Office of Dean Academic Affairs
Cluster University Srinagar
Gogji-Bagh, Srinagar-190008
UT-Jammu & Kashmir (India)

Email address: - dean.aa@cusrinagar.edu.in

Notification

Consequent upon the approval of the competent authority, it is notified for the information of all concerned that the Hon'ble Vice Chancellor has been pleased to authorize the adoption of the Syllabi for Entrance Test of Ph.D. Programmes 2025-26, notified vide Admission Notification No.: 07-CUS of 2025; Dated: 29-08-2025 of Cluster University Srinagar.

The syllabi of Entrance Test of Ph.D. Programmes is available as annexure to this notice on the University website (https://www.cusrinagar.edu.in)

22/10/2025

Prof. (Dr.) Nazir Ahmad Simnani
Dean Academic Affairs

No: CUS/DAA/ 1011-28 /2025 Dated: 22.10.2025

Copy for information and necessary action:

1. Registrar, Cluster University of Srinagar
2. Controller Examinations, Cluster University of Srinagar
3. Principals of all Constituent and Affiliated Colleges, Cluster University of Srinagar
4. Dean of all Faculties, Cluster University of Srinagar;
5. Assistant Registrar, Cluster University Srinagar
6. PRO to Vice Chancellor for information of Hon'ble Vice Chancellor
7. In-charge IT for uploading of notification on university website.
8. Office file.

Cluster University of Srinagar

Ph.D. Entrance Test Syllabus

Paper: Research Methodology

Note: The syllabus will be common to all subjects.

Unit 1: Foundations of Research

1. Research: Meaning, Objectives, Scope, and Characteristics.
2. Significance of Research – Objectivity, verifiability, replicability, etc.
3. Types of Research – Basic, applied, action, descriptive, analytical, exploratory, and experimental.
4. Research Paradigms – Positivist, interpretivist, constructivist, critical theory.
5. Criteria of Good Research – Reliability, validity, generalizability.
6. Ethics in Research – Plagiarism, informed consent, data privacy, authorship norms.

Unit 2: Research Problem and Design

1. Identifying and Formulating Research Problems – Sources of problems, narrowing down a topic.
2. Hypothesis: Nature and Types – Null, alternative, directional, non-directional.
3. Variables and Constructs – Independent, dependent, moderating, control.
4. Research Design – Concept, importance, and types (qualitative, quantitative, mixed).
5. Sampling Methods – Random, stratified, purposive, snowball, etc.
6. Errors in Research – Sampling error, measurement error, non-response error.

Unit 3: Data Collection and Measurement

1. Types and Sources of Data – Distinction between primary vs. secondary data; sources like surveys, census, archives.
2. Methods of Data Collection – Questionnaire, interviews, observation, focus groups.
3. Measurement Scales – Nominal, ordinal, interval, and ratio.
4. Reliability and Validity – Ensuring accuracy and consistency of instruments.
5. Secondary Data Use and Evaluation – Authenticity, relevance, and limitations.
6. Qualitative vs. Quantitative Data Collection – Comparative strengths and applications.

Unit 4: Data Analysis and Interpretation

1. Data Processing: Editing, Coding, Tabulation
2. Descriptive Statistics: Mean, Median, Mode, Standard Deviation
3. Inferential Statistics: t-test, Chi-square, ANOVA (Basics Only)
4. Correlation and Regression (Introduction Only)
5. Use of Software in Data Analysis: SPSS, Excel, R (Introductory Overview)
6. Interpretation of Data and Drawing Conclusions

Unit 5: Research Communication and Aptitude

1. Structure of Research Reports and Theses – Components: introduction, literature review, methods, results, discussion.

2. Referencing and Citation Styles – APA, MLA, Chicago; bibliography vs. references.
3. Plagiarism and Academic Integrity – Definitions, tools for detection, penalties.
4. Use of ICT in Research – Online libraries, reference managers (Zotero, Mendeley), databases.
5. Analytical and Logical Reasoning – Arguments, assumptions, deductions.
6. Reading Comprehension and Interpretation – Extracting meaning, critical analysis of texts.

Department of BiochemIstry
CLUSTER UNIVERSITY SRINAGAR
Gogji-Bagh, Srinagar-190008

Syllabus
for
Ph.D. Entrance Test
Subject: Biochemistry
Academic Session 2025-2026

Subjects covered under Life Sciences include: Microbiology, Biochemistry, Molecular Biology, Cell Biology, Physiology, Genetics, Human Nutrition, Biotechnology, Bioinformatics, Biophysics, Immunology, Pharmacology, Zoology, Botany, Veterinary Science, Environmental Sciences, and Public Health

Unit 1: Foundations of Biological Chemistry

- 1.1 Basic Principles:
  - Chemical bonds (covalent, ionic, hydrogen, hydrophobic interactions)
  - Acids, bases, pH, and buffers
  - Thermodynamics in biological systems
- 1.2 Biomolecules:
  - Structure, composition, and properties of carbohydrates, lipids, proteins, nucleic acids, vitamins and coenzymes
  - Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds)
  - Enzymology: Enzyme kinetics, inhibition, regulation, coenzymes, isozymes, allosteric enzymes, and industrial enzymes.
- 1.3 **Human Nutrition**:
  - Macronutrients and micronutrients, nutritional disorders, diet planning, antioxidants.
- **1.4 Plant and Animal life**:
  - Plant physiology (photosynthesis, respiration, plant hormones), stress biology. Animal physiology, behavior, developmental biology.

Unit 2: Metabolism and Intermediary Biochemistry

- 2.1 Bioenergetics:

- Glycolysis, Oxidative phosphorylation, coupled reactions, and the electron transport system for ATP production.

- 2.2 Macromolecule Metabolism:
  - Carbohydrate metabolism: Glycolysis, TCA cycle, and pentose phosphate pathway.
  - Lipid metabolism: (β-oxidation, fatty acid biosynthesis, ketogenesis).
  - Amino acid metabolism, nitrogen cycle, and urea cycle.

Unit 3: Cellular Organization

- 3.1 Cell Structure and Function:
  - Structure and function of prokaryotic and eukaryotic cell wall and cell membrane
  - Structural organization and function of intracellular organelles
  - Organization of genes and chromosomes
  - Cell cycle and cell division
- 3.2 Microbiology physiology and Immunology
  - Classification and structure of bacteria, viruses, fungi, and protozoa. Microbial Growth, Culture techniques, quorum Sensing,
  - Innate and adaptive immunity, antigen presentation, MHC, antibodies, complement system. hypersensitivity, autoimmunity

Unit 4: Fundamental of Genetics and Molecular Biology

- 4.1 Chromosomal inheritance and Genetic Analysis
  - Principles of Mendelian inheritance, codominance, incomplete dominance, penetrance and expressivity
  - Allele, multiple alleles, pseudoallele, complementation tests; Mutation types, causes and detection
  - Gene transfer in bacteria: transformation, conjugation, transduction, sex-duction
- 4.2 Molecular Genetics:
  - DNA replication, repair, and recombination
  - RNA synthesis and processing (transcription, translation, post-transcriptional and post-translational modifications)
  - Gene expression regulation in prokaryotes and eukaryotes

Unit 5: Biotechnology, Bioinformatics, Biophysics & Instrumentation

- 5.1 Biotechnology:
  - Restriction enzymes, various cloning vectors, DNA sequencing, PCR, oligonucleotide synthesis, genetic engineering, CRISPR-Cas, industrial and environmental biotechnology.

- 5.2 Bioinformatics**:**
  - Sequence alignment, genome annotation, databases (NCBI, KEGG, PDB), protein structure prediction, molecular docking.
- 5.3 Biophysics**:**
  - Biomolecular interactions, thermodynamics, spectroscopic techniques (UV, IR, CD, NMR, Fluorescence), X-ray crystallography.
- 5.4 Instrumentation**:**
  - Principles and applications of centrifugation, electrophoresis, chromatography (HPLC, GC), mass spectrometry, microscopy (light, electron, confocal).

CLUSTER UNIVERSITY SRINAGAR
Gogji-Bagh, Srinagar-190008
Syllabus for Ph.D. Entrance Test
Subject: Botany
Academic Session: 2025-2026

UNIT-1 **10 Marks**

Eubacteria and Archaebacteria: Ultrastructure, growth, nutrition, reproduction, ecological and economic importance of bacteria. Structural differences of archaebacteria with eubacteria and eukaryotes. Methanogens, halophiles, thermophiles archaebacteria and their evolutionary significance.

Cyanobacteria: Salient features. *Anabaena, Nostoc*. Cyanobacterial symbiosis. endosymbiotic evolution. Biological and ecological importance.

Fungi: General characteristics. Cell wall composition. Heterothallism. Nutrition (saprobic and biotrophic). Structural diversity and mode of reproduction in Mastigomycotina *(Albugo),* Zygomycotina *(Rhizopus, Mucor),* Ascomycotina *(Morchella),* Basidiomycotina *(Puccinia, Agaricus),* and Deuteromycotina *(Fusarium, Colletotrichum).* Mycorrhizae-types and ecological role. Fungi as a source of food and medicine.

UNIT-2 **10 Marks**

Plant Pathology: Koch's postulates. Integrated pest management. Symptoms and control of plant diseases: Fungal diseases (Apple scab, Damping off of seedlings). Bacterial diseases (Citrus canker). Viral and viroid diseases (Tabacco mosaic). Nematode diseases (Root not disease). Mycoplasma diseases (Sandal spike).

Algae: General Characters. Habitats. Thallus organization. Reproduction (vegetative, asexual, sexual). Life-cycles. Salient features: Chlorophyta (*Ulothrix*), Charophyta *(Chara),* Xanthophyta *(Vaucheria),* Bacillariophyta *(Navicula),* Phaeophyta *(Fucus) and* Rhodophyta *(Batrachospermum).* Economic importance.

Bryophytes: General characteristics. Evolution of gametophyte and sporophyte. Morphology, anatomy and reproduction: *Marchantia, Anthoceros* and *Funaria.* Economic importance.

UNIT-3 **10 Marks**

Pteridophytes: General characteristics. Morphology, anatomy and reproduction: *Psilotum*, *Lycopodium*, *Selaginella, Equisetum* and *Dryopteris*. Heterospory and seed habit. Telome theory. Stelar system. Ecological and economic importance.

Gymnosperms: General characteristics. Diversity, morphology, anatomy and reproduction of *Cycas*, *Pinus* and *Gnetum*. Gymnosperms of Jammu & Kashmir. Ecological and economic importance.

Angiosperms growth, development and reproduction: General characters of angiosperms. Monocots and dicots. Secondary growth in dicots. Organization of shoot and root apical meristem. ABC Model of flower development. Development of male and female gametophyte. Types of ovules. Pollination mechanisms. Double Fertilization. Self-incompatibility types. Endosperm, polyembryony and apomixis. Seed dormancy. Ecological and economic importance.

UNIT-4 **10 Marks**

Taxonomy of Angiosperms: Concept of artificial, natural and phylogenetic system of classifications. Taxonomic hierarchies. Botanical gardens and herbaria of India. Botanical Survey of India. ICN Principles. Melbourne and Shenzhen code. Typification. Basionyms, synonyms, homonyms, autonyms and tautonyms.

Plant Physiology: Mechanisms of electron transport in photosynthesis. C3, C4 and CAM pathways. Photorespiration. Biological nitrogen fixation. Plant hormones (Auxins, Gibberellins, Cytokinin, Ethylene, Abscisic acid, Brassinosteroids, Polyamines, Jasmonic acid and Salicylic acid). Uptake, transport and translocation of water, ions and solutes, through xylem and phloem. Transpiration. Mechanisms of loading and unloading of photoassimilates. Role of photoperiodism and vernalization in flowering.

Cell and Molecular Biology: Structural difference in cell wall of bacteria, fungi, and plants. Structure, function and organization of membrane, chloroplasts, mitochondria and nucleus. Meiosis and mitosis. Central Dogma. Replication: Mechanisms and enzymes involved in replication of prokaryotes and eukaryotes. Meselson-Stahl experiment. Transcription: Process of RNA synthesis, role of RNA polymerase and promoters. Translation: Protein synthesis, role of ribosomes, mRNA and tRNA.

UNIT-5 **10 Marks**

Instrumentation and Techniques: Principles of Microscopy. Light Microscopes (Compound, Phase-Contrast, Fluorescence). Electron Microscope (SEM, TEM). PCR. Thermal cycler. Taq DNA polymerase. Primers. Gel electrophoresis. UV-transilluminator. Gene cloning. Cloning vectors (plasmid (Ti-plasmid), phage, cosmid, BAC and YAC). Restriction endonuclease.

Ligase. Plant Tissue Culture: Explant. Totipotency. Callus. Somatic embryogenesis. Protoplast fusion. Hybrids versus Cybrids, Micropropagation, Somaclonal variation and Germplasm Conservation.

Inheritance Biology: Mendel's laws; Dominance. Segregation and Independent assortment. Codominance and incomplete dominance. Gene interactions and epistasis. Complementary inheritance: Variation in Four o'clock plant (*Mirabilis jalapa*). Crossing Over. Homologous recombination and non-homologous recombination. Allele and genotype frequencies. Hardy-Weinberg principle.

Ecosystem, ecology and biodiversity: Habitat and Niche. Competition. Mutualism. Predation. Herbivory. Commensalism. Edge effect and Ecotone. Gross and Net primary production (GPP and NPP). Ecological Pyramids. Food chains and food webs. Biogeochemical cycles; carbon, nitrogen, phosphorus and sulphur. Theory of Island Biogeography. Biomes (Aquatic and terrestrial). Ecological Succession. Biodiversity. Threats to biodiversity. Red Data Book. IUCN list. In-situ and ex-situ conservation. Keystone species. Umbrella Species. Indicator Species.

End

Department of Chemistry
Cluster University Srinagar
(Gogji-Bagh, Srinagar-190008)
Syllabus for Ph.D. (Chemistry) Entrance Test
Academic Session (2025-2026)

Unit-1 Physical Chemistry

- **Quantum chemistry:** Basic principles of quantum mechanics, operators, particle-in-a-box, harmonic oscillator, Eigen functions, eigen values, Angular momentum and eigen values of angular momentum, Pauli exclusion principle, Schrödinger's equation (time dependent), shapes of atomic orbitals, Huckel theory for conjugated π-electron systems. Variational principle, perturbation theory up to second order in energy, tunnelling effect.
- **Electrochemistry:** Debye-Huckel theory of ion - ion interactions, Verification of Debye-Huckel limiting law. Activity, coefficients at moderate concentrations and higher concentrations. Activity coefficients as a function of ion-ion and ion-solvent interactions. Mean activity coefficients. Debye-Huckel-Onsager equation and brief idea of its extension. Metal-electrolyte electrified interface, Lippman equation, electrocapillary curves.
- **Kinetics**: Empirical rate laws and temperature dependence, complex reactions, steady state approximation, determination of reaction mechanisms, collision and transition state theories, unimolecular reactions; enzyme kinetics, salt effects, homogeneous catalysis, kinetics of photochemical reactions.
- **Chemical thermodynamics**: Laws, state and path functions and their applications, thermodynamic description of various types of processes, Maxwell's relations, spontaneity, and equilibria, temperature and pressure dependence of thermodynamic quantities, Le Chatelier principle, elementary description of phase transitions, phase equilibria and phase rule, thermodynamics of ideal and non-ideal gases and solutions.
- **Statistical thermodynamics**: Boltzmann distribution; kinetic theory of gases; partition functions and their relation to thermodynamic quantities.

Unit-II Inorganic Chemistry

- **Structure and bonding:** Bonding in homo and heteronuclear molecules, shapes of molecules (VSEPR theory), Hydrogen bonding, hybridisation.
- **Main group elements**: Structure, bonding, and their industrial importance.
- **Transition elements and Coordination compounds:** Structure, bonding theories, spectral and magnetic properties.
- **Organometallic compounds:** synthesis, bonding and structure, and reactivity. Organometallics in homogeneous catalysis. Cages and metal clusters, metal complexes in medicine
- **Bioinorganic chemistry:** photosystems, porphyrins, metalloenzymes, oxygen transport, electron- transfer reactions.

Unit-III Organic Chemistry

- **Nomenclature and aromaticity:** Nomenclature of organic molecules, Aromaticity of benzenoid and non-benzenoid compounds, Hom aromatic compounds.
- **Organic reactive intermediates:** Generation, stability, and reactivity of carbocations, carbanions, free radicals, carbenes, benzynes and nitrenes
- **Stereochemistry:** Configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction.
- **Heterocyclic compounds:** Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms (O, N, S).
- **Named reactions and rearrangements**: Reimer-Tiemann reaction, Pechmann reaction, Fries rearrangement. Wagner-Merwin, Pinacolone, Wolf, Hofmann, Curtius, Schmidt, Baeyer-Villiger, Stevens, Witting.
- **Biomolecules***:* Structure, classification and functional importance of carbohydrates, amino acids, nucleic Acids.

Unit-IV Molecular Symmetry and Spectroscopy

- **Symmetry elements and operations:** Point groups and character tables, Orthogonality theorem, Reducible and Irreducible representations, construction of character tables for C2V, and C3V point groups. Applications of group theory to IR and Raman spectroscopy.
- **Electromagnetic spectrum:** Rotational spectrum, Moment of inertia, classification of molecules on the basis of moment of inertia. Energy of a rigid diatomic rotor, selection rules for rotational transition, relative population of rotational levels and spectral intensity, Vibrational Spectrum, Classical and quantum mechanical (qualitative) treatment of simple harmonic oscillator, selection rules for vibrational transition, pure vibrational spectrum of a diatomic molecule,
- **Beer-Lambert law:** molar absorptivity, presentation, and analysis of electronic spectra. Types of electronic excitations.
- **Structure Elucidation**: Structure determination of inorganic/organic compounds by IR, UV-Vis, ^{1}H & ^{13}C NMR, EPR, and mass spectroscopic techniques

Unit-V Environmental and Surface Chemistry

- **Composition of atmosphere:** Atmospheric Structure, Particles, ions and radicals in the atmosphere, photochemical reactions in atmosphere, oxygen and ozone chemistry, chemistry of oxides of sulphur and nitrogen, organic compounds in atmosphere. Chemistry of CFC's, chemistry behind greenhouse effect, Ozone hole depletion, photochemical smog.
- **Water parameters**: chemical oxygen demand (COD) and biological oxygen demand (BOD) of waste water. Water quality parameters, water purification techniques (Physical and Chemical methods).
- **Surfactants**: micelles, micellization, cmc, kraft temperature, factors affecting cmc and cloud point, hydrophobic effect in micellization. Detergency, mechanism of dirt removal by surfactants.

DEPARTMENT OF COMMERCE CLUSTER UNIVERSITY OF SRINAGAR

Syllabus: Ph.D. (Commerce) Entrance Test-2025

Unit I Business Environment and Business Economics

Meaning and Elements of Business Environment

Economic environment, Economic Policies, Economic Planning

Legal environment of Business in India, Competition policy, Consumer protection, Environment protection.

Policy Environment: Liberalization, Privatisation and globalisation, Second generation reforms, Industrial policy and implementation, Industrial growth and structural changes, WTO- Its functions and policies, MNCs ni India, Regional Integration, SAARC, ASEAN, EC and NAFTA

Nature and uses of Business Economics, Concept of Profit and Wealth maximization. Demand Analysis and Elasticity of Demand, Indifference curve analysis.

Utility Analysis and Laws of Returns and Law of variable proportions.

Cost, Revenue, Price determination in different market situations: Perfect competition, Monopolistic competition, Monopoly, Price discrimination and Oligopoly, Pricing strategies.

Unit-II

Financial & Management Accounting

Basic Accounting concepts, Capital and Revenue, Financial statements.

Partnership Accounts: Admission, Retirement, Death, Dissolution and Cash Distribution.

Advanced company accounts: Issue, forfeiture. Purchase of Business, Liquidation. Valuation of shares. Amalgamation Absorption and Reconstruction. Holding Company Accounts.

Cost and Management Accounting: Ratio Analysis, Funds Flow Analysis, Cash Flow Analysis, Managerial costing and Break-even analysis, Standard costing. Responsibility accounting. Accounting Standards in India, Money and Capital Markets, Working of Stock Exchange ni India, NSE, OTCEI, NASDAQ, Human Resource Accounting, Social Accounting and Inflation Accounting.

Unit-III

Business Management and Marketing Management

Principle of Management

Planning-objective, strategies, planning process, decision-making

Organising, organisational structure, formal and informal organisations, organisational culture.

Staffing

Leading: Motivation, leadership, committees, communication. Controlling

Corporate governance and business ethics

The evolution of marketing, concepts of marketing, marketing mix, marketing environment

Consumer behavior, market segmentation Product decisions

Pricing decisions Distribution decisions Promotion decisions

Marketing planning, organizing and control, Direct Marketing, Social Ethical and Legal Aspects.

Unit-IV

Financial Management and Human resource management

Capital structure, financial and operating leverage Cost of capita, capital budgeting

Working capital management

Dividend policy, Venture, Capital, Merger and Acquisition, Mutual Funds, Lease Finance.

Concepts, role and functions of Human Resource Management

Human resource planning, Job Analysis, Job Description and Job Specifications, recruitment and selection

Training and development, succession planning

Compensation: wage and salary administration, incentive and fringe benefits,

Morale and productivity.

Performance appraisal

Industrial relations in India, health, safety, welfare and social security, workers' participation in Management.

Unit-V Income-Tax Law and Tax Planning

Basic concepts, Residential Status and tax incidence, exempted incomes, Computation of taxable income under various heads

Computation of taxable income of individuals and firms.

Deduction of tax, filing of returns, different types of assessment; Defaults and penalties

Tax Planning: Concept, Significance and problems of tax planning, Tax evasion and tax avoidance, methods of tax planning

Tax consideration in specific business decisions, viz., make buy ; own or lease, retain or replace; export or domestic sales; shut - down or closure; expand or contract; invest or disinvest

Computer Application in Income tax and Tax planning

Department of Information Technology
Cluster University Srinagar
Gogji-Bagh, Srinagar-190008

Syllabus
For
Ph.D. Entrance Test
Subject: Computer Science
Academic Session 2025-2026

Unit 1 Discrete Structures and Digital Logic. 10 Marks

Discrete Structures and Optimization : Set Operations, Stack, Queues, Linked Lists, Trees, Heap, Hashing, Graphs, Sorting and Searching Algorithms, Logic, predicate calculus, rules of Logic, sets, functions, mathematical Induction, principles of counting, the Pigeon-Hole Principle, Permutation, combinations, repetitions, discrete probability, recurrence relations, solving recurrence relations, Relations and Its types, Equivalence relations, Partially Ordered Sets (Posets, Lattices, Graph theory, spanning trees, minimal spanning trees, Transitive closure, Eularian and Hamiltonian graphs, graph coloring, Linear Programming Problems, Simplex method, Transportation Problems.

Digital Logic: Logic Gates, Boolean Algebra, Map Simplifications, Combinational Circuits, Flip-Flops, Sequential Circuits, Integrated Circuits, Decoders, Multiplexers, Registers and Counters, Memory Unit. General Register Organization, Instruction Formats, Addressing Modes, RISC Computer, CISC Computer.

Unit 2 Programming, Theory of Computation and Compiler Design 10 Marks

Programming Language Concepts C/C++/Python: Data Types, Sequence Control, Subprogram Control, Arrays, Structures, Union, String, Pointers, Functions, File Handling, Command Line Arguments, Preprocessors. Class, Object, Inheritance, Encapsulation, Abstract Class, Polymorphism. Constructors and Destructors, Overloading, Overriding, Templates, Exception and Event Handling, Video-Display Devices, Raster-Scan and Random-Scan Systems, Graphics Monitors, Input Devices, Points and Lines, Line Drawing Algorithms, Mid-Point Circle and Ellipse Algorithms, Scan Line Polygon Fill Algorithm, Boundary-Fill and Flood Fill.

Theory of Computation: Deterministic Finite Automaton (DFA), Non-Deterministic Finite Automaton (NDFA), Equivalence of DFA and NDFA, Regular Languages, Regular Grammars, Regular Expressions, Properties of Regular Language, Pumping Lemma, Non-Regular Languages. Pushdown Automaton (PDA), Non-Deterministic Pushdown Automaton (NPDA), Context Free Grammar, Chomsky Normal Form, Greibach Normal Form, Ambiguity.

Compiler Design: Lexical Analysis, Syntax Analysis, Parsers, Semantic Analysis, Intermediate Code Generation, Code Optimization and Code Generator.

Unit 3 Database, Algorithms and Artificial Intelligence. 10 Marks

Database: Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces. Entity-Relationship Diagram, Relational Model - Constraints, SQL: Data Definition, Data Manipulation, Constraints, Queries, Insert, Delete, and Update Statements. Functional Dependencies and Normalization, Algorithms for Query Processing and Optimization. Data Modelling for Data Warehouses, Concept Hierarchy, OLAP and OLTP.

Algorithms: Asymptotic notations, Time and Space Complexity, Substitution method, Iteration method, Recursion, Randomized Algorithms, Divide and Conquer, Greedy Method, Knapsack problem, Dynamic programming, All pair shortest paths, Traveling salesman problems. Backtracking,

Artificial Intelligence: Agents, Min-Max Search, Supervised, Unsupervised, and Reinforcement Learning, Single Perceptron, Multi-Layer Perceptron. Association Rules, Classification, Clustering, Regression.

Unit 4 Operating System and Software Engineering. 10 Marks

Operating System: Operating System Structure, Operations and Services, Process Scheduling and Operations, Interprocess Communication, Process Synchronization, Critical-Section Problem, Peterson's Solution, Semaphores, CPU Scheduling. Deadlock : Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance and Detection, Recovery from Deadlock, Paging, Segmentation, Demand Paging, Page Replacement, Disk Scheduling Algorithms.

Software Engineering: Functional and Non-Functional Requirements, Eliciting Requirements, Software Requirements and Specification (SRS) Document. Cohesion and Coupling, Software Testing, McCall's Quality Factors, ISO 9126 Quality Factors, Risk Management, Risk Mitigation, LOC and FP-based Estimations, Estimating Cost and Effort, Constructive Cost Model (COCOMO).

Unit 5 Data Communication and Networking 10 Marks

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

Computer Networks: Network Topologies, Local Area Networks, Metropolitan Area Networks, Wide Area Networks, Wireless Networks, Internet. Layered Architecture, OSI Reference Model and its Protocols, TCP/IP Protocol Suite, Uniform Resource Locator (URL), Domain Name Service (DNS), Electronic Mail Architecture, SMTP, POP and IMAP, TELNET and FTP. Malwares, Cryptography and Steganography, Secret-Key Algorithms, Public-Key Algorithms, Digital Signature, Virtual Private Networks, Firewalls.

Ph.D. Entrance Examination Syllabus
Department of Economics
Cluster University Srinagar

Unit I: Microeconomic Theory

- Consumer Theory

- Preferences, utility and representation theorem
- Budget constraint and consumer choice
- Demand functions: ordinary and compensated
- Slutsky equation, Revealed preference theory
- Axioms of revealed preference, Roy's identity
- Shephard's Lemma, Hicksian and Marshallian demand
- Equivalent variation and compensating variation

- Production and Cost

- Production functions with one and more inputs
- Isoquants and returns to scale
- Cost functions in short-run and long-run
- Cost minimization and Cobb-Douglas production
- Short-run and long-run cost curves

- Market Structure

- Perfect competition and efficiency
- Monopoly: pricing and welfare effects
- Price discrimination (First, Second, Third degree)
- Monopolistic competition
- Oligopoly models: Cournot, Bertrand, Stackelberg

- Game Theory

- Strategic form games
- Dominant strategies and Nash equilibrium
- Mixed strategies and mixed strategy equilibrium
- Applications: Prisoner's dilemma, oligopoly models

- Public Goods and Market Failures

- Externalities and public goods
- Asymmetric information: adverse selection, moral hazard
- Market signaling, principal-agent problems

Unit II: Macroeconomic Theory

- Behavioural Functions

- Consumption functions: Keynesian, Life-cycle, PIH, Random walk
- Investment functions: accelerator, Tobin's q
- Demand for money: Classical, Keynesian, Friedman

• Macroeconomic Models (Closed Economy)

- Classical and Keynesian models of business cycles
- Simple Keynesian cross and multiplier
- IS-LM model and policy effectiveness
- Inflation: measurement, causes, effects
- Unemployment: types, causes, effects

• Macroeconomic Models (Open Economy)

- Mundell-Fleming model under different regimes
- Open economy IS-LM-BP framework
- Aggregate demand and supply analysis

• Growth Models

- Harrod-Domar model
- Solow model and transitional dynamics
- AK, Romer and Schumpeterian endogenous growth models

Unit III: Quantitative Methods (Statistics, Econometrics & Math)

• Statistics & Probability

- Probability theory, events and distributions
- Discrete & continuous probability distributions
- Sampling methods, sampling distributions
- Hypothesis testing: t, z, chi-square tests
- Confidence intervals, errors (Type I & II), power of test

• Econometrics

- Classical linear regression model and Gauss-Markov theorem
- Issues: multicollinearity, heteroscedasticity, autocorrelation
- Unit roots, spurious regression
- Simultaneous equation models and identification
- Dummy variables and model specification

• Mathematical Economics

- Differential calculus and optimization techniques
- Static optimization and constrained maximization
- Linear algebra: matrices, determinants, Cramer's Rule
- Input-output analysis and linear programming
- Differential and difference equations in economics

Unit IV: International & Public Economics

• International Economics

- Classical and modern theories of trade

- Gains from trade, trade multiplier
- Imperfect competition and strategic trade theory
- Tariffs, non-tariff barriers, dumping, anti-dumping
- WTO, GATT and trade blocks
- Balance of Payments: structure, adjustments
- Foreign exchange market, arbitrage and exchange rate systems
- Role of IMF and World Bank

• Public Economics

- Public goods, externalities and Coase theorem
-Optimum Taxation
- Cost-benefit analysis
- Environmental economics as a public goods issue

Unit V: Indian Economy

• Poverty, Inequality & Employment

- Trends, measurement, and policy interventions
- Urban and rural development strategies

• Fiscal & Monetary Policy

- Public expenditure and debt: trends and management
-Tax structure: direct vs indirect, progressive taxation
- Tax incidence and effects of taxation
- Tax and expenditure structure of GoI
- Role of Finance Commissions
- multipliers, FRBM Act, GST
- Budgeting and fiscal federalism in India
- Fiscal deficit and debt sustainability
- Inflation targeting and monetary frameworks
- Exchange rate policy and trade competitiveness

Structure of the Entrance Test

The entrance test will consist of two sections:

1. **Section I – Research Aptitude (Common to All Streams and Programmes)**
2. **Section II – Subject-Specific Component**

Detailed Structure:

- **Total Number of Questions: 100**
- **Section I: Research Aptitude – 50 Questions**
- **Section II: Subject-Specific – 50 Questions**
- **Type of Questions: Multiple Choice Questions (MCQs)**
- **Marks per Question: 1 Mark**
- **Total Marks: 100**

Section II

Syllabus for Ph.D. (Education) Entrance Test

Unit I: Educational Studies

- Sankhya, Yoga, Vedanta, Buddhism, Jainism & Islamic traditions with special reference to aims, curriculum, methods of teaching and discipline.
- **Contribution of Western schools of philosophy**: Idealism, Realism, logical positivism, Naturalism, Pragmatism and Existentialism with special reference to aims, curriculum, role of teacher, methods of teaching and discipline.
- Approaches to Sociology of Education (symbolic Interaction, Structural Functionalism and Conflict Theory). Concept and types of social Institutions and their functions (family, school and society), Concept of Social Movements, Theories of Social Movements (Relative Deprivation, Resource Mobilization, Political Process Theory and New Social Movement Theory)

- Socialization and education- education and culture; Contribution of thinkers (Swami Vivekananda, Rabindranath Tagore, J.Krishnamurti, Paulo Freire, Wollstonecraft, Nel Noddings and Savitribai Phule) to the development of educational thought for social change. National Values as enshrined in the Indian Constitution - Socialism, Secularism, justice, liberty, democracy, equality, freedom with special reference to education.

Unit II Learner and Learning Process

- Growth and Development: Concept and principles ,Cognitive Processes and stages of Cognitive Development , Personality: Definitions and theories (Freud, Carl Rogers, Gordon Allport)
- Approaches to Intelligence from Unitary to Multiple: Concepts of Social intelligence, multiple intelligence, emotional intelligence Theories of Intelligence by Sternberg, Gardner, Assessment of Intelligence, Concepts of Problem Solving, Critical thinking, Metacognition and Creativity
- Principles and Theories of learning: Behaviouristic, Cognitive and Social theories of learning, Factors affecting social learning, social competence, Concept of social cognition, understanding social relationship and socialization goals
- Guidance and Counseling: Nature, Principles and Need, Types of guidance (educational, vocational, personal, health and social & Directive, Non-directive and Eclectic), Approaches to counseling – Cognitive-Behavioural (Albert Ellis – REBT) & Humanistic, Person- centered Counseling (Carl Rogers) - Theories of Counseling (Behaviouristic, Rational, Emotive and Reality).

Unit III Teacher Education

- Meaning, Nature and Scope of Teacher Education; Types of Teacher Education Programs, The Structure of Teacher Education Curriculum and its Vision in Curriculum Documents of NCERT and NCTE at Elementary, Secondary and Higher Secondary Levels.
- Concept, Need, Purpose and Scope of In-service Teacher Education, Organization and Modes of In-service Teacher Education, Agencies and Institutions of In-service Teacher Education at District, State and National Levels (SSA, RMSA, SCERT, NCERT, NCTE

and UGC), Preliminary Consideration in Planning in-service teacher education programme (Purpose, Duration, Resources and Budget)

- Concept of Profession and Professionalism, Teaching as a Profession, Professional Ethics of Teachers, Personal and Contextual factors affecting Teacher Development, ICT Integration, Quality Enhancement for Professionalization of Teacher Education, Innovation in Teacher Education

Unit IV Technology in/for Education

- Concept of Educational Technology (ET) as a Discipline: (Information Technology, Communication Technology & Information and Communication Technology (ICT) and Instructional Technology, Applications of Educational Technology in formal, non-formal (Open and Distance Learning), informal and inclusive education systems.
- Overview of Behaviourist, Cognitive and Constructivist Theories and their implications to Instructional Design (Skinner, Piaget, Ausubel, Bruner, Vygotsky), Relationship between Learning Theories and Instructional Strategies (for large and small groups, formal and non-formal groups)
- learning (Offline, Online, Synchronous, Asynchronous, Blended learning, mobile learning)
- Emerging Trends in e-learning: Social learning (concept, use of web
- 2.0 tools for learning, social networking sites, blogs, chats, video conferencing, discussion forums), Open Education Resources (Creative Common, Massive Open Online Courses; Concept and application), E Inclusion - Concept of E Inclusion, Application of Assistive technology in E-learning.

Unit V Inclusive Education

- Inclusive Education: Concept, Principles, Scope and Target Groups (Diverse learners; Including Marginalized group and Learners with Disabilities), Evolution of the Philosophy of Inclusive Education: Special, Integrated, Inclusive Education.
- Legal Provisions: Policies and Legislations (National Policy of Education (1986), Programme of Action of Action (1992), Persons with Disabilities Act (1995), National Policy of Disabilities (2006), National Curriculum Framework (2005), Concession and

Facilities to Diverse Learners (Academic and Financial), Rehabilitation Council of India Act (1992), Inclusive Education under Sarva Shiksha Abhiyan (SSA), Features of UNCRPD (United Nations Convention on the Rights of Persons with Disabilities) and its Implication

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

Suggested Readings

- Sharma, R. A. (2008). Philosophical and sociological foundations of education. R. Lall Book Depot.
- Ozmon, H. A., & Craver, S. M. (2007). *Philosophical foundations of education* (8th ed.). Pearson Education.
- Gutek, G. L. (2005). *Historical and philosophical foundations of education: A biographical introduction* (4th ed.). Pearson.
- Bhattacharya, S. (2006). Foundations of education. Atlantic Publishers.
- Woolfolk, A. (2007). Educational psychology (10th ed.). Pearson Education.
- Slavin, R. E. (2006). *Educational psychology: Theory and practice* (8th ed.). Pearson Education.
- Santrock, J. W. (2006). Educational psychology (2nd ed.). McGraw-Hill.
- NCTE. (2009). National curriculum framework for teacher education: Towards preparing professional and humane teacher. National Council for Teacher Education.
- Sharma, A. P. (2009). Teacher education: Principles, theories and practices. Kanishka Publishers.
- Singh, L. C. (Ed.). (2007). Teacher education: A resource book. NCERT.
- Mangal, S. K., & Mangal, U. (2009). Essentials of educational technology. PHI Learning Pvt. Ltd.
- Sharma, R. A. (2007). Instructional technology and teaching aids. R. Lall Book Depot.
- Dash, M. (2006). Inclusive education for children with special needs. Atlantic Publishers.
- Florian, L. (Ed.). (2007). *The SAGE handbook of special education*. SAGE Publications.

- Noddings, N. (2005). *The challenge to care in schools: An alternative approach to education* (2nd ed.). Teachers College Press.
- Dewey, J. (1938). *Experience and education*. Macmillan.

And also consulted subject experts telephonically.

CLUSTER UNIVERSITY SRINAGAR

Syllabus for the Entrance Examination
For the admission in
Three Year Integrated Ph D Programme in English

Section II- Subject Specific Component

Unit I	**Drama** **Classical to Modern Drama** • Sophocles – *Oedipus Rex* • Christopher Marlowe – *Doctor Faustus* • William Shakespeare – *Hamlet, The Tempest, Julius Caesar* • Ben Jonson- *The Alchemist* • Henrik Ibsen – *A Doll's House* • George Bernard Shah- *Pygmalion* • Bertolt Brecht – *Galileo* • Samuel Beckett – *Waiting for Godot* • Tom Stoppard – *Rosencrantz and Guildenstern Are Dead* • Eugene O' Neill – *The Emperor Jones* • Sam Shepard – *The Buried Child* • Harold Pinter- *The Birthday Party* • Girish Karnad- *Tuglaq* • Mahesh Dattani – *Final Solution*
Unit II	**Poetry** **Medieval Period (1300-1500)** • **Geoffrey Chaucer** - *The Canterbury Tales:* The Wife of Bath's Prologue, The Nun's Priest's Tale **Renaissance Period/Early Modern Period (1500-1660)** • **Edmund Spenser** - *The Faerie Queene (Book IV and V)* • **William Shakespeare** – Sonnets (13, 18, 30, 66, 116, 123), • **John Donne** – Satyre of Religion, Valediction: Forbidden Mourning, The Extasie, Canonization • **Andrew Marvell** – The Garden, To his Coy Mistress **Restoration & 18th Century (1660–1798)** • **John Milton** - *Paradise Lost Book 1* • **John Dryden** - *Absalom and Ahithophel* • **Alexander Pope** – *The Rape of the Lock* • **William Blake** – *Songs of Innocence:* Introduction, The Shepherd, The Lamb, Holy Thursday *and Songs of Experience:* Introduction, The Sick Rose, The Tyger, London, The Human Abstract

Romantic Period (1798–1837)

- **William Wordsworth** – *The Prelude (Book 1)*
- **Samuel Taylor Coleridge** – The Rime of the Ancient Mariner
- **John Keats** – *The Fall of Hyperion* and *Ode to Autumn*
- **Percy Shelley** - Stanzas Written in Dejection Near Naples, Ode to the Skylark

Victorian Era (1837–1901)

- **Alfred Tennyson** – The Lady of Shalott, Ulysses
- **Robert Browning** – Porphyria's Lover, Fra Lippo Lippi, My Last Duchess
- **Matthew Arnold** – Dover Beach

American Poetry

- **Walt Whitman** – *Out of the Cradle Endlessly Rocking, When Lilacs Last in the, O Captain! My Captain!*
- **Emily Dickinson** - *Because I could not stop for Death, Hope is the thing with feathers*
- **Wallace Stevens** – The Emperor of Ice-Cream, Thirteen Ways of Looking at a Blackbird
- **Langston Hughes** – Harlem, Sing America

- **Modern Poetry (1900–1950)**
- **W.B. Yeats** – *The Second Coming, Sailing to Byzantium, The Tower, Among School Children*
- **T.S. Eliot** – *The Waste Land*
- **Robert Frost** – *The Road Not Taken, Mending Wall*
- **W. H. Auden** – *The Unknown Citizen, September 1, 1939*
- **Rabindranath Tagore** – *Gitanjali* (33, 34, 35)

Post-Colonial & Contemporary Poetry (1950–Present)

Africa & the Caribbean

- **Derek Walcott** – *Forests of Europe, A Far Cry from Africa*
- **Wole Soyinka** – *Telephone Conversation*

South Asia

- **A.K. Ramanujan** – *Obituary, The Highway Stripper*
- **Nissim Ezekiel** – *Night of the Scorpion, Background, Casually*
- **Kamala Das** – *An Introduction*, The Sunshine Cat

North America

- **Sylvia Plath** – *Daddy, Lady Lazarus, Tulips*
- **Ted Hughes** – *The Thought-Fox, Hawk Roosting, November, Thrushes*
- **Allen Ginsberg** - *Howl*
- **Maya Angelou** – *And Still I Rise*

	Canadian • **Margaret Atwood** – *Spelling, This is a Photograph of Me* **UK & Ireland** • **Philip Larkin** - *Church Going, Mr. Bleaney* • **Seamus Heaney** – *Digging, Punishment, Casualty*
Unit III	**Novel** **Novel I – 18th & 19th Century Novel** • Henry Fielding – *Joseph Andrews* • Emily Brontë – *Wuthering Heights* • George Eliot – *Middlemarch* • Charles Dickens – *Great Expectations* **Novel II – 20th Century Novel** • Joseph Conrad – *Heart of Darkness* • James Joyce – *A Portrait of the Artist as a Young Man* • Virginia Woolf – *To the Lighthouse* **Indian Writing in English – Novels** • Raja Rao – *Kanthapura* • Anita Desai – *In Custody* • Amitav Ghosh – *The Shadow Lines* **New Literatures in English – Novels** • Chinua Achebe – *Things Fall Apart* • Margaret Atwood – *Surfacing* • V. S. Naipaul – *A House for Mr. Biswas* **American Literature – Novels** • Nathaniel Hawthorne – *The Scarlet Letter* • Mark Twain – *The Adventures of Huckleberry Finn* • Toni Morrison – *The Bluest Eye*

Unit IV	**ELT, Linguistics, Essentials of Research and Research Methodology in Humanities**
	
	A. English Language Teaching (ELT)
	
	• Approaches and Methods: GT Method, Direct Method, Situational, Audio-Lingual, Communicative
	• Curriculum and Syllabus Designing:
	  ○ Classical Humanism, Reconstructionism, Progressivism
	  ○ Various Syllabus Designs
	• Lesson Planning
	• Testing & Evaluation
	• Language Skills:
	  ○ Reading, Writing, Listening, Speaking
	  ○ CODER Techniques, Dialogues, Role Play, Group Discussion

- Word Building:
  - Affixation, Homophones, Homonyms, Hyponymy, Polysemy, Concordance
- English in India and Kashmir:
  - Past and Present Scenarios of English Teaching
  - Broad trends in ELT in India and Jammu & Kashmir

B. Linguistics

- Language: Origin and Properties
- Linguistics: Definition, Scope, Branches, Relation with other disciplines
- Comparative Philology
- Structural Linguistics: Bloomfield, Saussure, Chomsky
- Language Change and Variation
- Sociolinguistics (Introductory)
- Phonetics & Phonology:
  - Speech Mechanism, Cardinal Vowels, Phoneme, Allophone
  - Description of English Sounds
  - Syllable, Stress, Intonation
- Phonemic/Phonetic Transcription
  - Transcription of Dialogue/Passages

Unit V	**Literary Criticism and Literary Theory**

Part I – Classical to Modern Criticism

Classical:

- Plato – *Republic* (Book X),
- Aristotle – *Poetics* (Ch. 1–4, 6–19)

Romantic:

- Wordsworth – *Preface to Lyrical Ballads*, Coleridge – *Biographia Literaria* (Ch. 12–14)
- **Victorian**:
- Matthew Arnold – *The function of Criticism at the Present Time*
- Modern:
- T. S. Eliot – *Tradition and the Individual Talent*,
- I A Richards-– *Two Uses of Language*

Part II – Contemporary Theory

New Criticism:

- J. C. Ransom – *Criticism, Inc*
- Cleanth Brooks – *Irony as a Principle of Structure*
- Wimsatt & Beardsley – *The Intentional Fallacy and Affective Fallacy*

Structuralism & Poststructuralism:

- Jacques Derrida – *Structure, Sign and Play*
- Roland Barthes – *From Work to Text*

Marxism & New Historicism:

- Karl Marx – *Ruling Class and Ruling Ideas*

- Antonio Gramsci – *The Formation of Intellectuals*
- Stephen Greenblatt – *Invisible Bullets*

Colonial/Postcolonial Theory:

- Edward Said – *Introduction to Orientalism*
- Gayatri Spivak – *Can the Subaltern Speak*

Cultural Studies:

- Raymond Williams – *Culture*

Department of Environmental Sciences
CLUSTER UNIVERSITY SRINAGAR
Gogji-Bagh, Srinagar-190008

Syllabus
for
Ph.D. Entrance Test
Subject: Environmental Sciences
Academic Session 2025-2026

Unit-I: Fundamentals of Environmental Sciences and Environmental Biology

Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere.
Meteorological parameters - pressure, temperature, precipitation, humidity, mixing ratio, saturation mixing ratio, radiation and wind velocity, adiabatic lapse rate, environmental lapse rate. Wind roses.
Natural resources and their assessment. Remote Sensing and GIS: Principles of remote sensing and GIS.
Ecosystem Structure and functions: Structures - Biotic and Abiotic components. Functions - Energy flow in ecosystems, energy flow models, food chains and food webs. Biogeochemical cycles, Ecological succession. Species diversity, Concept of ecotone, edge effects, ecological habitats and niche.
Population ecology: Characteristics of population, concept of carrying capacity, population growth and regulations. Population fluctuations, dispersion and metapopulation. Concept of 'r' and 'k' species. Keystone species.
Community ecology: Definition, community concept, types and interaction - predation, herbivory, parasitism and allelopathy. Biological invasions.
Biodiversity and its conservation: Definition, types, importance of biodiversity and threats to biodiversity. Concept and basis of identification of 'Hotspots'; hotspots in India. Measures of biodiversity. Strategies for biodiversity conservation: *in situ*, *ex situ* and *in vitro* conservation. National parks, Sanctuaries, Protected areas and Sacred groves in India. Extinct, Rare, Endangered and Threatened flora and fauna of India.
Environmental Biotechnology: Bioremediation – definition, types and role of plants and microbes for *in situ* and *ex situ* remediation. Bioindicators, Biofertilizers, Biofuels and Biosensors

Unit-II: Environmental Chemistry

Composition of air. Particles, ions and radicals in the atmosphere. Chemical speciation. Chemical processes in the formation of inorganic and organic particulate matters, thermochemical and photochemical reactions in the atmosphere, Oxygen and Ozone chemistry. Photochemical smog.

Hydrological cycle. Water as a universal solvent. Concept of DO, BOD and COD. Sedimentation, coagulation, flocculation, filtration, pH and Redox potential (Eh).
Inorganic and organic components of soils. Biogeochemical cycles – nitrogen, carbon, phosphorus and sulphur.

Unit-III: Environmental Pollution

Air Pollution:

Sources and types of Pollutants - Natural and anthropogenic sources, primary and secondary pollutants. Criteria air pollutants. Sampling and monitoring of air pollutants (gaseous and particulates); period, frequency and duration of sampling. Impact of air pollutants on human health, plants and materials. Acid rain. Dispersion of air pollutants. Mixing height/depth, lapse rates, Gaussian plume model, line source model and area source model.

Noise Pollution:

Noise dose and Noise Pollution standards. Noise control and abatement measures: Active and Passive methods. Vibrations and their measurements. Impact of noise and vibrations on human health.

Water Pollution:

Types and sources of water pollution. Impact on humans, plants and animals. Drinking water treatment: Coagulation and flocculation, Sedimentation and Filtration, Disinfection and Softening. Wastewater Treatment: Primary, Secondary and Advanced treatment methods. Common effluent treatment plant.

Soil Pollution:

Physico-chemical and biological properties of soil (texture, structure, inorganic and organic components). Analysis of soil quality. Soil Pollution control.

Unit-IV: Solid and Hazardous Waste Management

Solid Waste - types and sources. Solid waste characteristics, generation rates, solid waste components, proximate and ultimate analyses of solid wastes.
Solid waste processing and recovery – Recycling, recovery of materials for recycling and direct manufacture of solid waste products. Electrical energy generation from solid waste (Fuel pellets, Refuse derived fuels), composting and vermicomposting, biomethanation of solid waste.
Hazardous waste – Types, characteristics and health impacts. Hazardous waste management: Treatment Methods – neutralization, oxidation reduction, precipitation, solidification, stabilization, incineration and final disposal.

Unit-V: Environmental Assessment, Management and Legislation, Environmental issues

Aims and objectives of Environmental Impact Assessment (EIA). Environmental Impact Statement (EIS) and Environmental Management Plan (EMP). EIA Guidelines. Impact Assessment Methodologies. Procedure for reviewing EIA of developmental projects. Life-cycle analysis, cost- benefit analysis. EIA Notification, 2006 and amendments from time to time. Eco-labeling schemes.

Overview of Environmental Laws in India: Constitutional provisions in India (Article 48A and 51A). Wildlife Protection Act, 1972 amendments 1991, Forest Conservation Act, 1980, Biological Diversity Act, 2002, Water (Prevention and Control of Pollution) Act, 1974

amended 1988 and Rules 1975, Air (Prevention and Control of Pollution) Act, 1981 amended 1987 and Rules 1982, Environmental (Protection) Act, 1986 and Rules 1986,

Environmental Conventions and Agreements: Stockholm Conference on Human Environment 1972, Montreal Protocol, 1987, Basel Convention (1989, 1992), Ramsar Convention on Wetlands (1971), Earth Summit at Rio de Janeiro, 1992, Agenda-21, Convention on Biodiversity (1992), UNFCCC, Kyoto Protocol, 1997, Earth Summit at Johannesburg, 2002, RIO+20, UN Summit on Millennium Development Goals, 2000, Copenhagen Summit, 2009. IPCC, UNEP, IGBP.

Environmental issues related to water resource projects - Narmada dam, Tehri dam, Almatti dam, Cauvery and Mahanadi, Hydro-power projects in Jammu & Kashmir

National river conservation plan – Namami Gange and Yamuna Action Plan.

Eutrophication and restoration of lakes. Conservation of wetlands

Forest Conservation – Chipko movement, Appiko movement, Silent Valley movement and Gandhamardhan movement. People Biodiversity register.

Wild life conservation projects: Project tiger, Project Elephant, Crocodile Conservation, GOI-UNDP Sea Turtle project, Indo-Rhino vision.

Environmental Disasters: Minnamata Disaster, Love Canal Disaster, Bhopal Gas Disaster, 1984, Chernobyl Disaster, 1986, Fukusima Daiichi nuclear disaster, 2011

Cluster University of Srinagar

Syllabus for Ph. D. (Geography) Entrance Test

Unit I – Physical Geography

1. Geomorphology: Fundamental concepts; endogenetic and exogenetic forces; Denudation and Weathering; Geosynclines, continental drift and plate tectonics; Geomorphic Cycle (Davis and Penck); Landforms associated with fluvial, glacial, arid, coastal and karst cycles. Earth Movements (seismicity, folding, faulting and vulcanicity), Geomorphic Hazards (earthquakes, volcanoes, landslides and avalanches).

2. Climatology: Composition and structure of the atmosphere; Insolation & Heat budget; Temperature, Atmospheric pressure and general circulation of winds; Monsoon and jet stream; Atmospheric Circulation (air-masses, fronts, cyclones and anticyclones); Classification of world climates; koppens and Thornthwaite's schemes; Meteorological Hazards and Disasters (Cyclones, Thunderstorms, Tornadoes, Hailstorms, Heat and Cold waves Drought and Cloudburst , Glacial Lake Outburst (GLOF), Climate Change: Evidences and Causes of Climatic Change in the past, Human impact on Global Climate.

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

4. Bio-geography: Ecosystem; Ecology; Functions: Trophic Levels, Energy Flows, Cycles (geo-chemical, carbon, nitrogen and oxygen), Food Chain, Food Web and Ecological Pyramid, Human Interaction and Impacts; Legal Framework: Brundtland Commission, Kyoto Protocol, Agenda 21, Sustainable Development Goals, Paris Agreement; Environmental Hazards and Disasters (Global Warming, Urban Heat Island, Atmospheric Pollution, Water Pollution, Land Degradation

Unit II – Human Geography

1. Population Geography: Sources of population data (census, sample surveys and vital statistics); World Population Growth, Density & Distribution (Patterns and determinants); Demographic Transition, Theories of Population Growth (Malthus, Sadler, and Ricardo). Fertility and Mortality Analysis (determinants and world patterns). Migration (types, causes, consequences and theories), Population Composition and Characteristics (age, sex, rural-urban, occupational structure and educational levels).

2. Settlement Geography: Site, situation, types, size, spacing and internal morphology of rural and urban settlements; Theories of Origin of Towns (Griffith Taylor, Houston, Lewis Mumford); City-region; Primate city; Rank-size rule; Settlement hierarchy; Christaller's Central Place theory; August Losch's theory of market centers. Central Place Theories (Christaller and Losch), Models of Urban Land Use (Burgess, Hoyt and Harris and Ullman), Concepts of Megacities, Global Cities and Edge Cities, Changing Urban Forms (rural-urban fringe, satellite towns, green belt, Garden cities).

3. Economic Geography & Regional Development: Sectors of economy: primary, secondary tertiary and quaternary; Natural Resources (classification, distribution and associated problems), Natural Resources Management; Globalisation and Liberalisation; Economic growth and development; Indicators of development; Human Development; Concept and Components, Human happiness index,

Concept of Region; types; Regional planning in India; Theories of Regional Development (Gunnar Myrdal, John Friedman) Methods of regional delineation; Regional imbalances.

4. Agricultural and Industrial Geography: Measurement of agricultural productivity and efficiency; Crop combination and diversification; Von Thunen's Model.

Factors of Industrial Location; Classification of industries: Weber's and Losch's approaches; Resource based and footloose industries.

5. Political, Cultural and Social Geography: Heartland and Rimland theories; Boundaries and frontiers; Geopolitics of Climate Change, World Resources, India Ocean, Regional Organisations of Cooperation (SAARC, ASEAN, OPEC, EU).

Concept of Culture, Cultural Complexes, Cultural Heritage, Cultural Ecology, Cultural Convergence and divergence, Cultural Diffusion, Cultural realms.

Social Structure and Processes, Social Well-being and Quality of Life, Social Exclusion, Spatial distribution of social groups in India (Tribe, Caste, Religion and Language). Gujjar & Bakarwals, Santhals, Gonds, Nagas.

Unit II – Philosophy of Geography

Geographic Thought: Contributions of Greek, Roman, Arab and Indian Scholars, Contributions of Geographers (Immanuel Kant, Alexander von Humboldt, Carl Ritter, Vidal De La Blache, Jean Brunches, Huntington, Semple, Hartshorne, Mackinder, L.D. Stamp), Paradigm Shift in geography, Perspectives in Geography (Determinism, Possibilism, Quantitative revolution, Positivism, Behaviouralism, Humanism, Radicalism, Feminism and Postmodernism).

Unit IV – Geography of India

1. Physiography, Drainage, Climate, Soils, Natural resources, vegetation, population, agriculture, minerals, industries, Indian Agriculture; Agro-Climatic Zones, Green Revolution, Food Security and Right to Food. Industrial Regions and their characteristics, Industrial Policies in India. Internal and External Trade (trend, composition and directions).

Unit V – Geographical Techniques

1. Sources of Geographic Information and Data (spatial and non-spatial), Types of Maps, Techniques of Map Making (Choropleth, isopleth, Chorochromatic, Flow Maps) Data Representation on Maps (Pie diagrams, Bar diagrams and Line Graph, GIS Database (raster and vector data formats and attribute data formats). Functions of GIS (conversion, editing and analysis), Digital Elevation Model (DEM), Georeferencing (coordinate system and map projections and Datum), GIS Applications (thematic cartography, spatial decision support system), Basics of Remote Sensing (Electromagnetic Spectrum, Sensors and Platforms,

Resolution and Types, Elements of Air Photo and Satellite Image Interpretation and Photogrammetry), Types of Aerial Photographs, Digital Image Processing: Developments in Remote Sensing Technology and Big Data Sharing and its applications in Natural Resources Management in India, GPS Components (space, ground control and receiver segments) and Applications, Measures of Central Tendency, Dispersion, Skewness and Inequalities, Correlation and Regression Analysis, Time Series Analysis, Sampling, Hypothesis Testing (chi square test, t test, ANOVA), Computation of Composite Index, Principal Component Analysis and Cluster Analysis, Crop combination methods – Weaver, Rafiullah, Nelson, Morphometric Analysis: Ordering of Streams, Bifurcation Ratio, Drainage Density, Profiles, Slope Analysis, Clinographic Curve, Hypsographic Curve and Altimetric Frequency Graph.

Cluster University Srinagar

Syllabus of History

Unit – I

- Negotiating the Sources: Archaeological sources: Exploration, Excavation, Epigraphy and Numismatics. Dating of Archaeological Sites. Literary Sources: Indigenous Literature: Primary and Secondary: problem of dating Religious and Secular Literature, Myths, Legends, etc. Foreign Accounts: Greek, Chinese and Arabic.
- Pastoralism and Food production: Neolithic and Chalcolithic Phase: Settlement, distribution, tools and patterns of exchange.
- Indus/Harappa Civilization: Origin, extent, major sites, settlement pattern, craft specialization, religion, society and polity, Decline of Indus Civilization, Internal and external trade, First urbanization in India.
- Vedic and later Vedic periods; Aryan debates, Political and Social Institutions, State Structure and Theories of State; Emergence of Varnas and Social Stratification, Religious and Philosophical Ideas. Introduction of Iron Technology, Megaliths of South India.
- Expansion of State system: Mahajanapadas, Monarchical and Republican States, Economic and Social Developments and Emergence of Second Urbanization in 6th century BCE; Emergence of heterodox sects-Jainism, Buddhism and Ajivikas.

Unit – II

- From State to Empire: Rise of Magadha, Greek invasion under Alexander and its effects, Mauryan expansion, Mauryan polity, society, economy, Asoka's Dhamma and its Nature, Decline and Disintegration of the Mauryan Empire, Mauyan art and architecture, Asokan edicts: language and script.
- Dissolution of Empire and Emergence of Regional Powers: Indo-Greeks, Sungas, Satavahanas, Kushanas and Saka-Ksatrapas, Sangam literature, polity and society in South India as reflected in Sangam literature. Trade and commerce from 2nd century BCE to 3rd century CE, Trade with the Roman World, Emergence of Mahayana Buddhism, Kharavela and Jainism, Post-Mauryan art and Architecture. Gandhara, Mathura and Amaravati schools.
- Gupta Vakataka age: Polity and Society, Agrarian Economy, Land Grants, Land Revenue and Land Rights, Gupta Coins, Beginning of Temple Architecture, Emergence of Puranic Hinduism, Development of Sanskrit Language and Literature. Developments in Science Technology, Astronomy, Mathematics and Medicine.
- Harsha and his Times: Administration and Religion.
- Salankayanas and Visnukundins in Andhradesa.

Unit – III

- Emergence of Regional Kingdoms: Kingdoms in Deccan: Gangas, Kadmabas, Western and Eastern Chalukyas, Rashtrakutas, Kalyani Chalukyas, Kakatiyas, Hoysalas and Yadavas.
- Kingdoms in South India: Pallavas, Ceras, Colas and Pandyas,
- Kingdoms in Eastern India: Palas and Senas of Bengal, Varmans of Kamarupa, Bhaumakaras and Somavamsis of Odisha.
- Kingdoms in Western India: Maitrakas of Vallabhi and Chalukyas of Gujarat.
- Kingdoms in North India: Gurjara-Pratiharas, Kalacuri-Chedis, Gahadavalas and Paramaras.
- Characteristics of Early Medieval India: Administration and Political Structure Legitimation of Kingship.
- Agrarian economy; land grants, changing production relations; graded land rights and peasantry, water resources, taxation system, coins and currency system;
- Trade and urbanization: patterns of trade, and urban settlements, ports and trade routes, merchandise and exchange, trade guilds; trade and colonization in south east Asia.
- Growth of Brahminical religions: Vaisnavism and Saivism; Temples; Patronage and Regional Ramification; Temple Architecture and Regional Styles. Dana, Tirtha and Bhakti, Tamil Bhakti movement - Shankara, Madhava and Ramanujacharya.
- Society: Varna, Jati and Proliferation of Castes, Position of women; Gender, marriage and property relations; Women in public life. Tribes as peasants and their place in Varna order. Untouchability.
- Education and Educational Institutions: Agraharas, Mathas and Mahaviharas as Centres of Education. Growth of Regional Languages.
- Debates of state formation in early medieval India: A) Feudal model; B) Segmentary model; C) Integrative model
- Arab contracts: Suleiman Ghaznavid conquests. Alberuni's Accounts.

Unit – IV

- Source of Medieval Indian History: Archaeological, Epigraphic and Numismatic sources, Material evidences and Monuments; Chronicles; Literary sources – Persian, Sanskrit and Regional languages; Daftar Khannas: Firmans, Bahis / Pothis / Akhbarat; Foreign Travellers' Accounts – Persian and Arabic.
- Political Developments – The Delhi Sultanate – the Ghorids, the Turks, the Khaljis, the Tughlaqs, theSayyids and the Lodis. Decline of Delhi Sultanate.
- Foundation of the Mughal Empire – Babur, Humayun and the Suris ; Expansion and Consolidation from Akbar to Aurangzeb. Decline of the Mughal Empire.
- Later Mughals and Disintegration of the Mughal Empire.

- The Vijayanagara and the Bahmanis - Deccan Sultanate: Bijapur, Golkonda, Bidar, Berar and Ahmadnagar – Rise, Expansion and Disintegration; Eastern Gangas and Suryavamshi Gajapatis.
- Rise of the Marathas & the foundation of Swaraj by Shivaji: its expansion under the Peshwas ; Mughal – Maratha relations, Maratha Confederacy, Causes of Decline.

Unit – V

- Administration & Economy: Administration under the Sultanate, Nature of State – Theocratic and Theocentric, Central, Provincial and Local Administration, Law of succession.
- Sher Shah's Administrative Reforms ; Mughal Administration – Central, Provincial and Local : Mansabdari and Jagirdari Systems.
- Administrative System in the Deccan – The Vijayanagara State & Polity, Bahamani Administrative System; Maratha Administration – Asta Pradhan.
- Frontier Policies under Delhi Sultanate and Mughals.
- Inter-State Relations during the Sultanate and the Mughals.
- Agricultural Production and Irrigation System, Village Economy, Peasantry, Grants and Agricultural Loans, Urbanization and Demographic Structure.
- Industries – Cotton Textiles, Handicrafts, Agro-Based industries, Organisation, Factories & Technology.
- Trade and Commerce – State Policies, Internal and External Trade: European Trade, Trade Centres and Ports, Transport and Communication.
- Hundi (Bills of Exchange) and Insurance, State Income and Expenditure, Currency, Mint System; Famines and Peasant Revolts.

Department of Information Technology
Cluster University Srinagar
Gogji-Bagh, Srinagar-190008

Syllabus
For
Ph.D. Entrance Test
Subject: Information Technology
Academic Session 2025-2026

Unit 1 Discrete Structures and Digital Electronics. 10 Marks

Discrete Structures : Set Operations, Stack, Queues, Linked Lists, Trees, Heap, Hashing, Graphs, Sorting and Searching Algorithms, Logic, predicate calculus, rules of Logic, sets, functions, mathematical Induction, principles of counting, the Pigeon-Hole Principle, Permutation, combinations, repetitions, discrete probability, recurrence relations, solving recurrence relations, Relations and Its types, Equivalence relations, Partially Ordered Sets (Posets, Lattices, Graph theory, spanning trees, minimal spanning trees, Transitive closure, Eularian and Hamiltonian graphs, graph coloring,

Digital Electronics: Logic Gates, Boolean Algebra, Map Simplifications, Combinational Circuits, Flip-Flops, Sequential Circuits, Integrated Circuits, Decoders, Multiplexers, Registers and Counters, Memory Unit. General Register Organization, Instruction Formats, Addressing Modes, RISC Computer, CISC Computer.

Unit 2 Computer Programming and Theory of Computation 10 Marks

Programming Language Concepts C/C++: Data Types, Sequence Control, Subprogram Control, Arrays, Structures, Union, String, Pointers, Functions, File Handling, Command Line Arguments, Preprocessors. Class, Object, Inheritance, Encapsulation, Abstract Class, Polymorphism. Constructors and Destructors, Overloading, Overriding, Templates, Exception and Event Handling, Video-Display Devices, Raster-Scan and Random-Scan Systems, Graphics Monitors, Input Devices, Points and Lines, Line Drawing Algorithms, Mid-Point Circle and Ellipse Algorithms, Scan Line Polygon Fill Algorithm, Boundary-Fill and Flood Fill.

Theory of Computation: Deterministic Finite Automaton (DFA), Non-Deterministic Finite Automaton (NDFA), Equivalence of DFA and NDFA, Regular Languages, Regular Grammars, Regular Expressions, Properties of Regular Language, Pumping Lemma, Non-Regular Languages. Pushdown Automaton (PDA), Non-Deterministic Pushdown Automaton (NPDA), Context Free Grammar, Chomsky Normal Form, Greibach Normal Form, Ambiguity.

Unit 3 Database, Algorithms and Artificial Intelligence. 10 Marks

Database: Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces. Entity-Relationship Diagram, Relational Model - Constraints, SQL: Data Definition, Data Manipulation, Constraints, Queries, Insert, Delete, and Update Statements. Functional Dependencies and Normalization, Algorithms for Query Processing and Optimization. Data Modelling for Data Warehouses, Concept Hierarchy, OLAP and OLTP.

Algorithms: Asymptotic notations, Time and Space Complexity, Substitution method, Iteration method, Recursion, Randomized Algorithms, Divide and Conquer, Greedy Method, Knapsack problem, Dynamic programming, All pair shortest paths, Traveling salesman problems. Backtracking,

Artificial Intelligence: Agents, Min-Max Search, Supervised, Unsupervised, and Reinforcement Learning, Single Perceptron, Multi-Layer Perceptron. Association Rules, Classification, Clustering, Regression.

Unit 4 Operating System and Software Engineering. 10 Marks

Operating System: Operating System Structure, Operations and Services, Process Scheduling and Operations, Interprocess Communication, Process Synchronization, Critical-Section Problem, Peterson's Solution, Semaphores, CPU Scheduling. Deadlock : Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance and Detection, Recovery from Deadlock, Paging, Segmentation, Demand Paging, Page Replacement, Disk Scheduling Algorithms.

Software Engineering: Functional and Non-Functional Requirements, Eliciting Requirements, Software Requirements and Specification (SRS) Document. Cohesion and Coupling, Software Testing, McCall's Quality Factors, ISO 9126 Quality Factors, Risk Management, Risk Mitigation, LOC and FP-based Estimations, Estimating Cost and Effort, Constructive Cost Model (COCOMO).

Unit 5 Data Communication and Networking 10 Marks

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

Computer Networks: Network Topologies, Local Area Networks, Metropolitan Area Networks, Wide Area Networks, Wireless Networks, Internet. Layered Architecture, OSI Reference Model and its Protocols, TCP/IP Protocol Suite, Uniform Resource Locator (URL), Domain Name Service (DNS), Electronic Mail Architecture, SMTP, POP and IMAP, TELNET and FTP. Malwares, Cryptography and Steganography, Secret-Key Algorithms, Public-Key Algorithms, Digital Signature, Virtual Private Networks, Firewalls.

Ph.D Syllabus- Journalism and Mass Communication

UNIT I

- Communication: Meaning, Definition ,Nature;
- Elements and process of communication;
- Various forms and types of communication
- Communication barriers
- Nature and process of Mass Communication
- Media: Media functions for individuals; Media functions for society;
- Economics of mass media.
- Definition, meaning and process of development
- Development Communication- Definition, process and philosophy
- Paradigms of Development

UNIT II

- News: Definition, Changing concepts of News
- Elements, Values, Sources ,Structure of News
- Lead writing, kinds
- Newspaper Organization, Divisions/departments: Hierarchy and Roles
- Responsibilities of Copy Editor
- Print Media Terminology
- Backpack Journalist
- Ethical challenges of online journalism

UNIT III

- News reporting terminology
- Interviewing –kinds
- Beat Reporting
- Interpretative Reporting -purposes, techniques
- Functions and Classification of Editorials
- Headlines- Functions, Kinds
- Different design elements—sidebars, boxes, blurbs, infographics
- Elements of digital storytelling (Multimedia, Interactivity, Linking

UNIT IV

- Meaning of Research, Types of Research, Objectives and Elements of
- Research, Significance of Research.
- Variables, Scales of measurement, Tools of Data Collection, Sampling.

- Communication research and Media Research, Research Bias
- Ethical issues related to media
- Cable TV Regulation Act
- Film Censorship

UNIT V

- Qualitative and Quantitative Research, Formative and summative research, Research sources and feedback
- Methods of Data Collection
- Audience and Market Research, Media monitoring, opinion poll and exit poll, Data Analysis and interpretation
- Freedom of Speech and Expression
- Official secrets Act, RTI

Department of Physics,
Cluster University of Srinagar
Gogji-Bagh, Srinagar-190008
Syllabus for Ph. D. Entrance Test
Subject: Physics
Academic Session 2025-2026

Unit-I

Dimensional analysis. Vector algebra and vector calculus. Linear algebra, matrices, Cayley-Hamilton Theorem. Eigenvalues and eigenvectors. Linear ordinary differential equations of first & second order, Special functions (Hermite, Bessel, Laguerre and Legendre functions). Fourier series, Fourier and Laplace transforms. Elements of complex analysis, analytic functions; Taylor & Laurent series; poles, residues and evaluation of integrals.

Unit-II

Newton's laws, Scattering in laboratory and Centre of mass frames. Non-inertial frames and pseudoforces. Variational principle. Generalized coordinates. Lagrangian and Hamiltonian formalism and equations of motion. Conservation laws and cyclic coordinates, mass–energy equivalence.

Wave-particle duality. Schrödinger equation. Eigenvalue problems (particle in a box, harmonic oscillator). Tunneling through a barrier. Wave-function in coordinate and momentum representations. Commutators and Heisenberg uncertainty principle. Dirac notation for state vectors. Motion in a central potential: orbital angular momentum, angular momentum algebra, spin, addition of angular momenta, Hydrogen atom. Stern-Gerlach experiment.

Unit-III

Basic nuclear properties: size, shape and charge distribution, spin and parity. Binding energy, semi-empirical mass formula, liquid drop model. properties of nuclear forces. Deuteron problem. Shell model. alpha, beta and gamma decays and their selection rules. Fission and fusion. Nuclear reactions, compound nuclei and direct reactions. G. M. Counter.

Elementary particles and their quantum numbers Gellmann-Nishijima formula. Quark model, baryons and mesons. C, P, and T invariance. Application of symmetry arguments to particle reactions. Parity non-conservation in weak interaction.

Unit-IV

Semiconductor devices (diodes, junctions, transistors, field effect devices), device structure, device characteristics. Solar cells, photo-detectors, LEDs. Operational amplifiers and their applications.

Bravais lattices. Reciprocal lattice. Diffraction and the structure factor. Bonding of solids. Elastic properties, phonons, lattice specific heat. Free electron theory and electronic specific heat. Response and relaxation phenomena. Drude model of electrical and thermal conductivity. Hall effect and thermoelectric power. Band theory of solids. Type-I and type-II superconductors.

Unit-V

Lasers: spontaneous and stimulated emission, Einstein A & B coefficients. Optical pumping, population inversion, rate equation. Modes of resonators and coherence length.

Phase space, micro- and macro-states. Micro-canonical, canonical and grand-canonical ensembles and partition functions. Free energy and its connection with thermodynamic quantities. Classical and quantum statistics. Ideal Bose and Fermi gases.

Maxwell's equations in free space and linear isotropic media; boundary conditions on the fields at interfaces. Scalar and vector potentials, gauge invariance. Electromagnetic waves in free space. Dielectrics and conductors.

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Cluster University of Srinagar

Syllabus for Ph.D. Entrance Test

Subject: Zoology

Academic Session 2025-2026

Unit 1: Biomolecules and Metabolism

- Composition, structure, and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids, and vitamins).
- Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction).
- Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers.
- Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes.

Unit 2: Cell Biology: Organization, Communication, and Immunity

- Membrane structure and function
  Structure of cell membrane, lipid bilayer, active and passive transport.
- Structural organization and function of intracellular organelles
  Nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, chloroplast, structure & function of cytoskeleton, and its role in motility.
- Cell division and cell cycle
  Mitosis and meiosis, their regulation.
- Apoptosis and its significance
- Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity, and immunogenicity. Structure and function of antibody molecules. monoclonal antibodies, MHC molecules, activation, and differentiation of B and T cells.

Unit 3: Molecular Biology and Genetics

- DNA Replication and Repair
  Experimental evidence of DNA replication. Mechanism of replication in prokaryotes and eukaryotes. Sources of DNA damage and DNA repair mechanisms in prokaryotes and eukaryotes
- Gene Expression and Regulation
  Transcription in prokaryotes and eukaryotes. Structure and functions of different types of RNA. Post-transcriptional modifications. Post-translational modifications.
- Population Genetics
  Gene pool and allelic frequency. Genetic drift & genetic equilibrium. Hardy-Weinberg law & its applications.

Unit 4: Human Physiology

- Blood and circulation
  Composition of blood, functions of plasma, Haemopoiesis, Haemostasis.
- Cardiovascular System
  Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG – its principle and significance, cardiac cycle, blood pressure, neural and chemical regulation of heart rate and blood pressure.
- Respiratory system
  Transport of gases, exchange of gases, neural and chemical regulation of respiration.
- Excretory system
  Regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance.
- Digestive system
  Digestion, absorption, energy balance, BMR.
- Endocrinology and reproduction
  Endocrine glands, basic mechanism of hormone action, hormones and diseases, Menstrual cycle.

Unit 5: Ecology, Evolution, and Taxonomy

- Population Ecology: Characteristics of a population, population growth curves, population regulation, life history strategies (r and k selection), concept of metapopulation – demes and dispersal, age-structured populations.
- Community Ecology: Nature of communities, community structure and attributes, levels of species diversity and their measurement.
- Ecological Succession: Types, mechanisms, and changes involved in succession.
- Ecosystem Ecology: Ecosystem structure and function, energy flow and mineral cycling (C, N, P).
- Evolutionary History: The evolutionary time scale, Major events in the evolutionary time scale, Evolution of Man.
- Molecular Evolution: Concepts of neutral evolution, molecular divergence and molecular clocks; Molecular tools in phylogeny, classification and identification, Protein and nucleotide sequence analysis, origin of new genes and proteins, Gene duplication and divergence.
- Outline classification of Chordata and Non-Chordata.
- Species concept
- Principles of Biological Nomenclature.