

SCHEDULE-I

GOVT. OF ARUNACHAL PRADESH
SYLLABUS IN DIFFERENT SUBJECTS FOR THE
RECRUITMENT EXAMINATION FOR A.P.F.S.

1. COMPULSORY SUBJECTS -3 (THREE)

1. GENERAL KNOWLEDGE- 100 Marks

The Paper on general knowledge will include question covering current events of national and international importance, history of India including that of North East with Special reference to Arunachal Pradesh, Indian Freedom Movement, and Constitution of India. General appreciation and understanding of science including everyday matter of observation and experience as may be expected of well-educated person. Geography of nature, political system including local self government in Arunachal Pradesh / India's economy.

2. General English – 100 Marks

Essay, Précis writing, Letter writing, Usages, Vocabulary and application of grammar.

3. Mathematics – 100 Marks.

Including syllabus for Secondary Matriculation or equivalent standard of recognized University or Board.

4. OPTIONAL SUBJECTS 2(two) Subject carrying 200 Marks each.

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| 1. Agriculture. | 11. Electronics Engineering. |
| 2. Botany. | 12. Mechanical Engineering |
| 3. Chemistry. | 13. Environmental Science. |
| 4. Computer Application. | 14. Forestry. |
| 5. Computer Science. | 15. Geology. |
| 6. Agriculture Engineering. | 16. Horticulture. |
| 7. Chemical Engineering. | 17. Mathematics. |
| 8. Civil Engineering. | 18. Physics. |
| 9. Computer Engineering. | 19. Statistics. |
| 10. Electrical Engineering | 20. Veterinary. |
| | 21. Zoology. |

VIVA VOICE TEST

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Each optional subject will have one paper carrying 200 marks each. The standard and syllabus of each subject are approximately those of the University Degree Course Examination. A candidate is to select any two of the above subjects but will not be allowed to offer the following combination of subjects:-

- Agriculture, Agriculture Engineering and Veterinary Science.
 - Chemistry and chemical Engineering.
 - Computer Application /computer Science and Computer Engineering.
 - Electrical Engineering and Electronic Engineering.
- Mathematics and statistics.

BOTANY

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Origin of life : Basic ideas on origin of earth and origin of life

Biological Evolution: General account of biochemical and biological aspects of evolution and speciation

Cell Biology: Cell structure, function or organelles, mitosis, meiosis, significance meiosis, differentiation, senescence and death of cells.

Tissue system: Origin, development, structure and function of primary and secondary tissues.

Genetic: Law of inheritance, concept of gene and genetic code, linking, crossing over, gene mapping, mutation and polyploidy, hybrid vigour, sex determination, genetics and plant improvement.

Plant diversity: structure and function of plant form from evolutionary aspect (Viruses to angiosperms including license and fossils).

Plant systematic: Principle of nomenclature, classification and identification, modern approaches in plant taxonomy.

Plant growth and development: Dynamics of growth, growth movement and growth substances factor of morphogenesis, mineral nutrition, water relation, elementary knowledge of photosynthesis, respiratory metabolism, nitrogen metabolism, nucleic acids and protein synthesis, enzymes, secondary metabolites, isotopes in biological studies.

Method of reproduction and seed Biology: vegetative, asexual and sexual methods of reproduction, physiology of flowering pollination and fertilization, sexual incapability, development, structure dormancy and germination of seed.

(a) Plant Physiology: Including transpiration, absorption of water, respiration, photosynthesis assimilation and photoperiodism etc.

(b) Plant Pathology: Knowledge of disease of rice, wheat, sugarcane, potato, mustard, groundnut and cotton crops, principle of biological control, crown gall.

10. **Plant and Environment:** Biotic components, ecological adaptations, types of vegetation zones and forest in India, deforestation, forestation, social forestry, soil erosion, wasteland, reclamation, biodiversity conservation, NTFPs, joint forest management, micro planning and landscape ecology
11. **Botany-A Human Concern:** Importance of germplasm resources, endangered, threatened and endemic taxa, cell, tissue organ and protoplast culture, propagation and enrichment of genetic diversity, plants as sources of food, fodder, forage, fibres, fatty oils drugs, wood and timber, paper rubber beverages, spice essential oils and resins, gums dyes insecticides, pesticides and ornamentation.
12. Biomass as a source of energy, bio-fertilizer, technology in agro-horticulture medicine and industry.

CHEMISTRY

Atomic number, electron configuration of elements, Aufbau principle Hund's multiplicity Rule, Pauli's exclusion principle long form of the periodic classification of elements, salient characteristic of 's', 'p', 'd' and 'f' block elements.

Atomic and ionic radii, ionization, potential, electron affinity and electro negativity, their variation with the position of the element in periodic table.

Natural and artificial, radioactivity, the theory of disintegration, disintegration and displacement law's radioactivity series nuclear binding energy, nuclear reaction fission and fusion, radioactivity isotopes and their use.

Electronic theory of valency elementary ideas about sigma and pi-bonds hybridization and directional nature covalent bonds. Shapes of simple molecules bond order and bond length.

Oxidation state oxidation number, common redox reactions some equations. Bronsted and Lewis theories of acids and bases.

Chemistry of common elements and their compounds, treated from the point of view of periodic classification.

Principle of extraction of metals as illustrated by sodium, copper, aluminum, iron and nickel.

Werner's theories of coordination compounds and types of isomerism and 6 and 4 coordinate complexes. Role of coordination compounds in nature common metallurgical and analytical operations.

Structure of diborane, aluminum. Chloride ferrocene, alkylmagnesium halides, diethylenetriamine-platinum and xenon chloride.

Common ion effect, solubility products and their application in qualitative inorganic analysis.

Electron displacement- Inductive, mesomeric and hyperconjugative effects-effect of structure on dissociation constants of acids bases-bond formation and bond fission of covalent bonds-reaction intermediates carbocations, carbonions, free radicals and carbon-nucleophiles and electrophiles.

Alkanes, alkenes and alkynes-petroleum as a source of organic compounds-simple derivatives of aliphatic compounds halides, alcohol, aldehydes, ketones acids, esters and chlorides, amides anhydrides, other amines and imino compounds monohydroxy alcohols and amino acids-grignard's reagents-active methylene group malonic and acetoacetic esters and their synthetic uses-unsaturated acids.

Stereochemistry elements of symmetry chirality's optical isomerism and lactic and tartaric acids, D/L rotation, R/S rotation of compounds containing chiral centres, concept of conformation Fischer, sawhorse and Newman projections of butane-2,3 diol-geometrical isomerism of maleic and fumaric acids E and Z notation of geometrical isomers.

Carbohydrates: Classification and general reactions structure of glucose, fructose and sucrose, general idea on the chemistry of starch and cellulose.

Benzene and common monofunctional benzenoid compounds, concepts of aromaticity as applied by benzenesulphonic acid and pyrolysis-orientation influence in aromatic substances/ chemistry and uses of diazonium salt.

Elementary ideas of the chemistry of oils, fat, protein and vitamins- their role in nutrition and industry.

Basic principles underlying spectral techniques (UV visible, IR Raman and NMR) Kinetic theory of gases and gas laws, Maxwell's law of distribution of velocities, Van der-Waal's equation law of corresponding states, specific heat of gases, ratio C_p/C_v , thermodynamics, the first law of thermodynamics, isothermal and adiabatic expansions, enthalpy heat capacity and thermo-chemistry, heat of reaction, calculation and bond energies Kirchhoff's equation, criteria for spontaneous changes, second laws of thermodynamics, entropy free energy, criteria for chemical equilibrium.

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Solution: Osmotic pressure, lowering of vapour pressure, depression of freezing point and elevation of boiling point. Determination of molecular weight in solution, association and dissociation of solute.

Chemical equilibrium: Laws of mass action and its application of homogeneous and heterogeneous equilibrium, Le' Chatelier's principle and its application to chemical equilibrium.

Chemical Kinetic: Molecularity and order of reaction, first order and second order reactions. Temperature coefficient and energy activation, collision theory of reactions rates qualitative treatment of theory of activated compounds.

Electrochemistry: Faraday's laws of electrolysis conductivity and electrolyte, equivalent conductivity and its variation with dilution. Solubility of sparingly soluble salts Electrolytic dissociation Ostwald's dilution law, normality of strong electrolytes, solubility products, strength of acids and bases. Hydrolysis of salts hydrogen ion concentration, Buffer action, theory of indicators.

Reversible cell: standard hydrogen and calomel electrodes, Redox potentials concentration cells, ionic product of water, potentiometric titrations.

Phase Rule: Explanation of term involve. Application to one and two component system. Distribution law.

Colloids: General nature of colloidal solutions and their classification, coagulation, protective action and Gold number.

Absorption:

Catalysis:-Homogeneous and heterogeneous catalysis promoters and poisons.

FORESTRY

Principle of Forestry: Introduction for forestry: Forest and ecology, Tree study, Land and forests products measurement, Forest and its environment, Forest management, Wood characteristic, identification and uses, Wood for energy.

Principle of wildlife conservation: Concepts of wildlife and history of wildlife preserve and wildlife management and relationship with allied subjects, Wildlife value and conflicts Aesthetic economic, scientific, ecological, religious recreational land use priorities crop destruction, disease.

Cameras, studies of important, rare and endangered species of India and steps taken for their preservation; sanctuaries, national park, biospheres reserves and zoological parks of the country fundamental or morphology, classification,. Development habit, damage and control of insect attacking trees, with emphasis on these injuring trees and forest of the region.

3.. **Forest Measurements:** Theory of measurement and estimation procedure use of mensurational instrument, measurement of diameter girth, height, form bark thickness, mathematical and statistical principles and technique use to determine the volume and growth of tree and stand introduction of static and dynamic, forest models defining what they are and how they might be used and how they are developed. Assessment of growing stock and determination of yield.

4. **Dendrology:** Taxonomy and its significance. Brief history if classification system, plants nomenclature, importance, history international code of botanic nomenclature, plant geography, Introduction geography and relationship to plant distribution, physiographic are and their taxonomy. Modern trends in plant taxonomy, chemotaxonomy, palynology, numerical taxonomy, cyto-taxonomy,

systematic botany of India forest trees and shrubs, criteria of identification, reproductive biology or important trees and shrubs. 8/

5. Silviculture I (Nursery management): Biology of seed production of forest trees, forest trees seed, collection, extraction, storage and testing germination growth seedling eco-physiology. Nursery location and design consideration-soils aspect of nursery management control of grasses and weeds, types of nursery beds and their protection, seeds beds and shading method of irrigation. Use of chemical types of containers, direct sowing vs transplanting transplant raised from stumps outing. Evaluation of seedling quality.

6. Forest Ecology and Forest Fires: Basic ecological principles and concepts scope and importance of ecology in conservation of natural resources, land use, forestry, grassland management and wildlife-ecology and its relation to other sciences, Eco-system components, the food chain, trophic structure and ecological pyramids, forest environment. Forest biotic and abiotic components, their interrelationship and importance in forest ecology, interaction of different environmental factors, principles of limiting factors, ecological indicators, biotic community concepts. Life form structure and physiognomy concepts of ecological dominance, competition, tolerance aggression seral and climax communities, ecotones and edge effect, vegetation dynamic, auto-ecology, growth requirement of species competition moisture requirements and development, ecological productivity, environmental pollution.

Fire related synecology and auto-ecology of dominant species in forest and rangeland habits impact of fire on vegetation succession, effect of fire on soil nutrient cycling, forest development, natural role of fire in forest prescribed burning, use of fire as a silvicultural and hazard treatment tool use land development of fire danger rating system, fuel inventory, fire weather forecast, fire prevention, fire detection system, fire control and suppression procedures.

7. Silviculture (Regeneration Methods): Theory and practice involved in natural and artificial forest stand regeneration including species growth and silvicultural characteristic, soil-site relationship site evaluation, site preparation methods including mechanical and chemical control of vegetation insects and disease consideration, methods of insuring desired species composition in stand use of fire reforestation, regeneration by seed, coppice, root suckers sowing/transplanting stumps, branch cuttings and rhizomes.

8. Silviculture(system): Economic, soil and biological analysis of immature and mature stand management alternatives, diagnosis and presentation at intermediate stand treatments, and harvesting systems, cutting system and culture operations including clear felling, shelter wood, selection and coppice systems. Principle and techniques involving vegetation control, thinning, pruning, fertilizers and harvesting seed production system and tree improvement, integration of non-timber.

Production, Environment consideration related to stand treatments, conservation of management regime from one silviculture system to another.

Integrated pest management: Key factors capable of damaging forests and reducing forest yields, causal relationships and interactions between insects and disease control, general principles of integrated control measures control methods, chemical insecticides, biological silviculture, mechanical and physical attractants and repellants, male sterile technique Legislative control and plant quarantine measure impact and control as related to management objectives.

Wood anatomy: Introduction the cambium anatomical characteristic of the root, secondary growth in dicotyledonous root, stem primary and secondary structure, dicot and monocot stems. secondary growth in dicotyledonous stem, annual rings of growth rings, periderms, phellogen, phellem, commercial cork, phelloderm, lenticels, secondary xylems and lucia, gougainvillea, leptadenia and salvedora. Detailed study of collenchymas, sclerenchmya, zylem and phloem.

Remote sensing in forest: Theory, principles and techniques of interpretation for utilizing, serial photos for inventory and management of forest resources land form evaluation, hydrologic terrain erosion analysis land use/cover mapping and disease and insect infestations, photo mensurational techniques in preparation of stand and tree volume table, planning large scale aerial photo-projects and procurement of aerial photographs; Introduction to remote sensing and the use of satellite and large scale imagery in resource mapping.

Forestry Policy Legislation and Planning: Forest policy, definition, scope, legal and institutional approaches to forest resources management, foundation of a stable forest policy, India's national forest policy, forest law, legal definition of forests laws that effect the harvest and transport of forest produce laws effecting the right and responsibilities of panchayats, application of penal codes as forest principles of criminal law, criminal procedure codes as applied to forestry, law of evidence and the Indian evidence act, wildlife legislature principles and methods of forest planning, planning at the national level, the role of natural resources in development forests placed in National Policy, Impact of forest management and policy decisions in public welfare, multiple objectives land use planning concepts, types of forestry projects and the criterion for their evaluation, project design and evaluation, project implementation, monitoring and control.

Tribology: Definition of forestry, stage of forestry development and its influence on forestry today, distribution of major forest types in India, production and relative importance of climate, topography in India, production and relative importance of climate, topography and soil, forestry as a development tool, forestry organizations and agencies, their structure, organization and mandates, forestry employment opportunities forester's role in increasing wood, water, wildlife and forage value tribology, introduction-definition, types distribution and demography of tribes. Racial classification, constitutional provisions for the development of schedule tribes. Concepts of races, tribes, family clan and kinship, principle of social grouping, cultural traditional, customs, ethos, belief and practice of tribal in general.

Tree improvement: Emphasis is on the value and implementation of tree improvement in forest management programme. Study includes genetics of establishment and management, seedlings vrs clonal seed orchards, seed certification, selection practices in forestry, progeny testing, breeding for disease and pest resistance for wood, properties for agro-forestry objectives, tree, introduction, use of indigenous vrs. Exotic species, species testing. Provenance testing.

Wildlife management: Biological and ecological basis of management, distribution and behavior of animals, environmental gradients, zoo-geographic regions of world with special reference to wildlife in India, fundamental requirements of wildlife territory, factor affecting animals population, biological surplus and extinction threshold, social organization and behavior, animal communities, general inter and inter specific relationships, techniques of field studies of wildlife population estimation census and estimates.

Minor Forest Product: Fibre crops, fruits and nuts, gum and resins, dyes and tanning, forage crops.

Wood Technology: Wood conversion, seasoning, wood attackers, wood borers, preservatives, marine borers, soft wood, hardwood, veneers, manufactured board, wood working, tools, hand tools, saws, planes. Chisels, turning tools, veneering tools and fixing tools, power tools, electric drills, sawing, planners, power sanding, spindle tools, wood work, turning, carving picture, farming, finishing wood filling and sealing varnish, shellac-lacquer, wax and oil, painting, preservatives.

Forest products and their utilization: Wood anatomy, structural properties of wood, density, texture, wood seasoning, wood preservation, composite wood products, use of adhesive, plywood, particles board, pulp and paper, saw milling

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wood based industries logging definition, terminology, logging development process, felling practices and equipment, skidding practices and equipment, transportation practices and equipment, timber depots, size organization and management, forest labour, organization and management, wages planning of logging activities.

Advanced silviculture: Major forest types of India, silviculture, characteristics of the following families. Annonaceae, fixaceae and combretaceae, coniferae, cillieniaoease, flacourtiaceae and gramineae, guttifereae, eagaceae and juglandceae, legurninoceae, lythraceae, Magnoliasceae, malvaceae, theaceae and verberaceae, forest dynamics, forest succession, computer model of forest succession, gap models, the biomass, response of landscapes, predicting largest scale consequences of small scale changes, a theory of forest dynamics.

Social Forestry: The concepts of social forestry, scope and objectives, choice of species and planting role of exotics in social forestry, nurseries growing and supply of seedlings, maintenance and monitoring mass involvements and extension, benefits and constraint in the implementation of social forestry programme in India. Agro-forestry, farm forestry, role of forestry in watershed management.

Forest Economics and Project Evolution: Impact of time on investment planning project formulation, evaluation (benefit cost analysis), project management, externalities not covered by benefit cost analysis, forest valuation.

Joint Forest Management: Principles and practices, micro-planning, Forest Development Agency (FDA), village Forest Management committee.

GEOLOGY

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Introduction of Geology

General Geology

Structural Geology

Geotectonic

Crystallography, scope of mineralogy and definitions of minerals, physical and descriptive mineralogy

Crystal chemistry and Geochemistry, crystal chemistry and thermodynamics

Igneous petrology

Sedimentary petrology

Metamorphic petrology

Principles of stratigraphy

India stratigraphy and stratigraphy of North-Eastern India

Ore Genesis

Indian Mineral deposits

Hydrology

Paleontology and its principles

Engineering Geology

Prospecting and Mining methods

MATHEMATICS

Algebra: Elements of set Theory, Algebra of Real and complex numbers including De Moivre's Theorem Polynomials and Polynomial equations, Relations between coefficients and Roots, Symmetric functions of roots.

Elements of Group Theory: Sub-groups, cyclic groups, permutation Groups and their elementary properties.

Vector Spaces and Matrices: Vector space, Linear dependence and independence sub-space, basis and Dimensions, Finite Dimensional Vector spaces Linear Transformation of a finite dimensional vector space, matrix representation, singular and non-singular transformations, Rank and utility.

Matrices : Addition, Multiplication, Determinants of matrix, properties of determinants of order inverse of matrix, Cramer's rule.

Geometry and Vectors: Analytic-geometry of straight lines and conics in Cartesian and polar coordinates, three dimensional geometry for planes, straight lines, sphere, cone and cylinder, addition, subtraction and products of vectors and simple applications to geometry.

Calculus : Functions, sequences, series, limits continuity, derivatives, application of derivatives, rates of change, Tangents, normal, Maxima, minima, Rolle's theorem, mean value theorems of Lagrange and Cauchy, asymptotes curvature methods of finding indefinite integrals, definite integrals, fundamental

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theorem of integral calculus, application of definite integrals to area, length of a plane curve, volume and surfaces of revolution.

Ordinary differential equations: Order and degree of differential equation, first order differential equations, singular solution, geometrical interpretation, second order equations with constant coefficients.

Mechanics: Concepts of particles, Laminae, Rigid Body, Displacement, Force, Mass, Weight, Motion, Velocity, Speed, Acceleration parallelogram of forces, parallelogram velocity, acceleration, resultant, equilibrium of coplanar forces, moments couple, friction centre of mass, gravity, laws of motion, motion of a particle in a straight line, simple harmonic motion, motion under conservative forces, motion under gravity projects, escape velocity, motion of artificial satellite.

Elements of Computer programming: Binary system, Octal and Hexadecimal conversion to and from decimal systems, codes, bits, bytes and words in computer. Arithmetic and logical operations on numbers, precisions and Shift/Rotate operator algorithms and flow charts.

Statics: Equilibrium of a system of particles, work and potential energy, friction, catenary's principle of virtual work, stability of equilibrium, equilibrium of forces dimensions.

Dynamics: Degree of freedom, and constraints, rectilinear motion simple motion, motion in a plane, projectiles, constrained motion, work and energy, conservation of energy, motion under impulsive forces, Kepler's laws, orbits under central motion of varying mass, motion under resistance.

Complex analysis: Analytic function, Cauchy-Riemann equations, Cauchy's integral formula, power series, Taylor's series, Laurent's series, Cauchy's residue theorem, contour integration, Conformal mapping, transformations.

Probability: Sample space, Events, Algebra of events, probability-classical axiomatic approaches, combinatorial problems, geometric problems. Probability and Bayes's theorem, Random variables and probability. Distribution and continuous, Mathematical expectations, Binomial, poisson and normal joint distribution of random variables, independence, central limit theorem in probability.

Statistics: Concepts of population, sample, variable, attribute, parameter and measures of location and dispersion. Moments, skewness and kurtosis. Simple random sampling and sampling distribution of sample means and proportions.

PHYSICS

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 momentum, rotational Kinematics, rotational, dynamics, equilibrium of rigid bodies, gravitation, planetary motion, artificial satellites, surface tension and viscosity, fluid dynamics, streamline and turbulent motion. Bernoulli's equation with applications. Stokes's law and its application. Special theory of relativity Lorentz transformation. Mass energy equivalence.

Waves and oscillations: Simple harmonic motion, travelling and stationary waves, superposition of waves, forced oscillations, damped oscillations, resonance, sound waves, vibrations of air columns, strings and rods, ultrasonic waves and their application, Doppler's Effect.

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Optics: Matrix methods in paraxial optics, thin lens formulae, nodal planes, system of two thin lenses, chromatic and spherical aberration, optical instruments, eyepieces, nature and propagation of light, interference, division of wave front, division of amplitude, simple interferometers, diffraction, gratings, resolving power of optical instruments, Rayleigh criterion, polarization, production and detection of polarized light, Rayleigh scattering, Raman scattering lasers and their applications.

Thermal Physics: Thermometry, laws of thermodynamics, heat engines, entropy, thermodynamic potentials and Maxwell's relations, Van der-waals equation of state, critical constants, Joule-Thomson effect, phase transition transport phenomenon, heat conduction and specific heat in solids, kinetic theory of gasses, ideal gas equation, Maxwell's velocity distribution, equipartition of energy, mean free path, Brownian motion, black-body relation, Planck's law.

Electricity and magnetism: Electric charge fields and potentials, Coulomb's law, capacitance, dielectrics, Ohm's law, Kirchhoff's laws, magnetic field currents, LCR circuits, series and parallel resonance. Q – factor thermoelectric effect and their applications, electromagnetic waves, motion of charged particles in electricity and magnetic fields, particle accelerators, Van de Graaff's generator, Cyclotron betatron mass spectrometer, hall effect, diamagnetism and ferro magnetism.

Modern physics: Bohr's theory of hydrogen atom, Optical and X-ray spectro-photo-electric effect, Compton effect, wave nature of matter and wave particle duality, natural and artificial radio-activity, alpha, beta and gamma radiation, electron decay, nuclear fission, and fusion elementary particles and their classifications.

Electronics: Vacuum tubes-diode and triode p and n-type materials, p-n diodes and transistors, circuits for rectification, amplification and oscillations, logic gates.

STATISTICS

Probability: Random experiments, sample space, event, algebra of events, probability on a discrete sample space, basic theorems of probability and simple examples based on the conditional probability of an event, independent events, Baye's theorem and its application, discrete and continuous random variables and their distributions, expectation, moments, moment generating function, joint distribution of two or more random variables, marginal and conditional distributions, independence of random variables, covariance, correlation coefficient, distribution of a function of random variables, Bernoulli binomial, geometric negative binomial, hyper geometric, poisoning, multinomial, uniform, data, exponential, gamma Cauchy, normal, lognormal and bivariate normal distributions, real-life situations where these distributions provide appropriate models, Chebyshev's inequality, weak law of large numbers and central limit theorem for independent and identically distributed random variables with finite variance and their simple applications.

Statistical methods: Concept of a statistical populations and a sample, types of data, presentation and summarization of data, measures of central tendency, dispersion skewness and kurtosis measures of association and contingency, correlation, rank correlation. Intra-class correlation, correlation ratio, simple and multiple linear regression, multiple and partial correlations (involving three variables only), curve-fitting and principle of least squares, concepts of random sample, parameter and statistic, Z, χ^2 -test and F statistics and their properties and applications, distributions of sample range and Median (for continuous distribution only), censored sampling (concept and illustrations).

Statistical Inference: Unbiased new, consistency, efficiency, sufficiency, completeness, minimum variance unbiased estimation, Rao's Blackwell theorem, Lehmann-Scheffe theorem, Cramer-Rao's inequality and minimum chi-square, methods of estimation, properties of maximum likelihood and other estimators, idea of random interval, confidence intervals for the parameters of standard distributions, shortest confidence intervals, large sample confidence intervals.

Simple and composite hypotheses, two kinds of errors, level of significance, size and power of a test desirable properties of a good test, most powerful test, Nyman Pearson lemma and its use in simple examples, uniformly most powerful test likelihood ration test and its properties and applications.

Chi-square test, sign test, Wald-Wolfowiz run test, run test for randomness medium test Wilcoxon-Mann-Whitney test.

Walla's sequential probability ration test, OC and ASN functions application to binomial regression methods of estimation under simple and stratified random sampling, double sampling for ration and regression methods of estimation, two stage sampling with equal size first stage units.

Analysis of variance with equal number of observation per cell in one, two and three way classifications, analysis of covariance in one and two way classifications, basis principles of experimental designs, completely randomized design, randomized block design Latin square design, missing plot technique 2" factorial design, total and partial confounding, 32 factional experiments, split-plot design and balanced incomplete block design.

Optimization, Techniques: Different types of models in operational research, their construction and general methods of solution, simulation and Monte-Carlo methods, the structure and formulation of linear programming(LP) problem, simple LP model and its graphical solution, the simplex procedure, the two-phase method and the M-technique with artificial variables, the duality theory of LP and its economic interpretation. Sensitivity analysis, transformation and assignment problems, rectangular games, two person zero-sum games, methods of solution (Graphical and algebraic).

Replacement of failing or deteriorating items, group and individual replacement policies, concept of scientific inventory management and analytical structure of inventory problems, simple methods with deterministic and stochastic demand with and without lead time, storage models with particular reference to dam type.

Homogeneous discrete-time Markov chains, transition probability matrix, classification of states and ergodic theorems, homogeneous continuous time Markov chains, poison process, elements queuing theory M/M/I, M/M/K, G/M/I and M/GI queues.

Solution of statistical problems on computers using well known statistical software packages like SPSS.

ZOOLOGY

Cell structure and function: Structure of an animal cell, nature and function of cell organelles, mitosis and Meiosis, Chromosomes and genes, law of inheritance, nutation.

2. General survey and classification of non-chordates (upto sub classes) and chordates (up to Orders) of following protozoa, porifera, coelenterate, Platyhelminthes, Ascheminthes, Annelida, Anthorpoda, Mollusca, Echinodermata and Chordata.
3. Structure, reproduction and life history of following types Amoeba, Monocystis, Plasmodium, Paramecium, Sycon, Hydra, Obleia, Fasciola, Tania, Ascaris, Nereis, Pheretima, Leach, Prawn, Scorpion, Cockroach, a bivalve, a snail Balanoglossus, an Ascidian, Amph oxus.

4. **Comparative anatomy of vertebrates:** Integument endoskeleton, locomotory organs, digestive system, respiratory system, heart and circulatory system, urino-genital and sense organs.
5. **Physiology:** Chemical composition of protoplasm, nature and function of enzymes, colloids and hydrogen ion concentration, biological oxidation, elementary physiology of digestion, excretion, respiration of blood, mechanism of circulation with special reference to man nerve impulse, conduction and transmission across synaptic junction.
6. **Embryology:** Gametogenesis, Fertilization, Cleavage, gastrulation, early development and metamorphogenesis of frog, Asclian and retrogressive metamorphosis neoteny development of foetal membrane in thick 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, acclaptation of aquatic and desert fauna, parasitism and symbiosis'. Factors causing environmental population and its prevention endangered species., Chronobiology and Circadium rhythm.
9. **Economic Zoology:** Beneficial and harmful insects.
10. **Genetics:** Mendelian laws of inheritance, recombination linkage and linkage maps, multiple alleles, mutation (natural and induced) mutation and evolution, meiosis, chromosome.

HORTICULTURE

1. Introduction of Horticulture
2. Plan propagation
3. Fruit and vegetable crops/climate, package of practices for cultivation
4. Plantations crops
5. Manures and fertilizers
6. Extension education
7. Nursery management
8. Seed production and certification
9. Silviculture, Species and plantation crops
10. Forest production and conservation
11. Pest management of horticulture crops
12. Soil and water
13. Post harvest technology of horticulture crops
14. Olericulture and floriculture
15. Advance plan propagation
16. Weed management
17. Application of biotechnology
18. Bamboo and medicinal plant cultivation and value addition, processing and industry.

AGRICULTURE

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Cell as structural and functional unit, protoplasm, cytoplasm, plastids etc. colloids, permeability osmosis etc. absorption of water and its movement inside plants. factors affecting solute- absorption and transpiration. Vapo-transpiration, mineral nutrition, role of major and minor elements . In growth and developments enzymes and enzymes activity in different physiological process, carbon assimilation, respiration and photo respiration, nitrogen and fat metabolism, growth hormones and their importance in agriculture.

Properties and uses of nitrogen, phosphorous, potassium, helium, magnesium, sulphur, iron, copper, zinc, manganese boron, molybdenum, cobalt, mercury, aluminum, antimony, lead silicon, arsenic and sodium in relation to agriculture with reference to soil plant and animal.

Amino acids, proteins, carbohydrates, fats oil their concurrence. Classification, properties and functions, nuclei acids, composition and types, properties, structure and biological of RNA and DNA chemistry of photosynthesis, pigments, Calvin cycle.

Role of microorganisms in soil fertility management, efficient uses of fertilizer, acid soil management/ physical and chemical properties of soil, important biological process in soil- ammonification, nitrification, identification and nitrogen fixation, soils of India and Arunachal Pradesh, factors affecting loss of plant nutrients from soil, effect of soil on nutrient availability.

Scope, aim, importance of horticulture in Arunachal Pradesh, influences of soil and climate in horticulture crops, principles of plants propagation by seed, cutting layering and grafting, use of growth regulators in propagation, planning and management of nurseries. Orchard management practices. Types of vegetable crops, vegetable seed production, processing and preservation, cultivation of apples, pear, peach, plum, papaya, pineapple, banana etc.

Concept of chromosomes and genes, RNA and DNA, Mandelian principles of inheritance, plant breeding methods heterosis and its utilization in crop improvement concept of new plant type architecture and production breeding steps in release of varieties.

Basic concept of wants, goods, welfare, utility, property, value price, demand, supply factors of production, consumption, exchange incomes national income and per capita income, farming systems and types of farms, factors of production land use etc. farm management/ principles of co-operation, different types of co-operative institutions, agricultural marketing structure of agriculture credit in India.

A brief historical review of development of agriculture in India and Arunachal Pradesh, factors effecting distribution of crops, classification of crops, physiology of reproduction of major crops, crops rotation and cropping intensity, multiple relay and mixed cropping, cropping system, water management, weed control, fertilizers and manures, bio-fertilizers, green manuring/ factors affecting quality of seeds, seed production, techniques, seed certification, procedures of Indian seed act.

Classification of insects of economics importance up to orders with examples, identification, nature of damage, life history and management of major insects pests of field crops, vegetables/ fruit trees, stores grains and domestic animals. Beneficial and productive insects with special reference to sericulture, apiculture and lac-culture, classification of pesticides, their formulation and hazards, integrated pest management.

Bacteria, fungi, actinomycetes, algae/ protozoa and viruses their role in natural process in soil, milk, water, food, industry and disease, symbiosis and ambiosis, process of infection and disease development, principles of plant disease control fungicides and chemotherapy, major diseases of crops with emphasis on symptoms ethology, spread, perpetuation and control.

Plant parasite nematodes, their pathogenicity, relationship with other micro-organisms, methods of nematode control.

Meaning and importance of rural sociology, social change, group dynamics and leadership, extension education philosophy, teaching methods. Extension programme planning.

Control of soil erosion- contouring, strip cropping, terracing, gully control structure etc. Soil and water conservation, planning and application.

VETERINARY SCIENCE

1. **General:** Role of livestock in Indian economy and human health. Mixed farming, agro climate zones and live stock distribution. Socio-economic aspects of livestock enterprise with special reference of women.

2. **Genetics and Breeding :** Principle of genetics, chemical nature of DNA and RNA and their models and function. Recombinant DNA technology, transgenic animals, multiple ovulation and embryo transfer. Cytogenetics, immuno-genetics and biochemical and polymorphism and their application in animal improvement . Gene actions, systems and strategies for improvement of livestock for milk, meat, wool production and draught and poultry for eggs and meat . Breeding animals for disease resistance. Breeds of livestock, poultry and rabbits.

3. **Nutrition :** Role of Nutrition in animals health and production. Classification of feeds, proximate composition of feeds. Feeding standards, computation of rations, ruminant nutrition of total concepts of total digestible nutrients and starch equivalent system. Significant of energy, determinations. Conservation of feeds and fodder and utilization of agro-by-products. Feed supplement and additives. Nutrition deficiencies and their management.

4. **Management :** System of housing and management of livestock, poultry and rabbits, farm record, economics of livestock, poultry and rabbit farming, clean milk production veterinary hygiene with reference to water, air and habitation, sources of water and standards of portable water. Purification of water. Air changes and thermal comfort. Drainage system and effluent disposal, Biomass.

5. **Animal production:** (a) Artificial insemination, fertility and sterility. Reproductive physiology, semen-characteristics and preservation. Sterility its cause and remedies.

(b) Meat, egg and wool production, methods of slaughter of meat animals, meat inspection, judgment, carcass characteristics, adulteration and its detection processing and preservation. Meat products, quality control and nutritive value. By products, physiology of egg production, nutritive value, grading of eggs, preservation and marketing. Types of wool, grading and marketing.

6. **Veterinary science** (i) Major contagious diseases affecting cattle, buffaloes, horses, sheep and goats, pig, poultry/ rabbits and pet animals. Etiology, symptoms, pathogenicity, nagenesis, treatment and control of major bacterial viral rickettsial and parasitic infections.

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

(a) Production disease of much animals, pig and poultry.

(b) Deficiency disease of domestic livestock and birds.

(c) Poisoning due to infected/contaminate foods and feeds, chemicals and drugs

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

8. (a) Poisons used for killing animals-cuthanasia

(b) Drugs used for increasing production / performance efficiency and their adverse effects.

(c) Drugs used to tranquilize wild animals as well as animals in captivity

(d) Quarantine measures in India and abroad. Act, Rules and Regulations.

9. **Dairy science** : Physics – 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 collections, chilling, transportation processing, packing storage and distribution. Manufacture of market milk, cream, butter, cheese, ice-cream, condensed and dried milk by products and Indian products.

Unit operations in dairy plant.

Role of microorganism in quality of milk and milk products. Physiology of milk secretion.

CIVIL ENGINEERING

1. **Engineering Mechanics** : Static's units and dimensions, SI units, vectors, coplanar and non coplanar force systems, equations of equilibrium, free body diagram, static friction, virtual work, distributed force systems, first and second moments of area, mass moment of inertia.

2. **Kinematics and dynamics**: Velocity and acceleration in Cartesian and curvilinear coordinative systems, equations of motion and their integration, principles of conservation of energy and momentum, collision of elastic bodies, rotation of rigid bodies about fixed axis, simple harmonic motion.

3. **Strength of materials** : Elastic isotropic and homogenous materials, stress and strain, elastic constants, relation among elastic constants, axially loaded determinate and indeterminate members, shear force and bending moment diagrams, theory of simple bending, shear stress distribution, stitched beams.

4. **Deflection of beams**: Macaulay method, Mohr theorems, conjugate beam method, torsion, torsion of circular shafts, combined bending, torsion, and axial thrust, close coiled helical springs, strain energy, strain energy in direct stress, shear stress bending and torsion, thin and thick cylinders, columns and struts, Euler and Rankine loads, principal stress and strains in two dimensions—Mohr circle – theories of elastic failure, Structural analysis, indeterminate beams proposed, fixed and continuous beams shear force and bending moment diagram, deflections, three hinged and two hinged arches, rib-shortening, temperature effects, influence lines.

5. **Trusses** : Method of joints and method of sections, deflection of plane pin-jointed trusses.

6. **Rigid frames** : Analysis of rigid frames and continuous beams by theorem of three moments, moment distribution method, slope deflection method. Kari method and column analogy method metric analysis. Rolling loads and influence lines for beams and pin – joined girders.

7. **Soil Mechanics** : Classificaion and identification of soils, phase relationships surface tension and capillary phenomena, in soils, laboratory and field determination of coeff of permeability, seepage forces, flow nets, critical hydraulic gradient permeability of stratified deposits : Theory compaction, compaction control total and effective stress, pole pressure coefficient, shear strength param in terms of total and effective stress. Mohncoulomb theory, total and effective strees analysis of soil slopes, active and passive pressures, Rankiene and coulomb theories of earth pressure, pressure distribution on French sheeting, retaining walls, sheet pile walls, soil consolidation, terzahing one dimensional theory of consolidation primary and secondary settlement.

1. **Foundation Engineering** : Exploratory programme for sub-surfaces investigations, common types of boring and sampling, field test and their interpretation, water level observations, stress distribution beneath loaded areas by Bossiness and Steinbrenner methods use of influence chars, constant pressure distribution determination of ultimate bearing capacity by Terzaghi, Skempton and Hansen's methods, allowable bearing pressure beneath footings and rafts settlement enteria, design aspects of footings and rafts, bearing capacity of piles and pile groups, pile load tests, under reamed piles for swelling soil – wall foundations, conditions of statistical equilibrium vibration analysis of single degree freedom system, general consideration for design of machine foundation : Earth quake effects on soil foundation system, liquefaction.

9. **Fluid Mechanics** : Fluid properties, fluid static, forces on place and curved surface, stability of floating and submerged bodies.

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10. **Kinematics** : Velocity, stream lines, continuity equations, accelerations, irrotational and rotational flow, velocity potential and stream functions, flow net, separation and stagnation.

11. **Dynamics** : Euler's equation along streamline, energy and momentum equation. Bernoulli's theorem application's to pipe flow and free surface flows, free and forced vortices.

12. **Dimensional analysis and similitude** : Buckingham's theorem dimensionless parameter Similitude undistorted models, boundary layer on a flat plate, drag and lift on bodies.

13. **Laminar and turbulent** : Laminar flow through pipe and between parallel plates, transition to turbulent flow, turbulent flow through pipes, friction factor variation, energy loss in expansions, contraction and other non uniformities, energy grade line and hydraulic grade line, pipe networks, water hammer.

14. **Compressible flow** : Isothermal and isentropic flows velocity of propagation of pressure wave, mach number, sub-sonic and supersonic flows shock waves.

15. **Open channel flow** : Uniform and non uniform flows specific energy and specific flows critical depth, flow in contracting transition, free overfall, surges hydraulic jump surges gradually varied flow equation and its integration, surface profiles.

16. **Surveying : General principles** : Sign conventions, chain surveying principles of plane table surveying two-point problem, three point problem compass surveying, traversing, bearing, local attraction, traverse computations corrections.

17. **Leveling** : Temporary and permanent adjustments, fly levels, reciprocal leveling, contour leveling, volume computations, refraction and curvature corrections, theodolite adjustment, traversing, heights and distance, tachometric surveying.

Curved setting by chain and by theodolite, horizontal and vertical curves.

Triangulation and base line measurements, satellite stations, trigonometric leveling, astronomical surveying, Celestial coordinates, solution of spherical triangles, determination of azimuth, latitude, longitude and time.

Principles of aerial photogrammetry hydrographic surveying.

MECHANICAL ENGINEERING

Statics :

Simple application of equilibrium equations.

Dynamics :
power.

Simple application of equations of motion work energy and

Theory of machines :

Simple examples of kinematics chains and their inventions, different types of gears, bearings, governors flywheels and their functions. Static and dynamic balancing of rigid rotors. Simple vibrations analysis of bars and shafts.

Mechanics of solids :

Stress, strain and Hooke's law, shear and bending moments in beams, Simple bending and torsion of beams springs and thin walled cylinders, elementary concepts of elastic stability, mechanical properties and material testing.

Manufacturing science :

Mechanics of metal cutting, tool life, economics of machining, cutting tool Materials, basis types of machine tool and their process. Automatic machine tools, Transfer lines. Metal forming processes and machines shearing drawing, spinning forming extrusion. Types of casting and welding methods. Powder metallurgy and processing of plastics.

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 handling capital budgeting. Job shop and mass production, scheduling, dispatching, routing inventory.

Thermodynamics :

Basis concepts, definitions and laws, heat, work and temperature. Zeroth Law, temperature scales, behavior of pure substances, equations of state, first law and its corollaries second law and its corollaries, analysis of air standard power cycles, Carnot, Otto, Diesel, Brayton cycles, vapour power cycles, Rankine reheat and regenerative cycles, Refrigeration cycles Rankine reheat and regenerative cycles. Refrigeration cycles Ben Coleman, vapour absorption and Vapour compression cycle analysis. Open and closed cycle gas turbine with intercooling, reheating energy conversion.

Flow steam through nozzles, critical pressure ratio, shock formation and effect, steam generators, mountings and accessories. Impulse and reaction turbines, elements and layout of thermal power plants. Hydraulic turbines and pumps, specific speed, layout of hydraulic power plants.

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

Refrigeration and Air Conditioning :

Refrigeration equipment and operation and maintenance refrigerants, principles of air conditioning, psychometric chart, comfort zones, humidification and dehumidification.

ELECTRICAL ENGINEERING

Electrical circuit :

Network theorems and applications. Transient and steady state analysis of electric circuit transform techniques in circuit analysis. Resonant circuits. Coupled circuits. Balanced three phased circuits. Two-port networks. Network parameters. Elements of network synthesis, active filters

E---M Theory :

Electronic and magneto static fields, Maxwell's equations, Wave equations and electromagnetic waves. Antennas and wave propagation. Transmission lines microwave resonators, wave guides.

Control systems :

Mathematical modeling and simulation of physical dynamic systems. Transfer function, time response and frequency response of Linear's system. Bode-plot and Nichols chart, stability of linear feedback control system. Routh Hurwitz and Nyquist criteria of stability steady-state errors, root locus diagrams. Basis concepts in compensator design, state variable methods in system modeling, analysis and design, controllability and

absorbability, control system components error detectors and actuators.

Measurement and Instruments:

Electrical standards, error analysis, measurement quantities like current voltage power, energy power factor etc. measurement on resistance, inductance, capacitance and frequency, indicating instrument, bridge measurements. Electronic measuring instruments, electronic multimeter, CRO, digital voltmeter, frequency counter, Q Meter, spectrum, analyzer, distortion meter, etc. Transducers, Thermocouple, the mistor, LVDT, strain gauges prezo-electrical quantities line temperature, pressure, flow rate, displacement acceleration noise level etc. data acquisition systems.

Electronics :

Semi conductors and semi-conductor devices equivalent circuit. Transistors biasing, analysis of all types of amplifiers including feedback, d-c amplifiers, integrated circuit.

Communication engineering : Amplitude frequency and phase modulation, their generation and demodulation, noise.

Electrical machines : D---C machines, Characteristics and performance analysis of motors and generators. Applications, starting and speed control of motors. A---C generators, Construction and performance analysis measurement of machine parameters

ENVIRONMENTAL SCIENCE

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1. Definition and scope, basic components of environment: atmosphere and hydrosphere.
2. The living component of environment, the biosphere, ecosystem structure and function, impact of biosphere on environment.
3. Pollution, major categories of environmental pollution, air pollution, particulate matter, the green house effect, problem of ozone depletion, acid rain.
4. Land and water pollution, bio-accumulation and bio-magnification of pollutants. Eutrophication, treatment of biodegradable wastes. Noise pollution.
5. Wildlife and its management, biodiversity, remote sensing, environmental problems of North- East.
6. Ecosystem: Forest, grassland and wetland management, watershed approach to management of hill slopes, agricultural system management, etc.
7. Biodiversity management: Biodiversity and its implication of environmental health. Environmental indicators. Protected Area networking, bio-fertilizers and its application in environment health.
8. Waste management: Waste recycling, renewable energy sources, bio-energy. Environmental implications of biomass energy and Wasteland management.
9. Disaster management: Environmental degradation and pollution management, impacts and mitigation of natural disasters.
10. Environment policies and law: Environment legislation, public strategies in pollution control, Wildlife protection Act 1972 as amended 1991, Forest conservation Act, 1980. Indian Forest Act 1982 (revised). Air (Prevention and control of pollution) Act, 1974. Water (preventions and control of pollution) Cen Act. 1977, Environment (protection) Act, 1986 , Wetland policy and its legal implications, biodiversity convention, Kyoto Protocol, Bio-safety Bill
11. Environmental Techniques: Environmental impact Assessment (EIA) and Risk Assessment (RA), Natural resource and environmental accounting, pollution prevention methodologies including national and international standards, application of remote sensing (RS) and Geographic information system (GIS) in natural resources management and environment monitoring.
12. Environment degradation and sustainable development : Biodiversity and natural resources conservation , restoration of degraded landscapes, role of foresters in maintaining ecological balance, environment and human welfare, institutional and public constraints and socio-economic implications of environmental degradation.
13. Environmental engineering
 - 13.1 Solid wastes, classification and characteristics, principal of solid waste management, collection, handling and disposal of solid wastes.
 - 13.2 Air pollution and its control , air pollution , their standards , methods and equipments for control of air pollution , environment impact assessment, introduction, principles and methods of EIA, environmental legislation,

ELECTORNICS ENGINEERING

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SECTION -A

1. MATERIALS, COMPONENTS & DEVICES:

Structure and properties of Electronical & Electronic materials, Passive components-types & properties, Active components – types & properties, Solid state devices- physics, characteristics & models.

2. NETWORK THEORY:

Network theorems, Steady state & transient response of electrical circuits, Network analysis, Elementary Network synthesis.

3. ELECTROMAGNETIC THEORY & MICROWAVE ENGG:

Field theory, transmission line theory, Antenna theory ,Propagation of electromagnetic waves in bounded & media, microwave components & microwave sources.

4. MEASUREMENTS & INSTRUMENTATION:

Measurement basis of electrical quantities, Measuring instruments & their principles of working, Transducers, Measurement of non- electrical quantities.

5. COMPUTER ARCHITECTURE/ORGANNISATION:

Concepts of architecture & organization, Memory organization, processing unit, Arithmetic & logic operations, Hardware & micro program control, Different types of memory , Arthritics circuits, Instructions.

SECTION-B

1. LINEAR & NONLINEAR ANALOG CIRCUITS:

Basic linear electronic circuits, Single stage and multi stage BJT amplifiers, Tuned & feedback amplifiers, MOS & FET based circuits, pulse shaping circuits, Waveform generators, Stabilizers.

2. DIGITAL CIRCUITS & MICROPROCESSORS:

Logic circuits & Gates, Combinational & Sequentialj Circuits, DACs & ADCs, Microprocessors-evolution & generations, 8085 Microprocessor- Instruction sets, programming, Interrupts , Subroutines, Peripherals Intel 8251 , 8255 etc.

3. CONTROL SYSTEMS :

Feedback theory, Control system components, Response of control systems, Design of practical systems.

4. COMMUNICATION SYSTEMS:

Basic Information theory, Error detection & control coding principles, Modulation & detection process. Noises, Various types of communication system- Radio & Line communications, Television & Radar navigation, Satellite communication principles.

COMPUTER ENGINEERING

SECTION-A

1. Electronics:

Solid State device- physics, characteristic and model logic families- DTL, RTL, TTL, cMOS, Nmos, logic design-Binary arithmetic, Number system, Codes Boolean algebra circuit memorization, combinational circuits, synchronous, sequential

circuits, Asynchronous sequential circuits flip flops, counter and shift register , karnaugh map, encoder, decoder, multiplexer, demultiplexer, etc.

2. Computer programming and Data structures:

Programming in FORTRAN, PASCAL and C, syntax and semantics, variables, control flow, arithmetic and Boolean expression, structural programming, Sub-programming, Algorithms. Array, stack, queue, linked lists, tree, B-tree traversal, internal sorting techniques, object oriented programming.

3. Microprocessor:

Organisation and programming of 8 bit microprocessors, microprocessor support chips. (PPI, PIC DMA controller etc.) interacting memory and I/O devices, microprocessor development tools, microprocessor based system design. Introduction to 16 and 32 bit microprocessors, 8085 and 8086 microprocessors.

4. System Software:

Microprocessor and assemblers, linker, loader, monitor, editor, relocation, re-entrant routine, co routine.

Section-B

1. Computer Architecture:

Micro instructions, memory organization, cache memory virtual memory, stack array processor, pipeline processor, interconnection scheme for parallel processing, data flow machines, Internal structure of RAM, ROM, PAL, and DRAM, SCSI Hard disk, CISC & RISC m/cs.

2. Operating System :

Function and Component of OS, Batch processing ,time sharing Device drive, File system, process scheduling ,concurrent processes, memory management, swapping segmentation and paging virtual memory, disk scheduling, deadlock, case study of DOS and UNIX.

3. Compiler Design Programming Languages:

Lexical analysis, grammar, syntax analysis, topdown and bottom up parsing, semantic analysis, symbol table, error detection and recovery, code generation and an Optimization. Data abstraction, Design philosophy of Pascal, functions, NFA, Study of compiler Design tools (e. g Y ACC)

4. Data Processing :

File organization techniques, performance of sequential, indexed sequential, indexed, hashed inverted and multiring files, DBMS, relational data model, integrity constraints, relational algebra, relgebra, relational calculus, normalization, concurrency control.

5. Computer Graphics:

Graphics I/O devices, Display adapters, CGA, EGA, VGA, 2Dline and curve drawing, 2D transformation windowing, curves of 3D modeling transformation ,3D viewing, Hidden line and surface removal , shading, device independent graphics system.

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AGRICULTURE ENGINEERING

Section - A

1. Soil Water Conservation Engineering

Hydrologic cycle rainfall and runoff factor effecting them an their measurements, stream gauging evaluation of runoff from rainfall. Infiltration, evaporation, hydrograph, flood routing Definition and scope of soil conservation; Mechanics and type of erosion, their causes Erosion control measure. Biological and Engineering. Basic open channel hydraulic. Design of soil conservation structure-terraces, bunds, outlets and grassed waterways. Gully control structure such as chute, drop and crop inlet splitways. Stream bank erosion and its control. Wind erosion and its control Principles of flood control. Water harvesting. Design of farm pond and earth dams. Watershed management-investigation and implementation-selection of priority areas watershed work plan.

2. Irrigation and Drainage Engineering;

source of water for irrigation. Techniques of measuring soil moisture. Soil waterplant relationship, Planning and design of minor irrigation projects Command Area Development. Irrigation scheduling. Duty of water-consumptive use. Water requirements of crops. Measurement and cost of irrigation water. Measuring devices. Flow through orifices, wins and flumes. Land leveling Water Conveyance and control. Water application methods-border irrigation. Check basin irrigation, furrow irrigation. Sprinkler irrigation, drip irrigation. Irrigation efficiencies and their estimation.

Occurrence of ground water, ground water resources development and their utilization. Hydraulics of wells. Types of wells their design and construction. Drilling methods. Well development and Testing of Wells. Types of pumps. Characteristics curve and selection of centrifugal, submersible and turbine pump. Economics of pumping.

Drainage-Definition causes of water legging drainage coefficient. Methods of drainage. Drainage of irrigate lands. Design of surface and sub surface systems.

3. Agricultural Structure;

Kinds of building materials their properties, Timber, brickworks and RC construction. design of columns, beams, roof trusses, joints layout of farm-stead. Design of farm houses, farm roads, fences, animals shelters, storage structure for food grains, feed and forage, machinery sheds, green houses, poly houses.

Section B

1. Farm Power and Machinery ;

Sources of farm power. Thermodynamics, construction and working of different types of internal combustion engines and their systems. Different types of tractors and power tillers. Clutch, power transmission, differential, final drive, power take off (p.t.o) brake, steering, hydraulic systems, types and ballasting. Farm machinery for primary and secondary tillage, seeding machinery, intercultural tools and machinery. plant protection equipment spray and dusting. Harvesting and threshing equipment. Machinery for land development. Ergonomics of man-machine system. Machinery for horticulture and agro-forestry, feeds and forages.

2. Agro Energy;

selection installation, safety and maintenance of electric motors for agricultural applications. Solar, wind and biogas energy and their utilization in agriculture. Energy plantation and briquetting: gasificts and energy efficient cooking stoves.

3. Agriculture Process and food Engineering ‘

Importance processing of agriculture products Principles and equipment for cleaning grading sorting and size separation. Engineering properties of agricultural produces and by products. Material handling equipment such as belt and screw conveyors, bucket elevators etc: their capacity and power requirement. Mechanical properties of biological materials: size reduction and power requirement. Related machineries. Shelling, dehusking, and decortications of agricultural products. Milling and polishing Mechanical paddy, wheat pulses and oil seeds. Relates machinery. their maintenance: and plant layout psychometric. Theory of grain drying, Different types of grain dryers and dryer efficiency. Principles of preservation of foods. Various food preservation techniques viz-drying, heat-treatment such as pasteurization, sterilization etc: chemical treatment, refrigeration freezing etc. processing of milk and dairy products- homogenization, cream separation, sprayer and roller drying, butter making, ice cream, cheese and milk products Principles of heat and mass transfer an their application in the analysis of simple processing operations such as drying, evaporation, extraction.

ENGINEERING MATHEMATICS:

Determinants & matrices, system of linear equations, eigenvalues and eigenvectors.

Calculus – mean value theorems of integral calculus, partial, total and directional derivatives, maxima and minima. Sequences and Series, convergence, Fourier series.

Vector calculus – gradient, divergence and curl, line and surface integrals, Green, Gauss and Stokes theorems. Ordinary differential equations-first order equations linear and nonlinear equations, higher order linear equations with constant coefficients, initial and boundary value problems, Laplace transforms.

Complex analysis-complex numbers, polar form of complex numbers, Powers and roots, limit, derivative, analytical functions.

Probability and Statistics-concept of probability, means and variance, linear regression analysis.

PROCESS CALCULATIONS AND THERMODYNAMICS:

Laws of conservation of mass and energy; use of tie components; recycle, bypass and purge calculations; degrees of freedom. First and Second laws of thermodynamics and their applications; equations of state and thermodynamic properties of real systems; phase equilibria; fugacity, excess properties and correlations of activity coefficients; chemical reaction equilibria.

FLUID MECHANICS AND MECHANICAL OPERATIONS:

Fluid statics, Newtonian and non-Newtonian fluids, Macroscopic energy balance, Bernoulli equation, dimensional analysis, continuity equation, flow through pipeline systems, flow meters pumps and compressors, packed and fluidized beds, elementary boundary layer theory, size reduction and size separation; free and hindered settling; centrifuges and cyclones; thickening and classification, filtration; mixing and agitation; conveying of solids.

HEAT TRANSFER:

Conduction, convection and radiation, heat transfer coefficients, steady and unsteady heat conduction, Boiling, condensation and evaporation types of heat exchangers and evaporators and their design.

MASS TRANSFER:

Fick's law, mass transfer coefficients, Film, penetration and surface renewal theories; momentum, heat and mass transfer analogies; stagewise and continuous contacting and stage efficiencies; design and operation of equipment for distillation, absorption, leaching, liquid-liquid extraction, crystallization drying, humidification, dehumidification and adsorption.

CHEMICAL REACTION ENGINEERING:

Theories of reaction rates; Kinetics of homogeneous reactions, interpretation of kinetic data, single and multiple reactions in ideal reactors, non-ideal reactors; non-isothermal reactors; kinetics of heterogeneous catalytic reactions; diffusional effects in catalysis.

INSTRUMENTATION AND PROCESS CONTROL:

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Measurement of process variable; dynamics of simple systems such as CSTRs, heat exchangers etc; transfer functions and responses of simple systems, process reaction curve, controller modes (P, PI, and PID); control valves; analysis of closed loop systems including stability, frequency response (including Bode plots) and controller tuning.

PLANT DESIGN AND ECONOMICS:

Design of chemical engineering equipment; principles of process economics and cost estimation.

CHEMICAL TECHNOLOGY:

Inorganic chemical industries; sulfuric acid, NaOH, fertilizers; natural products industries (Pulp and Paper, sugar, Oil and Fats); petroleum refining and petrochemicals; polymerization industries; polyethylene, polypropylene and synthetic fibres.

COMPUTER APPLICATIONS

SECTION-A

Introduction to Computer and programming:-

Computer Organizations; Number systems: Logic gates; Boolean functions; NAND implementation; NOR implementation; Binary Codes; Combinations; Circuits; Sequential Circuits;

Programming fundamentals; Algorithm development; techniques of problem solving; Flowcharting; Programming in C, Pointers; structures and Unions; File Management; Object Oriented Programming; OOP programming methodologies; Programming in C++; visual program design; Programming using visual Basic/ VC++;

Data Structures:

Representation of Data; arrays; Static and Dynamic implementations of data structures; stacks and its applications; Queues; Linked Lists; Tress; Graphs: Different types of searching and sorting techniques;

Business Data processing and File Systems:

Data processing; Concepts: relevance and cycle; Organization and attributes of business data processing; Programming Methodologies; coding, testing and refinements; Business systems; Business computing Programming with COBOL;

Operation Systems:

Operating Systems Overview and functions; Processes, Process and CPU scheduling; Memory management; Segmentation: Deadlocks: Mutual Exclusions; classical Problems; File system implementations; Security and protection mechanisms; Disks; clocks, terminals; Case study of WINDOWS, WIN NT and UNIX operating systems;

System programming and Compiler Design:

Sets, Strings theory of automata, DFA, NFA, lexical analysis; Formal languages, regular grammars, context free grammars, sensitive grammars; Parsing techniques; translation schemes; code generation, symbol table management, error handling; assemblers, loaders, Linkers, relocating loaders etc.


SECTION-B

Computer architecture:

MIMD and SIMD computers; CISC and RISC processors; Superscalar processors; Hierarchical memory technology: Virtual memory technology; Linear pipeline processors; Multiprocessor systems, Parallel programming concepts; Parallel algorithms for multiprocessors;

Software Engineering and System Design:

Software product and process; Generic phases, Project scheduling and tracking; Verification, validation and performance evaluation; software measurement; Software testing techniques; Software Quality Assurance, Quality models: ISO 9000 and SEICMM; Real time and distributed systems; Systems development life cycle; System Design and modeling: Data Flow diagram, Entity Relationship diagram, structure charts;



Data Base Management System:

Date abstraction and data integration; components of DBMS; Relational data manipulations; SQL; relational database design, functional dependencies, Oracle-Data types, SQL: Function, Procedure, Cursor, Exceptions, Triggers etc.

Data Communication and Computer Networks:

Data Communication Systems; Data transmission: time domain and frequency domain concepts; Analog and Digital data transmission; Modulation techniques; Computer network concepts; OSI and TCP/IP models; LAN and MAC Layer protocols; Data Link Layer; Network Layer: Routing techniques; Bridges, Routers, Gateways; Transport Layer; TCP, UDP; Internetworking; IP Addresses, Application Layer; Network programming: Sockets; IPX/SPX procedures; RPC; Remote login;

Computer Graphics:

Basic of graphics systems; Display devices; Input devices; Line drawing algorithms; DDA algorithms, Circle drawing algorithms, Pixel addressing, anti-aliasing, clipping; translation, rotation, scaling, reflection, shear, matrix representation.

Internet Technology and E-Commerce:

Internet concepts; S/W requirements and Internet service products; Understanding the Web; Internet programming with JAVA/Perl; creating applets, Ebusiness concepts; Building blocks of E-commerce: Cryptography and security management; Payment systems; building e-commerce system, system architecture, secure links etc;

COMPUTER SCIENCE

SECTION -A

Introduction to Computer Science and Programming:

1. Algorithms to programs: Specification.
2. Introduction to system software.
3. Operation systems.
4. Compilers and multi-user environments.
5. Operating systems and system software.

DATA Structure:

1. Introduction to programming methodologies and design algorithms.
2. Survey of basic structures like arrays, stacks and queues.
3. Linked list structures.
4. Sorting techniques.

Numerical and Scientific Computing:

1. Review of matrices and linear systems.
2. Eigen values and singular value decompositions and linear systems sensitivity.
3. Review of convergence of iterative methods.
4. Newton's methods.

Computer Architecture:

1. Basic combinational and sequential circuit design.
2. Subsystems of a computer.
3. Instructions and their formats.
4. Assembly programming.
5. Study of CISC & RISC m/cs.


SECTION-B

Programme Languages:

1. Notions of syntax and semantics of programming languages.
2. Data operation and central constructs.
3. List of array manipulation.
4. Object Oriented Programming.

Introduction to Logic for Computer Science:

1. Syntax of propositional formalisms.
2. Validity of inconsistency.
3. Deduction systems for propositional logic.
4. Introduction to model theory.
5. Completeness and compactness theorems.
6. Applications of resolution to automatic theorems proving and logic programming.



Super Computing for Engineering Applications:

1. Programming for vector processors.
2. Mapping Loops
3. Process communication.
4. Load balancing
5. Optimization.
6. Monte-carlo simulation.

Digital Hardware Design:

1. Asynchronics and pulse mode circuit design and implementation.
2. Hardware description language and synthesis.
3. Microprogramme control design.

Introduction to Microprocessors:

1. Introduction to digital hardware design
2. Organization and programming of a microprocessor
3. Programmed and interrupt based I/O interfacing
4. Interrupt controller
5. Microprocessor applications

File Structures and Information System Design:

1. Data processing concepts.
2. Auxiliary storage media.
3. External sorting techniques

Database Management Systems:

1. Introduction of database concept.
2. Difference between a file system and database system.
3. Concurrency control.

Software Engineering:

1. Techniques of structured programming
2. Information hiding
3. Organization and management of large software design projects.
4. Chief programmes terms
5. Program libraries.
6. Documentation, testing, validation.