Vivek University, Bijnor

Moradabad Road, Post Agri, Bijnor, U.P. - 246701 Syllabus of "Vivek University Research Aptitude Test (VURAT)" for Ph. D. Programme.

There would be two sections of question paper (Section-I - Research Aptitude & Research Methodology & Section -II -subject specific).

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(Please chose any one as per subject of Ph. D Programme)	
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VURAT Section- I: Research Aptitude & Research Methodology (Common to All)

Unit-I.

Research: Meaning, Types, and Characteristics, Positivism and Post- positivistic approach to research. Methods of Research: Experimental, Descriptive, Historical, Qualitative and Quantitative methods. Steps of Research. Thesis and Article writing: Format and styles of referencing. Application of ICT in research. Research ethics.

Unit- II.

Data Interpretation Sources, acquisition and classification of Data. Quantitative and Qualitative Data. Graphical representation (Bar-chart, Histograms, Pie-chart, Table-chart and Line chart) and mapping of Data. Data Interpretation. Data and Governance.

Basic Statistics for Research: Basic of Stats with Mean, Median, Mode, Standard Deviation, Variance and their applications in research.

Unit- III.

Communication: Meaning, types and characteristics of communication. Effective communication: Verbal and Non-verbal, Inter-Cultural and group communications, Classroom communication. Barriers to effective communication. Mass-Media and Society.

Unit -IV.

Information and Communication Technology (ICT) ICT: General abbreviations and terminology. Basics of Internet, Intranet, E-mail, Audio and Video-conferencing. Digital initiatives in higher education. ICT and Governance.



VURAT Section- II: Subject Specific (Please chose any one as per subject of Ph. D Programme)

Unit -I.

Zoology

Animal Diversity: General characters and classification of non-chordate and chordates. Cell Biology: Theories of cell and cell as a unit of life, Structure of Prokaryotic and eukaryotic Cell, Cellular Oragnaelles and their functions: Plasma membrane and its various models, ionic transport, cell cycle and its regulation. Cancer and its types, Apoptosis and necrosis, oncogenes and tumour suppressor gene.

Molecular Biology: DNA replication. Genetic code. Transcription and translation in prokaryotes and eukaryotes. RNA Synthesis and processing. Mutations & DNA repair systems. Theories in support of DNA as a genetic material, The central Dogma of Molecular Biology. DNA: Structure and conformation, packing of DNA into chromosomes. Structural polymorphism of DNA & RNA. Three -dimensional structure of t-RNA. Cell communication and cell signaling

Unit- II.

Genetics: Mendelian laws (Law of dominance, Law of Independent assortment,) Exception of Mendelian laws, lethal allele, multiple alleles, gene interaction. Sex linked inheritance, linkage and crossing over, Fine Structure of gene, Giant Chromosome (Polytene and lampbrush chromosome), genetic disorders, cytoplasmic inheritance and extra chromosomal inheritance, Operon hypothesis, Hardy-Weinberg law and its application, Mutation and its types.

Evolution and Systematics: Concepts of organic evolution and evolutionary theories. Origin of life (including aspects of pre-biotic environment and molecular evolution). Micro and macroevolution. Synthetic theory of evolution, Natural selection. History of animal taxonomy. Species concepts (Typological, Nominalistic, Biological and Evolutionary). Linnean hierarchy. Zoological Nomenclature: ICZN; Taxon, Rank and Categories. Preparation of Keys, Techniques of museum preparation. The evolutionary time scale; Eras, periods and epoch; Major events in the evolutionary time scale; Origins of unicellular and multi cellular organisms; Stages in primate evolution including human.

Unit- III.

Biostatistics and Tools and Techniques: Calculation of mean, median, mode, range, variance, standard deviation. Concepts of co-efficient of variation, skewness & kurtosis. Simple correlation. Elementary idea of random variables. Students-t, chi-square and F- test of significance. Introduction to some distributions of random variables: Binomial, Poisson, normal microscopy, principle & applications - Light microscope and phase contrast microscope

, Fluorescence microscope, Electron microscope, General Principle and applications of, Colorimeter, Spectrophotometer, Flame photometer Separation techniques- Chromatography, principle type and applications. Electrophoresis, Centrifugation, Ultra centrifuge.



Unit- IV.

Animal Physiology: Physiology of digestion & absorption: Mechanism of Digestion and absorption of proteins, fats and carbohydrates. Physiology of respiration: Exchange of respiratory gases at the pulmonary surface. Transport of respiratory gases by blood. Oxyhaemoglobin dissociation curve. Neural and chemical control of respiration. Physiology of cardiovascular system: Characteristics of vertebrate cardiac muscle. Initiation, conduction and regulation of heart beat. ECG and myocardial infarction. Blood pressure and its regulation. Blood groups. Coagulation of blood. Physiology of excretion: Formation of urine: Functional anatomy of the kidney. Glomerular filtration and its control. Counter current mechanism. Functions of aldosterone, antidiuretic hormone and renin-angiotensin system in renal physiology. Nervous system: Functional differentiation of brain, Neuron - the basic functional unit. Nerve impels, Mechanism of synaptic transmission. Reflexes and types of reflexes. Mechanism of thermoregulation in poikilotherms, homeotherms and heterotherms.

Unit- V.

Developmental Biology: Potency, commitment, Specification, Cell Fate and Cell lineages, Stem Cells, Programmed cell death, Aging and Senescence. Development and differentiation of sperm and oocytes, capacitation, vitellogenesis. Mechanism of fertilization acrosomal reaction, cortical reaction and fertilization membrane. Parthenogenesis. Cellular differentiation, RNA processing and translation). axes and pattern formation in Drosophila, amphibia and chick; organogenesis – eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development- larval formation, metamorphosis; environmental regulation of normal development; sex determination.

Unit- VI.

Ecology: Definition, Scope, Importance, Application. Limiting Factors: Liebig's law of the minimum, Shelford's law of tolerance. Combined concept of limiting factor, Factor interaction. Homeostasis. Biogeochemical cycle (nitrogen, phosphorus, carbon & water cycle). Ecosystem. Concept; Energy flow; Food chains & Ecological pyramids. Habitat Ecology: Concept of habitats & ecological niche. Population: Concept & attributes: Biotic potential, Density, Natality, Mortality; Intrinsic rate of natural increase, survivorship curves. Population growth forms; Carrying capacity; Population regulation (Density dependent and independent). Community: Concept & characteristics: Density, Dominance, Diversity& Stratification. Succession of communities; Key stone species.

Unit- VII.

Immunology: Overview of The Immune System. Cells and Organs of The Immune System. Antigens, Haptens & Epitopes Immunoglobulins: Structure and Function. Major Histocompatibility Complex. Cytokines, Cell mediated cytotoxicity: Mechanism of T cell, B cells & NK cell mediated lysis. Hypersensitivity and Autoimmunity. Introduction to Transplantation. Vaccines: Active and Passive Immunization Introduction to Monoclonal Antibodies, single cell protein and Hybridoma technology. Antigen-Antibody Interactions: Precipitation Reaction, Agglutination Reactions, RIA, ELISA, Western Blotting, Immuno precipitation, Immunofluorescence.



Chemistry

Unit- I.

Structure and bonding in homo- and hetero nuclear molecules: Concept of hybridization, spectral and magnetic properties, Molecular orbitals approach of diatomic molecules, VSEPR Theory - Shapes of polyatomic molecules, reaction mechanisms. Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications.

Main group elements and their compounds: Allotropy of carbon, phosphorous and Sulphur, Classification, nomenclature, structure, bonding of main group compounds: boranes, metalloboranes, carboranes, metallocarborances, silicones, carbides, phosphazenes and sulphur – Nitrogen Compounds.

Metal-Ligand Bonding: Crystal field theory and its limitations. John teller effect, Spectrochemical series, nephelauxectic effect. Ligand field theory, M.O. theory for octahedral, tetrahedral & square planar complexes without and with π -bonding. Abnormal magnetic properties, orbital contribution and quenching of orbital angular momentum. Determining the energy terms. Spin-orbit (L.S) coupling scheme, ground state terms. Electronic spectra of transition metal complexes. Selection rules, Charge transfer spectra, Substitution reactions and mechanism of octahedral and square planar transition metal complexes, Inert and Labile complexes, Electron transfer reactions.

Organometallic compounds: synthesis, bonding and structure, and reactivity. Organometallics in homogeneous catalysis. Cages and metal clusters. Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, nitrogen fixation, metal complexes in medicine.

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

Unit-II.

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.

Advanced quantum chemistry: Approximate methods, angular momentum, electronic structure of atoms. Chemical applications of group theory; symmetry elements; point groups; character tables; selection rules.

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.

Classical thermodynamics: Partial molar properties, partial molar free energy, partial molar volume and partial molar heat content and their significance. Concept of fugacity, Non-ideal systems, activity, activity coefficient. Debye-Huckel theory for activity coefficient of electrolytic solutions.



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.

Unit- III.

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

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. Pericyclic reactions – electrocyclisation, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications of photochemical reactions in organic chemistry.

Unit- IV.

Principles of Separation: Principle and applications of Paper chromatography, Thin Layer chromatography, Column chromatography, Ion exchange. Gas chromatography & Highperformance liquid chromatography, Solvent extraction.

Spectral Studies: Theoretical treatment of rotational, vibrational and electronic spectroscopy. Principle of spin magnetic resonance, resonance spectroscopy, Mossbauer and photoelectron spectroscopy; group theoretical treatment of Vibrational and Raman spectroscopy.

Basic understanding of Atomic electronic spectroscopy, Microwave spectroscopy, Infra-red spectroscopy, Magnetic Resonance spectroscopy, Photoelectron spectroscopy, Mass spectroscopy, Photoelectron, Electron spin resonance, UV and IR spectroscopy.

Unit- V.

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. Polymer chemistry: Molar masses; kinetics of polymerization.

Characterisation of compounds by Raman, IR, UV-VIS, 1H & 13C NMR and Mass spectroscopy, EPR, Mössbauer, UV-vis, XRD, electron spectroscopy and microscopic techniques.

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



Physics

Unit- I.

Mathematical Methods of Physics: Vector calculus. Matrices and their properties, linear ordinary differential equations of first & second order, Special functions. Fourier series, Fourier and Laplace transforms. Complex analysis, Elementary probability theory, binomial, Poisson and normal distributions.

Unit- II.

Classical Mechanics: Dynamical systems, Phase space dynamics, stability analysis. Central force motions, Variational principle, Lagrangian and Hamiltonian formalism Small oscillations, Poisson brackets and canonical transformations. Special theory of relativity.

Unit- III.

Electromagnetic Theory: Electrostatics, Laplace and Poisson equations, Magnetostatics: Biot-Savart law, Electromagnetic induction. Maxwell's equations in free space. Electromagnetic waves in free space, dielectrics, conductors. Reflection and refraction, polarization, Fresnel's law, interference, coherence, and diffraction.

Unit- IV.

Quantum Mechanics: One dimensional Schrödinger equation. Commutators and Heisenberg uncertainty principle. Motion in a central potential: orbital angular momentum, angular momentum algebra, spin, addition of angular momentum; Hydrogen atom. Time-dependent and independent perturbation theory and applications. Variational method, identical particles. Elementary theories of scattering.

Unit- V.

Thermodynamic and Statistical Physics: Laws of thermodynamics. Maxwell relations, Phase space, micro- and macro-states. Micro-canonical, canonical and grand-canonical ensembles and partition functions. Classical and quantum statistics, Ideal Bose and Fermi gases. Blackbody radiation and Planck's distribution law.

Unit- VI.

Atomic & Molecular Physics: Quantum states of an electron in an atom. Electron spin, Spectrum of helium and alkali atom. LS & JJ couplings. Zeeman, Paschen-Bach & Stark effects. Electronic rotational, vibrational and Raman spectra of diatomic molecules, selection rules. Lasers.

Unit- VII.

Condensed Matter Physics: Bravais lattices. Reciprocal lattice. Diffraction and the structure factor. Bonding of solids. Free electron theory and electronic specific heat. Band theory of solids, Drude model of electrical & thermal conductivity, superconductivity.



Unit- VIII.

Nuclear and Particle Physics: Basic nuclear properties, Binding energy, semi-empirical mass formula, liquid drop model, shell model. Classification of fundamental forces. Elementary particles and their quantum numbers. Quark model, baryons and mesons.

Unit- IX.

Electronics and Experimental Methods: Semiconductor, device structure, device characteristics, frequency dependence and applications. Opto-electronic devices Operational amplifiers and their applications. Digital techniques and applications.



Mathematics

Unit-I.

Linear Algebra: Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations. Algebra of matrices, rank and determinant of matrices, linear equations. Eigen values 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-II.

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, Taylor series, Laurent series, and calculus of residues.

Algebra: Permutations, combinations, Euler's Ø- function, primitive roots. Groups, subgroups, normal subgroups, quotient groups, homomorphism, 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.

Unit-III.

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.

Unit- IV.

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.

Unit-V.

Descriptive statistics, exploratory data analysis Sample space, discrete probability, independent events, Bayes theorem. Random variables and distribution functions (univariate and multivariate); expectation and moments. Independent random variables, marginal and conditional distributions. Characteristic functions. Standard discrete and continuous univariate distributions.

Linear programming problem, simplex methods, duality. Elementary queuing and inventory models. Steady-state solutions of Markovian queuing models: M/M/1, M/M/1 with limited waiting space, M/M/C, M/M/C with limited waiting space, M/G/1.



Unit-VI.

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.

Unit-VII.

Linear Integral Equations: Linear integral equation of the first and second kind of Fredholm and Volterra type, Solutions with separable kernels. Characteristic numbers and eigen functions, resolvent kernel.

Unit -VIII.

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, derivative as a linear transformation, inverse and implicit function theorems. Metric spaces, compactness, connectedness. Normed linear Spaces. Spaces of continuous functions as examples.



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Botany

Unit-I.

Cryptogams (Fungi, Algae, Bryophytes and Pteridophytes): General characters of fungi, their significance human. Organization thallus. to of structure of fungal cell wall composition, nutrition reproduction, kinds of spores. Heterokaryosis, Heterothallism, Parasexuality, Mycorrhizae, Predaceous fungi. Role of fungi in industry (Alcohol). Medicine (Antibiotics a n d steroids), food (edible mushrooms). Structure, nutrition, reproduction & economic importance of bacteria; Structure & replication of viruses and bacteriophages.

Thallus organization in algae; Reproductive pattern in algae. Cyanobacteria: Salient features and Biological Importance; Algal Biofertilizers. Lichens: structure, reproduction and economic importance.

General characteristics features and classification of bryophytes and pteridophytes. Medicinal uses of bryophytes, Ecological importance of bryophytes. Apogamy, apospory, significance and experimental induction, Heterospory and Origin of seed habit in pteridophytes,

Unit- II.

Phanerogams (Gymnosperms and Angiosperms), plant taxonomy and Economic Botany: General characteristics features, classification and Economic importance of gymnosperms. Systems of classifications of angiosperms (Benthom & Hooker; Engler & Prantl, Takhtajan).

Diagnostic features of plant families: Malvaceae, Leguminosae, Euphorbiaceae, Solanaceae, Lamiaceae, Asteraceae, Cucurbitaceae, poaceae, Liliaceae, Orchidaceae.

Salient features of the International Code of Botanical Nomenclature, Botanical gardens and Herbaria.

Experimental Embryology: in vitro fertilization, anther, pollen and embryo culture, Anatomy in relation to taxonomy, Anomalous secondary structure.

Economic Botany: Origin, morphology, and uses of cereals, legumes, spices, beverages, medicines and fiber yielding plants.

Unit- III.

Cell Biology, Genetics and Molecular Biology: Cell wall composition and architecture. Cell Membranes – Structural models; Composition and dynamics; Nucleic Acids – DNA and RNA-structure and classes; repeated DNA, DNA Replication, Semi-conservative, bidirectional, replication origins, replication machinery.

Genetic code: Deciphering the genetic code, characteristics. Regulation of gene expression in prokaryotes: Operon concept, lac operon regulation by positive and negative mechanism, trp operon, regulation by negative and attenuation. Regulation of gene expression in eukaryotes. Transcriptional level: Regulatory sequences, nucleosome positioning, chromatin remodelling, Recombinant DNA technology- enzymes and vectors (plasmids, cosmids, lambda, artificial chromosomes).

Plant Cell and Tissue Culture: concept of cellular differentiation Totipotency, organogenesis and adventive embryogenesis; Fundamental aspects of morphogenesis, somatic embryogenesis and androgenesis-mechanisms, techniques and utility. Transgenic plants- transgenic for insect resistance, herbicide resistance, abiotic stress resistance, disease resistance, long shelf of fruits and flowers, male sterile lines, cryopreservation.



Unit- IV.

Plant Physiology and Biochemistry: Structure, metabolism, transport, significance and mechanism of action of Plant Hormones. Germination and Dormancy of seeds; factors affecting dormancy and its regulation by plant growth regulators and environmental factors.

Photosynthesis: General concepts, pigments, absorption of light and light harvesting complex, cyclic and non- cyclic photophosphorylation. The sequence of reactions in photosynthesis, the path of carbon assimilation (C3 and C4 cycles, CAM pathway), chemosynthesis.

Respiration: Overview of plant respiration, significance, mechanism of respiration Fermentation, glycolysis, krebs cycle, electron transport chain and ATP synthesis, pentose phosphate pathway, glyoxylate cycle, alternate oxidase system, general account of photorespiration.

Nitrogen Metabolism: Biochemistry of nitrogen fixation, the enzyme nitrogenase, nitrogen fixation in legumes and free-living systems, nitrate reduction, amination, transamination, biosynthesis of amino acids. Functions of Biological Molecules, cell and organisms as biochemical entities, Metabolism and Biochemical energetics.

Unit- V.

Plant Ecology: Population ecology: Concept, characteristics, population growth and regulation, species interactions, Ecosystem organization: structure and functions; primary production (global pattern and controlling factors); energy dynamics-trophic levels, energy flow pathways and ecological efficiencies; decomposition (mechanism, substrate quality and climatic factors); global biogeochemical cycles of C, N, P, & S, ecosystem stability (resistance and resilience).Global climate change stratospheric ozone layer and ozone hole; climate change acid forest types India. impacts. rain. of forest resources of India In situ conservation of biodiversity: Protected area in India: sanctuaries, national parks, biosphere Reserves. Conservation of biodiversity of wetlands, mangroves and coral reefs. Ex situ biodiversity conservation: principles and practices, field gene banks and seed banks.



Home Science

Unit- I.

Nutrition & Assessment

- Nutritional status assessment: Anthropometric, Clinical, Biochemical, Dietary
- Nutritional surveillance & social aspects
- Nutrients: Macronutrients, Micronutrients, Vitamins (fat & water soluble)
- Emerging concepts in human nutrition
- Nutrition across life stages: Pregnancy, Lactation, Infancy, Childhood, Adolescents, Adults, Elderly, Sports
- National nutritional intervention programs

Dietetics

- Modified diets: Fever, GI disorders, Renal, Liver, Heart, Metabolic diseases
- Obesity & undernutrition
- Patient care & rehabilitation

Unit- II.

Food Science

- Sensory & objective evaluation
- Cookery: Sugar, Starch, Milk, Eggs, Pulses, Vegetables, Meat, Fish
- Food adulteration, standards & laws
- Fortification, enrichment, GM foods

Food Processing

- Methods: Thermal, Freezing, Dehydration, Radiation, Fermentation
- Food technology for cereals, pulses, milk, meat, oils, spices
- Indicators of MCH (Maternal and Child Health) care

Unit- III.

Nutritional Biochemistry

- Carbohydrates, lipids, proteins metabolism
- Enzymes & co-enzymes (structure & functions)

Physiology

- Body systems: Cardiovascular, Respiratory, Digestive, Nervous, Excretory
- Endocrine system, muscles, skeleton, sensory organs
- Blood & body fluids, immunity, reproduction & development

Unit- IV.

Textile Science, Fashion Designing & Garment Production

- Textile fibers: Natural & synthetic
- Yarn classification, fabric construction (woven, knitted, non-woven)
- Testing, quality control, finishes
- Dyeing & printing techniques (block, batik, screen, digital)
- Traditional Indian textiles
- Eco-friendly textiles, banned dyes
- Advanced textiles: Nano, technical, zero waste
- Clothing construction: Drafting, flat pattern, draping

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- Fashion design, business & merchandising
- Garment care, body measurements, sewing tools & machines

Unit- V.

Family Resource Management & Consumer Science

- Home management concepts & theories
- Resource classification & utilization
- Decision-making & conflict resolution
- Time, money, energy management
- Household equipment, housing design
- Budgeting, banking, insurance, credit
- Consumer education, rights & protection laws
- Interior design: Art principles, color theory, furniture, lighting, flower arrangement
- Ergonomics, physiological cost of work
- Designing for special needs
- Environment & pollution; waste management; rainwater harvesting

Unit- VI.

Human Development & Family Dynamics

- Human development stages: prenatal to old age
- Domains: Physical, social, emotional, intellectual, language, personality
- Role of family, school, peers
- Developmental theories (cognitive, learning, personality)
- Population growth, women & child welfare programs
- Marriage & family life: Readiness, counseling, laws (marriage, divorce, adoption)
- Children with special needs & education
- ECCE (Early Childhood Care & Education): Trends & issues
- Puberty & adolescence challenges
- Advanced child study methods

Unit-VII.

Extension & Communication

- Home Science vocationalization & extension: Concepts, principles, approaches
- Rural development & community development programs
- Gender sensitivity & leadership training
- Panchayati Raj system
- Communication: Traditional & modern methods, barriers, models, strategies
- Programme planning (PERT, CPM), evaluation methods
- Entrepreneurship promotion, SHGs (Self Help Groups), HRD strategies



Microbiology

Unit-I.

1.Classification of Microorganisms (Haekel, Whittaker, Carl Woese), classification and salient features of bacteria according to Berger's Manual of Determinative Bacteriology.

2. Morphology and ultra structure of bacteria: size, shape, and arrangement of bacteria, ultra structure of bacterial cell wall of eubacteria and archeabacteria. Protoplast and spheroplast formation and L-form. Components external to cell wall: Structure and function of flagella, fimbriae and pilli, capsule- types, composition and function, slime layers, S-layers.

3. Prokaryotic cell membrane and cytoplasmic matrix – cell membrane structure and function of bacteria and archeabacteria, mesosomes, ribosomes, cytoplasmic inclusion bodies (polyhydroxy butyrate, polyphosphate granules, oil droplets, cyanophycin granules) and nucleoid.

4. Bacterial nutrition: Basic nutritional requirements, growth factors, nutritional categories, physical requirements of bacterial growth. Bacteriological media: types (complex, synthetic, differential, enrichment and selective media) and their uses, culture characteristics of bacteria on different media.

5. Cultivation of bacteria: aerobic and anaerobic culture, pure culture techniques, shaker and still culture, maintenance and preservation of microbial culture. Bacterial growth: growth kinetics, growth curve. Batch, continuous and synchronous culture. Measurement of growth and influence of environmental factors affecting growth.

Unit-II.

1. General properties of viruses, morphology and ultra-structure of viruses, capsid and their arrangements, types of envelopes and their composition, measurement of viruses.

2. Viral genome; their types and structure, viral related agents-viroids and prions.

3. Cultivation of viruses- in embryonated eggs, experimental animals and cell lines; primary and secondary cell lines, diploid cell culture.

4. Plant viruses: recent advance in classification of plant viruses. Structure and pathogenicity of TMV. Transmission of plant viruses with vector (insect, nematodes and fungi) and without vector (contact, seed and pollens). Biochemical changes induced by virus in plant cell.

5. Structure, reproduction and classification of fungi, general characteristics of Zygomycetes, Ascomycetes, Basidiomycetes, and Deuteromycetes. Cultivation of fungi, culture media for fungal growth, effects of environment on growth, isolation, identification and preservation of fungi. Lichens and Mycorrhiza.

Unit-III.

1. Structure of DNA, types, topological properties and role of topoisomerase. DNA denaturation and renaturation. DNA damage and repair: types of DNA damage (deamination, oxidative damage, alkylation and pyrimidine diamers), repair mechanism; mismatch repair, nucleotide excision repair, recombination repair, SOS repair.

2. DNA replication: general principle, various mode of replication, Structural features of RNA (rRNA, tRNA, mRNA) and polycistronic and monocistronic RNA. Transcription, types of RNA polymerases, inhibitors of RNA synthesis. Post-transcriptional modification, Translation of RNA.

3. Enzymes used in DNA technology: Restriction and modification enzymes, nucleases, polymerases, ligase, kinases and phosphatases.

4.Cloning techniques: DNA isolation (Bacteria, Fungi, Plant and animal), Insert preparation, Ligation, Transformation methods (chemical methods, Electroporation and microinjection), Transfection. DNA Sequencing: Sangers method, Maxmam Gilbert method, Thermocycle sequencing and Pyrosequencing

5. Principles of hybridization and hybridization based techniques: Colony, plaque, in-situ Hybridization, Southern, Northern, Western blotting, Oligonucleotide synthesis, Restriction mapping, S1 nuclease and RNase mapping.

Unit-IV.

1. Anatomical organization of immune system: primary and secondary lymphoid organs: structure and function.

2. Antigens- structure and properties, factors affecting the immunogenicity, properties of B and T-cell epitopes, haptens, mitogens, super antigen, adjuvants.



3. Antibody: structure, properties, types and function of antibodies, antigenic determinants on immunoglobulin; isotypes, allotypes, and idiotypes, molecular mechanism of antibody diversity and class switching.

4. Cell mediated immunity and its mechanism.

5. Major histocompatibility complex: organization of MHC genes, types and function of MHC molecules, antigen presentation, MHC polymorphism, MHC related diseases.

6. Complement system: components, activation pathways, regulation of activation pathways and role of complement system in immune response.

Unit- V.

1. Microscopy: history and principles, magnification power, resolution limit, resolving power, numerical aperture. Light microscopy, bright field, dark field, phase contrast and fluorescent microscopy. Determination of size of microorganisms by micrometery. Principles and application of electron microscopy- transmission and scanning electron microscopy. Fixation and staining techniques in electron Microscopy.

2. Chromatography: Principles, types and applications of partition, paper and thin layer chromatography. Adsorption and Gel filtration chromatography: Principle, matrix, column packing and applications. Affinity, ion exchange, and Gas chromatography: Principle and applications.

3. Principle, types and applications of Paper, Starch gel and Agarose gel electrophoresis, Native PAGE and SDS-PAGE,

4.Immunotechniques: ELISA, RIA, Hybridoma technique. Molecular markers: RFLP, AFLP, RAPD.



Management

Unit-I.

Management and Economics:

Management – Concept, Process, Theories and Approaches, Management Roles and Skills.

Functions – Planning, Organizing, Staffing, Coordinating and Controlling.

Communication – Types, Process and Barriers.

Decision Making - Concept, Process, Techniques and Tools

Organisation Structure and Design – Types, Authority, Responsibility, Centralisation, Decentralisation and Span of Control

Managerial Economics - Concept & Importance

Demand analysis - Utility Analysis, Indifference Curve, Elasticity & Forecasting

Market Structures - Market Classification & Price Determination

National Income – Concept, Types and Measurement

Inflation - Concept, Types and Measurement

Business Ethics & CSR

Ethical Issues & Dilemma

Corporate Governance

Value Based Organisation

Unit-II.

Organisational Behaviour:

Organisational Behaviour - Significance & Theories

Individual Behaviour – Personality, Perception, Values, Attitude, Learning and Motivation

Group Behaviour – Team Building, Leadership, Group Dynamics

Interpersonal Behaviour & Transactional Analysis

Organizational Culture & Climate

Work Force Diversity & Cross Culture Organisational Behaviour

Emotions and Stress Management

Organisational Justice and Whistle Blowing

Human Resource Management – Concept, Perspectives, Influences and Recent Trends Human Resource Planning, Recruitment and Selection, Induction, Training and Development

Job Analysis, Job Evaluation and Compensation Management



Unit- III.

Human Resource Management:

Strategic Role of Human Resource Management

Competency Mapping & Balanced Scoreboard

Career Planning and Development

Performance Management and Appraisal

Organization Development, Change & OD Interventions

Talent Management & Skill Development

Employee Engagement & Work Life Balance

Industrial Relations: Disputes & Grievance Management, Labour Welfare and Social Security

Trade Union & Collective Bargaining

International Human Resource Management - HR Challenge of International Business

Green HRM

Unit-IV.

Finance:

Accounting, Principles and Standards, Preparation of Financial Statements

Financial Statement Analysis - Ratio Analysis, Funds Flow and Cash Flow Analysis

Preparation of Cost Sheet, Marginal Costing, Cost Volume Profit Analysis

Standard Costing & Variance Analysis

Financial Management, Concept & Functions

Capital Structure – Theories, Cost of Capital, Sources and Finance

Budgeting and Budgetary Control, Types and Process, Zero base Budgeting

Leverages – Operating, Financial and Combined Leverages, EBIT–EPS Analysis, Financial Breakeven Point & Indifference Level.

Value & Returns – Time Preference for Money, Valuation of Bonds and Shares, Risk and Returns;

Capital Budgeting – Nature of Investment, Evaluation, Comparison of Methods; Risk and Uncertainly Analysis

Dividend – Theories and Determination

Portfolio Management – CAPM, APT

Working Capital Management – Determinants, Cash, Inventory, Receivables and Payables Management, Factoring

International Financial Management, Foreign exchange market



Unit- V.

Strategic Management:

Strategic Management – Concept, Process, Decision & Types

Strategic Analysis – External Analysis, PEST, Porter's Approach to industry analysis, Internal Analysis – Resource Based Approach, Value Chain Analysis

Strategy Formulation – SWOT Analysis, Corporate Strategy – Growth, Stability, Retrenchment, Integration and Diversification, Business Portfolio Analysis - BCG, GE Business Model, Ansoff's Product Market Growth Matrix

Strategy Implementation – Challenges of Change, Developing Programs Mckinsey 7s Framework

Unit- VI.

Marketing Management:

Marketing - Concept, Orientation, Trends and Tasks, Customer Value and Satisfaction

Market Segmentation, Positioning and Targeting

Product and Pricing Decision – Product Mix, Product Life Cycle, New Product development, Pricing – Types and Strategies

Place and promotion decision – Marketing channels and value networks, VMS, IMC, Advertising and Sales promotion

Consumer and Industrial Buying Behaviour: Theories and Models of Consumer Behaviour

Brand Management – Role of Brands, Brand Equity, Equity Models, Developing a Branding Strategy; Brand Name Decisions, Brand Extensions and Loyalty

Customer Relationship Marketing – Relationship Building, Strategies, Values and Process

Emerging Trends in Marketing – Concept of e-Marketing, Direct Marketing, Digital Marketing and Green Marketing

International Marketing – Entry Mode Decisions, Planning Marketing Mix for International Markets

Unit- VII.

Business Statistics:

Statistics for Management: Concept, Measures of Central Tendency and Dispersion, Probability Distribution – Binominal, Poison, Normal and Exponential

Data Collection & Questionnaire Design

Sampling - Concept, Process and Techniques

Hypothesis Testing – Procedure; T, Z, F, Chi-square tests

Correlation and Regression Analysis

Operations Management – Role and Scope

Facility Location and Layout - Site Selection and Analysis, Layout - Design and Process

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Enterprise Resource Planning - ERP Modules, ERP implementation

Scheduling; Loading, Sequencing and Monitoring

VIVE

Operation Research - Transportation, Queuing Decision Theory, PERT / CPM

Unit- VIII.

International Business:

International Business – Managing Business in Globalization Era; Theories of International Trade; Balance of payment

Foreign Direct Investment – Benefits and Costs

Role of International Financial Institutions - IMF, World Bank and WTO

Information Technology - Use of Computers in Management Applications; MIS, DSS

Artificial Intelligence and Big Data

Unit- IX.

Entrepreneurship Development:

Entrepreneurship Development – Concept, Types, Theories and Process, Developing Entrepreneurial Competencies

Women Entrepreneurship and Rural Entrepreneurship

Business Plan and Feasibility Analysis – Concept and Process of Technical, Market and Financial Analysis

Micro and Small Scale Industries in India; Role of Government in Promoting SSI

Institutional Finance to Small Industries – Financial Institutions, Commercial Banks, Cooperative Banks, Micro Finance.



Commerce

Unit- I.

Business Environment and International Business:

- Concepts and elements of business environment: Economic environment- Economic systems, Economic policies (Monetary and fiscal policies); Political environment Role of government in business; Legal environment- Consumer Protection Act, FEMA; Socio-cultural factors and their influence on business; Corporate Social Responsibility (CSR).
- Scope and importance of international business; Globalization and its drivers; Modes of entry into international business.
- Theories of international trade; Government intervention in international trade; Tariff and non-tariff barriers; India's foreign trade policy.
- Foreign direct investment (FDI) and Foreign portfolio investment (FPI); Types of FDI, Costs and benefits of FDI to home and host countries; Trends in FDI; India's FDI policy.
- Balance of payments (BOP): Importance and components of BOP.
- Regional Economic Integration: Levels of Regional Economic Integration; Trade creation and diversion effects; Regional Trade Agreements: European Union (EU), ASEAN, SAARC, NAFTA.
- International Economic institutions: IMF, World Bank, UNCTAD.
- World Trade Organization (WTO): Functions and objectives of WTO; Agriculture Agreement; GATS; TRIPS; TRIMS.

Unit- II.

Accounting and Auditing:

- Basic accounting principles; concepts and postulates.
- Partnership Accounts: Admission, Retirement, Death, Dissolution and Insolvency of partnership firms.
- Corporate Accounting: Issue, forfeiture and reissue of shares; Liquidation of companies; Acquisition, merger, amalgamation and reconstruction of companies Holding company accounts.
- Cost and Management Accounting: Marginal costing and Break-even analysis; Standard costing; Budgetary control; Process costing; Activity Based Costing (ABC); Costing for decision-making; Life cycle costing, Target costing, Kaizen costing and JIT.
- Financial Statements Analysis: Ratio analysis; Funds flow Analysis; Cash flow analysis.
- Human Resources Accounting; Inflation Accounting; Environmental Accounting Indian Accounting Standards and IFRS.
- Auditing: Independent financial audit; Vouching; Verification ad valuation of assets and liabilities; Audit of financial statements and audit report; Cost audit.
- Recent Trends in Auditing: Management audit; Energy audit; Environment audit; Systems audit; Safety audit.



Unit- III.

Business Economics:

- Meaning and scope of business economics.
- Objectives of business firms.
- Demand analysis: Law of demand; Elasticity of demand and its measurement; Relationship between AR and MR.
- Consumer behavior: Utility analysis; Indifference curve analysis.
- Law of Variable Proportions: Law of Returns to Scale.
- Theory of cost: Short-run and long-run cost curves.
- Price determination under different market forms: Perfect competition; Monopolistic competition; Oligopoly- Price leadership model; Monopoly; Price discrimination.
- Pricing strategies: Price skimming; Price penetration; Peak load pricing.

Unit- IV.

Business Finance:

- Scope and sources of finance; Lease financing.
- Cost of capital and time value of money.
- Capital structure Capital budgeting decisions: Conventional and scientific techniques of
- Capital budgeting analysis.
- Working capital management; Dividend decision: Theories and policies.
- Risk and return analysis; Asset securitization.
- International monetary system.
- Foreign exchange market; Exchange rate risk and hedging techniques.
- International financial markets and instruments: Euro currency; GDRs; ADRs.
- International arbitrage; Multinational capital budgeting.

Unit- V.

Business Statistics and Research Methods:

- Measures of central tendency.
- Measures of dispersion.
- Measures of skewness.
- Correlation and regression of two variables.
- Probability: Approaches to probability; Bayes' theorem.
- Probability distributions: Binomial, poisson and normal distributions.
- Research: Concept and types; Research design.
- Data: Collection and classification of data.
- Sampling and estimation: Concepts; Methods of sampling probability and nonprobability methods; Sampling distribution; Central limit theorem; Standard error; Statistical estimation.
- Hypothesis testing: z-test; t-test; ANOVA; Chi–square test; Mann-Whitney test (Utest); Kruskal-Wallis test (H-test); Rank correlation test.
- Report writing.



Unit- VI.

Business Management and Human Resource Management:

- Principles and functions of management.
- Organization structure: Formal and informal organizations; Span of control.
- Responsibility and authority: Delegation of authority and decentralization.
- Motivation and leadership: Concept and theories.
- Corporate governance and business ethics.
- Human resource management: Concept, role and functions of HRM; Human resource planning; Recruitment and selection; Training and development; Succession planning.
- Compensation management: Job evaluation; Incentives and fringe benefits Performance appraisal including 360 degree.
- Performance appraisal.
- Collective bargaining and workers' participation in management.
- Personality: Perception; Attitudes; Emotions; Group dynamics; Power and politics; Conflict and negotiation; Stress management.
- Organizational Culture: Organizational development and organizational change.

Unit- VII.

Banking and Financial Institutions:

- Overview of Indian financial system.
- Types of banks: Commercial banks; Regional Rural Banks (RRBs); Foreign banks; Cooperative banks.
- Reserve Bank of India: Functions; Role and monetary policy management.
- Banking sector reforms in India: Basel norms; Risk management; NPA management.
- Financial markets: Money market; Capital market; Government securities market.
- Financial Institutions: Development Finance Institutions (DFIs); Non-Banking Financial Companies (NBFCs); Mutual Funds; Pension Funds.
- Financial Regulators in India.
- Financial sector reforms including financial inclusion.
- Digitisation of banking and other financial services: Internet banking; mobile• banking; Digital payments systems.
- Insurance: Types of insurance- Life and Non-life insurance; Risk classification and management; Factors limiting the insurability of risk; Re-insurance; Regulatory framework of insurance- IRDA and its role.

Unit- VIII.

Marketing Management:

- Marketing: Concept and approaches; Marketing channels; Marketing mix; Strategic marketing planning; Market segmentation, targeting and positioning.
- Product decissions: Concept; Product line; Product mix decisions; Product life cycle; New product development.
- Pricing decisions: Factors affecting price determination; Pricing policies and strategies.
- Promotion decisions: Role of promotion in marketing; Promotion methods Advertising; Personal selling; Publicity; Sales promotion tools and techniques; Promotion mix.

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- Distribution decisions: Channels of distribution; Channel management.
- Consumer Behavior; Consumer buying process; factors influencing consumer buying decisions.
- Service marketing.
- Trends in marketing: Social marketing; Online marketing; Green marketing; Direct marketing; Rural marketing; CRM.
- Logistics management.

VIVE

Unit- IX.

Legal Aspects of Business:

- Indian Contract Act, 1872: Elements of a valid contract; Capacity of parties; Free consent; Discharge of a contract; Breach of contract and remedies against breach; Quasi contracts.
- Special contracts: Contracts of indemnity and guarantee; contracts of bailment and pledge; Contracts of agency.
- Sale of Goods Act, 1930: Sale and agreement to sell; Doctrine of Caveat Emptor; Rights of unpaid seller and rights of buyer.
- Negotiable Instruments Act, 1881: Types of negotiable instruments; Negotiation and assignment; Dishonor and discharge of negotiable instruments.
- The Companies Act, 2013: Nature and kinds of companies; Company formation; Management, meetings and winding up of a joint stock company.
- Limited Liability Partnership: Structure and procedure of formation of LLP in India The Competition Act, 2002: Objectives and main provisions.
- The Information Technology Act, 2000: Objectives and main provisions; Cyber crimes and penalties The RTI Act, 2005: Objectives and main provisions.
- Intellectual Property Rights (IPRs) : Patents, trademarks and copyrights; Emerging issues in intellectual property .
- Goods and Services Tax (GST): Objectives and main provisions; Benefits of GST; Implementation mechanism; Working of dual GST.

Unit- X.

Income-tax and Corporate Tax Planning:

- Income-tax: Basic concepts; Residential status and tax incidence; Exempted incomes; Agricultural income; Computation of taxable income under various heads; Deductions from Gross total income; Assessment of Individuals; Clubbing of incomes.
- International Taxation: Double taxation and its avoidance mechanism; Transfer pricing.
- Corporate Tax Planning: Concepts and significance of corporate tax planning; Tax avoidance versus tax evasion; Techniques of corporate tax planning; Tax considerations in specific business situations: Make or buy decisions; Own or lease an asset; Retain; Renewal or replacement of asset; Shut down or continue operations.
- Deduction and collection of tax at source; Advance payment of tax; E-filing of incometax returns.



Education

Unit-I.

Educational Studies:

Western School of Philosophy: Idealism, Realism, Naturalism, Pragmatism, Existentialism with special reference to the concepts of knowledge, reality and values; their educational implications for aims, contents and methods of teaching.

Indian Schools of Philosophy: Vedanta, Buddhism, Jainism, Islamic traditions with special reference to the concepts of knowledge, reality and values; and their educational implications

Contributions of Educational Thinkers: Vivekananda, Tagore, Gandhi and Aurobindo to education. Meaning and nature of Sociology of Education, Education and social change, Constraints on social change (Caste, ethnicity, class, language, religion, population and regionalism). Education as related to social equity and equality of educational opportunities. Education of socially and economically disadvantaged section of society with special reference to scheduled castes and scheduled tribes, Women and rural population. Education as a fundamental right.

Unit- II.

Learner and Learning Process:

Process of growth and Development with reference to: Physical, Social, Emotional and Intellectual development. Development of Concept formation, Logical reasoning, Problem solving and Creative thinking, Language Development.

Individual differences – determinants- role of heredity and environment. Implication of individual differences for organizing educational programmes. Intelligence Its theories and measurement.

Learning and Motivation: Theories of learning: Thorndike's connectionism, Pavlov's Classical and Skinners operant Conditioning; Learning by insight. Hull's reinforcement theory and Tolman's theory of learning. Gagne's hierarchy of learning. Factors influencing learning. Learning and Motivation. Transfer of learning and its theories.

Personality: Type and theories- measurement of personality Mental health and hygiene. Process of adjustment, conflicts and defence mechanism.

Concept and principles of guidance and counselling, types of guidance and counselling. Tools and Techniques of Guidance - records, scales and tests, interview. Organizing Guidance services at different levels of education, occupational information, kinds of services, like information testing, counselling and follow-up.

Unit- III.

Research in Education: Meaning and Nature of Educational Research, Types, Theory development, Nature of Variables, Formulation of Research Problem.

Hypothesis: Concept, difference with assumptions, source, various types of hypothesis. Sample: Concept of population and sample, Various method of sampling. Tools: Questionnaire, Observation and interview as tools of data collection, tests and scales Descriptive Research, Ex-Post facto Research, Survey Method, Historical Research Experimental Research:



Designs of experimental research, Characteristics internal and external validity in experimental research Qualitative research: Phenomenological research, Ethnomethodical and Naturalistic inquiry.

Analysis of Data Descriptive and inferential statistics. The null hypothesis, test of significance. Types of error, one-tailed and two-tailed tests The t-test The F- test (One-way ANOVA) Non-Parametric tests (Chi-Square test) Biserial, Point-biserial, tetrachoric and phi-coefficient of correlation Partial and Multiple correlations.

Measurement and Evaluation- Formative evaluation, Summative evaluation.

Characteristics of a good measuring tool, Reliability, Validity and Norm, Construction and standardization of Achievement test.

Unit- IV.

Educational Management, Administration and Leadership:

Universalization of elementary education in India Vocationalization of education in USA and India. Educational Administration in USA, UK (Britain and Ireland) and India Distance education and continuing education in Australia, UK and India Construction and Development of Curriculum-different models Administrative, Grassroots, Demonstration, System Analysis.

Educational Administration and Management: Concept and Development Taylorism, Administration as a process, Administration as a bureaucracy, Human relation approach to administration, System era.

Modern trends in Educational Administration such as Decision making and Organizational Compliance, Organizational Development, PERT, System Approach and Total Quality Management.

Unit- V.

Inclusive Education:

Inclusive Education: Concept, Principles, Scope and Target Groups (Diverse learners; Including Marginalized group and Learners with Disabilities), Evolution of the Philosophy of Inclusive Education: Special, Integrated, Inclusive Education, Legal Provisions: Policies and Legislations (National Policy of Education (1986), Programme of Action of Action (1992), Persons with Disabilities Act (1995), National Policy of Disabilities (2006), National Curriculum Framework (2005), Concession and Facilities to Diverse Learners (Academic and Financial), Rehabilitation Council of India Act (1992), Inclusive Education under Sarva Shiksha Abhiyan (SSA), Features of UNCRPD (United Nations Convention on the Rights of Persons with Disabilities) and its Implication.

Concept of Impairment, Disability and Handicap, Classification of Disabilities based on ICF Model, Readiness of School and Models of Inclusion, Prevalence, Types, Characteristics and Educational Needs of Diverse learners' Intellectual, Physical and Multiple Disabilities, Causes and prevention of disabilities, Identification of Diverse Learners for Inclusion, Educational Evaluation Methods, Techniques and Tools.

Planning and Management of Inclusive Classrooms: Infrastructure, Human Resource and Instructional Practices, Curriculum and Curricular Adaptations for Diverse Learners, Assistive and Adaptive Technology for Diverse learners: Product (Aids and Appliances) and Process (Individualized Education Plan, Remedial Teaching), Parent-ProfessionalPartnership:RoleofParents,Peers,Professionals,Teachers,School.



Barriers and Facilitators in Inclusive Education: Attitude, Social and Educational, Current Status and Ethical Issues of inclusive education in India, Research Trends of Inclusive Education in India.

Unit- VI.

Technology in /for Education:

Concept of Educational Technology (ET) as a Discipline: (Information Technology, Communication Technology & Information and Communication Technology (ICT) and Instructional Technology, Applications of Educational Technology in formal, non formal (Open and Distance Learning), informal and inclusive education systems, Overview of Behaviourist, Cognitive and Constructivist Theories and their implications to Instructional Design (Skinner, Piaget, Ausubel, Bruner, Vygotsky), Relationship between Learning Theories and Instructional Strategies (for large and small groups, formal and non formal groups)

Systems Approach to Instructional Design, Models of Development of Instructional Design (ADDIE, ASSURE, Dick and Carey Model Mason's), Gagne's Nine Events of Instruction and Five E's of Constructivism, Nine Elements of Constructivist Instructional Design, Application of Computers in Education: CAI, CAL, CBT, CML, Concept, Process of preparing ODLM, Concept of e-learning, Approaches to e-learning (Offline, Online, Synchronous, Asynchronous, Blended learning, mobile learning)

Emerging Trends in e-learning: Social learning (concept, use of web 2.0 tools for learning, social networking sites, blogs, chats, video conferencing, discussion forum), Open Education Resources (Creative Common, Massive Open Online Courses; Concept and application), E Inclusion - Concept of E Inclusion, Application of Assistive technology in E learning , Quality of E Learning – Measuring quality of system: Information, System, Service, User Satisfaction and Net Benefits (D&M ISSuccess Model, 2003),Ethical Issues for E-Learner and E-Teacher-Teaching, Learning and Research

Use of ICT in Evaluation, Administration and Research: E portfolios, ICT for Research - Online Repositories and Online Libraries, Online and Offline assessment tools (Online survey tools or test generators) – Concept and Development

Unit- VII.

Pedagogy, Andragogy and Assessment:

Pedagogy, Pedagogical Analysis - Concept and Stages, Critical Pedagogy-Meaning, Need and its implications in Teacher Education, Organizing Teaching: Memory Level (Herbartian Model), Understanding Level (Morrison teaching Model), Reflective Level(Bigge and Hunt teaching Model),

Concept of Andragogy in Education: Meaning, Principles, Competencies of Self-directed Learning, Theory of Andragogy(Malcolm Knowles), The Dynamic Model of Learner Autonomy

Assessment – Meaning, nature, perspectives (assessment for Learning, assessment of learning and Assessment of Learning)-Types of Assessment (Placement, formative, diagnostic, summative) Relations between objectives and outcomes, Assessment of Cognitive (Anderson and Krathwohl), Affective (Krathwohl) and psychomotor domains (R.H. Dave) of learning

Assessment in Pedagogy of Education: Feedback Devices: Meaning, Types, Criteria, Guidance as a Feedback Devices: Assessment of Portfolios, Reflective Journal, Field Engagement using Rubrics, Competency Based Evaluation, Assessment of Teacher Prepared ICT Resources



Assessment in Andragogy of Education –Interaction Analysis: Flanders' Interaction analysis, Galloway's system of interaction analysis (Recording of Classroom Events, Construction and Interpretation of Interaction Matrix), Criteria for teacher evaluation (Product, Process and Presage criteria, Rubrics for Self and Peer evaluation (Meaning, steps of construction).



Computer Science & Engineering

Unit- I.

C Programming and Data structure: Programming in C, Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs

Unit- II.

Operating Systems: Processes, Threads, Inter-process communication, Concurrency, Synchronization, Deadlock, CPU scheduling, Memory management and virtual memory, File systems, I/O systems, Protection and security.

Unit- III.

Software Engineering: Models, Process and Project Metrics, Analysis Concepts and Principles, Measures, Metric Indicators, Software Quality Assurance, Software Prototyping.

Unit- IV.

DBMS: ER-model, Relational model (relational algebra, tuple calculus), Database design (integrity constraints, normal forms), Query languages (SQL), File structures (sequential files, indexing, B and B+ trees), Transactions and concurrency control., DBMS design, Distributed Databases, Client/Server Architecture, ODBMS and RDBMS, Data Warehousing and Data Mining

Unit-V.

Network and Information Security: Concept of layering, Flow and error control techniques, Switching, IPv4/IPv6, Routing and routing algorithms, Basics of network and information security, Introduction to intelligent networking, Performance analysis of networks

Unit- VI.

Theory of Computation: Models of computation, Automata Languages accepted by models, Grammars, Languages, Non-computability and Examples of non-computable problems, Turing machine, Compiler design

Unit- VII.

Artificial Intelligence: Intelligent Agent, State space Representation Heuristic Search Techniques, Knowledge Representation, Planning, Linear and Non-Linear, Goal Stack, Hierarchical, STRIPS.

Unit- VIII.

Machine Learning: Types of learning, Supervised, Unsupervised, Semi Supervised, Reinforcement Learning Techniques, Models, Tree, Rule, Linear, Distance based Probabilistic.

Unit VIIII-

IOT – Introduction, Character tics, Elements, Transducers and types, Application.



Information Technology

Unit- I.

Discrete Structure:

Sets, Relation, Functions, Probability, Models of Computation- Finite Automata, Pushdown Automata, DFA, NFA and Languages accepted by these Structures, Non-Computability and Examples of Non-computable Problems.

Simple Graph, Multigraph, Digraph Weighted Graph, Connected graphs, Complete Graph and bipartite graphs, Paths, Cycles, Eulerian Paths and Circuits, Hamiltonian Paths and Circuits. Boolean Algebra, Laws and Theorems of Boolean algebra, SOP, POS, Minimization of Boolean expressions.

Unit- II.

Computer Organization and Architecture:

Numbers systems and conversions, Complements, Computer Arithmetic, Fixed and Floatingpoint Number Representation, Computer Codes, Logic Gates, Combinational and Sequential Circuits, CPU organization, Instruction Formats, Addressing Modes, Peripheral Devices, Input-Output Interface, Data Transfer, Modes of Transfer, Interrupts, DMA, Serial Communication, Memory types and organizations, Parallel Processing, Pipelining, Vector Processing. Microprocessor architecture and Programming (8085, P-III/P-IV). Microprocessor applications.

Unit-III.

Programming Skills:

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

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.

Unit- IV.

Data Structure and Algorithms:

Design of Algorithm, Algorithm Complexity, Asymptotic Notations, Array data Structure, Sparse Matrix, Stacks, Operations and Applications of Stack, Queues, Linked Lists, Binary Tree, Tree Traversal Algorithms, Binary Search Tree, Graph, Graph Traversal Algorithms, Minimum Spanning Tree, Prims, Kruskal and Dijkstra Algorithm, Searching and Sorting Algorithms.

Unit- V.

Computer Networks:

LAN, MAN, WAN, Internet, Network Topologies, Networking Devices.OSI model, TCP/IP model. Application Layer Protocols (DNS, SMTP, POP, FTP, HTTP), IPv4/IPv6, Multiple Access – CSMA/CD, CSMA/CA, Reservation, Polling, Token Passing, Congestion Control, routers and routing algorithms (distance vector, link state), GSM, CDMA, Mobile IP and Mobile Communication Protocol; Communication Satellites, Wireless Networks and Topologies; Cellular Topology, Mobile Adhoc Networks, Wireless Transmission and Wireless LANs; Wireless Geo location Systems, GPRS and SMS. Authentication, Network Security, Basics of Cryptography, Digital Signature, Virtual Private Networks, Firewalls.



Unit- VI.

Operating Systems:

Operating System Definition, Types, Structure, Operations and Services; System Calls, Operating-System Design and Implementation; System Boot. Process Scheduling and Operations, Communication in Client–Server Systems, Process Synchronization, Critical-Section Problem, Peterson's Solution, Semaphores, Synchronization. Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues.CPU Scheduling, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance and Detection; Recovery from Deadlock. Contiguous Memory Allocation, Swapping, Paging, Segmentation, Demand Paging, Page Replacement, Storage Mass-Storage Structure, Disk Structure and Scheduling, Virtual Machine, Basic concepts of Kernel, DOS and Windows Operating System.

Unit- VII.

Database Management System:

Data Models, Schemas, and Instances, Schema Architecture, Database Languages and Interfaces, Centralized and Client/Server Architectures for DBMS.E-R Diagram, Relational Model -Constraints, Languages, Design, and Programming, Relational Database Schemas, Update Operations and Dealing with Constraint Violations; Relational Algebra and Relational Calculus, DDL, DML, and DCL Commands, Functional Dependencies and Normalization, 1NF, 2NF, 3NF, BCNF, and 4NF,Transaction Processing, Concurrency Control Techniques, Database Recovery Techniques, Database Security and Authorization.

Unit-VII.

Computer Graphics:

Concept and Applications, Display types and Display devices, Colour Display techniques, Scan Conversion, Lines, Circle and Ellipse Design Algorithms, Polygon Filling Algorithms, 2D and 3D Transformations, Homogenous Coordinate System, Matrix representation, Composite Transformation, Projection, Windowing and Clipping, Bezier and B-Spline Curves, Hidden Surface removal Algorithms, Tweaking, Morphing, Anti-aliasing.

Unit-IX.

Software Engineering:

Definition, Problems, Approach and Goals of Software Engineering, Software Process Models, SDLC, Software Crisis, Software Requirements, Requirement Analysis and Modelling; Requirements Review, Software Requirement and Specification (SRS) Document. Software Design Principles, Design Strategies, Function Oriented and Object-Oriented Design, Cohesion and Coupling, DFD, Data Dictionary, Quality Control, Quality Assurance, Risk Management, COCOMO, Project Management, CPM/ PERT, Software Testing: Verification and Validation; Types of Testing, Software Maintenance.

Unit- X.

Soft Computing and AI:

Soft Computing Concept, Fuzzy Set, Membership Function, Fuzzy Relation, Fuzzy Rules, Machine Learning, Supervised, Unsupervised and Reinforcement Learning, Artificial Neural Network, Expert System.



Electrical Engineering

Unit-I.

Electrical Circuits

Network elements: ideal voltage and current sources, dependent sources, R, L, C, elements; Network solution methods: KCL, KVL, Node and Mesh analysis; Network Theorems: Thevenin's, Norton's, Superposition and Maximum Power Transfer theorem; Transient response of dc and ac networks, sinusoidal steady-state analysis, resonance, two port networks, balanced three phase circuits, star-delta transformation, complex power and power factor in ac circuits

Unit-II.

Electrical Machines

Single phase transformer : equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency; Three-phase transformers: connections, vector groups, parallel operation; Auto-transformer, Electromechanical energy conversion principles; DC machines: separately excited, series and shunt, motoring and generating mode of operation and their characteristics, speed control of dc motors; Three-phase induction machines: principle of operation, types, performance, torque-speed characteristics, no-load and blocked-rotor tests, equivalent circuit, starting and speed control; Operating principle of single-phase induction motors; Synchronous machines: cylindrical and salient pole machines, performance and characteristics, regulation and parallel operation of generators, starting of synchronous motors; Types of losses and efficiency calculations of electric machines.

Unit-III.

Power Systems

Basic concepts of electrical power generation, ac and dc transmission concepts, Models and performance of transmission lines and cables, Economic Load Dispatch (with and without considering transmission losses), Series and shunt compensation, Electric field distribution and insulators, Distribution systems, Per-unit quantities, Bus admittance matrix, Gauss- Seidel and Newton-Raphson load flow methods, Voltage and Frequency control, Power factor correction, Symmetrical components, Symmetrical and unsymmetrical fault analysis, Principles of over-current, differential, directional and distance protection; Circuit breakers, System stability concepts, Equal area criterion.

Unit-IV.

Control Systems

Mathematical modeling and representation of systems, Feedback principle, transfer function, Block diagrams and Signal flow graphs, Transient and Steady-state analysis of linear time invariant systems, Stability analysis using Routh-Hurwitz and Nyquist criteria, Bode plots, Root loci, Lag, Lead and Lead-Lag compensators; P, PI and PID controllers; State space model, Solution of state equations of LTI systems.

Unit-V.

Power Electronics

Static V-I characteristics and firing/gating circuits for Thyristor, MOSFET, IGBT; DC to DC conversion: Buck, Boost and Buck-Boost Converters; Single and three-phase configuration of uncontrolled rectifiers; Single and three phase AC to DC semi and full converters with R, RL and RLE loads, Freewheeling diode concept, Magnitude and Phase of line current harmonics for uncontrolled and controlled converters; Power factor and Distortion Factor of AC to DC converters; Single-phase and three-phase voltage and current source inverters, sinusoidal pulse width modulation, Single phase AC voltage controllers and cyclo converter with R and RL loads.



Computer Application & Information Technology

Unit- I.

Discrete Structure:

Sets, Relation, Functions, Probability, Models of Computation- Finite Automata, Pushdown Automata, DFA, NFA and Languages accepted by these Structures, Non-Computability and Examples of Non-computable Problems.

Simple Graph, Multigraph, Digraph Weighted Graph, Connected graphs, Complete Graph and bipartite graphs, Paths, Cycles, Eulerian Paths and Circuits, Hamiltonian Paths and Circuits.

Boolean Algebra, Laws and Theorems of Boolean algebra, SOP, POS, Minimization of Boolean expressions.

Unit- II.

Computer Organization and Architecture:

Numbers systems and conversions, Complements, Computer Arithmetic, Fixed and Floating- point Number Representation, Computer Codes, Logic Gates, Combinational and Sequential Circuits, CPU organization, Instruction Formats, Addressing Modes, Peripheral Devices, Input- Output Interface, Data Transfer, Modes of Transfer, Interrupts, DMA, Serial Communication, Memory types and organizations, Parallel Processing, Pipelining, Vector Processing. Microprocessor architecture and Programming (8085, P-III/P-IV). Microprocessor applications.

Unit-III.

Programming Skills:

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

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.

Unit- IV.

Data Structure and Algorithms:

Design of Algorithm, Algorithm Complexity, Asymptotic Notations, Array data Structure, Sparse Matrix, Stacks, Operations and Applications of Stack, Queues, Linked Lists, Binary Tree, Tree Traversal Algorithms, Binary Search Tree, Graph, Graph Traversal Algorithms, Minimum Spanning Tree, Prims, Kruskal and Dijkstra Algorithm, Searching and Sorting Algorithms.

Unit- V.

Computer Networks:

LAN, MAN, WAN, Internet, Network Topologies, Networking Devices.OSI model, TCP/IP model. Application Layer Protocols (DNS, SMTP, POP, FTP, HTTP), IPv4/IPv6, Multiple Access – CSMA/CD, CSMA/CA, Reservation, Polling, Token Passing, Congestion Control, routers and routing algorithms (distance vector, link state), GSM, CDMA, Mobile IP and Mobile Communication Protocol; Communication Satellites, Wireless Networks and Topologies; Cellular Topology, Mobile Adhoc Networks, Wireless Transmission and Wireless LANs; Wireless Geo location Systems, GPRS and SMS. Authentication, Network Security, Basics of Cryptography, Digital Signature, Virtual Private Networks, Firewalls.



Unit- VI.

Operating Systems:

Operating System Definition, Types, Structure, Operations and Services; System Calls, Operating-System Design and Implementation; System Boot. Process Scheduling and Operations, Communication in Client–Server Systems, Process Synchronization, Critical-Section Problem, Peterson's Solution, Semaphores, Synchronization. Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues.CPU Scheduling, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance and Detection; Recovery from Deadlock. Contiguous Memory Allocation, Swapping, Paging, Segmentation, Demand Paging, Page Replacement, Storage Mass-Storage Structure, Disk Structure and Scheduling, Virtual Machine, Basic concepts of Kernel, DOS and Windows Operating System.

Unit- VII.

Database Management System:

Data Models, Schemas, and Instances, Schema Architecture, Database Languages and Interfaces, Centralized and Client/Server Architectures for DBMS.E-R Diagram, Relational Model -Constraints, Languages, Design, and Programming, Relational Database Schemas, Update Operations and Dealing with Constraint Violations; Relational Algebra and Relational Calculus, DDL, DML, and DCL Commands, Functional Dependencies and Normalization, 1NF, 2NF, 3NF, BCNF, and 4NF,Transaction Processing, Concurrency Control Techniques, Database Recovery Techniques, Database Security and Authorization.

Unit- VII.

Computer Graphics:

Concept and Applications, Display types and Display devices, Colour Display techniques, Scan Conversion, Lines, Circle and Ellipse Design Algorithms, Polygon Filling Algorithms, 2D and 3D Transformations, Homogenous Coordinate System, Matrix representation, Composite Transformation, Projection, Windowing and Clipping, Bezier and B-Spline Curves, Hidden Surface removal Algorithms, Tweaking, Morphing, Anti-aliasing.

Unit- IX.

Software Engineering:

Definition, Problems, Approach and Goals of Software Engineering, Software Process Models, SDLC, Software Crisis, Software Requirements, Requirement Analysis and Modelling; Requirements Review, Software Requirement and Specification (SRS) Document. Software Design Principles, Design Strategies, Function Oriented and Object-Oriented Design, Cohesion and Coupling, DFD, Data Dictionary, Quality Control, Quality Assurance, Risk Management, COCOMO, Project Management, CPM/ PERT, Software Testing: Verification and Validation; Types of Testing, Software Maintenance.

Unit- X.

Soft Computing and AI:

Soft Computing Concept, Fuzzy Set, Membership Function, Fuzzy Relation, Fuzzy Rules, Machine Learning, Supervised, Unsupervised and Reinforcement Learning, Artificial Neural Network, Expert System.



Law

I. Jurisprudence

- 1. Nature and Sources of Law
- 2. Schools of Jurisprudence
- 3. Concept of Rights and Duties
- 4. Legal Personality
- 5. Concept of Property, Ownership and Possession

II. Constitutional Law

- 1. Preamble
- 2. Fundamental Rights and Duties
- 3. Directive Principles of State Policy
- 4. Judiciary

III. Administrative Law

- 1. Nature, Scope and Importance of Administrative Law
- 2. Principle of Natural Justice
- 3. Judicial Review of Administrative Actions

IV. Law of Crimes

1. General Principles of Criminal Liability– Actus reus and mens rea, individual and group liability and constructive liability

- 2. General Exceptions
- 3. Theories and Kinds of punishments
- 4. Crime against Property

V. Law of Torts

- 1. Nature and Definition of Torts
- 2. General Principles of Tortuous liability
- 3. General defenses
- 4. Strict and absolute liability

VI. Public International Law

- 1. Definition, Nature and Basis of International Law
- 2. Sources of International Law

VII. Family Law-I

- 1. Sources and schools
- 2. Marriage and Dissolution of Marriage

VIII. Family Law- II

- 1. Sources and schools
- 2. Marriage and Dissolution of Marriage

IX. Environment and Human Rights Law

- 1. Meaning and Concept of Environment and Environmental Pollution
- 2. Concept and Development of Human Rights

X. Mercantile Law

- 1. General Principles of Contract
- 2. Specific Contract



Pharmaceutical Sciences

Unit-I.

Pharmaceutical Chemistry: Basic organic chemistry regarding synthesis and reactions of the main organic functional groups, organic stereochemistry, substitution (free radical, nucleophilic, electrophilic); elimination reactions; addition reactions; rearrangement reactions. Medicinal chemistry: design and development of drugs, drug targets, drug-receptor interactions, drug metabolism, and pharmacokinetics, Biochemistry: biomolecules, enzymes, metabolic pathways, and their role in drug action and metabolism

Unit-II.

Pharmaceutical Analysis: Basic principles, instrumentation and applications of analytical chemistry: qualitative and quantitative analysis, gravimetric and volumetric analysis, and acidbase titrations, Instrumental methods of analysis: Principles of Absorption spectroscopy (UV, visible & IR), chromatography (TLC, Column, Paper, HPLC & GC), Fluorimetry, Flame photometry, Potentiometry, NMR (1H &13C), Mass spectroscopy. X-ray diffraction analysis.

Unit-III.

Pharmacology: General pharmacological principles including types of receptors, Pharmacokinetics, Pharmacodynamics, Drug- receptor interaction including signal transduction mechanism, Toxicology, Drug interaction, Drug-Food interactions, Adverse drug reactions, Pharmacological actions, Mechanism of action and classification of drugs: based on their pharmacological activity and therapeutic uses, Bioassays, Circadian rhythm, Biological clock.

Unit-IV.

Pharmaceutics: Pharmaceutical dosage forms: types, formulations, storage and factors affecting drug absorption and bioavailability, Drug delivery systems: routes of administration, sustained-release systems, and targeted drug delivery, pharmaceutical technology: physical and chemical properties of drugs, stability, and formulation development, New Drug Delivery System, bio-equivalence, dosage regimens, repetitive dosing, Biopharmaceutics: Biopharmaceutical classification, dissolution tests, Study of Buffers, Pharmaceutical calculations.

Unit-V.

Regulatory Affairs: Roles & responsibility of CDSCO, ICH guidelines, Clinical trials: phases of clinical trials, informed consent, and ethics in clinical research, Drug approval processes: NDA, ANDA, post-marketing surveillance, Pharmacy act and pharmaceutical ethics.

Unit-VI.

Pharmacognosy: Introduction to pharmacognosy: Biological sources, classification, quality control, and adulteration of crude drugs and their detection. Extraction techniques: successive and exhaustive extraction and other methods of extraction. Separation of phytoconstituents by the latest CCCET and SCFE techniques, including preparative HPLC and flash column chromatography. Phytochemistry: chemical constituents of medicinal plants, their isolation, and biological activities. Standardization of raw materials and herbal products.