A G R I C U L T U R E

Paper-I :

Agricultural Botany (Plant cytology, genetics, breeding and physiology, morphology of crop plants).

Agricultural Entomology and Plant Pathology. Life history of crops and stored grains, pests and methods of their control. Classification of insects up to orders. Insecticides and their use. Principles of plant quarantine regulations. Insect ecology. Life History of economic insects and methods of rearing them. Classification, taxonomy and nomenclature of Fungi. Major diseases of crops and methods of their prevention and control. Plant viruses and bacteria. Fungicides and their use.

Paper-II :

Agricultural Chemistry and Soil Science (Properties of important carbo-hydrates, proteins, lipids, organic acids, plant pigments and alkaloids) Chemistry of Fertilisers, Pesticides and Herbicides, Chemistry of simple and compound fertilisers and measures. Nitrification and nitrogem fixation. Soil development and their composition. Soil structures. Physical properties of soil. Soil -water relationship. Soil-plant relations soil fertility and plant growth. Soil Microbiology.

B O T A N Y

Paper-I :

Morphology, Anatomy, Embryology and Taxonomy of Angiosperms.

Anatomy - Tissues and Tissue systems, Morphology and anatomy of stem, root, leaf, flower and seed including developmental aspects and anomalous growth, Structure of anther and ovule. Fertilisation and development of seed.

Taxonomy - Principles of nomenclature anc1 classification of angiosperms. Modern trends in Taxonomy. A general knowledge of the more important families of angiosperm.

Physiology - Ecology and elementary idea of plant geography and dispersal of plants.

Paper-II :

Plant Pathology - Knowledge of important plant diseases in India caused by Fungi, bacteria and viruses. Mode of infection and methods of prevention and control physiology of parasitism.

Evolution, Cytology, Genetics and Plant Breeding; Economic Botany, Origin and importance of cultivated plants. General account of important sources of food, fibre, wood and drugs.

C H E M I S T R Y

Paper-I :

Physical and Organic

Atomic structure and Chemical bonding; valence bonds and molecular orbitals; Molecular structure and molecular spectra; Raman spectra; Chemical Kinetics, Catalysis. Electro-Chemistry; Transition metal Chemistry, Physical organic Chemistry, Aliphatic Chemistry, Carbohydrates, Stereo-Chemistry; Aromatic Chemistry; Dyes. Vitamins. Antibiotics, Cellulose, Starch and Organic Polymers, Organic Photo Chemistry.

Paper – II :

Inorganic and Industrial

Inorganic Polymers, Silicones. Alloys and Intermetallic compounds. Chemistry of : Boron, Titanium, Germanium, Tungsten, Tantalum, Thorium, Uranium, Octahedral and Planar Inorganic complexes, Industrial importance of Cellulose, Starch, Coal Tar Chemicals, Organic Polymers, Oils and fats, Petro-Chemicals, Vitamin, Hormone, Alkaloids, Antibiotics, Proteins.

C O M P U T E R S C I E N C E

Paper – I :

Operating system, System software, Software engineering, Computer networks, Internet and Java programming.

Paper-II :

Design and analysis of algorithms, Computer system architecture, Computer graphics, Relational data base management system.

C O M P U T E R A P P L I C A T I O N

Paper – I :

Digital computer fundamental, Discrete mathematics, Numerical methods, Resource management techniques, MC and Assembly language programming.

Paper – II :

Data and file structure, C programming, Object oriented programming, Visual programming, PC maintenance and trouble shooting.

AGRICULTURAL ENGINEERING

Paper-I :

1. Soil and Water Conservation :

Definition and scope of soil conservation; Mechanical and types of erosion their causes. Hydrologic cycle, rainfall and runoff-factors affecting them and their measurements, stream gauging-Evaluation of runoff from rainfall, Erosion control measures-Biological and Engineering.

Basic open channel hydraulics. Designs of soil conservation structures-terraces, bunds, outlets and grassed waterways. Principles of flood control. Flood routing. Design of farm ponds and earth dams. Stream bank erosion and its control, Wind er osion and its control. Principles of watershed management.

Investigation and planning in River Valley Projects.

2. Irrigation and drainage :

Soil-Water-plant relationships. Sources and types of Irrigations. Planning and design of minor irrigation pro jects, Techniques of measuring soil moisture.

Duty of water-consumptive use. Water requirement of crops. Measurement and cost of irrigation water. Measuring devices-flow through orifices, wires and flumes. Levelling and layout of irrigation systems, design and construction of channels, field channels, pip e lines, head gates, diversion boxes structures and road crossing. Occurance of ground water, Hydraulic of wells, Types of wells, their construction, drilling methods. Well development. Testing of wells.

Drainage-Definition-causes of water logging. Methods of drainage. Drainage of irrigated lands. Design of surface and subsurface systems.

Paper-II :

1. Building materials :

Kinds of building materials-their properties. Timber, Brick work and R.C. construction. Design of columns, beams, roof trusses, joints, Layout of farmstead. Design of farm houses, animals shelters and storage structures. Rural water supply and sanitation.

2. Farm power and machinery :

Construction of different types of internal combustion engines, Ignition, fuel, lubricating, Cooling and governing system of IC engines. Different type of tractors, chassis, transmission and stearing. Farm machinery for primary and secondary tillage, seeding machinery, interculture tools and machinery. Plant producting equipment. Harvesting and threshing equipment. Machinery for land development. Pumps and pumping machinery.

3. Electricity and rural electrification power generation and transmission :

Distribution of electricity for rural electrification; A.C. & D.C. circuits. Uses of electric energy on the farm. Electr ic motors used in agriculture-types, selection, installation and maintenance

CHEMICAL ENGINEERING

Paper-I :

1. Transport phenomena : (Under steady State conditions)

   (a) Momentum transfer :-

   i) Different patterns of flow and their criteria.

   ii) Velocity profile.

iii) Filtration; Sedimentation; Centrifuge.

iv) Flow of solids through fluids.

(b) Heat transfer : Different modes of heat transfer : conduction calculation for single and composite walls of flat, cylindrical, spherical shapes.

Convection-different diamentionless groups used in forced and free convection, Equivalent diameter. Determination of individual and overall heat transfer coeff.

Evaporation-Radiation-Stefan Boltzman law.

Emmissivity and absorptivity, Geometrical shape factor, Heat load of furnaces-Calculation.

(c) Mass transfer : Diffusion in gases and liquids. Absorption, desorption, humidification, dehumidification, drying and distillation Analogy between momentum, heat and mass and transfer.

2. Thermodynamics :

(a) 1^{st}, 2^{nd} and 3^{rd} Laws of thermodynamics.

(b) Determination of internal energy, entrophy, enthalpy and free energy-Determination of chemical equilibrium constants for homogeneous and heterogeneous systems. Use of thermodynamics in combustion, distillation and heat transfer. Mechanism and theory of mixing, various mixers for liquid-liquid, solid-liquid and solid-solid.

Paper-II :

1. Reaction Engineering :

i) Kinetics : Homogeneous and heterogeneous reactions, 1^{st}, 2^{nd} order reactions.

Batch and flows – Reactors and their design.

ii) Catalysis choice of catalysis; Preparations; Mechanics of catalysis based upon mechanism.

2. Transportation :

Storage and transport of materials and in particular, powders, resins volatile and non-volatile liquids, emulsions and dispersions, pumps, compressors and blowers, Mixer-Mechanisms and theory of mixing, various mixers for liquid-liquid; solid-solid; solid-liquid.

3. Materials :

Factors that determine choice of materials for construction in chemical industries-Metals and alloys, ceramics, plastics and rubbers, Timber and timber products, plywood laminates.

Fabrication of equipment with particular reference to production of vats, barrals, filter presses etc.

4. Instrumentation and process control :

Mechanical, hydraulic, pneumatic, thermal, optical, magnetic, electrical and electronic instruments, controls and control systems, automation.

CIVIL ENGINEERING

Paper-I :

1. Building materials and properties and strength of materials :

Building materials-Timber stone, brick, lime, tile, sand, surki, mortar and concrete, metal and glass structural properties of metals and alloys used in engineering practice.

Stresses and strains, Hook's law, Bending, Torsion and direct stresses. Elastic theory of bending of beams, maximum and minimum stresses due to eccentric loading, Bending moment and Shear force diagrams and deflection of beams under static and live loads.

2. Structural Engineering :

Steel structures : Permissible stresses, Design of beams, simple and built-up columns and simple roof trusses and girders, column bases and grillages for axially and eccentrically loaded columns, Bolted, rivetted and welded connections.

R.C.C. structures, Specification of materials used, proportioning workability and strength requirement, I.S.I. standards for design loads, permissible stresses in R.C.C. members subject to direct and bending stresses. Design of simply supported overhanging and cantilever beams, rectangular and Tee beams in floors, roofs and lintels, Axially loaded columns and their bases.

Paper-II :

1. Building-construction, water supply and sanitary engineering

Construction-Brick and stone masonry walls, floors and roofs, stair cases, carpentry in wooden floor, roof, ceiling, doors and windows, Finishes (plastering, pointing, painting and varnishing etc.).

Soil mechanics-Soil and their investigation. Bearing capacity and foundations of buildings and structures, principles of design,

Building estimates - principle, units of measurement, Taking out quantities for building and preparation of abstract of costs, specifications and data sheets for important items.

Water supply-sources of water, Standards of purity, methods of purification, layout of distribution system, pumps and boosters.

Sanitation - Sewers, storm water overflows, house drainage requirements and appurtenances, septic tanks, Imhoff tanks, sewage treatment and dispersion trenches. Activated sludge process.

2. Roads and bridges

Survey and alignment : Highway materials and their placements principles of design, width of foundation and pavement, camber, gradient, curves and super-elevation, Retaining walls.

Construction - Earth roads, stabilized and water bound macadam roads, bituminous surfaces and concrete roads, Draining of roads, Bridges - Types, Economical spans, I.R.C. loading, designing superstructure of small span bridges. Principles of designing foundation of abutments and piers of bridges, pile and well foundations.

Estimating Earthwork for roads and canals.

COMPUTER ENGINEERING

Paper-I :

Number system, Data representation, Microprocessors, Architecture and instruction set of microprocessors, Assembly language programming, Microprocessor based system design.

Paper-II :

Fundamental of computer architecture, Processor design, Control unit design, Memory organisation, System organisation, Personal computers and their typical use, Elemenets of high level programming language PASCAL/C, Use of data structure, Programming.

ELECTRICAL ENGINEERING

PAPER-I :

Network :

Steady state analysis of d.c. and a.c. networks, network theorems. Matrix Algebra, network functions, transient response, frequency response, Laplace transform, Fourier series and Fourier transform, frequency spectral polezero concept, elementary network synthesis.

Statics and Magnetics :

Analysis of electrostatic and Magnetostatic fields: Laplace and Poisson Equations, solution of boundary value problems, Maxwell's equations, electromagnetic wave propagation, ground and space waves, propagation between earth station and satellites.

Measurements :

Basic methods of measurements, standards, error analysis, indicating instruments, cathode ray oscilloscope, measurement of voltage, current, power, resistance, inductance, capacitance, time, frequency and flux; electronic meters.

Electronics :

Vacuum and semiconductor devices; equivalent circuits transistor parameters, determination of current and voltage gain and input and output impedances biasing technique, single and multistage, audio and radio small signal and large signal amplifiers and their analysis; feedback amplifiers and oscillators : wave shaping circuits and time base generators; analysis of different type of multivibrator and their uses; digital circuits.

Electrical Machines :

Generation of e.m.f., m.m.f. and torque in rotating machines; motor and generator characteristics of d.c. synchronous and induction machines equivalent circuits. Commutation parallel operation, phasor diagram and equivalent circuits of power trans former, determination of performance and efficiency, auto-transformers, 3-phase transformers.

PAPER-II :

SECTION -A

Control systems :

Methematical modelling of dynamic linear control systems, block diagrams and signal flow graphs, transient response steady state error, stability, frequency response techniques, root-locus techniques series compensation.

Industrial Electronics :

Principles and design of single phase and polyphase rectifiers, controlled rectification, smoothing tilters; regulated power supplies speed control circuits for drivers, inverters, d.c. to a.c. conversion, Choppers; timers and welding circuits.

SECTION - B (Heavy currents)

Electrical Machines :

Induction Machines - Rotating magnetic field; poly phase motor; principle of operation, phasor diagram; Torque slip characteristic; Equivalent circuit and determination of its parameters; circle diagram; starters; speed control double case motor; Induction generator; Theory; phasor diagram, characteristics and application of single phase motors. Application of two phase induction motor.

Synchronous Machines - e.m.f. equation phasor and circle diagrams; operation on infinite bus, synchronizing power, operating characteristic and performance by different methods; sudden short circuit and analysis of oscillogram to determine machine reactances and time constants, motor characteristics and performance methods of starting applications.

Special Machines – Amplidyne and metadyne operating characteristics and their applications.

Power Systems and Protection - General layout and economics of different types of power stations; Baseload, peak-load and pumped-storage plants; Economics of different systems of d.c. and a.c. power distribution; Transmission line parameter calculation; concept of G.M. D. short, medium and long transmission line; Insulators, voltage distribution in a string of insulators and grading; Environmental effects on insulators. Fault calculation by symmetrical components; load flow analysis and economic operation; steady state and transient stability; Switch-gear Methods of arc extinction: Re-striking and recovery voltage; Testing of circuit breaker, Protective relays; protective schemes for power system equipment; C.T. and P.T. Surges in transmission lines; Travelling waves and protection,

Utilisation- Industrial drives electric motors for various drives and estimates of their rating; Behaviour of motors during starting acceleration, braking and reversing operation; Schemes of speed control for d.c. and induction motors.

Economic and other aspects of different systems of rail traction; mechanics of train movement and estimation of power and energy requirements and motor rating characteristics of· traction motors, Dielectric and induction heating.

O R

SECTION- C (Light currents)

Communication Systems – Generation and detection of amplitude frequency-phase – and pulse-modulate signals using oscillators, modulators and demodulators ,Comparison of modulated systems, noise, problems, channel efficiency sampling theorem, sound and vision broadcast transmitting and receiving system, antennas, feeders and receiving circuits, transmission line at audio, radio and ultra high frequencies.

Microwaves – Electromagnetic wave in guided media, wave guide components cavity resonators, microwave tubes and solid state devices, microwave generators and amplifiers, filters microwave measuring techniques, microwave radiation pattern; communication and antenna systems. Radio aids to navigation.

D.C. Amplifiers – Direct coupled amplifiers, difference amplifiers, choppers and analog computation.

ELECTRONICS ENGINEERING

PAPER-I :

1. Physical Electronics :

Conduction in Semiconductors, principle of operation of p-n junction diodes, scr's and transistors; electron emission: deflection of electron beam with electric and magnetic fields and its application in CRT and picture tubes.

2. Electronic Circuits :

Rectifiers and filters; transistor characteristics; and concept of load line, hybrid parameters of transistors; transistor amplifiers (biasing, stabilization and frequency response); feedback in amplifiers; transistor oscillators, power amplifiers; DC and AC power control using SCR's.

3. Operational Amplifiers and Analog computers :

Basic principle and structure of operational amplifiers, its, characteristics; scalar, adder, sub-tractor and Integrator using op. amps; Analog Computation fundamentals, solution of differential equations, concept of time and amplitude scaling.

4. Control Systems :

Concept of open and closed loop systems; block diagram and signal flow graph of control systems; transient and frequency response of control systems; stability concepts; Root-locus technique.

PAPER – II :

1. Digital Electronics :

Pulse response of linear passive circuits, clipping and clamping; Representation of numbers, Boolean Algebra, binary arithmetic, Logic Gates; astable, monostable and bistable multivibrators; registers and counters.

2. Instrumentation and Measurement :

Basic Instrumentation Scheme; transducers for non-electrical quantities; use of op. amps in Instrumentation; D/A and A/D converters.

Indicating Instruments :-

CRO, Digital voltmeter; Time and Frequency Measurements, Q-measurement, measurement of sensitivity, selectivity and fidelity of an AM Receiver.

3. Principles of Communication :

Basic principles of telegraph and telephone, two and four terminal passive networks, attenuators, filters and transmission lines; principles of amplitude and frequency modulation and demodulation; time division and frequency multiplexing; fundamentals of digital communication, sampling, quantization, pulse code modulation; signal transmission in presence of noise and signal to noise ratio; optical Communication fundamentals.

4. Electromagnetic fields and Antennas :

Displacement current; Maxwell's Equations; Wave Equation and its solution for sinusoidal variations; propagation of electromagnetic waves; directional properties of dipole antennas; two-element array; broadcast arrays.

5. Microprocessor fundamentals :

Computer organisation; Architecture of microprocessors, micro and macro operations; Input/Output, Memory and peripheral devices; Concepts of Interrupts and Interfacing; Assembly level programming.

MECHANICAL ENGINEERING

Paper-I :

1. Strength of Materials

Stresses and strains, Hooke’s Law and relations between elastic constants, Compound bars in tension and compression and stresses due to temperature changes.

Bending Moment, shear force and deflection in simply supported, over hanging and cantilever beams for simple loading.

Torsion in round bars – Transmission of power by shafts, springs.

Simple cases of combined bending and direct stresses, and combined bending and torsion.

Elastic theory of failure – Stress concentration and fatigue.

2. Applied Thermodynamics

Fuel Combustion, Air supply, Analysis of fuels and exhaust gases.

Boilers, Superheaters and Economisers, Boiler mountings and accessories, Boiler trial.

Physical properties of steam, Steam tables and their use.

Laws of Therodynamics, gas law, expansion and compression of gases, air compressors.

Ideal and actual engine cycle, use of temperature, entropy, heatentropy and pressure-volume charts and diagrams.

Simple steam engines and internal combustion engines.

Indicators and Indicator Diagrams-Mechanical, Thermal, air standard and actual efficiencies – General construction – Engine trial and heat balance.

Paper-II :

1. Theory of machines and Machine Designs

Relative velocities of parts in machines graphically and by calculation.

Crank effort diagram of engines, Speed-Variation of flywheels, Governors power transmitted by belt drives, Friction and Lubrication of journals and thrust bearings, ball and roller bearings, Design of fastenings and locking devices, preparations for revetted, bolted and welded joints and fastenings.

2. Production Engineering

Common machine tools : Working principles and design features of Lathes, Shapers, planners, drilling machines, Milling machines, Grinding machines, jigs and fixtures. Metal cutting tool materials, Tool geometry.

Cutting forces, Abrasive Wheels.

Welding, Weldability and different welding processes, testing of welds.

Forming process-moulding, casting, forging, rolling and drawing of metals.

Metrology, Linear and angular measurements, Limits and fits. Measurement of screws and gears, surface finish. Optical instruments.

Industrial engineering Methods of study and work measurement Motion-time data, work sampling, job evaluation, wages and incentives, planning, control, plant lay out.

3. Fluid mechanics and Water power

Bernoulli's equation, Moving plates and vanes, pumps and turbines Design Principles, application and characteristic curves; Principles of similarity, Governing, Hydraulic accumulators and intensifiers, Cranes and Lifts, Surge tanks and Storage reservoirs.

ENVIRONMENTAL SCIENCE

PAPER-I :

Fundamentals of Environment :

Concept of environment- hydrosphere, lithosphere, atmosphere and biosphere; impact of man and environment; period of hunting and food gathering; period of plant and animal domestication; period of science, technology and industrialization.

Ecosystem :

Concept, components, food chain and food web, energy flow and productivity in ecosystem, nutrient cycle in ecosystem, types of ecosystems (forest, grassland, desert, aquatic, marine) and their problems, ecological imbalance.

Natural Resources and their management :

Water, land, forest, minerals, soil, agriculture, wildlife and energy resources status and their proper management/conservation; non-conventional resources.

Environmental Pollution :

Cause, effect and prevention of human induced environmental problems of air, water, soil, thermal, noise and marine pollution : socio-economic consequences of pollution in urban, industrial and rural areas of India.

PAPER-II :

Global Environmental Problems :

Green house effect, acid rain, El-nino, O3 depletion, deforestation, desertification, salinization, habitat and diversity loss, chemical and radiation hazards (Chernobyl disaster, Bhopal tragedy etc.) and their management.

Environment and Public Health :

Major water, food and air-borne diseases of men and animals, civic sense and personal hygiene issues, health hazards in agricultural pest control, heavy metal toxicity.

Environmental Monitoring and Impact Assessment :

Bioindicators and Monitoring; environmental impact assessment and management, safe limits of the key environmental pollutants.

Waste Management and Bioremediation :

Treatment of waste water, solid waste management, management of persistent organic pollutants, Silent valley project, the Ganga action plan, cost effective abatement technology.

The Environment Protection Laws and Human Rights :

Sustainable development environmental policies, environmental ethics, human rights issues relating to environment human population growth and lifestyle, HIV / AIDS.

FORESTRY

PAPER – I :

Section A

1. Silviculture – General :

General Silvicultural Principles : Ecological and physiological factors influencing vegetation, natural and artificial regeneration of forests; methods of propagation, grafting techniques; site factors; nursery and planting techniques -nursery beds, polybags and maintenance, water budgeting, grading and hardening of seedlings; special approaches; establishment and tending.

2. Silviculture – systems :

Clear feeling, uniform shelter wood selection, coppice and conversion systems. Management of silviculture systems of temperat e, subtropical, humid tropical, dry tropical and coastal tropical forests with special reference to plantation silviculture, choice of species, establishment and management of standards, enrichment methods, technical constraints, intensive mechanized methods, aerial seeding thinning.

3. Silviculture – Mangrove and Cold desert :

Mangrove : Habitat and characteristics, mangrove, plantation-establishment and rehabilitation of degraded man grove formations; silvicultural systems for mangrove; protection of habitats against natural disasters. Cold Desert – Characteristics, identification and management of species.

4. Silviculture of trees :

Traditional and recent advances in tropical silvicultural research and practices. Silviculture of some of the economically important species in India such as Acacia catechu. Acacia nilotica, Acacia auriculiformis, Albizzla lebbeck, Albizzia procera, Antocephalus Cadamba, Anageisus latifolia, Azadirachta indica, Bamboo spp, Butea monosperma, Cassia siamea, Casuarina equisetifolia, Cedrus deodara, Chukrasia tabularis, Dalbergia sisoo, Dipterocarpus spp., Emblica officindils, Eucalyptus spp, Gmelina Arborea, hardwickia binata, Largerstroemia Lanceolata, Pinus roxburghi, Populus spp, Pterocarpus marsupium, prosopis juliflora, Santalum album, Semecarpu s anacardium, Shorea robusta, Salmalia malaba ricum, Tectona grandis, Terminalis tomemtosa, Tamarindus indica.

Section B

1. Agroforestry, Social Forestry, Joint Forest Management and Tribology :

Agroforestry-Scope and necessity; role in the life of people and domestic animals and in integrated land use, planning especially related to (i) soil and water conservation; (ii) water recharge; (iii) nutrient availability to crops; (iv) nature and eco-system preservation including ecological balances through pest-predator relationships and (v) providing opportunities for enhancing biodiversity, medicinal and other flora and fauna. Agroforestry systems under different agro-ecological zones; selection of species and role of multipurpose trees and NTEPs techniques, food fodder and fuel security. Research and Extension needs. Social/Urban Forestry:Objectives, scope and necessity; peoples participation.

JFM: Principles, objective, methodology, scope, benefits and role of NGOs.

Tribology - tribal scence in India; tribes, concept of races, principles of social grouping, stages of tribal economy, education, cultural tradition, customs, ethos and participation in forestry programmes.

2. Forest Soils, Soil Conservation and Watershed management :

Forests Soils, classification, factors affecting soil formation, physical, chemical and biological properties.

Soil conservation: Definition, causes for erosion; types - wind and water erosion; conservation and management of eroded soils/areas, wind breaks, shelter belts, sand dunes; reclamation of saline and alkaline soils, water logged and other waste lands. Role of forests conserving soils. Maintenance and build up of soil organic matter, provision of loppings for green leaf manuring; forest leaf litter and composting; Role of microorganisms in ameliorating soils, N and C cycles, VAM.

Watershed Management: Concepts of watershed; role of mini-forests and forest trees in overall resource management, forest hydrology, water shed development in respect of torrent control, river channel stabilization, avalanche and landslide controls, rehabilitation of degraded areas; hilly and mountain areas; watershed management and environmental functions of forests; Water -harvesting and conservation; ground water recharge and watershed management, role of integrating forest trees, horticultural crops, field crops, grass and fodders.

3. Environmental Conservation and Biodiversity :

Environment : Components and importance, principles of conservation, impact of deforestation; forest fires and various human activities like mining, construction and developmental projects, population growth on environment.

Pollution : Types, global warming, green house effects, ozone layer depletion, acid rain, impact and control measures, enviro nmental monitoring; concept of sustainable development. Role of trees and forests in environmental conservation; control and prevention of air, water and noise pollution. Environmental policy and legislation in India. Environmental Impact Assessment. Economics assessment of watershed development vis-a-vis ecological and environmental protection.

4. Tree Improvement and seed Technology :

General concept of tree improvement, methods and techniques, variation and its use, provenance, seed source, exotics: quantit ative aspects of forest tree improvement, seed production and seed orchards, progeny tests, use of tree improvement in natural forest and stand improvement, genetic testing programming, selection and breeding for resistance to diseases, insects, and adverse envir onment; the genetic base, forest genetic resources and gene conservation in situ and ex-situ. Cost benefit ratio, economic evaluation.

PAPER II :

Section - A

1. Forest Management and Management Systems :

Objective and principles; techniques; stand structure and dynamics, sustained yield relation; rotation, normal forest, growing stock regulation of yield; management of forest plantations, commercial forests, forest cover monitoring. Approaches viz., (i) site-specific planning, (ii) strategic planning, (iii) Approval, sanction and expenditure, (iv) Monitoring, (v) Reporting and governance. Details of steps involved such as formation of Village Forest Committees, Joint Forest Participatory Management.

2. Forest Working Plan :

Forest planning, evaluation and monitoring tools and approaches for integrated planning; multipurpose development of forest resources and forest industries development; working plans and working schemes, their role in nature conservation, bio-diversity and other dimensions; preparation and control. Divisional working Plans, Annual Plan of Operations.

3. Forest Mensuration and Remote Sensing :

Methods of measuring - diameter, girth, height and volume of trees; form-factor; volumes estimation of stand, current annual.· increment; mean annual increment. Sampling methods and sample plots. Yield calculation; yield and stand tables, forest cover monitoring through remote sensing; Geographic Information Systems for management and modeling.

4. Surveying and Forest Engineering :

Forest surveying-different methods of surveying, maps and map reading. Basic principles of forest engineering. Building materials and construction. Roads and Bridges,· General principles, objects, types, simple design and construction of timber bridges.

Section B

1. Forest Ecology and Ethnobotany :

Forest ecology : Biotic and abiotic components, forest eco - systems; forest community concepts, vegetation concepts, ecological succession and climax, primary productivity, nutrient cycling and water relations; physiology in stress environments (drought, water logging salinity and alkalinity). Forest types in India, identification of species, composition and associations; dendrology; taxonomic classification, principles and establishment of herbaria and arboreta. Conservation of forest ecosystems. Clonal parks.

Role of Ethnobotany in Indian Systems of Medicine; Ayurveda and Unani - Introduction, nomenclature, habit, distribution and botanical features of medicinal and aromatic plants. Factors affecting action and toxicity of drug plants and their chemical constituents.

2. Forest Resources and Utilization :

Environmentally sound forest harvesting practices; logging and extraction techniques and principles, transportation system, storage and sale; Non-Timber forest Products (NTFPs) definition and scope; gums, resins, oleoresins, fibres, oil seeds nuts, rubber, canes, bamboos, medicinal plants, charcoal, lac and shellac, Katha and Bidi leaves, collection; processing and disposal.

Need and importance of wood seasoning and preservation; general principles of seasoning, air and kiln seasoning, solar dehumidification, steam heated and electrical kilns. Composite wood; adhesives-manufacture, properties, uses, plywood manufacture-properties, uses, fibre boards - manufacture properties, uses, particle boards manufacture, properties uses. Present status of composite wood industry in India in future expansion plans. Pulp-paper and rayon; present position of supply of raw material to industry, wood substitution, utilization of plantation wood; problems and possibilities.

Anatomical structure of wood, defects and abnormalities of wood, timber identification – general principles.

3. Forest Protection & Wildlife Biology : Injuries to forest-abiotic and biotic, destructive agencies, insect-pests and disease, effects of air pollution on forests and forest die back. Susceptibility of forest to damage, nature of damage, cause, prevention, protective measures & benefits due to chemical and biological control. General forest protection against fire, equipment and methods, controlled use of fire, economic and environmental costs; timber salvage operations after natural disasters. Role of afforestation and forest regeneration in absorption of CO_2. Rotational and controlled grazing, different methods of control against grazing and browsing animals; effect of wild animals on forest regeneration, human impacts; encroachment, poaching, grazing, live fencing, theft, shifting cultivation and control.

4. Forest Economics and Legislation :

Forest economics : Fundamental principles, cost-benefit analyses; estimation of. demand and supply; analysis of trends in the national and international market and changes in production and consumption patterns; assessment and projection of market structures; role of private sector and co-operatives; role of corporate financing. Socio-economic analyses of forest productivity and attitudes; valuation of forest goods and service.

Legislation : History of forest development; Indian Forest policy of 1894, 1952 and 1990. National Forest Policy, 1988 of people's involvement, Joint Forest management, involvement of women; Forestry Policies and issues related to land use, timber and non-timber products, sustainable forest management; industrialisation policies; institutional and structural changes. Decentralization and forestry Public Administration. Forest laws, necessity; general principles, Indian Forest Act 1927; Forest Conservation Act, 1980; wildlife protection Act 1972 and their amendments; Application of Indian Penal Code to Forestry. Scope and objectives of Forest invent ory.

G E O L O G Y

Paper-I :

General Geology

Origin and internal constitution of the earth; Volcanoes and earthquakes; Geological work of water, wind, and glacier; Isostasy; Common types of landforms; Soils.

Structural Geology and Geotectonics

Diastrophic and Non-diastrophic; Structures; Types of folds and faults; Joints; Planar and linear structures; Geosynclines, mobile belts and island arcs; Mid-oceanic ridges; Continental drift and concepts of sea-floor spreading and plate tectonics.

Stratigraphy

Principles of stratigraphy; Standard stratigraphic column; Principles of measurement of geological time; Sedimentary environment; Sedimentary facies: Principles of stratigraphic correlation; stratigraphy of India.

Palaeontology

Systematic palaeontology; palaeo-ecology; stratigraphic palaeontology; Important genera of India vertebrate, invertebrate and plant fossils; Organic evolution.

Paper-II :

Crystallographv and Mineralogy

Crystal habits and forms; Crystal symmetry; Classification of crystals ; Principles of uses of X-ray in the study of crystals; Physical and optical properties of minerals - their classification.

Petrology

Petrography of common sedimentary rocks Forms and petrography of common igneous rocks; Principles of crystallisation of magma; Classification of igneous rocks Genesis of common types of igneous rocks; Environment, factors and types of metamorphism; Structure and petrography of common metamorphic rocks.

Economic Geology

Formation of mineral deposits and their classification; Important metalliferous and non-metalliferous deposits of India; Coal and Petroleum resources of India; Ground water geology; Principles of engineering·geology; Elements of prospecting and mineral economics.

HORTICULTURE

PAPER-I :

Principles and fundamentals of horticulture, Orchard management, nursery management and seed production. Importance of fruits and vegetables in human nutrition. Contribution of horticulture in National Economy and export. Improved production technology for fruit, plantation, spices and warm and cool season vegetable crops. Protected cultivation of vegetables, organic farming, breeding of self and cross pollinated crops, Rejuvenation of old and unproductive orchards.

PAPER-II :

Importance and scope or floriculture. History and development of gardens. Production technology of commercial flowers, medicinal and aromatic plants. Principles of art and their application in landscape compositions and interior decoration.

Harvesting techniques. Maturity standards, handling, grading, storage and transport of fruits, vegetables, plantation crops, flowers, spices and medicinal plants. Codex standards, quality assurance system, food laws, value addition, primary processing, various produ cts from horticultural crops.

Elementary statistics, experimental design and computer application.

MATHEMATICS

Paper-I :

1. Algebra

Complex numbers, De Moivre's theorem, Determinants and Matrices; Groups and Fields.

2. Analytical Geometry of Two and Three Dimensions.

Polar equation of a conic; reduction of second degree general equation to the normal form; straight line, sphere, Cone, Cylinder.

3. Vector Algebra and Vector Calculus.

Addition and multiplication of vector, vector triple product; Rot, Div, Grad of a vector.

4. Differential Calculus, Integral Calculus and Differential Equations.

Indeterminant form, Maxima and Minima of two or more variables, Improper Integrals, Areas and Volumes, Solution of differential equation by separation of variables, Equation with constant co-efficients, Simple applications.

Paper-II :

1. Linear Programming :

The simplex method, Two phase simplex method Duality Application, The transportation and assignment problem, Convex sets, Fundamental Theorems of Linear Programming, Linear Programming Game Theory.

2. Probability and Statistics :

Events space, Axiomatic foundation, Baye's theorem. Histogram, Mean, Median, Mode, Variance; Mathematical expectation of a set of data; Binomial, Normal poissonian distributions with simple examples.

3. Statics and Dynamics :

Reduction of Coplanar forces, Friction : Sliding, tumbling and rolling, Laws of motion, Motion in a straight line under variable acceleration; Simple Harmonic Motion, Motion of Artificial Satellites around an attractive body, Simple cases of constrained motion.

4. Hydrostatics :

Perfect fluid, pressure at a point, Compressibility, Thrust on plane surfaces and on curved surfaces; Equilibrium of fluid rotating about a fixed axis, Equilibrium of the atmosphere shape and energy of liquid film, Hydraulic press; Common pumps.

P H Y S I C S

Paper-I :

Mechanics of a single particle. Mechanics of a system of particles, Properties of deformable bodies, Properties of liquids an d gases, waves and Oscillations. Electro-acoustics Ultrasonics. Head Transmission by Conduction, Convection and Radiation. First and Second Laws of Thermodynamics, Entropy, Classical Statistics, Bose-Einstein and Fermi-Dirac Statistics.

Paper-II :

Electrostatic and Magnetostatic Fields. Direct Current Circuits. Electro-magnetic induction. Alternative Current Circuits. Optical Phenomena of Interference, diffraction and polarization. Fundamentals of Atomic and Nuclear Physics. X-ray and Radioactivity. Semi-conductor Physics. Electronics, Principles of Radio and Television.

STATISTICS

PAPER-I :

Probability, Descriptive Statistics, Numerical Mathematical Analysis, Theoretical Statistics, Elementary Theory of Estimation, Elementary Theory of Testing Hypothesis.

PAPER-II :

Economic Statistics, Vital Statistics, Application of Statistics to Agriculture, Quality Control, Sample Survey, Official Statistics.

VETERINARY SCIENCE

Paper-I :

Gross anatomy I, II and III, Veterinary Physiology I, II, III and IV. General Veterinary Biochemistry. Biostatistics and comp uter application, General Livestock Management. Fodder production and grassland management. Physiological chemistry. Introduction to Molecular Biology and Biotechnology. Principles of Genetics and Population Genetics. Animal Housing Sanitation. Histology and Embryolog y, Principles of animal nutrition and breeding (includes avian), evaluation of feed staff and feed technology. General veterinary parasitology, microbiology and pathology. Applied anatomy, Applied nutrition I, II, Veterinary helminthology, bacteriology, protozoology, epidemiology and mycology. Autonomic and systemic pharmacology.

General and CNS pharmacology, entomology, special pathology I and II.

Paper-II :

Sociology and principles of veterinary and A.H. Extension. Livestock Economics, marketing and Business Management. Immunology and serology, systemic pathology, livestock breeding system, milk and hygiene and public health, swine or equine production and management, wild and zoo animal health care and management. Lab animal or rabbit or fur animal care and management and pet animal care. Veterinary and systemic virology, Special Pathology I, II, Cattle or buffalo or sheep or goat and avian production and management, Milk and Meat and their product technology, abattoir practice and animal by-product technology, clinical bio-chemistry, chemotherapy, zoonosis and human health, environmental hygiene, general surgery and anasthesia, extension techniques, toxicology, gynaecology and obstretrics, regional and clinical surgery, clinical and preventive veterinary medicines, andrology and artif icial insemination, lab diagnosis and ambulatory clinics.

Z O O L O G Y

Paper-I :

Invetebrata – Distinctive characters of Protozoa, Platehelminthes, Nematoda, Arthropoda, Structures with functions and life history of representative species under each order.

An outline knowledge of social insects with special reference to termite and honey-bee.

Elementary knowledge of sericulture.

Chordata – General organisation and distinctive characters of pisces; elementary knowledge of fisheries.

General organisation, distinctive character and examples of Amphibia, Reptilia, Aves and Mamalia.

Paper-II :

Cytogenetics, Embryology and Histology. Laws of Heredity, Linkage and crossing over, Sex-linked inheritance and sex determination and Mutation.

Evolution, adaptation, animal association including ecology : Fertilization, Parthenegenesis, Cleavage and formation of three germinal layers in rabbit.

Development of eye, heart, brain and kidney in chick.

*** Optional Subjects with Code :**

Agriculture (01); Botany (02); Chemistry (03); Computer Science (04); Computer Application (05); Agricultural Engineering (06); Chemical Engineering (07); Civil Engineering (08); Computer Engineering (09); Electrical Engineering (10); Electronics Engine ering (11); Mechanical Engineering (12); Environmental Science (13); Forestry (14); Geology (15); Horticulture (16); Mathematics (17); Physics (18); Statistics (19); Veterinary Science (20) and Zoology (21).

N.B. : IF A CANDIATE OFFERS 2 (TWO) OPTIONAL SUBJECTS WHICH HAVE RESTRICTION ON CHOICE AS PER "**SCHEME AND SYLLABUS**" OF W.B. FOREST SERVICE EXAMINATION, 2013, HE/SHE WILL BE ALLOWED ONLY THE OPTIONAL SUBJECT MENTIONED FIRST.

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1. **WALKING TEST** :

   Male candidates will be required to pass a Physical fitness test covering a distance of 25 kilometers within four hours on foot and the female candidates will be required to cover a distance of 16 kilometers within four hours on foot.

2. **HEALTH CERTIFICATE** :

   In case of direct recruitment the candidates shall have to undergo medical examination to be c onducted by a Medical Board. The Medical Board shall issue a health certificate and shall also certify that the candidate is fit for undertaking strenuous outdoor activity in the Forest Department.

3. **IN-SERVICE TRAINING (*FOR POSTS IN WEST BENGAL FOREST SERVICE*)** :

   (a) The candidates selected for appointment on the basis of the Main Examination (Written) and personality Test) shall be sent for in-service training at any of the State Forest Service Colleges or Institutes of the Government of India from time to time.

   (b) Nomination for training : Name of the candidates selected for admission together with attested copies of all certificates prescribed hereunder should be submitted to the Director, Forest Education, Government of India by the Forest Department, Government of West Bengal;

   (c) Certificates :

   The following certificates or Mark-sheets, as the case may be in original must be submitted by the candidate for verification to the Principal at the time of admission for training ;

   i) Proof of age;
   ii) Bachelor's degree
   iii) a certificate of physical test issued by Competent Authority;
   iv) Certificate of health issued by Medical Board;
   v) Appointment and Nomination letter issued by the Sponsoring Authority.