elements markings, signs, signals, street lighting; Traffic surveys.

6. Hydrology

Hydrological cycle, precipitation, evaporation, transpiration, despression storage, infiltration, overland flow, hydrograph. Ground water flow: Specific yield, storage coefficient of permeability, confined and unconfined aquifers,

aquitards, radial flow into a well under confined and unconfined conditions, tube walls, pumping and recuperation tests ground water potential

7. Irrigation Engineering

Water requirements of crops : consumptive-use, quality of water for irrigation, duty and delta, irrigation methods and their efficiencies. Canals: Distribution systems for canal irrigation, canal capacity, canal losses, most efficient section, lined canals, their design, regime theory, critical shear stress, bed load, local and suspended load transport. Water logging: causes and control, drainage system design, salinity. Canal structures: Khosla's theory, energy dissipation, stilling basin, sediment excluders. Spillways: Spillway types, crest gates, energy dissipation. River training: Objectives of river training, methods of river training.

8. Environment 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, waterborne diseases, standards for potable water. Intake of water: Pumping and gravity schemes, water treatment; principles of coagulation, flocculation and sedimentation; Slow- rapid- pressure filters; chlorination, softening, removal of taste, adour and salinity. Analysis of distribution systems.

Sewerage systems: Domestic and industrial wastes, store sewerage-separate and combined system, flow through sewers, design of sewers. 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, chambers, sedimentation tank trickling filters, oxidation ponds, activated sludge process, septic tank, disposal of sludge.

6. COMMERCE & ACCOUNTANCY

Part-I : Accounting and Finance

1. Financing Accounting

Accounting as a financial information system. Impact of behavioural sciences. Advanced problems of company accounts. Amalgamations, absorption and reconstruction of companies. Valuation of shares and goodwill.

2. Cost Accounting

Nature and functions of cost accounting. Job costing. Process costing. Marginal costing. Techniques of segregating semi variable costs into fixed and variable costs. Cost-volume-profit relationship. Aid to decision making including pricing decisions, shutdown etc. Techniques of cost control and cost reduction. Budgetary control, flexible budgets. Standard costing and variance analysis. Responsibility accounting, investment, profit and cost centres.

3. Taxation

Definitions. Basis of charge. Incomes which do not form part of total income. Simple problems of computation of income under various heads, i.e. salaries, income from house property, profits and gains from business of profession, capital gains, income of other persons included in assessee's total income. Aggregation of income and set off/carry forward of loss. Deductions to be made in computing total income.

4. Auditing

Meaning and objects of auditing. Internal check and internal audit. Audit of cash transactions, expenses, incomes, purchases, sales. Valuation and verification of assets with special reference to fixed assets, stocks and debts. Verification of liabilities. Audit of limited Companies. Appointment, removal, powers, duties and liabilities of a company auditor. Auditor's report and qualifications therein. Board outlines of company audit with reference to share capital transactions and statutory report. Audit of Govt. Companies under sec. 619 of the Companies Act. Cost audit under sec. 233 (B) of the Companies Act. Special points in the audit of different organisations like clubs, hospitals, colleges, charitable societies.

5. Business Finance and Financial Institutions

Finance function. Nature, scope and objectives of financial management. Risk and return relationship. Financial

analysis as a diagnostic tool. Management of working capital and its components. Forecasting working capital needs, inventory, debtors, cash and credit management. Investment decisions. Nature and scope of capital budgeting. Various types of decisions including make or buy and lease or buy. Techniques of appraisal and their application. Analysis of non-financial aspects. Rate of return on investments. Required rate of return. Its measurement. Cost of Capital. Weighted average cost. Different weights. Concept of valuation of firm's fixed income; securities and common stocks. Dividends and retention policy-residual. Actual practices. Capital structure, leverages, significance of leverages, theories of capital structure. Planning the capital structure of a company. EBIT-EPS Analysis Cashflow ability to service debt, capital structure ratios, other methods. Raising finance (short term and long terms). Bank finance (norms and conditions). Money markets. The purposes of money markets. Money markets in India Organisation and working of capital markets in India. Organisation structure and role of financial institutions in India. Banks and investing institutions. National and international financial institutions. Supervision and regulation of banks. Monetary and credit policy of Reserve Bank of India. Provisions of the Negotiable Instruments Act, 1881 relating to crossings and endorsements with particular reference to statutory protection to the paying and collection bankers. Salient provision of the Banking Regulation Act, 1949 with regard to chartering, supervision and regulation of banks.

Part II : Organisation Theory and Industrial Relations

1. Organisation Theory

Nature and concept of organisation. Organisation goals. Primary and secondary goals, single and multiple goals, ends means chain-displacement, succession, expension and multiplication of goals. Formal organisation- type, structure, line and staff. Informal organisation–functions and limitations. Evolution of organisation theory: Classical, neoclassical and system approach. Organisation behaviour as a dynamic system. Technical, social and power system. Interrelations and interactions. Perception. Status system. Theoretical and emperical foundation of theories and models of motivation. Moral and productivity. Leadership. Theories and styles. Management of conflicts in organisations. Limits or rationality. Organisational change, adaptation, growth and development. Professional management Vs. family management. Organisation control and effectiveness.

2. Industrial Relations

Nature and scope of industrial relations the socio economic setup, need for positive approach. Industrial labour in India and its commitment–stages of commitments. Migratory nature–merits and shortcomings. Theories of Unionism. Trade Union movements in India—origin, growth and structure. Attitude an approach of management in India—recognisation. Problems before Indian Trade Union movement. Sources of industrial disputes -Strikes and lockouts. Compulsory adjudication and collective bargaining–approaches. Workers participation in management–philosophy, rationale. Present day state of affairs and future prospects. Prevention and settlement of industrial disputes in India. Industrial relations in public enterprises. Absenteeism and labour turnover in Indian industries-causes. Relative wages and wage differentials. Wage policy in India. The Bonus issue International Labour Organisation and India. Role of personal department in the organisation.

7. ECONOMICS

Part–I

1. Micro Economic Analysis

Concept of equilibrium. Law of demand. Marshallian utility and indifference curve analysis and their comparisons. Concept of consumer surplus. Elasticity of demand. Income elasticity. Theory of production. Production function and technological progress. Law of Returns to Scale. Law of variable proportions. Isocost and Isoquants. Theory of cost. Concept of opportunity cost. Cost curves. Perfect competition. Price determination. Equilibrium of firm and industry in market period. Supply curves. Monopoly. Equilibrium of the monopolist. Comparison of perfect competition and monopoly. Price discrimination. Equilibrium in discriminating monopoly and effects of price discrimination. Monopolistic competition. Demand curves. Firm and group equilibrium. Determination of equilibrium level. Comparison with pure competition and monopoly. Theory of marginal productivity. Theories of wage determination. Modern theory of rent. Theories of interest, classical, neo-classical and liquidity preference. Gross and

net profit.

Ricardian, Marshallian. Types of Markets and price determination. Alternate theories of distribution.

2. Nature, types and functions of money. Measurement of price level changes. Monetary standards. High powered money and quantity theory of money, its variants and critiques thereof. Demand for and supply of money. The moneymultiplier. Theory of money (Fishers, Cambridge and Keynes version). Theories of determination of interest rate. Interest and prices. Theories of inflation and control of inflation.

3. Full employment and Say's Law. Under employment equilibrium. Keynes's theory of employment (and income) determination. Critiques of Keynesian theory. Applicability of Keynesian approach to developing countries. Wage and employment - classical and Keyne' s views.

4. Functions of Central Bank, Process of credit creation, Credit control - types and effects, structure of money markets and capital markets in developing countries like India.

5. Public finance and its role in market economy in stabilisation, supply, stability, allocative, efficiency, distribution and development. Sources of revenue. Forms of taxes and subsidies, their incidence and effects. Limits to taxation, loans. Crowding-out effects. Limits to borrowings. Types of budget deficits. Public expenditure and its effects.

6. International Economics :

(i) Old and new theories of international trade. (a) Comparative advantage, terms of trade and offer curve. (b) "Trade as an engine of growth" and theories of under development in an open economy.

(ii) Forms of protection.

(iii) Balance of payments, composition, disequilibria, types, remedies for adverse balance of payments, fixed versus floating rates.

(iv) IMF and the World Bank; W.T.O.

7. Growth and Development :

(i) Theories of growth : Classical and neo-classical theories. The Harrod model. Economic development under surplus labour, Wage-goods as a constraint on growth. Relative importance of physical and human capitals in growth. Innovations and development. Productivity, its growth and source of changes thereof. Factors determining savings to income ratio and the capital-output ratio.

(ii) Main features of growth : Changes in sectoral compositions of income. Changes in occupational distribution. Changes in income distribution. Changes in consumption levels and patterns. Changes in savings and investment and in patterns of investments. Case for and against industrialization. Significance of agriculture in developing countries.

(iii) Relation between state planning and growth. Changing roles of market and plans in growth. Economic policy and growth.

(iv) Role of foreign capital and technology in growth. The significance of multi-nationals.

(v) Welfare indicators and measures of growth. Human development indices. The basic needs approach.

Part-II

1. Indian Economics in Past : Independence Era - Contribution of Vakil, Gadgil and Rao. National and percapita Income, patterns, trends, aggregate and sectoral. Composition and change therein.

2. Employment : Nature and types of unemployment in developing countries. Factors determining employment in short and longperiods. Role of capital, wages-goods, wage-rate and technology. Measures of unemployment. Relation between income poverty and employment and issues of distribution and social justice. Agricultural development in India since 1951. Agriculture institutional set-up of land system, size of agricultural holdings and efficiency. Green revolution and technological changes. Agricultural price and terms of trade. Role of public distribution and farm subsidies on agricultural prices. Employment and poverty in agriculture. Employment schemes. Growth experience. Land reforms. Regional disparities in agricultural growth. Role of Agriculture in export. IRDP.

3. Industry : Industrial development in India since 1951 and industrial policy. Industrial system of India.

Trends in composition and growth. Role of public and private sectors. Role of small and cottage industries. Indian Industrial strategy. Capital versus consumer goods.Wage goods versus luxuries. Capital intensive versus labour. Intensive techniques. Import substituting versus export promotions. Sickness and high cost Industrial policies and their effects. Recent moves for liberalisation and their effects of Indian industry.

4. Money and Banking : The munetary institutions of India. Instruments of credit control. Factors determining demand for and supply of money. Sources of reserve money. Money multipliers. Techniques of money supply regulation under open economy. Functioning of money market in India. Budget deficits and money supply.

5. Index numbers of price level : Course of price level in post—Independence period. Sources and causes of inflation. Role of monetary and supply factors in price level determination. Policies towards control of inflation. Role of monetary and supply factors in price level determination. Policies towards control of inflation. Effects of inflation under open economy.

6. Trade balance of payments and exchange : Foreign trade of India. Composition and direction. Shifts in trade policy from import substitution to export promotion. Balance of payment problem and policies to cure it. Impact of liberalisation on pattern of trade. India's external borrowings and the debt problem. Exchange rate of the rupee, devaluations, depreciations and their effects on balance of payments. Rupee in an open economy. Integration of Indian economy with world economy. India and the WTO.

7. Public Finance and Fiscal policy : Characteristics and trends in India's public finance. Tax structure in India-drawbacks and remedies. Effect of taxation. Taxable capacity. Role of taxes (direct and indirect) and subsidies. Fiscal and monetary deficits. Public expenditures and their significance. Public finance and inflation. Public debt - its role and burden. Limiting government's debt. Recent fiscal policies and their effects. Sources of income and heads of expenditure of the Centre and State Govts. Center-State financial relations. Latest Finance Commission Report. Deficit financing in Protection of consumer interests in India-meaning, significance and implications.

8. Economic Planning in India : Trends in savings and investment. Trends in saving income and capital.

Output ratios. Growth versus distribution. Transition from central planning to indicative planning. Relation between market and plan. Strategies for growth, social justice and plans. Planning and increasing the growth rate. Features and strategies of economic planning in India. A critical review of our planned development since 1951. Outlines of the current Five Year Plan. India's population problem and policy to control it.

8. ELECTRICAL ENGINEERING

Part-I

1. Electrical Circuits-Theory and Applications

Circuit components; network graphs, KCL, KVL; Circuit analysis methods; nodal analysis, mesh analysis; basic network theorems and applications; transient analysis: RL, RC and RLC circuits; 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, Elements of networks synthesis. Filter-theory: design and applications. Active filters. Circuit simulation.

2. Signals & Systems

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

3. E.M. Theory

Maxwell's equations, wave propagation in bounded media, Boundary conditions, reflection and refraction of plane waves. Transmission lines: Distributed parameter circuits, travelling and standing waves, impedance matching,

4. Analog Electronics

Characteristics and equivalent circuits (large and small-signals) of Diode, BJT, JFET and MOSFET. Diode circuits: Clipping, clamping, rectifier. Biasing and bias stability. FET amplifiers. Amplifiers; single and multistage, differential, operational, feedback and power. Analysis of amplifires frequency-response of amplifiers. Oscillators; criterion for oscillation. Power supplies.

5. Digital Electronics

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

6. Energy Conversion

Principles of electromechanical energy conversion: Torque and emf in rotating machines. DC machines; characteristics and performmnce analysis; starting and speed control of motors. Transformers: Principles of operation and analysis; regulation, efficiency; 3-phase transformers, 3-phase induction machines and synchronous machines; characteristics and perfomance analysis; speed contro1. Special machines: Stepper motors, brushless dc motors, permanent magnet motors, single-phase: motors; FHP.

7. Power Electronic and Electric Drives

Semiconductor power devices : diode, transistor, thyristor, triac, GTO and MOSFET -static characteristics and principles of operation; triggering circuits; phase control rectifiers; bridge converters; fully-controlled and half-controlled; principles of thyristor choppers and inverters; basic concepts; of speed control of dc motor drives.

8. Analog Communication

Signal to noise ratio. Amplitude modulation; DSB, DSB-SC and SSB. Modulators and Demodulators; Phase and Frequency modulation: PM & FM signals; narrows and FM; generation & detection of FM and PM. Superhetrodyne receivers, AM receivers, communication receivers, FM receivers. Signal to noise ratio calculation for AM and FM receivers.

Part-II

1. Control Systems

Elements of control systems, block-diagram representations; open-loop & closed-loop system; principles and applications of feed-back. LTI systems; time-domain and transform-domain analysis. Stability; Routh Hurwitz criterion, root-loci, Nyquist's criterion, Bode-plots, Design of lead-lag compensators Proportional. State-variable representations and analysis of control systems. Principles of discrete-control systems.

2. Electrical Engineering Materials

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

3. Microprocessor and Microcomputers

8-bit microprocessor; architecture, CPU, module design, memory interfacing, I/O, peripheral controllers.

4. Measurement and Instrumentation

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

5. Power Systems; Analysis and Control

Steady-state performance of overhead transmission lines and cables; principles of active and reactive power transfer and distribution; per-unit quantities; bus admittance and impedance matrices; load flow; volatage control and power factor correction; economic operation; symmetrical components, analysis of symmetrical and unsymmetrical faults. Concepts of system stability; swing curves and equal area criterion. Static VAR system Basic concepts of HVDC transmission. Active power control. Frequency control. Economic dispatch.

6. Power System Protection

Principles of over, current, differential and distance protection. Concept of solid state relays. Circuit brakers Computer aided protection; introduction; line, bus, generator, transformer protection; numeric relays.

7. Non-conventional Energy Sources and Energy Management Introduction to the energy problem; difficulties with conventional energy sources. Wind-Energy; Basics of Wind turbine aerodynamics; wind-energy conversion systems

and their integration into electrical grid. Solar-Energy: Thermal conversion photo-voltaic conversion. Wave-energy. Importance of Energy Management: Energy audit; energy economics; discount rate, payback period, internal rate of return, life cycle costing.

9. ENGLISH LITERATURE

The Syllabus consists of two parts designed to test a first hand and critical reading of texts prescribed from the following periods in English Literature; Part I: 1600-1900 and Part II : 1900-1990.

Part-I

Texts for detailed study are listed below. Candidates will also be required to show adequate knowledge of the following topics and movements: Metaphysical Poetry; The Epic and the Mock-epic. The Romantic Movement; The Rise of the Novel; The Victorian Age.

Section (A)

1. William Shakespeare : King Lear and The Tempest.
2. John Donne. The following poems:
   —Canonization.
   — Death be not proud.
   —The Good Morrow.
   —On his Mistress going to bed.
3. John Milton: Paradise Lost I
4. Alexander Pope. The Rape of the Lock.
5. WilliamWordsworth; The following poems.
   —Ode on Intimations of Immortality.
   —Tintern abbey.
   —Three years she grew in Sun and Shower
   —She dwelt among the untrodden ways.
   —Michael.
   —Resolution and Independence.
   —The World is too much with us.
   —Upon Westminster Bridge.
6. Alfred Tennyson : In Memoriam

Section (B)

1. Jane Austen. Pride and Prejudice.
2. Henry Fielding. Tom Jones.
3. Charles Dickens. Hard Times.
4. George Eliot. The Mill on the Floss.
5. Thomas Hardy. Tess of the d'Urbervilles.

Part-II

Texts for detailed study are listed below. Candidates will also be required to show adequate knowledge of the following topics and movements.

Modernism The stream-of-consciousness Novel; Indian Writing in English; Marxist.

Section-(A)

1. William Butler yeats. The following poems :
   —Easter 1916.
   —The Second Coming.
   —A Prayer for my daughter.
   —Sailing to Byzantium.

—The Tower Among School Children.

—Leda and the Swan.

—Meru.

—The Second Coming.

2. T. S. Eliot. The following poems :

—The Love Song of J.Alfred Prufrock.

—Journey of the Magi.

3. W.H. Auden. The following poems :

—Partition.

—Musee des Beaux Arts

—In Memory of W.B. Yeats .

—Lay your sleeping head, my love

—The Unknown Citizen.

—Consider.

—The Shielf of Achilles

—September 1, 1939.

—Petition.

4. Philip Larkin. The following poems :

—Next

—Please

—Deceptions

—Afternoons

(All these poems are available in the anthology Ten twentieth Century Indian Poets, edited by R. Parthasarthy, published by Oxford University Press, New Delhi).

Section (B)

1. D.H. Lawrence. Sons and Lovers.
2. E.M. Forster. A Passage to India.
3. Virginia Woolf. Mrs. Dalloway.
4. Raja Rao. Kanthapura.

10. GEOGRAPHY

Part-I

1. Physical Geography

(i) Geomorophology : Origin and evolution of the earth's crusts. Earth movements. Endogenic and exogenic forces, Physical condition of earth's interior. Geosynclines. Continental drift. Isostasy. Plate tectonics. Mountain building. Volcanicity. Earthquakes. Concepts of geomorphic cycles. Weathering and erosion. Cycle of erosion. Landforms associated with fluvial. arid. glacial. coastal and karst.

(ii) Climatology : Temperature and pressure belts of the world. Insolation and heat budget of the earth. Planetary and local winds. Monsoons and jet streams. Air masses and fronts. Temperate and tropical cyclones. Types and distribution of precipitaton. Koppen's and Thornthwaite's classification of world climate. Hydrological cycle.

(iii) Oceanography : Relief of ocean floors. Temperature and salinity of the oceans. Nature, classification and world distribution of ocean deposits. Ocean currents and tides. Marine resources-biotic, mineral and energy resources. Coral reefs and atolls.

(iv) Biogeography : Gensis of soils. Classification and distribution of soils. Soil profiie. Soil erosion and conservation. Problems of deforestation and conservation measures. Social forestry, agro-forestry. Environmental degradation and conservation. Ecosystems and their management. Global warming. Reduction in bio-diversity and depletion of forests.

2. Human Geography

(i) Economic Geography : World agriculture-typology of agricultural regions. Agricultural inputs and productivity. Food and nutritions problems. Famine-causes, effects and remedies. Green revolution—its nature and consequences for the third world countries. Second generation problems of green revolution and approaches to solve these problems. Diversification in agriculture. W. T.O. and its impact on Indian agriculture. Factors affecting agricultural location. A critical appraisal of Von Thumen's theory of agricultural location. Major sectors of economic activity (primary, secondary and tertiary). A detailed discussion of their nature and basic principles. Transporation as a factor in the choice and location of economic activities. Ullman's model of spatial interaction. Factors affecting industrial location (with special reference to precurement and distribution costs). A critical appreciation of Weber's theory of industrial location. Trends in location and distribution of the following industries: iron and steel, cotton textiles, automobiles, petrolium refineries, aluminium, Major industrial regions of the world.

(ii) Population and settlement Geography : Growth and distribution of world population, Causes and consequences of migration. World population problems. Types and patterns of rural settlements. Hierachy of urban settlements. Concept of primate city and rank-size rule. Functional classification of towns. Sphere of urban influence. Rural-urban fringe. Satellite towns. Problems of urbanisation. Spatial organisation of settlements with an introduction to the Charistaller's central place theory.

Part-II

1. Geography of India

(i) Physical Setting : Structure and relief. Mechanism of Indian monsoons. Tropical cyclones and their consequences and western disturbances. Floods and droughts. Climatic regions. Natural vegetation, soil types and their distributions.

(ii) Resources : Fishries, Surface and ground water. Production and future prospects of energy resources. Energy crisis. Minerals (iron ore, manganese, mica). Biotic resources, their distribution, utilisation and conservation.

(iii) Agriculture : Infrastructure-irrigation, seeds, fertilizers, power. Institutional factors-land holldings, land tenure and land reforms. Agricultural productivity, agricultural intensity, crop combination, land capability. Agro-and social-forestry. Green revolution and its socio-economic and ecological implications. Significance of dry farming. Livestock resources and white revolution. A detailed study of the distribution and production of wheat, rice, sugarcane, cotton and tea. Regional imbalance in levels of agricultural development.

(iv) Industry and transport: Evolution of industries. Locational factors of cotton textiles, sugar, jute, Iron and steel, fertiliser, paper and automobile industries. Industrial complexes and industrial regionlisation. New industrial policy. Multinationals and liberalisation. Road, railway, inland waterway, airway networks and their complementary roles in regional development. Growing importance of ports on national and foreign trade. Trade balance. Free trade and export promotion zones. Developments in commnunication technology and its impact on economy and society.

(v) Cultural Setting : Major tribes and their problems. Growth, distribution and density of population. Demographic attributes-sex-ratio, age structure, literacy rate, work-force, dependency ratio, fertility and mortality and longevity. Migration (inter-regional, intra-regional and international, rural-urban migration) and associated problems, population problems and policies.

(vi) Settlements : Types, patterns and morphology of rural settlements, Urban development. Morphology of Indian cities. Functional classification of Indian cities, conurbations and metropolitan regions. Urban sprawl, slums and associated problems. Town planning. Problems of urbanisation.

(vii) Regional Planning : Five Year Plans. Integrated rural development programmes. Panchayati Raj and decentralised planning. Command area development. Watershed management. Planning for backward area, desert, drought-prone, Hill travel area development.

(viii) Contemporary Issues : Environmental hazards-landslides, earthquakes, epidemics. Issues related to environmental pollution. Population explosion and food security. Environmental degradation. Problems of agrarian and industrial unrest. Regional disparities in economic development. Concept of sustainable growth and development. International boundary of India and related issues. Disputes on sharing of water resources. India and geopolitics of

Indian Ocean.

11. HINDI LITERATURE (IN DEVNAGRI SCRIPT)

Part-I

1. History of Hindi Language and Nagari Lipi.

1. Grammatical and applied forms of Apbhransh, Swahatta & Arambhik Hindi.
2. Development of Braj and Awadhi as Literary languages during medieval period.
3. Early form of Khari-boli in Siddha-Nath Sahitya, Khusro, Sant Sahitya, Rahim etc. and Dakhni Hindi.
4. Development of Khari-boli and Nagari Lipi during the 19th Century.
5. Standardisation of Hindi Bhasha & Nagari Lipi.
6. Development of Hindi as a National Language during freedom movement.
7. The development of Hindi as a National Language of Union of India.
8. Scientific and Technical development of Hindi Language.
9. Prominent dialects of Hindi and their interrelationship.
10. Salient features of Nagari Lipi and the efforts for its reform & Structure of Standard Hindi.
11. Grammatical structure of standard Hindi.

2. History of Hindi Literature

I. The relevance and importance of Hindi literature and tradition of writing History of Hindi Literature.

II. Literary trends of the following four periods of history of Hindi Literature.

A. Adikal-Sidh, Nath and Raso Sahitya. Prominent poets- Vidyapati, Hemchandra, Chandravardai, Khusro.

B. Bhaktikal-Sant Kavyadhara, Sufi Kavyadhara, Krishna Bhaktidhara and Ram Bhaktidhara. Prominent Poets-Kabir, Jayasi, Tulsi & Sur.

C. Ritikal- Ritibaddhkavya & Riti Mukta Kavya. Prominent Poets-Keshav, Padmakar, Bihari Ghananand.

D. Adhunik Kal-

(i) Renaissance, the development of Prose, Bharatendu Mandal and its contribution.

(ii) Prominent writers-Bharatendu, Bal Krishna Bhatt & Pratap Narain Mishra.

(iii) Prominent trends of modern Hindi Poetry : Chhayavad, Pragativad, Prayogvad, Navgeet and Contemporary poetry and Janvadi Kavita.

Prominent Poets—Maithili Sharan Gupt, Prasad, Nirala, Mahadevi, Dinkar, Agyeya, Muktibodh, Nagarjun.

III. Katha Sahitya

A. Upanyas and Realism.

B. The origin and development of Hindi Novels.

C. Prominent Novelists-Premchand, Jainendra, Yashpal, Renu and Bhism Sahani.

D. The origin and development of Hindi short story.

E. Prominent Short Story Writers-Premchand, Prasad, Agyeya, Mohan Rakesh and Krishna Sobti.

IV. Drama and Theatre

A. The origin and Development of Hindi Drama.

B. Prominent Dramatists-Bharatendu, Prasad, Jagdish Chandra Mathur, Ram Kumar Verma, Mohan Rakesh.

C. The Development of Hindi Theatre.

V. Criticism

A. The origin and development of Hindi Criticism: Saiddhantik, Vyavharik, Pragativadi, Manovishleshanvadi and Nai Alochana.

B. Prominent critics-Ramchandra Shukla, Hazari Prasad Dwivedi, Ram Vilas Sharma and Nagendra.

VI. The other forms of Hindi prose-Lalit Nibandh, Rekhachitra, Sansmaran Yatra-vrittant.

Part-II

First hand reading of the following texts to test the critical ability of the candidates :—

1. Kabir : Kabir Granthawali, Ed. Shyam Sundar Das (First hundred Sakhis)
2. Surdas : Bhramar Gitsar, Ed. Ramchandra Shukla (first hundred Padas)

3. Tulsidas	:	Ramcharit Manas (Sundar Kand), Kavitawali (Uttarkand)
4. Jayasi	:	Padmawat Ed. Shyam Sundar Das (Sindhi Dwip Khand & Nagmativiyog Khand)
5. Bihari	:	Bihari Ratnakar Ed. Jagnnath Prasad Ratnakar (First 100 Dohas)
6. Mathili Sharan Gupt	:	Bharat Bharati.
7. Prasad	:	Kamayani (Chinta and Sharddha Sarg)
8. Nirala	:	Rag-Virag, Ed. Ram Vilas Sharma (Ram Ki Shakti Puja and Kukurmutta)
9. Dinkar	:	Kurukshetra
10. Agyeya	:	Angan Ke Par Dwar (Asadhya Vina)
11. Muktibodh	:	Brahm Rakhashas
12. Nagarjun	:	Badal Ko Ghirte Dekha Hai, Akal Ke Bad, Harijan Gatha
13. Bharatendu	:	Bharat Durdhasha
14. Mohan Rakesh	:	Ashad Ka Ek Din
15. Ramchandra Shukla	:	Chintamani (Part-I) (Kavita Kya Hai, Sharddha Aur Bhakti)
16. Dr. Satyendra	:	Nibandh Nilaya-Bal Krishan Bhatt, Premchand, Gulab Rai, Hazari Prasad Dwivedi, Ram Vilas Sharma, Agyeya, Kuber Nath Rai
17. Premchand	:	Godan, Premchand Ki Sarvashreshtha Kahaniyan, Ed. Amrit Rai
18. Prasad	:	Skandgupta
19. Yashpal	:	Divya
20. Phaniswar Nath Renu	:	Maila Anchal
21. Mannu Bhandari	:	Mahabhoj
22. Rajendra Yadav	:	Ek Dunia Samanantar (All Stories)

12. INDIAN HISTORY

Part-I

History of India (Down to AD 750)

1. The Indus Civilisation : Origin and extent. Characteristic features. Major cities. Trade and contacts. Causes of decline. Survival and continuity.

2. The Vedic Age : Vedic literature. Differences and similarities between Indus Civilisation and Vedic culture. Political, social and economic patterns. Major religious ideas and rituals.

3. The Pre-Maurya Period : Religious movements (Jainism, Buddhism and other sects). Social and economic conditions. Republics and growth of Magadha imperialism.

4. The Maurya Empire: Alexander's invasion and its effects. Source, rise, extent and fall of Maurya a empire. Administration. Social and economic conditions. Ashoka's policy and reforms. Art.

5. The Post-Maurya Period (200 B.C. -300 A.D.): Rule of Indo-Greeks. The Sakas and the Kushanas.

Principal dynasties in Northern and Southern India. Economy of society. Sanskrit, Prakrit and Tamil. Religion (rise of Mahayana and theistic cults). Art (Gandhara, Mathura and other schools). Contacts with Central Asia.

6. The Gupta Age: Rise and fall of the Gupta Empire. The Vakatakas. Administration, society, economy, literature, art and religion. Contacts with South East Asia. General review of education and learning.

7. Post-Gupta Period (B .C. 500-750A.D.) : Pushyabhutis. The Muakharis : The later Guptas. Harshvardhana and his times. Chatukyas of Badami. The Pallavas. Society, administration and art. The Arab conquest. Rise of Cholas and their administration.

Medieval India (750 A.D. to 1765 A.D.)

India: (750 A.D. to 1200 A.D.)

1. Political and social conditions. The Rajputs-their policy and social structure. Land structure and its impacts on society. Growth of feudalism in north India. Turkish invasion.

2. Trade and commerce.

3. Maritime Activities: Contacts with the Arabs, Mutual, cultural impacts.

4. Rashtrakutas, their role in history—Contribution to art and culture. The Chola Empire. Local Self Government, features of the Indian village system. Society, economy, art and learning in the South.

5. Indian Society on the eve of Mahmmud of Ghazni's campaigns.

India : 1200 AD -1765AD

6. Foundation of the Delhi Sultanate in Northern India. Causes and circumstances. Its impact on the Indian society. Economic experience of Allauddin Khilji.

7. Khilji imperialism—significance and implications, administrative and economic regulations and their impact on state and the people.

8. New Orientation of state policies and administrative principles under Muhammed bin Tughluq. Religious policy and public works of Firoz Shah. Scheme of Muhammed Tughluq : Administration of Firoz Shah.

9. Disintegration of the Delhi Sultanate—causes and its effects on the Indian polity and society. Nature and character of State, political ideas and institutions. Agrarian structure and relations, trade and commerce, condition of artisans and peasants.

10. Influence of Islam on Indian Culture. Muslim mystic movements. Nature and Significance of Bhakti saints. Cultural interaction between Hindus and Muslims.

11. The Vijaynagar Empire : Its origin and growth. Contributioin to art, literature and culture. Social and economic conditions. System of administration. Break-up of the Vijaynagar Empire. The Bahmani Kingdom.

12. Sources of History : Important chronicles, inscriptions and travellers' accounts.

13. Establishment of Mughal Empire in northern India. Political and social conditions in Hindustan on the eve of Babur's invasion. Babur and Humayun. Establishment of the Portuguese control in the Indian ocean, its political and economic consequences.

14. Sur Administration—political, revenue and military administration.

15. Expansion of the Mughal Empire under Akbar, political unification, new concept of monarchy under Akbar, Akbar's religio-political outlook. Relations with the non Muslims. Akbar conquest. Rajput policy. Religious policy.

16. Growth of regional languages and literature during the medieval period. Development of art and architecture.

17. Political ideas and institutions : Nature of the Mughal state, Mughal administration, land revenue administrations (the Mansabdari and the Jagirdari systems, the landed structure and the role of the Zamindars, agrarian relations), the military organisations. Deccan and NW Frontier policy of Mughals. Social, cultural and economic conditions during the Mughal period.

18. Aurangzeb's religious policy. Expansion of the Mughal Empire in Deccan. Revolts against Aurangzeb-character and consequences. Aurangzeb and break up of Mughal empire.

19. Growth of urban centres. Industrial economy-urban and rural. Foreign trade and commerce. The Mughals and the European trading companies.

20. Socia-religious relations of Hindu-Muslim during 16 to 18th centuries and growth of composite culture.

21. Rise of Shivaji, his conf1ict with the Mughals. Administration of Shivaji. Expansion of the Maratha power under the peshwas (1707 -1761). Maratha political structure under the First, Three Peshwas. Chauth and Sardeshmukhi. Third Battle of Panipat, causes and effect. Emergence of the Maratha confederacy, its structure and role.

22. Disintegration of the Mughal Empire. Emergence of the new Regional States.

Part-II

Modern India and Freedom Struggle (1757 AD-1947AD)

1. Coming of European powers. Historical forces and factors which led to the British conquest of India. British occupation of Bengal, Growth of British power during Warren Hastings, Wellesley, William Bentick, Dalhousi with special reference to Bengal, Marathas, Sind, Punjab and Oudh. Resistence of Indian powers and causes of their failure. Civil rebillions and Revolt of 1857.

2. Evolution or British paramountcy over princely states.

3. Administrative Structure and policies—revenue, judicial, social and educational and their linkages with British colonial interests.

4. British economic policies and their impact Commercialisation of agriculture. Rural indebtedness. Growth of agriculture labour. Destruction of handicraft industries. Drain of wealth. Growth of modern industry and rise of a capitalist class. Activities of the Christian Missions.

5. Socio-religious movements. Social, religious, political and economic ideas of the reformers and their vision of future. Nature and limitation of 19th century "Renaissance". Caste movements in general with special reference to South India and Maharashtra. Tribal revolts, specially in Central and Eastern India, Peasant revolts with special reference to indigo revolt, deccan riots and Mapplia uprising.

7. Rise and growth of Indian National Movement. Social basis of Indian nationalism. Foundation of INC. Programmes of the early nationalists (moderates) and extremist. Militant revolutionary groups. Rise and growth of communalism. Emergence of Gandhiji in Indian politics and his techniques of mass mobilisation. Khilafat Movement. Non-Cooperation. Civil Disobedience and Quit India Movement. Trade union and peasant movements. State(s) people movements. The Congress socialists and communists. British official response to National Movement. Constitutional developments during British period (Acts of 1909,1919, 1935). Indian National Army, Navy Mutiny of 1946. Muslim League. The Partition of India. India's Independence.

13. LAW

Part-I

I. Constitutional Law of India

1. Nature of the Indian Constitution. The distinctive features of its federal character.
2. Fundamental Rights. Directive Principles and their relationship with Fundamental Rights. Fundamental Duties.
3. Right to Equality.
4. Right to Freedom of Speech and Expression.
5. Right to Life and Personal Liberty.
6. Religious, Cultural and Educational Rights.
7. Constitutional position of the President and relationship with the Council of Ministers.
8. Governor and his powers.
9. Supreme Court and High Courts. Their powers and jurisdiction.
10. Union Public Service Commission and State Public Service Commissions. Their powers and functions.
11. Principles of Nature Justice.
12. Distribution of legislative powers between the Union and the State.
13. Delegated legislation. Its constitutionality, judicial and legislative controls.
14. Administrative and financial relations between the Union and the States.
15. Trade, commerce and intercourse in India.
16. Emergency provisions.
17. Constitutional safeguards to civil servants.

18. Parliamentary privileges and immunities.
19. Amendment of the Constitution.

II. International Law

1. Nature of International Law.
2. Sources: Treaty, Customs, General Principles of Law recognized by civilized nations, subsidiaries means for the determination of Law, Resolutions of International organs and regulation of International organs and regulations of Specialized Agencies.
3. Relationship between International Law and Municipal Law.
4. State Recognition and State Succession.
5. Territory of States; modes of acquisition.
6. Sea. Inland waters. Territorial Sea. Contiguous Zone. Continental Shelf. Exclusive. Economic Zone and ocean beyond national Jurisdiction.
7. Air-space and aerial navigation.
8. Outer-space. Exploration and use of outer space.
9. Individuals, Nationality, Statelessness; Human Rights and procedures available for their enforcement.
10. Jurisdiction of States; bases of jurisdiction.
11. Extradition and Asylum.
12. Diplomatic Missions and Consular Posts.
13. Treaties; Formation, application and termination.
14. State Responsibility.
15. United Nations: its principal organs, powers and functions.
16. Peaceful settlement of disputes.
17. Lawful recourse to force; aggression, selfdefence, intervention.
18. Legality of the use of nuclear weapons.

Part-II

I Law of Crimes

1. Concept of crime: actus reus, mens rea, mens rea in statutory offences, punishments mandatory sentences preparation and attempt.
2. Indian Penal Code
   (a) Application of the Code
   (b) General exceptions.
   (c) Joint and constructing liability.
   (d) Abetment.
   (e) Criminal conspiracy.
   (f) Offences against the State.
   (g) Offences against public tranquility.
   (h) Offences by or relating to public servants.
   (i) Offences against human body.
   (j) Offences against property.
   (k) Offences relating to Marriage: cruelty.
   (l) Defamation.

II. Law of Torts

1. Nature of tortious liability.
2. Liability based upon fault and strict liability.
3. Statutory liability.
4. Vicarious liability.

5. Joint Tort-fessors.
6. Remedies.
7. Negligence.
8. Occupier's liability and liability in respect of structures.
9. Defamation.
10. Nuisance.
11. Conspiracy.
12. False Imprisonment and Malicious Prosecution.

III Law of Contracts and Mercantile Law

1. Formation of contract. (Indian Contract Act, 1872).
2. Factors vitiating consent.
3. Void, voidable, illegal and unenforceable agreements.
4. Performance of contracts.
5. Dissolution of contractual obligations, frustration.
6. Quasi-contracts.
7. Remedies for breach of contract.
8. Sale of goods and hire purchase (Sales of Goods Act, 1930).
9. Agency.
10. Formation and dissolution of Partnership (Indian Partnership Act, 1932).
11. Negotiable Instruments.
12. The Consumer Protection Act, 1986.

IV Law of Evidence and Indian Evidence Act

Note: Neither bare Act will be provided nor the candidates are allowed to bring a copy of any bare Act in the examination hall.

14. MATHEMATICS

Part-I

1. Linear Algebra

Vector space, Linear dependence and independence, Sub spaces, Bases, Dimensions, Finite dimensional vector spaces.

Matrics, Cayley-Hamilton theorem, Eigenvalues and Eigenvectors, Matrix of linear transformation, Row and column reduction, Echelon form, Equivalence, Congruence and Similarity. Reduction to Canonical from, Rank, Orthogonal, symmetrical, Skew Symmetrical, Unitary, Hermitian Skew-Hermitian forms-their given values. Orthogonal and Unitary reduction of quardratic and Hermition forms, Positive definite quadratic forms, Simultaneous reduction, Sylvester's law of inertia.

2. Calculus

Real numbers, Limits, Continuity, Differentiability, Mean-value Theorems, Taylor's theorem with remainders, Indeterminate forms, Maxima and Minima, Asymptotes, Functions of several variables, Continuity, Differentiability, Partial derivatives, Maxima and Minima, Lagrange's method of Multipliers, Jacobian, Riemann's definition of Definite integrals; Indefinite integrals, infinite and improper integral, Double and triple integrals (techniques only). Repeated integrals, Beta and Gamma functions. Areas, Surface and Volumes, Centre of Gravity.

3. Geometry

Cartesian and Polar coordinates in two and three dimension, Second degree equations in two and three dimensions, Reduction to Cannonical forms, Straight lines, Plane, Sphere, Cone, Cylinder, Paraboloid, Ellipsoid, Hyperboloid of one and two sheets and their properties. Shortest distance between two skew lines, Curves in space, Curvature and torsion. Serret-Frenet's formulae.

4. Ordinary Differential Equations

Formation of differential equations, Order and Degree, Equations of first order and first degree, Integrating factor, Equations of first order but not of first degree, lairaut's equation, singular solution. Higher order linear equations with constant coefficients. Complementary function and particular integral. General solution. Euler-Cauchy equation.

Second order linear equations with variable coefficients. Determination of complete solution when one solution is known. Method of variation of parameters.

5. Statics

Equilibrium of a system of particles, work and potential energy. Friction, Common Catenary, Principle of Virtual work, Stability of Equilibrium, Equilibrium of forces in three dimensions. 'Lemi's theorem'.

6. Dynamics

Degree of freedom and constraints, Rectillnear motion, Simple Harmonic motion. Motion in a plane, Projectiles. Constrained Motion, Work and energy, Conservation of energy, Motion under Impulsive forces, Kepler's laws, Orbits under Central forces, Motion of varying mass, Motion under resistance.

7. Hydrostatics

Pressure of heavy fluids. Equilibrium of fluids under given system of forces, Centre of pressure, Thrust on curved surfaces, Equilibrium of floating bodies Stability of equilibrium. Metacentre, Pressure of gases, problems relating to atmosphere.

Part-II

1. Vector Analysis

Scalar and vector fields, triple products. Differentiation of Vector function of a scalar variable, Gradient, Divergence and Curl in Cartesian, Cylindrical and Spherical coordinates and their physical interpretation. Higher order derivatives Vector Identities and Vector Equations, Application to Geometry, Gauss and Stoke's Theorems, Green's identities.

2. Real Analysis

Real number system, Ordered sets. Bounds, Ordered Field, Real number systems as an Ordered Field with least Upper Bound, Cauchy Sequence, Completeness. Completion Continuous Functions, Uniform Continuity. Properties of continuous functions on compact sets. Riemann Integral, Improper integrals. Differentiation of functions of several variables, Maxima and Minima, Absolute and conditional Convergence of series of real and Complex terms, Rearrangement of series, Uniform convergence, Infinite Products. Continuity, differentiability and integrability for series, Multiple integrals. Infinite and alternating series.

3. Numerical Analysis

Numerical Methods: Solution of algebraic and transcendental equations of one variable by bisection, Regula-falsi and Newton-Raphsons methods Solution of system of linear equations by Gaussian elimination and Gauss-Jordan (direct) methods. Gauss Seidel (iterative) method.

Interpolation: Nedwton's (forward and backward) and Lagrange's method.

4. Mechanics

Concepts of particles, Lamina, Rigid Body, Displacement, Force, Mass, Weight, Motion, Velocity, Speed, Acceleration. Parallelogram of forces. Parallelogram of velocity, acceleration, resultant, equilibrium of coplanar forces. Moments, Couple, Friction, Centre of mass, Gravity. Laws of motion. Motion under conservative forces. Motion under gravity. Projectile, Escape velocity; Motion of artificial satellites.

5. Probability

Sample space, Events, Algebra of events, Probability-classical, Statistical and Axiomatic Approaches. Conditional Probability and Baye's Theorem Random Variables and Probability. Distributions-Discrete and Continuous. Mathematical Expectations. Binomial, Poisson and. Normal Distributions.

6. Statistical Methods

Collection, Classification, tabulation and presentation of data. Measures of central value. Measures of dispersion. Skewness, moments and Kurtosis. Correlation and regression.

15. MECHANICAL ENGINEERING

Part-I

1. Theory of machines

Kinematic and dynamic analysis of planar mechanisms. Cams, Gears and gear trains. Flywheels, Governors, Balancing of rigid rotors. Linear vibration analysis of mechanical system, (single degree and two degrees of freedom). Critical speeds and whirling of shafts. Automatics controls. Belt and chains drives.

2. Mechanics of Solids

Stress and strain in two dimensions. Principal stresses and strains. Mohr's circle, linear elastic materials. Stress-strain relations, uniaxial loading, thermal stresses. Beams: Bending moment and shear force diagrams, bending stresses and deflection of beams. Torsion of shafts, helical springs. Combined stresses. Thick and thin walled pressure vessels. Struts and columns, Strain energy concepts and theories of failure.

3. Engineering materials

Basic concepts on structure of solids. Crystalline materials, Defects in crystalline materials. Alloys and binary phase diagrams. Properties of common engineering materials. Heat treatment of steels. Plastics, ceramic, and composite materials, common applications of various materials. Corrosion. Powder Metallurgy.

4. Manufacturing Science

Merchant's force analysis. Taylor's tool life equation, machinability and machining economics. Rigid, small and flexible automation NC, CNC. Recent machining methods-EDM, ECM and ultrasonics. Applications of lasers and plasmas. Jigs, fixtures, tools and gauges, inspection of length, position, profile and surface finish.

5. Manufacturing Management

Production planning and Control, Forecasting-Moving average, exponential smoothing, operations scheduling; assembly line balancing, Product development, Break-even analysis, Capacity planning; PERT and CPM. Control operations; Inventory control-ABC analysis. Basic EOQ model, Materials requirement planning, Job Design, Job standards. Work measurement. Quality Management-Quality analysis and control statistical quality control.

Value Engineering: Value analysis, for coat/value, Just in Time (JIT) technique, Enterprises Resources Planning (ERP). Total quality management. Project management.

Part-II

1. Thermodynamics

Basic concept, Open and closed systems, Applications of Thermodynamic Laws. Gas equations, Clepeyron equation. Availability, Irreversibility.

2. C.I. Engineer, Fuels and Combustion

Spark Ignition and compression Ignition engines, Four stroke engine and Two-stroke engines, Mechanical, thermal and volumetric efficiency, Heat balance sheet, combustion process in S.I. and C.I. engine, Choice of engine fuels, Octane and Cetane ratings, Alternate fuels, Carburration and Fuel injection. Solid, liquid and gaseous fuels, stoichometric air requirements and excess air factor, higher and lower calorific values,

3. Heat Transfer, Refrigeration and Air Conditioning

One dimensional heat conduction, Heat transfer from extended surfaces, Heat transfer by forced and free convection. Heat exchangers. Fundamentals of diffusive and convective mass transfer, Radiation laws, heat exchange between black and non-black surfaces, Network Analysis, Heat pump refrigeration cycles and systems, Condensers, evaporators and expansion devices and controls. Properties and choice of refrigerant, Refrigeration systems and components psychrometrics, cooling load calculations, solar refrigeration.

4. Turbo-Machines and Power Plants

Theory and design of axial flow turbines and compressors. Flow through turbo-machine blade, cascades, centrifugal compressors. Dimensional analysis and modelling, selection of site for steam, hydro, nuclear and stand-by power plants, selection, base and peak load power plants. Modern High pressure, High duty boilers, station and plant heat rates, operation and maintenance of various power plants, preventive maintenance, economics of power generation.

16. PHYSICS

Part-I

1. Mechanics

Conservation Laws, collisions, impact parameter, scattering cross-section, centre of mass. Rutherford Scattering. Motion of a rocket under constant force field Rotating frames of reference. Coriolis force, motion of rigid bodies. Angular momentum. Torque and procession of a top. Central forces, Motion under inverse square law, Kepler's Laws, motion of satellites (including geostationary). Galilean Relativeity, Special Theory of Relativity, Mischelson-Morley Experiement, Lorentz transformation-addition theorem of velocities. Variation of mass with velocity. Mass-Energy equivalence. Fluid dynamics, streamlines, turbulance, Barnoulli's Equation with simple applications.

2. Thermal Physics

Laws of thermodynamics, entropy, Carnot's cycle, isothermal and adiabatic changes. Thermodynamic Potentials Maxwell's relations. The Clausius-Clapeyren equation reversible cell. Joule-Kalvin effect etc. Kinetic theory of gases. Maxwell's distribution law of velocities. Equipartition of energy, Specific heats of gases, mean free path. Brownian motion, black body radiation. Specific heat of solids-Einstean & Dabye theories.Wein's law, Planck's law solar constant.

3. Waves and Oscillations

Oscillations. Simple harmonic motion. Stationary and travelling waves. Damped harmonic motion. Forced oscillation and Resonance. Wave equation. Harmonic solutions. Plane and spherical waves. Superposition of waves, Phase and group velocities. Beats. Hygen's principle Interference. Diffraction Fresnel and Fraunhofer. Diffraction by single slits. Resolving power of grating and optical instruments. Rayleigh Criterion. Laser sources (Ruby). Holography, theory and and applications.

Part-II

1. Electricity & Magnetism

Coulomb's Law, electric field. Gauss's Law, Electric Potential Poission and Laplace equations for a homogeneous dielectric uncharged conducting sphere in a uniform field. Point charge and infinite conducting plane. Magnetic shell, Magnetic induction and field strength. Blot-Savart law and applications, electromagnetic induction. Faraday's and Lenz's laws, Self and mutual inductances. Alternating currents. L.C.R. circuits series and parallel resonance circuits, quality factor. Kirchoff's laws with application. Transverse nature of electromagnetic waves. Poynting vector. Magnetic fields in matter-dia, para, feroo antioferro and ferri magnetism (qualitative approach only).

2. Modern Physics

Raman effect. Photo-electric effect. Compton effect. Debrogilee waves Wave particle quality and uncertainty principle. Schrodinger wave equation with application to (i) particle in a box. (ii) Bohr's theory of H-atom, calculation of e/m ratia and charge on e^-. Principle radioactivity. Alpha, beta and gamma radiations. Elementary theory of the alpha decay. Nuclear binding energy. Nuclear fission and fusion. Elementary reactor physics. Elementary particles and their classification. Strong and weak electromagnetic interactins. Particle accelerators; cyclotron. Elementary ideas of superconductivity.

3. Electronics

Band theory of Solids-Conductors, insulators and semiconductors; intrinsic and extrinsic semiconductors, P-N junction. Zenner diodes reverse and forward biased P-N junction, use of diodes and transistors for rectification, amplification and oscilliation, Logic Gate (AND, OR, NOT).

17. POLITICAL SCIENCE AND INTERNATIONAL RELATIONS

Part-I

Political Theory

1. General characteristics of Western political thought. Plato, Aristotle, Machiavelli, Hobbes, Locke, Montesquieu, Rousseau, Bentham, J.S. Mill, T.H. Green, Hegel, Marx, Lenin, Mao-se Tung.

2. Nature and scope of political science. Significance of political theory. Elite and theories of Elite. Growth of political science as a discipline. Traditional vs. contemporary approaches. Behaviouralism and post behavioural developments. System theory and other recent approaches to political analysis. Marxist approach to politcal analysis. power, authority and legitimacy. Different dimension of power. Theories of power in society.

3. The emergence and nature of the modern state. Sovereignty. Monistic and pluralistic analysis of sovereignty. Dominant perspectives of modem state: alternate perspectives. Political culture and political socialization. Political participation and political communication. Modernisation and political development. Alienation and theory of Alienation. National building and national integration. Social conflict and revolution.

4. Political obligation. Resistance and revolution. The concepts of freedom, liberty. equality, rights, property, Justice, Human rights and gender issues. Theories of distributive justice. Notions of common good. Consumer protection with special reference to India.

5. Democracy and political participation. Dominant theories of democracy. Political process and social change. Theories of social change-revolutionary change. Concepts of development, socialist, liberal, Gandhian and others. Critics of development modal, the debate on welfare state. Development and environment-the contemporary debates.

6. Liberalism, evolutionary socialism (democratic and fabian). Marxian socialism, Fascism.

Government and politics with special Reference to India

1. Approaches to the study of comparative politics. Study of Western and non-western perspectives.

2. Political institutions. The legislature, executive and judiciary. Parties and pressure groups. Theories of party system (Lenin, Michels and Duverger). Electoral system. Bureaucracy-Weber's view and modern critiques of Weber.

3. Indian Political System : (a) The Roots, colonialism and nationalism in India. A general study of modern Indian social and political thought of Raja Rammohan Roy, Dadabhai Nauroji, Gokhale, Tilak, Sri Aurobindo, Iqbal, Jinnah, Gandhi, B.R. Ambedkar, M.N. Roy, Nehru, Vinobha Bhave and Jai Parkash Narain.

(b) The structure - Basic features of Indian Constitution, Fundamental Rights and Directive Principles, Union Government, Parliament, Cabinet, Supreme Court and Judicial Review, Indian Federalism, Centre-state relations, State Government, Role of the Governor, Panchayati Raj institutions.

(c) The Functioning-class and castle in Indian politics. Politics of regionalism, linguism and communalism. Problem of secularization of the policy and national integration. Political elites, the changing composition. Political parties and political participation. Pressure groups. Public opinion. Voting behaviour and electoral process. Ethnicity. Planning and developmental administration. Socio-economic changes and its impact on Indian democracy.

Part-II

1. Nature and concepts of international politics. Functioning of the sovereignation state system; cold war and neo-cold war-its origin, end and impact on global politics. Power. National interest. Balance of power. Power vacuum.

2. Theories of international politics: The Realist theory, System theory, Critical theories etc.

3. Foreign policy determinants and choices. National interest. Ideology. Elements of national power (including nature of domestic social-political institution). Imperialism. Balance of power. Allegiances. Isolationalism. Nationalistic universalism (Pax Britiannica, Pax Americana, Pax Sovietica), The Middle Kingdom complex of China, Non-alignment.

4. Non-alignment movement Its meaning and basis. Its role in international relations. De-colonization and expansion of the international community. Neo-colonialism and facialism, their impact on international relations.

5. International economic order: Aid, trade and economic development. The struggle for the new international economic order. Sovereignty over natural resources. The crisis in energy resources. Global politics of environment. Role of IMF, World Bank, WTO, ADB and North South Dialogue.

6. Origin and development of international organisations. The United Nations and specialized agencies and their role in international relations.

7. Role of Regional organisations : OAS, OAU, the Arab League, the ASEAN. EU, APEC, SAARC, NAFTA etc.

8. Arms race, disarmament and arms control. Conventional and nuclear arms. Proxy wars and problem of terrorism. The Arms trade its impact on Third world and its role in international relations. The uses and mis-uses of nuclear energy. The impact of nuclear weapons on international relations. The Partial Test ban Treaty. The Nuclear Non-Proliferation Treaty (NPT), Peaceful Nuclear Explosions (PNE) and CTBT.

9. Theory and practice of diplomacy. External intervention: Ideological, political and economic. Cultural imperialism. Covert intervention by the major power.

10. The problems and prospects of the Indian Ocean being made a peace-zone and emerging cooperation under IOR-ARC and the conflict situation in West Asia.

11. The post-war foreign policies of the major powers viz. United States, Soviet Union, China.

India and the World

1. Determinants and making of India's foreign policy.

2. India's policy of non-alignment and its contribution through NAM.

3. India's relations with major powers: USA, USSR, Russia, Japan, EU.

4. India and its neighbours : China, Pakistan, Bangladesh, Sri Lanka and Nepal.

5. Conflict and cooperation in South and South east Asia Major conflicts:, SAARC, ASEAN, ARF, IOR-ARC.

6. India's foreign economic policy, globalization and changing world order; India and people of Indian origin.

7. India's concerns for nuclear proliferation and peace. PTBT, NPT, PNE, CTBT, UN Peace-Keeping and global disarmament.

8. Changing global environment and assessment of India's foreign policy.

18. PSYCHOLOGY

Part-I : Foundations of Psychology

1. Scope and Methods of Psychology

Relation of psychology with sociology and anthropology. Methods of psychology-observation, interview, questionnaires, experimental methods, test methods, scales, case study. Methodological problems of psychology, General design of psychological research. Designs in experimental psychology.

2. Biological basis of Psychology: Nerves and synapse, transmission of neural impulses, synaptic transmission. Organisation of the nervous system. Division of nervous system-spinal cord, the brain, Hierarchical structure of the brain-central core, limbic system. Endocrine system in context of human behaviour. Central peripheral nervous system. Genetic influence on behaviour-genetic laws of inheritance the structure and functions of chromosomes. Reflex action. Localisation of function in human cortex. Characteristics of sleep and arousal. Stages of sleep Neural mechanism in sleep.

3. Perception

Meaning, kinds and determinants of attention and vigilance. Perception of form, colour, depth, distance, motion. Theories of colour, vision and hearing. Geometrical illusions (types and theories). Theories of perception. Perceptual organization. Person perception. Perceptual defence. Transactional approach to perception. Perception and personality. Figural after-effect. Perceptual styles, perceptical abnomnalities.

4. learning

Types of learning. Learning theories. Operant and Classical conditioning, Instrumental conditioning type (appetitive and aversive conditioning). Cognitive learning. Transfer of learning. Perceptual learning. Learning and motivation. Laws of learning. Factors influencing learning. Discrimination learning. Probability learning. Programmed learning.

5. Emotions and Stress

Characteristics of emotional behaviour. Expressions of emotions (emotional reactions). Physiological correlates of emotions. Role of nervous system and endocrine glands in emotions. Theories of emotions: James Lange, Cannon Bard and Schachter. Stress-Stressors (causes of stress)-conflict, change, lack of control unpredictability. Coping with stress.

6. Memory

Nature of Memory. Methods of reproduction. Factors influencing memory. Stage of memory (encoding storage and retrieval). Theories of memory. Short-term memory. Longterm memory. Measurement of memory. Forgetting reminiscence. Theories of foregetting. Causes of forgetting.

7. Thinking

Nature and elements of thinking, Images and thinking. Language and thinking. Concept formation. Creative thinking. Deductive and Inductive reasoning. Problem solving-Nature and scientific methods of problem solving.

8. Intelligence and Aptitude

Nature of intelligence. Theories of intelligence. Measurement of intelligence. Measurement of creativity. Constancy of I.Q. Aptitude. Measurement of aptitudes. The concept of social intelligence. Types of intelligence and aptitude tests.

9. Motivation

Concept of need, drive, arousal and incentive. Characteristics of motivated behaviour. Classification of motives. Extrinsic versus intrinsic motivation. Theories to motivation: psycho-analytic theory, drive theory, need hierarchy theory, vector valence theory. Concept of level of aspiration. Measurement of motivation. The apathetic and the alienated individual Incentives.

10. Personality

The concept and nature of personality. Development of self, culture and personality. Trait and type approaches. Determinants of personality. Theories of personality: Freud, Allport, Murray, Cettell. The Indian approach to personality-the concept of gunas. Measurement of personality: Subjective techniques, objective techniques and projective techniques.

11. Attitudes and Values

Definition of attitudes. Measurement of attitudes. Characteristics formation and development of social attitude. Theories of attitudes. Balance and congnitive dissonance theory. Attidute measurement. Theories of attitude change. Values. Types of values. Motivational properties of values. Measurement of values.

12. Development of Human Behaviour and Socialization

Effect of heredity, environment and cultural factors on behaviour. Nature, agencies and factors of socialization. Meaning, characteristics and formation of social norms. Meaning and determinants of social roles. Meaning and type of social status.

13. Statistics in Psychology

Frequency distribution. Graphical representation of data. Histogram and polygon. Uses of mean, median, mode. Measures of central tendency variability. Standard deviation. Correlation and its use in psychology, Percentile and percentile ranks. Method for ungrouped data.

Part-II : Issues and Applications of Psychology

1. Individual Differences

Psychological Tests and General Mental ability (intelligence). Types of psychological tests. Characteristics of a good psychological test (s). Limitation of psychological tests. General mental ability (intelligence)-nature and theories of intelligence: Spearman, Thurston, Guilford, Jensen and Piaget. Heritability of intelligence.

2. Classification of Psychological Disorders

Classifying psychological disorders. Emperical approaches to classification DSM system of classification. Recurring issues in classification.

3. Abnormal behaviour

Psychological, disorders. Concept of normalcy and abnormalcy. Causes of abnormal behaviour- biological, psychological and Socio-cultural. Structural aspect of Freudian theory and defence mechanism. Neurosis-symptoms, aetiology and treatment. Phobic disorder, obsessive compulsive disorder, anxiety disorder, conversion disorder, disossiative disorder. Psychosomatic disorders-hypertension and peptic peptic ulcers. Psychotic disorders-sympotms, aetiology and treatment. Functional Psychosis—depressive disorders, manic depressive psychosis, schizophrenia. Drug abuse-alchohal, narcotics, stimulants (amphetamines), hallucinogens (LSD), marijuana (hashish). Methods of assessing abnormal behaviour.

4. Therapeutic Approaches (Treatment of Abnormalcy)

Psychoanalysis. Behaviour therapy. Client centered therapy. Cognitive therapy. Group therapy. Chemotherpy-Anti-psychotic drugs Anti-anxiety drugs. Anti-depressent drugs. ECT.

5, Application of Psychology to Organisational and Industrial settings

Personnel selection. Training. Work motivation. Job satisfaction. Worker's participation in management.

6. Groups

Nature, types and functions of group. Crowd, mob and audience. The concept of small group. Properties of groups. Theories of group behviour. Measurement of group behaviour. Interpersonal relations. Leadership-Nature, types, qualities, functions. Theories of leadership (Trait theory, complex strait theory, interactional theory).

7. Social Change

Nature and characteristic of social change, Factor, and theories of social change. Psychological basis of change. Steps in the change process, Resistance to change. Factors contributing to resistance. Planning for change. The concept of change-proneness. Meaning of social perception. Nature and Importance of stereo-types. Nature, factors and theories of propaganda.

8. Psychology and the Problem of Social Integration

The problem of ethnic prejudice. Nature of prejudice. Manifestations of prejudice. Development of prejudice. Measurement of prejudice. Amelioration of prejudice. Prejudice and personality. Steps to achieve Social integration.

9. Problems of Contemporary Society

Alcoholism and drug addiction. The socially deviant juvenile delinquency. Crime rehabilitation of the deviant. The problems of the aged. Success and failure of marriage. Divorce separation. Parental fixation. Sibling rivalary, Special needs children (mentally retarded, blind, orthopaedically and hearing handicapped etc.) Approaches in dealing with them. Their physical, social, psychological and educational problems.

19. PUBLIC ADMINISTRATION

Part-I Administrative Theory

I Basic Premises : Meaning, scope and significance of Public Administration. Private and Public Administration. Its role in developed and developing societies. Ecology of administration- social, economic, cultural, political and legal. Evolution of Public. Administration as a discipline. Public Administration as an art and a science. New Public Administration .

II. Theoriess of Organisation: Classical theory of Organisations (Henri Fayol, Luther gulic and Others). The Human Relations Theory of Organisations (Elton Mayo and his dolleagues). Behavioural approach. Systems approach. Organizational effectiveness.

III. Principles of Organization : Hierarchy. Unity of command. Authority and responsibility. Coordination.

Span of control/supervision. Span control of coordination. Supervision and control. Centralization and decentralization. Delegation. Communication public relations - meaning, methods and significance.

IV. Administrative Behaviour: Decision making with special reference to the contribution of Herbert Simon.

Theories of leadership. Communication. Morale. Motivation.

V. Structure of Organisations : Chief Executive. Types of Chief Executives and their functions. Line, staff and auxiliary agencies. Forms of administrative organisation. Departments, corporations, companies, boards and commissions Indepndent regulatory commissions. Headquarters and field relationship.

VI. Personal Administration: Bureaucracy and civil services. Position classification. Recruitment. Training. Career development Performance appraisal. Promotion. Pay and service conditions. Retirement benefits. Discipline. Employer-employee relations, Integrity in administration. Generalists and specialists. Neutrality and anonymity. Public Service Commission. Morale. Joint consulative machinery (white councils).

VII. Financial Administration: Concept of budget. Principle of budget making. Preparation, passing and execution of budget. Performance budgeting. Legislative control. Accounts and audit. Significance of audit. Parliamentary control over public finance.

VIII. Accountability and Control : The concepts of accountability and control. Legislative, executive and judicial control over administration. Parliamentary and government control over public corporation. Citizen and administration.

IX. Administrative Reforms: O&M. Work study. Work measurement. Administrative reforms. Process and obstacles.

X. Administrative Law: Importance of administrative law. Delegated legislation- meaning, types, advantages, limitations and safeguards. Administrative tribunals.

Xl Comparative and Development Administration : Meaning, nature and scope of comparative public administration. The concept, scope and significance of development administration. Political, economic, and socio-cultural context of development administration. The concept of administrative development.

XII. Public Policy: Relevance of policy making in public administration. The processes of policy formulation and implementation.

Part-II Indian Administration

I. Evolution of Indian Administration: Kautilya, Mughal period and British period. Features of Indian administration, its role in the context of democratic system and socio- economic development.

II. Environmental Setting: Constitution. Parliamentary democracy, Federalism Planning. Socialism.

III. Political Executive at the Union Level: President. Prime Minister. Council of Ministers. Cabinet Committees.

IV. Structure of Central Administration: Secretariat, Cabinet Secretariat, Ministries and Departments, Board and Commissions. Field organisations.

V. Centre-State Relations: Legislative. Administrative. Planning and financial.

VI. Public Services : All India Services. Central Services. State Services. Local Civil Services. Union and State Public Service Commission. Recruitment, training, promotion, discipline, morale of civil services.

VII. Machinery for Planning: Plan formulation at the national level. National Development Council. Planning Commission. Planning machinery at the state and district levels. State planning board. Preparation of Five Year Plans. Centre State relations regarding planning.

VIII. Public Undertakings: Forms, management, control and problems,

IX. Control of Public Expenditure : Preparation of Indian budget and its enactment. Parliamentary control over public finance in India. Role of the Finance Ministry. Role of Comptroller and Auditor General over financial administration. Composition and function of Public Accounts Committee and Estimates Committees at the centre.

X. State Administration : Governor. Chief Minister, Council of Minister, Secretariat, Chief Secretary, Directorates.

XI. District Administration : Salient features of district administration. Role and position of Deputy Commissioner and Superintendent of Police in district administration. Role of Deputy Commissioner in development functions. Role of Divisional Commissioner. District Rural Development Agency. Special Development Programmes. Role of District Collector in land and revenue matters. Role of District Magistrate in law and order.

XII. Local Administration : Meaning and significance. Evolution of local government in India since 1882 Municipalities-composition, functions, finances, personal, general working of municipal bodies with special reference to Haryana State Governemnt's control over municipal bodies. Autonomy of local bodies. Problems of municipalities. State department and directorate of municipal bodies. Its organisation and functions. Role of the Ministry of Urban Development as well as the central council of local self-government in regard to municipalities. Municipal Corporation-composition, functions and finances. Town and metropolitan planning in India. 74th Constitutional Amendment Act, 1992. Rural Local Government-Zila Parishad, Panchayat Samiti, Panchayat. Their composition, functions, finance, personnel. State Government's control over their working. Role of political parties in Panchayati Raj. 73rd Constitutional Amendment Act, 1992. Problems of rural-urban relationship.

XIII. Administration for Welfare : Meaning, objective and concept of welfare state. Social welfare administration in India. Welfare state and the constitution of India. The directive principles of the state policy. Administration for the welfare of weaker sections like scheduled castes, scheduled tribes and women. Welfare programmes for them.

XIV. Issue Areas in Indian Administration : Relationship between political and permanent executives. Generalists and specialists in administration. Integrity in administration. People's participation in administration. Redressal of citizen's grievances. Lok Pal and Lok Ayuktas. Administrative reforms in India. Accountability of Indian administration to the parliament and judiciary. Problems and causes for the backwardness of agricultural development. Programme of centre and state government for agricultural development.

20. PUNJABI LITERATURE

Part-I

1. Origin of Punjabi language: Different stages of development and recent development in Punjabi language. Characteristics of Punjabi phonology and the study of its tones. Classification of vowels and consonants.

2. Punjabi morphology: The number-gender system (animate and inanimate), prefixes, affixes and different categories of post positions; Punjabi word formation; Tatsam, Tad Bhav forms; sentence structure, the notion of subject and object in Punjabi; noun and verb phrases.

3. Language and dialect: The notions of dialect and idiolect; major dialects of Punjabi (Pothohari, Majhi, Doabi, Malwai, Paudhi) ; the validity of speech variation on the basis of social stratification, the distinctive features of various dialects with special reference to tones, language and script; origin and development of Gurmukhi; suitability of Gurmukhi for Punjabi.

4. Classical background: Nath Jogi Sahit.

[Medieval literature: Gurmat, Sufi, Kissa and Var: janamsakhis:]

5. Modern trends : Mystic, romantic, progressive and neomystic (Vir Singh, Puran Singh, Mohan Singh, Amrita Pritam, Bawa Balwant, Pritam Singh Safeer, J. S. Neki). Experimentalist (Jasbir Singh Ahluwalia, Ravinder Ravi, Ajaib Kamal). Aesthetes (Harbhajan Singh, Tara Singh). Neo-progressive (Pash, Jagtar, Patar).

6. Folk literature: Folk songs, folk tales, riddles, proverbs.

Epic: (Vir Singh, Avtar Singh Azad, Mohan Singh)

Lyric: (Gurus, sufis and Modern Lyricists-Mohan Singh, Amrita Pritam, Shiv Kumar, Harbhajan Singh).

7. Drama: (I.C. Nanda, Harcharan Singh, Balwant Gargi, S.S. Sekhon, Alamjit and A.S. Aulakh).

Novel: (Vir Singh, Nanak Singh, Jaswant Singh Kanwal, Sukhbir, Gurdial Singh, Dalip Kaur Tiwana, Swarn Chandan, Ram Saroop Ankhi).

Short Story: (Sujan Singh, K.S. Duggal, K. S. Virk, Prem Parkash, Waryam Sandhu)

8. Socio-cultural literary influences: Sanskrit, Persian and Western.

Essay: (Puran Singh, Teja Singh, Gurbaksh Singh, N. S. Kapoor).

Literary Criticism: (S. S. Sekhon, Attar Singh, Kishan Singh, Harbhajan Singh, S. S. Noor, Najam Hussain Sayyad).

Part-II

This part will require first-hand reading of the texts prescribed and will be designed to test the candidate's critical ability.

1. Sheikh Farid: The complete Bani included in the Adi Granth.

2. Guru Nanak : Japu Ji Baramah, Asa di Var.

3. Builieh Shah: Kafian

4. Waris Shah: Heer

5. Shah Mohammad: Jangnama (Jang Singhan te Firangian)

Dhani Ram Chatrik (poet) : Chandan Vari, Sufi Khnna, Nawan Jahan.

6. Nanak Singh (Novelist) : Chitta Lahu, Pavittar Papi, Ek Mian Do Talwaran.

7. Gurbaksh Singh (Essayist): Zindagi di Ras, Nawan Shivala, Merian Abhul Yadaan.

Balraj Sahni (Travelogue): Mera Roosi Safarnama, Mera Pakistani Safarnama

8. Balwant Gargi (Dramatist) : Loha Kutt, Dhuni-di-Agg, Sultan Razia.

Sant Singh Sekhon (Critic) : Sahityarth, Parsidh Punjabi Kavi, Punjabi Kav Shiromani.

21. SANSKRIT LITERATURE

Part-I

1. Main characteristics of Vedic Sanskrit language. Prominent feature of classical Sanskrit language. Contribution of Sanskrit to linguistic studies.

2. Significant features of grammar, with particular stress on Sanjna, Sandhi, Karaka, Samasa, Kartri and Karma vacyas (voice usages)

3. General knowledge of : (a) Literary history of Sanskrit (b) Principal trends of literary criticism (c) Ramayana (d) Mahabharata (e) The origin and development of literary geners of Mahakavya, Rupaka (drama), Katha, Akhyayika, Champu, Khandakavya, Muktaka Kavya.

4. Essential of Indian Culture with stress on: (a) Purusarthas (b) Samaskaras (c) Varnasrama vyavastha (d) Arts and fine arts (e) Technical sciences

5. Trends of Indian Philosophy: (a) Mimansa (b) Vedanta (c) Nyaya (d) Vaisesika (e) Sankhya (f) Yoga (g) Bauddha (h) Jaina (i) Charvaka

6. Short Essay in Sanskrit (at least 250 words)

7. Unseen passage with the questions (to be answered in Sanskrit).

8. Translation from Hindi to Sanskrit.

Part-II

1. General-study of the following works: (a) Isavasyopanisad (b) Bhagavadgita (c) Sundarakanda of Valmiki's Ramayana (d) Arthasastra of Kautilya (e) Raghuvamsam-Kalidasa.(f) Kumarasambhavam-Kalidas (g) Kadambari-Banabhatta (h) Dasakumaracaritam-Dandin (i) Sivarajyodayam-S.B. Varnekar (j) Svapanavasavadattam-Bhasa (k) Abhijnana Sakuntalam-Kalidasa (l) Mrcchakatikam - Sudraka (m) Mudrsaraksasa-Visakhadatta (n) Uttarammacharitam—Bhavbhuti (o) Ratnavali-Sriharshavardhana

2. Write short notes in Sanskrit on the following: (a) Meghadutam—Kalidasa (b) Nitisatakam—Bhartrhari (c) Panchtantra-Vishnusharma (d)Rajatarangini-Kalhana (e) Harsacharitam- Banabhatta (f) Gitagovindam--Jayadeva.

3. Evidence of first hand reading of the following selected texts (questions are to be answered in Sanskrit) : (a) Isavasyopanisad-verses-1, 2, 4, 6, 7,15 and 18. (b) Bhagavatgita-II chapter, verses 13 to 25 (c) Sundarakandam of Valmiki-Canto 15, Verses 1 to 30 (Geeta Press Edition) (d) Raghuvamsam-Canto I, Verses 1 to 10 (e) Kumarasambhavam-Canto I, Verses 1 to 10 (f) Meghadutam-verses 1 to 10 (g) Nitisatakam-Verses 1 to 10 (Edited by D.D. Kosambi, Bharatiya Vidya Bhavan Publication) (h) Kadambari-Sukanasopadesa (only) (i) Svapnavasavadattam Act VI (j) Abhijnansakuntalam Act IV verses 15 to 30 (M.R. Kale Edition) (k) Uttararamacharitam Act I verses 31 to 47 (M.R. Kale Edition) .

22. SOCIOLOGY

Part- I General Sociology

1. Sociology as a Discipline

Sociology as a science and as an interpretative discipline. Impact of industrial and French Revolution on the emergence of sociology. Sociology and its relationship with history, economics, political science, psychology and anthropology.

2. Scientific Study of Social Phenomena

Problem of objectivity and value neutrality. Issue of measurement in social science; Elements of scientific method-concepts, theory and fact, hypothesis. Research designs-descriptive, exploratory and experimental.

3. Techniques of Data Collection and Analysis

Significance of social research. Participant, Non participant and quasi-participant. Methods and techniques of data collection (observation, interview, questionnaire and schedule, survey and case study). Sampling-size, reliability and validity. Types and sources of data (primary and secondary). Tabulation, classifications and analysis of data. Scaling techniques-social distance and Likert scale. Statistical methods in social research-measure of central tendency (mean, median, mode), measure of dispersion (mean deviation, standard deviation).

4. Pioneering Contributions to Sociology

(a) Karl Marx : Historical materialism, mode of production, alienation and class struggle. (b) Emile Durkheim Division of labour, social fact, religion and society. (c) Max Weber: Social action, ideal types, authority, bureaucracy, protestant ethic and the spirit of capitalism. (d) Tolcott Parsons: Social system, pattern variables. (e) Robert K. Merton; Latent and manifest functions, conformity and deviance, reference groups.

5. Marriage and Family

Types and forms of marriage. Family-structure and function. Personality and socialization. Social control. Family lineage, descent and property. Changing structure of family. Marriage and sex roles in modern society. Divorce and its implications. Gender issues. Role conflicts.

6. Socail Stratification

Concepts-hierachy, inequality and stratification. Theories of stratification-Marx, Davis and Moore Critique. Forms and functions. Different conceptions of class. Class-in-itself and class-for-itself. Caste and class. Caste as a class.

7. Social Mobility

Types of mobility–open and closed models. Intra-and inter-generational mobility. Vertical and horizontal mobility. Social mobility and social change.

8. Economic System

Sociological dimensions of economic life. The impact of economic processes on the larger society. Features of pre-industrial and industrial economic system. Industrialisation and social change, Social determinants of economic development. Globalization and Liberalization.

9. Political System

The nature of power-personal power, community power, power of the elite, class power, organizational power, power of the un-organised masses. Authority and legitimacy Pressure groups and political parties. Voting behaviour. Modes of political participation-democratic and authoritarian forms.

10. Educational System

Education and Culture. Equality of educational opportunity, Social aspects of mass education Problems of universalisation of primary education. Role of community and state intervention in education. Education as an instrument of social change.

11. Religion

Origins of religious beliefs in pre-modern societies. The sacred and the profane. Social functions and dysfunctions of religion. Monistic and pluralistic religion. Organised and unorganised religions, Sect and cults, Magic, religion and science.

12. Social Movements

Concept of social movement. Genesis of social movements. Ideology and social movement. Social movement and social change. Types of social movements.

13. Social Change and Development

Continuity and change as fact and as value. Theories of social change–Marx, Persons and Sorokin. Directed social change. Social policy and social development.

Part- II Study of Indian Society

1. Historical Moorings of the Indian Society and Indian Social Structure.

Traditional Hindu social organisation, Socio-cultural dynamics through the ages. Impact of Buddhism, Islam and the West. Factors in continuity and change. Unity and diversity.

2. Caste System

Origin of the caste system. Cultural and structural views about caste. Mobility in caste system. Caste among Muslims and Christians, Change and persistence of caste in modern India. Issues of equality and social justice. Views of Gandhi and Ambedkar on caste. Caste and Indian polity. Emergence of Dalit consciousness.

3. Marriage, Family and Kinship

Meaning of marriage. Types of marriage. Rules of mates selection. Stability of marriage. Patterns of marriage among Hindus, Muslims. Ways of acquiring mates among the tribes. Marriage among different ethnic groups, its changing trends and its future. Family -its structural and functional aspects-changing forms. Types of family (nuclear, extended and joint family). Family problems, Disintegration of family, its causes, future of family. Impact of legislation and socio-economic change on marriage and family. Generation gap, Inheritance, succession and descent of kinship. Regional variations in kinship systems, North and South Indian kinship patterns.

4. Class and Agrarian Class Structure

Indian Social class structure. Emergence of middle class. Peasant society and agrarian systems. Land tenure systems-historical perspectives. Social consequences of land reforms and green revolution. Feudalism and semi-feudalism debates. Emerging agrarian class structure. Agrarian unrest.

5. Industry and Society

Path of industrialisation and occupational diversification. Trade union and human relations. Market economy and its social consequences. Economic reforms-liberalisation, privatisation and globalization.

6. Political Processes

Working of the democratic political system in a traditional society. Political parties and their social bases. Social structural origins of political elites and their orientations. Regionalism, pluralism and national unity. Decentralisation of power. Panchayati Raj and Nagarpalikas. 73rd and 74th Constitutional Amendments. Women and Panchayati Raj.

7. Education

Directive Principles of State Policy and primary education. Educational inequality and change. Education and social mobility. The role of community and state intervention in education. Universalisation of primary education. Total literacy campaign. Educational problems of disadvantaged groups.

8. Religion and Society

Size, growth and regional distribution of different religious groups. Educational levels of different groups. Problems of religious minorities. Communal tensions. Secularism. Religious fundamentalism. Conversions.

9. Tribal Societies

Distinctive features of tribal communities and their geographical spread. Problems of tribal communities-land alienation, poverty, indebtedness, health and nutrition, education. Tribal development efforts after independence. Tribal policy-isolation, assimilation and integration, issues of tribal indentity.

10. Population Dynamics

Population size, growth, composition and distribution. Components of population growth (birth rate, death rate and migration). Determinants and consequences of population growth. Issues of age at marriage, sex ratio, infant mortality rate. Population policy and family welfare programmes.

11. Dimensions of Development

Strategy and ideology of planning, poverty, indebtedness and bonded labour. Strategies of rural development-poverty alleviation programmes. Problems involved in urban growth-basic infrastructure, environment, housing, slums, and unemployment. Programmes for urban development.

12. Social Change

Endogenous and exogenous sources of change and resistance to change.-Processes of change-sanskritisation and modernization. Factors (agents) of social change - demographic, environmental, technological, economical, mass media and communication, educational, cultural, religious, legislative. Processes of social change in India-Sanskritization, urbanization, westernization, secularization, industrialization, modernization. Problems of change and modernisation. Structural contradictions and breakdowns. Development and social change. Theories of social change-linear, cyclic fluctuation, conflict. Formal strategies of social change - social planning and legislation. Informal strategies of social change - social movements in India.

13. Social Movements

Reform movements-Brahm Samaj, Arya Samaj and Satya Sadhak Samaj. Peasant movements-Kisan Sabha, Telengana and Naxalbari. Backward castes movement. Self-respect movement. Backward castes mobilisation in North India.

14. Women and Society

Demographic profile of women. Special problems-dowry, atrocities, discrimination, gender inequality, marital adjustment, family tension and violence. Welfare programmes for women and their impact. Child Welfare Schemes.

15. Social Problems

Prostitution, AIDS, alcoholism, drug addiction. corruption, dowry, youth unrest, regionalism, casteism, poverty, unemployment, bonded labour, discrimination and atrocities on S.C./S.T and women. Legal measures to eradicate the social problems .

23. ZOOLOGY

1. Non-Chordata

1. A general survey, classification and relationship of the various phyla and their subdivision upto class.
2. Protozon: Study of the structure and life history of Paramaccium, Monocyotis, malarial parasite, Trypanosoma. Locomotion, nutrition and reproduction in Protozoa.
3. Porifera: Canal system, skeleton and reproduction.
4. Coelentrata : Structure and life history of Obelia and Aurelia, Polymorphism in Hydrozoa, coral formation, metagenesis.
5. Helminths: Structure and life history of Fasciola, Taenia and Ascaris. Parasitic adaptation. Helminths in relation to man.
6. Annelida: Earthworm and leech. Coelom and metamerism, modes of life in polychactes.
7. Artropoda: Cockroach, larval forms and parasitism in Crustacea, respiration in arthoropods, social life and metamorphosis in insects. Importance of Peripatus.
8. Mollusca : Pila, oyster culture and pearl formation.
9. Echinodermata-General organisation, affinities of Echinodermata.

2. Protochordata

1. General organisation and characters, outline classification and inter-relationship of protochordata with chordates.
2. Neoteny and retrogressive metamorphosis.

3. Chordata

1. A general study of comparative account of the various systems of vertebrates.
2. Locomotion, migration and respiration in fishes; affinities of Dipnoi.
3. Origin of Amphibia; anatomical peculiarities and affinities of urodela and Apoda.
4. Origin of Reptiles; adaptive radiation in reptiles; fossil reptile; poisonous and non-poisonous snakes of India; poison apparatus of snakes.
5. Origin of birds; aerial adaptation and migration of birds.
6. Origin of mammals; dentition and skill derivatives in mammals; distribution, structural peculiarities and phylogenetic relations of Prototheria and Metatheria.

4. Ecology

1. Environment : Abiotic factors and their role. Biotic factors-intra and interspecific relations.
2. Animal : Organisation at population and community levels, ecological successions.
3. Ecosystem : Concept, components, fundamental operation, energy flow, biogeo-chemical, cycles, food chain and trophic levels.
4. Adaptation in fresh water, marine and terrestrial habitats.
5. Pollution in air, water and soil.
6. Wild life in India and its conservation.

5. Ethology

1. General survey of various types of animals behaviour.
2. Role of hormones and phermones in behaviour.

6. Biostatistics

Methods of sampling, frequency distribution and measures of central tendency, standard deviation, standard error and standard deviance, correlation and regression and Chisquare and t-test.

7. Economic Zoology

1. Parasitism, commensalism and host parasite relationship.
2. Parasitic protozoans, helminthis and insects of man and domestic animals.
3. Insect pests of wheat, paddy and sugarcane and stored products.
4. Beneficial insects.
5. Pisciculture and induced breeding (carps only).

Part-II

1. Cell Biology

Structure and function of cell and cytoplasmic. constituents. Structure of nucleus. Plasma membrane mitochondria, golgibodies, endo-plasmic reticulum and ribosomes. Cell division (mitosis and meiosis). Watson-Crick models of DNA. Replication of DNA. Genetic code. Protein synthesis, Cell differentiation.

2. Genetics

Mendelian laws of inheritance. Recombination linkage and linkage maps. Multiple allels. Mutation (natural and induced). Mutation and evolution. Chromosomal abberations : structural rearrangements, aneuploidy and polyploidy. Cytoplasmic inheritance. Regulation of gene expression in prokaryotes and eukaryotes. Genes and diseases. Eugenics.

3. Evolution and systematics

Origin of life. History of evolutionary through Lamarck and his works, Darwin and his works, sources and nature of organic variation. Natural selection. Hardy-Weinberg Law. Cryptic and warning colouration mimicry. Isolating mechanisms and their role. Concept of species and subspecies, principles of classification. Zoological nomenclature. Fossils, outline of geological eras, phylogeny of horse, origin and evolution man, principles and theories of continental distribution of animals.

4. Biochemistry

Structure of carbohydrates, lipids, aminoacids, proteins, and nucleic acids, glycolysis and krebs cycle, oxidation and reduction, oxidative phosphorylation, energy conservation and release ATP, b oxidation of fatty acids, structure and functions of cholesterol steroid hormones. Types of enzymes, mechanism of enzyme action, immunoglobulin and immunity. Hormones, their classification, biosynthesis and functions.

5. Physiology

Physiology with special reference to mammals. Composition of blood, blood groups in man, coagulation, oxygen and carbondioxide transport, haemoglobin, breathing and its regulation. Nephron and urine formation, acid base balance

and osmoregulation: Mechanism of conduction of nerve impulse along axon and across synapes, neurotransmitters. Types of muscles, ultrastructures and mechanism of contraction of skeletal muscle. Role of salivary gland, liver, pancreas and intestinal glands in digestion, absorption of digested food, nutrition and balanced diet of man. Mechanism of action of steroid and peptide hormones, role of hypothalamus, pituitary thyroid, parathyroid, pancreas, adrenal, testis ovary and pineal organs and their inter-relationships. Physiology of reproduction in humans.

6. Embryology

Gametogenesis, fertilization, types of eggs, cleavage, development upto gastrulation in frog and chick. Fate maps of frog and chick, meta-morphosis in frog. Formation and fate of extra embryonic membranes in chick. Formation of amnion allantois and types of placenta in mammals, function of placenta in mammals; Organisers. Regeneration Organogenesis of central nervous system, sense organs, heart and kidney of vertebrate embryos .

DHARAM VIR,
Chief Secretary to Government, Haryana.

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