Directorate of Admissions
CLUSTER UNIVERSITY OF SRINAGAR
Gogji Bagh, Srinagar
Website: www.cusrinagar.edu.in Email: admissions@cusrinagar.edu.in

Subject: PG Entrance Syllabus for the academic session 2026-27.

NOTICE

It is hereby notified for the information of all the candidates desirous of appearing in the Postgraduate Entrance Examination for admission to various PG Programmes for the Academic Session 2026–27, that the syllabus for the Entrance Examination has been uploaded on the official website of Cluster University of Srinagar under Admissions tab.

The candidates are advised to visit the university website: www.cusrinagar.edu.in regularly and download the concerned syllabus for preparation of the Entrance Examination.

Further, candidates are advised to remain in touch with the official website for updates regarding the admission process and schedule of examinations.

Sd/-
Director Admissions
Cluster University of Srinagar

No: CUS/Adm-PG(CUSET-2026)/2506-25
Dated: 20-04-2026

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P.G. ENTRANCE SYLLABUS - 2026

M.Sc. Artificial Intelligence and Machine Learning and M.Sc. Data Science

Unit 1: Computing Mathematics

Set Theory, Boolean Algebra: Fundamental operations in Boolean Algebra, Logic, Arithmetic, geometric and harmonic progressions, binomial theorem, permutations and combinations, Graph Theory Fundamentals. Matrices: Determinants, Addition, Multiplication, Transpose, Inverse. Rank of a matrix and other basic operations.

Unit 2: Computer System Organization and Architecture

Representation of characters, integers, and fractions, binary, decimal, octal and hexadecimal representations and inter-conversions, Binary Arithmetic-Addition, subtraction, division, multiplication, One's complement arithmetic and two's complement arithmetic, floating point representation of numbers, normalized floating point representation. Concept of Adders, Subtractors, Counters, Flip Flops

Computer Architecture: Organization of CPU, Hardwired and Micro-programmed CU, Register Organization and Instruction formats. Instruction set- register transfer, arithmetic, logic and shift operations. Addressing modes. Memory Management, Associative Memory, cache memory, virtual memory, Introduction to 8086 instruction set.

Unit 3: Programming with C/C++

C-language fundamentals, Basic Constructs-l-oops, control statements, Arrays, Functions, Structures and Unions, Pointers, Files. Object Oriented Paradigm (OOPs), Classes, Objects, Abstraction, Polymorphism, Inheritance, Encapsulation, Constructors, Destructors, Inline and friend function, dynamic and static binding, virtual class, Virtual functions, Operator overloading and function overloading

Unit 4: Database Management System

Introduction, Database Vs File Systems, Database Users, DBMS- Basic Concepts and Terminology, Models and Architecture. Relational algebra and Relational DBMS. Normalization. Elements of Structured Query Language, Transaction Management, Concurrency control techniques, Recovery techniques, Different Types of Files like Sequential, Index based Files, etc.

Unit 5: Data Structures

Introduction, Algorithmic complexity, Stacks, Queues, linked Lists. Sorting and Searching Techniques: Quick Sort, Merge Sort, Heap Sort, Bubble sort, Selection sort, and Insertion sort. Linear and binary search algorithms. Trees and Graph terminology and representation in memory, binary tree, traversal techniques of graphs, Concept of Hashing and Hash Functions.

Unit 6: Operating Systems

Introduction, Operating System, Organization, Process Management, Inter process communications, Concept of Deadlocks, Prevention, Avoidance and Recovery, Memory Management, Physical and virtual address space; memory allocation strategies, Paging,

Segmentation, Page replacement algorithms, File and I/O Management, Protection and Security, Disk Scheduling Algorithms

Unit 7: Data Communications and Computer Networks.

Introduction, Data Transmission concepts- Simplex, half Duplex, Full Duplex. Bandwidth and Channel Capacity. Analog and Digital signals. Transmission media- Twisted pair, coaxial cable, optical fiber, terrestrial and satellite communications.

Introduction to Computer Networks, Network Classification, Topologies, Networks Switching Techniques and Access Mechanisms, OSI and TCP/IP model. Network Layers: Physical Layer, Data Link Layer Functions and Protocol, Multiple Access Protocol and Networks, Networks Layer Functions and Protocols, Transport Layer Functions and Protocols, Overview of Application layer protocol.

Unit 8: Software Engineering

Introduction, SDLC, Phases of System Development Life cycle. Structured Analysis, Elements of Design, DFD, Process descriptions, Data dictionary. ER Diagram. System planning and Feasibility Analysis. Project Management – PERT and CPM. CASE Tools.

Concept and Nature of Software, Software Crisis, Software Engineering - Concept, Goals and Challenges, Software Engineering Approach; Software Development Process, Process Models - Waterfall Model, Evolutionary and Throwaway Prototyping Model, Incremental and Iterative Models, Spiral Model, Agile Process Model, Component based and Aspect Oriented development.

Unit 9: Logical Reasoning

Syllogisms, Statement and conclusions, Statement and arguments, Blood relations, Direction sense tests, Seating arrangement (linear and circular), Puzzles (based on arrangements, comparisons, etc.), Venn diagrams, Coding and decoding, Arithmetic number series

Unit 10: Sets, Relations and Functions and Calculus

Sets, Relations and Functions- Definition and types of sets, Operations on sets, Types of relations and functions, Domain, range, and codomain, Composite functions and inverse functions ,Calculus Limits and Continuity-Concept of limits and continuity of functions, Differentiation, application of derivatives, integration and differential equations

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M.Sc. Biochemistry

Unit 1: Introduction to Biochemistry

- Fundamental properties of elements, their role in formation of biomolecules and in chemical reactions
- Non-covalent interaction: hydrogen bond, Vander Waals force, dipole –dipole interactions, hydrophobic and hydrophilic interactions
- Concepts of mole, mole fraction, molarity, etc;
- Structural isomerism: Chain, Position and Functional isomerism

- Stereoisomerism: Geometrical and Optical isomerism
- Unique property of water as a universal solvent, Concept of acid and bases, relationship between pH and pH

Unit 2: Biomolecules

- Carbohydrates: Structure, classification and properties
- Amino acids: Structure, classifications and isomerism
- Proteins: Structure, classification and properties
- Lipids: Structure, classification and properties
- Nucleic acids: Structure, composition and properties
- Key contributions of scientists such as Hans Krebs, G. N. Ramachandran, Melvin Calvin, Louis Pasteur, Har Gobind Khorana, Watson etc.

Unit 3: Cell Biology

- Structure of Prokaryotic and Eukaryotic cells
- Cell Membrane structure & function, Membrane Transport
- Structure and function of cell organelles - ER, Golgi, Nucleus, Mitochondria and lysosome.
- Composition of cytoskeleton and extracellular matrix.
- Cell cycle and its regulation

Unit 4: Enzymology

- Enzymes: classification and nomenclature
- Enzyme activity, factors affecting enzyme activity
- Enzyme kinetics: Michaelis Menten equation, Lineweaver-Burk plot
- Enzyme inhibition: competitive, uncompetitive and noncompetitive
- Enzyme regulation: allosteric enzymes
- Mechanism of enzyme action

Unit 5: Immunology

- Immune system including cells, organs and receptors.
- Structure and functions of different classes of immunoglobulins, the genetic basis of antibody diversity
- The importance of humoral, cell-mediated and innate immune responses in combating pathogens.
- Different types of hypersensitivity, and the importance of conventional vs. recombinant vaccines.
- Principles of tolerance, autoimmunity and the role of immunity in protection against pathogens.

Unit 6: Biophysical and Biochemical Techniques

- Centrifugation: Basic principle – Relative centrifugal force, sedimentation velocity and sedimentation coefficient
- Spectroscopy - Principles and application of Absorption & Fluorescence spectroscopy
- Electrophoresis- Principle, Instrumentation & applications of polyacrylamide and agarose gel electrophoresis

- Chromatography – Basic principle, Paper and Thin layer chromatography, Column chromatography –Principle and application of size exclusion and affinity chromatography

Unit 7: Human Physiology

- Physiology of Digestive system: Structure of Stomach, Gastric Secretion mechanisms and physiology of hepatobiliary system
- Physiology of Respiratory and Circulatory system: Transport of gases, Exchange of gases in lungs and tissues, Physiology and anatomy of the heart.
- Physiology of Musculo-skeletal and Nervous systems: molecular mechanism of contraction. Sarcomere, Structure of neuron. Mechanism of Nerve impulse conduction. Role of neurotransmitters.
- Physiology of Excretory system: Structure of Kidney and nephron. Physiology of Urine formation

Unit 8: Microbiology

- Introduction to microbial systems
- Bacteria: morphology, nutrition and their growth
- Structure, transmission and role of viruses
- Host-microbe interactions: Infection, colonization, pathogenicity
- Pathogen virulence and transmission
- Methods for studying microbes: staining and microscopy
- Importance of microbiology in human health and environment

Unit 9: Genetics

- Mendelian genetics – concept of heredity and inheritance, laws of inheritance - monohybrid, dihybrid cross
- Chromosomal basis of segregation, concept of allele, independent assortment, Incomplete
  dominance, co-dominance, Linkage and crossing over
- Chromosome organization - Structural and Numerical changes in Chromosomes- Down's syndrome, Tay Sachs syndrome; Histone modifications and their role in gene expression

Unit 10: Genetic Engineering and Biotechnology:

- Recombinant DNA technology tools: Importance of Restriction endonucleases, DNA Ligase in recombinant DNA technology
- General characteristics of plasmids, Different types of plasmid vectors, bacteriophages as cloning vectors,
- Polymerase chain reaction and its types, Applications of Gene Cloning and
- recombinant DNA technology (rDNA)

Unit 11: Laws of Thermodynamics and Bioenergetics

- Laws of thermodynamics and their application
- Concept of enthalpy, entropy and their free energy
- Criteria for thermodynamic equilibrium and spontaneity
- Bioenergetics, Energy change during a biochemical reaction
- Energy rich compounds in living organisms and their classification
- Coupled reactions, ATP as energy currency, ATP-ADP cycle

Unit 12: Metabolism

- Glycolysis, TCA cycle, pentose phosphate pathway, gluconeogenesis
- Glycogen synthesis and breakdown, Electron transport chain and ATP synthesis
- β-oxidation of fatty acids, biosynthesis of fatty acids
- Transamination and deamination reactions, urea cycle
- Metabolism of purines and pyrimidines

Unit 13: Molecular Biology

- Central dogma of molecular biology, Evidences for DNA as a genetic material
- Replication in prokaryotes and eukaryotes, concept of replicon
- Origin of replication in prokaryotes and eukaryotes, fidelity of replication
- Basic mechanism of transcription and translation in prokaryotes and eukaryotes
- Operon concept, transcription and translation inhibitors

Unit 14: Clinical Biochemistry

- History and scope of Clinical Biochemistry,
- role of clinical biochemistry in health and disease, quality control, body fluid and specimens: blood, urine and CSF
- Clinical lab diagnosis; Kidney, Liver and thyroid function tests (KFT, LFT, and TFT)
- Lipid profile, Glucose tolerance tests, Urine and stool examination

Unit 15: Ecology and Environmental conservation

- Ecology and environmental conservation
- Air Pollution, water pollution and their control
- Conservation and management of biological resources
- Nitrogen, phosphorous and carbon cycle
- Macro- and micronutrients: uptake and role
- Metal toxicity and its impact on biodiversity

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M.Sc. Botany

UNIT-1 Microbes & Algae:

Microbes: General characteristics of viruses; structure and life cycle of DNA and RNA Viruses (T-phage, TMV); isolation and purification of viruses; general characteristics and economic importance of Bacteria; gram staining, cell wall, cell structure, growth and reproduction in Bacteria; general characteristics of *Mycoplasma*

Algae: General characteristics, ecological and economic importance of Algae; classification of algae (Round 1965); range of thallus organization in Algae; thallus structure, reproduction and life cycle of *Nostoc, Volvox, Chlamydomonas, Oedogonium Vaucheria, Batrachospermum*

UNIT-2 Fungi & Plant Pathology:

Fungi: General characteristics, economic importance, cell wall composition, nutrition and reproduction in Fungi; classification of Fungi (Alexopolous et al. 1996); general account of Oomycota, Chytridiomycota, Zygomycota, Ascomycota, Basidiomycota, and Deuteromycota; thallus structure, reproduction and life cycle of *Phytophthora, Physarum, Rhizopus, Agaricus, Aspergillus, Morchella, Alternaria;* Mycorrhizal association and its ecological role; general account of Lichens

Plant pathology: Koch's postulates; plant diseases, symptoms and their preventive measures (Blights of Potato, Powdery Mildew of Cucurbits, Apple Scab, Tabacco mosaic, Stem Rust, Leaf Rust, Rice Blast, Rice Blight)

UNIT-3 Bryophytes, Pteridophytes Gymnosperms:

Bryophytes: General characteristics and classification of Bryophytes (Proskauer, 1957); morphology, anatomy and reproduction: *Marchantia, Anthoceros* and *Funaria;* evolution of sporophyte; alternation of generation; economic and ecological importance of Bryophytes

Pteridophytes: General characteristics; ecological and economic importance of Pteridophytes; classification of Pteridophytes (Sporne 1966); morphology, anatomy and reproduction: *Psilotum*, *Lycopodium*, *Selaginella*, *Equisetum* and *Dryopteris*; heterospory and seed habit; telome theory; stelar system

Gymnosperms: General characteristics; ecological and economic importance of Gymnosperms; Gymnosperms of Jammu & Kashmir; classification of Gymnosperms (Sporne 1965); diversity, morphology, anatomy and reproduction of *Cycas* and *Pinus*

UNIT-4 Plant Taxonomy:

Taxonomic hierarchies; artificial, natural and phylogenetic system of classifications; methods of phenetics and cladistics; taxonomic keys; classification systems: Bentham and Hooker (1862-1883); AGP-IV (2016); Semitechnical description of following families: Brassicaceae, Asteraceae, Solanaceae, Lamiaceae, Liliaceae; Botanical Gardens and Herbaria of world (including India); Botanical Survey of India; Flora, Monographs and Manuals; ICN Principles; Melbourne, Shenzhen and Madrid code; Typification; Basionyms; Synonyms; Homonyms; Autonyms; Tautonyms

UNIT-5 Plant Physiology

Water Relations: Diffusion; DPD; osmosis; water potential; pathways of water absorption; ascent of sap; transpiration; its mechanism; significance; factors affecting

Plant Nutrition: Essential nutrients for plants; physiological roles; deficiency symptoms

Photosynthesis: Photosynthetic pigments; LHC; PSI, PSII; electron transport mechanism in cyclic and non-cyclic photophosphorylation; inhibitors of photosynthesis; pathways of CO_2 fixation: C_3, C_4 and CAM; C_2 cycle.

Respiration: Glycolysis and its regulation; TCA cycle; anaerobic respiration; ETC and Oxidative phosphorylation; Pentose phosphate pathway and its significance

Plant growth regulators: Discovery and physiological roles of auxins, gibberellins, cytokinin, ABA and ethylene; Photoperiodism; Vernalization

UNIT-6 Plant Biochemistry

Carbohydrates: Classification, synthesis and biological significance of monosaccharides disaccharides and polysaccharides

Amino acids, proteins and fatty acids: Types, structure, properties and biological significance of amino acids, proteins and fatty acids

Nucleosides, nucleotides and polynucleotide: Types, properties and biological significance of RNA and DNA

Enzymes: Classification, nomenclature, properties and mode of enzyme action of enzymes

Nitrogen Metabolism: Biological nitrogen fixation, nitrite and nitrate reduction, nitrogen assimilation, nitrate and ammonium assimilation; amino acid biosynthesis

UNIT-7 Plant Morphology and Anatomy

Morphology: Types and modifications of root, stem, and leaves; types of inflorescence; aestivation; androecium & gynoecium (types, position, number and fusion); placentation and its types; fruits and types; seeds and types

Anatomy: classification and structure of meristematic tissue; organization of root and shoot apex; structural differences in monocot and dicot stem, root, and leaf; heart wood and sap wood; stomata structure and types; types and arrangement of vascular bundles; secondary growth in dicot stem

UNIT-8 Cell Biology

Characteristics of prokaryotic and eukaryotic cell; structure and functions of cell wall and plasma membrane, chloroplast, mitochondria, peroxisomes, glyoxysomes, endoplasmic reticulum, golgi apparatus, lysosomes and ribosomes; organization and functions of microfilaments, microtubules, nuclear pore complex, nucleolus; chromatin organization (nucleosome model); cell cycle phases; regulation of cell cycle and checkpoints; germ cell and somatic cell division (meiosis and mitosis)

UNIT-9 Molecular Biology

Molecular Biology: DNA as genetic material (Griffith's experiment); molecular structure of DNA (Watson and Crick model); DNA replication in prokaryotes and eukaryotes; DNA damage and repair mechanisms; homologous recombination (Holliday Model); RNA structure and types; RNA polymerases, sigma factor, promoters, transcription in prokaryotes and eukaryotes (initiation, elongation and termination); post transcriptional modifications; splicing and processing of pre-mRNA; operon models (inducible and repressible system): Lac and Trp operons; genetic code and its characteristics; structure of ribosomes and assembly; central dogma; mechanism of translation in prokaryotes and eukaryotes (initiation, elongation and termination of polypeptides); post-translational modification of proteins

UNIT-10 Embryology of Angiosperms:

ABC Model of flower development; microsporogenesis and megasporogenesis; development of male and female gametophyte; types of ovules; pollination and its types; pollen-pistil interaction; self-incompatibility (sporophytic and gametophytic); double fertilization and its significance; embryo and endosperm development in dicot and monocot; seed and fruit development and dispersal; seed dormancy; polyembryony; apomixis

UNIT-11 Genetics and Cytogenetics

Genetics: Mendel's Laws of inheritance; back cross and test cross; incomplete dominance and codominance; gene interaction: complementary (9:7); duplicate (15:1); epistasis: dominant (12:3:1); recessive (9:3:4); lethal genes (2:1); collaborative genes (9:3:3:1); cytoplasmic inheritance in plants (male sterility)

Cytogenetics: Ultra structure of chromosome; crossing over; deletions, duplications, inversions, translocations (homologous and non-homologous); non-disjunction in meiosis I&II; euploidy: monoploidy, autopolyploidy; allopolyploidy; aneuploidy monosomy; nullisomy; trisomy; tetrasomy

UNIT-12 Plant biotechnology

Plant Tissue Culture: Composition of MS medium; explant; totipotency; callus; somatic embryogenesis; synthetic seed production; protoplast fusion; hybrids; cybrids; micropropagation; somaclonal variation; germplasm conservation

Recombinant DNA Technology: Enzymes used in recombinant DNA Technology; PCR its principle and application; primer designing; gel electrophoresis; blotting techniques; cloning vectors: plasmid; bacteriophage and cosmid vectors; application of transgenic plants: Golden rice; Bt cotton; Flavr Savr tomato

UNIT-13 Economic Botany

Vavilov's centres of origin; origin and uses of cereals (rice, wheat, maize); processing non-alcoholic beverages (tea and coffee); active constituents of clove, black pepper, saffron, turmeric, ginger, cinnamon, cardamom, chilli, fennel; processing and of jute and cotton; uses of mustard, groundnut, lavender and rosemary; uses of *Podophyllum hexandrum, Bergenia ciliata, Digitalis purpurea*

UNIT-14 Plant Breeding

Objectives and achievements of plant breeding; gene pool; germplasm conservation; breeding methods in self-pollinated and cross-pollinated and asexually propagated crops; pure line selection and uses of pure line; hybridization objectives, types and techniques; acclimatization and its affecting factors; heterosis and inbreeding depression; Hardy-Weinberg Law and its affecting factors; introduction, evaluation and release of new varieties

UNIT-15 Plant Ecology and Conservation biology:

Plant Ecology: Soil classification and soil profile; habitat and Niche (fundamental and realized); population growth curves; r and k selection populations; ecotypes; ecads; edge effect; species interactions (positive, negative and neutral); ecological succession;

function of ecosystem; food chain; food web; ecological pyramids; energy flow; endemism; major terrestrial biomes; phytogeographical divisions of India; production and productivity; biogeochemical cycles: C, N, P and S

Conservation Biology: Biodiversity: values and threats to biodiversity; diversity: genetic, species, ecosystem; alpha, beta and gamma; species richness and evenness; IUCN Red list; threatened and endemic species of J&K; conservation strategies: in-situ (National Parks, Wildlife Sanctuaries and Biosphere Reserves); ex-situ (botanic gardens); biodiversity hotspots; Sustainable Development Goals; International Organizations (IUCN, WWF, UNEP, IPBES, UNESCO). Indian conservation efforts: Biological Diversity (Amendment) Act, 2023, National Biodiversity Authority

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Masters in Business Administration

The MBA Entrance Test syllabus for 2026 -27 is as follows:

- **Verbal Ability and Reading Comprehension**
- **Data Interpretation and Logical reasoning**
- **Quantitative Aptitude and Data Analytics**
- **English Communication Aptitude**
- **Current Business Awareness**

(A) Verbal ability and Reading Comprehension include:

- English usage or Grammar
- Fill in the blanks
- Close passage
- Jumbled paragraph
- Summary sentence
- Verbal reasoning
- Sentence completion
- Summary questions
- Facts/judgements/inferences
- Vocabulary
- Reading comprehension

(B) Data interpretation and Logical reasoning include:

- Tables
- Bar Graphs
- Line charts
- Pie diagrams
- Venn Diagrams

- Column Graphs
- Number and letter series
- Binary Logic
- Logical sequence
- Seating arrangement
- Clocks, Cubes, Calendars
- Logical connectives
- Syllogism
- Blood Relations

(C) Quantitative Aptitude and Data Analytic include:

- Number systems
- LCM and HCF
- Profit and Loss
- Probability
- Functions
- Time and Work
- Averages
- Ratio and Proportion
- Speed, Time, and Distance
- Surds and Indices
- Inequalities
- Sequences and Series

(D) English Communication Aptitude include:

- English communication ability
- Verbal ability assessment
- Reading skills assessment
- Vocabulary- Synonyms, Antonyms and Analogy
- Grammar -Verb Agreement, Modifiers, Parallelism, Pronoun Antecedent Agreement, Verb Time, Sequence/ Tenses, Prepositions, Comparison, Determiners, Voices and Speech, Articles, etc.

(E) Current Business Awareness include:

- Current Affairs related to Business & Economy

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M.Sc. Chemistry

Physical Chemistry

Unit I: States of Matter

Gaseous State: Ideal Gas equation, Deviation of gases from ideal behaviour, Van der Waal's equation of state. PV isotherms of real gases, continuity of states, isotherms of Van der Waal's equation. Relationship between critical constants and Van der Waal's constants, the law of corresponding states, reduced equation of state. Liquefaction of gases. Concept of root mean square, average and most probable velocities, Qualitative discussion of the Maxwell's distribution of molecular velocities.

Liquid State: Viscosity and factors affecting viscosity of liquids. Surface tension and factors affecting surface tension.

Solid State: General characteristics of solids (Amorphous and Crystalline), Crystal lattice and unit cell, number of atoms in the unit cell, Symmetry elements in crystals, close-packed structures, packing efficiency, and imperfections in solids (Point defects). Laws of Crystallography, Lattice Planes and Miller indices; Interplanar distance, Bragg equation.

Unit II: Thermodynamics

Thermodynamic functions: State and path functions and their differentials. Thermodynamic processes. Concept of heat and work.

The first law of thermodynamics: Mathematical form of first law of thermodynamics, Heat capacity, heat capacities at constant volume and constant pressure and their relationship. Calculation of U & H for the expansion of ideal gases under isothermal and adiabatic conditions.

The second law of thermodynamics: Need for the law, and different statements of the law, spontaneous and non-spontaneous processes, Concept of entropy, entropy as a function of V&T and P&T, entropy as criteria of spontaneity and equilibrium, Clausius inequality, Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, G & A as criteria for thermodynamic equilibrium and spontaneity (Gibbs Helmholtz Equation).

Third law of thermodynamics: Nernst heat theorem, third law of thermodynamics, concept of residual entropy.

Unit-III: Chemical Kinetics

Order of reaction; derivation of rate equations for first, second order reactions. Determination of order of reaction by differential rate, integration, half-life period and isolation methods. *Temperature dependence of reaction rates:* -Arrhenius equation, concept of activation energy.

Theories of chemical kinetics: Simple collision theory based on hard sphere model, estimation of rate constants of atomic reactions. Activated complex theory of reaction rates (Thermodynamic formulation). Comparison with collision theory.

Kinetics of fast reactions: General features of fast reactions, study of fast reactions by flow method, relaxation method and flash photolysis.

Kinetics of Solution Phase Reactions: Effect of solvent on reaction rates (diffusion-controlled reactions), Ionic Reactions; single & double sphere models of ionic reactions, the effect of ionic strength.

Unit IV: Quantum Chemistry:

Limitation of classical mechanics: Blackbody radiation, photoelectric effect, heat capacity of solids and atomic spectra. Wave-particle duality: de-Broglie equation.

Operators: Elementary concept of operators, Algebra, Rules for setting operators (position and linear momentum), eigenfunctions and eigenvalues, Hamiltonian operator, Linear and Hermitian operators,

Wave function: Physical interpretation of wave function, Orthogonality and Normalization of wave function. Schrodinger's wave equation and its` importance. Postulates of quantum mechanics. Solution of Schrodinger wave equation for particle in one-dimensional box.

Unit V: Surface Chemistry:

Liquid Interface: Kelvin equation, Surface excess, Gibbs adsorption isotherm.

Surfactants: Introduction, types, cmc, micellization, factors affecting cmc.

Solid surfaces: Adsorption at solid surfaces, adsorption isotherms; Freundlich and Langmuir adsorption isotherm.

Inorganic Chemistry

Unit VI: Chemical Bonding and Molecular Structure

Bonding and theories: Types of bonding, salient features of ionic and covalent bonding, Fajan's rules, percentage ionic character of a polar covalent bond. Dipole moment and its applications.
VSEPR Theory: Shapes of molecules/ions
Valence Bond Theory: Directional characteristics of covalent bond, types of hybridization and limitations of VB theory.
MO treatment: Mo treatment of homo & hetero nuclear diatomic molecules (B2, F2, CO & HF). Energy level diagrams, Bond order and its applications.

Unit VII: Main Group Chemistry
Introduction to s-block elements, Anomalous behaviour and diagonal relationship. Chemical reactivity of S block elements towards water, oxygen, hydrogen, and halogens. Chemical characteristics of the compounds of alkali and alkaline earth metals (carbonates, bicarbonates and sulphates of Li and Mg). Flame coloration of Alkali and Alkaline earth metals. P-block elements:

Boranes, Nomenclature, Classification, Preparation, Properties, Structure and Bonding with special reference to Diborane.

Carbides: Classification, Preparation, Properties and Uses. Intercalation compounds of graphite. Nitrogen Compounds: Preparation, properties and uses of Hydrazine, oxides and oxo acids of nitrogen. Oxygen: Chemistry of different forms of Oxygen (atomic, molecular and ozone). Structure & Bonding of Oxides, and Oxy acids of Sulphur. Hydrogen Peroxide: Preparation, Properties, structure and uses. Halogens: Comparative chemical reactivity, Properties, Structure & Bonding of Hydrogen halides. Interhalogens and polyhalides.

Structure and Bonding of oxyacids of Chlorine Noble gases: Isolation and Applications of noble gases, Valence bond treatment of bonding in Fluorides, oxides and oxyfluorides of Xenon

Unit-VIII Transition Elements

Transition elements: variable oxidation states, anomalous electronic configurations. Trends in ionic radii, hydration and lattice energy of 3d series. Standard Electrode Potentials of M^{2+}/M and M^{3+}/ M^{2+} systems. Complexing ability, Catalytic properties. Acidic/Basic character of transition metal compounds in various oxidation states. Stabilization of unusual oxidation states. Chemistry of selected transition metal compounds (Potassium ferricyanide and sodium nitroprusside).

Magnetic properties: calculation of magnetic moment value (spin only). Spectral properties (d-d bands and charge transfer transitions).

Chemistry of Inner-Transition Elements: Electronic configuration, oxidation states, f-orbital's. Complexing behaviour of inner transition elements (Stereochemistry and stability). Spectral and Magnetic Properties (comparison with transition metals). Consequences of Lanthanide contraction (case studies). Separation of Lanthanides by ion–exchange and solvent extraction methods.

Unit IX: Bonding in Coordination Compounds

Coordination Chemistry: Werner's Theory. Geometrical and optical isomerism. Bonding models in coordination complexes: Limitations of VBT, Crystal field theory of octahedral tetrahedral and square planar complexes. Factors affecting magnitude of Δ. CFSE calculations of weak and strong field ligands.

Stability of coordination compounds and factors affecting stability. Chelate and Macrocyclic effect. Spectrochemical series. Magnetic properties of transition metal complexes. Limitations of Crystal field theory. Analytical applications of coordination compounds.

Unit X: Organometallic Chemistry

Organometallic compounds: Definition and classification. Hapticity concept, Applications of 18-electron rule. Stability of organometallic compounds. Preparation, structure and bonding in Zeise's salt. Homogenous and heterogenous catalysis.

pi-Acid Complexes of Transition Metals: Transition Metal Carbonyls: Carbon Monoxide as ligand; synthesis, and bonding in mononuclear carbonyls (synergistic bonding). Spectral analysis of metal carbonyl compound (FTIR)

Organic Chemistry

Unit-XI: General Organic Chemistry

Electron Displacement: Inductive, Electrometric, Resonance, Hyperconjugation and their applications. Reactive Intermediates: Structure, generation and stability of carbocations, carbanions, free- radicals, benzynes, carbenes and nitrenes. Aromatic compounds: Requirements of aromaticity. Huckel's rule and its significance. Explanation using molecular orbital diagram of benzene. Aromaticity of non-benzenoid compounds like pyrrole, thiophene, furan and aromatic ions (3, 5, 6 and 7 membered rings-some representative examples). Electrophilic aromatic substitution reactions of benzene (nitration, sulphonation, halogenation, Friedel Crafts alkylation/acylation)

Unit XII: Hydrocarbons , Substitution and Elimination

Organic Chemistry Addition Reactions of alkenes: Mechanistic details including regioselectivity and stereochemical implications of halogenation, hydrohalogenation. Free Radical Addition Reactions: Radical additions to alkenes; Anti-Markovnikov addition of HBr (peroxide effect), Addition of halogens, Kharasch addition, Stereochemical aspects of radical additions. Substitution and elimination reactions: Mechanistic details of SN 1 and SN2 reaction, Effects of structure of substrate, nature of nucleophiles, leaving groups and solvent; E1 and E2 reactions, Regioselectivity and stereochemistry of E2 reactions- Hoffman and Saytzev's rules.
Acidic character of alkynes. Catalytic and metal-ammonia reductions of alkynes. Catalytic hydration of alkynes.

Unit XIII: Stereochemistry

Chirality, Chirality of organic molecules with one chiral centre, Chirality in molecules with more than one chiral Center. R, S configurations. Chirality of biphenyls, allenes, spiranes., optical purity, and methods of resolution. Stereospecificity and stereoselectivity of organic reactions, Determination of enantiomeric excess by optical activity. Conformations: Origin of conformational energy. Angle and Pitzer strain. Conformations of cycloalkanes, cyclohexene, cyclohexanones, decalins and decalones. Conformation of sugars and anomeric effect. Effect of conformation on reactivity

Unit XIV: Reactions of Carbonyl compounds

Reaction Mechanism: General mechanism, reactivity, orientation and stereochemical implications of addition reactions involving electrophiles, nucleophiles and free radicals. Ene-reaction, Michael reaction and Sharpless asymmetric epoxidation. Wittig, Mannich, Aldol, Cross Aldol, Evans-Aldol reaction, Cannizarro's, Knoevenagel, Robinson annulation, Claisen, Dickman, Benzoin, Perkin, Reformat sky and Stobbe's reactions. Henry reaction, Bamford Stevenson reaction, Baylis-Hillman reaction,.

Unit XV: Spectroscopy

Principles of Ultra Violet Spectroscopy: Electronic transitions in organic molecules, Woodward- Fieser rules for calculation of Absorbance maxima of organic compounds.
Principles of Infrared spectroscopy: The Infrared spectrum, the functional group and fingerprint regions, Characteristic IR absorption bands, Intensity and position of absorption bands. Structural features effecting vibrational frequency. Application of IR spectroscopy in structural elucidation of organic compounds.
NMR: Basic concepts, Chemical shift and its measurements for various classes of compounds.. Proton exchange, deuterium exchange, Peak broadening exchange. Applications of 1H NMR in structural elucidation of simple molecules

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M.A. ECONOMICS

Microeconomic Theory

Nature of Economics; scarcity, choice, and opportunity cost; Production Possibility Frontier. Demand and supply functions; determinants; shifts; elasticity of demand and supply and its measurement. Consumer preferences and utility functions; consumer equilibrium; income and substitution effects; Slutsky equation; revealed preference theory. Production function in short and long run; law of variable proportions; returns to scale; isoquants and isocosts. Cost concepts and short-run and long-run cost curves; total, average and marginal revenue and their relationships. Perfect competition; monopoly and price discrimination; monopolistic competition; oligopoly models including Cournot, Stackelberg, Bertrand, and kinked demand curve.

Macroeconomic Theory

Concepts of GDP and GNP; methods of measurement; nominal and real income. Say's Law; full employment; wage-price flexibility; classical dichotomy. Consumption and saving functions; effective demand; income determination; multiplier (investment, government, tax, balanced budget); paradox of thrift. Marginal efficiency of capital; autonomous and induced investment. Classical and Keynesian demand for money; liquidity trap; contributions of James Tobin and William Baumol. Types of inflation and unemployment; inflation–unemployment relationship; phases of business cycles; theories of John Maynard Keynes, Paul Samuelson and John Hicks.

Indian Economy

Public sector in India; economic reforms of 1991; Planning Commission and NITI Aayog. Green Revolution; food security and Public Distribution System; agricultural pricing. Industrial policy; privatization and disinvestment; MSMEs. Poverty and its measurement; inflation (WPI and CPI).

Statistical Methods in Economics

Measures of central tendency and dispersion; skewness, moments and kurtosis; sampling methods. Karl Pearson's coefficient; rank correlation; regression equations. Index

numbers: types and construction; time and factor reversal tests. Components of time series; trend measurement methods; probability approaches.

Mathematical Methods in Economics

Functions, sets, and basic mathematical concepts. Limits, continuity, differentiation; optimization. Partial derivatives; elasticities; Lagrangian optimization. Definite and indefinite integrals; applications in economics.

International Trade

Absolute and comparative advantage; opportunity cost; Heckscher–Ohlin model; Rybczynski and Stolper–Samuelson theorems. Gains from trade; terms of trade; offer curves. Tariffs, quotas, dumping, subsidies; role of World Trade Organization.

Public Economics

Public goods; externalities; Coase theorem; free rider problem. Principles of taxation; incidence; equity and efficiency; Laffer curve; GST. Public expenditure; Wagner's hypothesis; Peacock–Wiseman hypothesis.

Development Economics

Concepts of growth and development; GDP, PCI, HDI; capability approach of Amartya Sen. Inequality and poverty: Lorenz curve, Gini coefficient, Kuznets hypothesis. Development theories: classical, big push, balanced and unbalanced growth; Lewis and Harris–Todaro models; Myrdal and Krugman.

Money and Banking

Functions and types of money; money supply; high-powered money; multipliers. Commercial banking; role of Reserve Bank of India. Monetary policy instruments; MPC; inflation targeting; financial markets and instruments.

History of Economic Thought

Mercantilism; Physiocracy; contributions of Adam Smith, David Ricardo, Thomas Robert Malthus, Jean-Baptiste Say. Karl Marx; marginalists: William Stanley Jevons, Leon Walras, Carl Menger. Indian economic thought: Dadabhai Naoroji, Mahatma Gandhi, B. R. Ambedkar, Amartya Sen.

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MA EDUCATION

Unit 1: Basics of Education

- Concept, Nature and Scope of Education
- Aims of Education: Individual & Social
- Interdisciplinary/Multidisciplinary Nature of Education

- Current Trends: Online Learning, ODL, MOOCs

Unit 2: Structure of Indian Education (NEP 2020)

- Foundational Stage
- Preparatory Stage
- Middle Stage
- Secondary Stage
- Higher Education

Unit 3: Philosophical and Ideological Foundations of Education

- Meaning and Branches of Philosophy
- Relationship between Education and Philosophy
- Idealism
- Pragmatism
- John Dewy
- Rabindranath Tagore
- M. K. Gandhi

Unit 4: Sociological Foundations of Education

- Meaning, Nature and Scope of Sociology of Education
- Society and Types
- Education and Social Change
- Social Change and its Theories (Functionalist Theory and Conflict Theory)
- Social Mobility
- Culture and Education
- Cultural Lag

Unit 5: Psychological Foundations of Education

- Educational Psychology
- Learning Theories: Thorndike, Pavlov, Skinner, Bandura
- Intelligence and IQ
- Theories and Tests of intelligence:

- Two Factor Theory (Spearman)
- Multi Factor Theory (Thorndike)
- Group Factor Theory (Turnstone)
- Simon - Binet Scale (Verbal Intelligence Test)
- Cattell's Culture Fair Test (Non-verbal)

- Personality Theories: Type Theory - William Sheldon , Carl Gastuv Jung , Trait Theory - G.W. Allport & Psycho-Analytical -Sigmund Freud

Unit 6: Historical Development of Indian Education

- Vedic, Buddhist & Muslim Education
- Macaulay's Minutes (1835)
- Woods Dispatch (1854)
- Hunter Commission (1882)
- Sargent Report (1944)
- University Education Commission (1948-49)
- Secondary Education Commission (1952-53)
- Indian Education Commission (1964-66)
- NPE (1986)
- NEP 2020

Unit 7: Inclusive Education

- Exceptionality
- Concept of impairment, disability & handicapped
- Types of Disabilities: Visual impairment, Hearing impairment & Mental retardation.
- Inclusive Education Principles
- Policies: National Policy for Persons with Disability 2006, PWD Act 2016, NEP 2020

Unit 8: Educational Technology & ICT

- Educational Technology
- Teaching Aids

- Teaching Technology, Behavioural Technology and Instructional Technology.
- Hardware & Software approach of Educational Technology
- E-learning, Blended Learning, Flipped Learning, MOOCs

Unit 9: CREATIVITY AND EDUCATION

- Creativity: Convergent & Divergent thinking
- Stages of creativity
- Baqir Mehdi test of creativity
- Torrance test of creativity
- Guilford test of creativity
- Brainstorming
- Creative Problem Solving
- Synectic Model

Unit 10: Guidance, Counselling & Educational Statistics

- Guidance, Meaning, Need and Importance
- Types of Guidance- Personal Educational, and Vocational
- Basic Principles of Guidance services
- Counseling, Meaning, Importance and Steps
- Types of Counselling-Directive and Non-directive
- Qualities and Qualifications of an effective counsellor
- Theories of Counselling: Psychoanalytic Theory, Behavioural Theory & Humanistic Theory
- Measures of Central Tendency -Concept & Computation of Mean, Median & Mode
- Measures of variability: Concept & Computation of Range, QD & Standard Deviation

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M.A. English

Unit	Sub-Unit	Authors/Reference Books	Works
Unit I: Poetry	Forms & Early Poetry	Geoffrey Chaucer William Shakespeare;	General Prologue Sonnets 18, 66, 116;
	Metaphysical & Classical	John Donne; John Milton; Alexander Pope; Thomas Gray	The Sun Rising; The Flea A Valediction: Forbidding Mourning; Batter My Heart; Paradise Lost Book 1, Lycidas; On His Blindness; Elegy Written in a Country Churchyard
	Romantic	William Wordsworth; William Blake	Tintern Abbey; Resolution and Independence; London; The Lamb, Tyger
	Victorian	Alfred Tennyson; Robert Browning	Ulysses; Break Break Break; My Last Duchess; The Last Ride Together
	Modern	T. S. Eliot; W. B. Yeats	The Love Song of J. Alfred Prufrock; Easter 1916; Sailing to Byzantium, Among School Children
	American	Emily Dickinson; Robert Frost; Langston Ted Hughes	Because I Could Not Stop for Death; , Hope is the Thing with Feathers; Birches; Stopping by Woods; Mending Wall, The Road Not Taken Let America Be America Again
	Indian & Postcolonial	Nissim Ezekiel; Kamala Das;	Enterprise; Poet Lover Birdwatcher;

Unit	Sub-Unit	Authors/Reference Books	Works
		AK. Ramanujan; Derek Walcott; Sujata Bhatt; Lala Ded; Habba Khatoon	An Introduction; My Mother at Sixty-Six; Obituary A River; A Far Cry from Africa; he One Who Goes Away" Search for My Tongue; Vakhs; Lyrics
Unit II: Drama	Classical to Modern	William Shakespeare; Christopher Marlowe; Oscar Wilde; George Bernard Shaw	Macbeth; Twelfth Night; Othello; Doctor Faustus; The Importance of Being Earnest; Pygmalion
	Modern & Contemporary	Eugene O'Neill; Girish Karnad; August Wilson Bertrolt Brecht Eugene Ionesco	The Hairy Ape; The Emperor Jones; Tughlaq; Fences Mother Courage and her Children Rhinoceros
Unit III: Fiction (Novel)	Classic & Victorian	Jane Austen; Charlotte Brontë; Charles Dickens; Emily Brontë; Mary Shelley George Eliot	Pride and Prejudice; Jane Eyre; Great Expectations; Wuthering Heights; Frankenstein Middlemarch
	Modern & Postcolonial	Virginia Woolf; Chinua Achebe; George Orwell;	Mrs Dalloway; Things Fall Apart; 1984; Animal Farm;

Unit	Sub-Unit	Authors/Reference Books	Works
		Toni Morrison; Alice Walker	Beloved; Color Purple
Unit IV: Short Stories	—	O. Henry; Edgar Allan Poe; Guy de Maupassant; Leo Tolstoy; Nikolai Gogol; Jhumpa Lahiri; Mulk Raj Anand	The Gift of the Magi; The Purloined Letter; Fear; There Are No Guilty People; The Overcoat; Unaccustomed Earth; Two Lady Rams
Unit V: Essays & Non-Fiction	—	Francis Bacon; Virginia Woolf; Salman Rushdie; Ralph Waldo Emerson; Henry David Thoreau	Of Studies; Of Friendship The Death of the Moth; Imaginary Homelands; Self-Reliance; Civil Disobedience
Unit VI: Literary Criticism	Classical to Victorian	Plato; Aristotle; Philip Sidney; William Wordsworth; Matthew Arnold	Republic; Poetics; Apology for Poetry; Preface to Lyrical Ballads; Function of Criticism
Unit VII: Modern Literary Theory	—	Shklovsky; Eikhenbaum; T. S. Eliot; I. A. Richards; Karl Marx; Virginia Woolf;	Art as Technique; Formal Method; Tradition and Individual Talent; Two Uses of Language; Marxism and Literary Criticism; A Room of One's Own; Orientalism;

Unit	Sub-Unit	Authors/Reference Books	Works
		Edward Said; Frantz Fanon; Saussure; Derrida; Freud; Lacan; Iser; Fish	The Wretched of the Earth; Linguistic Sign; Deconstruction; Ego and Id; Mirror Stage; Reader Response Texts
Unit VIII: Indian Writing in English & Diaspora	—	R K Narayan Mulk Raj Anand; Raja Rao; Jhumpa Lahiri; Salman Rushdie	The Guide Untouchable; Kanthapura; Unaccustomed Earth; Midnight's Children
Unit IX: Linguistics & ELT	—	Noam Chomsky; B. F. Skinner; Stephen Krashen; Dell Hymes	Language Acquisition Theory; Behaviourism; Input Hypothesis; Communicative Competence
Unit X: Literary Terms & Genres		Glossary of Literary Terms (M H Abrams) The Bedford Glossary of Critical and Literary Terms (Supryia M Ray, Ross C Murfin) Dictionary of Literary Terms and Literary Theory (J A Cuddon)	Allegory; Ballad; Blank Verse; Comedy; Dissociation of Sensibility; Dramatic Monologue; Elegy; Enlightenment; Epic; Fancy and Imagination; Imitation; Intentional Fallacy; Irony; Motif; Ode; Onomatopoeia; Paradox; Plot; Figures of Speech; Satire; Soliloquy; Sonnet; Tragedy; Wit; Fiction; Non-fiction; Life Writing; Diary; Drama; Essay; Novel; Poetry; Prose; Short Story; Travelogue; Science Fiction

M.Sc. Environmental Science

Unit 1: Ecology and Environment

Concept and Importance of Environment; Structure and composition of Atmosphere, Hydrosphere and Lithosphere; Hydrological Cycle; Origin and evolution of life on Earth; Structure of Earth; Ecology – levels and organisation; Concept, structure and functions of ecosystem; Food chain, Food web, Ecological Pyramids; Ecological balance in nature; Flow of energy in ecosystems; Ecosystem productivity; Ecological succession.

Unit 2: Natural Resources and Biodiversity

Natural resources: concept, classification and distribution; Forest resources; Water resources; Mineral resources; Energy resources (Renewable and Non-renewable); Soil resources and soil types of India; Basic principles of natural resource management; Biodiversity: Status and importance; Endemism; Hot spots of biodiversity; India as a mega-diversity nation; Biogeographical realms of the world; Threats to biodiversity; IUCN's Red list (Scheme and Status); Biodiversity conservation: *In-situ* and *Ex-situ*.

Unit 3: Environmental Chemistry

Concept of mole, molarity and normality; Stoichiometry; Titrimetry and Gravimetry; Concept of acids and bases; Buffer system; Principles and applications of Spectrophotometry and Chromatography; Thermochemical and photochemical reactions in atmosphere (Acid rain, Smog and Ozone depletion); Chemistry of greenhouse gases; Solubility of gases in water; Carbonate and bi-carbonate system; Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD); Inorganic and organic components of soil.

Unit 4: Human and Environment

Environmental education - goals, objectives and need for public awareness; Role of women in environmental education; Awareness for sustainable development, Environmental organizations and Role of NGO's and mass media, Environmentalism and Environmental Justice; Chipko movement, Appiko movement, Narmada Bachao Andolan, Tehri Dam conflict, Environmental ethics.

Unit 5: Environmental Pollution

Types and sources of air pollution; Effects of air pollutants on environment and health; Indoor air pollution; Air Quality Index (AQI); Control of air pollution; Sources, effects and control of noise pollution; Surface and groundwater pollution; Causes, impacts and prevention/control of water pollution; Eutrophication; Thermal pollution, Acid precipitation; Soil pollution: causes, effects and control measures, Soil erosion and land degradation, Radiation Pollution; Solid waste: sources, classification and management; Biomedical and hazardous waste; Electronic and plastic wastes; Impacts of Municipal and Hazardous wastes on environment.

Unit 6: Environmental Geosciences

Geological time scale; Continental drift and tectonic plates; Types of rocks and rock cycle; Internal and external earth surface processes; Rare Earth elements; Geochemical cycles; Natural hazards and Disasters; Floods, Earthquakes, Landslides, Tsunamis, Volcanos, Epidemics and Pandemics; Disaster management framework; Disaster risk and vulnerability; Basic principles of disaster management; disaster management cycle; Disaster management policy; Natural disasters and environmental challenges.

Unit 7: Environmental legislation and Policy

Constitutional provisions in India: Article 21, 48A, 51A(g); Wildlife Protection Act-1972; The Water (Prevention and Control of Pollution) Act-1974; Forest Conservation Act-1980; The Air (Prevention and Control of Pollution) Act-1981; Environment Protection Act-1986; Noise Pollution Rules-2000; Polluter Pay Principle; National Environmental Policy, 2006, National Water Policy, 2012, National Energy Policy, 2017, National Forest Policy, 2018, National Mission for Green India; Swachh Bharat Mission; International initiatives: Stockholm Conference, Earth Summit, Montreal and Kyoto protocols, UNFCCC.

Unit 8: Aquatic and Terrestrial Ecology

Freshwater Ecosystems: classification and distribution; Lakes and Wetlands: origin and classification; Lake stratification; Classification of streams and rivers; Impacts of pollution, overexploitation on freshwater ecosystems; Classification and distribution of terrestrial ecosystems; Community structure and functioning; Major forest types of the world and India; Deforestation and global climate change; Introduction to world deserts; Classification of deserts; Ecological adaptation of desert flora and fauna; Major grassland types of India and world.

Unit 9: Environmental Economics and Sustainable Development

Environmental economics: definition and scope; Natural capital and flow; Concept of intangibles and externalities; Carbon credits and carbon trading; Carbon footprints; Ecosystem Services; Incentives for Ecosystem Services; Concept of sustainable development; Sustainable development goals; Circular economy; green infrastructure; Sustainable cities and globalization.

Unit 10: Atmospheric Dynamics and Climate Change

Meteorological properties: pressure, temperature, precipitation, humidity, specific heat and latent heat; Radiation Energy Balance; horizontal and Vertical wind circulation; Monsoon and climatic zones of India; El-Nino and southern oscillations (ENSO); Concept of climate change; Indicators of climate change; Extreme climate events; Impacts of climate change; Climate change mitigations and adaptations; Carbon sequestration.

Unit 11: Environmental Pollution Control Technology and Management

Control of gaseous and particulate air pollution; Effluent and sewage treatment, wasteland reclamation and sustainable agricultural practices; Role of remote sensing and GIS in environmental management; Bio-remediation; Biofertilizers and biofuels;

Recombinant DNA technology in environmental pollution control; Environmental genomics; Concepts of green technology, Importance of Vermicompost in agri-horticultural practices, Vermicomposting for Organic Farming; Vermicomposting techniques for pollution control and organic waste management.

Unit 12: Emerging Environmental Issues and Challenges

Climate change vulnerability and risk; Human population growth and environment; loss of biodiversity, biological invasion, Water Conflicts; Water and food security linkages; Plastic Pollution and Microplastics, Radioactive waste (Threats, Safety & Management), Emerging Environmental Contaminants.

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M.A/M.Sc. Geography

Physical Geography

Geography: Introduction as a discipline, Changing Nature of Geography, Sub-Branches of Geography, Physical Geography and its various branches, Structure of Earth's interior, Continental Drift Theory – Wegener's concept, Sea Floor Spreading & Plate Tectonics, Earthquakes, Nature and Development of Geomorphology, Geological time scale, Principles of Geomorphology- Uniformitarianism, order of superposition and Catastrophism, Concept of Dynamic Equilibrium, Isostasy, Weathering and Erosion, Models of landform development (Davis), Fluvial processes, Glacial processes, Aeolian processes, Karst processes and their resultant land forms

Climatology

Climatology: Definition & Significance, Composition & Structure of atmosphere, Insolation, Global heat budget, Atmospheric Pressure, Winds: Major classification (Planetary, Periodic & Local); Cyclones & anticyclones, Jet Streams & El – Nino, Elements of Weather & Climate, Composition & Structure of the Atmosphere, Temperature Distribution: Vertical & Horizontal; Inversion of Temperature, Humidity & Precipitation, Clouds - Major types, Air Masses & Fronts, Indian Monsoons: Mechanism, Western Disturbances, Theory of Indian Monsoons – Classical & Modern, Climatic Classification – Koeppen

Oceanography

Evolution of Oceanography: nature, and scope, Surface configuration of ocean floor, Ocean morphology: Bottom Relief of Pacific, Atlantic and Indian Oceans, Temperature & Salinity: Horizontal & Vertical Distribution, Coral Reefs: Origin, Types & Distribution, Movement in Ocean Waters – Tides, Currents, Ocean currents: Atlantic, Pacific, and Indian Ocean, Marine Deposits and Resources, Law of the Sea & Exclusive Economic Zone, Ocean Hazards: Tsunami & Cyclone, Sea level Change, Ocean Acidification & Coral Bleaching

Glaciology

Cryosphere and its Significance, Basic concepts of a Glacier-Snout, Equilibrium Line Altitude (ELA), Transient Snow Line (TSL), Accumulation and Ablation Zone, Classification System of Glaciers based on Temperature and Location, Global Distribution of Glaciers, Glacier Mass Balance, Glacier Movement, Permafrost and Ground Ice, Glacial Runoff and its Impact on the Environment, Glacier Hazards: GLOF, Surge, Introduction to Himalayan Glaciers, Major Glaciers of Western Himalayas, Impact of climatic change on Glaciers: Gangotri and Kolahoi, Remote Sensing in Glaciology

Hydrology

Introduction to Hydrology, Hydrologic Cycle and Water Balance, Understanding Catchment Concepts: Linear and Aerial Dimensions, Runoff: Natural Flow, Surface Runoff, Overland Flow, Direct Runoff, and Base Flow, Groundwater Hydrology: Role of Groundwater in the Hydrological Cycle, Occurrence of Groundwater: Aquifers, Aquicludes, Aquifuges, and Aquitards, Water Movement in Saturated Soils: Application of Darcy's Law, Groundwater Fluctuation: Long-Term, Seasonal, and Short-Term Variations

Human Geography

Nature and Relevance, Branches and emerging domains of Human Geography, Evolution of Human Geography – Stages and recent transformations, Fundamental concepts in Human Geography: Location , Space and Place and their modern day relevance, Approaches to Human Geography – Determinism, Possibilism and Probabilism

Evolution of Geographic thought

Areal Differentiation and Spatial Organization, Dualism in Geography: Regional/General, Physical/Human, Historical/Contemporary ,Contribution of Phoenicians ,Greeks: Thales, Anixamander, Eratosthenes, Hecatus, Contribution of Romans: Strabo and Ptolemy, Contribution of Arabs: Al-Biruni, Al-Masudi, Dark Age and its Impact, Approaches to study of Man-Environment Relationship: Neo-Determinism, Positivism, Humanism, Behaviouralism, Quantitative Revolution in Geography.

Population Geography

Population: Growth, Density and Distribution (Trends, Factors and Challenges), Population Dynamics and Structure: Fertility, Mortality and Migration (Concept and Determinants); Age and Sex Composition, Concept of Over, Under and Optimum Population, Theories of Population Growth: Malthus and Demographic Transition Theory, Human Development – Sustainability and Future Challenges

Urban Geography

Nature and Recent Approaches, Origin and Growth of Cities, Classification of Cities, Urbanization: Processes, Trends and Pattern, The internal structure of cities: The

Concentric Zone Theory, The Sector Theory, Multiple Nuclei Theory, The Social Area Analysis Model, Primate City and Rank Size Rule, Rural Urban Fringes and City Region: Delimitation and Characteristics, Concept of Green Belt, Satellite Town, Ribbon Settlement, Conurbation and Smart Cities, Urban Sprawl: Characteristics and Causes, Urban Poverty & Informal Sector, Slums and Squatter Settlements, Urban Environmental Issues: Urban Heat Island Effect, Solid Waste Pollution

Economic Geography

Introduction to Economic Geography, Approaches to the Study of Economic Geography, Classification of Economic Activities, Factors of Location of Economic Activities, Factors of Industrial location and Classification of Industries, Industrial Location Theories: Weber and Losch , Major Industrial Regions of the World, Iron and Steel Industry and Automobile Industry of the World, Liberalization, Privatization and Globalization and its impact on Indian Economy, Regional Disparities in the Levels of Economic Development, Market Linkages: Market Centers and E- Commerce, Recent Themes: Agglomeration Economies, Commodity Chain, Knowledge Economy, Green Economy, Special Economic Zones and Technological Parks

Regional Planning & Development

Concept of Region and its Attributes, Types of Regions, Approaches to Delineation of Region, Relevance of Regional Planning , Types of Planning: Sectoral & Spatial, Short Term & Long Term Planning, Concept of Multilevel Planning – Approaches, Regional Planning in India –History, Significance of Regional Planning in India, Achievements of Regional Planning in India, Macro, Meso and Micro Planning Regions of India, Concept of Growth & Development, Major components of Development, Indicators of Development, Human Development Index –Concept and construction

Fundamentals of Remote Sensing

Concepts and overview of Remote Sensing, EMS (Electro Magnetic Spectrum), Interaction of EMR with Atmosphere and earth's Surface ,Important Satellite Systems, LANDSAT & IRS, Sensors and Their Types, Resolution (Spatial, Spectral, Temporal and Radiometric), Aerial Photographs: Types and Characteristics, Geometry of Aerial Photographs, Elements of Visual Image Interpretation: Importance and Factors, Image Interpretation Keys, Digital Image Interpretation, Ground Truthing- Importance and Methods, Digital Image Processing, Geometric and Radiometric Corrections, Image Classification: (Supervised and Unsupervised), Image enhancement-contrast and Density Slicing

Fundamentals of GIS & GPS

GIS: Concept and Development, Components of GIS, Geospatial Data- Characteristics and types , Geospatial Database: Development and Organization , Data Structures in GIS-Raster and Vector, Spatial and non-spatial Data integration, Data Analysis (Overlay, proximity and buffer) , Applications of GIS in geographical studies (Land use /land cover and urban studies) Introduction to Global Positioning System (GPS) Development of GPS System: NAVSTAR and GLONASS, Global Navigation Satellite System (GNSS)

,Basics of Geodesy: Geoid, Datum and Ellipsoid. GPS Segments: Space, Control and User Fundamentals of GPS Positioning Sources of Errors and accuracy enhancement, Applications of GPS, Natural Resource, Land Surveying and urban planning

Cartography

Cartography-Definition and Scope, Maps – Definition, Essentials & Classification, Scale-Definition, Importance & ways of expression, Construction of Scales – Plain, Diagonal & Comparative, Cartographic Symbols: Types; Use of Point & area symbols to represent distribution & density of Population, Contours – Definition, Importance and Drawing of Contours, Representation of different types of Land forms – U shaped and V shaped valleys, conical hills, Plateau, Ridge and Slopes, Drawing of Profiles: Serial, Superimposed, Longitudinal and Composite, Line graph and Bar graph: Drawing of Simple and Compound Line and Bar graphs, Representation of Climatic Data: Climograph and Hythergraph

Quantitative Techniques in Geography

Data and its Sources, Measures of Central Tendencies: Mean, Median, Mode
Partition Value: Quartiles, Deciles and Percentiles, Measures of Dispersion: Range, Quartile Deviation, Mean Deviation, Measures of Skewness and Kurtosis, Correlation and its types: Karl Pearson and Spearman's rank correlation, Sampling and its Types.

Surveying

Field Survey: Introduction, Classification and Types, Plane table Survey- Accessories, Procedures and Precautions, Plane table Survey- Radiation and Intersection, Introduction to General Toposheet (relief, drainage, Settlements and Communication)

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M.A. History

Unit I: Ancient India

1. Sources: Archaeological and Literary
2. Paleolithic, Mesolithic, Neolithic and Chalcolithic cultures: Main Features
3. Indus Valley Civilization: Origin, Features and Decline
4. Vedic Ages: Polity, Society, Economy and Religion.
5. Rise of Magadha
6. Non-Conformist Movements: Buddhism and Jainism
7. Mauryan Empire: Polity, Economy, Society, Ashoka's Dhamma and Decline
8. India Between 200 BCE and 300 CE- Indo-Greeks, Sakas and Kushanas: Overview
9. Guptas: Polity, Economy and Decline
10. Harshavardhana: Administration
11. Early Medieval India-Polity, Economy and Society; Status of women

Unit II: Medieval India

1. Prominent Persian Sources of Sultanate Period
2. Foundation, Consolidation and Expansion of Delhi Sultanate; Focus on Role of Iltutmish, Balban and Alauddin Khilji
3. Administration under Sultans; Central and Provincial
4. Sources of Mughal India- Literary and Travel Accounts
5. Foundation and Expansion-Role of Babar and Humayun
6. The Sur Interlude: Contribution of Sher Shah Suri
7. Bakhti Movement: Main teachings
8. Sufi movement in India: Major orders
9. Consolidation of Mughal rule under Akbar-Mansabdari system and Religious policy
10. Administration Under Mughals: Central and Provincial
11. Aurangzeb's Deccan policy
12. Decline of Mughal Empire

Unit III: Modern India

1. Foundation of British rule in India: Importance of Battle of Plassey and Battle of Buxar
2. European penetration in India: Struggle for Hegemony
3. Expansion of British rule: Tools (Subsidiary Alliance and Doctrine of Lapse)
4. Revolt of 1857: Causes, Failure and Consequences
5. Colonial Economy: Land Revenue Settlements Drain of Wealth, and De- Industrialization
6. Foundation of Indian National Congress
7. Role of Moderates and Extremists.
8. Development of Modern Education: Macaulay's Minute and Wood's Despatch.
9. Socio-Religious Reform Movements: Brahmo Samaj, Aligarh Movement and Arya Samaj
10. Gandhian Era: Khilafat and Non-Cooperation Movement
11. Quit India Movement, Cripps Mission, Cabinet Mission Plan and Mountbatten Plan
12. Indian Constitution: Salient Features
13. Dalit Movement: Jyotibha Phule and Bhim Rao Ambedkar

Unit IV: History of Kashmir

1. Prehistoric Kashmir—Palaeolithic and Neolithic Cultures: Features
2. Kashmir's contacts with the neighbouring world (From earliest times up to 5^{th} Century CE).
3. Karkotas: Empire Building and Architecture
4. Utpalas: Economy and Temple Architecture

5. Loharas: A Brief account of Lohara rulers
6. Establishment of Sultanate; Developments under Shah Mir and Shihab ud Din
7. Contribution of Zain-ul-Abidin
8. Architecture under Sultans: Features
9. Kashmir under Chaks; Role of Yousuf Shah Chak
10. Mughal rule in Kashmir-Conquest-Changes in economy and architecture
11. Kashmir under Afghans-An assessment
12. Kashmir under Sikhs-An appraisal
13. Formation and Nature of Dogra State: Treaty of Amritsar
14. Role of British Residency
15. Foundation and Role of Muslim Conference; Formation of National Conference

Unit V: World History

1. Feudal Europe: An overview of main features
2. Geographical Explorations: Causes and Impact
3. Renaissance: Emergence and Significance
4. Reformation: Role of Martin Luther
5. Enlightenment: Main features
6. American Revolution: Causes and Significance
7. French Revolution: Causes and Significance
8. World War-I: Causes and Consequences
9. Rise of Fascism and Nazism: Causes
10. World War-II: Causes and Consequences
11. Formation and Role of UNO

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M.Sc. Information Technology

1. Computer Fundamentals & Operating Systems

Basic organization of computer, CPU, memory, input/output devices, Types of memory (RAM, ROM, cache), Number system (binary, decimal, basics), Operating system basics: Functions of OS, Types of OS (Windows, Linux, Unix), Process management (basic idea), Memory management (basic idea), File system

2. Programming Concepts & Data Structures

Basics of C/C++: variables, data types, operators, control statements (if, loops), functions (basic idea), arrays (1D basics), pointers (basic idea), Object Oriented Programming: class, object, inheritance, polymorphism (basic concepts), Introduction to data structures, Arrays (operations), Linked list (basic idea), Stack and Queue (operations), Searching (linear, binary), Sorting (bubble, selection – basic idea)

3. Database Management & Software Engineering

Data, database, DBMS concepts, Advantages of DBMS, Tables, records, fields, Keys (primary, foreign), SQL basics (SELECT, INSERT, DELETE), Normalization (basic idea), Software development life cycle (SDLC), Types of software, Software testing (basic idea)

4. Computer Networks & Cyber Security

Basics of networking, Types of networks (LAN, WAN, MAN), Internet basics, IP addressing (basic idea), Network devices (router, switch), OSI model (basic layer understanding), Cyber security basics, Virus and malware, Data protection, Safe use of internet and IT systems

5. Mathematics, Logical Reasoning & Computer Applications

Discrete mathematics basics (sets, relations, functions), Boolean algebra (basic logic), Probability (basic), Logical reasoning (series, coding-decoding, analytical thinking), Introduction to common computer applications, Basics of word processing (creating, editing documents), Basics of spreadsheets (simple calculations, tables), Basics of presentations (slides, text, images), Internet browsing and search techniques, Email basics (sending, receiving, attachments), Introduction to online services (forms, downloads, uploads), Use of computers in daily life (education, banking, communication), Basic troubleshooting (restart, checking connections, simple fixes)

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Masters in Computer Applications (MCA)

Note: Note: The MCA entrance exam syllabus typically covers four key areas: Mathematics, Analytical Ability & Logical Reasoning and Computer Awareness. This paper assess/evaluates fundamental computing knowledge and the general aptitude of the candidate.

Unit 1: Computing Mathematics

Set Theory, Boolean Algebra: Fundamental operations in Boolean Algebra, Logic, Arithmetic, geometric and harmonic progressions, binomial theorem, permutations and combinations, Graph Theory Fundamentals. Matrices: Determinants, Addition, Multiplication, Transpose, Inverse. Rank of a matrix and other basic operations.

Unit 2: Computer System Organization and Architecture

Representation of characters, integers, and fractions, binary, decimal, octal and hexadecimal representations and inter-conversions, Binary Arithmetic-Addition, subtraction, division, multiplication, One's complement arithmetic and two's complement arithmetic, floating point representation of numbers, normalized floating point representation. Concept of Adders, Subtractors, Counters, Flip Flops

Computer Architecture: Organization of CPU, Hardwired and Micro-programmed CU, Register Organization and Instruction formats. Instruction set- register transfer, arithmetic, logic and shift operations. Addressing modes. Memory Management, Associative Memory, cache memory, virtual memory, Introduction to 8086 instruction set.

Unit 3: Programming with C/C++

C-language fundamentals, Basic Constructs-l-oops, control statements, Arrays, Functions, Structures and Unions, Pointers, Files. Object Oriented Paradigm (OOPs), Classes, Objects, Abstraction, Polymorphism, Inheritance, Encapsulation, Constructors, Destructors, Inline and friend function, dynamic and static binding, virtual class, Virtual functions, Operator overloading and function overloading

Unit 4: Database Management System

Introduction, Database Vs File Systems, Database Users, DBMS- Basic Concepts and Terminology, Models and Architecture. Relational algebra and Relational DBMS. Normalization. Elements of Structured Query Language, Transaction Management, Concurrency control techniques, Recovery techniques, Different Types of Files like Sequential, Index based Files, etc.

Unit 5: Data Structures

Introduction, Algorithmic complexity, Stacks, Queues, linked Lists. Sorting and Searching Techniques: Quick Sort, Merge Sort, Heap Sort, Bubble sort, Selection sort, and Insertion sort. Linear and binary search algorithms. Trees and Graph terminology and representation in memory, binary tree, traversal techniques of graphs, Concept of Hashing and Hash Functions.

Unit 6: Operating Systems

Introduction, Operating System, Organization, Process Management, Inter process communications, Concept of Deadlocks, Prevention, Avoidance and Recovery, Memory Management, Physical and virtual address space; memory allocation strategies, Paging, Segmentation, Page replacement algorithms, File and I/O Management, Protection and Security, Disk Scheduling Algorithms

Unit 7: Data Communications and Computer Networks.

Introduction, Data Transmission concepts- Simplex, half Duplex, Full Duplex. Bandwidth and Channel Capacity. Analog and Digital signals. Transmission media- Twisted pair, coaxial cable, optical fiber, terrestrial and satellite communications.

Introduction to Computer Networks, Network Classification, Topologies, Networks Switching Techniques and Access Mechanisms, OSI and TCP/IP model. Network Layers: Physical Layer, Data Link Layer Functions and Protocol, Multiple Access Protocol and Networks, Networks Layer Functions and Protocols, Transport Layer Functions and Protocols, Overview of Application layer protocol.

Unit 8: Software Engineering

Introduction, SDLC, Phases of System Development Life cycle. Structured Analysis, Elements of Design, DFD, Process descriptions, Data dictionary. ER Diagram. System planning and Feasibility Analysis. Project Management – PERT and CPM. CASE Tools.

Concept and Nature of Software, Software Crisis, Software Engineering - Concept, Goals and Challenges, Software Engineering Approach; Software Development Process, Process Models - Waterfall Model, Evolutionary and Throwaway Prototyping Model, Incremental and Iterative Models, Spiral Model, Agile Process Model, Component based and Aspect Oriented development.

Unit 9: Logical Reasoning

Syllogisms, Statement and conclusions, Statement and arguments, Blood relations, Direction sense tests, Seating arrangement (linear and circular), Puzzles (based on arrangements, comparisons, etc.), Venn diagrams, Coding and decoding, Arithmetic number series

Unit 10: Sets, Relations and Functions and Calculus

Sets, Relations and Functions- Definition and types of sets, Operations on sets, Types of relations and functions, Domain, range, and codomain, Composite functions and inverse functions ,Calculus Limits and Continuity-Concept of limits and continuity of functions, Differentiation, application of derivatives, integration and differential equations

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M.Ed

Unit 1: Structure of Indian Education (NEP 2020)

- Foundational Stage
- Preparatory Stage
- Middle Stage
- Secondary Stage
- Higher Education

Unit 2: Philosophical and Ideological Foundations of Education

- Concept, Nature and Scope of Education
- Aims of Education: Individual & Social
- Interdisciplinary/Multidisciplinary Nature of Education
- Meaning and Branches of Philosophy
- Relationship between Education and Philosophy
- Idealism
- Pragmatism
- Existentialism
- John Dewy
- Froebel
- Rabindranath Tagore
- M. K. Gandhi

Unit 3: Sociological Foundations of Education

- Meaning, Nature and Scope of Sociology of Education
- Society and Types
- Education and Social Change
- Social Change and its Theories (Functionalist Theory and Conflict Theory)
- Social Mobility
- Culture and Education
- Cultural Lag

Unit 4: Psychological Foundations of Education

- Growth and development
- Learning Theories: Thorndike, Pavlov, Skinner
- Intelligence and IQ
- Theories and Tests of intelligence:
  - Two Factor Theory (Spearman)
  - Multi Factor Theory (Thorndike)
  - Group Factor Theory (Turnstone)
  - Simon - Binet Scale (Verbal Intelligence Test)
- Personality Theories: Type Theory, Trait Theory - G.W. Allport & Psycho-Analytical - Sigmund Freud

Unit 5: Historical Development of Indian Education

- Vedic, Buddhist & Muslim Education
- Macaulay's Minutes (1835)
- Woods Dispatch (1854)
- Hunter Commission (1882)
- Sargent Report (1944)
- University Education Commission (1948-49)

- Secondary Education Commission (1952-53)
- Indian Education Commission (1964-66)
- NPE (1986)

Unit 6: Inclusive Education

- Exceptionality
- Concept of impairment, disability & handicapped
- Types of Disabilities: Visual impairment, Hearing impairment & Mental retardation.
- Inclusive Education Principles
- Policies: National Policy for Persons with Disability 2006, PWD Act 2016, NEP 2020

Unit 7: Teacher Education

- Historical development of teacher education in India (Pre and Post-independence Commissions)
- National Curriculum Framework for Teacher Education (NCFTE, 2009)
- Micro Teaching: meaning, history, types, advantages and disadvantages
- Flanders' Interaction Analysis Model
- District Institute of Education and Training (DIET)
- State Council of Educational Research and Training (SCERT)
- National Council of Educational Research and Training (NCERT)
- National Council for Teacher Education (NCTE)

Unit 8: Guidance and Counselling

- Guidance, Meaning, Need and Importance
- Types of Guidance- Personal Educational, and Vocational
- Basic Principles of Guidance services
- Counseling, Meaning, Importance and Steps
- Types of Counselling-Directive and Non-directive
- Qualities and Qualifications of an effective counsellor
- Theories of Counselling: Psychoanalytic Theory, Behavioural Theory & Humanistic Theory

Unit 9: Educational Technology

- Educational Technology
- Teaching Aids
- Teaching Technology, Behavioural Technology and Instructional Technology.
- Hardware & Software approach of Educational Technology

Unit 10: Educational Measurement & Evaluation

- Meaning of measurement, assessment and evaluation
- Scales of Measurement: Nominal, Ordinal, Interval and Ratio
- Reliability and validity
- Formative and Summative Evaluation
- Continuous & Comprehensive CCE
- Choice Based Credit System (CBCS)
- Open Book Examination.

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M.Sc. Physics

Mechanics and Relativity

Inertial and Non-inertial frames, Fictitious forces, Conservative and Non-conservative Forces, Centre of mass for a system of particles, Motion of the center of mass, Kinetic energy, Linear

and angular momentum for a system of particles, Central forces, Coriolis force, Moment of inertia, Kepler's laws, Simple harmonic motion, Forced oscillations, Differential equation of wave motion, Plane progressive waves, Stationary waves, Phase and group velocities.

Special theory of relativity, Lorentz transformation, Velocity addition, Length contraction and time dilation, Mass-energy equivalence.

Electromagnetism and Optics

Gauss's law and Applications, Lorentz Force Law, Cyclotron Frequency, Divergence and Curl of **B**, Ampere's Law and applications, Electromagnetic Induction, Faraday's Law (Differential & Integral Form), The Induced **E** Field, Energy in Magnetic Fields, Amper's Law & Displacement Current, Maxwell Equations, Equation of Continuity.

Chromatic and spherical aberrations, Coma, Astigmatism, Curvature of the field, Distortion, Interference of light waves, Coherence, Newton's rings, Michelson's interferometer, Polarization of light waves, Brewster's law, Malus law, Double refraction, Quarter and half wave plates, Fraunhofer diffraction at two and N-slits, Diffraction grating, Grating spectrum, Rayleigh criterion of resolution, Resolving power of grating.

Thermal and Statistical Physics

Laws of thermodynamics, Heat capacities, Internal energy, Carnot cycle, Efficiency of reversible heat engine and refrigerator, Entropy, Enthalpy, Helmholtz and Gibb's functions, Maxwell's relations.

Macrostates and Microstates, Idea of ensemble, Maxwell-Boltzmann distribution, Partition Function, Thermodynamics of two-level system, Bose-Einstein and Fermi-Dirac statistics.

Mathematical Physics

Directional derivatives and normal derivative, Gradient of a scalar field, Divergence and curl of a vector field. Del and Laplacian operators, Vector identities, Ordinary integrals of vectors, multiple integrals, Line, Surface, Volume elements and integrals, Flux of a vector field, Gauss's divergence theorem, Stokes theorem.

Quantum Mechanics

Wave functions, Probability density, Operator Algebra, Heisenberg's uncertainty principle, Time dependent and independent Schrodinger equations, Stationary states, Continuity equation, Particle in a box, Potential step and barrier (tunnelling), Finite square well, Linear harmonic oscillator, Schrodinger equation in spherical coordinates, Orbital angular momentum operators and their commutation relations, Eigen values and eigen functions.

Electronics

Semiconductors, PN junction, Zener diode, BJT transistor, Amplifiers, Q-point, Stability factor, Feedback, Op-Amp and applications, Number systems, Logic gates, Truth tables,

Atomic Molecular and Laser Physics

Electronic configuration and atomic states, Spin-orbit interaction, Fine structure, Intensity rules for structure doublets, Selection rules, LS and jj coupling, Terms and levels Hund's rules, Zeeman effect. Basic principle and properties of laser, Ruby and He-Ne lasers.

Solid State Physics

Lattice, Basis, Unit cell, Bravais lattices, Common Crystal structures, Miller indices, Reciprocal lattice, Bragg law, Brillouin zones, Bonding in crystals, Lattice vibrations, Acoustical and optical modes, Dulong-Petit law, Einstein and Debye theories of specific heat, Electrical and thermal conductivities, Hall effect, Semiconductors, Magnetism and superconductivity.

Nuclear and Particle Physics

Nucleus: Constituents, Size, Charge and Mass, Mass defect and binding energy, Fission and fusion, Nuclear forces and their properties, Alpha, beta and gamma-decays, Photoelectric effect, Compton effect and pair production, Weizsacker's semi-empirical mass formula, Shell model. Basic interactions and their mediating quanta, Classification of particles, Fermions and Bosons, Leptons and Hadrons, Particles and antiparticles, Conservation rules in fundamental interactions.

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M.A. Political Science

Political Theory	**UNIT: I**	1. Political Science: Nature and Scope. What is Politics? (Politics as Art of Government; Politics as Power). 2. Approaches to the Study of Politics: (Philosophical Tradition; Empirical Tradition; Scientific/ Behavioral Tradition). 3. State: Evaluation and Elements; Difference between State, Civil Society and Nation. 4. Perspectives of State: Liberal, Marxist and Feminist. 5. Role of State: Minimal State and Social-Democratic State.
	UNIT: II	1. Liberty: Negative vs Positive. 2. Equality: Liberal, Libertarian and Socialist Perspective of Equality. 3. Justice: Procedural, Distributive and Gender Justice. 4. Democracy: Meaning and Forms- Procedural and Substantive. 5. Rights: Meaning and Theories of Rights- Natural, Human and Political Rights. 6. Power: Meaning and Conceptions: (Power and Legitimacy; Grounds of Political Obligation).
		1. **Plato** a. Ideal State b. Theory of Justice 2. **Aristotle** a. Moral Action and best Constitution; Citizenship. b. Classification of Government 3. **Augustine and Thomas Aquinas** a. Christian Political Thought in Middle Ages. 4. **Machiavelli**

Western Political Thought	**UNIT: III**	a. Humanism and Republicanism
	UNIT: IV	5. **Thomas Hobbes** a. State of Nature and Social Contract b. Theory of Sovereignty 6. **John Locke** a. State of Nature and Social Contract b. Concept of Natural Rights c. Liberal Limits on Government 7. **J.J Rousseau** a. State of Nature and Social Contract b. Concept of General will
	UNIT: V	8. **Jeremy Bentham and John Stuart Mill** a. Utilitarianism b. Concept of Liberty c. Representative Government 9. **Karl Marx** a. The State and Class Struggle. b. Concept of Historical Materialism 10. **A. Gramsci and J. Rawls** a. Hegemony and Civil Society b. Liberal Egalitarian Theory of Justice.
Comparative Politics	**Unit: VI**	1. The nature, scope and methods of Comparative Political Analysis 2. Systems and Structural and Functional Approach 3. Political Culture and Political Socialization 4. Classification of political systems: Parliamentary and Presidential: UK and USA.
	UNIT: VII	1. Constitution as a Framework of Governance. 2. Functions of Organs of Govt: Legislature, Executive and Judiciary (Comparative Analysis). 3. Electoral System: First Past the Post System, Proportional Representation and Mixed Systems. 4. Party system: One-Party Two-Party and Multi-Party System: Comparison of Party System in India, US, UK and China.
	UNIT: VIII	1. India's Foreign Policy a. Basic determinants b. India and Non alignment c. India as an emerging power 2. Second World War and Origins of Cold War; Phases of Cold War 3. Collapse of Soviet Union and Post-Cold War Era. 4. Emerging Centers of power in post-Cold War Era. (European Union, China, Japan).

International Relations	**UNIT: IX**	1. Classical Realism (Hans J. Morgenthau) and Neo-Realism (Kenneth Waltz); Neo- liberalism/complex interdependence – Robert O, Keohane, Joseph Nye 2. Democratic Peace Theory (Doyle) 3. International Political Economy Approach (Robert Giplin) 4. Feminist Perspective of IR (Cynthia Enloe) 5. Dependency Theory and Neo-colonialism
Indian Political Thought	**UNIT: X**	1. Modern Indian Political Thought: Salient Feature 2. **Raja Ram Mohan Roy:** Social Reforms 3. **Mahatma Gandhi:** Swaraj and Critique of Modernity 4. **Maulana Azad:** Composite Nationalism 5. **B.R. Ambedkar:** Annihilation of Caste 6. **J. Nehru:** Democratic Socialism 7. **M.N Roy:** Radical Humanism
Public Administration	**UNIT XI**	1. Public Administration as a Discipline: Public and Private Administration; Comparative Approach to Public Administration 2. Principles of Organization; Line, Staff and Auxiliary agencies. 3. Approaches to Public Administration: Ecological Approach (Riggs); Systems Approach (Chester Bernard); Decision Making Approach (Herbert Simon).
	UNIT XII	1. Indian Bureaucracy: Continuity and Change. 2. Impact of Liberalization, Privatization and Globalization on Indian Administration. 3. Good Governance Initiative in India. 4. Public Administration in Developing and Developed States: Comparative Analysis.
Indian Constitution and Politics	**UNIT XIII**	1. Constituent Assembly of India: Formation and Working. 2. Basic Features of Indian Constitution. 3. Fundamental Rights and Directive Principles of State Policy. 4. Union Legislature: Structure and Powers. 5. Union Executive: Structure and Powers
	UNIT XIV	1. Union Judiciary: Powers and Functions of Supreme Court, Judicial Review, Judicial; Activism, Public Interest Litigation. 2. Indian Federalism; Nature and emerging issues. 3. Election Commission; Composition and Powers. 4. Decentralization (73rd and 74th Amendments). 5. Party System; changing nature. 6. Critical Issues in Indian Politics: Religion; Region; Caste; Development

J&K Politics	**UNIT XV**	1. Formation of Jammu and Kashmir State; Emergence of All Jammu and Kashmir Muslim Conference; National Conference; Jammu Praja Parishad. 2. Instrument of Accession; Land Reforms in Jammu and Kashmir. 3. Electoral Politics in J&K and UT Administration. 4. Local Self Government in Jammu and Kashmir. 5. Incorporation, Erosion and Abrogation of Article 370; Jammu and Kashmir State Re-organization Act 2019.

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M.Sc. Zoology

UNIT 1. ANIMAL DIVERSITY: NON-CHORDATES

General characters and classification up to class level of Protozoa, Porifera, Coelenterate, Platyhelminthes, Nematoda, Annelida, Arthropoda, Mollusca & Echinodermata. Locomotion in Protozoa. Canal system in Porifera. Parasitic adaptations in Helminths. Metamerism in Annelida, Vision in insects & insect metamorphosis. Torsion in gastropods. Water vascular system in Echinodermata.

UNIT 2. ANIMAL DIVERSITY: CHORDATA

General characters and classification of protochordates & Chordates. General characters and classification of Pisces, amphibians, reptiles, Aves and mammals up to order level. Osmoregulation in fishes. Parental care in amphibians. Characters of poisonous and non-poisonous snakes. Flight adaptations in birds. Adaptive radiation in mammals.

UNIT 3. COMPARATIVE ANATOMY OF VERTEBRATES

Comparative structure of integument, dermal and epidermal derivatives: Glands, scales, horns, Antlers. Comparative account of gastrointestinal tract and its associated glands. Teeth: Structure & types; dental formula in Mammals. Structure and types of gills in vertebrates, comparative account of lungs; air sacs in birds. Evolution of Heart and aortic arches, Evolution of kidney and urinogenital ducts. Comparative account of brain, Receptor organs: Eye & Ear. Structural organization of Endocrine glands. General structure of different types of muscles.

UNIT 4. COMPARATIVE PHYSIOLOGY OF VERTEBRATES

Physiology of digestion & absorption, Neuro-hormonal control of digestion. Excretory wastes & osmoregulation. Urine formation & regulation. Mechanism of respiration; respiratory pigments. Transport of respiratory gases, oxygen dissociation curve. Cardiac cycle; origin and conduction of heart beat, formation and composition of blood, blood coagulation. Conduction of nerve impulse; Synapse and its types, Neuromuscular junction. Physiology of muscle contraction. Hormones: nature, functions and mode of action.

UNIT 5. FUNDAMENTALS OF IMMUNOLOGY

Historical background & scope of immunology. Cells, tissues and organs of immune system. Innate and acquired immunity, Vaccination. Antigens: nature & properties, Haptens, Adjuvants, Antibodies: structure, types & functions, production and applications of monoclonal antibodies. Antigen-antibody interaction MHC: structure &

types, Exogenous and Endogenous pathways of antigen processing and presentation, Complement system: components & pathways, Cytokines: types, properties and functions. Primary & Secondary immunodeficiency: SCID and AIDS; Autoimmunity: Autoimmune Anemia, Lupus and Arthritis. Hypersensitivity: Concept & classification, Mechanism of type I & type II hypersensitivity reactions, Transplantation immunology: mechanism of homograft rejection.

UNIT 6. FUNDAMENTALS OF PARASITOLOGY

Animal associations with special emphasis on parasitism; terms & definitions in parasitology. Origin, evolution and distribution of parasites in animal kingdom; parasitic adaptations. Host parasite relationships. Zoonosis: definitions & types. Protozoan parasites of man with emphasis on *Entamoeba* & *Plasmodium*. Trematode parasites of man with emphasis on *Schistosoma* & *Paragonimus.* Cestode parasites of man with emphasis on *Taenia* & *Diphyllobothrium.* Nematode parasites of man with emphasis on *Ascaris* & *Ancylostoma.* Protozoan parasites of poultry (*Eimeria*) & cattle (*Babesia*). Trematode parasites of fish (*Diplozoon*) & ruminants (*Fasciola*). Cestode parasites of fish (*Adenoscolex*) & ruminants (*Moneizia*). Nematode parasites of Aves (*Heterakis*) & ruminants (*Haemonchus*). Introduction to phyto-nematodes with emphasis on their ecology & biology. Morphology, Life-cycle, pathogenicity and management of *Meloidogyne*. General account and distinguished features of acanthocephalans. Acanthocephalan parasites of fish (*Pomphorhynchus).*

UNIT 7. ANIMAL ECOLOGY

Ecosystem structure and function. Ecosystems types: forest, grassland, freshwater and marine. Energy flow and mineral cycling (CNP), Food chain, food web and Ecological pyramids. Life history strategies: r and k selection, characteristics of population: natality, mortality, density, dispersion and growth curves, Age structure, Population regulation: extrinsic and intrinsic factors. Community structure and characteristics, Biotic interactions: intra-specific & inter-specific. Ecological succession: types & mechanisms, levels of species diversity and measurement.

UNIT 8. CELL & MOLECULAR BIOLOGY

Cell structure and function, Fluid-Mosaic model, Membrane transport, Structure and function: nucleus, mitochondria, ribosomes, Endoplasmic reticulum, Golgi complex, Microtubules and microfilaments. Cell division & Cell cycle: mitosis and meiosis, their regulation. Cell signalling, Signal transduction pathways: MAP kinase and JAK/STAT pathways. Apoptosis and cell renewal, characteristics of transformed cells. DNA: structure and replication, RNA and its types, Transcription, post transcriptional modification in eukaryotes and translation in Prokaryotes and Eukaryotes, Genetic code, Lac operon.

UNIT 9. FUNDAMENTALS OF ENTOMOLOGY

Insects: Characteristics and Classification up to order level, Structure and composition of integument. Structure of head, thorax and abdomen. Mouth parts: adaptations to different feeding habits. Insect anatomy: digestive, respiratory, reproductive and neuro-endocrine systems. Social behaviour and caste system in Ants and Honey bee, insect hormones: types, biological effect and applications, metamorphosis in insects and its hormonal control, bioluminescence: light producing organs, mechanism and significance of light production in insects. Effect of high-altitude environment on morphology, physiology and

development of insects, effect of temperature, humidity and light on the activities of insects, insect population dynamics, insect-plant interaction.

UNIT 10. ANIMAL BEHAVIOUR

Food selection and optimal foraging theory, home range, territoriality, dispersal & habitat selection. Genetic and environmental components in the development of behavior. Neural basis of behaviour: stimulus filtering & biological rhythms. Social organization in insects. Social behaviour in primates. Parental care in fishes. Communication in animals: auditory, visual, chemical and tactile. Courtship and mating behaviour. Learning behaviour in vertebrates, biological rhythms.

UNIT 11. PRINCIPLES OF ANIMAL GENETICS

Mendelian laws of inheritance, Co-dominance and pseudo-dominance, Concept of gene: allele, multiple alleles, pseudo-alleles & lethal alleles. Sex determination and dosage compensation in mammals, Gene interactions: complementary and supplementary genes, Pleiotropy. Chromatin organization: structural and numerical alterations of chromosomes, Gene mutation and disorders, crossing-over and gene recombination, Linkage & Linkage maps, Gene pool and allelic frequency in populations, Ecological genetics & polymorphism - phenotypic & genotypic polymorphisms, Genetic drift & genetic equilibrium, Hardy-Weinberg law & its applications Gene cloning: an overview. Restriction endonucleases: types & modification enzymes. PCR & gel electrophoresis. Vectors: plasmid & Cosmid; gene library.

UNIT 12. FUNDAMENTALS OF ICHTHYOLOGY

General charters of fishes, Outline classification of fishes up to order level. Structure, types and modification of scales & fins. Bioluminescence in fishes. Digestive system and physiology of digestion. Structure and function of gills; Accessory respiratory organs; Swim bladder. Structure and function of heart and blood vessels. Physiology of Excretion and Osmoregulation. Structure and function of nervous system, lateral line system in fishes, Reproduction and fecundity. Fish adaptations, Hill stream and deep-sea fishes.

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Integrated B.Ed – M.Ed

UNIT I: General Awareness

- Current Affairs
- National and International Events
- Important Days and Awards

UNIT II: Indian Constitution and Governance

- Structure of Government
- Fundamental Rights and Duties
- Democracy and Elections
- Public Welfare Schemes

UNIT III: Reasoning and Mental Ability

- Series Completion
- Coding-Decoding
- Relationship Tests
- Analytical Reasoning

UNIT IV: Language and Communication

- Reading Comprehension
- Antonyms / Synonyms
- One Word Substitution
- Articles and Narration

UNIT V: Environmental Education

- Eco system
- Pollution and its kinds
- Protection of natural resources
- Environmental Protection Act
- Sustainable Development Goals

UNIT VI: Information Technology and Digital Awareness

- Basics of Computers
- Internet and Email
- Online Learning Platforms
- Cyber Safety Basics

UNIT VII: Growth and Development

- Determinants of Growth and Development (Heredity and Environment)
- Childhood
- Adolescence
- Old age
- Areas of Development: Physical, Cognitive, Social & Emotional

UNIT VIII: Educational Policies and Provisions

- NPE (1986)
- NCF (2005)
- SSA, RMSA, RUSA
- NEP (2020)
- RTE, 2009

UNIT IX: Educational Organisations

- DIET
- SCERT
- NCERT
- NCTE

UNIT X: Issues and Problems

- Unemployment
- Brain Drain
- Drug Addiction
- Child Labour and Child Abuse
- Poverty and Illiteracy
- Corruption
- Gender Discrimination

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M.Com.

Unit I: Fundamentals of Accounting

Accounting concepts and Conventions, Preparations of Day Book, Ledgers & Subsidiary Books and Trial Balance, Depreciation and its Methods, Inventory Valuation. Partnership Deed, Fluctuating and Fixed Capital Accounts, Provisions applicable on Admission and Retirement of partner, Accounting Treatment and Computation of Goodwill, Dissolution of Partnership. Preparation of Final accounts Profit and Loss Account and Balance sheet of non-trading concerns.

Unit II: Financial Analysis

Financial statement Analysis: Meaning, significance and Objectives. Tools of Analysis - comparative statements and Common size statements. Ratio Analysis: Concept and significance of Ratio Analysis, Liquidity Ratios, Solvency Ratios, Profitability Ratios, Activity Ratios and Leverage Ratios.

Unit III: Corporate Accounting

Concept and Types of companies, Issuance of Shares at par, premium and discount. Oversubscription and pro-rata allotment. Forfeiture and Reissue of Shares, Transfer to Capital Reserve. Debentures: Concept and types of debentures, issue at par, premium and discount. Redemption of debentures Lump sum method, Instalment method and purchase in open market. Final Accounts of Corporates, Income Statement and Balance Sheet as per schedule III of Co's Act 2013. Cash Flow statement: Classification of cash flows from Operating activities, Financing activities, and Investing Activities. Treatment of Depreciation, change in working capital, issue & redemption of shares and debentures.

Unit IV: Cost Accounting

Nature and scope of cost accounting, Cost and Financial accounting, Cost classification Fixed & Variable, Direct & Indirect, Product & Period, Implicit & Explicit cost. Elements of cost Material cost, Labour cost and Overheads. Determination of Prime cost, Factory cost, Cost of production and Cost of Sales.

Unit V: Income Tax Law and Practice

Meaning and purpose of Taxation, Cannons of taxation, Direct and indirect taxes, Assessee, Assessment year, Previous year, Tax Year, Agricultural Income, Person, Scope of total Income, Residential Status. Income under head Salary: Basis of charge, salary components – basic pay,

allowances, perquisites. Income under head House property: Gross Annual Value, Self Occupied & Let-out property, Interest on Housing loan, Unrealized Rent, Vacancy Loss. Income under head PGBP: Meaning and scope, Basic admissible and inadmissible expenses, General principles of computation (basic level). Income under head Capital Gain: Capital Asset, Transfer, Short Term Capital Gain and Long Tern Capital Gain. Income from other sources: Interest income, Dividend income, Casual incomes – winning from horse race, online gaming etc. Deductions under section 80C, 80D, 80E.

Unit VI: Indian Financial System

Nature and structure of Indian financial system, Financial Dualism, Components of Financial system. Financial Markets: Meaning and classification, Money market – Features, Primary and secondary segment, Functions. Capital Market – Features, primary and secondary segment of capital market. Financial Institutions: Meaning and classification, Banking Institutions and Non-banking. Financial Instruments: Money market instruments – Treasury Bills, Commercial paper, Certificates of Deposit, Call Money. Capital Market Instruments: Government Securities, Equity shares, Preference shares, Debentures and Bonds. Financial Services: Meaning and Types, Merchant Banking, Leasing, Factoring and Forfaiting, Credit Rating.

Unit VII: Financial Management

Nature and scope of financial management, Profit maximization and Wealth maximization, Conflict of interest. Time value of Money: Concept and reasons for time value of money, Compounding techniques (Future Value) – Lumpsum, Annuity and uneven cash flows, Discounting Techniques (Present Value) – Lumpsum, Annuity and Uneven cash flows. Discounting and Compounding factors. Risk and Return: Meaning of risk and return, systematic and unsystematic risks, Risk return trade-off.

Unit VIII: General Management

Meaning and nature of management, Management levels, Managerial roles and skills. Management thoughts: Classical Theories – Scientific Management, Administrative Theory. Neo-Classical Theories – Human Relations Approach, Hawthrone Experiments. Modern Theories – Behavioral Science Approach. Management Functions: Planning – Planning process, Types of plans and Decision making, Organizing – Principles, Organizational Structure. Staffing – Human resource planning, Recruitment and selection. Directing – Meaning and Elements, Motivation theories (Maslow and Herzberg), and Communication process and barriers. Controlling – Controlling process, Techniques of control.

Unit IX: Business Economics

Meaning of Business economics, Positive and Normative Economics, Micro and Macro Economics, Role of business economics in decision making. Demand Analysis: Concept of Utility, Law of Diminishing Marginal Utility, Law of Demand, Demand Elasticity, Price, Income and Cross Elasticity. Indifference Curve: Meaning and assumptions, Properties of Indifference Curve, and Consumer equilibrium. Market Structures: Concept of market and classification, Perfect markets features. Imperfect Maret, Monopoly, Monopolistic, and Oligopoly. National Income: Concept of Gross Domestic Product (GDP), Gross National Product (GNP), Net Domestic Product (NDP), Net National Product (NNP), Per Capita Income (PCI). Measurement of National Income: Value Added Method, Income Method, and Expenditure Method.

Unit X: Business Statistics

Measures of Central Tendency: Arithmetic Mean, Simple and Weighted Mean, Median, Mode, and Geometric Mean. Measures of Dispersion: Range, Quartile Deviation, Mean Deviation, Variance, and Standard Deviation. Skewness: Symmetric and Asymmetric distributions, Measures of skewness Karl Pearson's Coefficient. Correlation & Regression: Karl Pearson and Spearman's Rank Correlation, Interpretation of Correlation coefficients. Regression equation X on Y and Yon X, Regression Coefficients, Relationship between correlation and regression.

M.A. Music

PG Entrance Syllabus 2026

Unit Number	Unit Name	Sub Topics
1	Ragas	Bilawal, Alhaiya Bilawal, Bhairav, Kafi, Yaman, Khamaj, Asawari, Bhupali, Brindabani Sarang, Malkauns, Bihag, Bhimpalasi, Bageshri, Des, Jaijaiwanti, Ramkali, Kedar, Kamod
2	Talas	Dadra, Keharwa, Rupak, Teevra, Jhaptal, Sultal, Ektal, Chautal, Teental, Tilwada, Dhamar, Jhumra, Ada Chautal
3	Basic Musical Terms	Nad, Shruti, Swara, Thaat, Vadi, Samvadi, Anuvadi, Vivadi, Jati, Varna, Alankar, Sthayi, Gamak, Meend, Kan, Krintan, Soot, Zamzama, Ghaseet, Kaku, Avirbhav, Tirobhav
4	Physics of Sound	Pitch, Intensity, Timbre, Harmony, Melody
5	Musical Forms	Dhrupad, Dhamar, Khayal, Tarana, Tappa, Chaturang, Thumri
6	Instrumental Music	Masitkhani Gat, Razakhani Gat, Alap, Jhala
7	Tala Theory	Tala (meaning), Avartan, Matra, Tali, Khali, Sam, Vibhag, Das Pranas of Tala
8	Texts	Natya Shastra, Brihaddeshi, Sangeet Makarand, Sangeet Ratnakar, Swarmel Kalanidhi, Raga Tarangini, Sangeet Parijat, Chaturdandi Prakashika
9	Musicians	Tansen, Amir Khusru, Jaidev, Man Singh Tomar, V.N. Bhatkhande, V.D. Paluskar, S.N. Ratanjankar, Omkarnath Thakur, Bade Ghulam Ali Khan, Abdul Karim Khan, Allaudin Khan, Mushtaq Ali Khan
10	Classification of Instruments	Tat, Avanaddha, Ghana, Sushir
11	Instruments (Study & Tuning)	Sitar, Tanpura, Tabla
12	Classification of Ragas	Raga-Ragini, Thaat-Raga, Time Theory of Ragas
13	Notation Systems	Bhatkhande Notation, Paluskar Notation, Staff Notation (basic)
14	Gharana System	Meaning and importance, Gwalior, Agra, Delhi, Kirana, Jaipur, Patiala