

BOTANY

1- Cell and molecular biology of plants:-

Structural organization of plant cell, specialized plant cell types chemical foundation of plant cells, molecule of life, covalent and noncovalent bonds and their importance, biochemical energetics,

Plasmamembrane, plant vacuole, Chloroplast, Mitochondria:

Nucleus, Ribosomes, Cell shape and Motility, Cell cycle and apoptosis, Other Cell Organelles (Structure functions of microtubules Golgibodies, Lysosomes, endoplasmic reticulum), Techniques use in cell biology.

II- Cytology, Genetics and Gytogenetics

Chromatin Organisation, Structural and Numerical alterations in chromosomes, Genetics, Gene Structure and Expression, Genetic recombination and Genetic Mapping, Plasmids, Mutations, Molecular Cytogenetics, Alien gene transfer through chromosomal magnipulations.

III- Biology and Biodiversity of Viruses, Bacteria, Fungi, Nematodes and Lower Plants:

Viruses, Phytoplasma, Archebacteria and Eubacteria, General Characters of fungi, reproduction in fungi, classification account of Mastigonycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina, Phylogeny of Fungi, Economic importance of fungi. General Character of plant parasitic nematodes. Phycology- Thalls structure, reproduction, classification economic uses as food, biofertilizer and in industry. morphology, anatomy reproduction, classification of Bryophytes, Economic and ecological importance. Morphology anatomy classification of pteridophytes, General account of fossil pteridophytes (Rhynia, Horneophyton, Asterxylon) Diagnostic Features of Psilopida, Lycopsida, Sphenopsida & Pteropsida.

Taxonomy and biodiversity of seed plants

Introduction: Gymnosperms, the vesselless and fruitless seed plant having drop mechanism. Types of pollen grains and ovules, development of male and female gametophyte.

Classification of gymnosperms (Coulter & Chamberlain, Sahni, Sporne and Sandra Holms.) Distribution of living gymnosperms in India Economic importance of gymnosperms.

Brief account of fossil families: Lygenopteridaceae Medulloseaceae. Ceytoniaceae and Glossopteridaceae, General account of Cycadeodaceae and Cordaitales, Vegetative structure and reproductive organs of Cycadales, Ginkgoales, Coniferales, Ephedrales and Gnetales.

Taxonomy of Angiosperms, The species concept, Taxonomic evidence, Taxonomic Tools, Systems of Angiosperms classification (Historical background, basis and outline classification of (i) Bentham and Hooker, (ii) Takhtajan, (iii) Bessey, (iv) Hutchinson, (v) Cronquist), Origin of interpollination variation, Diagnostic Characters of following families (Annonaceae, Ranunculaceae, Portulacaceae, Fumariaceae, Papaveraceae, Brassicaceae, Malvaceae, Rutaceae, Fabaceae, Apiaceae, Rhamnaceae, Zygophyllaceae, Moringaceae, Lythraceae, Oleaceae, Acanthaceae, Solanaceae, Lamiaceae, Chenopodiaceae, Euphorbiaceae, Convolvulaceae, Scrophulariaceae, Casuarinaceae, Liliaceae, Polygonaceae, Commelinaceae, Cyperaceae, Poaceae), Concept of Phytogeography.

Plant Development: Cell wall: Nature formation, growth of cell wall, microscope and submicroscopic structure, function of cell wall, shoot development, Root development, vascular Cambium, Secondary ducts and Laticiferous, Leaf growth and differentiation, Plant Reproduction (Flower Development, genetics of floral organ differentiation. Male gametophyte, female gametophyte, Pollination, Pollen-pistil interaction and fertilization. Self incompatibility, double fertilization and in vitro fertilization), Seed development and fruits Growth,

Plant Physiology and Biochemistry:

Energy flow, Enzymology, Membrane Transport and Translocation of water and solutes, Sensory Photobiology, Flowering process, Plant growth regulators and elicitor, Photochemistry and

Photosynthesis, Respiration and lipid metabolism, Nitrogen Fixation, nitrogen and sulphur metabolism, sensory photobiology, plant growth regulators and elicitors. The flowering process, stress physiology.

Plant Ecology.

Climate soil and major vegetation and soil types of the world, Vegetation organization, Ecosystem Organization, Vegetation Development, Biological diversity, Air, water and soil pollution, Ecosystem stability, Ecological management.

Plant Resource Utilization and conservation:

Plant Biodiversity, World centres of primary diversity of domesticated plants, Origin, Evolution, Botany, Cultivation and uses of - (i) Food (Wheat, Rice) forage (sorghum) and fodder crop (Berseem), (ii) fibre crop (cotton). (iii) Medicinal and aromatic plants, and (iv) Vegetable oil yielding crops. (v) Gums, dyes, Resins. (vi) Raw material for paper making (vii) Important Fire-wood and Timber yielding plants and nonwood forest product (NWFPS): Acacia, Mangifera, Delbergia, Tectona, Shorea, pinus and Cedrus. Strategies for conservation: In-situ conservation, Strategies for conservation: Ex situ conservation, Green Revolution.

Biotechnology and Genetic Engineering of Plant and Microbes

Biotechnology (Basic concept, principles, and scope new Vistas and emerging scenario, role of plant genetics manipulation, Large Scale culture, prospects and problems of genetically modified food). Plant cell and Tissue Culture, Aseptic Technique, Organogenesis, Organ Microculture, Protoplast isolation and somatic hybridization, Recombinant DNA Technology (Gene cloning, principles and techniques, construction of genomic/cDNA Libraries choice of vectors, DNA synthesis and sequencing, polymerase chain reaction, DNA finger printing) Genetic Engineering of; plants (Aims, strategies for development of transgenic (with suitable examples). Agrobacterium the natural genetic engineer. T-DNA and transposon mediated gene tagging, chloroplast transformation and its utility, intellectual property rights, possible ecological risks and ethical concerns). Microbial Genetic manipulation, Genomics and Proteomics.

2 Home Science

Human development

1-Introduction to Human Development

a- Definition, concept, principles of Human Development

c- Historical perspective of Human Development.

- The Western perspective
- The Ancient Indian perspective
- The Scientific study of Children in india

e-Need and Seope of the field of Human Development

- Opportunities for Roles and Employment
- Settings Available

2- Growth and Development

- Definitions of Growth and Development
- General Principles of development
- Constraints and facilitators in growth and development (influences of heredity and environment)
- Genetic inheritance-Fertilization, Number of Chromosomes, Determination of Sex, Genotype and phenotype, Sex linked genetic effects.
- Environment
- Interaction between environment and inheritance

3- Prenatal development and Birth process

4- Development stages and tasks across the Life Span

5- Physical and motor Development-Across Life Span.

Physical Development, motor development, cognitive development, language development, social development, emotional development, personality development, moral development.

6-Early Childhood Care and Education: Concepts, objectives, need, scope and significance

7-Types of Pre-school, ECCE in the National policy on Education

8-Contribution of the thinkers in ECCE, ECCE in India

9-Contribution of the mentioned agencies/Programmes to ECCE in India: ICCW, IAPE, NCERT, ICDS, UNICEF, NCTE, Mobile Creche etc.

10- Methods and Approaches to the study of Human Development, their strength and limitations.

11-Theories of Human development and behavior Psychological Theory-Sigmund Freud, Erik Erikson Social Learning Theory-Albert Bandura Learning Theories-Pavlov and Skinner Cognitive Development Theory- Jean Piaget socio- Cultural Theory of Cognitive Development-Vygotsky Kohlberg's Moral Judgment theory Ecological Theory- Urie Bronfenbrenner.

12-Principles and objectives of family guidance and counseling.

13- Children with Special Needs: Definition, types, factors. Need for intervention. rehabilitation, Services for special children.

14- Programmes for children and Families: specific programmes for children related to health, nutrition, education and their management. National family welfare policies and their management.

Foods & Nutrition

1-Nutrition and health- definition and inter - relationship

- Food-Definition, physical and chemical composition of food, functions of food
- Classification of food according to source and function
- Effect of cooking, processing, preservation and storage of nutrients in:
 - Fruits and vegetables
 - Pulses and legumes
 - Cereals
 - Milk and Milk product
 - Eggs
 - Meat, fish and poultry
 - Sugar and beverages

2- Methods of enhancing nutritive value of food- germination, fermentation, supplementation and fortification

3-Food additives and its uses in food preparations

4-Sensory evaluation: Definition and types

5-Food Adulteration: definition ,common adulterants, methods of detections .

6-Legislation, Quality control and Assurance: Food laws and Act, FSSAI 2006

7-Food Analysis: Sampling for products, proximate principles, nutrient analysis

a-General analytical techniques (Colorimeter, spectrophotometer, ELISA etc.)

8-Microbiology of Food and Diseases: Introduction, Sources of food contamination and spoilage, Food Toxins, Food Safety and sanitation, HACCP, microbes in diseases.

9- 12- Nutritional and biochemical aspect of Protein, Carbohydrate and dietary fibre,

- Lipids, Vitamins, Minerals. Function, digestion, absorption and sources of nutrients
- Energy metabolism: Energy value of food BMR, Factors affecting energy requirement.
- Minimum nutritional requirement and RDA, formulation of RDA and Dietary guidelines- reference man and reference women.
- d- Metabolism: Carbohydrate, protein and fat metabolism, role of enzyme in metabolism.

10-Normal and Therapeutic Nutrition: Concept of balanced diet, Meal planning

11-Factors to be considered when planning meals for a family. Requirement and diet plans for different stages of life: Infancy, Childhood, Adolescence, Adulthood- including pregnancy and lactation, old age.

12- Dietary modification- soft diet, liquid diet, Total parenteral nutrition, other therapeutic diets. Nutrition in common diseases:

- Fever, typhoid and TB
- Diarrhea and constipation
- Infective hepatitis, cirrhosis
- Obesity
- Diabetes
- Hypertension, Coronary heart diseases
- Renal disease: Nephrotic syndromes, glomerulonephritis, acute and Chronic renal failure,
- Rheumatic arthritis, osteoporosis, gout
- Cancer

13- Community Nutrition: Concept, Nutritional epidemiology, assessment of nutritional status, nutritional problems of community: PEM , Vitamin. A deficiency, anaemia, iodine deficiency, Community nutrition services, National nutrition policy.

Family Resource Management

1- Introduction to management: Basic concept of management, Purpose of management, Obstacles to the improvement of management

2- Factors motivating management: Values, Goal, Standards, resource.

3- Management Process: Decision- role of decision making in management. Meaning and elements of process- planning, controlling the plan and evaluating, decision making.

Planning-importance, techniques, types of plan

Controlling the plan in action

Evaluation: Importance, relationship to goals, Techniques of self evaluation. Time and energy management: organization and work in relation to time and efficiency

4- Work simplification: Methods, study of organization of work centres in the kitchen, work spaces, storage and equipments

5-Ergonomics: Definition, Scope, nature of work in house hold and other occupations, physiology of neuromuscular functions in relation to occupational ergonomics, job analysis for occupational ergonomics, anthropometry in relation to occupational ergonomics.

6-Family finance: family income, expenditure, economic problems, family budget and saving and investments.

7-Consumer Economics: concepts, theory of consumer behavior, market and market price, consumer credits and consumer protection.

8- Entrepreneurship Management: concept, need and process. Types of enterprise, Role of enterprise in national and global economics.

9-Housing

- Family`s housing needs- protective, economic, affectional, social standard of living, housing goals, style, function, occupation
- Factors influencing selection and purchase of site for house building
- Planning different rooms
- Landscape planning- principles and applications

10-Financial considerations- availability of funds for housing

11- Interior designing and furnishing elements and principles of art and design and their application

12- Furniture: Arrangement of furniture for living, sleeping, dining and multipurpose room

13- Furnishing fabrics: Types of curtains, draperies, floor coverings, rugs and carpets, cushion covers, bed linen and table linen

14- Accessories and their role in interiors

Textile & Clothing

1- Introduction and classification of textiles

2- Manufacture and physical, chemical properties and uses of following fabric-

- Natural - cotton, linen, wool and silk
- Man made- rayon, polyester and acrylic

3- Classification of Yarns, simple, novelty metallic and texturised yarns

4- Fabric construction methods- Fetting, braiding, bonding, netting, knitting and weaving

5- Fabric finishes:

- Basic - Singeing, beatling, shearing, sizing, tentering, bleaching, calendaring and mercerizing
- Texturizing- embossing, moiring and napping
- Functional- water resistant and repellent, flame retardant, soil and stain resistant, moth proofing finishes
- Dyeing and printing: Types of dyes, general theory of dyeing, tie and dye and batik
- Difference between dyeing and printing, block printing, roller printing, screen printing and stencil printing

6- **Textile Testing and Quality control:** standardizing and testing conditions, Study of Fibre, yarn and fabric properties, fabric colour, fastness testing

7- **Textile and Apparel designing:** anthropometrical measurements, pattern making, lay out planning, different types of stitches, seams, dart manipulations, patten alterations. alteration for fitting. Basic body blocks.

8- **Fashion designing:** Principles of elements and arts in dress designing. Use of software`s in designing. Fashion trends in India and abroad.

9- Trditional textiles and embroideries of India

Extension and Communication

1-Extension: Meaning, changing concepts of extension, philosophy, principles, functions, components of extension.

2-**Extension Teaching:** Methods and process, steps in extension teaching methods: Teaching Aids: types, characteristics and functions: Role of Media in the process of Learning Extension techniques and methods- personal contacts, demonstration, literature group discussion. Audio Visual Aids in Extension. Classification and importance Selection , preparation and effective use of A.V. Aids in extension work

3-**Extension systems:** Outline of National Extension Systems in India: Community Development Programme: KVK, Role of State Governments in Extension Programmes related to Community Health and other policies, Central Social Welfare Board, Panchayati Raj System.

4- **Community:** Definition, concept and characteristics of a community, Structure and organization of different types of communities: tribal, rural and urban, social groups and Organizations

5. **Community Leadership:** Concept, leadership theories, patterns and characteristics of leadership in different communities, Role of leadership in community development.

6- **Programme planning**

- Programme cycle and its components
- Preparatory work with local people- involve people, collect basic data, need assessment, community based support
- Designing the project- defining objectives, identifying resources, methods/approach, feasibility and work plan
- Implementing
- Monitoring and evaluation
- Documentation-Need for reporting and recording

7- **Communication Systems:** Concept, types, Function and significance. Elements, characteristics of mass communications. Media systems, trends and techniques. Contemporary issues in media. Human rights and media, women and media Advertisements.

9- Gender and Development

- Capacity building for women: education, decision making abilities and opportunities, awareness and information on legal and political issues
- Women`s organizations and collective strength: Women`s action groups, women`s participation in development initiative, self help group, women in agriculture, women in industry and support services.
- National and International efforts for gender empowerment;
- Policies and programmes for women development

10- Research Methodology:

- Sampling, Tools and Techniques of Data Collection, Interview, Questionnaire, Observation, Case Study and Projective techniques.
- Research Management Techniques:
- PERT, CPM , SWOT analysis
- Types of variables:
- Theory of probability:
- Conceptual understanding of statistical measures. Classification and tabulation of data. Measurement of central tendency, measures of variation.
- Frequency distribution, histogram, Frequency, polygons, Oliver;
- Normal distribution- Use of normal probability tables
- Parametric and non-parametric tests.
- Testing of hypothesis. Levels of significance
- Chi-square test. Application `t` test for small samples.
- Co-relation, coefficient of co-relation, rank co- relation
- Regression and prediction
- Analysis of variance- one way and two- way classification.

Chemistry

General Chemistry

- **Atomic Structure**

Bohr's theory and its limitation, Debroglie equation, Heisenberg's principle of uncertainty, Pauli's exclusion principle, Hund's rule of maximum multiplicity, Aufbau principle.

-Planck's quantum theory- Wave- Particl duality.

-Schrodinger wave equation.

-Angular momentum, quantisation of electronic energies (qualitative treatment of hydrogen atom)

- Periodicity in properties of atoms: Atomic and Ionic radii, Ionisation potential, Electronaffinity, Electronegativity, Hydration energy, Lattice energy.
- Chemical bonding: Valence bond theory, Hybrdization, valence shell electron pair repulsion theory (VSEPR) M O theory- molecular orbital diagram of homo and heteronuclear diatomic molecules.
- General properties of s-and p block elements.
- Chemical effects of unclear transformation- Nuclear fissionand fusion. Radioactive isotopes and their applications.
- Electronic displacement- Inductive, Electromeric and Mesomeric effects, Resonance and its application to organic compounds. Conjugation and hyper-conjugation.
- Oxidation- Reduction, Oxidising and Reducing agents Balancing of redox reactions.
- Concepts of acids and bases- Bronsted -Lowry theory, Lewis concept of acids and bases. Hard and fast acid and bases.
- Polymers: Definition and classification of polymers, properties of polymers with special reference to polyethene, polyvinyl chloride.
- Pollutants and their influence of environment, Chemical toxicology.
- **Symmetrty and Group Theory:** Symmetry elements and symmetry operations, definition of group and sub-groups, paint symmetry groups assignment of point groups of molecules like NH_3 , H_2O , PCl_5 and XeF_4 .

Inorganic Chemistry

- Chemistry of Transition elements- General Characteristics: variable oxidation states, colour, complex formation, magnetic and catalytic properties.
- Chemistry of lanthanides and actinides, lanthanide contraction. Oxidation states. Spectral and magnetic properties. Principle of separation and isolation.
- Coordination Chemistry- IUPAC system of nomenclature of complex compounds, Isomerism, valence bond theory and its limitation. Crystal field theory: d-orbital splitting in octahedral and tetrahedral complexes, weak and strong field octahedral complexes, spectrochemical series. Electronic spectra of d-block elements. Complexes, selection rules for electronic transitions. Spectroscopic ground states for d^0 to d^9 systems.
- Main Group Elements and their Chemistry- Oxyacids of nitrogen, phosphorus and sulphur, Interhalogens and pseudohalides, Noble gas compounds, boranes, carboranes borazines and phosphazenes, silicates and silicones,
- Organometallic Chemistry- Synthesis, Structure and bonding of organometallic compounds, Homogeneous catalytic reaction π -acid metal complexes.

- **Bio-inorganic and Supramolecular Chemistry**

Essential and trace elements in biological processes, Haemoglobin and myoglobin, Biological role of alkali and alkaline earth metals with special reference to Ca^{2+} , Photosynthesis and Nitrogen fixation.

Supramolecular Chemistry: introduction and nomenclature of supramolecules, molecular recognition and carrier design.

Organic Chemistry

Stereochemistry: Conformational analysis of cycloalkanes, elements of symmetry, chirality, molecules with more than one chiral centre. Optical purity. Enantiotropic and diastereotropic atoms, optical activity in the absence of chiral carbon.

Nucleophilic aromatic substitution: aromatic SN_1 , and SN_2 , mechanism, leaving group and attacking nucleophile, evidences of neighbouring group participation, classical versus non-classical carbonium ion-the present status. Addition

to carbon-carbon multiple bond, electrophilic, free radical and nucleophilic addition. Esterification and hydrolysis of esters: evidence for tetrahedral intermediate, BAC_2 and AAC_2 mechanism and elimination reaction: the E_1 , E_2 and E_{CB} mechanisms, Hoffmann versus Saytzeff elimination, competition between elimination and substitution reaction.

Heterocyclic Chemistry: Heterocyclic compounds with five and six membered ring-Pyrazoles, imidazoles, Pyridine and quinoline, applications of heterocyclic compounds- caffeine, diazepam and phenothiazines.

Pericyclic reactions: Molecular orbital symmetry, frontier orbital of ethylene, Woodward-Hoffmann correlation diagrams, cycloaddition, unimolecular tautomerism Ene reaction.

Photochemistry of aromatic compounds: ring isomerisation and cyclisation reactions, Photochemistry of carbonyl compounds, intramolecular and intermolecular hydrogen abstraction. Norrish cleavage (Type I and II)

Chemistry of natural products: Terpenes and alkaloids vitamins and Hormones-introduction of fat soluble and water soluble vitamins, functions of vitamin A,D,E,K Vitamin B-complex and vitamin C. Introduction. Classification and characteristics of hormones with special reference to thyroid hormones (thyroxin)

Molecules of life processes: Sugar, DNA and RNA enzymes-definition, classification and applications.

Physical Chemistry

Solid state Chemistry

Crystalline State of solids, unit cell, Bravais lattices, Miller indices, Diffraction of X-rays by crystalline solids, Crystal defects and non-stoichiometry, Perfect and imperfect crystals, Frenkel and Schottky defects Properties of solids ionic conductivity and diffusion and ferroelectric properties. Electronic properties and band theory- band structure of metals. Semiconductors (extrinsic and intrinsic) n-p-junction, superconductors.

Surface phenomenon: Surface tension, adsorption on solids, electrical phenomena at interfaces including electrokinetic, micelle and reverse micelle.

Chemical Equilibria: Le-chatelier`s principle and its application:

Free energy and entropy of mixing. Partial molar quantities, Gibbs-Duhem equation, Phase diagram of one and two component system and phase rule.

Thermodynamics

First law of thermodynamics, Heat capacities at constant volume and pressure and their relationship, Joule-Thomson coefficient, calculation of w, q, dU and dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process. Hess`s law of heat summation and its applications, Heat of reaction at constant pressure and at constant volume, enthalpy of neutralization, bond energy and its calculation from thermo- chemical data.

Second law of thermodynamics- definition, Carnot cycle and efficiency. Concept of entropy, changes in ideal gases and mixing of gases.

Third Law of thermodynamics- statement and concept of residual entropy, Gibbs (G) and Helmholtz (A) Functions , thermodynamical quantities, variation of G and A with P, V and T.

Spectroscopy

Time- dependent states and spectroscopy, absorption and emission of radiations and selection rules, line shapes and widths.

Magnetic- resonance spectroscopy, principle and application, chemical shift and spin-spin coupling first order spectra of A_3, X, AX and AMX system. Electronic spectroscopy of diatomic molecules, rotational fine structures.

IR spectroscopy, symmetry properties and nuclear spin affect, Raman Effect, vibration of polyatomic molecules.

Electrochemistry

Quantitative treatment of Debye -Hukel theory of ion-ion interaction and activity coefficient. Thermodynamics of double layer. Determination of association constant (k_a) from conductance data, Application of measurement of electrochemical rate constant.

Agriculture

Agro-climatic zones of U.P. and geographical distribution of agronomical and horticultural crops. Climate change, its impact on agriculture and appropriate management.

Concept of crop rotation, mixed cropping, Inter cropping, Relay cropping, multiple cropping, strip cropping and multistoried cropping. Package of practices for improved Cultivation of cereals, pulses, oilseeds, fibre Sugar and fodder crops. Dry farming and rainfed agriculture, Agro forestry, organic farming.

Major tropical and Subtropical fruit crops of U.P. and their package of practices, High density planting of fruit crops. Cultivation of Cole crops. Cucurbits, Solanaceous and legume Vegetables. Nursery rising, Cultivation of protected crops. Post harvest technology of Fruits and Vegetables.

Pests and diseases of major agronomical and horticultural crops. Integrated Pest Management. Herbicides and weed management.

Use of plant growth regulators and hormones. Role of nutrients, diagnosis of nutrient deficiency symptoms and their amelioration Biotic and abiotic stresses and their management. Quality of crop produce and their evaluation.

Classification and Characteristics of U.P. soils. Physical. Chemical and biological properties of soil. Essential and beneficial plant nutrients and their requirement. Problem soils and their reclamation. Manufacturing and efficient use of organic, inorganic and biofertilizers. Integrated nutrient Management (INM) . Quality of irrigation water.

Importance of Genetics and plant Breeding in improvement of agronomical crops. Development of Hybrids and Composites. Mutagenic agents and polyploidy. Methods of Plant breeding in self and cross-pollinated crops. Genetic engineering and application of biotechnological tools. Genetically modified crops. seed production.

Role of Milched animals, poultry farming, fisheries and apiculture in agricultural economy. Milk production,

processing and marketing Management of common diseases of cattles and poultry.

Agricultural implements, machinery, Plant protection and post harvest technology equipments, their importance and uses in agriculture, Types of soil erosion, methods land practices of its control. Water harvesting and watershed management, Zero tillage.

Principles of economics in relation to agriculture. Farm planning. budgeting and resource management system and types pfarming. Marketing of agricultural inputs and produces. Role of co-operatives and regulated markets in increasing marketing efficiency. Rural credits. Minimum support price and its importance, Problems of agricultural labourers and their welfare.

Rural development projects and their role in increasing agriculture production and rural employment, Training and its methodology. Role of KVKs. Women empowerment.

STATISTICS

1. Probability Measure

"Random experiments, sample space, events, algebra of events, axiomatic definition of probability, probability spaces, role of frequency ratios, properties of probability measure, Boole's inequality, conditional probability and associated probability space, Bayes theorem, independence of events.

Random variables as functions, induced probability measure, induced probability distribution, distribution functions and their properties, probability mass function (pmf) of discrete random variables, probability density function (pdf) of continuous random variables, independence of random variables, functions of random variables, random vector, marginal and conditional distributions.

Mathematical expectation, moments, moment generating function, Chebyshev's inequality, Markov's inequality.

Statistical distributions: Cauchy distribution, bivariate normal distribution and its marginal and conditional distributions."

Field, σ -field, measure, measure spaces, measurable functions.

Probability space of a random experiment, probability measures, random variables as a measurable function, decomposition of distribution functions in purely discrete, absolutely continuous and singular components, Sequences of distribution functions, Helly-Bray theorem, Different types of convergence of sequence of random variables. Weak and strong law of large numbers, Khinchin,

Borel-Cantelli lemmas, Characteristic function, Inversion theorem Continuity theorem, One dimensional central limit problem: Lindeberg-Levy, Lyapunov.

2. Statistical Inference

"Sampling distribution of a statistic, standard error, sufficiency, factorization theorem, consistency, Undiasedness, Estimation methods of maximum likelihood, moments.

Distribution Theory: Derivation of X^2 , t, F and z distribution and their applications in tests of significance, Beta, Gamma and Laplace densities, Binomial and Poisson indices of dispersion."

Estimation: Completeness, Rao/Blackwell theorem, Lehman Scheff'e theorem, One parameter exponential family and its completeness, Cramer-Rao inequality, Best linear unbiased estimator, Bayesian estimation, Confidence intervals.

Statistical Tests of Hypothesis- Fundamental concepts including the power function, Neyman and Pearson Lemma, most powerful (MP) and uniformly most powerful (UMP) tests, large sample tests based on binomial and normal distributions.

Tests: Likelihood ratio test, Unbiased test, Randomized test for binomial and Poisson distributions, X^2 - test of goodness of fit, Contingency table, Test of equality of several variances, Significance test for correlation coefficient."

(3) SAMPLE SURVEYS

Concept of Sampling design, Sampling scheme and Sampling strategy. Probability and non Probability Sampling, Sampling with varying Probability with and without Replacement. H-T Method of Estimation, Desraj Method of Estimation. Sampling Strategy due to Rao, Hartely and Cochran.

Stratified Random Sampling, Reason of Stratification, Choice of Sample Sizes in different Strata, and Relative Precision of Stratified Sampling with Simple Random Sampling, Estimation of gain in Precision due to Stratification, Effect of Deviation from an Optimum Allocation, Formation of Strata, and Determination of number of Strata.

Systematic Sampling, Cluster Sampling, Two Stage Sampling, Two Phase Sampling.

Ratio and Regression Method of Estimation, unbiased and almost Unbiased Ratio Type Estimator, Midzuno Scheme of Sampling, Product Estimator, Non-Sampling Errors, Errors in Surveys, (Observational Error), Non Response Error.

(4) LINEAR ESTIMATION & DESIGN OF EXPERIMENT

Linear Estimation- estimable functions, estimation and error space, Best linear unbiased estimate (BLUE), Markov theorem, use of g-inverse, distribution of quadratic form.

Design of Experiments- Analysis of Variance: Two-way classification with equal number of observations per cell and Tukey's test, general two-way classification, Analysis of covariance, 2^2 , 3^2 and 3^3 factorial experiments, complete and partial confounding, Balanced Incomplete Block Design (BIBD), construction of BIBD, intra block and inter block analysis, Partially Balanced Incomplete Design (PBIBD), split plot design.

(5) LINEAR ALGEBRA & MULTIVARIATE ANALYSIS

Matrix Theory-Inverse of partitioned matrices, g-inverse, orthogonal matrices, properties of idempotent matrices, characteristic roots and vectors, Cayley-Hamilton theorem, quadratic forms, definite, semi-definite and indefinite forms, simultaneous reduction of two quadratic forms, properties of similar matrices.

Multivariate normal distribution, Characteristic function, Maximum likelihood estimators of the mean vector and covariance matrix, Multiple and partial correlation coefficients and their null sampling distributions, Wishart distribution, Hotteling's T^2 , Mahalanobis' D^2 and their applications, Discriminant analysis, Principal components, Canonical correlations and variables, Factor analysis.

Zoology

Non-chordates

Principles of Animal Taxonomy- International Code of Zoological nomenclature. Classification of Non-chordate Phyla, Locomotory Organs, Locomotion , Reproduction and Nutrition in protozoa, Human Parasites in Protozoa. Canal System in Sponges. Parasitic adaptation in Helminthes. Respiratory Organs, Pigments and mechanism of respiration in invertebrates. Excretory organs and mechanism of excretion in invertebrates. Origin and evolution of nervous system invertebrates phyla. General organization of Rotifers. Polymorphism in coelentrata. Larval forms of free living invertebrates and their evolutionary significances. Larval forms of parasites.

Chordates

Origin of Chordates. Nutrition- Digestion and absorption of Carbohydrats, protein and lipids, regulation of secretion of digestive fluids, Muscles construction and action. Respiration - Pigments: mechanism and regulation of breathing. O₂ and CO₂ transport. Gametogenesis. Spermatogenesis, Oogenesis, fertilization, Biochemistry of fertilization .Types of eggs and cleavage in chordates. Foetal membrane with special reference to chick. Placenta in mammals. Excretion- Nitrogenous wastes- role of nephron in urine formation . Circulation -blood groups, cogulation, structure and function of blood cells .

Animal ecology, taxonomy and evolution :

Principles and concepts pertaining to energy and energy flow in ecological system. Population, its organization, structure growth, density and control. Community and its organization. Predation, Mutualization and commensalisms. Terrestrial, Marine and Fresh water ecology. Taxonomy, its history and functions, species concepts. Genes in population, Hardy Weiberg Law, Natural selection, Micro and Macro evolution.

Entomology

Mouth parts, Photoreception, Bioluminescence and Larval forms of insects economic importance(Apiculture, Lac culture, sericulture) of insects, methods of application of insecticides and fumigants and type of appliances used for insects control , insects paste and their control, control of parasites and predators, insects hormones.

Fisheries

Origin and evolution of fishes(elasmobranches and bony-fishes), Electric light and sound producings organ, Lateral line system, Weberiann ossicless. Induced breeding. Fish disease and their control, fish preservation and processing, cause of spoilage methods of preservation.

Animal development and morphogenesis

Gaemetes and fertilization, nature of eggs and their cleavage, organogeresis of vertebrates, evolution of viviparity in mammals, Cellular and biochemical events in metamorphosis of insects and amphibians, cell differentiation, Regeneration and axial gradient.

Cell physiology and Biochemistry

Prokaryotic and eukaryotic cells, their organization, structure, properties and transport mechanisms; cell cycle. pH and buffers. Structure, properties and classification of carbohydrates, lipids, amino acids, proteins and nucleic acids. Enzymes, their mechanism of action and classification. Vitamins. Metabolic pathways of carbohydrates, lipids and amino acids. Replication, transcription and translation.

Mammalian physiology

Nervous system- generation and transmission of nerve impulse, neurotransmitters, structure of muscle mechanism and regulation of muscle action, Digestion of carbohydrates, lipids and proteins and their absorption, structure of heart, constitution of blood, its clotting, role of hemoglobin, Respiration- mechanism of CO₂ & O₂, transport, Bohr's effect, Urine formation, urea synthesis, acid-base balance, nitrogen excretion, Temperature regulation mechanism

Cytogenetics and Biostatistics

Chromosome structure and their behaviour in cell division, Concept of genomes, DNA finger printing, Gene cloning, gene library, Sex determination, Mutation, Cytoplasmic inheritance.

Biostatistics- Collection and classification of biological data, concepts of probability, Standard deviation, Standard error, Student's t test and Chi-square test.

Endocrinology and Animal behaviour

Endocrine glands in vertebrates and invertebrates, Types of hormones, Hormonal action mechanism. Physiological basis of behaviour, latency, warm up, summation & fatigue, Stereotyped and acquired behaviour, migratory behaviour of birds & fishes, reproductive behaviour, Pheromones, biological clock, social organization of primates.

Toxicology

Basic concepts of toxicology, acute, short-term & chronic toxicology, mutagenicity, carcinogenicity. Effects of pesticides on physiological system, Mode of action of organochlorine, Organophosphorus, carbamates, pyrethroid pesticides. Integrated pest management.

Mathematics

1-Modern Algebra

Sylow's theorems, Sylow p -subgroups, Direct product of groups. Structure theorem for finitely generated Abelian groups. Normal and subnormal series. Composition series, Jordan-Holder theorem. Solvable groups. Insolubility of S_n for $n \geq 5$. Nilpotent groups.

Extension fields. Finite, algebraic, and transcendental extensions. Splitting fields. Simple and normal extensions. Perfect fields. Primitive elements. Algebraically closed fields. Automorphisms of extensions. Galois extensions.

Fundamental theorem of Galois theory. Galois group over the rationals.

Cyclic modules, simple modules and semi-simple modules. Schur's lemma. Free modules. Noetherian and Artinian modules and rings. Hilbert basis theorem.

Solution of polynomial equations by radicals. Insolubility of the general equation of degree ≥ 5 by radicals. Finite fields.

Canonical forms: Similarity of Linear transformations. Invariant subspaces. Reduction to triangular forms. Nilpotent transformations. Index of nilpotency. Invariants of a nilpotent transformation. The primary decomposition theorem. Jordan blocks and Jordan form.

Vector space- Vector spaces, subspaces and linear spans, linear dependence and independence. Finite dimensional vector space. Linear transformations and their matrix representations. Algebra of linear transformations, the rank and nullity theorem. Change of basis. Dual spaces, bi dual space and natural isomorphism. Eigen values and eigen vectors of LT. Diagonalization, Cayley-Hamilton theorem.

Inner product spaces, Cauchy-Schwarz inequality orthogonal vectors. Orthonormal basis, Bessel's inequality, Gram-Schmidt orthogonalization process.

Discrete Mathematics- Lattices and Boolean algebra: Logic: propositional and predicate. Lattices as partially ordered sets and as algebraic systems. Duality, Distributive, Complemented and complete lattices. Lattices and Boolean Algebra. Boolean functions

and expressions. Application of Boolean algebra to switching circuits (using AND and NOT gates) Graphs and Planar Graphs: Graph, Multigraph, Weighted Graphs. Directed graphs. Paths and circuits. Matrix representation of graphs. Eulerian Paths and Circuits. Planar graphs.

2-Topology

Definition and examples of topological spaces. Closed sets. Closure. Dense sets. Neighbourhoods, interior, exterior, and boundary Accumulation points and derived sets Bases and sub-bases. Subspaces and relative topology.

Alternative methods of defining a topology in terms of Kuratowski closure operator and neighbourhood systems.

Continuous functions and homeomorphism. First and second countable space. Lindelof spaces. Separable spaces.

The separation axioms T_0 , T_1 , T_2 , $T_{3/2}$, T_4 their characterizations and basic properties. Urysohn's lemma. Tietz extension theorem.

Compactness. Basic properties of compactness. Compactness and finite intersection property. Sequential, countable and B-W compactness Local compactness One point and Stone-Cech compactifications.

Connected spaces and their basic properties. Connectedness of the real line. Components. Locally connected spaces,

Tychonoff product topology in terms of standard sub base and its characterizations. Product topology and separation axioms, connectedness and compactness (incl the Tychonoff's theorem), countability and product spaces.

Nets and filters, their convergence, and interrelation

Hausdorffness and compactness in terms of net/filter convergence.

3- Advanced Analysis

Definition and existence of Riemann-Stieltjes integral, Conditions for R-S integrability. Properties of the R-S integral, R-S integrability of functions of a function. Integration of vector-valued functions, Rectifiable curves.

Series of arbitrary terms. Convergence, divergence and oscillation, Abel's and Dirichlet's tests. Multiplication of series. Rearrangements of terms of a series, Riemann's theorem.

Sequences and series of functions, pointwise and uniform convergence, Cauchy's criterion for uniform convergence. Weierstrass M-test, Abel's and Dirichlet's for uniform

convergence, uniform convergence and continuity, uniform convergence and Riemann-Stieltjes integration, uniform convergence and differentiation. Weierstrass approximation theorem. Power series. Uniqueness theorem for power series, Abel's and Tauber's theorems.

Functions of several variables. Derivative of functions in an open subset of \mathbb{R}^m into \mathbb{R}^n as a linear transformation. Chain rule. Partial derivatives. Taylor's theorem. Inverse function theorem. Implicit function theorem. Jacobians.

Measures and outer measures. Measure induced by an outer measure, Extension of a measure. Uniqueness of Extension, Completion of a measure. Lebesgue outer measure. Measurable sets. Non-Lebesgue measurable sets. Regularity. Measurable functions. Borel and Lebesgue measurability.

Integration of non-negative functions. The general integral. Convergence theorems. Riemann and Lebesgue Integrals.

The L_p - space. Convex functions. Jensen's inequality. Holder and Minkowski inequalities. Completeness of L_p . Convergence in measure, Almost uniform convergence.

Normed linear spaces: Banach spaces and examples. Quotient space of normed linear space and its completeness. Equivalent norms. Riesz lemma. Basic properties of finite dimensional normed linear space and compactness.

Signed measure. Hahn and Jordan decomposition theorems. Absolutely continuous and singular measures. Radon Nikodym theorem. Lebesgue decomposition. Riesz representation theorem. Extension theorem (Carathéodory). Lebesgue-Stieltjes integral.

Product measures. Fubini's theorem. Baire sets. Baire measure. Continuous functions with compact support. Regularity of measures on locally compact spaces. Integration of continuous functions with compact support. Riesz-Markoff theorem.

Set theory : Countable and uncountable sets. Infinite sets and the Axiom of choice. Cardinal numbers and its arithmetic. Schroder-Bernstein theorem. Well-ordering theorem.

Complex Analysis : Complex Integration. Cauchy-Goursat Theorem. Cauchy's integral formula. Higher order derivatives. Morera's theorem. Cauchy's inequality and Liouville's theorem.

The fundamental theorem of algebra. Taylor's Theorem. Maximum modulus Principle, Schwarz lemma.

Lalurent's Series. Isolated singularities. Casporati-Weierstress theorem. Meromorphic functions. The argument principle. Rouché's theorem. Inverse function theorem.

Residues. Cauchy's residue theorem. Evaluation of integrals. Branches of many valued functions with special reference to $\arg Z$, $\text{Log } Z$, and Z^a .

Analytic continuation. Uniqueness of direct analytic continuation. Uniqueness of analytic continuation along a curve. Power series method of analytic continuation. Schwarz reflection Principle. Monodromy theorem and its consequences.

Functional Analysis- Bounded Linear transformations. $B(X, Y)$ as a normed linear space. Open mapping and closed graph theorems.

Uniform boundedness Principle and its consequences. Hahn-Banach theorem for real linear spaces, complex linear spaces and normed linear spaces. Application of Hahn-Banach theorem. Dual spaces with examples. Separability. Reflexive. Spaces. Stone-Weierstrass theorem. Weak convergence. Weak sequential compactness. Compact operators.

Inner product spaces, Hilbert spaces. Orthonormal sets. Bessel's inequality. Complete orthonormal sets and Parseval's identity. Structure of Hilbert spaces. Projection theorem. Riesz representation theorem. Riesz Fischer theorem, Adjoint of an operator on a Hilbert space.

4- **Differential equations, Integral equation and calculus of variation**

Differential equations: Ordinary Differential Equations- Linear differential equations, Selfadjoint differential equations, Lagrange identity, The existence and uniqueness theorem. Green's Function for ordinary differential initial and boundary value problem.

Series solution of differential equations- Power series method, Bessel, Legendre and Hypergeometric equations. Bessel, Legendre and Hypergeometric functions and their properties. Convergence, recurrence and generating relations. Orthogonality of

functions. Sturm-Liouville problem. Eigen-functions and eigen-values. Orthogonality of Bessel functions and Legendre polynomial.

Linear systems in \mathbb{R}^2 , System of first order linear differential equations, Fundamental theorem for linear systems, Fundamental matrices, Initial value problems, Autonomous systems and stability, Almost linear system.

Partial differential equations of the first order. Lagrange's solutions. Some special types of equations which can be solved easily by methods other than the general method. Charpit's general method of solution. Partial differential equations of second and higher orders. Classification of linear partial differential equations of second order. Homogeneous and non-homogeneous equations with constant coefficients. Monge's methods.

Integral Equation: Classification of integral equations of Volterra and Fredholm types. Conversion of initial and boundary value problem into integral equations. Conversion of integral equations into differential equations (when it is possible) Volterra and Fredholm integral operators and their iterated kernels. Resolvent kernels and Neumann series method for solution of integral equations. Banach contraction principle, its application in solving integral equations of second kind by the method of successive iteration and basic existence theorems.

Abel's integral equations and tautochrone problem.

Fredholm-alternative for Fredholm integral equation of second kind with degenerated kernels.

Use of Laplace and Fourier transforms to solve integral equations.

Calculus of variations: Variational problems with fixed boundaries. Euler's equation for functionals containing first order and higher order total derivatives. Functionals containing first order partial derivatives. Variational problems in parametric form. Invariance of Euler's equations under coordinates transformation.

Variational problems with Moving Boundaries-Functional dependent on one and two functions. One sided variations. Sufficient conditions for an extremum-Jacobi and Legendre conditions.

5- **Integral Transform**

Laplace Transform- Existence theorem for Laplace transform, properties of Laplace transform, Laplace transform of derivatives and integrals, inverse Laplace transform, convolution theorem, Heaviside expansion formula, complex inversion formula, evaluation of integrals, solution of initial and boundary-value problems of ordinary and partial differential equations.

Fourier Transform- Infinite Fourier transform, Fourier cosine and sine transform, finite Fourier transform, finite Fourier cosine and sine transform,. Solution of initial and boundary value problems of ordinary and partial differential equation.

6. Numerical Analysis

Error Solution of Equations: Bisection, Secant, Regular False, Newton's Method, Roots of Polynomials.

Interpolation: Lagrange and Hermite Interpolation. Divided differences. Differences schemes. Interpolation formula using differences.

Difference operators. Δ , E , S and μ .

Numerical Quadrature: Newton-Cotes's formulas, Gauss quadrature formulas. Chebychev's formulas.

Linear Equations: Direct methods for solving systems of Linear Equations(Gauss Elimination, LU Decomposition, Cholesky Decomposition) Iterative Methods (Jacobi, Gauss-Seidel, Relaxation Methods) Matrix norm, ill conditioned system.

Algebraic Eigenvalue Problem: Jacobi's method, Given's method, Householder's method, power method, Lanczos method. QR decomposition, singular value decomposition.

Ordinary Differential Equation: Euler method, Single-step methods, Runge-Kutta's method, Multi-step methods, Milne-Simpson method, Methods based on numerical integration. Methods based on numerical differentiation. Boundary value problems. Eigenvalue problems. Difference Equations.

Approximation: Different type of approximation, Least square polynomial approximation, polynomial approximation using orthogonal polynomials. Approximation with trigonometric functions, Exponential functions, Chebychev polynomials. Rational Functions. Boundary value problems of ordinary and partial differential equations, finite, difference Galerkins method, collocation method.

7. **Mechanics** Rotation of a vector in two and three dimensional fixed frame of reference. Kinetic energy and angular momentum of rigid body rotating about its fixed point.

Euler dynamics and geometrical equations of motion.

Generalized coordinates, momentum and force components. Lagrange equations of motion under finite forces, cyclic coordinates and conservation of energy.

Lagrangian approach to some known problems-motions of simple, double, spherical and cycloidal pendulums, motion of a particle in polar system, motion of a particle in a rotating plane, motion of a particle inside a paraboloid, motion of an insect crawling on a rod rotating about its one end, motion of masses hung by light strings passing over pulleys, motion of a sphere on the top of a fixed sphere and Euler dynamic equations.

Lagrange equations for constrained motion under finite forces. Lagrange equations of motion under impulses, motion of parallelogram about its centre and some of its particular cases.

Small oscillations for longitudinal and transverse vibrations.

Equations of motion in Hamiltonian approach and its application on known problems as given above. Conservation of energy. Legendre dual transformation.

Hamilton principle and principle of least action. Hamilton-Jacobi equation of motion, Hamilton-Jacobi theorem and its verification on the motions of a projectile under gravity in two dimensions and motion of a particle describing a central orbit.

Phase space, canonical transformations, conditions of canonicity, cyclic relations, generating functions invariance of elementary phase space, canonical transformations form a group and Liouville theorem.

Poisson brackets, Poisson first and second theorems, Poisson-Jacobi identity and invariance of Poisson bracket.

8. **Tensor Differential Manifold**

Tensors-Contravariant and Covariant vectors, Transformation formulae, Tensor product of two vector spaces. Tensor of type (r, s) Symmetric and Skew-symmetric properties. Contraction of tensors, Quotient law. Inner product of vectors.

Geometry General equations of second degree-System of conics, Confocal conics, Polar equation of a conic.

Plane-The straight line and the plane, Sphere.

Cone, Cylinder, Central conicoids. Tangent plane at a point of central conicoid, Normal, Polar planes and polar lines.

Paraboloids plane sections of Conicoids, Generating lines confocal conicoids.

Differential geometry of Manifold- Topological groups. Lie groups and Lie algebras. Product of two Lie groups. One parameter subgroups and exponential maps. Examples of Lie groups. Homomorphism and isomorphism. Lie transformation groups. General linear groups.

Principal fiber bundle. Linear frame bundle. Associated fiber bundle. Vector bundle. Tangent bundle. Induced bundle. Bundle homeomorphisms.

Almost complex and almost contact structures. Nijendhuis tensor. Contravariant and covariant almost analytic vector fields in almost complex manifold. F-Connexion.

Almost complex and almost contact submanifolds and hypersurfaces.

8 Physics

(1) Mathematical Physics

Vector algebra and vector calculus, Matrices, Hermitian and skew Hermitian matrices, Eigen value and eigen vector, linear differential equation of first and second order, Fourier Series, Fourier and Laplace transforms. Elementary probability theory, random variables.

(2) Classical Mechanics

Generalised co-ordinates, D-Alembert Principle and Langrange's equation of motion, Derivation of Langrange's equation from Hamilton's principle, Types of oscillation's, small oscillation's using generalized co-ordinates, normal modes and normal co-ordinates, coupled pendulum, constraints & their classification.

(3) Quantum Mechanics

Fundamental concepts: Heisenberg Uncertainty principle, wave function, Schrödinger equation (time dependent and time independent) Eigen value problem (particle in a box, harmonic oscillator etc.) Commutators and operators, Dirac notation for state vectors, Hydrogen atom, Stern Gerlach experiment, Time dependent perturbation theory and Fermi golden rule, Selection rules, Pauli exclusion principle, Spin angular momentum operators and their algebra, eigen values and eigen functions of L^2 and L_z operators, Schwartz inequality.

(4) Electromagnetic Theory

Clausius-Mossotti equation, Evaluation of molecular polarizability for simple models, Debye equation and temperature dependence of dielectric constant. Maxwell equations, Microscopic and Macroscopic fields, Dielectric tensor. Scalar and vector potentials Gauge Transformation, (Lorentz and Transverse) Maxwell equations in terms of electromagnetic potentials, Plane wave in an anisotropic

medium, Fresnel's Formula for propagation of light in crystals , Reflection and refraction of electromagnetic waves from a plane interface between two dielectric, Polarisation by reflection, Total internal reflection .

(5) Thermodynamics and Statistical physics

Law of thermodynamics and their consequences, Thermodynamic potentials, Chemical potentials, Phase equilibria, Micro canonical and grand canonical ensembles and partition function. Free energy and its connection with thermodynamical quantities, Ideal Bose and Fermi gases, Blackbody radiation and Planck's distribution law.

(6) Electronics

Semiconductor devices (junction diodes, transistors, field effect devices, homo and heterojunction devices) structure, devices characteristics, Frequency dependence and applications. Optoelectronic devices (Solar cells, photo detectors LED's.), Boolean Algebra, Microprocessor and Microcontroller basics, Memories , C-MOS, ROM, MOS, RAM, D/A and A/D converters.

(7) Atomic and Molecular Physics:

Quantum states of an electron in an atom. Electron spin, Spectrum of helium and alkali atom. Hyperfine structure and isotopic shift, width of spectrum lines, LS & J J couplings. Zeeman and Paschen-Back & Stark effects, Electron spin resonance, Nuclear magnetic resonance, chemical shift, Born-Oppenheimer approximation, Electronic, Rotational, Vibrational and Raman spectra of diatomic molecules, selection rules.

Laser: Spontaneous and stimulated emission, Einstein A and B Coefficients, optical pumping, population inversion, rate equation, modes of resonance and coherence length.

(8) Nuclear and Particle physics

Basic nuclear properties: Size, shape and distribution, Spin and parity. Binding energy, semi empirical mass formula, liquid drop model ,

Nature of the nuclear force, Evidence of shell structure, Single particle shell model, its validity and limitation, Elementary ideas of alpha, beta and gamma decays and their selection rules. Fission and Fusion Nuclear reactions, Reaction mechanism, Compound nuclear and direct reactions.

Classification and important properties of elementary particles, Application of symmetry arguments to particle reactions, Parity –non-Conservation in weak interaction, Relativistic kinematics.

(9) Solid State Physics

Bravais lattices, Reciprocal lattice, Diffraction and the structure factor. Bonding in solids, Elastic properties, Phonons, specific heat, Free electron theory and electronic specific heat, Drude model for electrical and thermal conductivity, Hall effect and thermoelectric power, Electron motion in a periodic potential, Origin of energy gap, Classical theory of Dia, para and ferromagnetism, Ferromagnetic Weiss theory, Curie point, Anti ferromagnetic Neel temperature, Anti ferromagnetic magnons.

(10) Topic of Special Interest

Superconductivity: Type-I and Type-II superconductors, Meissner effect, Josephson junctions, Superfluidity. Fullerenes: Synthesis of C_{60} , and its properties, various forms of fullerene materials,

Physics of low dimension, nano Scale, Quantum Confinement (quantum well, quantum wire, quantum dot.), Graphene, Carbon Nanotubes (Single walled and multi walled) applications.

9 ECONOMICS

1-Micro Economics: Theory of consumer behaviour and demand analysis-cardinal approach, ordinal approach and revealed preference theory: Theory of production: production function-Cobb-Douglas production function, CES and VES production functions: Theory of cost-cost and revenue curves: Modern approach to the theory of cost- technical progress and techniques of production: Equilibrium of firm under different market forms: pricing of factors of production: Concept of economic welfare, pareto optimality and compensation principles.

2-Macro Economics : National Income-concepts, components and methods of accounting: Classical and Keynesian theories of employment and income: Investment Multiplier, accelerator, interaction of multiplier and accelerator: concepts of economic growth and economic development: determinants of economic growth: development models of economic growth-Harrod -Domar, solow, Meade and Joan Robinson: Theories of trade cycles.

3- Money and Banking: Concepts and functions of money: Supply of Money- determinants of money supply: high powered money: money multiplier: Quantity theory of money- Fisher and Cambridge version: Keynesian, Patinkin, Friedman, Baumal and Tobin's approach: Theories of inflation: Philips curve analysis: Monetary Policy of India.

4- Public Finance: Role of the Government in economic activity-allocation, distribution and stabilization functions: private, public, and merit goods: Concepts of deficit and Budgets of the Union Government of India: Public expenditure theories, effects and evaluation:

Public Revenue- Theories of taxation, impact, incidence, effects and shifting of tax, taxable capacity: Public Debts- sources, effects, burden and its management: Fiscal Federalism- theory and problems: role of finance Commission in India: Fiscal Policy-neutral, compensatory and functional finance.

5- International Economies : Theory of comparative cost, Haberler's opportunity cost theory, Heckscher- Ohlin theorem: Free trade and protection: Balance of Payment and adjustment mechanism: foreign exchange rate determination: IMF, IBRD and WTO.

6-Indian Economy: Basic features of Indian Economy: Planning-objectives, approaches, priorities and problems of resource mobilization: Issues and policies relating to population, poverty and unemployment in India: Structural changes-State vs. Market policy for sustainable development: Developing human capital: Agricultural policy- issues of food security, developing rural infrastructure and evaluation of policies promoting rural development: Industrial reforms and their impact on industrial growth: PSUs and disinvestment: small scale enterprises in Indian Economy: Public- Private partnership in India: productivity and environmental issues.

7- Quantitative Techniques of Economic Analysis: Function, limits, equations, identity and simple differentiation: Measures of central tendency, dispersion, skewness and kurtosis: Simple correlation and regression analysis: Methods of Sampling: Index numbers and time series analysis: Elementary theory of probability-Binomial Possion and Normal distribution.

Political Science

State-Theories of Sovereignty- Monistic, Pluralistic, Theories of origin of State-Divine, Force, Social Contract, evolutionary, and Marxian, Theories of function of State- Liberal, Socialist and Welfare , Concepts- Rights, Liberty, Equality and Justice and Secularism.

Political Theories -Liberalism, Marxism & Gandhism. Theories of Representation, Public Opinion, Pressure Groups & Political Parties.

II

Main Ideas of following political thinkers-

Plato, Aristotle ,St. Thomas Aquinas, Machiavelli, Hobbes, Locke, Rousseau, Montesquieu, Bentham, J.S Mill, Hegel, T.H. Green, Karl Marx, Kautilya, Manu, Tilak, Gandhi, Nehru, Dr. Ambedkar, John Rawls.

III

Comparative Politics, Approaches- Traditional, Behavioural & Post- Behavioural Comparative Politics, Comparative Government-Relation and Distinction, Concepts of Political System, Classification of political system (British & American models, Dictatorship, Totalitarian political system), Political Development, Modernization, Theories of political Culture, Concept and role of civil Society.

IV

Land Marks of Indian Freedom Movement, The Indian constitution _ Basic Features, Fundamental Rights & Duties, Directive Principles of State policy, Indian federal System, Legislature, Executive and Judiciary, Panchayati Raj System in India Urban Local Self Government.

V

The Study of International politics & Relation, Realist, Liberal & System Theory of International Politics, National Power, National Interest, National Security, Balance of Power, Collective Security, Disarmament & Arms Control, Diplomacy and Cold war, United Nation and its organs NAM, ASEN, SAARC, European Union, The third world Politics, New International Economic Order (NIEO), Indian Foreign Policy and Relations. Foreign policies of

U.S.A., Russia and China, Issues of Human Rights and International Law, Globalization.

VI

Evolution of Public Administration as discipline, Organization, Theories of Organization, Principle of Organization, Personnel Administration, Bureaucracy and Civil Services, Financial Administration, Indian Administration- Evolution and main features.

11 Urdu

Part-I

- Language and its importance. Difference between language and dialect. Background of Urdu Language families.
- Different theories of the origin of Urdu Language. Urdu, Hindi and Hindustani. Development of Urdu Literature in Deccan. Role of Sufi's in the development of Urdu Language & Literature.
- Literary contributions of Fort William College and Delhi College.
- Two Classical Schools of Urdu Poetry -Delhi & Lucknow School.
- Beginning Structure of Urdu Prose (From the beginning to Aligarh

Movement) . Different movements and trends of Urdu Literature (Aligarh Movement, Romanticism, Progressive movement, Modernism, Post modernism) Role of Urdu in the independence movement (National and Patriotic Poetry) . Folk Literature (Qissa Goe, Folk Stories Folk Songs, Dohas) Urdu Literature after independence. Composite traditions of Urdu-Hindi Literature.

Part II Poetry

Ghazal: Definition, tradition and Salient features-Renowned Poets, Wali Dard, Meer, Ghalib, Faani, Firaq, Nasir Kazmi and Shahryaar.

Nazm : Definition, tradition and Salient features- Renowed poets. Nazeer, Akbar, Chakbast, Iqbal, Josh, Faiz, Akhtarul Iman, Parveen Shakir.

Qasida: Definition, tradition and Salient features-Renowned poets,Sauda, Zauq ,Ghalib, Mohsin.

Masnavi: Definition, tradition and Silient features-Renowned Poets, Mulla wajhi (Qutub Mushtari), Meer Hassan (Sahrul Bayan) Daya Shankar Nasim (Gulzar-e-Nasim) Nawab Mirza shouq (Gahr-e-ishq)

Marsia: Definition, tradition and Saight features-Renowned poets salient Zameer, Anis, Dabeer, Nasim Amrohvi, Jamil Mazhari.

Part III (Prose)

Daastan: Definition, tradition and Salient features- Mulla wajhi (sab Ras) Meer Amman (Bagh-o-Bahar) Rajab Ali beg Suroor(Fasana-e-Ajaeb) Ratan Naath Sarshaar (Fasana-e-Azad).

Novel: Definition, tradition and salient features-Renowned Novelists. Nazeer Ahmed (Ibnul Waqt),Miza Hadi Ruswa (Umrao Jaan Ada), prem Chand (Gaudaan) Qurratulain Haider (Aag Ka Dariya), Qazi Abdus Sattar (Dara Shikoh),Ilyas Ahmed Gaddi (Fire area).

Short Stories: Definition, tradition and salient features- Renowned writers. Prem Chand, Sajjad Haider Yaldaram, saadat Hasan Mintoo, Rajendra Singh Bedi, Krishn Chandra Ismat chughatee, surendra Prakash, Syed Mohammad Ashraf .

Drama: Definition, tradition and salient features-Renowned Drama Writers, Amanat Lcuknawi (Indra Sabha), Agha Hashra Kashmiri (Silver King) Imtiyaz Ali Taj (Anarkali) Mohammad Hassan (Zahak) Habib Tanvir (Agra bazaar).

Literary Criticism: Definition, tradition and Salient features-Renowned critics, Haali, Shibli, Imdad ImamAsar, Aal Ahmad Suroor. Ehtesham Hussain, Kalimuddin Ahmed, Mohammad Hassan, Gopi Chand Narang,Shamsur Rahman Farooqi.

Literary Research: Definition, tradition and Salient features-Renowned Researchers, Hafiz Mahmood Shirani, Qazi Abdul Wadood. Moulvi Abdul Haque,Imtiyaz Ali Khan Arshi, Rasheed Hassan Khan.

Non-Fictional Prose: Swaneh (Haali,Shibli) Khaaka (Rasheed Ahmad Siddiqui, Shaukat thanvi) Tanz-o-Mizah (Pitras Bukhari,Mushtaque Ahmad Yusufi) Safar Nama (Yusf Khan Kambal Posh) Essay (Sir Syed Ahmad Khan) Khutoot Nigari (Ghalib, Abdul Kalam Azad),Tazkira (Meer, Mohammad Hussain Azaad), Journalism (Moulana Abul Kalam Azad,Moulana Md. Ali Jouhar).

12 Painting/Drawing

Philosophy of Art & Aesthetics

- Basic concept of Eastern & Western aesthetics.
- Scope of aesthetics and its relation to Science and Philosophy.
- Comparative study of Painting. Music & Poetry
Concept of art and beauty with special reference to thinkers such as Plato, Aristotle.
Baumgartner, Kant, Hegel, Roger Fry, Clive Bell, Tolstoy etc.
- Oriental aesthetic and its scope, basic principles of Indian philosophy and religious thoughts. Theories of Rasa and Rasanispati.
- Six Limbs of Indian Art,
- Inter relationship of various aesthetic concepts and their relevance to work of art.
- Globalization of Art,
- Theory relating to creativity.
- Distinction between Aesthetics and appreciating Criticism.
- Art as a form of social consciousness and reality.
- Psychology of Artistic Perception.
- Some theories relating to creativity: Emotion, Imagination, Intuition,
- Imitation, Art and Communication. Art and tradition, Art & Expression, Art & Religion, Art & Symbolism
- Art & Design, Art & Society.
- Impact of Industrialization, Science and Technology on Art.
- Psychological mechanism of Artistic Creation.

Trends & Traditions of Indian Art

- Pre Historic Age- Paleolithic, Mesolithic, Neolithic. The quest of Pre- historic painting, Important Centre of Pre-historic painting in India. Subject matter and style of Pre -historic art. The technique of pre-historic painting.
- Indus Valley Civilization- Sculpture, Terracotta & Pottery.
- Pre Buddha and Buddha period- paintings of Jogimara caves, importance of Jogimara cave paintings. classical wall painting: Ajanta, Bagh, Ellora, Sittanvasal, Ajanta, Situation

of Ajanta , Discovery and renovation of Ajanta caves. The techniques of Ajanta murals, Subject matter of Ajanta caves, Paintings of Ajanta cave No. 9,10,16,17 and 19th caves. The Characteristics of Ajanta painting, Linear beauty. expression of sentiments, colour scheme, variety of life, expression of Emotions. through hand postures, women in ideal form, decoration, ornamentation, hair style, symbolic painting, depiction of nature, birds and animals.

Origin of miniature paintings and their main schools: Jain Pala, Apabhraṃśh, Mewar, Kishangarh, Bundi-Kota, Mughal & Pahari School.

Subject matter of miniature paintings, definition of eyes, colour scheme, symbolic depiction, decoration , human figure expression thought postures of hands, romantic scenes, folk influence.

Historical background, symptoms of decline of patronage of traditional art and Hill courts during early 19 th century.

The Company School of paintings and their painters.

Indian Modern and Contemporary Art

Nationalist Movement and Revival of Traditional, Indian art. Bengal School and their School of Paintings and their painters: A.N. Tagore, Nand Lal Bose, K.N. Majumdar, Khastgir, A.K. Haldar etc.

Views of Anand Comaraswamy. E.B. Havell, Rabindranath Tagore, Ganganendra Nath Tagore etc.

New Trends in modern Indian Painting and their painters: R.N. Tagore, G.N. Tagore, Jamini Roy. Amrita Shergil, Raja RaviVerma, Ram Kinkar etc.

contemporary art of India, Art Movement of India such as progressive Art Group, Shilpi Chakra, Samikshavad.

Creative analysis of important painters, Sculptors and their work such as Roerich, Souza, M.F. Hussain, Tayab Mehta ,K.S.Kulkarni, Ram Kumar, Marjeet Bava, Swaminathan, G.R. Santosh, Himmat Shah, Jera Patel, Ramchandran, Bhupen Khakkar, R.s.Bist, M.L. Nagar, A.S.Pawar, Ram Chandra shukla etc.

Impact of Folk, Tribal and Classical Art on Contemporary Art of India.

Current Trends in Indian art scenario.

Trends & Traditions of European Paintings

Important Centres of Pre- historic paintings in Europe. Subject matter and style of pre-historic art. The technique of pre-historic painting. Egyptian, Greek and Roman painting

Early Christian and Byzantine Painting, Romanesque and Gothic Painting, Renaissance Painting;

Lives & Works of 17th century painters like Rembrandt, Rubens, Vermeer, Velazquez and others. 18 th Century painting of England and France, Mannerism, Baroque & Rococo Painting.

Western Modern and Contemporary Art

Main Movements in paintings and sculpture from mid 19 th century to the present day with emphasis on the contributions of important artists in Europe and America.

Visual analysis and ideological source.

Realism, Expressionism, Surrealism and their work & Painters.

Contemporary Art movements such as Action painting- Synchronism, Orphism, Raynism,

Constructivism, Abstract Expressionism etc.

Current trends in European Art.

13
PSYCHOLOGY

Theoretical approaches to psychology: S-R Cognitive information processing, and humanistic.

Attention: Selective, divided and sustained attention

Perception : Approaches: Bottomup and top down, perceptual development: nature and nurture controversy;

Learning: Classical and instrumental conditioning, observational learning, verbal learning.

Memory: Encoding, storage and retrieval: sensory, short- term and long-term memory. forgetting: Theories.

Language: Properties, acquisition and development.

Reasoning, Decision Making and Problem Solving: Types and **Factors of reasoning:** Heuristic and decision Making: Types of problem and strategies of problem solving: Creative thinking.

Affective Processes: Motivation, conceptual issues and theoretical frameworks. Emotion: Conceptual and theoretical issues , neurphysiological approach.

Cognitive Neuropsychology: Assumption, methods, organization of brain, techniques of measurement of brain activities.

Personality: Approaches to personality: Trait and types: Psychoanalytic, behaviouristic and humanistic. Determinants and assessment of personality.

Individual Differences: General mental ability. Theoretical **approaches:** Spearman. Thurstone, Guilford, Jensen, Piaget, Gardener.

Research Methods , Experimental Design and Statistics: Problem, hypothesis, variables, control techniques: Design : Meaning, Purpose, and types: Between group: Single factor, randomized and matched group: Within group design: One and multiple factors, repeated measures: Factorial design: Main and interaction effects, types.

Statistics: Testing of hypothesis: analysis of variance: One way, factorial, repeated measure: Post -hoc comparisons: Non-parametric **statistics:** Chi square, Median test, Wilcoxon test, Mann Whitney Utest, Friedman test Factor Analysis Extraction and rotation of factors , multivariate analysis: multi regression analysis: Simultaneous, hierarchical and step-wise.

Psychological Assessment and Testing: Principles, tools, administration, analysis and interpretation of data: Reliability, validity and norms.

Life Span Development: Developmental stages and determinants. Cognitive, social and moral development. Changes in adulthood and old age and coping with changes. Major concerns of old age.

Social Psychology: Social influence: bases of social influence processes, leadership, group factors in performance, control and power, cultural influence: Social cognition: Meaning. approaches: Attribution, schema and cross cultural; Interpersonal attraction: theories.

Organisational Psychology: Human resource management: Planning, assessment Job analysis, recruitment, selection and training: Organizational development and change: Process, action, research, interventions, models of plant change: Organizational communication: Model, process, barrier, direction and network in communication. Communication skills. Industrial relations: Union management relations, grievance handling approaches.

Health Psychology: Models and issues, Stress and health, Coping with stress Type A personality. Managing stress - diet and nutrition, relaxation, biofeedback, exercises.

Clinical Psychology: Diagnosis: methods Case study, interview, testing and neuropsychological testing: Therapy: Major approaches: Psychodynamics (Freudian) Cognitive- behaviour (Ellis & Bech) Humanistic- existential (Rogers, gestalt, Frenkl & Transactional) and systemic.

Psychopathology: Classification of disorders (ICD-10 and DSM_IV) Symptoms and etiology of disorders: child psychopathology: Types of disorders: Intellectual deviance and learning disabilities.

14
Defence Studies

1. Indian Philosophy of War- Kautilya, Military Organisation, Weapon, Patterns of Warfare and Mandal System.
2. Mauryan Military System.
3. Arab & Turkish Invasion of India: New Trends of warfare
4. Rajput Military System with special reference to battle of Tarrain
5. Mughul Military System.
6. Maratha Military System
7. Sikh military system under Khalsa and Ranjit Singh
8. Concept of National power: Elements of national power
9. Contemporary concept of National Security
10. Concept of Nation Interest.
11. Non- alignment : concept and importance in modern times
12. Collective security & Collective Defence
13. Cold war—Nature & evolution since 1945
14. Détente: Nature & U S & Soviet perceptions
15. War as an Instrument of National policy
16. Machiavelli : War, War & policy
17. Clausewitz: War & War & policy
18. Jomini: concept of strategy and fundamental principles of strategy
19. Concepts & theories of revolutionary war and Guerrilla warfare: Mao Tse-Tung & Che- Guevara
20. Armoured Warfare: J.F.C. Fuller and Liddell Hart
21. Airpower theory: Douhet, Mitchell & Seversky
22. Theory of Seapower: Mahan
23. German Strategy in the Machine Age
24. Allied Strategy in World War-II

25. Nuclear Deterrence: Nature and concept with special reference Y. Harkavi
26. Concept and theories of Disarmament & Arms Control.
27. Concept of Peace Keeping & Peace Building
28. Gandhian techniques of conflict resolution.
29. International Terrorism.
30. Proliferation of weapons of Mass destruction and NPT, CTBT, MTCR, SALT & START.
31. India Nuclear policy and programme
32. Pakistan's Nuclear policy and programme.
33. India's relations with USA, Russia, China, Pakistan, Srilanka, Bangladesh, Nepal.
34. Indian Ocean and India's security consideration.
35. Insurgency in Kashmir and North East India.
36. Internal threats to India's security.
37. Economic theory of defence—Adam Smith, David Ricardo.
38. Defence and Development.
39. War Potential of a nation- Natural, Physical, Financial, Industrial and Manpower resources.
40. Defence production programme in India.
41. Defence Budgeting in India after 1947.
42. Mobilization of resources for Defence during war times.
43. Economic causes of war.
44. Power Rivalry in South Asia, USA, Russia, China (Past & Present).
45. Regional Cooperation in South Asia.
46. Pattern of Civil- Military Relations in India.
47. War and Psychological warfare: Propaganda, Rumour & Brain washing.
48. Arab- Israeli war; 1956, 1967 & 1973.
49. South East Asia with special reference to ASEAN

50. Role of United Nation in maintaining international Peace and Security, Structure & Role of Security Council
51. Methods of Conflict Resolutions: Peaceful and Forceful methods
52. Revolution in Information Technology.
53. Legal control of armed conflicts.
54. Corelation between foreign , defence and domestic policies.
55. Science & Technology in India's security, India's Scientific & technological base for national defence, India's Research and Development, India's Defence Industrialization and achievements.
56. Imperatives of a comprehensive national security Strategy .
57. Napoleonic Art of warfare with special reference to battle of Trafalgar (1805) and Waterloo (1815).
58. American Civil war (1861-65) and new military trends.
59. First world war ; Causes, Strategy, role of airforce and navy.
60. Second world war ; causes, Allied and Axis objective.
61. Crisis in Korea ; Strategy, tactics & weapons system .
62. Iran Iraq conflict : causes, strategy & tactics.
63. Gulf conflict (1991).

Commerce

Unit- 1

Business Economics- Concept; Nature and significance of Business Economics; Principles of Business Economics; Demand Analysis; Production Analysis; Pricing Analysis; Business Cycles, Inflation.

Unit- 2

Business Environment- Concept, Nature and significance of Business Environment; Elements; Techniques of environmental scanning and monitoring; Economic Systems; Government Policies; Political, Legal, and Socio- Cultural Environment.

Unit- 3

Organisational Theory and Behaviour- Evolution; Contingency theories of organization; Models of organizational behaviour; Personality; Perception and Learning; Transaction-Analysis;- Theories and Styles of Leadership; Management by Objective.

Unit- 4

Business Statistics- Coefficient of Association, Methods and Uses of Chi-Square Test; Addition, Multiplication and Bay's Theorem of Probability; Binomial, Normal, and Poisson Method of theoretical frequency distribution; Types of Sampling; Standard Error; Hypothesis Testing.

Unit-5

Accounting for Managerial Decisions- Nature; Scope and Objectives of Management Accounting; Ratio Analysis; Fund Flow and Cash Flow Analysis; Types of Budgets; Kinds of Variances and their uses; Cost- Volume-Profit Analysis; Break -Even Analysis and its practical applications.

Unit- 6

Strategic Management- Concept of Strategy; Mission and Purpose; Objectives and Goals; Strategic Business Unit; Functional Strategies; Enviromental Analysis and Diagnosis, Strategy Formulation and Choice of Alternatives; Strategy Implementation; Strategy Evaluation.

Unit- 7

Business Management- Evolution of Management Thought, Ethical Issues in Management; Social Responsibilities of Business; Corporate Governance; Essentials of Planning; Importance and Process of Decision Making; Nature of Organising; Different types of Organisational Structures; Leadership and its Role in Management of Organisations; Nature, Process and Types of Control; Essentials of an Effective Control System.

Unit- 8

Entrepreneurship and Small Business- Functions, Types and qualities of an Entrepreneur; Main Theories of Entrepreneurship; Environmental factors affecting Entrepreneurial Development; Role of Government and other Institutions in the development of entrepreneurship in India; Role of Small and Medium Enterprises(SMEs) in Indian Economy; Problems of SMEs in India

MUSIC (VOCAL)

- (a) Concept of shruti, Placement of shuddha and vikrit swaras on different shruties according to Lochan, Ahobal, Pundarik Vithal, Ramamatya, Somnath.
- (b) Consonance and dissonance , Chords and its different kinds, Salient features of Western Staff Notation , Key—Signature, Time Signature, Musical Scale, Musical Intervals, Harmony and Melody,
- © Comparative Study of Hindustan and Karnatak Swar, Karnatak Tal System, Biographies of Musicians and musicologists as Bhat Khande, Vishnu Digambar etc, Role of modern science in the development and propagation of music.
- (d) Nad and its different kinds, Swayambhoo Swar (Harmonies), Characteristics of Vaggey kar, Gharanas of Hindustani Sangeet like Kirana , Gwalior, Agra, Jaipur etc. History of Indian Music with special reference to Ancient, Medieval and Modern period, Study of Granthas of Indian Music like Natya Shastra, Sangeet Ratnakar, Gita Govind, Brahadeshi, Sangeet Parijat etc. Different classifications of Ragas, Salient features of prabandh, Dhrupad, Dhamar, Khyal, Different kinds of gram and moorchana , various forms of folk music and Folk Dance, Haveli Sangeet, music therapy, Concept of Aesthetics and different views of Philosophers, Rasa and its different kinds, Relation of music with Aesthetics and Rasa, Utility of Dhyana and Rag-Ragini paintings in music, Role of electronic equipments in music teaching , Contemporary trends of music, Music and its inter relationship with other arts like music and painting , music and poetry, Music and Dance, Relation of Raga with Season, Importance of Bandish (Composition) in music, Kaku-Bhed,
- (e) Identification of Ragas by given notes or Phrases, Ragas like Todi, Chayanat, Lalit, Bhairav, Kanhora, Devgiri Bilabal, Kedar, Sur

Malhar, Nat Malhar, Chaudrakauns, Rageshree, Kalyan, Shyam Kalyan, Sarang, Patdeep, Maru-Bihag, Basant, Jog, Nand, Madhuvanti, Darvari, Multani, Deshi, Miya Malhar, JaiJaiwanti etc.

(f) Identification of Talas like Teental, Jhaptal, Tilvara, Chartal, Dhamar, Roopak, Ada- Chartal, Tivra etc., Knowledge of Laya and different Laykaries like Dugun, Tigun, Chaugun, Ada etc.

2. INTERVIEW (Practical)

The candidates will be required to give performance and viva in Interview. They should bring their own instrument and arrange their accompanist at the time of interview.

Candidates will be required to present in performance one detail Raga of his/her choice for minimum 7 minutes. The expert will test the knowledge of the candidate by one more Raga out of the prescribed ragas as well as put up questions on the comparative study of Ragas. Candidate will also be required to present one Dhrupad/ Dhamar or Thumari, besides he/ she should be able to sing patriotic songs, Bhajan, Geet and other forms of light music. Identification of Ragas, Playing Harmonium, Tanpura and Thekas of accompanying talas will form a compulsory part of Interview. Knowledge of the following Ragas will be compulsory.

1- Kalyan. Shyam Kalyan, Sarang, Shuddha Sarang, Madmad Sarang, Todi, Gurjari Todi, Bilaskhani Todi, Kanhara, Adana, Miya Malhar, Gaud Malhar, Sur Malhar, Bilabal, Devgiri Bilabal, Yamni Bilabal, Kedar, Jaunpuri, Lalit, Ramkali, Gaud Sarang, Bhairav, Maru Bihag, Chandrakauns, Baggeshree, Rageshree, Patdeep, Bhimpalasi, Basant, Paraj, Pooriya, Hindol, Multani, Marwa, Deshi, Jaijaiwanti, Kamod, Chayanut, Jog, Nand etc.

2- Performance of vilambit/Drut Khayal, Dhrupad/Dhamar/Thumri in any of the above Raga.

- 3- Playing of theka on Tabla and hand of the talas like Teental, Ektal, Chautal, Jhaptal, Dadra, Roopak, Kaharva etc.
- 4- Identification of Ragas
- 5- Playing of Harmonium, Tuning and playing of Tanpura will be compulsory.
- 6- Besides performance and knowledge of General form of singing like Saraswati Vandana, Ganesh Vandana, Folk Songs will also be required.

17 Sociology

Unit-I

Basic Sociological Concepts- Emergence and Nature of Sociology; Institutions, Community, Association, Social groups, Society, Status and role, Culture, Norms and Values.

Unit-II

Social Processes- Cooperation, Competition, Conflict; Diffusion, Assimilation, Acculturation; Socialization.

Unit-III

Classical Sociological Theories

Evolutionary,
Structural,
Functional,
Interactionist,
Conflict,

Unit-IV

Contemporary Sociological Theories

Phenomenology and Ethnomethodology,
Neo Functionalism, Neo Structuralism, Neo Marxism, Post modernism,
Exchange Theory.

Unit-V

Research Methodology

Meaning and nature of Social Research, Social Survey; Objectivity and Subjectivity; Research design, Hypothesis, Sampling, Techniques of data Collection- Qualitative and Quantitative; Basic concepts of Statistics- Central tendency, dispersion, correlation.

Unit-VI

Social Change- Concept, Types and Theories

Development, Progress, Transformation, Social movement.
Processes - Industrialization, Urbanization, Westernization, Globalization.

Unit-VII

Indian Society-Concepts, Perspectives and Processes

Concepts: Class, Caste, Kinship, religion, marriage and family;
Processes: Sanskritisation, Westernization, Secularization and Globalization.
Perspectives: Indological, Structural-Functional, Civilizational, Subaltern.

Unit- VIII

Contemporary Issues/Problems

Gender and Caste inequality, Family Disharmony; White Collar Crime and Corruption, Drug Addiction, Ecological Degradation, Communalism, Regionalism, Ethnic Diversity, Poverty, Unemployment.

Unit-IX

Rural Society in India

Caste System, Jajmani Relations, Agrarian Relations and Mode of Production, Panchayti Raj, Rural Development and Change.

Unit-X

Other Issues

- (a) Empowerment of Scheduled Castes and Scheduled Tribes, Women, OBCs; Constitutional provisions and their impact.
- (b) Population, Culture and development.

18
Philosophy

1. Metaphysics of the **Upanisads**: The nature of the Ultimate Reality, Individual Soul and the World. The ethical teachings of Bhagvadgita.
2. **Charvaka**
Theory of Reality and Knowledge, Refutation of Anuman and Vyapti.
3. **Jainism**
Syadvada and Anekantvada, Nayavada Bondage; and liberation.
4. **Buddhism**
Four noble truths Pratitayasamutpada, Nirvana, Astangicmarga, Ksanabhangvada, Anatmavada. **Schools of Buddhism** Epistemological distinction between Vaibhasika and Sautrantika, arguments for Idealism, Kinds of Vijnana, Various interpretations of Sunya.
5. **Samkhya**
Satkaryavada, Prakrti and its evolutes, arguments for the existence of Prakrti, nature of Purusa, arguments for the existence and plurality of Purusa, relationship between Purusa and Prakrti, bondage and liberation.
6. **Yoga**
Pattanjali's concept of citta and citta-Vritti, eight fold path of Yoga, the role of God in Yoga.
7. **Nyaya**
Sources of Knowledge, Pramanya and apramanya, concept of God and arguments for the existence of God, Theory of error.
8. **Vaisesika**
Vaisesika categories, causation, Paramanuvada

9. **Purva-Mimansa**

Knowledge and its conditions, svatahpramanyavada, sources of valid knowledge, Nature of Knowledge, Triputi-Pratyaksavada and Jnatatavada, Plurality of self, concept of Dharma and Apurva. The nature of Vedic statements, theories of error.

10. **Vedanta.**

Advaita Vedanta: Adhyasa, Anirvachaniya Khyativada, Brahman and Maya. Vivartvada, Brahman and Isvara, Jiva and Jagat, Knowledge and liberation. Is Samkara a crypto Buddhist?

Visistadvaita:

Saguna Brahman, refutation of Maya, Sat Khyativada, Aprthakasiddhi, Parinamvada, Jiva, Bhakti and Prapatti.

Ballabha Vedanta

The main features of Suddhadvaita Vedanta.

Contemporary Indian Philosophy

1- **Vivekanand**

Practical Vedanta, Universal religion

2- **Aurobindo**

Evolution and Integral Yoga.

3- **Iqbal**

The theory of God and Soul.

4- **Tagore**

Religion of man, ideas on education.

5- **K.C. Bhattacharya**

Concept of Philosophy, subject as freedom,

6- **Radhakrishnan**

The idealist view of life

7- **Gandhi**

Non-Violence, Satyagrah Swaraj.

8- **Ambedkar**

Varna and caste system, Neo-Buddhism

Indian and Western Ethics

- 1- The doctrine of Karma and rebirth.
- 2- The four Purusharthas, varnashram Dharma.
- 3- The Hedonistic ethics of Carvaka.
- 4- Ethical teachings of Samkara and Ramanuja.
- 5- Problem of Free-will, Determinism and responsibility.
- 6- Intuitionism: Butler's theory of conscience as the ultimate standard of Moral Judgement.
- 7- Kant's doctrine of categorical imperative and its formulations, The doctrine of Good will, postulates of Morality. The limitations of Kantian ethics
- 8- Hedonism: Bentham, Mill and Sidgwick's contribution to Hedonism.
- 9- Perfectionism: Green's theory of common Good, Perfectionism as a system of idealistic values and as synthesis of Egoism and Altruism.

Western Philosophy

1. **Plato**
Theory of Knowledge, theory of Ideas, the method of dialectic, soul and God.
2. **Aristotle**
Critique of Plato's theory of Ideas, theory of causation, form and matter, Potentiality and actuality, Soul and God.
3. **St. Augustine**
Problem of evil
- 4- **St. Anselm**
Ontological argument.
- 5- **St. Thoman Aquinas**
Faith and reason, Proofs for the existence of God.

6. **Descartes**- The method of doubt, cogito ergo sum, Mind body relation, God : Nature and proofs for His existence.

7. **Spinoza**: Substance, attributes and modes, The concept of God or Nature, Pantheism, mind-body problem.

8. **Leibnitz** : Monadology, Theory of Pre-established Harmony, God: nature and proofs for His existence.

9. **Locke**: Theory of knowledge, Kinds of Ideas refutation of innate ideas, limits of knowledge, Primary and Secondary qualities.

10. **Berkeley**: Berkeley's Idealism, Esse est Percipi, Refutation of abstract ideas, the problem of solipsism: God and self.

11. **Hume**: Hume's theory of knowledge, his refutation of the existence of God and self, his refutation of causality; Hume's skepticism.

12. **Kant**: Conception of critical philosophy, Classification of Judgments: analytic, synthetic, a priori, a posteriori, possibility of synthetic a priori judgments, forms of sensibility, Categories of understanding, The metaphysical and the transcendental deduction of categories, phenomena and noumena, the ideas of reason, Soul God and the world as a whole, freedom and immortality.

13- **Hegel**: Hegelian Dialectic and its structure, Concepts of being, non-being and becoming, absolute idealism.

14. **Moore**: Refutation of idealism, defence of common sense.

15. **Russell**: Refutation of idealism, logic as the essence of philosophy, logical atomism.

16. **Wittgenstein**: Language and reality, facts and objects, names and properties, the picture theory, philosophy and language, meaning and use, forms of life.

17 **Husserl**: Phenomenological method, intentionality.

18. **Logical Positivism and A.J. Ayer**: Elimination of metaphysics and verification theory of meaning, function of philosophy and analysis.

19. **C.S. Pierce and Willium James**: Pragmatic theories of meaning and truth.

20. **G. Ryle**: Systematically misleading expressions, category mistake, concept of mind, critique of Cartesian dualism.

21- Chief tenets of **existentialism** with special reference to S. **Kierkeggard** and **J.P. Sartre**.

Logic

1. Truth and Validity.
2. Nature of Proposition.
3. Categorical syllogism.
4. Law's of Thought.
5. Classification of propositions.
6. Square of opposition.
7. Truth functions and propositional logic.
8. Quantification and rules of quantification.
9. Decision procedures.
10. Proving Validity.
11. Argument and Argument form.
12. Axiomatic system, consistency, completeness.

Philosophy of Religion

1. Foundations of religious belief; Faith, reason, revelation and mystical experience.
2. Attributes of God.
3. Traditional arguments and arguments based on religious experience for the existence of God.
4. Problem of evil and its solutions.
5. Religious tolerance, conversion and secularism.
6. Religious language.

Socio-Political Philosophy

1. Social Institutions: Individual and state, individual and society.
2. Stateless society.
3. Democracy, socialism, Indian socialism, liberty, equality, sovereignty and social justice.
4. Obligation and rights.
5. Political action.
6. Theories of punishment.
7. Gender equality.

Unit-I Literary & Social Background

Study of the main literary trends and socio-cultural background from 16th to 20th Century.

Unit-II Poetry

- | | | |
|--------------------|---|---|
| John Donne | - | The Canonization |
| | - | A Valediction: Forbidding Mourning |
| | - | A Valediction : Of the Book |
| | - | A Valediction : Of My Name |
| | - | A Valediction : Of Weeping |
| Alexander Pope | - | The Rape of the Lock |
| William Wordsworth | - | Lines Composed a Few Miles Above Tintern Abbey. |
| | - | Odeon Intimations of Immortality. |
| | - | Sonnet on Sonnet |
| S.T. Coleridge | - | The Rime of the Ancient Mariner |
| | - | Ode to Dejection |
| P.B. Shelley | - | To A Skylark |
| | - | Ode to the West Wind |
| | - | The Indian Summer |
| John Keats | - | Ode on a Grecian Urn |
| | - | Ode to Autumn |
| | - | on first looking into Chapman's Homer |
| Lord Tennyson | - | Crossing the Bar |
| | - | Prologue (In Memorium) |
| | - | The Lotus Eaters. |
| Robert Browning | - | Rabbi Ben Ezra |
| | - | My Last Duchess |
| | - | Prospice. |
| T.S. Eliot | - | The Waste Land |
| W.B. Yeats | - | The Second Coming |
| | - | Sailing to Byzantium |
| | - | Prayer for my Daughter |
| W.H. Auden | - | In Memory of W.B. Yeats |

- The Unknown Citizen
- Petition
- Philip Larkin - Church Going
- Poetry of Departures
- Reasons for Attendance.

Unit-III Drama

- William Shakespeare -The Tempest
- Macbeth
- Richard II
- Twelfth Night
- John Webster - Duchess of Malfi
- Ben Jonson - Volpone
- Goldsmith - She Stoops to Conquer
- G.B. Shaw - Saint Joan
- T.S.Eliot - The Family Reunion
- Harold Pinter - The Birthday Party
- S.Beckett - Waiting for Godot
- John Osborne - Look Back in Anger

Unit-IV Novel

- Henry Fielding - Tom Jones
- Jane Austen - Pride and Prejudice
- Charles Dickens - Great Expectations.
- Thomas Hardy - Hard Times
- Virginia Woolf - Mrs. Dalloway.
- E.M. Forster - A Passage to India
- Graham Greene - Power and the Glory
- William Golding- Lord of the Flies
- D.H. Lawrence - The Rainbow

Unit-V Prose

- Francis Bacon - Of Marriage and Single Life
- Of Truth.
- Addison and Steele- Of The Club.
- Sir Roger At Home

- Charles Lamb - Disappointment In Love
- Charles Lamb - Dream Children 'A Reverie'
- Charles Lamb - Poor Relations
- Charles Lamb - In Praise of Chimney Sweepers
- George Orwell - Notes on Nationalism
- Walter Pater - On Style
- Bertrand Russell- Unpopular Essays- Ideas that have Helped Mankind, Ideas that have Harmed Mankind

Unit-VI Literary Criticism

- Aristotle - The Poetics
- Philip Sidney - An Apology for Poetry
- W. Wordsworth - Preface to the Lyrical Ballads.
- Matthew Arnold- Function of Criticism at Present Time
- T.S. Eliot - Tradition and The Individual Talent.
- I.A. Richards - Principles of Literary Criticism.
- F.R. Leavis - The Great Tradition

20
Geography

1. **Geomorphology**

Basic concepts; Geomorphic theories; Climatic geomorphology; structural geomorphology; Plate tectonics and mountain building; Slope development; weathering and mass movement; Rejuvenation and polycyclic relief's; karst geomorphology, coastal geomorphology; arid geomorphology; periglacial geomorphology; morphometry; Applied geomorphology.

2. **Climatology**

Heat budget of the earth and atmosphere, tricelleular meridional circulation of atmosphere; coriolis force; Jet streams; Monsoon; El Nino and southern oscillation; Atmospheric stability & instability; Atmospheric humidity and precipitation; Cyclones and tornadoes; Air masses; Classification of world Climates; Climate Change.

3. **Oceanography**

Historical development of oceanography; Origin and evolution of ocean basins; Morphology of ocean basin's; Marine deposits; Coral Reefs and coral bleaching; Ocean currents; ocean tides; marine bio zones.

4. **Environment**

Biosphere as ecosystem; Ecosystems and Ecology; Circulation of Matter and Energy in the biospheric ecosystem; Ecological productivity and production; Bio-geo-chemical cycles; Environmental degradation and pollution; Natural disaster-types; causes and management; Soil erosion and conservation; Global warming; Environmental Management and Sustainable Development.

5. **Biogeography**

Meaning and types of bio-geography; Development of biogeography; Approaches; Plant system-evolution, biotic succession and distribution, Animal system-evolution, dispersal and distribution of animals; Biodiversity; Wildlife conservation; major world biomes and biogenic; Forest conservation in India.

6. Geographical Thought

General characteristics of geographical knowledge during the ancient and medieval period; Foundation of modern geography contribution of German, French, British and American Schools; Conceptual and methodological developments during 20th century; Changing paradigms in geography : Man and Environment, determinism and Possibilism, Areal Differentiation, Spatial organization, Quantitative revolution, Positivism, Humanism, Radicalism and Behaviouralism in geography; Recent trends in geography.

7. Population and Settlement Geography

Growth and distributional pattern of population in the world, Theories of population growth, Population Migration, Population-Resource regions.

Settlement Geography- Types and pattern of settlements, Spacing and internal morphology of rural and urban settlements, Trend of urbanization in India and world, Urban Fringe, Umland, Rank-size rule, Settlement hierarchy, Christaller's Central place theory, August Losch's theory of Market centres.

8. Economic Geography

Concept and approaches of economic geography; Sectors of economy-primary, secondary, tertiary, and Quaternary ; Concept and Types of Resources-Renewable and non renewable, Conservation of resources; **Agricultural Geography**- concept and techniques of delimitation of agricultural regions, Measurement of agricultural productivity and efficiency; Crop combinations and diversification, Von Thunen's model, Agricultural regions of the world. **Industrial Geography**- Theories and models of industrial location; Delimitation of industrial regions and major industrial regions of the world; **Geography of Transport and Trade**- Models of transportation and transport Cost, concept of accessibility, Connectivity and locational Utility; Means and mode of transport; Changing pattern of international trade.

9. Political Geography

Definition and Scope of political geography; Heartland and Rim land theories; Concept of Nation, State and Nation-State;

Boundaries and Frontiers: Politics of world resources: Geography and Federalism.

Social Geography: Nature and Scope of social geography; Social structure and social processes; Elements of social geography-ethnicity, Tribe, Dialect, Language, Caste, Religion and communalism, Concept of social well-being.

Cultural Geography:Environment and culture, Concept of Cultural Areas and cultural regions, Theories of Tribal groups: Dwelling places as cultural expression.

10. **Regional Planning**

Regional concept in geography and its application to planning; Concept of Planning region; Regional hierarchy; Types of regions and methods of regional delineation; Conceptual and theoretical framework of regional planning; Regional Planning in India; Concept of development; Indicators of development; Regional imbalance.

11. **Geography of India**

Geological Structure, Physiographic divisions; Drainage System, Soils and Natural vegetation; Climatic regionalization; Coastal and Marine resources; Water resource and river valley projects; Irrigation; Agriculture; Agro climatic regions; Mineral and power resources; Major Industries and Industrial regions; Industrial policy; Population distribution and growth; Population policy, Regional disparities in social and economic development; Historical perspective on Unity in diversity; International boundaries of India and related geo-political issues; India and the geopolitics of Indian Ocean. Regional Consciousness and National Integration; States Reorganization.

12. **Cartography**

Map as a tool in geographical studies; Types of maps; Single purpose and composite maps; Characteristics of different types of map projections; Choropleth, Isopleths and Chorochromatic maps and Pie Diagrams; Study and interpretation of topographical sheets. Remote sensing and computer application in mapping; Geographical information System (G.I.S).

Statistical Methods

Data sources and types of data; Statistical diagrams; Measures of Central tendency; Measures of dispersion and concentration; Lorenz curve; Simple and Multiple Correlation; Regression; Sampling techniques for geographical studies.

21
PHYSICAL EDUCATION

UNIT: I

- Definition, Aim and Objectives of Physical Education, Health Education and Recreation.
- Philosophies of Physical Education- Idealism, Naturalism, Realism, Pragmatism, Existentialism, Humanism.
- Benefits of Exercise, Exercise and Well-being and Body types.
- Definition and theories of play, General Principles of Growth and development, principles of Motor skills acquisition, Transfer of Training.
- Role of sports in socialization Process, physical activities and sports as cultural Heritage, role of sports in Globalization process.
- Physical Education in Ancient Greece, Rome, Germany, Sweden, Denmark and Russia.
- Olympic Movement. Historical Development of Ancient and Modern Olympic Games.
- Historical development of physical Education in India.

UNIT: II

- Physiology of Muscular activity, Neurotransmission and Movement Mechanism.
- Physiology of cardio- Respiratory System.
- Energy cost of various Sports Activities.
- Bio- Energetics and energy Process.
- Physiological Factors Influencing sports Performance.
- Athletic Injuries- their Management and Rehabilitation.
- Therapeutic modalities and Massage manipulations.
- Ergogenic Aids and Doping.
- Ageing Process and Exercise .

UNIT: III

- Joints and their movements- Planes and Axes.
- Kinematics-Liner and angular Motion, Levers and their applications in sports.
- Laws of motion, Principles of Equilibrium and Force, Spin and Elasticity.
- Posture- Deformities and their corrections
- Muscular/ mechanical analysis of Motor Movements.
- Mechanical Analysis of basic movements-Running, Walking, Jumping, Throwing, Pulling and Pushing.

UNIT-IV

- Learning Process- Theories and laws of learning, Factors affecting Motor Learning.
- Motivation- Types, Theories and Dynamics of Motivation in sports.
- Psychological Factors affecting sports performance.
- Personality- Its dimensions theories personality, relationship between personality and performance, traits of Athletic personality.
- Individual differences and sports performance.
- Group Dynamics, Team Cohesion and Leadership in sports.
- Media and sports, Audience behaviour and performance, cognitive process in sports.

UNIT-V

- Development of Teacher Education in Physical Education.
- Ethical Values in physical education and sports.
- Principles of curriculum planning.
- Principles of classification of pupils for physical activities.

UNIT-VI

- Health- Guiding principles of Health and Health Education.
- Balanced Diet, Nutrition and Directory manipulation.

- Health Related fitness, Obesity and its management.
- Communicable Diseases-Their preventive and therapeutic aspects.
- School Health programme and personal Hygiene.
- Theories and principles of Recreation.
- Recreation Programme for various categories of pupils.

UNIT-VII

- Principles and characteristics of sports training.
- Training Load- Its components, super-compensation and adaptation process.
- Process of periodisation.
- Training Methods and specific Training programme for developing various Motor abilities.
- Technique and phases of skill acquisition.
- Strategy and Tactics, various systems of play in team games.
- Short term and Long term training programmes.
- Principles of planning physical activities.
- Talent identification, its process and procedures.
- Types of competitions, special preparations for competitions, psychological preparation.
- Rules of games and sports and their interpretation.

UNIT-VIII

- Nature, scope and types of research, formulation and selection of research problem.
- Sampling- process and techniques.
- Methods of research.
- Data collection – tools and techniques.
- Statistical techniques of data analysis, measures of central tendency and variability, correlation, normal probability curve, t-test, f-test, chi-square, z-test.
- Hypothesis-formulation types and testing.
- Writing research report.
- Application of ICT in physical education and sports.

UNIT-IX

- Concept of test, Measurement and evaluation.
- Principles of Measurement and evaluation.
- Construction and classification of tests.
- Criteria of test evaluation.
- Concepts and assessment of physical fitness, motor fitness, motor abilities and Motor educability.
- Specific skill tests for Badminton, Basketball, Hockey, Lawn-tennis, soccer, Volleyball.
- Testing psychological variables-competition anxiety, aggression, team-cohesion, motivation, self concept.
- Anthropometric measurements and body composition.

UNIT-X

- Concept and Principles of management.
- Organization and Function of sports bodies.
- Intramural and Extramural programmes.
- Management of infrastructure, equipments, finance and personnel.
- Methods and techniques of teaching in physical education.
- Principles of planning physical education lessons.
- Pupil-teacher inter-action and relationship.
- Concept of supervision and its techniques.

EDUCATION

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1- Philosophy and Sociology of Education, 2- Psychological Foundations of Education, 3- Methodology of Educational Research, Measurement and Statistics 4- Educational Technology, 5- Educational Guidance, 6- History of Indian Education, 7- Contemporary issues and problems of Education, 7-Distance Education, 8- Teacher Education, 9- School Management and supervision, 10- Special Education, 11- Population Education, 12- Environmental Education, 13- Women's Education, 14- Comparative Education.

1- **Philosophy / Sociology of Education** :- a- Meaning and nature of Philosophy, Relationship between Education and Philosophy, Need of Philosophy of Education. Naturalism, Idealism, Pragmatism, Realism, Existentialism and Humanism-views, implications for curriculum, methods, concept of teacher, discipline. Indian Philosophy and related concepts in Vedant, Sankhya, Geeta, Budhism, Jainism & Islamic Traditions. Views of Educational Thinkers- Swami Vivekanand, Raxindra Nath Tagore, Mahatma Gandhi, Sri Aurobindo, Dr. S. Radhakrishnan & Pt. Madan Mohan Malviya, Rousseau, John Dewey.

b- Meaning, Nature and Scope of Sociology of Education, The society- nature, characteristics. Social Interaction, Social Structure, Social Stratification. Social Change and Education. Culture and role of Education, Socialization and Education. Modernization, Urbanization, Westernization and role of Education, Democracy and Education, Secularism, Socialism & National Integration. Social Control and role of Education.

2- **Educational Psychology:** Concept of Psychology, its nature. Educational Psychology, Education and Psychology, Methods of Educational Psychology and its use for teachers.

Growth and Development: Concept, principles, and stages of development, characteristic`s of each stage with special reference to cognitive and moral development. Piaget's theory of cognitive

development, Kohlberg's theory of Moral development, special features of growth and development of adolescents. **Personality:** Concept theories- Allport, Cattell and Eysenck, Freud, Maslow, Rogers and Erickson. Assessment of Personality: subjective, objective and projective. **Learning** Concept's, Definition, Theories- Pavlov, Thorndike, Skinner, Hull, Bandura- Criticism and implications. Transfer of Learning, Motivation and learning, Theories of motivation and its educational implications.

Intelligence and Creativity: Intelligence- definitions, theories, and measurement. Gifted, retarded and learning disabled children and their education. Creativity- definitions, assessment and theories. Its relationship with intelligence and fostering of creativity in the classroom.

3. Methodology of Educational Research, Measurement and Statistics-

1- Educational Research :- Meaning, Types of Educational Research, Quantitative and Qualitative approaches of Research, Experimental, Descriptive, Historical, Selection of problem, Review of the literature, Hypothesis, Formulation of good hypothesis, Testing of hypothesis, Sample and Sampling Techniques, Tools and Techniques of data collection; Observation, Interview, Questionnaire, Rating Scale.

2- Measures of Central Tendency and dispersion, Normal Probability curve, Skewness and Kurtosis, Correlation: Rank order and Product Moment, T-Test, F-Test and χ^2 test.

3- Concept of educational measurement, Scales of measurement, Norm reference & Criterion reference test, Reliability and Validity, Standardization and construction of a test, Norms, Types of norms, Attitude scale and its types.

4. Educational Technology -

Educational Technology- Meaning, nature, Trends of educational Technology, Software, Hardware and system approach.

Programme Learning - Principles, Styles- Linear, Branching and Mathematics, Mastery Learning- concepts, types, planning, Strategies, Personalized system of instruction, Models of teaching, Microteaching, Flanders Interactions, Communication and its

principles. Open and Distance Learning,- concept, definition and characteristics, Educational Radio, Educational Television, Interactive audio-video programmes, Role of ICT in education, Web- based Learning, Virtual classroom, Use of e-resources in teaching, learning, evaluation and research.

5- Guidance & Counselling

Guidance- concept, principles, needs, types different agencies and tools of guidance.

Counselling- Meaning, needs and types of counselling.

6- History & Problems of Education-

History of Education from Vedic period to Modern period. its specific features and concepts. Development of primary, elementary, secondary, higher and Teacher education and problems.

Different Commissions and Committees Reports, New Policy in education, National Curriculum Framework-2005, Committees of education- formation, role and recommendations. Human Right education, Right to education, Role of NCTE, UGC, NCERT, SCERT & SIET.

7- **Distance Education-** Meaning, concept, needs and role of distance education, Techniques used by Distance education, Open Learning material, Delivery System, Learner support services and evaluation.

8- Teacher Education & Teaching Behaviour:

Teacher Education: Concept, Needs, Objectives and Scope, Preservice and In-service Teacher Education,: IASE, CTE & DIET's role in Teacher Education, Structure of Teacher Education curriculum at Elementary and Secondary Stage.

9- School Management & Supervision:

Meaning and Nature of School Management, Functions of School management, Institutional Planning, Steps. Supervision: Nature and Techniques. Role of Head Master. School Time Table, School Budget, Programme Evaluation, Nature, Steps and Uses.

Different agencies of Administration, at Central Level. State Level and District Level/ Local bodies.

10- SPECIAL EDUCATION

1- Meaning and scope of Special Education; Meaning of Universalization of Education as per constitutional provision, NPE-1986, POA 1992 and PWD Act.1995 National Institutes of Handicapped. RCI. Government policies for disabled persons.

2- Concept of early intervention and Early Identification, main Streaming, inclusive education, integrated education, Resource Room, Resource Teacher, Remedial Teaching.

3- Types of Special Children:- Visually impaired, Hearing impaired, Mentally Retarded, Learning disabled, Gifted Characteristics, educational programme and placement.

11- Population Education

Nature and scope of Population Education. Meaning, Concept, Need and Importance of Population Education, Objectives of Population Education.

Population related Policies and Programmes:- Population Policy in relation to health environment Education Policies; Programmes related to Employment social movement, Voluntary and international agencies. UNFPA, WHO, UNESCO.

12- ENVIRONMENTAL EDUCATION

Nature, meaning and importance of environmental Education. Education for environmental awareness, attitude change and community development, Ethics and Social responsibility towards environment.

13- WOMEN'S EDUCATION

Status of Women Education in India. Education of Women in Ancient India, during Medieval Period and in Modern India- Pre-Independence Period and Post Independence Period.

14-Comparative Education

Comparative Study of Education systems of Following countries the.

- Primary Education- USA, UK, Russia, India.
- Secondary Education- USA, UK, Russia, India.
- Higher Education- USA, UK, Russia, India

BACHELOR OF EDUCATION (B.Ed.)

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Meaning, Nature and Scope of Sociology of Education, The society- nature, characteristics. Social Interaction, Social Structure, Social Stratification. Social Change and Education. Culture and role of Education, Socialization and Education. Modernization, Urbanization, Westernization and role of Education, Democracy and Education, Secularism, Socialism & National Integration. Social Control and role of Education.

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Guidance- concept, principles, needs, types different agencies and tools of guidance.

Counselling- Meaning, needs and types of counselling.

6- **History & Problems of Education-**

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8- **Teacher Education & Teaching Behaviour:**

Teacher Education: Concept, Needs, Objectives and Scope, Pre service and In-service Teacher Education,: IASE, CTE & DIET's role in Teacher Education, Structure of Teacher Education curriculum at Elementary and Secondary Stage.

Teaching: Concept, Definition, Stages, Factors, Variables of Teaching; Presage, Process & Product.

Teaching Competencies: Classification of Teaching skills, Introduction, Questioning, Reinforcement, Explanation, Stimulus Variation, Classroom Management.

Teaching Methods : Teacher Centered & Student Centered, Instructional Objectives in behavioural terms, Lesson Planning.

Teaching Aids: Audio visual aids, Characteristics, Achievement Tests: Preparing Blue Print, Nature of Test items.

Diagnostic Tests: Construction and uses.

Remedial Teaching.

9- School Management & Supervision:

Meaning and Nature of School Management, Functions of School Management, Institutional Planning, Steps. Supervision: Nature and Techniques. Role of Head Master. School Time Table, School Budget, Programme Evaluation, Nature, Steps and Uses. Different agencies of Administration, at Central Level, State Level and District Level/ Local bodies.

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1- Meaning and scope of Special Education; Meaning of Universalization of Education as per constitutional provision, NPE-1986, POA 1992 and PWD Act. National Institutes of Handicapped. RCI. Government policies for disabled persons.

2- Concept of early intervention and early identification, Main Streaming, inclusive education, integrated education, Resource Room, Resource Teacher, Remedial Teaching.

3- Types of Special Children :- Visually impaired, Hearing impaired, Mentally Retarded, Learning disabled, Gifted Characteristics, educational programme and placement.

COMPUTER SCIENCE

1- Computer Hardware and Architecture: Fundamentals, Organization of Digital computer, Storage Systems, I/O devices, Elements of Microprocessors and microcomputers, Parallel computing and super computers.

2- System Software: Operating system" Fundamentals and services, O.S. Process concepts, memory management, file and I/O management, protection and security. anti-virus, Device drivers, Machine and assembling language, Compilers, Interpreters, Linkers, Loaders LINUX and shell programming.

3- Programming Concepts: Programming languages, Algorithms, Flowcharts, concepts of C-language including file processing Numerical Methods.

4- Data Structures: Fundamentals, Linear and Non-linear Arrays, Stacks, Queues, linked Lists, Multilinked Lists, multilinked lists, Sorting, searching, Matrix inversion, time and space complexity, practical problems.

5- Computer Communication and Networks: Computer networks, protocols, OSI and TCP/IP reference model, X.25 frame-relay, Data transmission, Encoding Schemes, Multiplexing, Layering technologies, Transmission media LAN and WAN technology and Network security.

6- System analysis and Design: Information science concepts, system concepts, Evaluation and scope of software engineering, software requirement analysis, software design process, software testing and debugging.

7- Database Management system: Fundamentals. Relational model, language & systems (SQL & PL/SQL), Database design, Transaction concepts, Data protection, concurrency control & recovery techniques, Design methods and concepts of databases Distributed database, Data mining & data warehousing.

8-Oops and Applications: Object oriented programming concepts, object oriented analysis and design, JAVA and C++ programming language concepts & design methods, application software, Visual programming techniques.

9- Discrete Mathematical structure: Mathematical logic, set theory, graph theory, Overview of theory of computation. Lattices and Boolean algebra.

- 2-

10- Computer graphics: Fundamentals. 2_D & 3-D representations, Geometrical transformation, Curves and Surfaces, fractals, Solid modeling , Animation and applications.

11- Soft Computing: Fuzzy sets, Fuzzy measures, Fuzzy systems and applications, Artificial intelligence concepts, AI search techniques, AL Knowledge representation, AL Symbolic and statistical reasoning, Expert systems, Artificial Neural network concepts. ANN algorithms, neuronal dynamics and synaptic cognitive science concepts, problem solving and rationality of cognitive science, Genetic algorithms and natural languages.

12- Digital Signal Processing: Fundamentals Discrete time system, Z-Transforms, realization of Digital system, digital filters and its applications.

13- Web Technologies and Multimedia systems: Fundamentals, web browsers, protocols, Searching and download technologies, web servers and securities, web design and mark-up languages, Designing of dynamic functionality in web pages, Scripting languages, middleware architecture and cyber laws. Multimedia technology concepts, Authoring tools, Internet applications.

14- Simulation and Modeling: Fundamentals, modeling techniques and its types, Mathematical representations, approximation, practical representation of useful models, simulation techniques, Continuous and discrete systems, Queuing systems, Simulation application Software.

25 MICROBIOLOGY

General Microbiology: History, development and scope of Microbiology, Techniques in Microbiology. Differentiation futures of prokaryotes, eubacteria and archaebacteria, Microbial growth: Measurement and phases of growth, Factors affecting bacteria growth: chemostat and turbidostat.

Bacterial Physiology: Relations between structure and function in prokaryotes. Endospore structure and process of bacterial sporulation. Physiology of extremophiles: thermophiles, psychrophiles, osmophiles, acidophiles and alkalophiles. Bacterial luminescence. Bacterial transport system. Signal transduction and two-component regulatory system Bacterial photosynthesis. Biological nitrogen fixation. Nitrate and ammonia assimilatory enzymes.

Structure. Function of Biomolecules and Analytical Technique: Structure, physical and chemical properties of water. Chemical structure, nomenclature, classification, properties and biological significance of carbohydrates. proteins. Function and properties of saturated and unsaturated fatty acids. Membrane structure and composition. membrane channels. Components. structures and properties of nucleic acids.

Centrifugation, spectrophotometry, Autoradiography, Chromatography and Electrophoretic techniques-their principles and applications.

Microscopy: Principles and application of bright field, dark field, phase contrast, fluorescence, confocal: scanning and transmission electron microscopy.

Agriculture & Environmental Microbiology; Transformation of carbon, nitrogen and phosphorus. Biofertilizers, Microbial associations Microbiology of air, water and soil. Biogas generation. Microbial decomposition of cellulose, hemicellulose and lignin. Degradation of pesticides Xenobiotics and plastics. Bioplastic and biopesticides. Microbial adaptation to environmental stress. Biomagnification and bioremediation.

Genetically engineered microbes in environment. Green house effect.

Biocatalysis, Bioenergetics and Metabolic Pathways:

Enzymes, Structure and Biochemical energetics. Respiratory electron transport. metabolism and regulation of carbohydrates. Biosynthesis of proteins. protein engineering Lipid metabolism. Molecular Biology and Bacterial Genetics: Concepts of nucleic acids as genetic material, genome organization DNA replication. Gene transcription. Protein biosynthesis. Concept of reverse transcriptase. Genetic code. Genomics, transcriptomics and proteomics. Mutation Lac, Ara His and Trp operons and their regulation, Regulation of gene expression. Bacterial genetic recombination: transformation, conjugation and transduction. Restriction and modification. Gene mapping plasmids. Viruses: General properties, structure and classification. Bacterial, animal and plant viruses and their reproduction. General features of prions and viroids. Lytic cycle of infection. Lysogeny.

Medical Microbiology: Normal microflora of human body. Medically important microbes with respect to history. pathogenicity, epidemiology. prophylaxis and treatment General characteristics and diseases caused by viruses pathogenic fungal diseases protozoal diseases. Principles of chemotherapy. antibiotics-action mechanism. drug resistance in bacteria, drug sensitivity test.

Microbial Taxonomy: Classification and phylogeny of bacteria. Numerical taxonomy and molecular approaches in taxonomy. Origin of cells and unicellular evolution. Molecular evolution and its mechanism. Evolution of prokaryotic and eukaryotic cells.

Immunology: History of immunology: cells and organs of immune system. Active and passive immunity. Antigens. antigenicity and immunogenicity. Adjuvants, haptens. Toxins and toxoids. Types, structures and function of antibodies Antibody diversity. Monoclonal and polyclonal antibodies. Defense mechanisms: Specific and Non-specific immunity. Hypersensitivities, Antimicrobial substances Major histocompatibility complex: Graft rejection. Immunodeficiency diseases Blood groups Rh factor Interferon ELISA RIA vaccination.

Industrial & Food Microbiology: Fermentor systems scaling up and downstream processing Solid state and submerged

fermentations. Microbial production of ethanol: citric and lactic acids" amino acids-glutamic acid, lysine: enzymes-amylases. proteases and lipases: vitamin-riboflavin: antibiotics- penicillin, streptomycin: vinegar, wine beer and polysaccharides. Microbial deterioration and control of: leather cotton. paint, wool. fermentation of tea, coffee, and tobacco. Microbes as food and feed. Silage microbiology; Microbial transformation of antibiotics and steroid. Microbial leaching of metal ores. immobilization of microbial cells/enzymes and their use. Common food spoilage, intoxication and disease causing microbes. Factors affecting microbial growth in foods. Food preservation techniques. food fermentations. Therapeutic use of fermented foods. Food spoilage. Food poisoning. Food infections and intoxications.

Modern Microbial Technology: Synthesis of commercial products using microbial system- insulin, interferon, growth hormone, restriction endonucleases. Production of vaccines and therapeutic agents. Bioremediation of xenobiotic compounds and heavy metals. PGPR Microbial insecticides. *Bacillus thuringiensis* and its genetic engineering Use of *Agrobacterium tumefaciens* in transgenic plants.

History.**Section-A**

Sources of Medieval Indian History: Archaeology, Epigraphy and Numismatic materials and monuments.

Literary source: Persian, Sanskrit and regional languages, Epigraphical materials. Accounts of foreign travellers.

Sultanate: Ghori's invasions of Indian Turks, Khaljis, Tughlaqs, Sayyids and Lodis. Foundation of Mughal empire- Babar, Humayun and Suri: Expansion of empire from Akbar to Aurangzeb. Decline of the Mughal Empire. Political, Administrative and economic causes. Later Mughals and disintegration of Mughal empire . Vijayanagar and Bahamani state- Rise, expansion and disintegration. Maratha movement- Foundation of swaraj by Shivaji, Its extension under Peshwas. Maratha Confederacy- causes of its downfall.

Administration under Delhi Sultanate; Non military, Judicial, kingship, and Military.

Administrative reform of Shershah ; Mughal Administration. Land Revenue and sources of the income of state. Mansabdari and Jagirdari systems.

Administration in the south; Vijayanagar & Bahamani States.

Agricultural production:- Village economy, Peasants class, Urban centres and urbanization. Industry: Cotton Industry, Handicrafts, Agriculture Based Industrial organization. Karkhanas, Technology, Trade and Commerce, Policy of state, External and internal trade, European Trade, Trade Centres and harbours, Transport and Communication, Hundi and Insurance, Currency.

Sufi- Silsilah's, Belief and systems. Eminent sufi saints. Bhakti school- Shavism and its branches, Vaishnavism and its branches. Medieval saints- of South and North India, sangria and nirguha saints. their impact on Social, Political and Religious lives, Sikh Movement- Guru Nanak Dev and his teachings, Adigranth, Khalsa.

Ruling class, Religious class and Occupational class. Rural society- petty nobles, village worker, peasants and non peasant class, status of women.

Education system, Literature: Persian, Sanskrit, Hindi and regional languages. Major schools of painting, Music, Architectural development in south and North India. Indo Islamic Architecture of mediaeval India.

Section - B

Modern Indian History

Mercantilism, European Traders in India in the Seventeenth and eighteenth centuries- Portuguese, Dutch, French and British. Ascendancy of English East India Company in the Indian Subcontinent.

Battles of Plassey (1757) and Buxar (1764) as curtain raiser to the acquisition of Diwani. The company as territorial power. Foundation of early land settlements. Permanent settlement, Mahalwari Settlement, Ryotwari Settlement, Subsidiary Alliance system, Doctrine of Lapse.

British Parliament and the Indian empire: Constitutional developments during the company Raj (ie till 1857); Constitutional development under the crown (1858-1935), evolution of administration under the company and the crown. British relations with Indian states.- Awadh, Mysore, Punjab.

Uprisings of 1857 : Historiographical debates Causes, Nature and Consequences, Foundation of Indian National Congress, economic nationalism, Swadeshi movement, moderates and extremists, Muslim policies and foundation of Muslim League; Rise of left in Indian Politics, Rise of Communalism leading to the partition of India. Gandhian Era and Gandhian movements - Non Co-operation, Civil Disobedience movement, Individual Satyagraha, Quit India movement. Governance and British policy: Lytton, Ripon and Curzon.

Indian revolutionary movement, Tribal Movement. Rise of leftist movement, Indian Communalism. Cripps Mission, Wavel plan, Cabinet Mission, Mountbatten plan.

Socio religious movement of 19th Century, Subhah Chandra Bose and Indian National Army; Naval revolt of 1946. Indian

independence Act, 1947, India's Foreign Policy with particular reference to China, Pakistan, USSR, U.S.A. Five Years Plan. Non alignment movement, Role of India in the emergence of Bangladesh. Indo China war (1962). Indian Emergency and coalition politics.

Section- C

Renaissance, Reformation, Counter Reformation, American war of Independence, French Revolution of 1789, Chinese revolution of 1911, Achievements of Sun Yat Sen and Chiang Kai Sheik, Modernization of Japan, Growth of capitalism, Imperialism, Liberalism, Socialism and Nationalism, The Two World Wars, Russian Revolution of 1917, Nazism, Fascism, Communism, League of Nations, UNO, Cold war, NAM, S.A.P.T.A, S.A.A.R.C, C.H.O.G.M.(Commonwealth Head of Government Meet), W.T.O., Globalization and its economic and political impact.

Section- D

Meaning and Scope of History.

Interrelation between History and Auxiliary Sciences- philology and Linguistics, paleography, Epigraphy, Numismatics, sigillography and sphragistics.

Philosophy of History: Objectivity, Determinism, Causation and chance.

Major Theories of History: Hegel (Dialectical Method), Karl Marx, Oswald Spangler (cyclic theory), Arnold Toynbee.

Utility of Museums, Archives and Art galleries in History

Historiography: Definition, Major schools of Indian historiography.

Sources of Historiography- Primary and secondary.

Historians of Medieval Indian History: Ziauddin Barani, Abul Fazl, Abdul Qadir Badayuni, Col. James Todd, V.A. Smith.

Historians of Modern Indian History: James Mill, Satish Chandra, Bipan Chandra, D.D. Koshambi.

Ancient History

Unit 1.

Archaeological, Vedic, Sangam, historiographical and Conceptual background of Ancient Indian History.

A. Prehistoric Past

- Basis of the Prehistoric, Protohistoric and Historic divisions of the past.
- Ages of the prehistoric past principal Indian prehistoric sites, tool traditions and Zoological remains.

B. Historiographical and conceptual aspects

- Sources of ancient Indian history
- Salient forms, features and texts of ancient Indian traditional historiography
- Imperialist/Orientalist/Indological, Nationalist, Marxist and post-Marxist approaches to ancient Indian history.

C. Protohistoric Past: Highlights of Harappan Civilization and Chalcolithic Cultures of India :

- a) Harappan Civilization- salient features, principal sites and significance
- Principal Harappan Sites their nature and location.

- Harappan civilization as first urbanization,
 - Distinctive features: town planning, trade import-export, storage, weights and measures.
 - Harappan religion : Main features, burial customs and cemeteries, seals and sealings depicting Gods, Goddesses and rites .
 - Harappan Art and Architecture : stone art, terracotta art, beads, Great Bath, Dockyard, Warehouse, Granary, fire altars.
 - End of Harappan civilization: various theories about its down fall.
- b) Principal Chalcolithic Cultures of India- Salient features, principal sites and significance
- Cultures of Vindhya - Ganga region- Atranjikhhera, Jhunsi, Imalidih, Chirand.
 - West Indian Cultures- Jorwe, Nevasa, Navdatoli, Inam Gaon.
- c) Vedic Culture
- Principal Vedic Texts and stages of the development of Vedic literature
 - Main features of Vedic society, economy, polity, religion and philosophy.
- d) Sangam Culture
- Texts and their date
 - Society and Religion
 - Economy and trade, internal as well as overseas

Unit 2. Principal religious movements

- Jainism
- Buddhism
- Vaisnavism
- Saivism

Unit 3. Political History

a) Age of 16 Mahaganapadas and rise of Magadha and Magadhan imperialism

- Under the Nandas
- Under the Mauryas
- Under the Guptas

Post Gopher Ancient India

b) Foreign invasions:

- Persian
- Macedonian- Alexander
- Indo-Greeks

- Saka- Pahlava

- Kusana

- Huna

- Arab

- Turk

c) Principal Regional Powers:(Rajput Age,700-1206A.D.)

- Sunga-Kanva
- Andhra -Satavahana
- Maukhri- Pushyabhuti

- Dynasties of Kashmir
- Gurjara- Pratihara
- Gahadavala
- Chandella
- Paramara
- Chaulukya
- Chalukyas of Badami and Vengi
- Pallava
- Rashtrakuta
- Chalukyas of Kalyani and Pattadakal
- Chola

Unit 4. History of economy of Ancient India

- Agriculture
- Industry, including Handicraft
- Coinage and Trade- internal, long distance, overseas
- Srenis, Nanadesis
- Main theories of Indian Feudalism and Urbanization

Unit 5. History of Ancient Indian Society

- Tribes and Primitive Societies
- Varana-Jati- Purusartha System
- Sanskaras
- Untouchability
- Women
- Education

Unit 6. Principal Monuments, Artefacts records and antiquities

- Temples, Rockcut as well as structural
- Stupas, Rockcut as well as structural
- Basati, Vihara, Matha, Rockcut as well as structural
- Tools, Divices and Proto-Machines
- Art and Articulture, Extant Examples, Concepts and Terminology-Indian, Central Asian and Southeast Asian
- Inscriptions and Charters of Endowments

General Studies

- 1-General Science.
- 2-Current Events of National and International importance.
- 3-History of India (Including Indian National Movement).
- 4-Indian Polity and Economy.
- 5-Geography Indian and world.
- 6-Mental ability and Statistical data analysis.

Candidates are expected to have general awareness about the above topics with special reference to Uttar Pradesh.