HARYANA GOVERNMENT
PERSONNEL DEPARTMENT
Notification
The 31st March, 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 02-01-2003, 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) 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 microbiological 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 nurtrients. 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 polymorphism 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 contageous 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, transporation 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 potential, 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 geneal 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 Werner'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 :—Nomenclature; 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; synthesis and reactions of alkylhalides, alkanols, alkanals, alkanones, alkanoic acids, esters, amiders, nitriles, amines, acid anhydrides, ethers 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 SN1 and SN2 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 teritary 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 C_p and C_v.

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 eqaution . Heat capacities.

(ii) Second law and its applications :—Spontaneity of a process, entropy and entropy changes in various process, free energy functions, criteria for spontanity, 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; integeral 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:- Obsorption 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 mechanism).

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 in two 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, continuous 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 of momentum equation from control volume equation, applications to pipe flow, dimensional analysis. Boundary layer on a flat plate, 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. Pareto-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 averages. 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; LT1 systems; convolution; impulse response; time-domain analysis of LT1 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; P1, 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. Magnetic 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; mininisation 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 FM.

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: multimeter, 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 ; performance characteristics, starting and speed control, armature reaction and commutation; three-phase induction motor ; performance characteristics, starting and speed control. Single-phase induction motor. Synchronous generators: performance characteristics, regulation, parallel operation. Synchronous motors: starting characteristics, applications; 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 Drivers

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.