



Vikrant University

— GWALIOR —

PhD Entrance Examination

Syllabus- 2023-24

— GWALIOR —

PhD stands for Doctor of Philosophy, which is a title that is desired by a lot of individuals who are interested in devoting their careers to research in a particular field. This is a title that is also desired by many individuals who aspire to be educators to future generations. The most common way to get a PhD is by applying for various entrance exams that facilitate the individual to get a PhD. Here are some reasons why a PhD is necessary today:

- A PhD offers the holder a guaranteed job in a university or college. Depending upon the subject, candidates can secure jobs in law firms, consultancies or even publishing houses.
- The mastery and expertise over the subject matter gives the candidate an edge over the competition.
- And the most valuable asset of all - better reputation in terms of qualification.

The subjects and topics included in PhD Syllabus vary based on the PhD specialization and sub-stream one chooses. The subjects included in PhD Syllabus focus on the research and practical aspects of the subject, with a little focus on theoretical knowledge.

PhD Entrance Exam Paper Pattern: The model PhD Entrance Test Pattern consists of two parts:

Part A: It is compulsory and consists of 50 questions on Research Methodology

Part B: It consists of 50 discipline specific questions

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2. Syllabus of Part B (Subject wise)

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- XXXII. AGRICULTURE**



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Part A: Research Methodology

Introduction to Research: Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India.

Defining the Research Problem: What is a Research Problem? Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, factors affecting RDs, Relation among RDs, Developing a Research Plan.

Sampling design and Procedures: Sample or Census, The Sampling Design Process, A Classification of Sampling Techniques, Choosing Nonprobability Versus Probability Sampling, Uses of Non probability Versus Probability Sampling.

Measurement and Scaling: Non-comparative Scaling Techniques, Continuous Rating Scale, Itemized Rating Scale, Non-comparative Itemized Rating Scale Decisions, Multi-item Scales, Scale Evaluation, Choosing a Scaling Technique.

Methods of Data Collection: Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Some Other Methods of Data Collection, Collection of Secondary Data, Selection of Appropriate Method for Data Collection.

Questionnaire & form design: questionnaire & observation forms, questionnaire design process.

Data analysis: tests of significance based on t, f and z distribution chi-square test; cross tabulation

Multiple Regression: Overview of Multiple Regression, Statistics Associated with Multiple Regression, Conducting Multiple Regression, Stepwise Regression, Multicollinearity

Discriminant Analysis: Discriminant Analysis Model, Statistics Associated with Discriminant Analysis, Conducting Discriminant Analysis

Part B

I. Civil Engineering

Engineering Mathematics

- (a) **Linear Algebra:** Matrix algebra; Systems of linear equations; Eigen values and Eigen vectors.
- (b) **Calculus:** Functions of single variable; Limit, continuity and differentiability; Mean value theorems, local maxima and minima; Taylor series; Evaluation of definite and indefinite integrals, application of definite integral to obtain area and volume; Partial derivatives; Total derivative; Gradient, Divergence and Curl, Vector identities; Directional derivatives; Line, Surface and Volume integrals.
- (c) **Ordinary Differential Equation (ODE):** First order (linear and non-linear) equations; higher order linear equations with constant coefficients; Euler- Cauchy equations; initial and boundary value problems.
- (d) **Partial Differential Equation (PDE):** Fourier series; separation of variables; solutions of one dimensional diffusion equation; first and second order one- dimensional wave equation and two dimensional Laplace equation.
- (e) **Probability and Statistics:** Sampling theorems; Conditional probability; Descriptive statistics – Mean, median, mode and standard deviation; Random Variables – Discrete and Continuous, Poisson and Normal Distribution; Linear regression.
- (f) **Numerical Methods:** Error analysis. Numerical solutions of linear and non- linear algebraic equations; Newton's and Lagrange polynomials; numerical differentiation; Integration by trapezoidal and Simpson's rule; Single and multi-step methods for first order differential equations.

Structural Engineering

- (a) **Engineering Mechanics:** System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Frictions and its applications; Centre of mass; Free Vibrations of undamped SDOF system.
- (b) **Solid Mechanics:** Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Simple bending theory, flexural

and shear stresses, shear centre; Uniform torsion, Transformation of stress; buckling of column, combined and direct bending stresses.

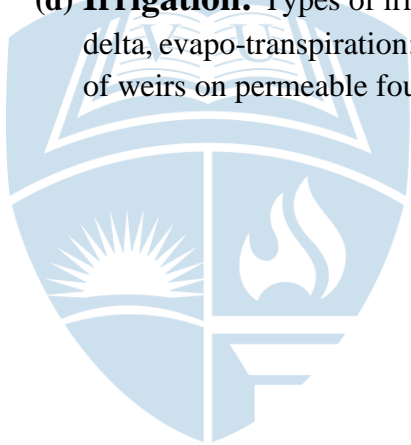
- (c) **Structural Analysis:** Statically determinate and indeterminate structures by force/energy methods; Method of superposition; Analysis of trusses, arches, beams, cables and frames; Displacement methods: Slope deflection and moment distribution methods; Influence lines; Stiffness and flexibility methods of structural analysis.
- (d) **Concrete Structures:** Working stress and Limit state design concepts; Design of beams, slabs, columns; Bond and development length; Prestressed concrete beams.
- (e) **Steel Structures:** Working stress and Limit state design concepts; Design of tension and compression members, beams and beam-columns, column bases; Connections - simple and eccentric, beam-column connections, plate girders and trusses; Concept of plastic analysis - beams and frames.

Geotechnical Engineering

- (a) **Soil Mechanics:** Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability - one dimensional flow, Seepage through soils - two - dimensional flow, flow nets, uplift pressure, piping, capillarity, seepage force; Principle of effective stress and quicksand condition; Compaction of soils; One dimensional consolidation, time rate of consolidation; Shear Strength, Mohr's circle, effective and total shear strength parameters, Stress-Strain characteristics of clays and sand; Stress paths.
- (b) **Foundation Engineering:** Sub-surface investigations - Drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests; Earth pressure theories - Rankine and Coulomb; Stability of slopes - Finite and infinite slopes, Bishop's method; Stress distribution in soils - Boussinesq's theory; Pressure bulbs, Shallow foundations - Terzaghi's and Meyerhof's bearing capacity theories, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations - dynamic and static formulae, Axial load capacity of piles in sands and clays, pile load test, pile under lateral loading, pile group efficiency, negative skin friction.

Water Resource Engineering

- (a) **Fluid Mechanics:** Properties of fluids, fluid statics; Continuity, momentum and energy equations and their applications; Potential flow, Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth; Concept of lift and drag.
- (b) **Hydraulics:** Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Channel Hydraulics - Energy-depth relationships, specific energy, critical flow, hydraulic jump, uniform flow, gradually varied flow and water surface profiles.
- (c) **Hydrology:** Hydrologic cycle, precipitation, evaporation, evapo- transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, reservoir capacity, flood estimation and routing, surface run-off models, ground water hydrology - steady state well hydraulics and aquifers; Application of Darcy's Law.
- (d) **Irrigation:** Types of irrigation systems and methods; Crop water requirements - Duty, delta, evapo-transpiration; Gravity Dams and Spillways; Lined and unlined canals, Design of weirs on permeable foundation; cross drainage structures.



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II. Computer Science & Engineering

Mathematical Techniques

1. Linear Algebra

- Mathematical operations with matrices (addition, multiplication)
- Matrix inverses and determinants
- Solving systems of equations with matrices
- Euclidean vector spaces
- Eigenvalues and eigenvectors
- Orthogonal matrices
- Positive definite matrices
- Linear transformations
- Projections
- Linear dependence and independence
- Singular value decomposition

2. Calculus

- Continuity and Differentiability
- Mean value Theorems
- Evaluation of Definite and Improper Integrals
- Surface and Volume Integrals
- Gauss and Green's Theorems

3. Differential equations

- Higher Order Linear Differential Equations with Constant Coefficients
- Laplace and Fourier Transforms
- Solutions of one-Dimensional Diffusion
- Wave Equations
- Laplace Equation

4. Probability and Statistics

- Definitions of Probability and Sampling Theorems
- Normal and Binomial Distributions

5. Numerical Methods

- Finite Differences
- Numerical Integration
- Numerical Solutions of Linear and Non-Linear Algebraic Equations

6. Data Structures

- Advanced Sorting Methods
- Algorithm Design Paradigms
- Complexity of Algorithm
- Depth-first and Breadth-first Algorithms
- Kinetic Data Structures

7. Algorithms

- Asymptotic analysis
- Asymptotic notation
- Basic concepts of complexity classes
- Connected components
- Dynamic programming
- Notions of space and time complexity
- Tree and graph traversals
- Worst and average case analysis
- Computational Geometry
- Growth of Functions
- Heuristic Methods

8. Computation Theory

- Regular Languages and Finite Automata
- Languages and Pushdown Automata
- Recursively Enumerable sets and Turing Machines

9. Operating Systems

- Agreement Protocols for handling Processor Failures
- Comparative Performance Analysis
- Distributed Mutual Exclusion
- Distributed Operating Systems
- Local and Global states
- Process Deadlocks
- Resource Models
- Synchronization Mechanisms
- Coordination of Processes and related Algorithms
- Failure Handling and Recovery Mechanisms
- Multiprocessor Operating Systems and related Thread Handlings
- Token and Non-token based Algorithms
- Database Systems

10. Database design

- Indexing and Hashing
- Relational model
- Storage and File Structures
- Extended Relational Model

- Mobile Databases and Web-enabled Database Systems
- Transactions and Concurrency control

11. Computer Organization and Architecture

- Cache and main memory
- CPU control design
- Design and synthesis of combinational and sequential circuits
- Instruction pipelining
- Machine instructions and addressing modes
- Number representation and computer arithmetic
- Secondary storage
- Structured Memory Design for Parallel Systems

12. Software Engineering

- Team Software Process
- Systems Modeling Language
- Requirement and feasibility analysis
- Process Models- Iterative
- Planning and managing the project
- Personal Software Process
- Domain specific modeling
- Software architecture and design patterns
- Software reliability and Advanced testing techniques
- Aspect oriented programming

13. Computer Networks

- LAN technologies
- Application layer protocols
- Flow and error control techniques
- Introduction to intelligent networking
- Performance analysis of networks

III. Mathematics

UNIT – 1 Analysis: Elementary set theory, finite, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property, supremum, infimum. Sequences and series, convergence, \limsup , \liminf . Bolzano Weierstrass theorem, Heine Borel theorem. Continuity, uniform continuity, differentiability, mean value theorem. Sequences and series of functions, uniform convergence. Riemann sums and Riemann integral, Improper Integrals. Monotonic functions, types of discontinuity, functions of bounded variation, Lebesgue measure, Lebesgue integral. Functions of several variables, directional derivative, partial derivative, and derivative as a linear transformation, inverse and implicit function theorems. Metric spaces, compactness, connectedness. Normed linear Spaces. Spaces of continuous functions as examples.

Linear Algebra: Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations. Algebra of matrices, rank and determinant of matrices, linear equations. Eigenvalues and eigenvectors, Cayley-Hamilton theorem. Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms. Inner product spaces, orthonormal basis. Quadratic forms, reduction and classification of quadratic forms

UNIT – 2 Complex Analysis: Algebra of complex numbers, the complex plane, polynomials, power series, transcendental functions such as exponential, trigonometric and hyperbolic functions. Analytic functions, Cauchy-Riemann equations. Contour integral, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem, Maximum modulus principle, Schwarz lemma, Open mapping theorem. Taylor series, Laurent series, calculus of residues. Conformal mappings, Mobius transformations.

Algebra: Permutations, combinations, pigeon-hole principle, inclusion-exclusion principle, derangements. Fundamental theorem of arithmetic, divisibility in \mathbb{Z} , congruences, Chinese Remainder Theorem, Euler's ϕ -function, primitive roots. Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups, permutation groups, Cayley's theorem, class equations, Sylow theorems. Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domain, principal ideal domain, Euclidean domain. Polynomial rings and irreducibility criteria. Fields, finite fields, field extensions, Galois Theory.

Topology: basis, dense sets, subspace and product topology, separation axioms, connectedness and compactness.

UNIT – 3 Ordinary Differential Equations (ODEs): Existence and uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs. General theory of homogenous and non-homogeneous linear ODEs, variation of parameters, Sturm-Liouville boundary value problem, Green's function.

Partial Differential Equations (PDEs): Lagrange and Charpit methods for solving first order PDEs, Cauchy problem for first order PDEs. Classification of second order PDEs, General solution of higher order PDEs with constant coefficients, Method of separation of variables for Laplace, Heat and Wave equations.

Numerical Analysis: Numerical solutions of algebraic equations, Method of iteration and Newton-Raphson method, Rate of convergence, Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods, Finite differences, Lagrange, Hermite and spline interpolation, Numerical differentiation and integration, Numerical solutions of ODEs using Picard, Euler, modified Euler and Runge-Kutta methods. Calculus of Variations: Variation of a functional, Euler-Lagrange equation, Necessary and sufficient conditions for extrema. Variational methods for boundary value problems in ordinary and partial differential equations. Linear Integral Equations: Linear integral equation of the first and second kind of Fredholm and Volterra type, Solutions with separable kernels. Characteristic numbers and eigenfunctions, resolvent kernel.

Classical Mechanics: Generalized coordinates, Lagrange's equations, Hamilton's canonical equations, Hamilton's principle and principle of least action, Two-dimensional motion of rigid bodies, Euler's dynamical equations for the motion of a rigid body about an axis, theory of small oscillations.

IV. Botany

UNIT-I: Algae:classification, Salient features of major divisions; Ecological and economic importance of Algae. Fungi:Classification of fungi; general characters, Fungal associations and their significance; Agricultural significance of Fungi. Bryophyta:Classification and general characters; economic importance Pteridophyta: Classification and general characters of Pteridophytes Gymnosperms:General characteristic features of Gymnosperms and their affinities with pteridophytes and angiosperms; classification of Gymnosperms; Distribution of Gymnosperms in India.

UNIT II: Introduction to the Angiosperms: Taxonomic History; classification; Keys for identification of plants; Basal angiosperms and Magnoliids; Basal monocots; Petaloid monocots; Commelinids; Basal eudicots and Caryophyllids; Rosids; Asterids. Botanical Nomenclature: Kinds of names; ICBN, Names according to rank; Citation of authors; Priority; Type method; Naming a new species; Legitimacy;Synonyms. Phylogenetics: The nature of phylogeny; How we depict phylogeny? Theimportance of homology, Polarizing characters of homology; The problem of homoplasy. Salient Features and Economic Importance of Monocot/Dicot Families: Apocyanaceae; Verbenaceae; Chenopodiaceae; Capparidaceae; Caryophyllaceae; Myrtaceae; Apiaceae; Acanthaceae; Moraceae; Rubiaceae; Amaranthaceae; Musaceae; Cannaceae; Commelinaceae. Origin and economic significance of the following: Medicinal and aromatic plants; Fiber yielding plants, Spices and condiments; cereals, pulses, Rubber yielding plant; tea, coffee, Oil yielding plants; source and uses of plant based insecticides

UNIT-III: Plant Cell and Tissue Culture: Principles, Cellular totipotency; Somatic embryogenesis and synthetic seeds, Somatic hybridization; Application in biotechnology. Plant Breeding: Objectives, domestication and centres of origin of cultivated plants. Hybridization: Role and methods, Back-cross breeding. Pedigree method; Bulk method; Single-seed descent method; Heterosis, Inbreeding depression. Breeding for resistance: Breeding for biotic and abiotic stresses, physical and chemical mutagens; Gamma gardens; Heritability and its Methods of estimation; Reciprocal recurrent selection; Reciprocal recurrent selection based on test cross of half-sib families; Reciprocal recurrent selection based on half-sib progenies of prolific plants; Reciprocal full-sib recurrent selection. Phytopathology: process of infection and pathogenesis, Defense mechanism in plants, Diseases in plants: Symptoms, etiology and disease cycle. Wheat- rust, smut; Rice-sheath blight; Cucurbits- Powdery mildew; Sugarcane-red rot; Potato-late and early blight; Crucifers-white rust; dieback disease of grasses. Chemical and biological means of disease control.

UNIT-IV: Genome: Genome organization in prokaryotes and eukaryotes, Nuclear DNA content; law of DNA constancy and C-value paradox; Cot curves, chromosomes, linkage and genetic mapping, gene mapping methods, transposons Prokaryotic & eukaryotic DNA replication, Prokaryotic and eukaryotic transcription, Protein synthesis and processing, Control of gene expression at transcription and translation level, Transgenic Plants, recombinant DNA technology, Gene Transfer Methods in Plants (direct gene transfer methods; restriction endonucleases, ligases, applications of genetic engineering; floral-dip

UNIT-V: Biomolecules: biomolecules (composition, structure and function), stabilizing interactions, conformation of proteins; conformation of nucleic acids (helix (A, B, Z), t-RNA, micro-RNA); stability of proteins and nucleic acids. Physiology: Water and Plant Cells; Mineral Nutrition, photosynthesis in higher plants; plant respiration, Phytochromes and cryptochromes; Photoperiodism., Plant Hormones, principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes; Stress physiology, Nitrogen metabolism, Physiology of flowering, seed germination, senescence

UNIT-VI: Ecology and Environment: Definition, history and scope of ecology, subdivisions of ecology, ecology vs environmental science. Interdisciplinary nature of environmental science. Evolution and Natural Selection, Ecological succession, Ecosystem organization: Structure and functions; primary production; energy dynamics; global biogeochemical cycling and ecosystem nutrient cycles, primary and secondary productivity, food chains, food webs, ecological pyramids, energy flow and nutrient cycles. Environment Protection: Conservation of Soil, Agriculture, Biodiversity, aquatic systems; Bioremediation, Phytoremediation, Endangered and threatened species. International concern and efforts for environmental protection, Earth Summits. Global warming; Climate change. Phytogeography: Climate, vegetation and botanical zones of India, Application of remote sensing in vegetation classification.

UNIT-VII Techniques: Microscopy, Chromatographic techniques, Centrifugation, Electrophoresis and Isoelectric focusing, Molecular techniques: Random Fragment Length Polymorphism (RFLP); Fluorescence In-Situ Hybridization (FISH), Genomic In-Situ Hybridization (GISH), Fiber-FISH, Q-FISH; Flow FISH: Flow Cytogenetics, Flow karyotyping; Random amplified polymorphic DNA. Proteomics, Separation and identification of cellular proteins, Genomics, genome sequencing strategies.

V. ZOOLOGY

Unit 1 : Systematics and Animal Diversity :

Systematics : Principles of Animal taxonomy, Carl Linnaeus taxonomic hierarchy, binomial nomenclature, species concept and taxonomic procedures; Major and minor phyla-diagnostic features with example for each phylum and their classification.

Non-chordata : Organization of Metazoans; amoeboid, flagellate and ciliary locomotion; hydrostatic movement; patterns of feeding and digestion in lower metazoans, respiratory organs and pigments, osmoregulation, excretory organs; primitive and advanced nervous system, sense organs and their importance; larval forms and importance of invertebrate fossils.

Chordata : Origin of chordates, systematic position of protochordates and vertebrates, nature of vertebrate morphology, homology and analogy, parallelism and convergence; classification of vertebrates, vertebrate integument and its derivatives; evolution of circulatory, respiratory and urinary systems; Development and organization of brain, spinal cord, nervous system and sense organs; Adaptive radiation of vertebrates.

Unit 2 : Environmental Biology and Wildlife :

Environment : Abiotic and biotic factors, bio-geochemical cycles, population ecology, demography; air, water and soil pollution; Fresh and marine water ecology; Food chain and food web; Conservation and management of natural resources; Environmental education, Environmental monitoring and EIA; microbial ecology, ecological role of microorganisms.

Wildlife : Values of wildlife, causes of wildlife depletion, human-wildlife conflicts, wildlife and human welfare, conservation strategies - in-situ and ex-situ conservation, wildlife act and legislation, conservation projects in India, Biosphere reserves, National Parks, sanctuaries; Biodiversity profile of India and Karnataka, Biodiversity hotspots.

Unit 3 : Developmental Biology - Molecular events during fertilization, nucleocytoplasmic interactions in development, cleavage and gastrulation, morphogenetic determinants, laying down embryonic body plan - Drosophila and mammals; competence, determination; induction, early embryogenesis in Drosophila - gap genes, pair rule genes, segment polarity genes and Homeotic genes, post embryonic development; Role of ecdysone and thyroxin in metamorphosis; sources of cells for regeneration; teratogenesis.

Unit 4 : Biological chemistry – Chemistry of DNA and RNA, Watson-Crick model of DNA, cyclic nucleotides; vitamins as co-enzymes, trace elements; chemical bonds, Vander-waal's force, normality and molarity of solutions; chemistry and biological properties of carbohydrates and lipids; nomenclature of enzymes, enzyme dynamics, enzyme inhibition, ribozymes and abzymes; colorimetry, spectrophotometry, TLC, HPLC, electrophoresis, ELISA.

Unit 5 : Applied Zoology-Insect pests of major crops, plant-insect interaction, insect pest control strategies, IPM; Insect vectors of diseases, epidemiology of - malaria, filariasis, leishmaniasis, Japanese encephalitis, dengue, chikungunya; silkworm races and culture practices, lac culture, venomous insects; fisheries of India, culture practices of-fish, prawn and oyster.

Unit 6 : Basic and advanced genetics- Mendelian principles in haploid organisms (*Chlamydomonas* and *Neurospora*), tetrad analysis, dominance relationships, allelic variation and gene function, types of mutations, molecular mechanisms of mutations, methods of detection of mutations, P-mediated mutagenesis; genome in prokaryotes and eukaryotes, c-value paradox, split genes, mobile genetic elements, mapping of genome, linkage, molecular markers; comparative genomics of *C. elegans*, *Drosophila*, mouse and *Homo sapiens*; bacterial transformation, transduction and conjugation; morphogenesis and recombination in bacteriophages.

Unit 7 : Cell and Molecular Biology—Ultrastructure of cell organelles and their function; biology of cancer; biology of immune system; gene regulation in prokaryotes and eukaryotes; genetic code; DNA replication, transcription and translation in prokaryotes and eukaryotes, molecular mechanisms of DNA repair, principles and applications of recombinant DNA technology.

Unit 8 : Reproductive Biology and Endocrinology—Functional morphology of female reproductive system - ovary and accessory organs; Functional morphology of male reproductive system - testis and accessory organs; Fertility control methods-barrier, surgical and hormonal; Structure and function of endocrine organs - adrenal, pituitary, thyroid, parathyroid, pancreas, pineal, hypothalamus, ovary and testis; Mechanism of action of endocrine organs.

Unit 9 : Animal Physiology - Aerobic and anaerobic breakdown of glucose, stepwise release of energy and production of ATP, exchange (at respiratory surface) and transport of respiratory gases; Composition of blood, cardiac cycle, ECG; Different modes of nitrogen excretion, molecular organization of sarcomere and mechanism of muscle contraction; transmission of nerve impulse, sensory transduction, tolerance and resistance; osmoregulation in aqueous and terrestrial environment; thermoregulation.

Unit 10 : Organic Evolution : Darwinism and Neo-Darwinism; Population genetics; Hardy-Weinberg genetic equilibrium and its destabilizing forces; speciation, reproductive isolation, models of speciation, micro and macro-evolution; Neutral theory of evolution, molecular evolution, molecular clock, construction and types of phylogenetic trees.

VI. MECHANICAL ENGINEERING

Engineering Materials: Structure and properties of engineering materials and their applications; effect of strain, strain rate and temperature on mechanical properties of metals and alloys; heat treatment of metals and alloys, its influence on mechanical properties.

Applied Mechanics: Engineering mechanics – equivalent force systems, free body concepts, equations of equilibrium; strength of materials – stress, strain and their relationship, Mohr's circle, deflection of beams, bending and shear stress, Euler's theory of columns.

Theory of Machines and Design: Analysis of planar mechanisms, cams and followers; governors and fly wheels; design of elements – failure theories; design of bolted, riveted and welded joints; design of shafts, keys, spur gears, belt drives, brakes and clutches.

Thermal Engineering: Fluid mechanics – fluid statics, Bernoulli's equation, flow through pipes, equations of continuity and momentum; thermodynamics – zeroth, first and second law of thermodynamics, thermodynamic system and processes, calculation of work and heat for systems and control volumes; air standard cycles; basics of internal combustion engines and steam turbines; heat transfer – fundamentals of conduction, convection and radiation, heat exchangers.

Metal Casting: Casting processes – types and applications; patterns – types and materials; allowances; moulds and cores – materials, making, and testing; casting techniques of cast iron, steels and nonferrous metals and alloys; solidification; design of casting, gating and risering; casting inspection, defects and remedies.

Metal Forming: Stress-strain relations in elastic and plastic deformation; concept of flow stress, deformation mechanisms; hot and cold working – forging, rolling, extrusion, wire and tube drawing; sheet metal working processes such as blanking, piercing, bending, deep drawing, coining and embossing; analysis of rolling, forging, extrusion and wire /rod drawing; metal working defects.

Metal Joining Processes: Welding processes – manual metal arc, MIG, TIG, plasma arc, submerged arc, electro slag, thermit, resistance, forge, friction, and explosive welding; other joining processes – soldering, brazing, braze welding; inspection of welded joints, defects and remedies; introduction to advanced welding processes – ultrasonic, electron beam, laser beam; thermal cutting.

Machining and Machine Tool Operations: Basic machine tools; machining processes – turning, drilling, boring, milling, shaping, planing, gear cutting, thread production, broaching, grinding, lapping, honing, super finishing; mechanics of machining – geometry of cutting tools, chip formation, cutting forces and power requirements, Merchant's analysis; selection of machining parameters; tool materials, tool wear and tool life, thermal aspects of machining, cutting fluids, machinability; principles and applications of nontraditional machining processes – USM, AJM, WJM, EDM and Wire cut EDM, LBM, EBM, PAM, CHM, ECM

Tool Engineering: Jigs and fixtures – principles, applications, and design; press tools – configuration, design of die and punch; principles of forging die design.

Metrology and Inspection: Limits, fits, and tolerances, interchangeability, selective assembly; linear and angular measurements by mechanical and optical methods, comparators; design of limit gauges; interferometry; measurement of straightness, flatness, roundness, squareness and symmetry; surface finish measurement; inspection of screw threads and gears; alignment testing of machine tools.

Powder Metallurgy: Production of metal powders, compaction and sintering.

Polymers and Composites: Introduction to polymers and composites; plastic processing – injection, compression and blow molding, extrusion, calendaring and thermoforming; molding of composites.

Computer Integrated Manufacturing: Basic concepts of CAD, CAM, CAPP, cellular manufacturing, NC, CNC, DNC, Robotics, FMS, and CIM.

Product Design and Development: Principles of good product design, tolerance design; quality and cost considerations; product life cycle; standardization, simplification, diversification, value engineering and analysis, concurrent engineering.

Facility Design: Facility location factors and evaluation of alternate locations; types of plant layout and their evaluation; computer aided layout design techniques; assembly line balancing; materials handling systems.

Production Planning and Inventory Control: Forecasting techniques – causal and time series models, moving average, exponential smoothing, trend and seasonality; aggregate production planning; master production scheduling; MRP and MRP-II; order control and flow control; routing, scheduling and priority dispatching; push and pull production systems, concept of JIT manufacturing system; logistics, distribution, and supply chain management; Inventory – functions, costs, classifications, deterministic and probabilistic inventory models, quantity discount; perpetual and periodic inventory control systems.

Operation Research: Linear programming – problem formulation, simplex method, duality and sensitivity analysis; transportation and assignment models; network flow models, constrained optimization and Lagrange multipliers; simple queuing models; dynamic programming; simulation – manufacturing applications; PERT and CPM, time-cost trade-off, resource leveling.

Quality Management: Quality – concept and costs, quality circles, quality assurance; statistical quality control, acceptance sampling, zero defects, six sigma; total quality management; ISO 9000; design of experiments – Taguchi method.

VII. CHEMISTRY

Organic Chemistry: IUPAC nomenclature of organic molecules including regio- and stereoisomers.

Principles of stereochemistry: Configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselective and asymmetric induction.

Aromaticity: Benzenoid and non-benzenoid compounds – generation and reactions.

Organic reactive intermediate: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, benzyne and nitrenes. Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Determination of reaction pathways. Common named reactions and rearrangements – applications in organic synthesis.

Organic transformations and reagents: Functional group interconversion including oxidations and reductions; common catalysts and reagents (organic, inorganic, organometallic and enzymatic). Chemo, regio and stereoselective transformations.

Concepts in organic synthesis: Retrosynthesis, disconnection, synthons, linear and convergent synthesis, umpolung of reactivity and protecting groups.

Asymmetric synthesis: Chiral auxiliaries, methods of asymmetric induction – substrate, reagent and catalyst controlled reactions; determination of enantiomeric and diastereomeric excess; enantio-discrimination. Resolution – optical and kinetic. Pericyclic reactions – electrocycloaddition, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications of photochemical reactions in organic chemistry. Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms (O, N, S).

Chemistry of natural products: Carbohydrates, proteins and peptides, fatty acids, nucleic acids, terpenes, steroids and alkaloids. Biogenesis of terpenoids and alkaloids. Structure determination of organic compounds by IR, UV-Vis, ^1H & ^{13}C NMR and Mass spectroscopic techniques.

Inorganic Chemistry: Chemical periodicity. Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules (VSEPR Theory). Concepts of acids and bases, Hard-Soft acid base concept, Non-aqueous solvents. Main group elements and their compounds: Allotropy, synthesis, structure and bonding, industrial importance of the compounds. Transition elements and coordination compounds: structure, bonding theories, spectral and magnetic properties, reaction mechanisms. Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications.

Organometallic compounds: synthesis, bonding and structure, and reactivity. Organometallics in homogeneous catalysis. Cages and metal clusters. Analytical chemistry- separation, spectroscopic, electro- and thermoanalytical methods.

Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron- transfer reactions; nitrogen fixation, metal complexes in medicine. Characterisation of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer, UV-vis, NQR, MS, electron spectroscopy and microscopic techniques.

Nuclear chemistry: nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis.

Physical Chemistry: Basic principles of quantum mechanics: Postulates; operator algebra; exactly- solvable systems: particle-in-a-box, harmonic oscillator and the hydrogen atom, including shapes of atomic orbitals; orbital and spin angular momenta; tunneling.

Approximate methods of quantum mechanics: Variational principle; perturbation theory up to second order in energy; applications. Atomic structure and spectroscopy; term symbols; many-electron systems and antisymmetry principle. Chemical bonding in diatomics; elementary concepts of MO and VB theories; Huckel theory for conjugated π -electron systems. Chemical applications of group theory; symmetry elements; point groups; character tables; selection rules.

Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules; basic principles of magnetic resonance.

Chemical thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell's relations; spontaneity and equilibria; temperature and pressure dependence of thermodynamic quantities; Le Chatelier principle; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions.

Statistical thermodynamics: Boltzmann distribution; kinetic theory of gases; partition functions and their relation to thermodynamic quantities – calculations for model systems

Electrochemistry: Nernst equation, redox systems, electrochemical cells; Debye- Huckel theory; electrolytic conductance – Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations.

Chemical kinetics: Empirical rate laws and temperature dependence; complex reactions; steady state approximation; determination of reaction mechanisms; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions.

Colloids and surfaces: Stability and properties of colloids; isotherms and surface area; heterogeneous catalysis.

Solid state: Crystal structures; Bragg's law and applications; band structure of solids.

Polymer chemistry: Molar masses; kinetics of polymerization.

Data analysis: Mean and standard deviation; absolute and relative errors; linear regression; covariance and correlation coefficient.



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VIII. MASS COMMUNICATION

Unit - 1

Introduction to and Mass Communication

- a. Concept of mass communication, mass communication in India.
- b. History, growth and development of print and electronic media. Major landmarks in print and electronic media in Indian languages. Media's role in formulation of states of India.
- c. Media criticism and media literacy, Press Council and Press Commissions of India, status of journalism and media education in India. Media policies of the Government of India since Independence.
- d. Models and theories of mass communication, normative theories, administrative and critical traditions in communication, media and journalism studies, communication and theories of socio-cultural, educational and agricultural change. Technological determinism, critique of Marshall McLuhan's views on media and communication and Marxist approaches. Information and knowledge societies.
- e. Indian traditions and approaches to communication from the Vedic era to the 21st century. Western and Eastern philosophical, ethical and aesthetic perceptions of communication - Aristotle and Plato, Hindu, Buddhist, and Islamic traditions.
- f. Media and culture - framework for understanding culture in a globalised world. Globalisation with respect to politico-economic & socio-cultural developments in India.

Unit - 2

Communication for Development and Social Change

- a. Concept and definition of development communication, role of media and journalism in society, characteristics of Indian society – demographic and sociological impact of communication, media and journalism. Media and specific audiences.
- b. Development and social change. Issues and post-colonial conceptions.
- c. Deconstruction of dominant paradigm of communication and development. Responses and critique of dominant models.
- d. Corporatisation of development - Corporate Social Responsibility, non-state actors in development, mass campaigns by NGOs, Government of India, international agencies and corporates. Paradigms and discourse of development communication.
- e. Emergence of global civil societies, public sphere, global communication system - nation state-universal, national communication policies.
- f. Leading influencers of social reform in India - Raja Rammohan Roy, Pandit Madanmohan Malviya, Bal Gangadhar Tilak, Mahatma Jyotiba Phule, Mahatma Gandhi, Acharya Vinoba Bhave, Dr B. R. Ambedkar, Deendayal Upadhyay, Dr RamManohar Lohia etc.

Unit - 3

Reporting and Editing

- a. News-concepts, determinants (values), structure and perspectives. Reporting for print, radio, television and digital media. Types of reporting. National and international news agencies and feature syndicates, functions and role.
- b. Writing for print, electronic and digital news media. Translation and transcreation.
- c. Editing and presentation techniques for print, television and digital media.
- d. Journalism as profession, reportage of contemporary issues, ethics of reporting.
- e. Critique of western news values, effect of new technology on global communication flows.
- f. Niche Reporting.

Unit - 4

Advertising and Marketing Communication

- a. Definition, concept, functions, types, evolution of advertising, standards and ethics in advertising. Theories and models of communication in advertising.
- b. Brand management.
- c. Advertising management - agency-role, structure and function, client-agency relationship, media planning and budgeting.
- d. Advertising and creativity, language and translation.
- e. Advertising campaign and marketing.
- f. Advertising and marketing research.

Unit - 5

Public Relations and Corporate Communication

- a. Public Relations and Corporate Communication - definition, concept and scope.
- b. Structure of PR in State, Public, Private and non-government sectors.
- c. Tools and techniques of PR and Corporate Communication.
- d. Crisis communication and crisis communication management.
- e. Ethics of Public Relations.
- f. International Public Relations, communication audit.

Unit - 6

Media Laws and Ethics

- a. Concept of law and ethics in India and rest of the world.
- b. The Constitution of India, historical evolution, relevance.
- c. Concept of freedom of speech and expression in Indian Constitution.
- d. Defamation, Libel, Slander-IPC 499-502, Sedition IPC 124(A), Contempt of Courts Act 1971, Official Secrets Act 1923, Press and Registration of Books Act 1867, Working Journalists and other Newspaper Employees (Conditions of Service) and Miscellaneous Provisions Act 1955, Wage Boards, Law of Obscenity (Section 292-294 of IPC); the Miller test, the Hicklin test, Indecent Representation of Women (Prohibition) Act 1986, Scheduled Castes and Tribes (Prevention of Atrocities) Act, 1989, Parliamentary Privileges. Famous cases involving journalists and news media organisations.
- e. Right to Information Act 2005, Copyright Act 1957, Intellectual Property Rights, Cable Television Network (Regulation) Act 1995, Information Technology Act (relevant) 2000 and cyber laws, Cinematograph Act 1952, Film Censorship, Press Council Act as amended from time to time, IPR, ASCI, Drugs and Magic Remedies (Objectionable Advertisements) Act, 1954, Various regulatory bodies for print, TV, Advertising, PR, and Internet.
- f. Rules, regulations and guidelines for the media as recommended by Press Council of India, Information and Broadcasting ministry and other professional organisations, adversarial role of the media, human rights and media.

Unit – 7

Media Management and Production

- a. Definition, concept of media management. Grammar of electronic media.
- b. Communication design theories and practice.
- c. Media production techniques – print and electronic.
- d. Digital media production techniques.
- e. Economics and commerce of mass media in India.
- f. Principles and management in media industry post liberalisation.

Unit – 8

ICT and Media

- a. ICT and media - definition, characteristics and role. Effect of computer mediated communication. Impact of ICT on mass media. Digitisation.
- b. Social networking.
- c. Economics and commerce of web enabled media.
- d. Mobile adaption and new generation telephony by media, ethics and new media.
- e. ICT in education and development in India, online media and e-governance.
- f. Animation - concepts and techniques.

Unit - 9

Film and Visual Communication

- a. Film and television theory.
- b. Film and identity in Indian film studies, leading film directors of India before and after Independence. Indian cinema in the 21st century.
- c. Approaches to analysis of Indian television.
- d. Visual Communication. Visual analysis.
- e. Basics of film language and aesthetics, the dominant film paradigm, evolution of Indian cinema-commercial and 'non-commercial' genres, the Hindi film song, Indian aesthetics and poetics (the theory of Rasa and Dhvani).
- f. National cinema movements: Soviet Montage cinema, German Expressionistic cinema, Italian Neo-Realistic cinema, French New Wave cinema, British New Wave cinema, Indian New Wave cinema, Period cinema. Cinema in the new millennium.

Unit - 10

Communication Research

- a. Definition, concept, constructs and approaches to communication research process.
- b. Research Designs - types, structure, components, classical, experimental and quasi experimental, variables and hypotheses; types and methods of research; basic, applied, descriptive, analytical, historical, case study, longitudinal studies.
- c. Research in journalism, Public Relations, advertising, cinema, animation and graphics, television, Internet, social media practices, magazines, children's media. Communication, journalism and media research in India.
- d. Levels of measurement: sampling-probability and non-probability, tests of validity and reliability, scaling techniques. Methods and tools of data collection- interviews, surveys, case studies, obtrusive and non-obtrusive techniques, ethnography, schedule, questionnaire, diary, and internet based tools, media specific methods such as exit polls, opinion polls, telephone, SMS surveys and voting with regard to GEC (general entertainment content).
- e. Data analysis, testing, interpretation, application of statistical tests-parametric and non-parametric, tests of variance-univariate, bivariate and multivariate, tests of significance, computer mediated research.
- f. Ethical considerations in communication, media and journalism research, writing research reports, plagiarism.

IX. ECONOMICS

Micro – Economic Analysis

Demand Analysis – Marshallian, Hicksian and Revealed preference approaches Consumer behaviour under conditions of uncertainty. Theory of Production and Costs. Pricing and output under different forms of market structure. Different models of objectives of the firm – Baumol, Morris and Williamson. Factor Pricing analysis. Elements of general equilibrium and new welfare economics.

Macro – Economic Analysis

Determination of output and employment – Classical approach, Keynesian approach, Consumption hypotheses. Demand for Money – Fisher and Cambridge versions, Approaches of Keynesian, Friedman, Patinkin, Baumol and Tobin. Supply of Money, Determinants of money supply, High – powered money, Money multiplier. Phillips Curve analysis. Business cycles – Models of Samuelson, Hicks and Kaldor. Macro – economic Equilibrium – Relative roles of monetary and fiscal policies Fleming – Mundell open economy model.

Development and Planning

Economic Growth, Economic Development and sustainable Development – Importance of institutions – Government and markets – Perpetuation of underdevelopment – Vicious circle of poverty, circular causation, structural view of underdevelopment – Measurement of development conventional, HDI and quality of life indices. Theories of growth and development – Models of growth of Joan Robinson and Kaldor; Technical Progress – Hicks, Harrod and learning by doing, production function approach to the determinants of growth : Endogenous growth : role of education, research and knowledge – explanation of cross country differentials in economic development and growth.

Theories of Development – Classical, Marx and Schumpeter; Economic Growth – Harrod – Domar model, instability of equilibrium, Neoclassical growth – Solow’s model, steady state growth. Lewis model of development, Ranis – Fei model, Dependency theory of development. Approaches to development: Balanced growth, critical minimum effort, big push, unlimited supply of labour, unbalanced growth, low income equilibrium trap. Indicators and measurement of poverty.

Indian Economy

Basic Economic indicators – National income, performance of different sectors Trends in prices and money supply. Agriculture – Institutional and technological aspects, new agricultural policy Industry – New industrial policy and liberalization. Money and banking – Concepts of money supply, inflation, monetary policy and financial sector reforms.

Public finance – Trends in revenue and expenditures of the Central and State Governments, Public debt; analysis of the Union Budget. Foreign trade – Trends, Balance of payments and trade reforms. Poverty, unemployment, migration and environment.

Quantitative Methods

Measures of Central tendency, dispersion, skewness and kurtosis. Elementary theory of probability – Binomial, Poisson and Normal distributions. Simple correlation and regression analysis. Statistical inferences – Applications, sampling distributions (t, χ^2 and F tests) sampling of attributes, testing of Hypothesis. Index numbers and time series analysis. Sampling and census methods, types of sampling and errors.



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X. COMMERCE

Unit—I

Business Environment

Meaning and elements of Business Environment. Economic environment. Economic Policies, Economic Planning.

Legal environment of business in India.

Competition policy. Consumer protection, Environment protection.

Policy Environment: Liberalization, privatisation and globalisation. Second generation reforms,

Industrial policy and implementation, Industrial growth and structural changes.

Unit—II

Financial & Management Accounting

Basic Accounting Concepts, Capital and Revenue, Financial Statements.

Valuation of shares, Amalgamation, Absorption and Reconstruction, Holding Company Accounts.

Accounting standards - objectives of financial reporting - users of financial statements and their needs. I A S B framework preparation and presentation of financial statements - human resource accounting - social and environmental accounting.

Cost and Management Accounting : Ratio Analysis, Funds Flow Analysis, Cash Flow Analysis, Marginal Costing and Break-even analysis. Standard Costing, Budgetary Control. Costing for Decisionmaking. Responsibility Accounting.

II Financial Accounting

Unit—III

Business Economics

Nature and uses of Business Economics. Concept of Profit and Wealth Maximization. Demand

Analysis and Elasticity of Demand. Curve Analysis Law.

Utility Analysis and Indifference of Returns and Law of variable proportions cost.Revenue.

Price determination in different market situations. Perfect competition, Monopolistic competition.

Monopoly. Price discrimination and oligopoly, Pricing strategies.

Unit—IV

Business Statistics & Data Processing Data types, Data collection and analysis, sampling, need, errors and methods of sampling.

Normal distribution. Hypothesis testing. Analysis and Interpretation of Data. Correlation and Regression. small sample tests- t-test f-test and chi-square test. Data Processing—Elements.

Data entry, Data processing and Computer applications.

Computer Application to Functional Areas—Accounting. Inventory control, Marketing.

Unit—V

Business Management

Principles of Management

Planning—Objectives, Strategies, Planning Process, Decision-making. Organising, Organisational Structure, Formal and Informal Organisations. Organisational Culture.

Staffing

Leading : Motivation, Leadership, Committees, Communication Controlling. Corporate Governance and Business Ehtics.

Unit—VI

Marketing Management

The evolution of marketing. Concepts. Concept of marketing, Marketing mix.

Marketing

environment.

Elements of consumer behaviour, Market segmentation. Product decisions.

Pricing decisions.

Distribution decisions.

Promotion decisions.

Marketing planning. Organising and Control.

International Marketing

Advertisement Management

Supply Chain Management

Unit—VII

Financial Management

Capital Structure. Financial and Operating leverage. Cost of Capital. Capital budgeting.

Working Capital Management.

Dividend Policy.

Unit—VIII

HUMAN RESOURCE MANAGEMENT

HRM- Introduction, meaning, definition, nature and scope of HRM and HRD, evolution of HRM, features of HRM, HRM functions, objectives of HRM, Opportunities and Challenges in Human Resource Management.

Job design, Job analysis, HR planning: introduction, objectives of HRP, linkage of HRP to other plans.

Recruitment: definition, objectives, subsystems, factors affecting, recruitment policy.

Selection, placement and Induction

Performance management: Introduction, meaning, need, purpose, -objectives, contents of PAS, Appraisers and different methods of appraisal, uses of performance appraisal.

Human Resource Development: Introduction, definition, concepts, activities **Training and development:** meaning of T & D, importance of training, benefits of training.

Internal mobility: Introduction, meaning, Promotion, Transfer, Demotion.

Career planning and Development: meaning, need, career development, actions. **Compensation & Benefits Administration:** Compensation Management: - salary structure, salary fixation, incentives, profit sharing, bonus concepts, ESOPs, pay for performance, Benefits administration, employee welfare and working conditions-statutory and voluntary measures.

Industrial peace and harmony: Discipline maintenance, Grievance Handling, Workers participation in management, maintaining good human and industrial relations, benefits accrued by the organization due to the development of congenial environment.

CRM

E-CRM

Unit—IX

Banking and Finance

Importance of Banking to Business, Types of Banks and Their Functions. Reserve Bank of India and its functions. NABARD and Rural Banking.

Banking Sector Reforms in India, NPA, Capital Adequacy Norms.

E-banking.

Development Banking : IDBI, IFCI, SFCs, UTI, SIDBI.

International liquidity, International Economic Institutions—IMF, World Bank, IFC, IDA, ADB.

World Trade Organisation—Its functions and policies.

Unit—X

Business Taxation:

Direct Taxes: Basic

- Concepts Heads of
- Income
- Computation of total income
- Corporate income taxation and planning
- Wealth tax
-

Indirect Taxes Theoretical

- Framework Excise Duty
- Customs duty
- VAT and Service Tax
- Proposed GST
-
-

Business Taxation:

Direct Taxes: Basic

- Concepts Heads of
- Income
- Computation of total income
- Corporate income taxation and planning
- Wealth tax
-

Indirect Taxes Theoretical

- FrameworkExcise Duty
- Customs duty
- VAT and Service Tax
- Proposed GST
-
-



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XI. ENGLISH

Unit 1

1. Historical Background from 14th to 16th Century – Chaucer’s “Prologue”; Sidney: *Sonnets I, V & VI (Astrophel and Stella)*; Spenser: *Prothalamion, Epithalamion*; Surrey : 1. “*Love that liveth and reigneth in my thought*”, 2. “*Set mewhereas the sun doth parch the green*” ; Wyatt :1. “*Who so list to hunt*” , 2. *They flee from me*; Donne: “*The Good Morrow*”, “*Song: Go and Catch a Falling Star*”, “*Death be Not Proud*”, “*At the Round Earth’s Imagined Corner*”, “*Sunne Rising*”, “*Resurrection*”; Herbert: “*The Pulley*”, “*The Collar*”, “*Virtue*”, “*Discipline*”; Andrew Marvell – “*To His Coy Mistress*”, “*Thoughts in a Garden*” ; Marlowe’s *Dr. Faustus*; Jonson’s *Volpone*; Kyd’s *Spanish Tragedy*; Shakespeare’s *Sonnets 18,29,30,33, 60,71,73,114,116; Macbeth; Julius Caesar; As You Like It*;

Unit 2

Historical Background to 17th and 18th Century; *Dryden’s Absalom and Achitophel*; Alexander Pope’s *The Rape of the Lock*; Bunyan’s *Pilgrim’s Progress Book-1*; William Congreve - *The Way of the World*; Sheridan’s *The School for Scandal*; Aphra Behn’s *Oroonoko (Royal Author)*; Daniel Defoe: *Robinson Crusoe*; Jonathan Swift – *Gulliver’s Travels – Book IV (Voyage to the Land of Houyhnhnms)*; Addison & Steele: *Spectator Essays: Addison (1) Sir Roger at Church, (2) Sir Roger at Assizes; Steele: 1) The Gentleman 2) The Spectator Club*

Unit 3

Historical Background to 19th Century; William Blake’s *Tyger, London, The Chimney Sweeper*, William Wordsworth’s *Tintern Abbey, Ode to Immortality, Lucy Poems; A Slumber Did My Spirit Seal, She Dwelt Among Untrodden Ways*; P.B. Shelley’s *Ode to the West Wind; To A Skylark*; Tennyson’s *Ulysses, Lotus Eaters*; Jane Austen’s *Emma*; Emily Bronte’s *Wuthering Heights*; Charles Dickens’ *Hard Times*; Thomas Hardy’s *Jude the Obscure*; J.Ruskin: *Unto the Last (Chs.1 and 2)*, J.S.Mill: “*On Liberty*”; Mathew Arnold: *Culture and Anarchy (chapter 1: Sweetness& Light chapter 2: Hellenism & Hebraism)*;

Unit 4

Historical Background to 20th Century; G.M. Hopkins: *The Wreck of Deutschland, Windhover*; W.B Yeats: *Sailing to Byzantium, Byzantium, Second Coming, Easter 1916*, Thomas Hardy’s *Green Slaten (Penpethy), The Darkling Thrush, The Man He Killed, The Broken Appointment*; T.S. Eliot’s *The Wasteland, The Journey of the Magi*; W H Auden’s *In Memory of W. B. Yeats, Musee des Beaux Arts*, Sylvia Plath’s *The Arrival of the Bee Box: Lady Lazarus*; Dylan Thomas: *After the Funeral, Fern Hill*; Seamus Heaney: *Tollund Man, Digging, Casualty*; Philip Larkin: *Church*

Going, Next Please, Love Again; Ted Hughes: Thought Fox, Hawk Roosting, Full Moon and Little Frieda

Unit 5

Origin, growth, and development of Literary Criticism, Various Posits and Literary Contexts, Principles of Literary and Practical Criticism; Post World War Scenario, Twentieth Century Social Milieu, Twentieth Century Theatre, Twentieth Century Novel, Great Economic Depression, Stream of Consciousness, Postmodernism, Aristotle: *Poetics*; Longinus: *On the Sublime*; Plato on Mimesis in *A Short History of English Literary Criticism* by Wimsatt & Brooks); Sidney's *Apologie for Poetry*; Samuel Johnson's *Preface to Shakespeare*; Dryden: *On Dramatic Poesy*; W. Wordsworth's *Preface to Lyrical Ballads*; Coleridge :*Biographia Literaria* Chapters 13,14,17; Arnold: *The Function of Criticism at the Present Time*; DH Lawrence: *The Rainbow*; Virginia Woolf: *To the Lighthouse*; E.M.Forster: *A Passage to India*; Doris Lessing: *The Golden Notebook*; Samuel Beckett – *Waiting for Godot*; John Osborne: *Look Back in Anger*; Virginia Woolf: “On Modern Fiction”; George Lukacs: “The Meaning of Contemporary Realism”, (chapters on Kafka & Modernist Fiction); Raymond Williams: “When was Modernity?”

Unit 6

Russian Formalism, Psychoanalysis, Structuralism, Deconstruction, Postcolonialism, Phenomenology and certain other forms of Hermeneutics. Marx, Nietzsche, Freud, Gramsci, T.S. Eliot: *Tradition and Individual Talent*, F.R. Leavis: *Literature and Society, Tragedy and the Medium* (From **The Common Pursuit**), C. Jung: ‘*Psychology and Literature*’, N. Frye: *Archetypes of Literature*, G. Genette: ‘*Structuralism and Literary Criticism*’, J. Derrida: ‘*Structure, Sign, and Play in the Discourse of Human Sciences*’, Elaine Showalter: “*Towards a Feminist Poetics*”, Helene Cixous: “*The Laugh of the Medusa*”

Unit 7

Anglicists and Orientalists Debates, *Macaulay's Minute*, Rajaram Mohan Roy's *Letter to Lord Amherst*, The Rise of the Indian English Novel, Novel as a Social Act; Colonization and its aftermath, Culture Vs Modernity: The Indian Context , The Modern Indian Psyche vis a vis Indian Writing in English and in Translation; Toru Dutt's *Prahlad; Our Casurina Tree*; Rabindranath Tagore's *Gitanjali*: First five and last five poems; Sarojini Naidu: *Coromandel Fishers, Indian Weavers*; Girish Karnad: *Hayavadhana*; Vijay Tendulkar: *Silence! The Court is in Session*, Mahesh Dattani: *The Final Solution*; Aurobindo: *Savitri* Canto-I; Mulk Raj Anand: *Untouchable*; Raja Rao: *Kanthapura*; R. .K. Narayan: *The Man Eater of Malgudi*; Hiriyanna: *Art Experience*: Indian Aesthetics (Chs. 1 and 2); Ananda Coomaraswamy: “The Dance of Shiva”; Aurobindo: *The Poets of Dawn -1&2* (From *Future Poetry*) Arundathi Roy: *God of Small Things*; Amitav Ghosh: *Shadow Lines* (Partition); Jahnvi Barua : *Next Door*; M. K. Gandhi: *My Experiments with Truth*;

Amrita Pritham: *Revenue Stamp*; Dom Morales: *My Sons' Father* ; Gayathri Spivak: "Can the Subaltern Speak?", Meenakshi Mukherjee: "The Anxiety of Indianness", Aijaz Ahmed: "Introduction" to *In Theory*

Unit 8

Philosophy and Aesthetics of Commonwealth Literature, paradigm shifts from commonwealth to New Literatures, Chinua Achebe's *Arrow of God*; Ngugi Wa Thiongo *Homecoming* Part-II: (a) The Writer and His Past, (b) The Writer in a Changing Society; Wole Soyinka's *The Lion and the Jewel*; Denis Brutus' *At the Funeral, If This Life is All That We Have*; David Diop's *Africa, Vultures* ; Gabriel Okara: *Piano and Drums. The Call of the River Nun*; Margaret Atwood: *Surfacing* Northrop Frye : "Conclusion" to *Literary History of Canada*

AJM Smith: *The Lonely Land* ; E.J. Pratt: *The Dying Eagle*; Patrick White: *The Tree of Man* Judith Wright: *Preoccupations in Australian Poetry* (Chapter 13 on A.D. Hope); Judith Wright: *Woman to Man*, A.D. Hope: *Australia*; V S Naipaul's *A House for Mr. Biswas*; Wilson Harris' *Tradition and the West Indian Novel* ; Derek Walcott: *Almond Trees, A Far Cry from Africa, Mass Man, Missing the Sea*; Braithwaite: *Starvation, Blues, Caliban, Thirst*

Unit 9

American Renaissance, Journey as Metaphor, Westward Movement, Transcendentalism, Emerson: American Scholar, Nature, Thoreau: **Walden** (Chapters on *Economy & Where I Lived and What I Lived For*), Emily Dickinson: *Because I Could Not Stop for Death, The Soul Selects her Own Society*, Wallace Stevens: *Emperor of Ice-Cream, Anecdote of The Jar*, Walt Whitman: *When Lilacs Last in the Dooryard Bloomed, A Noiseless Patient Spider*, Robert Frost: *Mending Wall, The Road Not Taken*, Mark Twain: *Huckleberry Finn*, Ernest Hemingway: *The Old Man and the Sea*, Leslie Stephen: *King of the Jews*, Toni Morrison: *The Bluest Eye*, Alice Walker: *The Color Purple*, Frederick Douglas: *Narrative of the Life of an American Slave*

Unit 10

Introduction to Spanish, French, German and Russian Literatures of the 19th and 20th Century: a. Political , b. Cultural c. Philosophical d. Social with special reference to the authors in the syllabus; Gustave Flaubert: **Madam Bovary**; Franz Kafka : **Metamorphosis**, Cervantes: **Don Quixote**; Fyodor Dostoevsky: **Crime and Punishment**

XII. Management

I - Managerial Economics

Nature and scope of Managerial Economics. Importance of Managerial decision— making; Marginal analysis; Objective of a firm, Demand function, Elasticity of demand and its significance in Managerial decision-making; Consumer equilibrium-utility and indifference curve approach; Price, income and substitution effects; Fundamentals of demand estimation and forecasting; Short-run and long-run production functions; Cost curves and economics of scale; Price and output determination under perfect competition, monopoly, monopolistic, competition, and oligopoly; Pricing strategies and tactics; National Income— alternative concepts and measurement of National income; Inflation—types, measurement and control; Balance of Payments; Monetary and Fiscal Policies.

II - Business Statistics

Univariate Analysis : An overview of central tendency, dispersion, and skewness. Probability Theory; Classical, relative and subjective probability, - Addition and multiplication probability models; Conditional probability and Baye's Theorem. Probability Distributions: Binomial, Poisson, and normal distributions; Their characteristics and applications. Sampling and sampling methods; Sampling and non-s Sampling errors; Law of Large Number and Central Limit Theorem; Sampling distributions and their characteristics. Statistical Estimation and Testing; Point and interval estimation of population mean, proportion, and variance; Statistical testing of hypothesis and errors; Large and small sampling tests—Z, t and F tests. Non—Parametric Tests: Chi-square tests; Correlation and Regression Analysis : Two variables case. Index Numbers : Meaning and types; Weighted aggregative indices-Laspeyre's and Paasch's indices; Uses and problems of Index number; Time Series Analysis; Trend Analysis.

III - Business Environment

Nature, components and determinants of business environment, dynamics of business environment, key indicators; Risk in business environment, Assessing business environment — country risk and political risk. Current state of business environment in India Economic reforms — Liberalisation, privatisation, globalisation, industrial policy and industrialisation trends, public enterprise reforms and disinvestment programmes; competitive environment; financial environment. India's current balance of payment position, globalisation trends, Trade reforms & trends, FDI policy & trends, India's share in world economy. Trends in global trade & investment; Nature & operations of multilateral economic institutions- World Bank, WTO IMF and their impact on Indian business environment. Factors of global competitiveness.

IV - Operations Research

Management Science - Basic concepts and its role in decision- making; Linear programming, meaning, scope & assumptions. Formulation of linear programming problem & solution by graphical & Simplex methods. Some special cases like degeneracy, unbounded ness, infeasibility and multiple optimal solutions. Transportation and Assignment models including trans-shipment and routing problems; Some special cases like minimization , unbalanced problems, degeneracy in transportation models. Queuing theory; Inventory management techniques; PERT/CPM; Decision theory and decision trees; Game theory; Simulation.

V - Business Research Methodology

Nature and Scope of Research Methodology, Problem Formulation and Statement of Research, Objectives; Value and Cost of Information; Bayesian Decision Theory; Research Process; Research Designs - Exploratory, Descriptive and Experimental; Methods of Data Collection — Observational and Survey Methods; Questionnaire and Interviews. Attitude Measurement Techniques; Administration of Surveys; Sample Design; Selecting an Appropriate Statistical Technique. Field Work and Tabulation of Data; Analysis of Data; Use of SPSS and other Statistical Software Packages Advanced Techniques for Data Analysis — ANOVA. Discriminate Analysis, Factor Analysis, Conjoint Analysis and Clustering Methods.

VI - Business Policy and Strategic Management

An Introduction to business policy — Nature, Objective and importance of business policy; An overview of strategic management; Strategic decision making; Process of strategic decision making. Types of planning systems - corporate planning, strategic planning and long range planning; Strategy Formulation, Company's mission, purpose and objectives; Corporate strategy - concept, significance and objectives; types of strategies; Environmental and organizational appraisal (Internal & external) techniques of business environment analysis. Strategic alternatives and choice; Business ethics and corporate strategy Concept of value chain and competitive advantage. Strategy implementation - Designing organisational structure and activating strategies; Matching structure and activating strategy, Structural, Behavioural and Functional implementation. concept of synergy. Strategy Evaluation - Strategic evaluation and Control, Strategic and Operational Control; techniques of evaluation and control, Role of organisational system in evaluation.

VII - Marketing Management

Nature, scope and concept of marketing, Corporate orientations towards the marketplace; The Marketing environment and Environment scanning; Marketing information system and Marketing research; Understanding consumer and Industrial markets; Market segmentation, Targeting and positioning; Product decisions — product mix, product life cycle, new product development, branding and packaging decisions; Pricing methods and strategies; Promotion decisions— promotion mix, advertising, sales promotion, publicity and personal selling; Channel management -Types and functions, Selection, Cooperation and conflict management, vertical marketing implementation and systems, Marketing Logistics; Organizing and implementing marketing in the organization; Evaluation and control of marketing efforts; Ethics in Marketing; New issues in marketing - Globalization, Consumerism, Green Marketing, Direct Marketing, Network Marketing, Event Marketing.

VIII - Human Resource Management

OB: Personality; Perceptions; Attitudes; Learning; Decision-making; Management by Objectives; Understanding and managing group processes- interpersonal and group dynamics; Applications of Emotional Intelligence in organizations. Leadership and influence process; Work Motivation. Understanding and Managing organizational system—Organizational design and structure, Work stress, Organizational Change and development; Conflict Management; Stress Management.

HR: Concepts and Perspectives on Human Resource Management; Human Resources Management in a changing environment; Corporate objectives and Human Resource Planning; Career and succession planning; job analysis; Methods of manpower search; Attracting, Selecting and retaining human resources; Induction and socialization; Manpower training and development; Performance appraisal and potential evaluation; Job evaluation and compensation; Employee welfare; Industrial relations & trade unions; Dispute resolution & grievance management, Employee empowerment.

IX - Financial Management

Introduction to financial management Objectives of financial management; Time value of money, sources of finance, Investment decisions: Importance, Difficulties determining cash flows, methods of capital budgeting Risk analysis : Cost of capital; Concept and importance, Computations of cost of various sources of finance; Weighted Average Cost of Capital; Capital Structure decisions; Theories of capital structure, Factors determining capital structure. Optimum capital structure; Management of working capital - Cash, Receivables and Inventory Management, Internal Financing and Dividend Policy; Financial Modelling.

X – Tourism Management

Contemporary issues in Tourism Management, Guest Service Management (Front Office, F&B Service), Housekeeping Operations & Management, Culinary Services & Management, Travel & Tourism Management, Transport Systems & Management, Human Resource Management, Tourism Marketing Management and Promotion, Hospitality & Tourism Management, Tourism Project Planning and Programme Management, Use of Computers and Software in Hospitality & Tourism.

XIII. COMPUTER SCIENCE AND APPLICATIONS

Unit - 1 : Discrete Structures and Optimization

Mathematical Logic: Propositional and Predicate Logic, Propositional Equivalences, Normal Forms, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference.

Sets and Relations: Set Operations, Representation and Properties of Relations, Equivalence Relations, Partially Ordering.

Counting, Mathematical Induction and Discrete Probability: Basics of Counting, Pigeonhole Principle, Permutations and Combinations, Inclusion- Exclusion Principle, Mathematical Induction, Probability, Bayes' Theorem.

Group Theory: Groups, Subgroups, Semi Groups, Product and Quotients of Algebraic Structures, Isomorphism, Homomorphism, Automorphism, Rings, Integral Domains, Fields, Applications of Group Theory.

Graph Theory: Simple Graph, Multigraph, Weighted Graph, Paths and Circuits, Shortest Paths in Weighted Graphs, Eulerian Paths and Circuits, Hamiltonian Paths and Circuits, Planner graph, Graph Coloring, Bipartite Graphs, Trees and Rooted Trees, Prefix Codes, Tree Traversals, Spanning Trees and Cut-Sets.

Boolean Algebra: Boolean Functions and its Representation, Simplifications of Boolean Functions.

Optimization: Linear Programming - Mathematical Model, Graphical Solution, Simplex and Dual Simplex Method, Sensitive Analysis; Integer Programming, Transportation and Assignment Models, PERT-CPM: Diagram Representation, Critical Path Calculations, Resource Levelling, Cost Consideration in Project Scheduling.

Unit - 2: Computer System Architecture

Digital Logic Circuits and Components: Digital Computers, Logic Gates, Boolean Algebra, Map Simplifications, Combinational Circuits, Flip-Flops, Sequential Circuits, Integrated Circuits, Decoders, Multiplexers, Registers and Counters, Memory Unit.

Data Representation: Data Types, Number Systems and Conversion, Complements, Fixed Point Representation, Floating Point Representation, Error Detection Codes, Computer Arithmetic - Addition, Subtraction, Multiplication and Division Algorithms.

Register Transfer and Microoperations: Register Transfer Language, Bus and Memory Transfers, Arithmetic, Logic and Shift Microoperations.

Basic Computer Organization and Design: Stored Program Organization and Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output, Interrupt.

Programming the Basic Computer: Machine Language, Assembly Language, Assembler, Program Loops, Subroutines, Input-Output Programming.

Microprogrammed Control: Control Memory, Address Sequencing, Design of Control Unit.

Central Processing Unit: General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, RISC Computer, CISC Computer.

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Vector Processing Array Processors.

Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, DMA, Serial Communication.

Memory Hierarchy: Main Memory, Auxillary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

Multiprocessors: Characteristics of Multiprocessors, Interconnection Structures, Interprocessor Arbitration, Interprocessor Communication and Synchronization, Cache Coherence, Multicore Processors.

Unit - 3: Programming Languages and Computer Graphics

Language Design and Translation Issues: Programming Language Concepts, Paradigms and Models, Programming Environments, Virtual Computers and Binding Times, Programming Language Syntax, Stages in Translation, Formal Transition Models.

Elementary Data Types: Properties of Types and Objects; Scalar and Composite Data Types.

Programming in C: Tokens, Identifiers, Data Types, Sequence Control, Subprogram Control, Arrays, Structures, Union, String, Pointers, Functions, File Handling, Command Line Arguments, Preprocessors.

Object Oriented Programming: Class, Object, Instantiation, Inheritance, Encapsulation, Abstract Class, Polymorphism.

Programming in C++: Tokens, Identifiers, Variables and Constants; Data types, Operators, Control statements, Functions Parameter Passing, Virtual Functions, Class and Objects; Constructors and Destructors; Overloading, Inheritance, Templates, Exception and Event Handling; Streams and Files; Multifile Programs.

Web Programming: HTML, DHTML, XML, Scripting, Java, Servlets, Applets.

Computer Graphics: Video-Display Devices, Raster-Scan and Random-Scan Systems; Graphics Monitors, Input Devices, Points and Lines; Line Drawing Algorithms, Mid-Point Circle and Ellipse Algorithms; Scan Line Polygon Fill Algorithm, Boundary-Fill and Flood-Fill.

2-D Geometrical Transforms and Viewing: Translation, Scaling, Rotation, Reflection and Shear Transformations; Matrix Representations and Homogeneous Coordinates; Composite Transforms, Transformations Between Coordinate Systems, Viewing Pipeline, Viewing Coordinate Reference Frame, Window to View-Port Coordinate Transformation, Viewing Functions, Line and Polygon Clipping Algorithms.

3-D Object Representation, Geometric Transformations and Viewing: Polygon Surfaces, Quadric Surfaces, Spline Representation, Bezier and B-Spline Curves; Bezier and B-Spline Surfaces; Illumination Models, Polygon Rendering Methods, Viewing Pipeline and Coordinates; General Projection Transforms and Clipping.

Unit – 4: Database Management Systems

Database System Concepts and Architecture: Data Models, Schemas, and Instances; Three-Schema Architecture and Data Independence; Database Languages and Interfaces; Centralized and Client/Server Architectures for DBMS.

Data Modeling: Entity-Relationship Diagram, Relational Model - Constraints, Languages, Design, and Programming, Relational Database Schemas, Update Operations and Dealing with Constraint Violations; Relational Algebra and Relational Calculus; Codd Rules.

SQL: Data Definition and Data Types; Constraints, Queries, Insert, Delete, and Update Statements; Views, Stored Procedures and Functions; Database Triggers, SQL Injection.

Normalization for Relational Databases: Functional Dependencies and Normalization; Algorithms for Query Processing and Optimization; Transaction Processing, Concurrency Control Techniques, Database Recovery Techniques, Object and Object-Relational Databases; Database Security and Authorization.

Enhanced Data Models: Temporal Database Concepts, Multimedia Databases, Deductive Databases, XML and Internet Databases; Mobile Databases, Geographic Information Systems, Genome Data Management, Distributed Databases and Client-Server Architectures.

Data Warehousing and Data Mining: Data Modeling for Data Warehouses, Concept Hierarchy, OLAP and OLTP; Association Rules, Classification, Clustering, Regression, Support Vector Machine, K-Nearest Neighbour, Hidden Markov Model, Summarization, Dependency Modeling, Link Analysis, Sequencing Analysis, Social Network Analysis.

Big Data Systems: Big Data Characteristics, Types of Big Data, Big Data Architecture, Introduction to Map-Reduce and Hadoop; Distributed File System, HDFS.

NOSQL: NOSQL and Query Optimization; Different NOSQL Products, Querying and Managing NOSQL; Indexing and Ordering Data Sets; NOSQL in Cloud.

Unit – 5 : System Software and Operating System

System Software: Machine, Assembly and High-Level Languages; Compilers and Interpreters; Loading, Linking and Relocation; Macros, Debuggers.

Basics of Operating Systems: Operating System Structure, Operations and Services; System Calls, Operating-System Design and Implementation; System Boot.

Process Management: Process Scheduling and Operations; Interprocess Communication, Communication in Client–Server Systems, Process Synchronization, Critical-Section Problem, Peterson’s Solution, Semaphores, Synchronization.

Threads: Multicore Programming, Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues.

CPU Scheduling: Scheduling Criteria and Algorithms; Thread Scheduling, Multiple-Processor Scheduling, Real-Time CPU Scheduling.

Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance and Detection; Recovery from Deadlock.

Memory Management: Contiguous Memory Allocation, Swapping, Paging, Segmentation, Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files.

Storage Management: Mass-Storage Structure, Disk Structure, Scheduling and Management, RAID Structure.

File and Input/Output Systems: Access Methods, Directory and Disk Structure; File-System Mounting, File Sharing, File-System Structure and Implementation; Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance; Recovery, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Requests to Hardware Operations.

Security: Protection, Access Matrix, Access Control, Revocation of Access Rights, Program Threats, System and Network Threats; Cryptography as a Security Tool, User Authentication, Implementing Security Defenses.

Virtual Machines: Types of Virtual Machines and Implementations; Virtualization. **Linux**

Operating Systems: Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, File Systems, Input and Output; Interprocess Communication, Network Structure.

Windows Operating Systems: Design Principles, System Components, Terminal Services and Fast User Switching; File System, Networking.

Distributed Systems: Types of Network based Operating Systems, Network Structure, Communication Structure and Protocols; Robustness, Design Issues, Distributed File Systems.

Unit – 6: Software Engineering

Software Process Models: Software Process, Generic Process Model – Framework Activity, Task Set and Process Patterns; Process Lifecycle, Prescriptive Process Models, Project Management, Component Based Development, Aspect-Oriented Software Development, Formal Methods, Agile Process Models – Extreme Programming (XP), Adaptive Software Development, Scrum, Dynamic System Development Model, Feature Driven Development, Crystal, Web Engineering.

Software Requirements: Functional and Non-Functional Requirements; Eliciting Requirements, Developing Use Cases, Requirement Analysis and Modelling; Requirements Review, Software Requirement and Specification (SRS) Document.

Software Design: Abstraction, Architecture, Patterns, Separation of Concerns, Modularity, Information Hiding, Functional Independence, Cohesion and Coupling; Object-Oriented Design, Data Design, Architectural Design, User Interface Design, Component Level Design.

Software Quality: McCall's Quality Factors, ISO 9126 Quality Factors, Quality Control, Quality Assurance, Risk Management, Risk Mitigation, Monitoring and Management (RMMM); Software Reliability.

Estimation and Scheduling of Software Projects: Software Sizing, LOC and FP based Estimations; Estimating Cost and Effort; Estimation Models, Constructive Cost Model (COCOMO), Project Scheduling and Staffing; Time-line Charts.

Software Testing: Verification and Validation; Error, Fault, Bug and Failure; Unit and Integration Testing; White-box and Black-box Testing; Basis Path Testing, Control Structure Testing, Deriving Test Cases, Alpha and Beta Testing; Regression Testing, Performance Testing, Stress Testing.

Software Configuration Management: Change Control and Version Control; Software Reuse, Software Re-engineering, Reverse Engineering.

Unit – 7: Data Structures and Algorithms

Data Structures: Arrays and their Applications; Sparse Matrix, Stacks, Queues, Priority Queues, Linked Lists, Trees, Forest, Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree, B Tree, B+ Tree, B* Tree, Data Structure for Sets, Graphs, Sorting and Searching Algorithms; Hashing.

Performance Analysis of Algorithms and Recurrences: Time and Space Complexities; Asymptotic Notation, Recurrence Relations.

Design Techniques: Divide and Conquer; Dynamic Programming, Greedy Algorithms, Backtracking, Branch and Bound.

Lower Bound Theory: Comparison Trees, Lower Bounds through Reductions. **Graph**

Algorithms: Breadth-First Search, Depth-First Search, Shortest Paths, Maximum Flow, Minimum Spanning Trees.

Complexity Theory: P and NP Class Problems; NP-completeness and Reducibility. **Selected Topics:** Number Theoretic Algorithms, Polynomial Arithmetic, Fast Fourier Transform, String Matching Algorithms.

Advanced Algorithms: Parallel Algorithms for Sorting, Searching and Merging, Approximation Algorithms, Randomized Algorithms.

Unit – 8: Theory of Computation and Compilers

Theory of Computation: Formal Language, Non-Computational Problems, Diagonal Argument, Russels's Paradox.

Regular Language Models: Deterministic Finite Automaton (DFA), Non-Deterministic Finite Automaton (NFA), Equivalence of DFA and NFA, Regular Languages, Regular Grammars, Regular Expressions, Properties of Regular Language, Pumping Lemma, Non-Regular Languages, Lexical Analysis.

Context Free Language: Pushdown Automaton (PDA), Non-Deterministic Pushdown Automaton (NPDA), Context Free Grammar, Chomsky Normal Form, Greibach Normal Form, Ambiguity, Parse Tree Representation of Derivation Trees, Equivalence of PDA's and Context Free Grammars; Properties of Context Free Language.

Turing Machines (TM): Standard Turing Machine and its Variations; Universal Turing Machines, Models of Computation and Church-Turing Thesis; Recursive and Recursively-Enumerable Languages; Context-Sensitive Languages, Unrestricted Grammars, Chomsky Hierarchy of Languages, Construction of TM for Simple Problems.

Unsolvable Problems and Computational Complexity: Unsolvable Problem, Halting Problem, Post Correspondence Problem, Unsolvable Problems for Context-Free Languages, Measuring and Classifying Complexity, Tractable and Intractable Problems.

Syntax Analysis: Associativity, Precedence, Grammar Transformations, Top Down Parsing, Recursive Descent Predictive Parsing, LL(1) Parsing, Bottom up Parsing, LR Parser, LALR(1) Parser.

Semantic Analysis: Attribute Grammar, Syntax Directed Definitions, Inherited and Synthesized Attributes; Dependency Graph, Evaluation Order, S-attributed and L-attributed Definitions; Type-Checking.

Run Time System: Storage Organization, Activation Tree, Activation Record, Stack Allocation of Activation Records, Parameter Passing Mechanisms, Symbol Table.

Intermediate Code Generation: Intermediate Representations, Translation of Declarations, Assignments, Control Flow, Boolean Expressions and Procedure Calls.

Code Generation and Code Optimization: Control-flow, Data-flow Analysis, Local Optimization, Global Optimization, Loop Optimization, Peep-Hole Optimization, Instruction Scheduling.

Unit – 9: Data Communication and Computer Networks

Data Communication: Components of a Data Communication System, Simplex, Half-Duplex and Duplex Modes of Communication; Analog and Digital Signals; Noiseless and Noisy Channels; Bandwidth, Throughput and Latency; Digital and Analog Transmission; Data Encoding and Modulation Techniques; Broadband and Baseband Transmission; Multiplexing, Transmission Media, Transmission Errors, Error Handling Mechanisms.

Computer Networks: Network Topologies, Local Area Networks, Metropolitan Area Networks, Wide Area Network, Wireless Networks, Internet.

Network Models: Layered Architecture, OSI Reference Model and its Protocols; TCP/IP Protocol Suite, Physical, Logical, Port and Specific Addresses; Switching Techniques.

Functions of OSI and TCP/IP Layers: Framing, Error Detection and Correction; Flow and Error Control; Sliding Window Protocol, HDLC, Multiple Access – CSMA/CD, CSMA/CA, Reservation, Polling, Token Passing, FDMA, CDMA, TDMA, Network Devices, Backbone Networks, Virtual LANs.

IPv4 Structure and Address Space; Classful and Classless Addressing; Datagram, Fragmentation and Checksum; IPv6 Packet Format, Mapping Logical to Physical Address (ARP), Direct and Indirect Network Layer Delivery; Routing Algorithms, TCP, UDP and SCTP Protocols; Flow Control, Error Control and Congestion Control in TCP and SCTP.

World Wide Web (WWW): Uniform Resource Locator (URL), Domain NameService (DNS), Resolution - Mapping Names to Addresses and Addresses to Names; Electronic Mail Architecture, SMTP, POP and IMAP; TELNET and FTP. **Network Security:** Malwares, Cryptography and Steganography; Secret-Key Algorithms, Public-Key Algorithms, Digital Signature, Virtual Private Networks, Firewalls.

Mobile Technology: GSM and CDMA; Services and Architecture of GSM and Mobile Computing; Middleware and Gateway for Mobile Computing; Mobile IP and Mobile Communication Protocol; Communication Satellites, Wireless

Networks and Topologies; Cellular Topology, Mobile Adhoc Networks, Wireless Transmission and Wireless LANs; Wireless Geolocation Systems, GPRS and SMS. **Cloud Computing and IoT:** SaaS, PaaS, IaaS, Public and Private Cloud; Virtualization, Virtual Server, Cloud Storage, Database Storage, Resource Management, Service Level Agreement, Basics of IoT.

Unit – 10 : Artificial Intelligence (AI)

Approaches to AI: Turing Test and Rational Agent Approaches; State Space Representation of Problems, Heuristic Search Techniques, Game Playing, Min-Max Search, Alpha Beta Cutoff Procedures.

Knowledge Representation: Logic, Semantic Networks, Frames, Rules, Scripts, Conceptual Dependency and Ontologies; Expert Systems, Handling Uncertainty in Knowledge.

Planning: Components of a Planning System, Linear and Non Linear Planning; Goal Stack Planning, Hierarchical Planning, STRIPS, Partial Order Planning.

Natural Language Processing: Grammar and Language; Parsing Techniques, Semantic Analysis and Pragmatics.

Multi Agent Systems: Agents and Objects; Agents and Expert Systems; Generic Structure of Multiagent System, Semantic Web, Agent Communication, Knowledge Sharing using Ontologies, Agent Development Tools.

Fuzzy Sets: Notion of Fuzziness, Membership Functions, Fuzzification and Defuzzification; Operations on Fuzzy Sets, Fuzzy Functions and Linguistic Variables; Fuzzy Relations, Fuzzy Rules and Fuzzy Inference; Fuzzy Control System and Fuzzy Rule Based Systems.

Genetic Algorithms (GA): Encoding Strategies, Genetic Operators, Fitness Functions and GA Cycle; Problem Solving using GA.

Artificial Neural Networks (ANN): Supervised, Unsupervised and Reinforcement Learning; Single Perceptron, Multi Layer Perceptron, Self Organizing Maps, Hopfield Network.

XIV. Physics

I. Classical Mechanics

Newton's laws. Dynamical systems, Phase space dynamics, stability analysis. Central force motions. Two body Collisions - scattering in laboratory and Centre of mass frames. Rigid body dynamics- moment of inertia tensor. Non-inertial frames and pseudoforces. Variational principle. Generalized coordinates. Lagrangian and Hamiltonian formalism and equations of motion. Conservation laws and cyclic coordinates. Periodic motion: small oscillations, normal modes. Special theory of relativity- Lorentz transformations, relativistic kinematics and mass-energy equivalence. Dynamical systems, Phase space dynamics, stability analysis. Poisson brackets and canonical transformations. Symmetry, invariance and Noether's theorem. Hamilton-Jacobi theory.

II. Quantum Mechanics

Wave-particle duality. Schrödinger equation (time-dependent and time-independent). Eigenvalue problems (particle in a box, harmonic oscillator, etc.). Tunneling through a barrier. Wavefunction in coordinate and momentum representations. Commutators and Heisenberg uncertainty principle. Dirac notation for state vectors. Motion in a central potential: orbital angular momentum, angular momentum algebra, spin, addition of angular momenta; Hydrogen atom. Stern- Gerlach experiment. Time-independent perturbation theory and applications. Variational method. Time dependent perturbation theory and Fermi's golden rule, selection rules. Identical particles, Pauli Exclusion Principle, spin-statistics connection. Spin-orbit coupling, fine structure. WKB approximation. Elementary theory of scattering: phase shifts, partial waves, Born approximation. Relativistic quantum mechanics: Klein-Gordon and Dirac equations. Semi-classical theory of radiation.

III. Atomic & Molecular Physics

Quantum states of an electron in an atom. Electron spin. Spectrum of helium and alkali atom. Relativistic corrections for energy levels of hydrogen atom, hyperfine structure and isotopic shift, width of spectrum lines, LS & JJ couplings. Zeeman, Paschen-Bach & Stark effects. Electron spin resonance. Nuclear magnetic resonance, chemical shift. Frank-Condon principle. Born-Oppenheimer approximation. Electronic, rotational, vibrational and Raman spectra of diatomic molecules, selection rules. Lasers: spontaneous and stimulated emission, Einstein A & B coefficients. Optical pumping, population inversion, rate equation. Modes of resonators and coherence length.

IV. Condensed Matter Physics

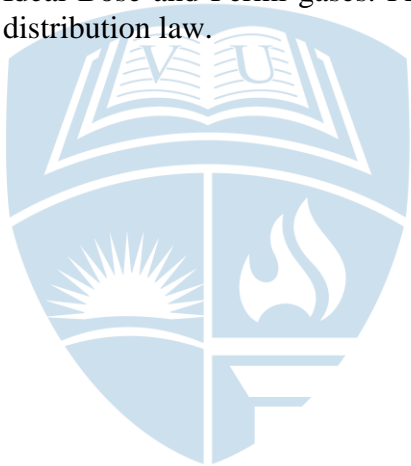
Bravais lattices. Reciprocal lattice. Diffraction and the structure factor. Bonding of solids. Elastic properties, phonons, lattice specific heat. Free electron theory and electronic specific heat. Response and relaxation phenomena. Drude model of electrical and thermal conductivity. Hall effect and thermoelectric power. Electron motion in a periodic potential, band theory of solids: metals, insulators and semiconductors. Superconductivity: type-I and type-II superconductors. Josephson junctions. Superfluidity. Defects and dislocations. Ordered phases of matter: translational and orientational order, kinds of liquid crystalline order. Quasicrystals.

V. Nuclear and Particle Physics

Basic nuclear properties: size, shape and charge distribution, spin and parity. Binding energy, semi-empirical mass formula, liquid drop model. Nature of the nuclear force, form of nucleon-nucleon potential, charge-independence and charge-symmetry of nuclear forces. Deuteron problem. Evidence of shell structure, single-particle shell model, its validity and limitations. Rotational spectra. Elementary ideas of alpha, beta and gamma decays and their selection rules. Fission and fusion. Nuclear reactions, reaction mechanism, compound nuclei and direct reactions. Classification of fundamental forces. Elementary particles and their quantum numbers (charge, spin, parity, isospin, strangeness, etc.). Gellmann-Nishijima formula. Quark model, baryons and mesons. C, P, and T invariance. Application of symmetry arguments to particle reactions. Parity non-conservation in weak interaction. Relativistic kinematics.

vi. Thermodynamic and Statistical Physics

Laws of thermodynamics and their consequences. Thermodynamic potentials, Maxwell relations, chemical potential, phase equilibria. Phase space, micro- and macro-states. Micro-canonical, canonical and grand-canonical ensembles and partition functions. Free energy and its connection with thermodynamic quantities. Classical and quantum statistics. Ideal Bose and Fermi gases. Principle of detailed balance. Blackbody radiation and Planck's distribution law.



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XV. Biotechnology

Biochemistry, Molecular & Cell Biology, Genomics

Biomolecules, Metabolism, Membrane transport, Structure and regulation of prokaryotes and eukaryotes genes, Transcription, Translation, Post-transcriptional and Translational modifications, Molecular interaction, Phyllogenetics, Molecular markers, Genetic and physical mapping, Gene interaction; Population genetics, Genetic engineering; Cloning and expression vectors, rDNA technology, Gene cloning approaches, Whole genome sequencing & annotation, High throughput gene expression and Function elucidation technologies, PCR, Blotting techniques, Gene transfer technologies, Protein-protein interactions, Mass spectrophotometry, Signal transduction pathways and their elucidation, Primary and secondary metabolic pathways, Systems biology frameworks for metabolic engineering, Nanobiotechnology, Genomics and proteomics.

Microbial & Plant Biotechnology

Microbial taxonomy and diversity (bacteria, fungi, virus); Microbial nutrition, growth and control; Microbial metabolism; Microbial genetics; Microbial production and purification of fermented food and food products, recombinant proteins, industrial enzymes; Free and immobilized enzyme kinetics; Types of bioreactors; Bioseparation techniques; Concept of plant cellular totipotency; Clonal propagation; Organogenesis and somatic embryogenesis, artificial seed, somaclonal variation, embryo culture, in vitro fertilization; Plant products of industrial importance; Plant-microbe interactions.

Medical Biotechnology

Infectious diseases: Microbial (viral, bacterial, fungal), Life style diseases, Cell & developmental biology, Cancer biology, Immunotechnology, Antigen antibody interactions, Antibody engineering, vaccines and the associated manufacturing processes, molecular and immuno diagnostics methods and their applications, Cell culture technologies, Regenerative medicine & transplantation technology, Hypersensitivity and autoimmune diseases, tolerance, animal biotechnology, Animal cell preservation, Stem cells and healthcare, Clinical trials

Environmental Biotechnology

Biotransformation and biodegradation; Biofertilizers; Biosensors – living biosensors for the management and manipulation of microbial consortia; Role of biotechnology in energy production.

XVI. ELECTRICAL ENGINEERING

1. Electric Machines: -

Transformers: Construction, Detailed Analysis, Equivalent circuit diagram, phasor diagram, efficiency, voltage regulation, analysis of three-phase transformers, transformer tests, instrument transformers.

D.C Machines: Principle of operation, emf and torque equations, equivalent and circuits, types of DC machines, DC Generator characteristics, parallel operation, DC Motor Torque speed characteristics, Speed control techniques, DC motor starting, Applications.

Induction Machines: Operating principle, Torque equation, Equivalent circuit, no-load and blocked rotor tests, torque speed characteristics, Speed-control techniques, starting, Applications, Induction generator,

Synchronous Machines: Voltage equation, windings, tests, characteristics, application, synchronous motor starting, V-curves, Synchronous condenser.

2. Power Systems:

Introduction to Power System generation, transmission and distribution. Element of AC distribution, Single fed, double fed and ring main distributor. Transmission line parameters and their evaluations, types of overhead conductors with calculations of inductance and capacitance. Models of short, medium and long transmission lines, skin, proximity and Ferranti effect. Classification of cables, Cable conductor's, insulating materials, insulation resistance, grading of cables,

Per unit Representation of power Systems: Fault Analysis (Balanced Faults): Faults, types of faults, symmetrical 3-phase balanced faults, calculation of fault currents, current limiting reactors. Fault Analysis, (unsymmetrical faults) Symmetrical components, sequence impedances, sequence networks, unsymmetrical faults-single line to ground, line to line, double line to ground faults on unloaded alternators and on power systems. Insulation Coordination. Surge performance of Transmission lines: Traveling waves on transmission lines, open-end line, short-circuited line, line terminated through a resistance, line connected to a cable. Interference of Power Lines with communication Circuit.

Load Flows: Nature and importance of the problem, Network model formulation, algorithm for the formulation of Ybus matrix, formulation of Ybus by singular transformation, primitive network, Bus incidence matrix, load flow problem, load flow equations, bus classification, Gauss – Seidel & Newton-Raphson method for solving load flow problem, Power System Stability: The stability problem, steady state, dynamic and transient stability, rotor dynamics and swing equation, power-angle curve, equal-Area criterion of stability, Numerical solution of swing equation, Factors affecting transient stability, Automatic Generation Control: Real power balance and its effect on system frequency, load frequency control of single area system-speed governing system. Control of voltage and Reactive Power: Methods of voltage control-injection of reactive power, tap changing transformers, booster transformers, phase-shift transformers. Economic Operation of Power System. Power System protection, Over current, overvoltage, Differential protection, Distance relays.

3. Electrical Measurements & Instrumentation :

Electro-mechanical indicating instruments, Classification, effects utilized in measuring instruments, errors and their types, various methods of damping, galvanometers (D' Arsonval and Ballistic) Ammeters and Voltmeters (PMMC, Induction, electrostatic and Dynamometer type), errors in voltmeters and ammeters, extension of instrument range, ammeter shunts, voltmeter multipliers, Measurement of Power, Energy and Power Factor Measurement of reactive power (single phase and 3-phase), Energy measurement using induction type classification, Wheatstone bridge, Meggar, Measurement of inductance, Capacitance and Frequency using a. c bridges, Potentiometers; D.C instrumentation: Introduction of virtual instrumentation. Measurement of Electrical and non-electrical quantities using virtual instruments control System. Renewable Energy: Solar, wind and Hybrid.

4. Power Electronics:

Power semiconducting devices, characteristics, snubber circuits, Gate drive circuits, series and parallel operations of Thyristors, single-phase and three phase uncontrolled and controlled rectifiers, DC-DC converters (Continuous and Discontinuous conduction modes of operation), AC voltage controllers, Cycloconverters, Inverter, Pulse Width Modulation Techniques, Variable-frequency Induction motor drives, Converter-Fed DC Motor Drives, Chopper-Fed DC Motor Drives, Electric Drives, Applications of Power Electronics.

5. Circuit Analysis:

D.C circuit Analysis: series and parallel resistor, KCL, KVL, circuit theorems, Nodal analysis, Mesh current analysis. A.C circuit Analysis: R, L, C, R-L, R-C, L-C, R-L-C (series and parallel) circuits excited by sinusoidal AC, Application of KCL, KVL and circuit theorem, series and parallel resonance, Power in AC circuits, concept of power factor and p.f improvement.

6. Control Systems :

Introduction of continuous control systems: Open-loop, closed loop (automatic and manual) control, Mathematical modeling: Transfer functions, block diagrams, signal flow graphs. First and second order system: sample of first and second order systems, responses of their systems to step, ramp, parabolic and sinusoidal inputs, transient, steady state and error analysis, Stability studies: stability and pole locations, stability and Routh Table, stability and frequency response bode plot, polar plot, Nyquist's criterion, root locus, proportional, integral, Derivative (P.I.D) control, state variable modeling Digital control system: Hardware elements of a digital control system, Z-transform, Nonlinear control systems. Linearization of Non-linear control system about and nominal operating point, analysis and design using linearized models.

7. Engineering Mathematics:

Linear Algebra, Matrix Algebra, Eigen values and Eigen vectors, calculus, partial derivatives, total derivative, Taylor series, Fourier series, Laplace transformations. Complex variables, Cauchy-Riemann equation, Numerical methods.

XVII. ELECTRONIC AND COMMUNICATION ENGINEERING

UNIT-I

Introduction to Semiconductor, energy bands in solids, concept of effective mass, density of states, Fermi levels. PN Junction, Diode equation and diode equivalent circuit, Breakdown in diodes, Zener diode, Tunnel diode, Metal semiconductor junction – Ohmic and Schottky contacts, Characteristics and equivalent circuits of JFET, MOSFET. Low dimensional semiconductor devices – quantum wells, quantum wires, quantum dots. High Electron Mobility Transistor (HEMT), Solar cells – I-V characteristics, fill factor and efficiency, LED, LCD and flexible display devices.

Emerging materials for future Devices: Graphene, Carbon Nano tubes (CNT), ZnO, SiC etc.

UNIT-II

IC fabrication – crystal growth, epitaxy, oxidation, lithography, doping, etching, isolation methods, metallization, bonding, Thin film deposition and characterization Techniques: XRD, TEM, SEM, EDX, Thin film active and passive devices, MOS technology and VLSI, scaling of MOS devices, NMOS and CMOS structures and fabrication, Characteristics of MOS transistors and threshold voltage, NMOS and CMOS inverters, Charge-Coupled Device (CCD) – structure, charge storage and transfer, Basics of VLSI design, stick diagrams, Layout design rules.

UNIT-III

Superposition, Thevenin, Norton and Maximum Power Transfer Theorems, Network elements, Network graphs, Nodal and Mesh analysis. Laplace Transform, Fourier Transform and Z-transform. Time and frequency domain response, Passive filters, Two-port Network Parameters : Z, Y, ABCD and h parameters, Transfer functions, Signal representation, State variable method of circuit analysis, AC circuit analysis, Transient analysis, Zero and Poles, Bode Plots.

Continuous time signals, Fourier Series and Fourier transform representations, Sampling theorem and applications, Discrete time signal, Discrete Fourier transform (DFT), Fast Fourier transform (FFT), Basic concepts of digital signal processing, digital filters – IIR, FIR.

UNIT – IV

Rectifiers, Voltage regulated ICs and regulated power supply, Biasing of Bipolar junction transistors and FETs, operating point and stability, Amplifiers, Classification of amplifiers, Concept of feedback, Hartley, Colpitt's and Phase Shift oscillators, Operational amplifiers (OPAMP) - characteristics, computational applications, comparators, Schmitt trigger, Instrumentation amplifiers, wave shaping circuits, Phase locked loops, Active filters, Multivibrators, Voltage to frequency convertors (V/F), frequency to voltage convertors (F/V).

UNIT-V

Logic Families, Logic Gates, Boolean algebra and minimization techniques, Combinational circuits, Programmable Logic Devices (PLD), CPLD, flip-flops, memories, Sequential Circuits: Counters – Ring, Ripple, Synchronous, Asynchronous, Shift registers, multiplexers and demultiplexers, A/D and D/A converters, Analysis and Design of fundamental mode state machines: State variables, State table and State diagram. Sequential PLD, FPGA, Analysis and Design of digital circuits using HDL.

UNIT-VI

Introduction of Microprocessor 8086: Architecture, Addressing modes, instruction set, interrupts, Programming, Memory and I/O interfacing. Introduction of Microcontrollers – 8051 for embedded systems, Architecture and register set of Microcontroller 8051, Addressing modes, Instruction set of 8051 – Data transfer instructions, Arithmetic instructions, Logic instructions, bit level and byte level control transfer instructions, 8051 assembly programming – stack operations, subroutines, interrupts, 8051 programming as timer/counter, 8051 serial communication, 8051 interfacing RS232, LED/LCD display, Keyboard, Stepper motor.

UNIT-VII

Electrostatics - vector calculus, Gauss's Law, Laplace and Poisson's equations, Magnetostatics – Biot Savart's law, Ampere's law and electromagnetic induction, Maxwell's equations and wave equations, Plane wave propagation in free space, dielectrics and conductors, Poynting theorem, Reflection and refraction, polarization, interference, coherence and diffraction, Transmission lines and waveguides – line equations, impedance, reflections and voltage standing wave ratio, rectangular waveguides. Antennas – retarded potential and Hertzian dipole, half wave antenna, antenna patterns, radiation intensity, gain, effective area and Frii's free space receiver power equation.

Microwave Sources and Devices - Reflex Klystron, Magnetron, TWT, Gunn diode, IMPATT diode, Crystal Detector and PIN diode.

Radar – block diagram of Radar, frequencies and power used, Radar range equation.

UNIT-VIII

Analog modulation and demodulation - AM, FM and PM, Principle of super heterodyne receiver, Random signals, noise, noise temperature and noise figure, Basic concepts of information theory, Error detection and correction, Digital modulation and demodulation – PCM, ASK, FSK, PSK, BPSK, QPSK and QAM, Time and Frequency-Division Multiplexing, Multiple Access techniques, Data Communications – Modems, Codes, Principles of Mobile and Satellite Communication, Optical communication, Optical sources - LED, spontaneous and stimulated

emission, semiconductor Lasers, Detectors – PIN photodiodes, Avalanche photodiodes (APD), Optical fibers – attenuation and dispersion characteristics, Bandwidth, Wavelength division multiplexing.

Fundamentals of Internet of Things (IoT) for communication.

UNIT-IX

Power devices – characteristics of SCR, DIAC, TRIAC, power transistors, Protection of thyristors against over voltage and over current. SCR triggering - dv/dt and di/dt , triggering with single pulse and train of pulses, A.C. and D.C. motors - construction and speed control. Switched Mode Power Supply (SMPS). Uninterrupted Power Supply (UPS).

Open loop and closed loop control system, Block Diagram reduction techniques, transfer function and signal flow diagram, Stability criterion: Routh-Hurwitz and Nyquist plot, On-off controller, Proportional (P), Proportional-Integral (PI), Proportional-Derivative (PD), PID controllers.

UNIT – X

Transducers – Resistance, Inductance, Capacitance, Piezoelectric, Thermoelectric, Hall effect, Photoelectric, Measurement of displacement, velocity, acceleration, force, torque, strain, temperature, pressure, flow, humidity, thickness, pH. Measuring Equipment – Measurement of R, L and C, Bridge and Potentiometers, voltage, current, power, energy, frequency/time, phase, Digital Multimeters, CRO, Digital Storage Oscilloscope, Spectrum Analyzer., Biomedical Instruments – ECG, EEG, Blood Pressure Measurements, MEMS and its applications Sensors for IoT applications.

XVIII. GEOGRAPHY

UNIT-I

Geomorphology

Continental Drift, Plate Tectonics, Endogenetic and Exogenetic forces. Denudation and Weathering, Geomorphic Cycle (Davis and Penck), Theories and Process of Slope Development, Earth Movements (seismicity, folding, faulting and vulcanicity), Landform Occurrence and Causes of Geomorphic Hazards (earthquakes, volcanoes, landslides and avalanches)

UNIT –II

Climatology

Composition and Structure of Atmosphere; Insolation, Heat Budget of Earth, Temperature, Pressure and Winds, Atmospheric Circulation (air-masses, fronts and upper air circulation, cyclones and anticyclones (tropical and temperate), Climatic Classification of Koppen & Thornthwaite, ENSO Events (El Nino, La Nina and Southern Oscillations), Meteorological Hazards and Disasters (Cyclones, Thunderstorms, Tornadoes, Hailstorms, Heat and Cold waves Drought and Cloudburst , Glacial Lake Outburst (GLOF), Climate Change: Evidences and Causes of Climatic Change in the past, Human impact on Global Climate.

UNIT-III

Oceanography

Relief of Oceans, Composition: Temperature, Density and Salinity, Circulation: Warm and Cold Currents, Waves, Tides, Sea Level Changes, Hazards: Tsunami and Cyclone

UNIT –IV

Geography of Environment

Components: Ecosystem (Geographic Classification) and Human Ecology, Functions: Trophic Levels, Energy Flows, Cycles (geo-chemical, carbon, nitrogen and oxygen), Food Chain, Food Web and Ecological Pyramid, Human Interaction and Impacts, Environmental Ethics and Deep Ecology, Environmental Hazards and Disasters (Global Warming, Urban Heat Island, Atmospheric Pollution, Water Pollution, Land Degradation), National Programmes and Policies: Legal Framework, Environmental Policy, International Treaties, International Programmes and Policies (Brundtland Commission, Kyoto Protocol, Agenda 21, Sustainable Development Goals, Paris Agreement)

UNIT –V

Population and Settlement Geography

Population Geography

Sources of population data (census, sample surveys and vital statistics, data reliability and errors). World Population Distribution (measures, patterns and determinants), World Population Growth (prehistoric to modern period). Demographic Transition, Theories of Population Growth (Malthus, Sadler, and Ricardo). Fertility and Mortality Analysis (indices, determinants and world patterns). Migration (types, causes and consequences and models), Population Composition and Characteristics (age, sex, rural-urban, occupational structure and educational levels), Population Policies in Developed and Developing Countries.

Settlement Geography

Rural Settlements (types, patterns and distribution), Contemporary Problems of Rural Settlements (rural-urban migration; land use changes; land acquisition and transactions), Theories of Origin of Towns (Gordon Childe, Henri Pirenne, Lewis Mumford), Characteristics and Processes of Urbanization in Developed and Developing Countries (factors of urban growth, trends of urbanisation, size, structure and functions of urban areas). Urban Systems (the law of the primate city and rank size rule) Central Place Theories (Christaller and Losch), Internal Structure of the City, Models of Urban Land Use (Burgess, Harris and Ullman , and Hoyt), Concepts of Megacities, Global Cities and Edge Cities, Changing Urban Forms (peri-urban areas, rural-urban fringe, suburban , ring and satellite towns), Social Segregation in the City, Urban Social Area Analysis, Manifestation of Poverty in the City (slums, informal sector growth, crime and social exclusion).

Unit–VI:

Geography of Economic Activities and Regional Development

Economic Geography

Factors affecting spatial organisation of economic activities (primary, secondary, tertiary and quarternary), Natural Resources (classification, distribution and associated problems), Natural Resources Management. World Energy Crises in Developed and Developing Countries.

Agricultural Geography

Land capability classification and Land Use Planning, Cropping Pattern: Methods of delineating crop combination regions (Weaver, Doi and Rafiullah), Crop diversification, Von Thunen's Model of Land Use Planning. Measurement and Determinants of Agricultural Productivity, Regional variations in Agricultural Productivity, Agricultural Systems of the World.

Industrial Geography

Classification of Industries, Factors of Industrial Location; Theories of Industrial Location (A. Weber, E. M. Hoover, August Losch, A. Pred and D. M. Smith). World Industrial Regions, Impact of Globalisation on manufacturing sector in Less Developed Countries, Tourism Industry, World distribution and growth of Information And Communication Technology (ICT) and Knowledge Production (Education and R & D) Industries.

Geography of Transport and Trade

Theories and Models of spatial interaction (Edward Ullman and M. E. Hurst) Measures and Indices of connectivity and accessibility; Spatial Flow Models: Gravity Model and its variants, World Trade Organisation, Globalisation and Liberalisation and World Trade Patterns. Problems and Prospects of Inter and Intra Regional Cooperation and Trade.

Regional Development

Typology of Regions, Formal and Fictional Regions, World Regional Disparities, Theories of Regional Development (Albert O. Hirschman, Gunnar Myrdal, John Friedman, Dependency theory of Underdevelopment, Global Economic Blocks, Regional Development and Social Movements in India

Unit – VII: Cultural, Social and Political Geography

Cultural and Social Geography

Concept of Culture, Cultural Complexes, Areas and Region, Cultural Heritage, Cultural Ecology. Cultural Convergence, Social Structure and Processes, Social Well-being and Quality of Life, Social Exclusion, Spatial distribution of social groups in India (Tribe, Caste, Religion and Language), Environment and Human Health, Diseases Ecology, Nutritional Status (etiological conditions, classification and spatial and seasonal distributional patterns with special reference to India) Health Care Planning and Policies in India, Medical Tourism in India.

Political Geography

Boundaries and Frontiers (with special reference to India), Heartland and Rimland Theories. Trends and Developments in Political Geography, Geography of Federalism, Electoral Reforms in India, Determinants of Electoral Behaviour, Geopolitics of Climate Change, Geopolitics of World Resources, Geo-politics of India Ocean, Regional Organisations of Cooperation (SAARC, ASEAN, OPEC, EU). Neopolitics of World Natural Resources.

Unit VIII: Geographic Thought

Contributions of Greek, Roman, Arab, Chinese and Indian Scholars, Contributions of Geographers (Bernhardus Varenius, Immanuel Kant, Alexander von Humboldt, Carl Ritter, Scheafer & Hartshorne), Impact of Darwinian Theory on Geographical Thought. Contemporary trends in Indian Geography: Cartography, Thematic and Methodological contributions. Major Geographic Traditions (Earth Science, man- environment relationship, area studies and spatial analysis), Dualisms in Geographic Studies (physical vs. human, regional vs. systematic, qualitative vs. quantitative, ideographic vs. nomothetic), Paradigm Shift, Perspectives in Geography (Positivism, Behaviouralism, Humanism, Structuralism, Feminism and Postmodernism).

Unit IX: Geographical Techniques

Sources of Geographic Information and Data (spatial and non-spatial), Types of Maps, Techniques of Map Making (Choropleth, Isarithmic, Dasymetric, Chorochromatic, Flow Maps) Data Representation on Maps (Pie diagrams, Bar diagrams and Line Graph, GIS Database (raster and vector data formats and attribute data formats). Functions of GIS (conversion, editing and analysis), Digital Elevation Model (DEM), Georeferencing (coordinate system and map projections and Datum), GIS Applications (thematic cartography, spatial decision support system), Basics of Remote Sensing (Electromagnetic Spectrum, Sensors and Platforms, Resolution and Types, Elements of Air Photo and Satellite Image Interpretation and Photogrammetry), Types of Aerial Photographs, Digital Image Processing: Developments in Remote Sensing Technology and Big Data Sharing and its applications in Natural Resources Management in India, GPS Components (space, ground control and receiver segments) and Applications, Applications of Measures of Central Tendency, Dispersion and Inequalities, Sampling, Sampling Procedure and Hypothesis Testing (*chi* square test, *t* test, ANOVA), Time Series Analysis, Correlation and Regression Analysis, Measurement of Indices, Making

Indicators Scale Free, Computation of Composite Index, Principal Component Analysis and Cluster Analysis, Morphometric Analysis: Ordering of Streams, Bifurcation Ratio, Drainage Density and Drainage Frequency, Basin Circularity Ratio and Form Factor, Profiles, Slope Analysis, Clinographic Curve, Hypsographic Curve and Altimetric Frequency Graph.

Unit – X: Geography of India

Major Physiographic Regions and their Characteristics; Drainage System (Himalayan and Peninsular), Climate: Seasonal Weather Characteristics, Climatic Divisions, Indian Monsoon (mechanism and characteristics), Jet Streams and Himalayan Cryosphere, Types and Distribution of Natural Resources: Soil, Vegetation, Water, Mineral and Marine Resources. Population Characteristics (spatial patterns of distribution), Growth and Composition (rural-urban, age, sex, occupational, educational, ethnic and religious), Determinants of Population, Population Policies in India, Agriculture (Production, Productivity and Yield of Major Food Crops), Major Crop Regions, Regional Variations in Agricultural Development, Environmental, Technological and Institutional Factors affecting Indian Agriculture; Agro-Climatic Zones, Green Revolution, Food Security and Right to Food. Industrial Development since Independence, Industrial Regions and their characteristics, Industrial Policies in India. Development and Patterns of Transport Networks (railways, roadways, waterways, airways and pipelines), Internal and External Trade (trend, composition and directions), Regional Development Planning in India, Globalisation and its impact on Indian Economy, Natural Disasters in India (Earthquake, Drought, Flood, Cyclone, Tsunami, Himalayan Highland Hazards and Disasters.)



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XIX. HISTORY

Unit – I

Negotiating the Sources: Archaeological sources: Exploration, Excavation, Epigraphy and Numismatics. Dating of Archaeological Sites. Literary Sources: Indigenous Literature: Primary and Secondary: problem of dating Religious and Secular Literature, Myths, Legends, etc. Foreign Accounts: Greek, Chinese and Arabic.

Pastoralism and Food production: Neolithic and Chalcolithic Phase: Settlement, distribution, tools and patterns of exchange.

Indus/Harappa Civilization: Origin, extent, major sites, settlement pattern, craft specialization, religion, society and polity, Decline of Indus Civilization, Internal and external trade, First urbanization in India.

Vedic and later Vedic periods; Aryan debates, Political and Social Institutions, State Structure and Theories of State; Emergence of Varnas and Social Stratification, Religious and Philosophical Ideas. Introduction of Iron Technology, Megaliths of South India.

Expansion of State system: Mahajanapadas, Monarchical and Republican States, Economic and Social Developments and Emergence of Second Urbanization in 6th century BCE; Emergence of heterodox sects-Jainism, Buddhism and Ajivikas.

Unit – II

From State to Empire: Rise of Magadha, Greek invasion under Alexander and its effects, Mauryan expansion, Mauryan polity, society, economy, Asoka's Dhamma and its Nature, Decline and Disintegration of the Mauryan Empire, Mauryan art and architecture, Asokan edicts: language and script.

Dissolution of Empire and Emergence of Regional Powers: Indo-Greeks, Sungas, Satavahanas, Kushanas and Saka-Ksatrapas, Sangam literature, polity and society in South India as reflected in Sangam literature. Trade and commerce from 2nd century BCE to 3rd century CE, Trade with the Roman World, Emergence of Mahayana Buddhism, Kharavela and Jainism, Post-Mauryan art and Architecture. Gandhara, Mathura and Amaravati schools.

Gupta Vakataka age: Polity and Society, Agrarian Economy, Land Grants, Land Revenue and Land Rights, Gupta Coins, Beginning of Temple Architecture, Emergence of Puranic Hinduism, Development of Sanskrit Language and Literature. Developments in Science Technology, Astronomy, Mathematics and Medicine.

Harsha and his Times: Administration and Religion.

Salankayanas and Visnukundins in Andhradesa.

Unit – III

Emergence of Regional Kingdoms: Kingdoms in Deccan: Gangas, Kadambas, Western and Eastern Chalukyas, Rashtrakutas, Kalyani Chalukyas, Kakatiyas, Hoysalas and Yadavas.

Kingdoms in South India: Pallavas, Ceras, Colas and Pandyas,

Kingdoms in Eastern India: Palas and Senas of Bengal, Varmans of Kamarupa, Bhaumakaras and Somavamsis of Odisha.

Kingdoms in Western India: Maitrakas of Vallabhi and Chalukyas of Gujarat.

Kingdoms in North India: Gurjara-Pratiharas, Kalacuri-Chedis, Gahadavalas and Paramaras.

Characteristics of Early Medieval India: Administration and Political Structure Legitimation of Kingship.

Agrarian economy; land grants, changing production relations; graded land rights and peasantry, water resources, taxation system, coins and currency system;

Trade and urbanization: patterns of trade, and urban settlements, ports and trade routes, merchandise and exchange, trade guilds; trade and colonization in south- east Asia.

Growth of Brahminical religions: Vaisnavism and Saivism; Temples; Patronage and Regional Ramification; Temple Architecture and Regional Styles. Dana, Tirtha and Bhakti, Tamil Bhakti movement - Shankara, Madhava and Ramanujacharya.

Society: Varna, Jati and Proliferation of Castes, Position of women; Gender, marriage and property relations; Women in public life. Tribes as peasants and their place in Varna order. Untouchability.

Education and Educational Institutions: Agraharas, Mathas and Mahaviharas as Centres of Education. Growth of Regional Languages.

Debates of state formation in early medieval India: A) Feudal model; B) Segmentary model; C) Integrative model

Arab contracts: Suleiman Ghaznavid conquests. Alberuni's Accounts.

Unit – IV

Source of Medieval Indian History: Archaeological, Epigraphic and Numismatic sources, Material evidences and Monuments; Chronicles; Literary sources – Persian, Sanskrit and Regional languages; Daftar Khannas: Firmans, Bahis /Pothis / Akhbarat; Foreign Travellers' Accounts – Persian and Arabic.

Political Developments – The Delhi Sultanate – the Ghorids, the Turks, the Khaljis, the Tughlaqs, the Sayyids and the Lodis. Decline of Delhi Sultanate.

Foundation of the Mughal Empire – Babur, Humayun and the Suris ; Expansion and Consolidation from Akbar to Aurangzeb. Decline of the Mughal Empire.

Later Mughals and Disintegration of the Mughal Empire.

The Vijayanagara and the Bahmanis - Deccan Sultanate; Bijapur, Golkonda, Bidar, Berar and Ahmadnagar – Rise, Expansion and Disintegration; Eastern Gangas and Suryavamshi Gajapatis.

Rise of the Marathas & the foundation of Swaraj by Shivaji ; its expansion under the Peshwas

; Mughal – Maratha relations, Maratha Confederacy, Causes of Decline.

Unit – V

Administration & Economy: Administration under the Sultanate, Nature of State – Theocratic and Theocentric, Central, Provincial and Local Administration, Law of succession.

Sher Shah's Administrative Reforms ; Mughal Administration – Central, Provincial and Local : Mansabdari and Jagirdari Systems.

Administrative System in the Deccan – The Vijayanagara State & Polity, Bahamani Administrative System; Maratha Administration – Asta Pradhan.

Frontier Policies under Delhi Sultanate and Mughals.

Inter-State Relations during the Sultanate and the Mughals.

Agricultural Production and Irrigation System, Village Economy, Peasantry, Grants and Agricultural Loans, Urbanization and Demographic Structure.

Industries – Cotton Textiles, Handicrafts, Agro-Based industries, Organisation, Factories & Technology.

Trade and Commerce – State Policies, Internal and External Trade: European Trade, Trade Centres and Ports, Transport and Communication.

Hundi (Bills of Exchange) and Insurance, State Income and Expenditure, Currency, Mint System; Famines and Peasant Revolts.

Unit – VI

Society and Culture: Social Organisation and Social Structure.

The Sufis – Their Orders, Beliefs and Practices, the leading Sufi Saints, Social Synchronization.

Bhakti Movement – Shaivism; Vaishnavism, Shaktism.

The Saints of the Medieval Period – North and South – their impact on Socio-Political and Religious Life – Women Saints of Medieval India.

The Sikh Movement – Guru Nanak Dev: his teachings and practices, Adi Granth; the Khalsa. Social Classification: Ruling Class, Major Religious Groups, the Ulemas, the Mercantile and Professional Classes – Rajput Society.

Rural society – Petty Chieftains, Village Officials, Cultivators and Non-Cultivating Classes, Artisans.

Position of Women – Zana System – Devadasi System.

Development of Education, Centres of Education and Curriculum, Madarasa Education.

Fine Arts – Major Schools of Painting – Mughal, Rajasthani, Pahari, Garhwali; Development of Music.

Art and Architecture, Indo-Islamic Architecture, Mughal Architecture, Regional Styles. Indo-Arabic Architecture, Mughal Gardens, Maratha Forts, Shrines and Temples.

Unit –VII

Sources of Modern Indian History: Archival Materials, Biographies and Memoirs, Newspapers, Oral Evidence, Creative Literature and Painting, Monuments, Coins. Rise of British Power: European Traders in India in the 16th to 18th Centuries – Portuguese, Dutch, French and the British. Establishment and Expansion of British Dominion in India. British Relations with Principal Indian States – Bengal, Oudh, Hyderabad, Mysore, Carnatic and Punjab. Revolt of 1857, Causes, Nature and Impact. Administration of the Company and the Crown; Evolution of Central and Provincial Structure under East India Company. Paramountcy, Civil Service, Judiciary, Police and the Army under the Company; British Policy and Paramountcy in the Princely States under the Crown. Local Self-Government. Constitutional Changes, 1909 – 1935.

Unit – VIII

Colonial Economy: Changing Composition, Volume and Direction of Trade.

Expansion and Commercialization of Agriculture, Land Rights, Land Settlements, Rural Indebtedness, Landless Labour, Irrigation and Canal System.

Decline of Industries – Changing Socio-Economic Conditions of Artisans; De-urbanisation; Economic Drain; World Wars and Economy.

British Industrial Policy; Major Modern Industries; Nature of Factory Legislation; Labour and Trade Union Movements.

Monetary Policy, Banking, Currency and Exchange, Railways and Road Transport, Communications – Post & Telegraph.

Growth of New Urban Centres; New Features of Town Planning and Architecture, Urban Society and Urban Problems.

Famines, Epidemics and the Government Policy. Tribal and Peasant Movements.

Indian Society in Transition: Contact with Christianity – the Missions and Missionaries; Critique of Indian Social and Economic Practices and Religious Beliefs; Educational and Other Activities.

The New Education – Government Policy; Levels and Contents; English Language; Development of Science, Technology, Public Health & Medicine – Towards Modernism.

Indian Renaissance – Socio-Religious Reforms; Emergence of Middle Class; Caste Associations and Caste Mobility.

Women's Question – Nationalist Discourse; Women's Organisations; British Legislation concerning Women, Gender Identity & Constitutional Position.

The Printing Press – Journalistic Activity and the Public opinion.

Modernisation of Indian Languages and Literary Forms – Reorientation in Painting, Music and Performing Arts.

Unit – IX

Rise of Indian Nationalism: Social and Economic basis of Nationalism. Birth of

Indian National Congress; Ideologies and Programmes of the Indian National Congress, 1885-1920: Early Nationalists, Assertive Nationalists and Revolutionaries. Swadeshi

and Swaraj.

Gandhian Mass Movements; Subas Chandra Bose and INA; Role of Middle Class in National Movement; Women Participation in National Movement.

Left Wing Politics. Depressed

Class Movement.

Communal Politics; Muslim League and Genesis of Pakistan. Towards Independence and Partition.

India after Independence: Challenges of Partition; Integration of the Indian Princely States; Kashmir, Hyderabad & Junagarh.

B.R. Ambedkar – The making of the Indian Constitution, its Features.

The Structure of Bureaucracy. New

Education Policy.

Economic Policies and the Planning process; Development, Displacement and Tribal Issues.

Linguistic Reorganisation of States; Centre-State Relations.

Foreign Policy Initiatives – Panchsheel; Dynamics of Indian Politics-Emergency; Liberalisation, Privatisation & Globalisation of Indian Economy.

Unit – X

Historical Method, Research, Methodology and Historiography: Scope and

Importance of History

Objectivity and Bias in History

Heuristics Operation, Criticism in History, Synthesis and Presentation History and its

Auxiliary Sciences

History a Science, Arts or a Social Science Causation and

Imagination in History Significance of Regional History

Recent Trends of Indian History Research

Methodology Hypothesis in History

Area of Proposed Research

Sources – Data Collection, Primary / Secondary, Original and Transit Sources

Trends in Historical Research Recent Indian

Historiography Selection of Topic in History

Notes Taking, References, Footnotes and Bibliography Thesis and

Assignment Writing

Plagiarism, Intellectual Dishonesty and History Writing Beginnings of Historical

Writings – Greek, Roman and Church Historiography

Renaissance and its Impact on History Writing Negative and Positive

Schools of Historical Writing Berlin Revolution in History Writing –

Von Ranke Marxist Philosophy of History – Scientific Materialism

Cyclical Theory of History – Oswald Spengler

Challenge and Response Theory – Arnold Joseph Toynbee Post – Modernism

in History



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XX. HOME SCIENCE

UNIT-I : FOOD SCIENCE AND FOOD SERVICE MANAGEMENT

1. Food science and nutrition.
2. Properties of food – physical and chemical properties
3. Quality evaluation of foods- objectives and subjective.
4. Effects of cooking and processing techniques on nutritional components and other physical parameters, food preservation and application.
5. Food pigments and additives.
6. Food standards, microbiological safety of food, HACCP, food packaging.
7. Perspectives of food service-menu planning, food cost analysis.
8. New product development - nano technology
9. Food service management of institutional level-hospital, educational institutions, social and special institutions
10. Research methods-fundamental issues, concept, need relevance, scope and ethics in research

UNIT-II : NUTRITION AND DIETETICS

1. Food groups – balanced diet, food pyramid, macro and micro nutrition.
2. Nutrients-role of nutrients in the body, nutrient deficiencies and requirements for Indians.
3. Public health nutrition
4. Nutrition through life span-physiological changes, growth and development from conception to adolescence, nutritional needs and dietary guidelines for adequate nutrition through life cycle, nutrition concerns.
5. Community nutrition, sports nutrition, nutrition in emergencies and disasters.
6. Nutritional assessment-methods and techniques.
7. Nutritional intervention-national nutrition policies and programmes, food and nutrition security.
8. Clinical and therapeutic nutrition.
9. Diet counseling and management.
10. Research methods- research designs, principles and purpose of research

Unit-III : TEXTILES

1. Textile terminologies- fibre, yarn, weave, fabric etc., classification of fibers, yarns and weaves, Identification of fibres and weaves.
2. Manufacturing process of major natural and manmade fibres, properties and their end uses.
3. Different methods of fabric construction-woven, knitted and non woven fabrics, their

- properties and end uses.
4. Textiles finishes-classification, processing and purposes of finishes.
 5. Dyeing and printing-classification, method of block printing, tie and dye, batik, roller printing, screen printing, discharge, heat transfer printing and digitized printing.
 6. Traditional textiles of India-embroidered textiles, printed textiles, woven textiles, dyed textiles of various regions in India. Identification on the basis of fibre content, technique, motif, colour and designed.
 7. Textile Testing and quality control-need of testing, sampling method, techniques of testing fibres, yarn, fabrics and garments. Testing of colour-fastness, shrinkage, pilling and GSM of fabrics.
 8. Textile and environment-banned dyes, eco-friendly textiles, contamination and effluent treatment, Eco-label and eco marks.
 9. Recent developments in textiles and apparels- nano textiles, technical textiles, occupational clothing, zero waste designing, up cycling and recycling.
 10. Research methods-types of research, descriptive, survey, historical, qualitative, quantitative, analytical and action research

UNIT-IV : APPAREL DESIGNING

1. Body measurements-procedure, need, figure types and anthropometry.
2. Equipments and tools used for manufacturing garments-advancements and attachments used for sewing machine. Types of machines used and their parts.
3. Elements and principles of design and its application to apparel. Illustrations and parts of garments.
4. Fashion-Terminologies, fashion cycle, fashion theories, fashion adoption, fashion forecasting and factors affecting fashion.
5. Pattern making-drafting, draping and flat pattern making techniques, pattern alteration and dart manipulation techniques.
6. Apparel manufacturing-terminology used, seams, techniques and machines used, process of fabric to apparel manufacture.
7. Apparel Quality testing-Quality standards and specification, Quality parameters and defects of fabrics and garments.
8. Care and maintenance of clothing-principles of washing, laundry agents, storage techniques case labels and symbols.
9. Selection of clothing for different age groups. Selection of fabrics for different and uses.
10. Research methods-hypothesis testing, types and scope

UNIT-V : RESOURCE MANAGEMENT AND CONSUMER ISSUES

1. Management-concept, approaches, management of time, energy, money, space, motivating factors, motivation theories, decision making.
2. Functions of management-planning, supervision, controlling, organizing, evaluation,

- family life cycle-stages, availability and use of resources.
3. Resources-classification, characteristics, factors affecting use, resource conservation, time management, work simplification techniques, classes of change, fatigue and its management.
 4. Management of natural resources-land, forest, water, air, water harvesting, municipal solid waste management, concept of sustainable development, SDGs.
 5. Money management-family income, types, supplementation, budgeting, household accounts, family savings and investment, tax implications.
 6. Human resource management- functions, need, human resource development-challenges, functions, manpower planning, training need assessment, training methodologies, training evaluation.
 7. Consumer-definition, role, rights and responsibilities, consumer behavior, consumer problems, education and empowerment.
 8. Consumer protection- consumer organization, cooperatives, alternative redressal, standardization, standard marks, quality control, buying aids, consumer legislation.
 9. Entrepreneurship-concept, process, barriers, entrepreneurial motivation, challenges, enterprise setting, project planning and appraisal, enterprise management.
 10. Research methods-sampling techniques, types of sampling, sampling procedures, probability and non probability sampling

UNIT-VI : HOUSING AND INTERIOR DESIGN

1. Design fundamentals – elements of art, principles of design, principles of composition.
2. Colour - dimensions of colour, psychological effects of colour, colour schemes, factors affecting use of colour.
3. Space planning and design-housing need and important, principles of planning spaces, types of house plans, economy in construction, planning for different income groups.
4. Building regulations-norms and standards, zoning, housing for special groups and areas, housing finance.
5. Housing and environment- building materials- impact on environment, green rating systems, energy efficiency in buildings, energy auditing, indices of indoor comfort.
6. Energy as a resource- conventional and non- conventional sources, renewable /non-renewable energy, energy management, national efforts on energy conservation.
7. Product design - design thinking process, diffusion and innovation, design communication, ergonomic considerations.
8. Ergonomics - significance, scope, anthropometry, man, machine, environment relationship, factors affecting physiological cost of work, body mechanics, functional design of work place, time and motion study, energy studies.
9. Furniture and furnishing - historical perspectives, architectural styles, contemporary trends, wall finishes, window and window treatments.
10. Research methods-selection and preparation of tools for data collection- questionnaire, interview, observation, measuring scales, ranking and measurement, reliability and validity of tools

UNIT-VII : CHILD/HUMAN DEVELOPMENT

1. Principles of growth and development, care during pregnancy and pre-natal and neonatal development.
2. Theories of human development and behavior.

3. Early childhood care and education – activities to promote holistic development.
4. Influence of family, peers, school, community and culture on personality development.
5. Children and persons with special needs, care and support, special education, prevention of disabilities, rehabilitation.
6. Children at risk-child labour, street children, children of destitute, orphans, child abuse and trafficking.
7. Adolescence and youth: changes, challenges and programs to promote optimal development.
8. Adulthood, characteristics, changing roles and responsibilities in early and middle adulthood.
9. Aging-physical and psychological changes and care needs.
10. Research methods-types of variables and their selection.

UNIT-VIII : FAMILY STUDIES

1. Dynamics of marriage and family relationships.
2. Family welfare-approaches, programmes and challenges, role in national development.
3. Domestic violence, marital disharmony, conflict, resolution of conflict.
4. Parent education, positive parenting, community education.
5. Family disorganization, single parent families.
6. Family studies-family in crisis, family therapy, initiatives for child development.
7. Human rights, rights of children, rights of women, status of women, gender roles.
8. Guidance and counseling- across life span and for care givers.
9. Health and well being across life span development.
10. Research methods- data collection and classification, coding, tabulation, inferential and descriptive statistics.

UNIT-IX : COMMUNICATION FOR DEVELOPMENT

1. Basics of communication- nature, characteristics, functions, process, models, elements, principles, barriers, perception, persuasion and empathy, types of communication, levels (settings) of communication transactions, process of listening.
2. Communication systems and communication theories- human interaction theories, mass communication theories, message design theories, communication systems, culture and communication.
3. Concept of development- theories, models, measurement and indicators of development.
4. Concept of development- communication models and approaches, diffusion and innovation, mass media, social marketing.
5. Role of communication in development- need and importance, development journalism, writing for development-print, radio, television and internet.
6. Concerns of development communication- gender, health, environment, sustainability, human rights, population, literacy, rural and tribal development.
7. Advocacy and behavior change communication- concept, theories, models, approaches,

application and challenges.

8. Traditional, modern and new media for development - folk forms of songs, art, dance, theatre, puppetry, advertisement, cinema, ICTs for development-community radio, participatory video, social media and mobile phones.
9. Organisation/agencies/institutes working for development communication-international/national/state and local.
10. Research methods-analysis of data through parametric and non parametric tests.

UNIT-X : EXTENSION MANAGEMENT AND COMMUNITY DEVELOPMENT

1. Historical perspectives of extension—genesis of extension education and extension systems in India and other countries, objectives of extension education and extension service, philosophy and principles of extension programme development.
2. Programme management- need assessment, situation analysis, planning, organization, implementation, monitoring and evaluation.
3. Extension methods and materials- interpersonal, small and large group methods, audiovisual aids-need, importance, planning, classification, preparation and field testing, use and evaluation of audio-visual materials.
4. Curriculum development and planning for extension education and development activities, Bloom's taxonomy of educational objectives and learning.
5. Non-Formal, adult and lifelong education-historical perspectives, concept, theories, approaches, scope, methods and materials used, challenges of implementation and evaluation, issues to be addressed.
6. Training, skill development and capacity building for human resource development-methods of training, entrepreneurship development.
7. Community development- perspectives, approaches, community organization, leadership, support structures for community development, Panchyati raj institutions, NGOs and community based organisations.
8. People's participation and stakeholders' perspectives, Participatory Learning and Action-methods and techniques.
9. Development programmes in India for urban, rural and tribal population groups-programmes for nutrition, health, education, wage and self employment, women's development, skill development, sanitation and infrastructure.
10. Research methods-scientific report writing, presentation of data, interpretation and discussion.

XXI. LAW

UNIT – I: JURISPRUDENCE

1. Nature and sources of law
2. Schools of jurisprudence
3. Law and morality
4. Concept of rights and duties
5. Legal personality
6. Concepts of property, ownership and possession
7. Concept of liability
8. Law, poverty and development
9. Global justice
10. Modernism and post-modernism

UNIT – II: CONSTITUTIONAL AND ADMINISTRATIVE LAW

1. Preamble, fundamental rights and duties, directive principles of state policy.
2. Union and State executive and their interrelationship
3. Union and State legislature and distribution of legislative powers
4. Judiciary
5. Emergency provisions
6. Temporary, transitional and special provisions in respect of certain states
7. Election Commission of India
8. Nature, scope and importance of administrative law
9. Principle of natural justice
10. Judicial review of administrative actions – Grounds.

UNIT – III: PUBLIC INTERNATIONAL LAW AND IHL

1. International law – Definition, nature and basis
2. Sources of International law
3. Recognition of states and governments
4. Nationality, immigrants, refugees and internally displaced persons (IDPs)
5. Extradition and asylum
6. United Nations and its organs
7. Settlement of international disputes
8. World Trade Organization (WTO)
9. International humanitarian law (IHL) - Conventions and protocols
10. Implementation of IHL - Challenges

UNIT – IV: LAW OF CRIMES

1. General principles of criminal liability – *Actus reus* and *mens rea*, individual and group liability and constructive liability
2. Stages of crime and inchoate crimes - Abetment, criminal conspiracy and attempt
3. General exceptions
4. Offences against human body
5. Offences against state and terrorism
6. Offences against property
7. Offences against women and children
8. Drug trafficking and counterfeiting
9. Offences against public tranquility
10. Theories and kinds of punishments, compensation to the victims of crime

UNIT – V: LAW OF TORTS AND CONSUMER PROTECTION

1. Nature and definition of tort
2. General principles of tortious liability
3. General defenses
4. Specific torts – Negligence, nuisance, trespass and defamation
5. Remoteness of damages
6. Strict and absolute liability
7. Tortious liability of the State
8. The Consumer Protection Act 1986 - Definitions, consumer rights and redressal mechanism
9. The Motor Vehicles Act, 1988 - No fault liability, third party insurance and claims tribunal
10. The Competition Act, 2002 - Prohibition of certain agreements, abuse of dominant position and regulation of combinations

UNIT – VI: COMMERCIAL LAW

1. Essential elements of contract and e-contract
2. Breach of contract, frustration of contract, void and voidable agreements
3. Standard form of contract and quasi-contract
4. Specific contracts - Bailment, pledge, indemnity, guarantee and agency
5. Sale of Goods Act, 1930
6. Partnership and limited liability partnership

7. Negotiable Instruments Act, 1881
8. Company law – Incorporation of a company, prospectus, shares and debentures
9. Company law – Directors and meetings
10. Corporate social responsibility

UNIT-VII: FAMILY LAW

1. Sources and schools
2. Marriage and dissolution of marriage
3. Matrimonial remedies - Divorce and theories of divorce
4. Changing dimensions of institution of marriage – *Live-in* relationship
5. Recognition of foreign decrees in India on marriage and divorce
6. Maintenance, dower and *stridhan*
7. Adoption, guardianship and acknowledgement
8. Succession and inheritance
9. Will, gift and *wakf*
10. Uniform Civil Code

UNIT –VIII: ENVIRONMENT AND HUMAN RIGHTS LAW

1. Meaning and concept of ‘environment’ and ‘environmental pollution’
2. International environmental law and UN Conferences
3. Constitutional and legal framework for protection of environment in India
4. Environmental Impact Assessment and control of hazardous waste in India
5. National Green Tribunal
6. Concept and development of human rights
7. Universalism and cultural relativism
8. International Bill of Rights
9. Group rights – Women, children, persons with disabilities, elderly persons, minorities and weaker sections
10. Protection and enforcement of human rights in India – National Human Rights Commission, National Commission for Minorities, National Commission for Women, National Commission for Scheduled Castes, National Commission for Schedule Tribes and National Commission for Backward Classes

UNIT – IX: INTELLECTUAL PROPERTY RIGHTS AND INFORMATION TECHNOLOGY LAW

1. Concept and meaning of intellectual property
2. Theories of intellectual property
3. International conventions pertaining to intellectual properties

4. Copyright and neighboring rights – Subject matters, limitations and exceptions, infringement and remedies
5. Law of patent – Patentability, procedure for grant of patent, limitations and exceptions, infringement and remedies
6. Law of trademark – Registration of trademarks, kinds of trademarks, infringement and passing off, remedies
7. Protection of Geographical Indications
8. Bio-diversity and Traditional Knowledge
9. Information technology law- digital signature and electronic signature, electronic governance, electronic records and duties of subscribers
10. Cyber crimes, penalties and adjudication

UNIT – X: COMPARATIVE PUBLIC LAW AND SYSTEMS OF GOVERNANCE

1. Comparative Law – Relevance, methodology, problems and concerns in Comparison
2. Forms of governments – Presidential and parliamentary, unitary and federal
3. Models of federalism – USA, Canada and India
4. Rule of Law – ‘Formal’ and ‘substantive’ versions
5. Separation of powers – India, UK, USA and France
6. Independence of judiciary, judicial activism and accountability – India, UK and USA
7. Systems of constitutional review – India, USA, Switzerland and France
8. Amendment of the Constitution – India, USA and South Africa
9. *Ombudsman* – Sweden, UK and India
10. Open Government and Right to Information - USA, UK and India

XXII. LIBRARY & INFORMATION SCIENCES

Unit – I

1. Data, Information, Knowledge and Wisdom.
2. Information Life Cycle - Generation, Collection, Storage and Dissemination.
3. Role of Information in Planning, Management, Socio-economic, Cultural, Educational and Technological Development.
4. Information Science - Relationship with other subjects, Information Society and Knowledge Society.
5. Communication – Concept, Types, Theories, Models, Channels and Barriers; Trends in Scholarly Communication.
6. Information Industry - Generators, Providers and Intermediaries.
7. IPR and Legal Issues - Categories, Conventions, Treaties, Laws.
8. Plagiarism: Concept and Types.
9. Right to Information Act (RTI); Information Technology Act.
10. National Knowledge Commission; National Mission on Libraries.

Unit – II

1. Historical Development of Libraries in India; Committees and Commissions on Libraries in India.
2. Types of Libraries – Academic, Public, Special and National.
3. Library Legislation and Library Acts in Indian States; The Press and Registration of Books Act; The Delivery of Books and Newspapers (Public Libraries) Act.
4. Laws of Library Science.
5. Library and Information Science Profession - Librarianship as a Profession, Professional Skills and Competences; Professional Ethics.
6. Professional Associations - National – ILA, IASLIC, IATLIS; International – IFLA, ALA, CILIP, ASLIB, SLA; Role of UGC, RRRLF and UNESCO in Promotion and Development of Libraries.
7. Library and Information Science Education in India.
8. Library Public Relations and Extension Activities.
9. Type of Users - User Studies, User Education.
10. Information Literacy - Areas, Standards, Types and Models; Trends in Information Literacy.

Unit – III

1. Information Sources - Nature, Characteristics, Types and Formats.
2. Sources of Information - Primary, Secondary and Tertiary; Documentary and Non-

- Documentary.
3. Primary Information Sources (Print and Electronic) - Journals, Conference Proceedings, Patents, Standards, Theses & Dissertations, Trade Literature.
 4. Secondary Information Sources (Print and Electronic) - Dictionaries, Encyclopedias, Bibliographies, Indexing & Abstracting, Statistical sources, Handbooks and Manuals.
 5. Tertiary Information Sources (Print and Electronic)- Directories, Year Books, Almanacs.
 6. Reference Sources - Bibliographical, Biographical, Educational, Language and Geographical.
 7. Electronic Information Resources - Subject Gateways, Web Portals, Bulletin Boards, Discussion Forums /Groups.
 8. Databases: Bibliographic, Numeric, Full text, Multimedia; Open Access Databases.
 9. Institutional and Human Resources.
 10. Evaluation of Reference Sources and Web Resources.

Unit - IV

1. Community Information Services.
2. Reference Service – Concept and Types; Referral Services
3. Alerting Services - CAS, SDI, Inter Library Loan and Document Delivery.
4. Mobile based Library Services and Tools – Mobile OPAC, Mobile Databases, Mobile Library Website, Library Apps, Mobile Library Instructions, Augmented Reality, SMS Alerts, Geo-Location, Reference Enquiry.
5. Web 2.0 and 3.0 - Library 2.0- Concept, Characteristics, Components; Instant Messaging, RSS Feeds, Podcasts, Vodcasts, Ask a Librarian
6. Collaborative Services- Social Networks, Academics Social Networks, Social Tagging, Social Bookmarking.
7. Web – Scale Discovery Services
8. National Information Systems and Networks: NISCAIR, DESIDOC, SENDOC, ENVIS, INFLIBNET, DELNET, NICNET, ERNET, National Knowledge Network (NKN), Biotechnology Information System Network
9. International Information Systems and Networks: INIS, AGRIS, INSPEC, MEDLARS, BIOSIS, ERIC, Patent Information System (PIS), Biotechnology Information System (BIS).
10. Library Resource Sharing and Library Consortia – National and International.

Unit - V

1. Universe of Knowledge - Nature and Attributes; Modes of Formation of Subjects.
2. Knowledge Organisation - Classification – Theories, Canners, and Principles; Simple Knowledge Organisation System (SKOS), Taxonomies, Folksonomy, Trends in Classification.
3. Mapping of Subjects in Library Classification Schemes – DDC, UDC and CC.
4. Knowledge Organisation: Cataloguing - Canners and Principles; Centralized and Co-operative Catalogue; Library Cataloguing Codes: CCC and AACR - II.
5. Standards of Bibliographic Record Formats and Description – ISBD, MARC 21, CCF, RDA, FRBR, Bibframe.
6. Standards for Bibliographic Information Interchange & Communication – ISO

2709, Z39.50, Z39.71.

7. Metadata Standards: Dublin Core; MARC21, METS, MODES, EAD.
8. Indexing Systems and Techniques: Assigned - Pre-coordinate; Post-Coordinate; Derived- Title-based; Vocabulary Control.
9. Abstracting – Types and Guidelines.
10. Information Retrieval System – Features, Components, Models and Evaluation.

Unit - VI

1. Management - Principles, Functions and Schools of thought.
2. Library and Information Centers Management - Book Selection Tools and Principles; Library Acquisition, Technical Processing, Circulation, Serial Control, Maintenance and Stock Verification; Preservation and Conservation; Hazards and Control Measures of Library Materials.
3. Human Resource Management – Planning, Job Analysis, Job Description, Job Evaluation, Selection, Recruitment, Motivation, Training and Development, Performance Appraisal; Staff Manual.
4. Financial Management in Libraries - Sources of Finance, Resource Mobilisation, Budgeting Methods; Cost Effective and Cost Benefit Analysis, Annual Reports & Statistics; Library Authority and Committee.
5. Project Management - SWOT, PEST, PERT / CPM.
6. Total Quality Management (TQM) - Concepts, Principles and Techniques, Six Sigma; Evaluation of Services of Libraries and Information Centers.
7. Library Building, Furniture and Equipments; Green Library Building; Information Commons; Makers Space; Security and Safety.
8. Management Information System (MIS), MBO, Change Management, Disaster Management, Crisis Management.
9. Knowledge Management – Principles, Tools, Components and Architecture.
10. Marketing of Library Products and Services – Plan, Research, Strategies, Mix, Segmentation, Pricing and Advertising; Management Consultancy.

Unit - VII

1. Computer Technology - Character Representation (ASCII, ISCII, Unicode); Computer Hardware, Software; Storage Devices; Input and Output Devices.
2. Types of Software - System Software, Application Software.
3. Programming Languages – Object Oriented, Procedural, High Level, Scripting; Web Languages.
4. Telecommunication - Transmission Channels, Mode, and Media, ISDN, PSDN, Multiplexing, Modulation, Standards and Protocols.
5. Wireless Communication – Media, Wi-fi, Li-fi, Satellite Communication, Mobile Communication.
6. Computer Networks - Topologies, Types of Networks – LAN, MAN, WAN.
7. Internet - Web browsers, WWW, E-mail; Search Engines, Meta and Entity Search engines.
8. Internet Protocols and Standards – HTTP, SHTTP, FTP, SMTP, TCP/IP, URI, URL.
9. Hypertext, Hypermedia, Multimedia, Video conferencing, Virtual Reality, Augmented Technologies.
10. Data Security, Network Security, Firewalls, Cryptographic Techniques, Anti-virus software, Anti-spyware, Intrusion Detection System.

Unit – VIII

1. Library Automation – Areas, Planning, Selection of Hardware and Software, Implementation and Evaluation; Standards for Library Automation.
2. Barcode, RFID, QR Code, Biometric, Smartcard: Features and Applications.
3. Digitization – Planning, Selection of Materials, Hardware, Software, Process, Issues.
4. Digital Library: Genesis, Characteristics, Types, Architecture; Standards, Formats and Protocols, DOI.
5. Digital Preservation - Need, Purpose, Standards, Methods, Techniques, Projects (National and International).
6. Digital Library Initiatives – National and International.
7. Institutional Repositories - Need, Purpose, Types and Tools; Institutional Repositories in India; ROAR, DOAR, SHARPA-ROMIO.
8. Content Management Systems – Architecture, Data Integration, CMS Software – Selection, Implementation and Evaluation.
9. Application of Artificial Intelligence, Expert Systems and Robotics in Libraries; Social Mobile Analytics Cloud (SMAC); Cloud Computing.
10. Ontology – Tools (RDF, RDFS, Potege); Semantic Web, Linked Data, Big Data, Data Mining, Data Harvesting.

Unit – IX

1. Research - Concept, Purpose, Functions, Scope and Ethics; Types of Research – Basic and Applied, Interdisciplinary and Multidisciplinary.
2. Research Methods: Historical, Descriptive, Experimental and Delphi.
3. Research Design - Selection of Research Problem, Review of Literature; Formulation of Research Problem; Hypothesis – Formulation, Types and Testing; Sampling Techniques.
4. Methods of Data Collection: Questionnaire, Interview, Observation, Library Records, Scales and Checklist.
5. Data Analysis and Interpretation - Presentation of Data; Statistical Methods/ Techniques.
6. Statistical Packages – Spreadsheet, SPSS, Bibexcel, 'R' Statistics.
7. Research Report Writing and Citation Tools – Structure, Style, Contents, Guidelines; Style Manuals; Online Citation Tools; Reference Style Management Tools; Anti-plagiarism Tools; Evaluation of Research Report.
8. Metric Studies in LIS - Bibliometrics, Scientometric, Webometrics, Altmetrics;
9. Impact Factors – Journal, Institutional and Authors; h-Index, g-Index, i10 Index.
10. Trends in Library and Information Science Research.

Unit –X

1. Academic Library and Information System.
2. Public Library and Information System.
3. Special Library and Information System.
4. Health Science Library and Information System.
5. Corporate Library and Information System.
6. Agricultural Library and Information System.
7. Engineering and Technological Library and Information System.
8. Archive, Museums and Oriental Libraries.
9. Community Information System.
10. Information Services and System for Persons with Disability, Children and Women.

XXIII. PHYSICAL EDUCATION

Unit -I:

Physical education and adapted physical education, their objectives Philosophies of education as applied to physical education

Development of Physical education in Greece, Rome, Sweden, Russia England, Denmark, Germany, USA, Australia and China.

Growth and development of physical education in India:

Recreation- its principles, characteristics and importance. Modern trends in recreation. Indoor and outdoor recreational programmes. Recreational programmes for various categories of people.

Wellness- its importance, benefits and challenges. Development and maintenance of wellness.

Teaching Aptitude – nature, objectives, characteristics of teaching, learner characteristics and teaching methods.

Social aspects of sports- sports as a socializing agency, social values , sports leadership, sports as cultural heritage and social aspects of competition.

Ancient & Modern Olympics games, Asian and Commonwealth games.

Structure and functions of international and national bodies controlling various games and sports,.

Prominent honours and awards in games and sports.

Unit -II:

Exercise physiology its scope and importance in the field of physical education and sports.

Cardio respiratory adaptations to long and short term physical activities.

Muscle- its types , characteristics and functions. Microscopic structure of muscle fibre. Sliding filament theory of muscular contraction. Types of muscle fibres and sports performance. Muscular adaptations to exercise.

Neuro-muscular junction and transmission of nerve impulse, kinesthetic Sense organs and neural control of motor skills.

Bio-chemical aspects of exercise - Metabolism of food products. Aerobic and anaerobic systems during rest and exercise. Direct and indirect methods of measuring energy cost of exercise.

Recovery process - Physiological aspects of fatigue. Restoration of energy stores. Recovery oxygen. Nutritional aspects of performance.

Environmental influence on human physiology under exercise.

Women in sports- trainability. Physiological gender differences and special problems of women athletes.

Aging - Physiological consequences, life style management and healthful aging. Physiological responses of various therapeutic modalities and rehabilitation.

Physiological aspects of various Ergogenic aids. Massage manipulations and their physiological responses.

Unit- III:

Kinesiology and biomechanics. Modern trends in biomechanics. Planes and Axes of human body. Joints and their movements.

Muscle attachments - Origin, insertion, action and leverage of the principal muscles used in sports.

Motion: its laws and their application in sports. Projectile and principles of projections

Linear and angular kinematics and kinetics. Friction, Spin, impact and elasticity.

Air and water dynamics.

Mechanical advantage and applications of Levers in sports. Posture and its deformities with their corrective exercises.

Kinesiological, Muscular and mechanical analyses of fundamental movements: Mechanical analyses of major sports skills

Unit – IV:

Sports psychology- its importance in the field of physical education and sports.

Motivation in sports- types, theories and dynamics.

Psychological factors affecting sports performance- Emotions, Anxiety aggression, stress, self confidence, concentration, mental practice and goal setting.

Personality- Theories of personality, measurement of personality.

Group dynamics, Group cohesion and leadership in sports.

Cognitive process- memory and thinking. Principles of Motor skill learning. Transfer of training and its types with its implication in sports.

Long and short term psychological preparation for performance/ competition. Psychological skill training for activation and relaxation

Spectators and sports performance.

Unit -V:

Development of teacher education for physical education in India. Comparative study of professional preparation in physical education of India with those of USA, Russia, Germany, Australia and UK.

Professional and other courses of physical education in India. Role of Government agencies monitoring professional courses in physical education.

Qualities, qualifications and responsibilities of physical education personnel at primary, secondary and higher education levels. Scope of physical education personnel in the promotion of health, fitness and wellness.

Recent Government policies for promoting physical education and sports in India.

Hierarchy of organizational set-up in physical education at schools, colleges and university level.

Role of public & private sectors in the promotion of physical education and sports in the country.

Curriculum development- Concepts and principles of curriculum planning. Subject matter for different levels of education - primary, secondary and higher education.

Curriculum design and content- importance, selection and classification of subject matter with reference to age, sex and differently abled pupils. Integrated programme for boys and girls.

Teaching aids - Time-table, Concepts, credit system for various subject courses- theory and practical, Impact of technology in physical education and sports,

Curriculum evaluation: Concepts and purpose; procedure and appraisal.

Unit -VI:

Health- its objectives and spectrum. Health education, its importance and principles. Role of genetics and environment in achieving health. Health-related physical fitness.

Community health programme- Health appraisal & health instructions. International and national health promoting government & private agencies.

School Health programme and personal hygiene.

Communicable diseases: causes, symptoms, prevention through other means and Immunization.

Psychosomatic disorders/ sedentary life style diseases : causes, symptoms and prevention.

Obesity related health problems. Body weight control and its significance on health. Role of exercise, dieting and combination of exercise & dieting on weight control.

First-aid- objectives and principles. First-aid for Shock, poisoning, burns, drowning, bleeding, electric shock and common sports injuries.

Pollution- Air, water, sound and radiation. Effects of pollution on health, Preventive and safety measures from pollution.

Nutrition- Balanced diet and its components. Nutritional Deficiencies. Understanding of malnutrition and nutritional supplements.

Effects of smoking, alcohol, & drugs on health; prevention and rehabilitation.

Unit -VII :

Sports training- its characteristics and principles. Training load, its features, principles and adaptation process. Means and methods of executing training load. Overload, its Causes, symptoms and remedial measures.

Strength- its characteristics, types of strength, factors determining strength and strength development.

Endurance- its characteristics, types of endurance, factors determining endurance and endurance development.

Speed- its characteristics, types of Speed, factors determining Speed and speed development.

Flexibility-its characteristics, types of flexibility, factors determining flexibility and flexibility development.

Coordinative abilities- its characteristics, types of coordinative abilities, factors determining coordinative abilities and development of coordinative abilities.

Technique and skill- its characteristics and importance. Different stages of technique development and technique training. Tactics and strategy.

Planning- its importance and principles. Types of planning.

Periodization- its importance, objectives and types of periodization. Concept of different periods - Preparatory, competition and transitional. Types of Competition:

Talent identification- process and procedure.

Unit -VIII:

Research in physical education- its importance and classification. Ethical issues in research.

Methods of research- Descriptive, historical and experimental. Experimental research designs.

Identification and formulation of research problem. Types of research hypotheses and their formulation. Hypotheses testing.

Tools of research- Questionnaires, opinionnaires, interviews and observation.

Sources and steps of literature search- library, research data bases, internet- search engines, online journals. Note taking and critical reading.

Sampling Techniques- Probability and non probability. Data, its types and collecting measures.

Normal probability curve and grading scales.

Statistical processes, their importance and uses in research.

Application of parametric and non parametric statistical techniques in research.

Computer applications- statistical packages for data analyses- SPSS, e-mail, search engines and Microsoft office.

Preparation of research proposal, report, abstract, paper for publication and paper for presentation.

Unit - IX:

Test, measurement and evaluation -their types and importance in physical education and sports. Principles and processes of evaluation in physical education.

Criteria of selecting an appropriate test and administration of testing programme.

Types of tests and construction of standard knowledge and skill tests.

Tests for fitness- Physical fitness, motor fitness, motor ability and motor educability. Health related fitness tests.

Test for fitness components- strength, endurance, speed, flexibility and coordinative abilities.

Sports skill tests- Badminton, Basketball, Football, Hockey, Tennis, and Volleyball.

Anthropometric Measurements- land marks and measurement of various body segments ,height, sitting-height, weight, diameters, circumferences, skinfolds, body mass index, ponderal index.

Somatotype and Posture evaluating techniques.

Testing of physiological phenomenons- Blood pressure, breathing frequency vital capacity, heart

rate, pulse rate, body temperature and body composition.

Tests for psychological variables- Anxiety, aggression, team cohesion, achievement motivation, mental-toughness, and self-efficacy.

Unit - X:

Management- its principles and theories. Scope of management in physical education and sports.

Guiding principles for organizing physical education & sports programmes in institutions.

Personnel management- objectives and principles. Self-appraisal, communication skills and time management. Essential skills of administration.

Financial management- objectives, purposes, principles and scope. Planning and preparation of budget. Mechanics of purchase and auditing.

Supervision - objectives, principles and importance of supervision. Techniques of supervision.

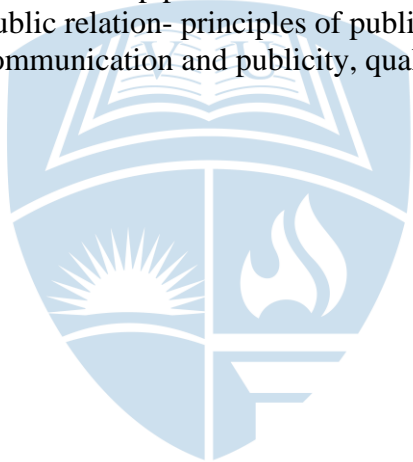
Duties and responsibilities of a supervisor.

Facility management- planning, procuring and maintenance of facilities- indoor and outdoor facilities. Planning and management of sports infrastructure. Management of records.

Role of sports manager- interpersonal, informational and decision making. Managerial skills – technical, human and conceptual. Qualities and qualification of sports manager.

Event management- its principles, planning, check list, rehearsal, itinerary, execution, reporting and follow-up procedures of an event.

Public relation- principles of public relations in physical education and sports. Mass Media-communication and publicity, qualifications of Public relation officer.



XXIV. POLITICAL SCIENCE

Unit - 1 : Political Theory

Concepts

Liberty, Equality, Justice, Rights, Democracy, Power, Citizenship,
Political Traditions Liberalism Conservatism Socialism

Marxism Feminism Ecologism Multiculturalism Postmodernism

Unit - 2 : Political Thought

Confucius, Plato, Aristotle, Machiavelli, Hobbes, Locke, Rousseau, Hegel, Mary Wollstonecraft,
John Stuart Mill, Karl Marx, Gramsci, Hannah Arendt, Frantz Fanon, Mao Zedong, John Rawls

Unit - 3 : Indian Political Thought

Dharamshastra, Kautilya, Aggannasutta, Barani, Kabir, Pandita Ramabai, Bal Gangadhar Tilak,
Swami Vivekanand, Rabindranath Tagore, M.K Gandhi, Sri Aurobindo, Periyar E. V. Ramasamy,
Muhammad Iqbal, M.N.Roy, V D Savarkar, Dr. B.R.Ambedkar, J L Nehru, Ram Manohar Lohia,
Jaya Prakash Narayan, Deendayal Upadhyaya

Unit - 4 : Comparative Political Analysis

Approaches: Institutional, Political Culture, Political Economy and New Institutionalism;
Comparative Methods

Colonialism and decolonization: forms of colonialism, anti-colonial struggles and decolonization
Nationalism: European and non-European.

State theory: debate over the nature of state in capitalist and socialist societies; post-colonial state;
welfare state; globalization and nations-states

Political regimes: democratic (Electoral, Liberal, Majoritarian and Participatory) and non-
democratic regimes (Patrimonialism, Bureaucratic authoritarianism, Military dictatorship,
Totalitarianism, and fascist).

Constitutions and Constitutionalism: forms of constitutions, rule of law, judicial independence and
liberal constitutionalism; emergency powers and crisis of constitutionalism.

Democratisation: democratic transition and consolidation.

Development: Underdevelopment, Dependency, Modernization, World Systems Theory,
development and democracy.

Structures of Power: ruling class, power elites, democratic elitism

Actor and Processes: Electoral Systems, Political Parties and Party System, Interest groups, Social
movements, new social movements, Non Governmental Organisations (NGOs) and civil society
campaigns; Revolutions.

Unit - 5 : International Relations

Approaches to the study of International relations: Idealism, Realism, Structural Marxism,
Neoliberalism, Neorealism, Social Constructivism, Critical International Theory, Feminism,
Postmodernism.

Concepts: State, state system and non-state actors, Power, Sovereignty, Security: traditional and
non- traditional.

Conflict and Peace: Changing Nature of Warfare; Weapons of mass destruction; deterrence;
conflict resolution, conflict transformation.

United Nations: Aims, Objectives, Structure and Evaluation of the Working of UN; Peace and
Development perspectives; Humanitarian intervention. International law; International Criminal
Court

Political Economy of IR; Globalisation; Global governance and Bretton Woods system, North-
South Dialogue, WTO, G-20, BRICS.

Regional Organisations: European Union, African Union, Shanghai Cooperation Organisation,
ASEAN.

Contemporary Challenges: International terrorism, Climate change and Environmental Concerns, Human Rights, Migration and Refugees; Poverty and Development; Role of Religion, Culture and Identity Politics.

Unit - 6 : India's Foreign Policy

Perspectives on India's Foreign Policy: India's Identity as postcolonial, development, rising power and as emerging political economy

Continuity and change in India's Foreign Policy: Principles and determinants; Non-Alignment movement: historical background and relevance of Non Aligned Movement; India's Nuclear Policy India's relations with major powers: USA, USSR/Russia, People's Republic of China

India's Engagement with multipolar world: India's relations with European Union, BRICS, ASEAN, Shanghai Cooperation Organisation, African Union, Southern African Development Community, Gulf Cooperation Council

India's relations with neighbourhood: SAARC, Gujaral doctrine, Look East/ Act East, Look West.

India's Negotiation Strategies in International Regimes: The United Nations, World Trade Organisation, International Monetary Fund, Intergovernmental Panel on Climate Change

Contemporary challenges: maritime security, energy security, environmental security, migrants and refugees, water resources, international terrorism, cyber security

Unit - 7 : Political Institutions in India

Making of the Indian Constitution: Colonialism heritage and the contribution Indian National Movement to the making of the Indian Constitution

Constituent Assembly: Composition, Ideological Moorings, Constitutional Debates

Philosophy of the Constitution: Preamble, Fundamental Rights, Directive Principles

Constitutionalism in India: Democracy, Social Change, National Unity, Checks and Balances, Basic Structure Debate, Constitutional Amendments

Union Executive: President, Prime Minister and Council of Ministers

Union Parliament: Structure, Role and Functioning, Parliamentary Committees

Judiciary: Supreme Court, High Court, Judicial Review, Judicial Activism, Judicial Reform.

Executive and Legislature in the States: Governor, Chief Minister, State Legislature

Federalism in India: Strong Centre Framework, Asymmetrical Federal Provisions and Adaption, Role of Intergovernmental Coordination Mechanisms, Inter-State Council, Emerging Trends.

Electoral Process and Election Commission of India: Conduct of Elections, Rules, Electoral Reforms.

Local Government Institutions: Functioning and reforms.

Constitutional and Statutory Bodies: Comptroller and Auditor General, National Commission for Scheduled Castes, National Commission for Scheduled Tribes, National Commission for Human Rights, National Commission for Women, National Commission for Minorities.

Unit - 8 : Political Processes in India

State, Economy and Development: Nature of Indian State, Development Planning model, New Economic Policy, Growth and Human Development.

Process of globalisation: social and economic implications. Identity Politics: Religion, Tribe, Caste, Region, Language. Social Movements: Dalit, Tribal, Women, Farmers, labour

Civil Society Groups: Non-Party Social Formations, Non-Governmental Organisations, Social Action Groups.

Regionalisation of Indian Politics: Reorganisation of Indian States, States as Political and Economic Units, Sub-State Regions, Regional disparities, Demand for New States,

Gender and Politics in India: Issues of Equality and Representation. Ideology and Social basis of Political Parties: National Parties, State Parties.

Electoral Politics: Participation, Contestation, Representation, Emerging trends.

Unit - 9 : Public Administration

Public Administration: meaning and evolution; public and private administration Approaches:

System Theory, Decision Making, Ecological Approach
Public administration theories and concepts: Scientific Management Theory,
Rational Choice theory, New Public Administration, Development Administration,
Comparative Public Administration, New Public Management, changing nature of Public
Administration in the era of liberalisation and Globalisation
Theories and Principles of Organization: Scientific Management Theory, Bureaucratic Theory,
Human Relations Theory
Managing the organization: Theories of leadership and motivation.
Organisational Communication: Theories and Principles, Chester Bernard Principles of
Communication, Information Management in the organization
Managing Conflict in the Organization: Mary Parker Follett Management by Objectives- Peter
Drucker

Unit – 10 : Governance and Public Policy in India

Governance, good governance and democratic governance, role of state, civil society and
individuals.

Accountability and control: Institutional mechanism for checks and balances, legislative control
over executive, administrative and budgetary control, control through parliamentary committees,
judicial control over legislature and executive, administrative culture, corruption and administrative
reforms

Institutional mechanisms for good governance: Right to Information, Consumer Protection Act,
Citizen Charter; Grievance redress system: Ombudsman, Lokpal, Lokayukta

Grassroots Governance: Panchayati Raj Institutions and their functioning

Planning and Development: Decentralised planning, planning for development, sustainable
development, participatory development, e-governance; NITI Aayog

Public policy as an instrument of socio-economic development: public policies with special
reference to housing, health, drinking water, food security, MNREGA, NHRM, RTE

Monitoring and evaluation of public policy; mechanisms of making governance process
accountable: jansunwai, social audit.

XXV. PSYCHOLOGY

UNIT 1 Emergence of Psychology

Psychological thought in some major Eastern Systems: Bhagavad Gita, Buddhism, Sufism and Integral Yoga. Academic psychology in India: Pre- independence era; post-independence era; 1970s: The move to addressing social issues; 1980s: Indigenization; 1990s: Paradigmatic concerns, disciplinary identity crisis; 2000s: Emergence of Indian psychology in academia. Issues: The colonial encounter; Post colonialism and psychology; Lack of distinct disciplinary identity. Western: Greek heritage, medieval period and modern period. Structuralism, Functionalism, Psychoanalytical, Gestalt, Behaviorism, Humanistic- Existential, Transpersonal, Cognitive revolution, Multiculturalism. Four founding paths of academic psychology - Wundt, Freud, James, Dilthey. Issues: Crisis in psychology due to strict adherence to experimental- analytical paradigm (logical empiricism). Indic influences on modern psychology.

Essential aspects of knowledge paradigms: Ontology, epistemology, and methodology. Paradigms of Western Psychology: Positivism, Post-Positivism, Critical perspective, Social Constructionism, Existential Phenomenology, and Co-operative Enquiry. Paradigmatic Controversies. Significant Indian paradigms on psychological knowledge: Yoga, Bhagavad Gita, Buddhism, Sufism, and Integral Yoga. Science and spirituality (avidya and vidya). The primacy of self-knowledge in Indian psychology.

UNIT 2 Research Methodology and Statistics

Research: Meaning, Purpose, and Dimensions.

Research problems, Variables and Operational Definitions, Hypothesis, Sampling.

Ethics in conducting and reporting research

Paradigms of research: Quantitative, Qualitative, Mixed methods approach Methods of research:

Observation, Survey [Interview, Questionnaires], Experimental, Quasi-experimental, Field studies, Cross-Cultural Studies, Phenomenology, Grounded theory, Focus groups, Narratives, Case studies, Ethnography

Statistics in Psychology: Measures of Central Tendency and Dispersion. Normal Probability Curve. Parametric [t-test] and Non-parametric tests [Sign Test, Wilcoxon Signed rank test, Mann-Whitney test, Kruskal-Wallis test, Friedman]. Power analysis. Effect size.

Correlational Analysis: Correlation [Product Moment, Rank Order], Partial correlation, multiple correlation.

Special Correlation Methods: Biserial, Point biserial, tetrachoric, phi coefficient.

Regression: Simple linear regression, Multiple regression.

Factor analysis: Assumptions, Methods, Rotation and Interpretation.

Experimental Designs: ANOVA [One-way, Factorial], Randomized Block Designs, Repeated Measures Design, Latin Square, Cohort studies, Time series, MANOVA, ANCOVA. Single-subject designs.

UNIT 3 Psychological testing

Types of tests

Test construction: Item writing, item analysis

Test standardization: Reliability, validity and Norms

Areas of testing: Intelligence, creativity, neuropsychological tests, aptitude, Personality assessment, interest inventories

Attitude scales – Semantic differential, Staples, Likert scale. Computer-based psychological testing

Applications of psychological testing in various settings: Clinical, Organizational and business, Education, Counseling, Military. Career guidance.

UNIT 4 Biological basis of behavior

Sensory systems: General and specific sensations, receptors and processes

Neurons: Structure, functions, types, neural impulse, synaptic transmission. Neurotransmitters.

The Central and Peripheral Nervous Systems – Structure and functions. Neuroplasticity.

Methods of Physiological Psychology: Invasive methods – Anatomical methods, degeneration techniques, lesion techniques, chemical methods, microelectrode studies. Non-invasive methods – EEG, Scanning methods.

Muscular and Glandular system: Types and functions Biological basis of Motivation: Hunger, Thirst, Sleep and Sex.

Biological basis of emotion: The Limbic system, Hormonal regulation of behavior.

Genetics and behavior: Chromosomal anomalies; Nature-Nurture controversy [Twin studies and adoption studies]

UNIT 5 Attention, Perception, Learning, Memory and Forgetting Attention: Forms of attention, Models of attention Perception:

Approaches to the Study of Perception: Gestalt and physiological approaches Perceptual

Organization: Gestalt, Figure and Ground, Law of Organization Perceptual Constancy: Size, Shape, and Color; Illusions

Perception of Form, Depth and Movement Role of motivation and learning in perception

Signal detection theory: Assumptions and applications

Subliminal perception and related factors, information processing approach to perception, culture and perception, perceptual styles, Pattern recognition, Ecological perspective on perception.

Learning Process:

Fundamental theories: Thorndike, Guthrie, Hull

Classical Conditioning: Procedure, phenomena and related issues Instrumental learning:

Phenomena, Paradigms and theoretical issues; Reinforcement: Basic variables and schedules; Behaviour modification and its applications

Cognitive approaches in learning: Latent learning, observational learning. Verbal learning and Discrimination learning

Recent trends in learning: Neurophysiology of learning

Memory and Forgetting

Memory processes: Encoding, Storage, Retrieval

Stages of memory: Sensory memory, Short-term memory (Working memory), Long-term Memory (Declarative – Episodic and Semantic; Procedural)

Theories of Forgetting: Interference, Retrieval Failure, Decay, Motivated forgetting

UNIT 6 Thinking, Intelligence and Creativity

Theoretical perspectives on thought processes: Associationism, Gestalt, Information processing, Feature integration model

Concept formation: Rules, Types, and Strategies; Role of concepts in thinking Types of Reasoning Language and thought

Problem solving: Type, Strategies, and Obstacles Decision-making: Types and models

Metacognition: Metacognitive knowledge and Metacognitive regulation

Intelligence: Spearman; Thurstone; Jensen; Cattell; Gardner; Stenberg; Goleman; Das, Kar & Parrila

Creativity: Torrance, Getzels & Jackson, Guilford, Wallach & Kogan Relationship between Intelligence and Creativity

UNIT 7 Personality, Motivation, emotion, stress and coping

Determinants of personality: Biological and socio-cultural

Approaches to the study of personality: Psychoanalytical, Neo-Freudian, Social learning, Trait and Type, Cognitive, Humanistic, Existential, Transpersonal psychology.

Other theories: Rotter's Locus of Control, Seligman's Explanatory styles, Kohlberg's theory of

Moral development.

Basic motivational concepts: Instincts, Needs, Drives, Arousal, Incentives,

Motivational Cycle.

Approaches to the study of motivation: Psychoanalytical, Ethological, S-R Cognitive, Humanistic
Exploratory behavior and curiosity

Zuckerman's Sensation seeking Achievement, Affiliation and Power Motivational Competence

Self-regulation Flow

Emotions: Physiological correlates

Theories of emotions: James-Lange, Canon-Bard, Schachter and Singer, Lazarus, Lindsley.

Emotion regulation

Conflicts: Sources and types

Stress and Coping: Concept, Models, Type A, B, C, D behaviors, Stress management strategies
[Biofeedback, Music therapy, Breathing exercises, Progressive Muscular Relaxation, Guided
Imagery, Mindfulness, Meditation, Yogasana, Stress Inoculation Training].

UNIT 8 Social Psychology

Nature, scope and history of social psychology

Traditional theoretical perspectives: Field theory, Cognitive Dissonance, Sociobiology,
Psychodynamic Approaches, Social Cognition.

Social perception [Communication, Attributions]; attitude and its change within cultural context;
prosocial behavior

Group and Social influence [Social Facilitation; Social loafing]; Social influence [Conformity, Peer
Pressure, Persuasion, Compliance, Obedience, Social Power, Reactance]. Aggression. Group
dynamics, leadership style and effectiveness. Theories of intergroup relations [Minimal Group
Experiment and Social Identity Theory, Relative Deprivation Theory, Realistic Conflict Theory,
Balance Theories, Equity Theory, Social Exchange Theory]

Applied social psychology: Health, Environment and Law; Personal space, crowding, and
territoriality.

UNIT 9 Human Development and Interventions

Developmental processes: Nature, Principles, Factors in development, Stages of Development.

Successful aging.

Theories of development: Psychoanalytical, Behavioristic, and Cognitive Various aspects of
development: Sensory-motor, cognitive, language, emotional, social and moral.

Psychopathology: Concept, Mental Status Examination, Classification, Causes

Psychotherapies: Psychoanalysis, Person-centered, Gestalt, Existential, Acceptance Commitment
Therapy, Behavior therapy, REBT, CBT, MBCT, Play therapy, Positive psychotherapy,
Transactional Analysis, Dialectic behavior therapy, Art therapy, Performing Art Therapy, Family
therapy.

Applications of theories of motivation and learning in School Factors in educational achievement
Teacher effectiveness

Guidance in schools: Needs, organizational set up and techniques Counselling: Process, skills, and
techniques

UNIT 10 Emerging Areas

Issues of Gender, Poverty, Disability, and Migration: Cultural bias and discrimination. Stigma,
Marginalization, and Social Suffering; Child Abuse and Domestic violence.

Peace psychology: Violence, non-violence, conflict resolution at macro level, role of media in
conflict resolution.

Wellbeing and self-growth: Types of wellbeing [Hedonic and Eudemonic], Character strengths,

Resilience and Post-Traumatic Growth.

Health: Health promoting and health compromising behaviors, Life style and Chronic diseases [Diabetes, Hypertension, Coronary Heart Disease], Psychoneuroimmunology [Cancer, HIV/AIDS]

Psychology and technology interface: Digital learning; Digital etiquette: Cyber bullying; Cyber pornography: Consumption, implications; Parental mediation of Digital Usage.



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XXVI. SOCIOLOGY

Unit -1 : Sociological Theory

1. Classical Sociological Traditions
 - Emile Durkheim
 - Max Weber
 - Karl Marx
2. Structure- Functionalism and Structuralism
 - Bronislaw Malinowski
 - A.R. Radcliffe- Brown
 - Talcott Parsons
 - Robert K. Merton
 - Claude Levi Strauss
3. Hermeneutic and Interpretative Traditions
 - G.H. Mead
 - Karl Manheim
 - Alfred Schutz
 - Harold Garfinkel
 - Erving Goffman
 - Clifford Geertz
4. Post Modernism, Post Structuralism and Post Colonialism
 - Edward Said
 - Pierre Bourdieu
 - Michel Foucault
 - Jurgen Habermas
 - Anthony Giddens
 - Manuel Castells
5. Indian Thinkers
 - M.K. Gandhi
 - B.R. Ambedkar
 - Radha Kamal Mukherjee
 - G. S. Ghurye
 - M.N. Srinivas
 - Irawati Karve

Unit - 2 : Research Methodology and Methods

1. Conceptualizing Social Reality
 - Philosophy of Science

- Scientific Method and Epistemology in Social Science
- Hermeneutic Traditions
- Objectivity and Reflexivity in Social Science
- Ethics and Politics

2. Formulating Research Design

- Reading Social Science Research, Data and Documents
- Induction and Deduction
- Fact, Concept and Theory
- Hypotheses, Research Questions, Objectives

3. Quantitative and Qualitative Methods

- Ethnography
- Survey Method
- Historical Method
- Comparative Method

4. Techniques

- Sampling
- Questionnaire and Schedule
- Statistical Analysis
- Observation, Interview and Case study
- Interpretation, Data Analysis and Report Writing

Unit -3 : Basic Concepts and Institutions

1. Sociological Concepts

- Social Structure
- Culture
- Network
- Status and Role
- Identity
- Community
- Diaspora
- Values, Norms and Rules
- Personhood, Habitus and Agency
- Bureaucracy, Power and Authority

2. Social Institutions

- Marriage, Family and Kinship
- Economy
- Polity
- Religion

- Education
- Law and Customs

3. Social Stratification

- Social Difference, Hierarchy, Inequality and Marginalization
- Caste and Class
- Gender, Sexuality and Disability
- Race, Tribe and Ethnicity

5. Social Change and Processes

- Evolution and Diffusion
- Modernization and Development
- Social Transformations and Globalization
- Social Mobility

Unit – 4 : Rural and Urban Transformations

1. Rural and Peasant Society

- Caste-Tribe Settlements
- Agrarian Social Structure and Emergent Class Relations
- Land Ownership and Agrarian Relations
- Decline of Agrarian Economy, De-Peasantization and Migration
- Agrarian Unrest and Peasant Movements
- Changing Inter-Community Relations and Violence

2. Urban Society

- Urbanism, Urbanity and Urbanization
- Towns, Cities and Mega-Cities
- Industry, Service and Business
- Neighbourhood, Slums and Ethnic Enclaves
- Middle Class and Gated Communities
- Urban Movements and Violence

Unit – 5 : State, Politics and Development

1. Political Processes in India

- Tribe, Nation State and Border
- Bureaucracy
- Governance and Development
- Public Policy: Health, Education and Livelihoods
- Political Culture
- Grass-root Democracy
- Law and Society
- Gender and Development

- Corruption
- Role of International Development Organizations

2. Social Movements and Protests

- Political Factions, Pressure Groups
- Movements based on Caste, Ethnicity, Ideology, Gender, Disability, Religion and Region
- Civil Society and Citizenship
- NGOs, Activism and Leadership
- Reservations and Politics

Unit – 6 : Economy and Society

- Exchange, Gift , Capital, Labour and Market
- Mode of Production Debates
- Property and Property Relations
- State and Market: Welfarism and Neoliberalism
- Models of Economic Development
- Poverty and Exclusion
- Factory and Industry Systems
- Changing Nature of Labour Relations
- Gender and Labour Process
- Business and Family
- Digital Economy, E-Commerce
- Global Business and Corporates
- Tourism
- Consumption

Unit - 7: Environment and Society

- Social and Cultural Ecology: Diverse Forms
- Technological Change, Agriculture and Biodiversity
- Indigenous Knowledge Systems and Ethno-Medicine
- Gender and Environment
- Forest Policies, Adivasis and Exclusion
- Ecological Degradation and Migration
- Development, Displacement and Rehabilitation
- Water and Social Exclusion
- Disasters and Community Responses
- Environmental Pollution, Public Health and Disability
- Climate Change and International Policies
- Environmental Movements

Unit - 8: Family, Marriage and Kinship

- Theoretical Approaches: Structure-Functionalist, Alliance and Cultural
- Gender Relations and Power Dynamics
- Inheritance, Succession and Authority
- Gender, Sexuality and Reproduction
- Children, Youth and Elderly
- Emotions and Family
- Emergent Forms of Family
- Changing Marriage Practices
- Changing Care and Support Systems
- Family Laws
- Domestic Violence and Crime against Women
- Honour Killing

Unit - 9 : Science, Technology and Society

- History of Technological Development
- Changing notions of Time and Space
- Flows and Boundaries
- Virtual Community
- Media: Print and Electronic, Visual and Social Media
- E-Governance and Surveillance Society
- Technology and Emerging Political Processes
- State Policy, Digital Divide and Inclusion
- Technology and Changing Family Relations
- Technology and Changing Health Systems
- Food and Technology
- Cyber Crime

Unit - 10 : Culture and Symbolic Transformations

- Signs and Symbols
- Rituals, Beliefs and Practices
- Changing Material Culture
- Moral Economy
- Education: Formal and Informal
- Religious Organizations, Piety and Spirituality
- Commodification of Rituals
- Communalism and Secularism
- Cultural Identity and Mobilization
- Culture and Politics
- Gender, Body and Culture
- Art and Aesthetics

- Ethics and Morality
- Sports and Culture
- Pilgrimage and Religious Tourism
- Religion and Economy
- Culture and Environment
- New Religious Movements



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XXVII. YOGA & NATUROPATHY

UNIT- I

Fundamentals of Yoga: History and Various Schools of Yoga

- History and Development of Yoga; Meaning & Definitions, Misconceptions, Aim and Objectives of Yoga.
- Introduction to Vedas, Upanishads and Prasthanatrayee; Concept of Purushartha Chatushtaya
- Basic concepts of Shad-darshanas- Epistemology, Metaphysics, Ethics and Liberation with special emphasis to Samkhya, Yoga and Vedanta Darshana.
- Introduction to Epics and Smriti- yoga in Ramayana (Aranyakand), Mahabharata (Shantiparva) and Yajnavalkya Smriti
- Brief introduction and yogic contribution of Maharshi Patanjali and Guru Gorakshanath Traditions.
- Yoga in Narada Bhaktisutra and Yoga in the Literature of Saints- Kabirdas, Tulasidas and Surdas.
- Yoga in Modern Times: Yogic Traditions of Swami Vivekananda, Shri Aurobindo; Maharshi Ramana and Maharshi Dayanand Saraswati
- Yoga in Contemporary Times: Brief Introduction of Sri Shyamacharan Lahidi ,Sri T. Krishnamacharya, Swami Shivanada Saraswati, Swami Rama of Himalayas, Maharshi Mahesh Yogi, Pt. Sri Ram Sharma Acharya and their contribution for the development and promotion of Yoga.
- Introduction to Jnanayoga, Bhaktiyoga, Karmayoga, Rajayoga, Hathayoga and Mantra Yoga
- Elements of Yoga in Jainism and Buddhism.

UNIT- II

Yogic Texts- I: Principal Upanishads, BhagavadGita, Yoga Vasishtha

Principal Upanishads

Brief Introduction of Ten Principal Upanishads.

Ishavasyopanishad: Concept of Karmanishta; Concept of Vidya and Avidya; Knowledge of Brahman; Atma Bhava.

KenaUpanishad: Self and the Mind; Intuitive realization of the truth; Moral of Yaksha Upakhyana.

KathaUpanishad: Definition of Yoga; Nature of Soul; Importance of Self Realization.

Prashna Upanishad: Concept of Prana and rayi (creation); Panchapranas; The six main questions;

Mundaka Upanishad: Two approaches to Brahma- Vidya- Para and Apara; The greatness of Brahavidya; Worthlessness of Selfish-karma; Tapas and Gurubhakti; The origin of creation, the ultimate aim of Meditation- Brahmanubhuti.

Mandukya Upanishad: Four States of Consciousness and their relation to syllables in Omkara.

Aitareya Upanishad: Concept of Atma, Universe and Brahman.

Taittiriya Upanishad: Concept of Pancha Kosha; Summary of Shiksha Valli, AnandaValli, Bhrguvalli.

Chhandogya Upanishad: Om (udgitha) Meditation; Shandilyavidya.

Brihadaranyaka Upanishad: Concept of Atman and Jnana Yoga; Union of Atman and Paramatman

Bhagavad Gita

General Introduction to Bhagavad Gita, Definitions of Yoga, their relevance & Scope; Essentials of Bhagavad Gita - meanings of the terms Atmaswarupa, Stithaprajna, Sankhya Yoga (Chpt.II), Karma Yoga (Chpt.III), Samnyasa Yoga and Karma Swarupa (Sakama and Nishkama) Samnyasa, Dhyana Yogas (Chpt. VI); Types of Bhakta(Chpt. VII) Nature of Bhakti (Chpt.XII), Means and End of Bhakti-Yoga; The Trigunas and nature of Prakriti; Three Kinds of Faith. Food for Yoga-Sadhaka, Classification of food (Chpt.XIV & XVII) Daivasura-Sampad-Vibhaga Yoga (Chpt.XVI);Moksa-SamnyasaYoga (Chpt. XVIII)

Yoga Vasishtha:

Salient features of Yoga Vashitha, Concept of Adhis and Vyadhis; Psychosomatic Ailments; The four Dwarpaals to Freedom; How Sukha is attained in the Highest State of Bliss; Practices to overcome the Impediments of Yoga; Development of Satvaguna; Eightlimbs of Meditation; Jnana Saptabhumi.

UNIT- III

Yogic texts- II: Yoga Upanishads:

- **Swetaswataropanisad:** (Chapter II) Techniques and Importance of Dhyanyoga, suitable place for Dhyana, sequence of pranayama & its importance, Prior symptoms of Yogasiddhis, Importance of Yogasiddhis , Tattvajna, (ChapterVI) Nature of God, techniques for Realization, Attainment of liberation.
- **Yogakundali Upanishad:** Methods of Pranayama Siddhi, Types of Pranayama, means of Self -realization.
- **Yogachudamadi Upanishad:** The description of the six limbs of yoga, their results and sequence
- **Trishikhibrahmanopanisad:** description of Ashtangayoga, Karmayoga and Jnanayoga.
- **Yogatattva Upanishad:** Mantrayoga, Layayoga, Hathayoga, Rajayoga and their stages, diet and Dincharya, primary symptoms of yoga siddhis and precautions.
- **Dhyانبindoopanisad:** importance of Dhyanyoga, Nature of Pranav, Techniques of Pranav meditation, Shadanyoga, Atmadarshan through Nadanusandhan.
- **Nadabindoopanisad:** Hansavidya : description of various limbs of Omkar, 12 matras of omkar and its results of their application with Pranas, Types of nadas, nature of nadanusandhan sadhana, state of Manolaya.
- **Yogarajopanisad:** Mantrayoga, Layayoga, Hathayoga, Rajayoga, nine chakras, procedures of Dhyana and its results.

UNIT- IV

Patanjala Yoga Sutra:

SAMADHI PAADA : Yoga, meaning & Nature of yoga; Concept of Chitta, Chitta-Bhumis, Chitta-Vrittis, Chitta-Vrittinirodhopaya, Abhyasa and Vairagya as the tools, Concept of Bhavapratyaya & Upaypratayaya, Sadhan Panchak, Chitta-Vikshepas (Antaraya), Ektattva Abhyasa, Chitta-prasadanam. Types and nature of Samadhi: Adhyatmaprasada and Ritambharaprajna; Samprajnata, Asamprajnata, Sabeeja & Nirbeeja Samadhi, Difference between Samapattis and Samadhi; Concept of Ishwara and attributes of Ishwara, Process of Ishwarapranidhana.

SADHANA PAADA: Concept of Kriya Yoga , theory of Kleshas ; Concept of Karmashaya and Karmvipaka, Nature of dhukha, Concept of Chaturvyuhavada, Drishyanirupanam, Drasthanirupanam, Prakriti-Purusha Samyoga; Brief Introduction to Ashtanga Yoga; Yama-Niyama; Concept of Vitarka & Mahavrata; Asana, Pranayama, Pratyahara and their siddhis.

VIBHUTI-PAADA: Introduction of Dharana, Dhyana and Samadhi, Nature of Sanyama; Concept of Chitta samskara, Parinamatraya and vibhutis.

KAIVALYA PAADA: Five means of Siddhis, concept of Nirman Chitta, Importance of siddhis achieved through Samadhi, Four types of Karmas; Concept of Vasana; Dharmamegh Samadhi and its result, Viveka Khyati Nirupanam, Kaivalya Nirvachana.

UNIT-V

Hatha Yoga texts

- **Introduction to Hatha Yoga and Hatha Yoga Texts.** Yoga Beeja, Goraksha Samhita, Vashishtha Samhita, Shiva Samhita, Siddhasiddhantapaddhati, Hatha Pradeepika, Gheranda Samhita and Hatha Ratnavali. Aim & objectives, misconceptions about Hathayoga, prerequisites of Hathayoga (dasha yama and dasa niyama), Sadhaka and Badhaka tattvas in Hathayoga; Concept of Ghata, Ghatashuddhi, Concept and importance of Shodhana kriyas in Hathayoga; Importance of Shodhana kriyas in health and disease; Concept of Matha, Mitaahara, Rules & Regulations to be followed by Hatha Yoga Sadhakas;
- **Asanas in Hatha Texts:** Definition, pre requisites and special features of Yoga-asana; Asanas in Hatha Pradeepika, Hatha Ratnavali, Shiv Samhita, Vasishta Samhita, Gheranda Samhita-benefits, precautions and contra indications of different Asanas;
- **Pranayama in Hatha Texts:** - Concept of Prana and Pranayama; Pranayama-its phases and stages; Prerequisites of Pranayama in Hathayoga Sadhana; Pranayama in Hatha Pradeepika, Gheranda Samhita; Shiv Samhita, Vashishtha Samhita-benefits, precautions and contra indications of different Pranayama.
- **Bandha, Mudra and other practices:** Concept and definition of Bandha and Mudras in Hatha Pradeepika, Hatha Ratnavali and Gheranda Samhita; Shiv Samhita, Vashishtha Samhita-benefits, precautions and contra indications. Concept, definition, benefits and Techniques of Pratyahara, Dhyana in Gheranda Samhita; Concept and benefits of Nada and Nadanusandhana

in Hatha Pradeepika, Four (stages) Avasthas of Nadanusandhana; Relationship between Hatha Yoga and Raja Yoga; Goal of Hatha Yoga. Relevance of Hatha Yoga in contemporary times.

UNIT-VI

General Psychology

- **Introduction to Altered States of Consciousness**

Sleep: Stages of Sleep, Sleep Disorders;

- **Behavioural Psychology:** Psychology as a Science of Behaviour; Psychological basis of behaviour;

- **Personality:** Nature and Types of Personality; Determinants of Personality: Heredity and Environment; Facets and Stages of Personality Development;

- **Cognitive Psychology:** Sensation, Perception, Attention, Memory, Learning :- Their definitions and types,

Mental Health; Causes and Consequences of Mental Conflicts and Frustrations; Introduction to Common mental disorders: Insomnia, Depression, Stress, Anxiety disorders

Introduction to Human Anatomy and Physiology

- Introduction to cell, tissue, organs and systems; Basic cell physiology-Cell-Introduction, Cell Organelles, Cell membrane, Movement of the substances and water through the cell membrane, Bioelectric potentials.
- Musculoskeletal systems: Skeleton - names of all bones, joints and muscles, cartilage, tendon and ligaments, types of bone, joints and their functions; spine, muscles and their functions; Skeletal muscles - Properties of skeletal muscles, Muscular contraction and relaxation, Neuromuscular junction, Sarcotubular system, Smooth muscle- mechanism of contraction
- Digestive and excretory system: Anatomy of digestive system, excretory system (component organs) and their functions; Gastro intestinal system- General structure of alimentary canal, Gastric secretion, Pancreatic secretion, Gastric motility-digestive peristalsis Gastrointestinal hormones.
- Renal physiology- Structure of kidney, Nephrons, Juxtra glomerular filtrate, Reabsorption, Secretion-mechanism of secretion, Concentrating and diluting mechanism of urine, Dialysis
- Nervous system and glands: Structure and properties of neurons, subdivisions of nervous system and their functions, types of glands (endocrine and exocrine glands), important endocrine and exocrine glands and types of hormones their functions.
- Sensory nervous system, Motor nervous system, Higher functions of the nervous system, Synapse, Reflexes Cerebrospinal fluid, Blood brain and blood CSF barrier
- Cardiovascular and respiratory system: Components of cardiovascular and respiratory system; functions of cardiovascular and respiratory system; Circulatory system- Functional anatomy of the heart, Properties of cardiac muscles, Conducting system of

the heart, Pressure changes during cardiac cycles, Capillary circulation, Arterial and venous blood pressure; Respiratory system-Mechanism of breathing, Ventilation, Regulation of respiration, Transport of gases, Hypoxia, Artificial ventilation, Non respiratory functions of the lungs

- Immune system: Component organs of immune system, Functions of immune system; Endocrinology-Endocrine glands, hormones, their functions;
- Reproductive system: Anatomy of male and female reproductive systems

Diet and Nutrition

- Basic concepts and components of food and nutrition Understanding Nutrition, Basic Terminology in Relation to Nutrition Requirement, Human Nutritional Requirements; Concept of food, Acceptance of Food, Functions of Food; Components of Food & their Classification; Macro Nutrients –Sources, Functions and Effects on the Body; Micro Nutrients - Sources, Functions and Effects on the Body; Fat Soluble Nutrients - Sources, Functions and Effects on the Body; Water soluble Nutrients - Sources, Functions and Effects on the Body; Significance of Carbohydrate, Proteins, Lipids, Vitamins, Minerals and water, Excessive and deficiency diseases of nutrients in the body; Antioxidants and their Role;
- Yogic concept of diet and its relevance in the management of lifestyle
- Nutrients, proximate principles of diet, balanced diet concept; Carbohydrates, proteins, fats – sources, nutritive values, importance; Minerals-calcium, iron, phosphorus etc. Vitamins – sources, roles, requirements
- Food groups.
Cereals & Millets –Selection, Preparation and Nutritive Value; Pulses, Nuts and Oil Seeds- Selection, Preparation and Nutritive Value; Milk and Milk Products- Selection, Preparation and Nutritive Value; Vegetables and Fruits- Selection, Preparation and Nutritive Value, Fats, Oils and Sugar, Jaggery, Honey, sprouts- Selection, Preparation and Nutritive Value
- Food and metabolism. Energy- Basic Concepts, Definition and Components of Energy Requirement, Energy Imbalance Concept of Metabolism, Anabolism, Catabolism, Calorie Requirement-BMR, SDA, Physical Activity; Metabolism of Carbohydrates, Lipids and Protein; Factors Affecting Energy; Requirement and Expenditure, Factors affecting BMR.

UNIT-VII

Yoga and Health

- Definition & Importance of Health According to WHO; Dimensions of Health: Physical, Mental, Social and Spiritual;
- Concepts of Trigunas, Pancha-mahabhutas, Pancha-prana and their role in Health and Healing; Concept of Pancha-koshas & Shat-chakra and their role in Health and Healing;
- Role of Yoga in preventive health care – Yoga as a way of life, Heyamdukhamanagatam; Potential causes of Ill-health: Tapatrayas and Kleshas, Physical and Physiological manifestation of Disease: Vyadhi, Alasya, Angamejayatva and Svasa-prashvasa.
- Mental and Emotional ill Health: Styana, Samshaya, Pramada, Avirati, Bhranti-darsana, Alabdha-bhumikatva, Anavasthitatva, Duhkha and Daurmanasya

- Yogic Diet - General Introduction of Ahara; Concept of Mitahara; Classification in Yogic diet according to traditional Yoga texts; Diet according to the body constitution (Prakriti) – Vata, Pitta and Kapha as also Gunas.
- Concepts of Diet: Pathya and Apathya according to Gheranda Samhita, Hathapradeepika and Bhagavad Gita; Importance of Yogic Diet in Yog Sadhana and its role in healthy living; Diet according to the body constitution (Prakriti) – Vata, Pitta and Kapha as also Gunas.
- Yogic Principles of Healthy Living: Ahara, Vihara, Achara and Vichara; Role of Yogic Positive Attitudes (Maitri, Karuna, Mudita and Upeksha) for Healthy Living, Concept of Bhavas and Bhavanas with its relevance in Health and well-being

UNIT-VIII

Therapeutic Yoga –

- **Yogic Practice** - Management of the diseases through suitable yogic practices - Yogic diet, Yama and Niyama, Shatkarma, Asanas, Pranayama; Meditation; changes in lifestyle according to yogic scriptures.
- **Integrated Approach of Yoga therapy for the following Common Ailments:**
 - **Respiratory disorders** - Allergic Rhinitis & Sinusitis: Chronic Bronchitis, Bronchial asthma
 - **Cardiovascular disorders:** Hypertension, Angina pectoris, Cardiac asthma:
 - **Endocrinal and Metabolic Disorder** - Diabetes Mellitus, Hypo and Hyper- Thyroidism; Obesity: Metabolic Syndrome
 - **Obstetrics and Gynecological Disorders, Menstrual Disorders:** Dysmenorrhea, Menopause and peri-menopausal syndrome: Yoga for Pregnancy and Childbirth, Ante-natal care, Post-natal care.
 - **Gastrointestinal Disorders:** Gastritis, Indigestion, Peptic Ulcers, Constipation, Diarrhoea, Irritable Bowel Syndrome, colitis, Piles.
 - **Muscular-Skeletal Disorders:** Back Pain, Intervertebral disc prolapse (IVDP) Lumbar Spondylosis, Cervical Spondylosis, , Arthritis
 - **Neurological Disorders:** Migraine, Tension-headache, Epilepsy
 - **Psychiatric Disorders:** Neurosis, Anxiety disorders, Phobias, Depression.

UNIT-IX

Applications of Yoga

- **Applied Philosophy:** Yoga as Applied philosophy; Meaning, definition and nature of consciousness as described in Vedas,, Upanishads, Bhagwad Gita, Yogasutra and Yogavashishtha; Spiritual and scientific approach to human consciousness. Yogic Method of elevation of human consciousness: Bhaktiyoga, Jnanyoga, Karmayoga, Mantrayoga, Ashtangayoga, Hathayoga.
- **Yoga in Education:** Salient features of Yoga Education, Factors of Yoga Education; Teacher, Student and Teaching, Value based education- Meaning and definition, types of values.
- **Teaching Methodology in Yoga:** Teaching and Learning: Concepts and Relationship between the two; Principles of Teaching: Meaning and scope of Teaching methods and factors influencing them; Teaching techniques- Individual, group and mass
- Essentials of Good Lesson Plan: concepts, needs, planning of teaching Yoga (Shodhanakriya, Asana, Mudra, Pranayama & Meditation)
- Models of Lesson Plan; need for a lesson plan and content plan; Eight Step method of Introduction as developed in Kaivalyadhama.
- Evaluation methods of an ideal Yoga class; Methods of customizing Yoga class to meet individual needs. The student will have demonstrations and training in the above mentioned aspects of teaching methods.
- Yoga classroom: Essential features, Area, Sitting arrangement in Yoga class, Student's approach to the teacher: Pranipaata; Pariprashna; Seva; (BG 4.34)

UNIT-X

Practical Yoga

Yogic Practices – Shatkarma, Asana, Pranayama, Mudra, Bandha, Dhyana, Surya Namaskara (Techniques, Salient Features, Benefits)

- **Shatkarmas:** Vamandhanti, Vastradhanti, Dandadhanti, Laghoo and Poorna sankhaprakshalana, Neti (Sutra and Jala), Kapalbhanti(Vaatkrama,Vyutakrama & Sheetkarma), Agnisara, Nauli, Tratak
- **Suryanamaskar-** Suryanamaskar must be practiced traditionally
- **Asanas (yogic postures)** Standing Postures-Ardhakatichakrasana, Padahastasana, Ardhakachakrasana, Trikonasana, Parivrittatrikonasana, Parsvakonasana, Veerasana.
- Sitting postures-Paschimottanasana, Suptavajrasana, Ardhamatsyendrasana, Vakrasana, Baddhakonasana, Merudandasana, Akarnadhanurasana, Gomukhasana,
- Prone postures- Bhujangasana, Shalabhasana, Dhanurasana, Urdhvamukhosvanasana, Makarasana,

- Supine postures- Halasana, Chakrasana, Sarvangasana, Matsyasana, Shavasana, Setubandhasana,
- Balancing postures- Vrikshasana, Garudasana, Namaskarasana, Tittibhasana, Natrajasana
- **Pranayama:** Breath awareness, Sectional breathing, Nadishuddhi, Suryabhedan, , Ujjai , Sitali, Sitkari, Bhastrika, Bhramari, Bahyavritti, Abhyantarvritti, Stambhavritti Pranayama
- **Practices leading to Meditation:** Pranav and Soham Japa, Yoga Nidra, Antarmauna, Ajapa Jap, Practices leading to Breath Meditation, Practices leading to Om Meditation, Practices leading to Vipassana Meditation, Practices leading to Preksha Meditation
- **Bandhas and Mudras:** Mula Bandha, Jalandhara Bandha, Uddiyana Bandha, Maha Bandha, Yoga Mudra, Maha Mudra, Shanmukhi Mudra, Tadagi Mudra, VipareetKarni Mudra
- **Contemporary Yogic Practices** – Yogic Sukshma Vyayama (Swami Dheerandra Brahmchari), Cyclic Meditation (S-VYASA); Mind Sound Resonance Technique (S-VYASA); Transcendental Meditation (Maharshi Mahesh Yogi); Yoga Nidra (BSY); Savita KiDhyan Dharana (DSVV).



XXVIII. FASHION DESIGN

UNIT I - MARKETING AND RETAILING:

Marketing: Introduction to marketing, overview of marketing process and marketing in modern economy, trends in marketing environment.

Market research: Understanding Consumer market trend, overview of market research process and research design

Product Decision- concept of product, clarification of product development, product positioning, segmentation and targeting

Branding, packaging and labeling

Price decision - Factor affecting price determination

Distribution channels, nature and function of distribution channels and physical distribution decision

Promotion decision- 4Ps of promotion mix

Meaning of retailing, social and economic significance of retailing, opportunities in retailing, characteristics of retailing, historical perspective of retail in India, types of retailers, service retailing

Retail Strategy- Meaning and Definition, building sustainable competitive advantage, growth strategies, global growth strategies, retail planning process, retail value chain

Ethics and social responsibility

UNIT II - QUALITY ASSURANCE:

Quality: Concept of Quality, managing quality through inspection and testing, seven tools of quality. Inspection: Inspection and its significance. Raw material inspection, In process inspection and Final quality inspection. Fabric faults as related to stages of manufacturing: yarn defects, weaving & knitting defects, dyeing, printing and finishing defects.

Quality control of textile products, Quality standards as applicable to various types of textiles (Garments yardage, knits, woven, carpets, processing, dyeing)

Textile testing: Introduction, precision and accuracy of test methods, atmospheric conditions for testing,

Fabric Testing: strength, dimensional changes in apparel due to laundering, dry cleaning, steaming pressing and color fastness, drapability & crease recovery.

Standards: Benefits of standards, Levels of standards, Sources of standards, ISO 9000 Series Standards. Introduction to AATCC, ASTM, ISO, BIS, INDA

Introduction to eco friendly textiles, banned dyes and eco parameters, environmental impact of Textile Industries

Care labeling: Importance, terminology, symbols and usage, International care labeling, elementary knowledge of wool mark and silk mark. Laundry aids: soaps, detergents, bleaches, stain removers, whiteness and stiffening agents, and functions of commercial laundry

UNIT III – ENTREPRENEURSHIP:

Entrepreneurship: concepts and nature. Entrepreneurial Traits: Leadership, risk taking, decision making, business planning Barriers in Entrepreneurship: Economic and non-economic

Institutional Support for new ventures:

Support organizations-State level –RFC,RIICO,DIC

Financial organizations-IFCI, IDBI, SIDBI and other Banks

Role of government in Entrepreneurial development: government incentives, subsidy and assistance

Promotion of a new venture: search for a business idea, preparation of plan, analysis of entrepreneurial opportunities, assessing the impact of opportunities and threats

UNIT IV - Research Methodology & STATISTICS:

Research : Definition and Concept of research, objectives of research, Types of Research – Descriptive Vs Analytical, Applied Vs Fundamental, Quantitative Vs Qualitative, Conceptual Vs Empirical, Historical, Longitudinal Research, Research Approaches, Significant of Research

Research Design: Meaning, need and characteristics of good research design. Identification of a research problem, Selection of a research problem, Hypothesis – purpose, characteristics, types and criteria of hypothesis, variables – Meaning and Concept, types of variables.

Data gathering instruments : Observation, Interview, Questionnaires and schedules, their construction, Techniques of data collection, Scrutiny of data, accuracy of measurements, testing of Questionnaire

Scaling Techniques and Sampling : Scaling Techniques, Purpose of Scaling, Techniques of scaling, Types of Scales – Nominal, Ordinal, Interval and Ratio scales.

Sampling : Meaning of census and sample, characteristics of a good sample, need for sample, type of samples based on Probability and Non-probability simplicity, probability sampling- Idea of simple random sampling, Stratified and Cluster sampling. Non-probability sampling Purposive and Quota sampling.

Statistics : Meaning, Importance and limitations of Statistics, classification and tabulation of data, discrete and continuous variables, frequency distribution and cumulative frequency distribution, diagrammatic presentation of data – one dimensional and two dimensional, graphical presentation of data – Histogram, Frequency Curve and Ogives, Measures of Central Tendency – Mean, mode and median their merits and demerits. Measures of Dispersion –Range, Quartile, Deviation, Mean Deviation and standard deviation, coefficient of variation. Moments, skewness and Kurtosis (their absolute and relative measures).

UNIT V – Merchandising

Fundamentals of merchandising, responsibilities of the merchandiser, merchandise planning: target markets, market segmentations and marketing research

Planning and Controlling and control tools: marketing calendar, merchandise calendar, sales forecast. Execution: Line development: elements, planning, control, research, line plan, styling direction and product development and adoption. Pricing: pricing strategies, objectives, pricing formula. Costing principles and strategies

Introduction to Standardization and Quality control in apparel industry. Importance of consumer perception of apparel quality. Managing apparel quality through inspection and sampling procedures.

Sourcing strategies: objectives, global sourcing, the role of merchandiser in sourcing, sourcing options, factors in sourcing options, factors in sourcing decision, customer/vendor relationship,

Domestic and International sourcing process

Visual Merchandising : Elements and functions of Visual Merchandising. Store exteriors, interiors & windows – image, atmosphere & theaters. Display props, fixtures, mannequins, floral, signage & graphics

UNIT VI - Apparel Construction Techniques

Locating Land marks: Taking Body Measurements for: men, women & children. Methods of pattern making: Drafting, flat pattern and draping

Fabric preparation-preshrinking, straightening, trueing. Pattern layout and cutting-open, half fold, partial fold, matching stripes, plaids and checks. Handling special fabrics while cutting and stitching (lace, velvet, chiffon). Supporting Fabrics: lining, underlining, interlining and interfacing.

Seam properties, seam types, stitch types, sewing machine feed mechanisms. Sewing machine needles and threads, sewing problems and its remedies. Elementary knowledge of machinery for seaming knitted garments

Identifying the components of apparel for –fabric, shaping devices, underlying

fabrics, pockets, neckline treatments, sleeve treatments, waistline treatments, closures, hem treatments & decorative details, Standards for evaluating the various components

Fitting: Definition & tools used in fitting room, Factors to be considered while fitting, Common Fitting problems and their remedies

UNIT VII - Fashion Dynamics

Origin of Fashion, Fashion terminology, Various fashion centers :- France, Italy, England, Tokyo and US

Elements of design, basics principles of designs, sources of inspiration and design sources – media, history, theatre and films. Role of Designer: Forecasting trends, theme interpretation, fashion forecasting

Components of fashion: Theories of fashion, Design development – seasons, elements and principles of designs and their relationship in the finish product.

Fashion cycle: Factors affecting fashion trends, fashion leaders and followers

Strengths of Indian fashion Industry, Fashion Designer with special reference to India

Role of CAD/CAM in Fashion Industry

XXIX. INTERIOR DESIGN

UNIT 1

Visualization and spatial ability:

Pictorial and diagrammatic questions to test the understanding of transformation and/or manipulation of 2D shapes and 3D objects and their spatial relationships.

UNIT 2

Environmental and social awareness:

General awareness of environmental factors (such as climate, population, water, vegetation, pollution, weather, natural resources) and their implications on the design of products, images, infrastructure and environment. Awareness of design terminologies, social and cultural connection with design, history of the designed artefact, and socially responsible and environmentally sustainable design responses. History of art, sculpture and literature.

UNIT 3

Analytical and logical reasoning:

Ability to analyse given information logically and select the most appropriate solutions; ability to weigh opinions, arguments or solutions against appropriate criteria; ability to use logic and structured thinking to deduce from a short passage, which of a number of statements is the most accurate response to a posed question.

UNIT 4

Language and creativity:

Ability to understand passages in commonly used English language; ability to think creatively in terms of alternatives; ability to distinguish innovative options and think out-of-the-box.

UNIT 5

Design thinking and problem solving:

Ability to understand the context, the users and the constraints and select the most appropriate solution for a given design problem.

UNIT 6

Observation and design sensitivity:

Ability to detect concealed properties in day-to-day life and think critically about them. Ability to discern subtle differences in visual properties and aesthetic outcomes.

UNIT 7

Drawing: Ability to draw products, people or scenes in proportion with good line quality, composition, proportion, perspective, and shading.

UNIT 8

Creativity: Ability to think out-of-the-box and come-up with unique as well as diverse solutions.

UNIT 9

Communication skills: Ability to communicate concepts and ideas clearly with the help of text and visuals.

UNIT 10

Problem identification skills: Ability to understand the user and the context, knowledge of properties of materials and their appropriate use in design.



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XXX. CHEMICAL ENGINEERING

UNIT 1

Process Calculations:

Steady and unsteady state mass and energy balances including multiphase, multicomponent, reacting and non-reacting systems.

UNIT 2

Thermodynamics:

First and Second laws of thermodynamics. Applications of first law to close and open systems. Second law and Entropy. Thermodynamic properties of pure substances: Equation of State and residual properties, properties of mixtures: partial molar properties, fugacity, excess properties and activity coefficients; phase equilibria: predicting VLE of systems; chemical reaction equilibrium.

UNIT 3

Fluid Mechanics and Mechanical Operations:

Fluid statics, Newtonian and nonNewtonian fluids, shell-balances including differential form of Bernoulli equation and energy balance, Macroscopic friction factors, dimensional analysis and similitude, flow through pipeline systems, flow meters, pumps and compressors, elementary boundary layer theory, flow past immersed bodies including packed and fluidized beds, Turbulent flow: fluctuating velocity, universal velocity profile and pressure drop. Particle size and shape, particle size distribution, size reduction and classification of solid particles; free and hindered settling; centrifuge and cyclones; thickening and classification, filtration, agitation and mixing; conveying of solids

UNIT 4

Heat transfer: Steady state Heat conduction:

One dimensional heat conduction equation – general heat conduction – boundary and initial conditions- Heat generation in solidsgeneralized thermal resistance network – extended surface heat transfer. Unsteady Heat Conduction: Unsteady state conduction – Lumped heat capacity system, plane wall with convection, infinite cylinder & sphere with convection. Convective heat transfer: Boundary layer theory – physical mechanism of convection- Flow over flat plates, cylinders and spheres. Design of heat exchangers: Types of heat exchangers-Standard Representation-classification – parallel flow and counter flow - LMTD, NTU methods.

UNIT 5

Mass Transfer:

Fick's laws, molecular diffusion in fluids, mass transfer coefficients, film, penetration and surface renewal theories; momentum, heat and mass transfer analogies; stage-wise and continuous contacting and stage efficiencies; HTU & NTU concepts; design and operation of equipment for distillation, absorption, leaching, liquidliquid extraction, drying, humidification, dehumidification and adsorption

UNIT 6

Chemical Reaction Engineering:

Introduction to chemical reaction engineering, performance equations for ideal reactors, rate parameter estimation for ideal reactors, reactor combinations, multiple reactions, selectivity and yield in multiple reactions, steps in heterogeneous reactions and rate-limiting step, heterogeneous catalytic and non-catalytic reactions and reactor design.

UNIT 7

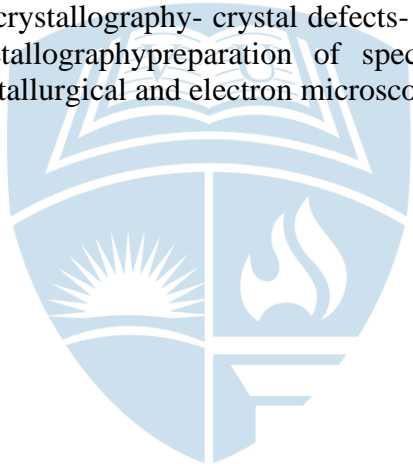
Process Control and Instrumentation:

Measurement of process variables; sensors, transducers and their dynamics, process modeling and linearization, transfer functions and dynamic responses of various systems, systems with inverse response, process reaction curve, controller modes (P, PI, and PID); control valves; analysis of closed loop systems including stability, frequency response, controller tuning, cascade and feed forward control.

UNIT 8

Basics of Materials Structure:

Atomic structure, chemical bonding – ionic, covalent, coordinate and metallic bonds, intermolecular forces, crystal systems- space latticemiller indices of atomic planes and directions- small problems in crystallography- crystal defects- point, line and surface defects- Bragg's law – X-ray diffraction- Metallographypreparation of specimen – micro structure examination- working principle of metallurgical and electron microscope.



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XXXI. MINING ENGINEERING

Unit 1: Mining Geology and Economic Geology

- 1.1 Physical Geology - Constitution of the earth's interior, earthquake, and volcano, weathering.
- 1.2 Mineralogy - Physical properties of minerals, identification of minerals, Mohs scale of hardness.
- 1.3 Petrology - Basics of igneous, sedimentary, and metamorphic rocks.
- 1.4 Structural geology - Dip and strike, folds, faults, joints, joint sets.
- 1.5 Stratigraphy - Geologic time scale, classification of Indian rock formations, fossils, and their uses.
- 1.6 Economic geology - Origin of coal, classification of Indian coals, Indian coal deposits, classification of ore deposits, Indian mineral wealth, mineral prospecting, sampling methods.

Unit 2: Mine Surveying

- 2.1 Principles of surveying.
- 2.2 Distance measurement techniques.
- 2.3 Chain surveying.
- 2.4 Computation of area and volume.
- 2.5 Underground surveying principles.
- 2.6 Levelling instrumentation and techniques.
- 2.7 Theodolite-principle, construction, surveying methods.
- 2.8 Superelevation.
- 2.9 Curve fitting.
- 2.10 Correlation surveying.

Unit 3: Mining Technology

- 3.1 Modes of entry to surface and underground mines.
- 3.2 Shaft sinking-methods, shaft lining.
- 3.3 Drilling and blasting-Drilling techniques, cut holes, explosives, detonators, blasting practices, blasting accessories, misfire, and its handling.
- 3.4 Methods of mining of coal and metalliferous deposits.
- 3.5 Roof support-Types and techniques, systematic support rules.
- 3.6 Mine lighting-Cap lamp, lamp room, electric lamps, mine lighting techniques.

Unit 4: Mine Transport and Machinery

- 4.1 Opencast and underground mines machinery - characteristic features and applicability.
- 4.2 Transportation systems in opencast and underground mines.
- 4.3 Mine pumps.

Unit 5: Rock mechanics and ground control

- 5.1 Physico-mechanical properties of rocks and their estimation.
- 5.2 Rock mass classification.
- 5.3 Mine subsidence parameters and their significance.
- 5.4 Ground control - Stowing methods.
- 5.5 Pit slope-parameters and stability.

Unit 6: Heat and Humidity

- 6.1 Sources of heat in underground mines.
- 6.2 Terminologies related to humidity.
- 6.3 Dry-bulb and wet-bulb temperatures (DBT and WBT).

6.4 Effect of heat and humidity.

6.5 Effect of air velocity.

Unit 7: Surface Mine Environment

7.1 Mine noise-Terminology, effects of noise, sources of noise generation and control, noise standards.

7.2 Air pollution-Primary/secondary air pollutants, acid rain, global warming, greenhouse effect, ozone layer depletion.

7.3 Water pollution-Classification of wastewater, biochemical oxygen demand (BOD), chemical oxygen demand (COD).

7.4 Surface mine fires.

7.5 Basics of EIA and EMP.

Unit 8: Underground Mine Environment and Ventilation

8.1 Mine gases-Properties and detection, mine damps.

8.2 Flame safety lamps-Constructional features, safety features, application.

8.3 Underground mine fires-Causes, prevention & control, detection of spontaneous heating, incubation period.

8.4 Mine explosions



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XXXII. AGRICULTURE

Unit-1

Crop growth analysis in relation to environment; agro-ecological zones of India. Quantitative agro-biological principles and inverse yield nitrogen law; Mitscherlich yield equation, its interpretation and applicability; Baule unit. Effect of lodging in cereals; physiology of grain yield in cereals; optimization of plant population and planting geometry in relation to different resources, concept of ideal plant type and crop modeling for desired crop yield. Scientific principles of crop production; crop response production functions; concept of soil plant relations; yield and environmental stress.

Unit-2

Water and its role in plants; water resources of India, major irrigation projects, extent of area and crops irrigated in India and different states. Water movement in soil and plants; transpiration; soil-water-plant relationships; water absorption by plants; plant response to water stress, crop plant adaptation to moisture stress condition. Soil, plant and meteorological factors determining water needs of crops; scheduling, depth and methods of irrigation; microirrigation system; fertigation; management of water in controlled environments and poly- houses. Water management of the crops and cropping systems; quality of irrigation water and management of saline water for irrigation; water use efficiency. Excess of soil water and plant growth; water management in problem soils; drainage requirement of crops and methods of field drainage.

Unit-3

Cropping systems: definition, indices and its importance; physical resources, soil and water management in cropping systems; assessment of land use. Concept of sustainability in cropping systems and farming systems, scope and objectives; production potential under monoculture cropping, multiple cropping, alley cropping, sequential cropping and intercropping, mechanism of yield advantage in intercropping systems. Above and below ground interactions and allelopathic effects; competition relations; multi-storied cropping and yield stability in intercropping, role of non-monetary inputs and low cost technologies; research need on sustainable agriculture. Crop diversification for sustainability; role of organic matter in maintenance of soil fertility; fertilizer use efficiency and concept of fertilizer use in intensive cropping system. Plant ideotypes for dryland; plant growth regulators and their role in sustainability.

Unit-4 Organic farming - concept and definition, its relevance to India and global agriculture and future prospects; land and water management - land use, minimum tillage; shelter zones, hedges, pasture management, agro-forestry. Organic farming and water use efficiency; soil fertility, nutrient recycling, organic residues, organic manures, composting, soil biota and decomposition of organic residues, earthworms and vermicompost, green manures and biofertilizers. Control of weeds, diseases and insect pest management, biological agents and pheromones, biopesticides. Socio-economic impacts; marketing and export potential: inspection, certification, labeling and accreditation procedures; organic farming and national economy.

Unit-5

Soil fertility and productivity - factors affecting; features of good soil management; problems of supply and availability of nutrients; relation between nutrient supply and crop growth Criteria of essentiality of nutrients; Essential plant nutrients – their functions, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients. Commercial fertilizers; composition, relative fertilizer value and cost; crop response to different nutrients, residual effects and fertilizer use efficiency, fertilizer mixtures and grades; agronomic, chemical and physiological methods of increasing fertilizer use efficiency; nutrient interactions. Time and methods of manures and fertilizers application; foliar application and its concept; relative performance of organic and inorganic manures; economics of fertilizer use; integrated nutrient management; use of vermicompost and residue wastes in crops.

Unit-6

Weed biology and ecology, crop-weed competition including allelopathy; principles and methods of weed control and classification; weed indices. Herbicides introduction and history of their development; classification based on chemical, physiological application and selectivity; mode and mechanism of action of

herbicides. Herbicide structure - activity relationship; factors affecting the efficiency of herbicides; herbicide formulations, herbicide mixtures; herbicide resistance and management; weed control through bio-herbicides, myco- herbicides and allelo-chemicals; Degradation of herbicides in soil and plants; herbicide resistance in weeds and crops; herbicide rotation. Weed management in major crops and cropping systems; parasitic weeds; weed shifts in cropping systems; aquatic and perennial weed control. Integrated weed management; cost : benefit analysis of weed management.

Unit-7

Definition, concept and characteristics of dry land farming; dry land versus rainfed farming; significance and dimensions of dry land farming in Indian agriculture. Soil and climatic parameters with special emphasis on rainfall characteristics; constraints limiting crop production in dry land areas; types of drought, characterization of environment for water availability; crop planning for erratic and aberrant weather conditions. Stress physiology and resistance to drought, adaptation of crop plants to drought, drought management strategies; preparation of appropriate crop plans for dry land areas; mid contingent plan for aberrant weather conditions. Tillage, tith, frequency and depth of cultivation, compaction in soil tillage; concept of conservation tillage; tillage in relation to weed control and moisture conservation; techniques and practices of soil moisture conservation (use of mulches, kinds, effectiveness and economics); anti-transpirants; soil and crop management techniques, seeding and efficient fertilizer use. Concept of watershed resource management, problems, approach and components.

Agricultural Economics

Unit-1

Theory of Consumer Behavior-Cardinal Utility Approach-Ordinal Utility Approach- Income effect and substitution effect-Applications of Indifference curve approach- Revealed Preference Hypothesis-Consumer surplus-Derivation of Demand curve-Elasticity of demand. Theory of Production- Production functions-Returns to scale and economies of scale-Technical progress-Theory of Costs-Cost curves-Profit maximization and cost minimization-Derivation of supply curve-Law of Supply-Producer's surplus. Market Equilibrium-Behavior of Firms in Competitive Markets-Perfect Competition-Effect of Taxation and Subsidies on market equilibrium-Monopoly-Monopolistic-Oligopoly-Theory of Factor Markets. General Equilibrium Theory-Welfare Economics-Pareto Optimality-Social welfare criteria-Social Welfare functions.

Unit-2

Nature and Scope of Macro Economics-Methodology and Keynesian Concepts National Income-Concepts and measurement-Classical theory of Employment and Say's Law-Modern theory of Employment and Effective Demand. Consumption function Investment and savings-Concept of Multiplier and Accelerator-Output and Employment-Rate of interest-Classical, Neo classical and Keynesian version-Classical theory Vs Keynesian theory-Unemployment and Full employment. Money and classical theories of Money and Price. Inflation: Nature, Effects and control. IS & LM frame work-General Equilibrium of product and money markets-Monetary policy-Fiscal policy-Effectiveness of Monetary and Fiscal policy.

Unit-3

Evolution of Economic Thought vs. Economic History. Ancient economic thought- medieval economic thought. Development of Classical Thoughts (Adam Smith, Robert Malthus and David Ricardo).The birth of neoclassical economic thought-Marshall and Walras-General Equilibrium Theory-Welfare Theory-Keynesian economics. The Era of globalization-Experiences of developing world. Economic Thought in India-Naoroji and Gokhale-Gandhian Economics -Economic thought of independent India-Nehru's economic philosophy-Experiences of the Structural adjustment programmes of the post liberalization era.

Unit-4

Nature, scope and significance of agricultural production economics-Agricultural. Factors of production, classification, interdependence, and factor substitution-Determination of optimal levels of production and factor application-Optimal factor combination and least cost combination of production-Theory of product choice; selection of optimal product combination. Cost functions and cost curves, components, and cost minimization Duality theory-cost and production functions and its applications-Derivation of firm's input demand and output supply functions. Measuring efficiency in agricultural production; technical, a locative and

economic efficiencies.

Unit-5

Agricultural marketing issues, and enhance expertise in improving the performance of the marketing institutions and the players in marketing of agricultural commodities. Characteristic of Agricultural product and Production-Problems in Agricultural Marketing from Demand and Supply and Institutions sides. Market intermediaries and their role-Need for regulation in the present context-Marketable & Marketed surplus estimation. Marketing Efficiency-Structure Conduct and Performance analysis-Vertical and Horizontal integration-Integration over space, time and form-Vertical coordination. Marketing Co-operatives- APMC Regulated Markets-Direct marketing, Contract farming and Retailing- Supply Chain Management-State trading, Warehousing and other Government agencies-Performance and Strategies-Market infrastructure needs, performance and Government role-Value Chain Finance. Role of Information Technology and telecommunication in marketing of agricultural commodities- Market research-Market information service-electronic auctions (e-bay), e- Chaupals, Agmarket and Domestic and Export market Intelligence Cell (DEMIC) price forecasting-time series analysis-time series models. Price policy and economic development-non-price instruments. Theory of storage future trading Price discovery- Hedging and Basis-Fundamental analysis-Role of Government in promoting commodity trading and regulatory measures.

Unit-6

Knowledge related to research process, data collection and data analysis etc. Importance and scope of research in agricultural economics. Types of research-Fundamental vs. Applied. Concept of researchable problem-research prioritization-selection of research problem. Hypothesis-meaning-characteristics-types of hypothesis-review of literature- setting of Course Objective and hypotheses-testing of hypothesis. Sampling theory and sampling design-sampling error-methods of sampling-probability and non-probability sampling methods. Project proposals- different types of projects to meet different needs. Research design and techniques-Types of research design. Data collection-assessment of data needs-sources of data collection. Mailed questionnaire and interview schedule. Scaling Techniques. Coding editing-tabulation- validation of data. Tools of analysis-data processing. Interpretation of results-Preparing research report / thesis-Universal procedures for preparation of bibliography-writing of research articles.

Unit-7

Introduction-relationship between economic theory, mathematical economics, models and econometrics, methodology of econometrics-regression analysis. Basic two variable regression-assumptions estimation and interpretation approaches to estimation-OLS, MLE and their properties- extensions to multivariable models-multiple regression estimation and interpretation. Multicollinearity, heteroscedasticity, autocorrelation. Use of dummy variables-limited dependent variables-specification, estimation and interpretation. Simultaneous equation models-structural equations-reduced form equations-identification and approaches to estimation.

Unit-8

Linear programming techniques. Decision Making-Concepts of decision making, introduction to quantitative tools, introduction to linear programming, uses of LP in different fields, graphic solution to problems, formulation of problems. Simple Method: Concept of simplex Method, solving profit maximization and cost minimizations problems. Formulation of farm and nonfarm problems as linear programming models and solutions. Extension of linear Programming models: dynamic programming. Game Theory- Concepts of game theory, two person constant sums, zero sum game. **Unit-9**

Role and Importance of Agricultural Finance. Financial Institutions and credit flow to rural/priority sector. Agricultural lending-Direct and Indirect Financing-Financing through 28 Co-operatives, NABARD and Commercial Banks and RRBs. District Credit Plan and lending to agriculture/priority sector. Micro-Financing and Role of MFI's-NGO, and SHG's. Lending to farmers-The concept of 5C's, 7P's and 3R's of credit. Estimation of Technical feasibility, Economic viability and repaying capacity of borrowers and appraisal of credit proposals. Understanding lenders and developing better working relationship and supervisory credit system. Credit inclusions-credit widening and credit deepening. Financial Decisions- Investment, Financing, Liquidity and Solvency. Preparation of financial statements-Balance Sheet, Cash Flow Statement and Profit and Loss Account. Ratio Analysis and assessing the performance of farm/firm. Project Approach in financing agriculture. Financial, economic and environmental appraisal of investment projects. Identification,

preparation, appraisal, financing and implementation of projects. Project Appraisal techniques–Undiscounted measures. Time value of money–Use of discounted measures-B-C ratio, NPV and IRR. Agreements. Net work Techniques–PERT and CPM. Risks in financing agriculture. Risk management strategies and coping mechanism. Crop Insurance programmes–review of different crop insurance schemes–yield loss and weather based insurance and their applications.....

Entomology

UNIT – 1

External morphology of the insect's body i.e., head, thorax and abdomen, their appendages and functions. Principles, utility and relevance: insect body wall structure, cuticular outgrowths, colouration and special integumentary structures in insects, body tagmata, sclerites and segmentation. Head- Origin, structure and modification; types of mouthparts and antennae, tentorium and neck sclerites. Thorax- Areas and sutures of tergum, sternum and pleuron, pterothorax; Wings: structure and modifications, venation, wing coupling apparatus and mechanism of flight; Legs: structure and modifications. Abdomen- Segmentation and appendages; Genitalia and their modifications; Embryonic and post- embryonic development; Types of metamorphosis. Insect sense organs (mechano-, photo- and chemoreceptors). Structure, modification and physiology of different systems- digestive, circulatory, respiratory, excretory, nervous, sensory, reproductive, musculature, endocrine and exocrine glands. Thermodynamics; physiology of integument, moulting; growth, metamorphosis and diapause. Insect nutrition- role of vitamins, proteins, amino acids, carbohydrates, lipids, minerals and other food constituents; extra and intra-cellular microorganisms and their role in physiology; artificial diets.

UNIT – 2

Brief evolutionary history of Insects- introduction to phylogeny of insects and Major Classification of Superclass Hexapoda – Classes – Ellipura (Collembola, Protura), Diplura and Insecta- Orders contained. Distinguishing characters, general biology, habits and habitats of Insect orders and economically important families contained in them. Collembola, Protura, Diplura. Class Insecta: Subclass Apterygota – Archaeognatha, Thysanura. Subclass: Pterygota, Division Palaeoptera – Odonata and Ephemeroptera. Division: Neoptera: Subdivision: Orthopteroid and Blattoid Orders (=Oligoneoptera): Plecoptera, Blattodea, Isoptera, Mantodea, Grylloblattodea, Dermaptera, Orthoptera, Phasmatodea, Mantophasmatodea, Embioptera, Zoraptera, Subdivision: Hemipteroid Orders (=Paraneoptera): Psocoptera, Phthiraptera, Thysanoptera and Hemiptera. Distinguishing characters, general biology, habits and habitats of Insect orders and economically important families contained in them (Continued). Division Neoptera – Subdivision Endopterygota, Section Neuropteroid- Coleopteroid Orders: Strepsiptera, Megaloptera, Raphidioptera, Neuroptera and Coleoptera, Section Panorpid Orders Mecoptera, Siphonaptera, Diptera, Trichoptera, Lepidoptera, and Section Hymenopteroid Orders: Hymenoptera.

UNIT – 3

History and Definition. Basic Concepts. Organization of the Biological world. Abundance and diversity of insects, Estimates and Causal factors. Study of abundance and distribution and relation between the two. Basic principles of abiotic factors and their generalized action on insects. Implications for abundance and distribution of organisms including insects- Law of the Minimum, Law of Tolerance, and biocoenosis, Systems approach to ecology. Basic concepts of abundance- Model vs Real world. Population growth basic models Exponential vs Logistic models. Discrete vs Continuous growth models. Balance of life in nature- Concepts of Carrying capacity, Environmental Resistance. Vital Statistics- Life Tables and their application to insect biology. Survivorship curves. Case studies of insect life tables. Population dynamics- Factors affecting abundance- Environmental factors, dispersal and migration, Seasonality in insects. Classification and mechanisms of achieving different seasonality- Diapause (Quiescence) - aestivation, hibernation. Biotic factors- Food as a limiting factor for distribution and abundance, 30 Nutritional Ecology. Food chain- web and ecological succession. Interspecific interactions- Basic factors governing the interspecific interactions- Classification of interspecific interactions – The argument of cost-benefit ratios. Competition- Lotka-Volterra model, Concept of niche, ecological homologues, competitive exclusion. Prey-predator interactions- Defense mechanisms against predators/parasitoids- Evolution of mimicry, colouration, concept of predator satiation; evolution of life

history strategies. Community ecology- Concept of guild, Organisation of communities. Relative distribution of organisms, Concept of diversity- the Wallacian view. Assessment of diversity. Diversity stability debate, relevance to pest management. Pest management as applied ecology.

UNIT – 4

History and origin, scope and need for IPM, definition and evolution of various related terminologies. Concept and philosophy, ecological principles, economic threshold concept, and economic consideration. Tools of pest management and their integration legislative, cultural, physical and mechanical methods; pest survey and surveillance, forecasting, types of surveys including remote sensing methods, factors affecting surveys; political, social and legal implications of IPM; pest risk analysis; pesticide risk analysis; cost- benefit ratios and partial budgeting; case studies of successful IPM programmes. History, principles and scope of biological control; important groups of parasitoids, predators and pathogens; principles of classical biological control- importation, augmentation and conservation. Biology, adaptation, host seeking behaviour of predatory and parasitic groups of insects. Role of insect pathogenic nematodes, viruses, bacteria, fungi, protozoa etc., their mode of action. Biological control of weeds using insects. Mass production of quality biocontrol agents- techniques, formulations, economics, field release/application and evaluation. Successful biological control projects, analysis, trends and future possibilities of biological control. Importation of natural enemies- Quarantine regulations, biotechnology in biological control. Semiochemicals in biological control.

UNIT – 5

Definition and scope of insecticide toxicology; history of chemical control, Classification of insecticides and acaricides based on mode of entry, mode of action and chemical nature. Structure and mode of action of organochlorines, organophosphates, carbamates, pyrethroids, tertiary amines, neonicotinoids, oxadiazines, phenyl pyrololes, insect growth regulators, microbials, botanicals, new promising compounds, etc. Principles of toxicology; evaluation of insecticide toxicity; joint action of insecticides synergism, potentiation and antagonism; factors affecting toxicity of insecticides; insecticide compatibility, selectivity and phytotoxicity. Insecticide metabolism; pest resistance to insecticides; mechanisms and types of resistance; insecticide resistance management and pest resurgence. Insecticide residues, their significance and environmental implications. Insecticide Act, registration and quality control of insecticides; safe use of insecticides; diagnosis and treatment of insecticide poisoning.

UNIT – 6

Systematic position, identification, distribution, host-range, bionomics, nature and extent of damage, seasonal abundance and management of insect and mite pests and vectors. Insect pests of cereals and millets and their management. Polyphagous pests: grasshoppers, locusts, termites, white grubs, hairy caterpillars, and non-insect pests (mites, birds, rodents, snails, slugs etc.). Insect pests of pulses, tobacco, oilseeds and their management.

Extension Education

UNIT-1

Extension Education, Adult Education and Distance Education. Poverty Alleviation Programmes – SGSY, SGRY, PMGSY, DPAP, DDP, CAPART – Employment Generation Programmes – NREGP, Women Development Programmes – ICDS, MSY, RMK, Problems in Rural Development. Current Approaches in Extension: Decentralized Decision Making, Bottom up Planning, Farming System Approach, Farming Situation Based Extension, Market – Led – Extension, Farm Field School, ATIC, Kisan Call Centers, and NAIP.

UNIT-2

Communication and communication process, Communication skills, fidelity of communication, communication competence and empathy, communication effectiveness and credibility. Methods of communication: Meaning and functions, classification. Forms and types of communication, organizational communication. Key communicators– Meaning, characteristics and their role. Agricultural Journalism, Techniques of writing scripts for Radio and TV.

UNIT-3

The adoption and Diffusion process, covert and overt processes at stages. Adopter categories and their rate of adoption, factors influencing rate of adoption. Diffusion effect and concept of over adoption, opinion

leadership- measurement and Characteristics of opinion leaders, multi-step flow of innovation; concepts of homophile and heterophily.

UNIT-4

Research, social research, Behavioural sciences research. Types and methods of Research. Review of literature, Research problem. Objectives, Concept & Construct, Variable, Hypothesis, Measurement. Validity and Reliability. Sampling – Universe, Sample and Sampling. Types of sampling and sampling procedures. Research Designs: types, advantages and limitations of each design. Data Collection devices – Interview, Enquiry forms, Schedules and Questionnaires Rating scales, Observation, Case studies and Social survey. Data processing and Report writing.

UNIT-5

ICTs- Concept, definition, tools and application in extension education. Reorganizing the extension efforts using ICTs, advantages, limitations and opportunities. ICTs projects, case studies in India and developing world. Different approaches (Models) to ICTs, ICT use in field of extension- Expert systems, Agricultural web sites and portals related crop production and marketing etc. Community Radio, Web, Tele, and Video Conferencing, Computer Aided Extension, Knowledge management, Information kiosks, Multimedia, Online, Offline Extension, Tools-Mobile technologies, e-learning concepts.

UNIT-6

Entrepreneur, Entrepreneurship and Agri – entrepreneurship, Theories of Entrepreneurship, Traits & Types of Entrepreneurs, Stages of establishing enterprise – Identification of sound enterprise. Project Management and Appraisal – Market, Technical, Financial, Social Appraisal of Projects. Micro enterprises – Profitable Agri enterprises in India – Agro Processing, KVIC industries. Gender issues in entrepreneurship development – Understanding gender and subordination of women, Gender as a development tool, Policy approaches for women entrepreneurship development. Management, Extension 32 Management, Planning and Decision making, Steps in DM Process, Meaning of Organization, Concept, Principles, Span of Management, Departmentalization, Authority and responsibility, Delegation and decentralization, line and staff relations. Coordination, Staffing, Training and Development and Direction. Supervision, Managerial Control, Budgeting, Observation, PERT and CPM, MIS.

UNIT-7

Human Resource Development, Conceptual frame work, inter disciplinary approach, function systems and case studies in HRD; HRD Interventions, Recruitment, Induction Staff Training and Development, Career planning; Social and Organizational Culture. Human Resource management: Collective bargaining, Negotiation skills; Human Resource Accounting (HRA). Intra personal processes: Collective behaviour, learning, and perception; Stress and coping mechanisms; Inter-Personal Process, Helping Process – communication and Feedback and interpersonal styles; Group & Inter group process: group information and group processes; Organizational communication, Team building Process and functioning, Conflict management, Collaboration and Competition; HRD & Supervisors: Task Analysis; Capacity Building – Counseling and Mentoring. Training and development strategies – Training types, models, methods and evaluation. Main issues in HRD: HRD culture and climate – organizing for HRD – emerging trends and Prospective.

Plant Breeding & Genetics

UNIT –1

Beginning of genetics; Cell structure and cell division; Mendel's laws; Multiple alleles, Sex determination, sex-linkage, Sex-influenced and sex-limited traits; in eukaryotes, Somatic cell genetics, Extra chromosomal inheritance. Population Genetics; Hardy-Weinberg equilibrium. Structural and numerical changes in chromosomes; Central Dogma; Genetic fine structure analysis, Jumping gene theory; Overlapping genes, pseudogenes, Oncogenes, Gene Regulation in Prokaryotes and eukaryotes; mutation; Bacterial plasmids, Molecular chaperones and gene expression. RNA editing. Gene isolation, synthesis and cloning, genomic and cDNA libraries, PCR based cloning; Nucleic acid hybridization and immunochemical detection; DNA sequencing; DNA restriction and modification, Anti-sense RNA and ribozymes; Micro-RNAs (miRNAs). Genomics and proteomics; Metagenomics. Transgenic bacteria and bioethics; Gene silencing; genetics of

mitochondria and chloroplasts. Concepts of Eugenics, Epigenetics, Genetic disorders and Behavioural genetics.

UNIT-2

Architecture of chromosome in prokaryotes and eukaryotes; Chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; artificial chromosome construction and its uses; Special types of chromosomes. Synapsis, structure and function of synaptonemal complex and spindle apparatus, anaphase movement of chromosomes and crossing over-mechanisms and theories of crossing over-recombination models, cytological basis, - Variation in chromosome structure: Evolutionary significance – Introduction to techniques for karyotyping; Chromosome banding and painting – in situ hybridization and various applications. Utilization of aneuploids in gene location somatic segregation and chimeras – Endomitosis and somatic reduction ; Evolutionary significance of chromosomal aberrations – balanced lethal and chromosome complexes. Inter- varietal chromosome substitutions; Polyploidy and role of polyploids in crop breeding allopolyploids utilization in gene mapping and gene blocks transfer – Alien addition and substitution lines – creation and utilization; Apomixis Reversion of autopolyploids to diploids; Genome mapping in polyploids – Interspecific hybridization and allopolyploids; Synthesis of new crops (wheat, triticale and brassica) Gene transfer using amphidiploids – Bridge species. Fertilization barriers in crop plants at pre- and post fertilization levels- In vitro techniques to overcome the fertilization barriers in crops; of haploids, dihaploids and doubled haploids in genetics and breeding.

UNIT –3

History & objectives of plant breeding, patterns & characteristics of evolution of crop plants; centres of Origin-biodiversity; Genetic basis of breeding self- and cross - pollinated crops; components of variation; Heritability and genetic advance, genotype environment interaction; General and specific combining ability; gene actions and implications in plant breeding; Plant introduction and role of plant genetic resources in plant breeding. Selfincompatibility and male sterility; Pure line theory, pure line election and mass selection methods; Line breeding, pedigree, bulk, backcross, single seed descent and multiline method; Population breeding; Breeding methods in cross pollinated crops; Heterosis & Hybrid breeding ; seed production of hybrid and their parent varieties/inbreds. Breeding methods in asexually/clonally propagated crops, clonal selection apomixes, clonal selection. Selfincompatibility and male sterility; Concept of plant ideotype and its role in crop improvement; Transgressive breeding. Mutation breeding; Breeding for abiotic and biotic stresses. Cultivar development- testing, release and notification, maintenance breeding, 34 Participatory Plant Breeding, Plant breeders' rights and regulations for plant variety protection and farmers rights.

UNIT-4

Mendelian traits vs polygenic traits; Multiple factor hypothesis - analysis of continuous variation; Variations associated with polygenic traits - phenotypic, Models of G X E; non-allelic interactions; Nature of gene action - additive, dominance, epistatic and linkage effects. ANOVA; MANOVA, biplot analysis; Experimental Designs; Genetic diversity analysis; D2 analyses; correlations; Path analysis and Parent - progeny regression analysis; Discriminant function and principal component analyses; Selection indices; Simultaneous selection models heritability and genetic advance. Generation mean analysis; Mating designs; Concepts of combining ability and gene action; adaptability and stability; Models for GxE analysis and stability parameters; AMMI analysis – principles and interpretation. QTL mapping; Marker assisted selection (MAS).

UNIT-5

Ultrastructure of the cell; eukaryotic and prokaryotic cells, macromolecules; Structure and function of cell wall, nuclear membrane and plasma membrane; Cellular Organelles Bioenergetics; Ultrastructure and function of mitochondria and biological membranes; Chloroplast and other photosynthetic organelles; Interphase nucleus- Structure and chemical composition; Cell division and physiology of cell division. Historical background of molecular genetics; Genetic material in organisms; Structure and properties of nucleic acid, DNA transcription and its regulation – Transcription factors and their role; Genetic code, regulation of protein

synthesis in prokaryotes and eukaryotes – ribosomes, t-RNAs and translational factors. Mechanisms of recombination in prokaryote; DNA organization in eukaryotic chromosomes – DNA content variation, types of DNA sequences; organelle genomes; Gene amplification and its significance; Proteomics and protein-protein interaction; Signal transduction; Genes in development; Cancer and cell aging.

UNIT-6

Biotechnology and its relevance in agriculture; Definitions, terminologies and scope in plant breeding. Tissue culture- History, callus, suspension cultures, cloning; Regeneration; Somatic embryogenesis; Anther culture; somatic hybridization techniques; Meristem, ovary and embryo culture; cryopreservation. Techniques of DNA isolation, quantification and analysis; Genotyping; Sequencing techniques; Vectors, vector preparation and cloning, Biochemical and Molecular markers: morphological, biochemical and DNA-based markers (RFLP, RAPD, AFLP, SSR, SNPs, ESTs etc.), mapping populations (F₂s, back crosses, RILs, NILs and DH). Molecular mapping and tagging of agronomically important traits. Statistical tools in marker analysis, Robotics; Marker-assisted selection for qualitative and quantitative traits; QTLs analysis in crop plants, Gene pyramiding. Molecular breeding; Genomics and geno-informatics for crop improvement; Integrating functional genomics information on agronomically/economically important traits in plant breeding; Marker- assisted backcross breeding for rapid introgression, Generation of EDVs. Recombinant DNA technology, transgenes, method of transformation, selectable markers and clean transformation techniques, vector-mediated gene transfer, physical methods of gene transfer. Production of transgenic plants in various field crops: cotton, wheat, maize, rice, soybean, oilseeds, sugarcane etc. Commercial releases. Biotechnology applications in male sterility/hybrid breeding, molecular farming. MOs and related issues (risk and regulations); GMO; International regulations, biosafety issues of GMOs; Regulatory procedures in major countries including India, ethical, legal and social issues; Intellectual property rights; 35 Bioinformatics & Bioinformatics tools. Nanotechnology and its applications in crop improvement programmes.

UNIT-7

Variety Development and Maintenance; Definition- variety, cultivar, extant variety, essentially derived variety, independently derived variety, reference variety, farmers' variety, hybrid and population; Variety testing, release and notification systems in India and abroad. DUS testing- Genetic purity concept and maintenance breeding. genetic deterioration of varieties - safeguards during seed production; Maintenance of varieties; Principles & methods of seed production; Generation system of seed multiplication -nucleus, breeders, foundation, certified, - Quality seed production technology; of self and cross-pollinated crop varieties viz. cereals & millets (wheat, barley, paddy, pearl millet, sorghum, maize and ragi etc.); Pulses (greengram, blackgram, cowpea, pigeonpea, chickpea, fieldpea, lentil); Oilseeds (groundnut, soybean, sesame, castor, sunflower, safflower, linseed, rapeseed and mustard); fibres (cotton, jute) and forages (guar, forage sorghum, teosinte, oats, berseem, lucerne).; Seed certification procedures; Seed laws and plant variety protection regulations in India and international systems.....

Plant Pathology

UNIT -1

Classification of fungi, economic mycology, edible fungi and entomogenous fungi mycorrhizal association, cell organelles, their morphology, functions and chemical composition.

UNIT 2

Nature, composition and structure of viruses and viroids Symptomatology of important plant viral diseases, transmission, properties of viruses , host virus interaction, virus vector relationship. Virus nomenclature and

classification, genome organization, replication and movement of viruses. Isolation and purification, electron microscopy, protein and nucleic acid based diagnostics. Myco-viruses, satellite viruses, satellite RNAs, phages, prions. Origin and evolution, mechanism of resistance, genetic engineering, ecology, and management of plant viruses.

UNIT 3

Importance of phytopathogenic bacteria. Evolution, classification and nomenclature of phytopathogenic procaryota and important diseases caused by them. Growth, nutrition requirements, reproduction, preservation of bacterial cultures and variability among phytopathogenic procaryota. General biology of bacteriophages, L form bacteria, plasmids and bdellovibrios. Procaryotic inhibitors and their mode of action against phytopathogenic bacteria. Survival and dissemination of phytopathogenic bacteria.

UNIT 4

Importance, definitions and concepts of plant diseases, history and growth of plant pathology, biotic and abiotic causes of plant diseases. Growth, reproduction, survival and dispersal of important plant pathogens, role of environment and host nutrition on disease development. Host parasite interaction, recognition concept and infection, symptomatology, disease development- role of enzymes, toxins, growth regulators; defense strategies- oxidative burst; Phenolics, Phytoalexins, PR proteins, Elicitors. Genetics of resistance; 'R' genes; mechanism of genetic variation in pathogens; molecular basis for resistance; marker- assisted selection; genetic engineering for disease resistance. Disease management strategies.

UNIT 5

Pure culture techniques, use of selective media to isolate pathogens. Preservation of plant pathogens and disease specimens, use of haemo-cytometer, micrometer, centrifuge, pH meter, camera lucida. Microscopic techniques and staining methods, phase contrast system, chromatography, use of electron microscope, spectrophotometer, ultracentrifuge and electrophoretic apparatus, disease diagnostics, serological and molecular techniques for detection of plant pathogens. Evaluation of fungicides, bactericides etc.; field experiments, data collection and preparation of references.

UNIT 6

Morphology and anatomy of typical monocotyledonous and dicotyledonous infected seeds. Recent advances in the establishment and subsequent cause of disease development in seed and seedling. Localization and mechanism of seed transmission in relation to seed infection, seed to plant transmission of pathogens. Seed certification and tolerance limits, types of losses caused by seed-borne diseases in true and vegetatively propagated seeds, evolutionary adaptations of crop plants to defend seed invasion by seed-borne pathogens. 37 Epidemiological factors influencing the transmission of seed-borne diseases, forecasting of epidemics through seed-borne infection. Production of toxic metabolites affecting seed quality and its impact on human, animal and plant health, management of seed-borne pathogen/diseases and procedure for healthy seed production, seed health testing, methods for detecting microorganism.

UNIT 7

Molecular mechanisms of pathogenesis, process of infection, variability in plant pathogens. Mechanism of resistance. Host defense system. Antiviral protein.SAR, active oxygen radicals. Hypersensitivity and its mechanisms Tissue culture, elementary genetic engineering. Gene-for-gene concept, protein-for-protein and immunization basis, management of resistance genes. Strategies for gene deployment.

UNIT 8

Introduction, definition, concept and tools of disease management, components of integrated disease management- their limitations and implications. Development of IDM- basic principles, biological, chemical and cultural disease management. IDM in important crops- rice, wheat, cotton, sugarcane, chickpea, rapeseed, mustard, pearl millet, kharif pulses, vegetable crops and fruit crops.

Soil Science & Agricultural Chemistry

UNIT-1

Chemical (elemental) composition of the earth's crust and soils. Elements of equilibrium thermodynamics, chemical equilibria, electrochemistry and chemical kinetics. Soil colloids: inorganic and organic colloids – origin of charge, concept of point of zero- charge (PZC) surface charge characteristics of soils; diffuse double layer theories of soil colloids, zeta potential, stability, coagulation/flocculation and peptization of soil colloids; electrometric properties of soil colloids; sorption properties of soil colloids; soil organic matter – fractionation of soil organic matter and different fractions, clay- organic interactions. Ion exchange processes in soil; cation exchange – theories based on law of mass action adsorption isotherms, donnan-membrane equilibrium concept, clay-membrane electrodes and ionic activity measurement, thermodynamics, statistical mechanics; anion and ligand exchange – innersphere and outer-sphere surface complex formation, fixation of oxyanions, hysteresis in sorption-desorption of oxy-anions and anions, AEC, CEC; experimental methods to study ion exchange phenomena and practical implication in plant nutrition. Potassium, phosphate and ammonium fixation in soils covering specific and non-specific sorption; precipitation – dissolution equilibria; step and constant –rate K; management aspects. Chemistry of acid soils; active and potential acidity; lime potential, chemistry of acid soils; sub-soil acidity. Chemistry of salt- affected soils and amendments; soil pH, ECe, ESP, SAR and important relations; soil management and amendments. Chemistry and electrochemistry of submerged soils.

UNIT – 2

Fundamentals of crystallography, space lattice, coordination theory, isomorphism and polymorphism. Classification, structure, chemical composition and properties of clay minerals; genesis and transformation of crystalline and non-crystalline clay minerals; identification techniques; amorphous soil constituents and other non-crystalline silicate mineral and their identification; clay minerals in Indian soils. Factors of soil formation, soil formation models; soil forming processes; weathering of rocks and mineral transformation; soil profile; weathering sequences of minerals with special reference to Indian soils. Concept of soil individual; soil classification system, soil mineralogy and soil maps – usefulness. Soil survey and its types; soil survey techniques – conventional and modern; soil series – characterization and procedure for establishing soil series; benchmark soils and soil correlations; soil survey interpretation; soil mapping, thematic soil maps, cartography, mapping units, techniques for generation of soil maps. Landform – soil relationship; major soil groups of India with special reference to respective states; land capability classification and land irrigability classification; land evaluation and land use type (LUT) – concepts and application; approaches for managing soils and landscapes in the framework of agro- ecosystem.

UNIT – 3

Soil biota, soil microbial ecology, types of organisms in different soils; soil microbial biomass; microbial interaction; un-culturable soil biota. Microbiology and biochemistry of root-soil interface; phyllosphere; soil enzymes, origin activities and importance; soil characteristics influencing growth and activity of microflora. Microbial transformation of nitrogen, phosphorus, sulphur, iron and manganese in soil; biochemical composition and biodegradation of soil organic matter and crop residues, humus formation; cycles of important organic nutrients. Biodegradation of pesticides, organic wastes and their use for production of biogas and manures; biotic factors in soil development; microbial toxins in the soil. Preparation and preservation of farmyard manure, animal manures, rural and urban composts and vermicompost. Biofertilizers – definition, classification, specifications, method of production and role in crop production.

UNIT – 4

Introduction and history of remote sensing; sources, propagation of radiations in atmosphere; interactions with matter. Sensor system – camera, microwave radiometers and scanners; fundamentals of aerial photographs and image processing and interpretations. Application of remote sensing techniques – land use soil surveys, crop stress and yield forecasting, prioritization in watershed and drought management, wasteland identification and management. Significance and sources of the spatial and temporal variability in soils; variability in relation to size of sampling; classical and geo- statistical techniques of evolution of soil variability. Introduction to GIS and its application for spatial and non – spatial soil and attributes.

UNIT – 5

Soil texture, textural classes, mechanical analysis, specific surface. Soil consistence; dispersion and workability of soils; soil compaction and consolidation; soil strength; swelling and shrinkage – basic concepts. Soil structure – genesis, types, characterization and management soil structure; soil aggregation, aggregate stability; soil tilth, characteristics of good soil tilth; soil crusting – mechanism, factors affecting and evaluation; soil conditioners; puddling, its effect on soil physical properties; clod formation. Soil water: content and potential, soil water retention, soil-water constants, measurement of soil water content, energy state of soil water, soil water potential, soil moisture characteristic curve; hysteresis, measurement of soil-moisture potential. Water flow in saturated and unsaturated soils, Poiseuille's law, Darcy's law; hydraulic conductivity, permeability and fluidity, hydraulic diffusivity; measurement of hydraulic conductivity in saturated and unsaturated soils. Infiltration; internal drainage and redistribution; evaporation; hydrologic cycle, field water balance; soil-plant-atmosphere continuum. Composition of soil air; renewal of soil air – convective flow and diffusion; measurement of soil aeration; aeration requirement for plant growth; soil air management. Modes of energy transfer in soils; energy balance; thermal properties of soil; measurement of soil temperature; soil temperature in relation to plant growth; soil temperature management.

UNIT – 6

Nature and sources of pollutants – agricultural, industrial, urban wastes, fertilizers and pesticides, acid rains, oil spills etc.; air, water and soil pollutants – their CPC standards and effect on plants, animals and human beings. Sewage and industrial effluents – their composition and effect on soil properties/health, and plant growth and human beings; soil as sink for waste disposal. Pesticides – their classification, behavior in soil and effect on soil microorganisms. Toxic elements – their sources, behavior in soils, effect on nutrients availability, effect on plant and human health. Pollution of water resources due to leaching of nutrients and pesticides from soil; emission of greenhouse gases – carbon dioxide, methane and nitrous oxide. Remediation/amelioration of contaminated soil and water; remote sensing applications in monitoring and management of soil and water pollution.

UNIT – 7

Soil fertility and soil productivity; nutrient sources; essential plant nutrients – functions and deficiency symptoms. Soil and fertilizer nitrogen – sources, forms, immobilization and mineralization, nitrification, denitrification; biological nitrogen fixation – 40 types, mechanism, microorganism and factors affecting; nitrogenous fertilizers and their fate in soils; management of fertilizer nitrogen in lowland and upland conditions for high fertilizer use efficiency. Soil and fertilizer phosphorus – forms, immobilization, mineralization, reactions in acid and alkali soils; factors affecting phosphorus availability in soils; phosphatic fertilizers – behavior in soils and management under field conditions. Potassium – forms, equilibrium in soils and its agricultural significance; mechanism of potassium fixation; management of potassium fertilizers. Sulphur – source, forms, fertilizers and their behavior in soils; calcium and magnesium – factors affecting their availability in soils; management of sulphur, calcium and magnesium fertilizers. Micronutrients – critical limits in soils and plants; factors affecting their availability and correction of their deficiencies in plants; role of chelates in nutrient availability. Common soil test methods for fertilizer recommendation; quantity – intensity relationships; soil test crop response correlations and response functions. Fertilizer use efficiency; blanket fertilizer recommendations – usefulness and limitations; site-specific nutrient management; plant need based nutrient management; integrated nutrient management. Soil fertility evaluation; soil quality in relation to sustainable agriculture.

(Horticulture)

Fruit Science

UNIT-1

Importance and management of tropical sub tropical temperate and dry land fruits grown in India. Commercial varieties of regional, national and international importance. Recent trends in propagation, rootstock influence, planting systems, cropping systems, root zone and canopy management, nutrient management, water management, fertigation, role of bio-regulators. Physiological disorders- causes and remedies, quality improvement by management practices; maturity indices, harvesting, grading, packing, storage and ripening techniques; industrial and export potential. Agri. Export Zones (AEZ) and industrial supports. Crops Mango, Banana, Citrus, Papaya, Guava, Sapota, Jackfruit, Aonla, Pomegranate, Ber, Apple, Pear, Grapes, Plums, Peach, Nuts- walnut, Almond Minor fruits- Bael, Fig and Jamun.

UNIT-2

Sexual propagation, apomixis, polyembryony, chimeras. Asexual propagation – rooting of soft and hard wood cutting under mist by growth regulators. Rooting of cuttings in hotbeds. Rejuvenation through top working– Progeny orchard and scion bank. Micro- propagation–principles and concepts, commercial exploitation in horticultural crops. Nursery–types, structures, components, planning and layout. Nursery management practices for healthy propagule production.

UNIT-3

Principles of biodiversity in germplasm conservation of fruit crops. Present status of gene centers; exploration and collection of germplasm in situ and ex situ; Intellectual property rights. Crops Mango, citrus, guava, banana, papaya, coconut.

UNIT-4

Principles and practices of breeding of fruit crops. Breeding systems, breeding objectives, approaches for crop improvement-introduction, selection, hybridization, mutation breeding, polyploidy breeding, rootstock breeding, improvement of quality traits, resistance breeding for biotic and abiotic stresses in the following

selected fruit crops. Crops Mango, banana, citrus, grapes, guava, papaya.

UNIT-5

Principles and practices in canopy management of fruit crops. Canopy management importance and advantages; factors affecting canopy development. Canopy types and structures with special emphasis on geometry of planting, canopy manipulation for optimum utilization of light. Canopy management through plant growth inhibitors, training and pruning and management practices in temperate fruits, grapes, mango, guava, citrus and ber. Role of hormones in different horticultural crops- fruit thinning, fruit drop, ripening, dormancy breaking and propagation.

(Horticulture)

Vegetable Science

UNIT-1

Production technology of vegetable crops. Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties / hybrids, sowing / planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post-harvest management, plant protection measures and seed production of vegetable crops like - solanaceous crops, root crops, bulb crops, cucurbitaceous crops, sweet potato, okra and leafy vegetables.

UNIT-2

Breeding methods (introduction, selection, hybridization, mutation) of vegetable crops. Resistance breeding for biotic and abiotic stress, quality improvement, molecular marker, genomics like - Potato, tomato, okra, peas, cabbage, cauliflower, carrot, radish, melons and pumpkins.

UNIT-3

Role of auxins, gibberellins, cytokinins and abscisic acid; Application of synthetic hormones, plant growth retardants and inhibitors for various purposes in vegetable crops; Role and mode of action of morphactins, antitranspirants, anti-auxin, ripening retardant and plant stimulants in vegetable crop production.

UNIT-4

Genetical and agronomical principles of seed production; methods of seed production; use of growth regulators and chemicals in vegetable seed production, methods of hybrid seed production. Categories of seed; maintenance of nucleus, foundation and certified seed; seed certification, seed standards; seed act and law enforcement, plant quarantine and quality control. Agro-techniques for seed production in solanaceous vegetables, cucurbits, leguminous vegetables, cole crops, bulb crops, okra and leafy vegetables.

UNIT-5

Production technology of underutilized vegetable crops. Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties / hybrids, sowing / planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching,

physiological disorders, harvesting, post harvest management, plant protection measures and production of: Asparagus, Elephant foot yam, lima bean, Sweet gourd, spine gourd and pointed gourd.

UNIT-6

Organic farming in vegetable production. Importance, principles, perspective, concept and component of organic production of vegetable crops. Organic production of vegetables crops, viz., solanaceous crops, cucurbits, cole crops, root and tuber crops. Methods for enhancing soil fertility, mulching, raising green manure crops. Indigenous methods of compost, Panchagavya, Bio-dynamics, preparation etc.

Biotechnology

UNIT 1

History, scope and importance; DNA structure, function and metabolism. DNA modifying enzymes and vectors; Methods of recombinant DNA technology; Nucleic acid hybridization; Gene libraries; PCR amplification; Plant and animal cell and tissue culture techniques and their applications. Molecular markers and their applications; DNA sequencing; Applications of gene cloning in basic and applied research; Genetic engineering and transgenics; Genomics, transcriptomics and proteomics. General application of biotechnology in Agriculture, Medicine, Animal husbandry, Environmental remediation, Energy production and Forensics; Public perception of biotechnology; Bio-safety and bioethics issues; Intellectual property rights in biotechnology.

UNIT 2

Historical developments of molecular biology; Nucleic acids as genetic material; Chemistry, structure and properties of DNA and RNA. Genome organization in prokaryotes and eukaryotes; Chromatin structure and function; DNA replication; DNA polymerases, topoisomerases, DNA ligase, etc; Molecular basis of mutations; DNA repair mechanisms. Transcription process; RNA processing; Reverse transcriptase; RNA editing; Ribosomes structure and function; Organization of ribosomal proteins and RNA genes; Genetic code; Aminoacyl tRNA synthases. Translation and post-translational modifications; Operon concept; Attenuation of trp operon; important features of gene regulation in eukaryotes.

UNIT 3

General structure and constituents of cell; Similarities and distinction between plant and animal cells; Cell wall, cell membrane, structure and composition of biomembranes, cell surface related functions. Structure and function of major organelles: Nucleus, Chloroplasts, Mitochondria, Ribosomes, Lysosomes, Peroxisomes. Endoplasmic reticulum, Microbodies, Golgi apparatus, Vacuoles, etc. Organellar genomes and their manipulation; Ribosomes in relation to cell growth and division; Cyto-skeletal elements. Cell division and regulation of cell cycle; Membrane transport; Transport of water, ion and biomolecules; Signal transduction mechanisms; Protein targeting.

UNIT 4

History of plant cell and tissue culture; Culture media; Various types of culture; callus, suspension, nurse, root, meristem, etc.; In vitro differentiation: organogenesis and somatic embryogenesis; Plant growth regulators: mode of action, effects on in vitro culture and regeneration; Molecular basis of plant organ differentiation. Micropropagation; Anther and microspore culture; Somaclonal variation; In vitro mutagenesis; In vitro fertilization; In vitro germplasm conservation; Production of secondary metabolites; Synthetic seeds.

Embryo rescue and wide hybridization; Protoplast culture and regeneration; Somatic hybridization: protoplast fusion, cybrids, asymmetric hybrids, etc. Methods of plant transformation; Vectors for plant transformation; Genetic and molecular analyses of transgenics; Target traits and transgenic crops; Biosafety issues, testing of transgenics, regulatory procedures for commercial approval.

UNIT 5

Introduction, scope and historical developments; Isolation, screening and genetic improvement (involving classical approaches) of industrially important organisms. Primary metabolism products, production of industrial ethanol as a case study; Secondary metabolites, bacterial antibiotics and non ribosomal peptide antibiotics; Recombinant DNA technologies for microbial processes; Strategies for development of industrial microbial strains with scale up production capacities; Metabolic pathway engineering of microbes for production of novel product for industry. Microbial enzymes, role in various industrial processes, production of fine chemicals for pharmaceutical industries ; Biotransformations, Bio- augmentation with production of vitamin C as a case study; Bioreactors, their design and types; immobilized enzymes based bioreactors; Microencapsulation technologies for immobilization of microbial enzymes. Industrial biotechnology for pollution control, treatment of industrial and other wastes, biomass production involving single cell protein; Bio- remediation of soil; Production of ecofriendly agricultural chemicals, bio- pesticides, bio-herbicides, bio-fertilizers, bio-fuels, etc.

UNIT 6

Principles of plant breeding; Breeding methods for self and cross pollinated crops; Heterosis breeding; Limitations of conventional breeding; Aspects of molecular breeding. Development of sequence based molecular markers - SSRs and SNPs; Advanced methods of genotyping; Mapping genes for qualitative and quantitative traits. QTL mapping using structured populations; AB-QTL analysis; Association mapping of QTL; Fine mapping of genes/QTL; Map based gene/QTL isolation and development of gene based markers; Allele mining by TILLING and Eco-TILLING; Use of markers in plant breeding. Marker assisted selection (MAS) in backcross and heterosis breeding; Transgenic breeding; Foreground and background selection; MAS for gene introgression and pyramiding; MAS for specific traits with examples.

Plant Physiology

UNIT 1

Cell organelles and their physiological functions, Cell membrane structure and functions. Water and its role in plants, properties and functions of water in the cell. Water potential of plant cells. Mechanism of water uptake and transport in roots, aquaporins, Mycorrhizal association on water uptake. Energy balance-Solar energy input-energy dissipation at crop canopy level- evapotranspiration, transpiration Stomata structure and function. Influence of water stress at cell, organ, plant and canopy levels. Indices for assessment of drought resistance. The role of mineral nutrients in plant metabolism. Essential elements. Mechanisms of uptake-translocation of minerals in plants. Metabolic functions of mineral elements, deficiency symptoms, and toxicity. Foliar nutrition. Synthesis of sucrose, starch, oligo and polysaccharides (composition of cell wall). Translocation of photosynthates. Mitochondrial respiration, growth and maintenance respiration, cyanide resistant respiration. Lipid metabolism- Types of lipids. Biosynthesis of fattyacids, diacyl and triacyl glycerol, fatty acids of storage lipids. Secondary metabolites. Hormonal concept of growth and differentiation, plant growth hormones and their physiological role synthetic growth regulators. Growth retardants, Apical dominance, senescence, fruit growth, abscission. Photo morphogenesis- Photo receptors, physiology of flowering, Photoperiodism and Vernalisation.

UNIT 2

Plant Biodiversity, evolution in plants. General Aspects – Plant growth and development; Analysis of plant growth. Mobilization of food reserves during seed germination; Hormonal control of seed germination and seedling growth. Shoot, Leaf and Root Development –Floral Induction and Development – Photoperiodism and Vernalization, Molecular genetics of floral development and floral organ differentiation; Sex determination. Seed Development and Dormancy – Molecular and genetic determinants; Seed maturation and dormancy. Senescence and Programmed Cell Death (PCD) – PCD in the life cycle of plants. Light Control of Plant Development. Phytochromes and cryptochromes, Molecular mechanisms of light perception, signal transduction and gene regulation; Biological clocks Embryonic Pattern Formation –Maternal , Zygotic and Homeotic gene effects in Drosophila; Embryogenesis and early pattern formation in plants. Regeneration and totipotency; Organ differentiation and development; Pollen germination and pollen tube guidance; Phloem differentiation; Sex determination in plants. Self-incompatibility and its genetic control; Heterosis and apomixis.

UNIT 3

Definition of abiotic stresses. Abiotic stress factors. Water stress and Drought characteristic features. Physiological processes affected by drought. Drought resistance. mechanisms: Drought avoidance, Stress proteins. Water use efficiency as a drought resistant trait. Molecular responses to water deficit: Stress and hormones- ABA as a signaling molecule. Oxidative stress: Reactive Oxygen Species (ROS). High temperature stress: HSP's, Chilling stress: Salinity: Glycophytes and halophytes. Heavy metal stress: Phytochelatin.

UNIT 4

Definition and classification of plant growth regulators- Hormones, endogenous growth substances and synthetic chemicals Site of synthesis, biosynthetic pathways and metabolism and the influence on plant growth development of individual group of hormones- Auxins, Gibberellins, cytokinins, Abscisic acid and Ethylene Brassinosteroids. Hormone mutants and transgenic plants in understanding role of hormones. Signal perception, transduction, and effect at functional gene level of different hormones- Auxins- cell elongation, Gibberellins -, germination of dormant seeds, cytokinins- cell division. Retardation of senescence of plant parts, Abscisic acid-Stomatal closure and induction of drought resistance, Ethylene- fruit ripening. Interaction of hormones in regulation of plant growth and development processes. Synthetic growth regulators- Classification, their effect on plant growth and development. Practical utility in agriculture and horticulture.

UNIT 5

Crop growth analysis, key growth parameters. Factors limiting crop growth and productivity- the concept of rate limitation. Phenology- Growth stages, Factors influencing flowering. Photoperiodic and thermo-periodic responses. Canopy architecture, light interception, energy use efficiency of different canopies. Source-sink relationships. Physiological and molecular control of sink activity. Plant growth analysis techniques, yield structure analysis, theoretical and actual yields. Plant ideotypes. Simple physiological yield models- Duncan's, Monteith's, and Passioura's. Crop growth models-empirical models testing and yield prediction.

UNIT 6

The cellular basis of growth and morphogenesis cyto-differentiation. The cell cycle- Cell division and cell organization. Cell structure, morphogenesis and cellular totipotency. Introduction to in vitro methods : Terms and definitions, Use of growth regulators. Beginning of in vitro cultures in our country. Embryo culture, embryo rescue Endosperm culture and production of triploids. Embryogenesis and organogenesis and their practical applications : Clonal Multiplication of elite species. (Micro-propagation) Haploids and their applications. Somaclonal variations. Protoplast isolation : Principles and applications. Testing of viability of isolated protoplast. Steps in the regeneration of protoplast. Somatic hybridization –Various methods for fusing protoplast. Use of markers for selection of hybrid cells. Practical applications of somatic hybridization (hybrids

vs cybrids). Use of plant cells, protoplast and tissue culture for genetic manipulation of plant : Introduction to *A. tumefaciens*. Tumour formation on plants using *A. tumefaciens* (Monocots vs Dicots), Root – formation using *A. rhizogenes*.

UNIT 7

Photosynthesis- its significance in plant growth, development and bio-productivity. Physiological and biochemical aspects: chloroplast structure development and replication, photo systems, mechanism of light absorption, electron transport chain, Coupling factors and mechanisms of ATP synthesis, quantum yield. Photosynthetic carbon reduction cycle and its regulation. CO₂ Concentration Mechanism (CCM) as a complementary strategy for carbon fixation. CCM in photosynthetic bacteria, micro algae, Submerged Aquatic macrophages (SAM), C₄, CAM and single celled C₄ organisms. Rubisco structure, assembly and kinetics, photorespiration and its significance. Carbon fluxes between chloroplast and cytoplasm, the concept of RA, RS and RM. Pi recycling, starch and sucrose synthesis and export. Concept of canopy photosynthesis, influence of environmental factors such as water stress, high light stress VPD etc. Molecular aspects: chloroplast genome organization, expression and regulation of plastid genes Genes regulating potential traits of photosynthesis, biotechnological approaches for improving photosynthetic rate and productivity – transgenics. Conceptual approaches of expressing C₄ photosynthesis genes in C₃ species. Photosynthesis and crop productivity, energy utilization efficiency by crops. Photo inhibition, 7 photo oxidation, excitation energy dissipation mechanisms, photochemical and no- photochemical quenching of chlorophyll fluorescence. Photosynthesis and transpiration interaction, significance of WUE, carbon isotope discrimination concept. Nitrogen assimilation in photosynthesizing cells – NO₃ -NO₂ - reduction, GS-GOGAT pathway. Photorespiration loss of Ammonia and its re-assimilation and NUE.....

