Srinath University

अध्ययन • अनुशासन • अनुग्रहण

JAMSHEDPUR, JHARKHAND

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Ph.D. Entrance Examination Syllabus

Session 2023

The pattern of the entrance examination shall be as under:

The question paper will be divided in two sections.

- **Paper-I (covers research methodology) 50 %.**

- **Paper - II (covers subject/discipline specific syllabus) 50 %.**

The question paper shall have MCQ types. Total 50 multiple choice questions to be asked from each paper. The questions will be of Post Graduate level. The question paper shall be of maximum 3 hours duration, and shall consist of total100 marks. There will be no negative marking. If a question has not been attempted no credit/marks will be given.Candidates acquiring minimum cut off from the sections taken together, shall be eligiblefor interview/viva-voce.

SYLLABUS FOR Ph.D. ENTRANCE EXAM

PAPER – I (RESEARCH METHODOLOGY)

1. **Basic concept of research problem**
   - Rationale of research
   - Identification of research problem
   - Research objective
   - Types of research- fundamental/ applied/ action/ quantitative/ qualitative
2. **Review of literatures**
   - Primary source
   - Secondary source
   - Searching e- resources, using search engines
   - Searching data base
   - Writing literature review
3. **Methods of research**
   - Concept and formulation of hypothesis
   - Survey method
   - Experimental method (variable, designs)
   - Historical methods
   - Content analysis
4. **Sampling of data**
   - Concept of sampling

- Probability sampling techniques
- Non probability sampling techniques
- Sampling error

5. **Collection of data**
    - Primary data generation
    - Secondary data collection
    - Methods of data generation/ collection – by experiments, questionnaire, interview schedule, focus groups etc

6. **Analysis of data**
    - Statistical analysis techniques
    - Qualitative analysis techniques
    - Application of computer in research data analysis
7. **Report preparation**
    - Structure and component of research report
    - Organization of data
    - Indexing of journal and research output
    - Citation, references, bibliography
    - Copyright, plagiarism, originality of research work
8. **Research ethics**
    - Ethics in research
    - National and Iinternational regulations/ laws/ ethics related to research on Human, Animals and Environments

SYLLABUS FOR PH.D. ENTRANCE EXAM

PAPER – II (EDUCATION)

UNIT I Psychological Foundations of Education

- Concept: Meaning, Nature, Scope, And Function of Psychology, Heredity and Environment, Growth and Development at Different Stages
- Schools of Psychology: Behaviorism, cognitivism, and constructivism.
- Theories – Thondike Theory of Learning, Piaget and Bruner's Cognitive Development, Maslow's Theory of Motivation, Erikson, Bandura and Vygotsky's Theories of Social Development, Kohlberg, Piajet's Theories Of Moral Development, Pavlov's Classical And Skinner's Operant Conditioning; Learning By Insight
- Factors Affecting Learning - Transfer of Learning, Memory, Forgetting and Imagination, Interest, Intelligence, Aptitude, Attitude, Creativity, Personality,
- Adjustment And Mental Health - Process of Adjustment. Conflicts And Defence Mechanism, Mental Hygiene and Mental Health

UNIT II Philosophical & Sociological Foundations of Education

- Indian Schools of Philosophy: Sankhya, Vedanta, Buddhism, Jainism, Islamic traditions with special reference to the concept of knowledge, reality and values and their educational implications. Contributions of Vivekananda, Tagore, Gandhi, and Aurobindo, JK Krushnamurty to educational thinking.
- Western Schools of Philosophy: Idealism, Realism, Naturalism, Pragmatism, Existentialism, with special reference to the concepts of knowledge, reality and values their educational implications for aims, curriculum and methods of education.
- Sociology of Education: Concept, Nature, and Scope; Relationship between Education and Society; Concept of Social Organization, Social Groups, Social Stratification, and Relation to Education - Social Mobility and Social Change; Major factors in the process of Social Change
- Agencies of Education for Socialisation: Family, School, Community and State - Religion-Meaning and characteristics and relation to education; Culture- Meaning and Nature; Role of Education in cultural context; Education and cultural change. Equality of educational opportunities; Education of deprived groups-SC, ST, Disabled, Gender, Minority groups, Social, Cultural and Economic - Directive principles of constitution, Articles related to education, RTE-2009, Education for national integration and international understanding

UNIT III Educational Leadership & Management

- Introduction To Management- Concept, Characteristics, Functions of Management.Theories Of Management – Peter Drucker, Fayol, Taylor.
- Resource Management – Human Resource Management, Records and Registers, Financial Management, Material Resource Management
- Leadership In Educational Administration: Meaning and Nature Of Leadership Theories Of Leadership Styles Of Leadership Measurements Of Leadership, Decision Making
- Quality In Education – TQM, Supervision and Inspection, PTA, School Climate, Challenges

In Management.

UNIT IV Guidance and Counseling

- Concept, Need and Importance of Guidance And Counselling. Difference Between Guidance & Counseling, Types of Counseling, Steps of Counseling, Organizing Guidance Services At Different Levels Of Education, Occupational Information,
- Tools And Techniques of Guidance—Standardized Tests (Personality Inventories, Aptitude, Intelligence, Interest Inventories), Non-Standardized Tests (Rating Scale, Interview, Questionnaire, Case Study, Anecdotal Records)
- Counselling For Special Education- Hearing Impaired, Visual Impaired, Slow Learners, Learning Disability, Physically Handicapped, Cerebral Palsy, ADHD, Autism, Mentally Challenged, Gifted.
- Inclusive Education – Concept, History, Need, Challenges, Infrastructure Requirement, Teachers Role, Strategies for Inclusive Classroom.

UNIT V Educational Evaluation

- Evaluation – Concept, Need and Importance, Types, Principles, Blooms Taxonomy
- Tools Of Measurement - Subjective and Objective Tools, Essay Test, Objective Test, Scales, Questionnaires, Schedules, Inventories, Performance Tests.
- Characteristics Of a Good Measuring Instrument: Validity Reliability Norms Usability, Etc. Test Standardization. Norm-Referenced and Criterion-Referenced Tests. Scaling Standard Scores. Measures Of Central Tendency, Measures of Variability, Normal Probability Curve
- New Trends in Evaluation – CBCS, Outcome Based Education, Grading System, Use Of Computer In Evaluation.

UNIT VI Teacher Education and Higher education

- Basics Of Teacher Education: Meaning, Concept, Scope, Historical Development, Elementary, Secondary and Teacher Education at Higher Level, Privatization, Globalization and Autonomy in Teacher Education, Problems in Teacher Education, Use of ICT In Education
- Professional Development: Professional Code of Ethics for Teacher Educators, Performance Appraisal, Trends in Research in Teacher Education, Innovative Practices in Teacher Education.
- Concept Of Higher Education: Concept and Purposes and History of Higher Education in India, Agencies and Their Functions in Higher Education: UGC, DST, ICSSR, ICMR, IISER, ICAR, AICTE, NCTE, RCI, NAAC., Issues and Problems in Higher Education
- Higher Education Management - Types of Universities- Central, State and Private, University Management and Autonomy, Constitutional Provision and Legislation for Universities
- RUSA
- Recommendations of kothari Commission 1964-66), National Policy of Education (N.E.P. 1986), P.O.A (1990), National Policy of Education (N.E.P. 2020) on teacher's education and higher education.

References:

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SYLLABUS FOR PH.D. ENTRANCE EXAM

PAPER – II (COMMERCE)

Unit 1: Accounting and Auditing

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

Unit 2: Business Finance

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

Unit 3: Business Statistics and Research Methods

- Measures of central tendency
- Measures of dispersion
- Measures of skewness
- Correlation and regression of two variables
- Probability: Approaches to probability; Bayes' theorem
- Probability distributions: Binomial, poisson and normal distributions
- Research: Concept and types; Research designs

- Data: Collection and classification of data
- Sampling and estimation: Concepts; Methods of sampling - probability and non-probability methods; Sampling distribution; Central limit theorem; Standard error; Statistical estimation
- Hypothesis testing: z-test; t-test; ANOVA; Chi–square test; Mann-Whitney test (U- test); Kruskal-Wallis test (H-test); Rank correlation test
- Report writing

Unit 4: Business Management and Human Resource Management

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

Unit 5: Banking and Financial Institutions

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

Unit 6: Marketing Management

- Marketing: Concept and approaches; Marketing channels; Marketing mix; Strategic marketing planning; Market segmentation, targeting and positioning
- Product decisions: Concept; Product line; Product mix decisions; Product life cycle; New product development
- Pricing decisions: Factors affecting price determination; Pricing policies and strategies
- Promotion decisions: Role of promotion in marketing; Promotion methods - Advertising; Personal selling; Publicity; Sales promotion tools and techniques; Promotion mix
- Distribution decisions: Channels of distribution; Channel management
- Consumer Behaviour; Consumer buying process; factors influencing consumer buying decisions
- Service marketing
- Trends in marketing: Social marketing; Online marketing; Green marketing; Direct marketing; Rural marketing; CRM
- Logistics management

Unit 7: Income-tax and Corporate Tax Planning

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

SYLLABUS FOR PH.D. ENTRANCE EXAM

PAPER – II (MANAGEMENT)

Unit – I

Management – Concept, Process, Theories and Approaches, Management Rolesand Skills Functions – Planning, Organizing, Staffing, Coordinating and Controlling.Communication –Types, Process and Barriers.

Decision Making – Concept, Process, Techniques and Tools, Organisation

Structure and Design – Types, Authority, Responsibility, Centralisation, Decentralisation and Span of Control, Managerial Economics – Concept & Importance, Demand analysis – Utility Analysis, Indifference Curve, Elasticity & Forecasting Market Structures – Market Classification & Price Determination

National Income – Concept, Types and Measurement Inflation – Concept, Types and Measurement

Business Ethics & CSR, Ethical Issues & Dilemma, Corporate Governance Value Based Organisation

Unit – II

Organisational Behaviour – Significance & Theories

Individual Behaviour – Personality, Perception, Values, Attitude, Learning and Motivation Group Behaviour – Team Building, Leadership, Group Dynamics

Interpersonal Behaviour & Transactional Analysis

Organizational Culture & Climate, Work Force Diversity & Cross Culture Organisational Behaviour Emotions and Stress Management, Organisational Justice and Whistle Blowing Human Resource Management – Concept, Perspectives, Influences andRecent Trends Human Resource Planning, Recruitment and Selection, Induction, Training and Development, Job Analysis, Job Evaluation and Compensation Management

Unit – III

Strategic Role of Human Resource Management, Competency Mapping & BalancedScoreboard Career Planning and Development, Performance Management and Appraisal Organization Development, Change & OD Interventions Talent, Management & SkillDevelopment,Employee Engagement & Work Life Balance, Industrial Relations: Disputes& Grievance Management, Labour Welfare andSocial Security, Trade Union & CollectiveBargaining, International Human Resource Management – HR Challenge of InternationalBusiness, Green HRM

Unit– IV

Accounting Principles and Standards, Preparation of Financial Statements,
Financial Statement Analysis – Ratio Analysis, Funds Flow and Cash Flow Analysis, DuPont Analysis, Preparation of Cost Sheet, Marginal Costing, Cost Volume Profit AnalysisStandard Costing & Variance Analysis, Financial Management, Concept & Functions
Capital Structure – Theories, Cost of Capital, Sources and Finance Budgeting andBudgetary Control, Types and Process, Zero base Budgeting
Leverages – Operating, Financial and Combined Leverages, EBIT–EPS Analysis, Financial Breakeven Point & Indifference Level.

Unit –V

Value & Returns – Time Preference for Money, Valuation of Bonds and Shares,Risk and Returns; Capital Budgeting – Nature of Investment, Evaluation, Comparison of Methods; Risk and Uncertainly Analysis, Dividend – Theories and Determination, Mergers and Acquisition – Corporate Restructuring, Value Creation, Merger Negotiations, Leveraged Buyouts, Takeover, Portfolio Management – CAPM, APT, Derivatives – Options, Option Payoffs, Option Pricing, Forward Contracts & Future Contracts, Working Capital Management – Determinants, Cash, Inventory, Receivables and Payables Management, Factoring, International Financial Management, Foreign exchange market

Unit - VI

Strategic Management – Concept, Process, Decision & Types
Strategic Analysis – External Analysis, PEST, Porter's Approach to industry analysis, Internal Analysis – Resource Based Approach, Value Chain Analysis, Strategy Formulation – SWOT Analysis, Corporate Strategy – Growth, Stability, Retrenchment, Integration and Diversification, Business Portfolio Analysis - BCG,GE Business Model, Ansoff's Product Market Growth Matrix, Strategy Implementation – Challenges of Change, Developing Programs Mckinsey 7s Framework

Marketing – Concept, Orientation, Trends and Tasks, Customer Value and Satisfaction Market Segmentation, Positioning and Targeting
Product and Pricing Decision – Product Mix, Product Life Cycle, New Product development, Pricing – Types and StrategiesPlace and promotion decision – Marketing channels and value networks, VMS, IMC, Advertising and Sales promotion.

Unit –VII

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

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

Logistics and Supply Chain Management, Drivers, Value creation, Supply Chain Design, Designing and Managing Sales Force, Personal Selling

Service Marketing – Managing Service Quality and Brands, Marketing Strategies of Service Firms, Customer Relationship Marketing – Relationship Building, Strategies, Values andProcess, Retail Marketing – Recent Trends in India, Types of Retail Outlets.

Emerging Trends in Marketing – Concept of e-Marketing, Direct Marketing, Digital Marketing and Green Marketing, International Marketing – Entry Mode Decisions, Planning Marketing Mix for International Markets.

Unit –VIII

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

Data Collection & Questionnaire Design Sampling – Concept, Process and TechniquesHypothesis Testing – Procedure; T, Z, F, Chi-square tests

Correlation and Regression Analysis Operations

Management – Role and Scope

Facility Location and Layout – Site Selection and Analysis, Layout – Design and Process Enterprise Resource Planning – ERP Modules, ERP implementation Scheduling; Loading, Sequencing and Monitoring, Quality Management and Statistical Quality Control, Quality Circles, Total QualityManagement – KAIZEN, Benchmarking, Six Sigma; ISO 9000 Series Standards, Operation Research – Transportation, Queuing Decision Theory, PERT / CPM

SYLLABUS FOR PH.D. ENTRANCE EXAM
PAPER – II (PHYSICS)

Mathematical Methods of Physics: Eigenvalues and eigenvectors, linear ordinary differential equations, Special functions. Fourier series, Transforms, Elements of complex analysis, Elementary probability theory, random variables, Distributions, Green's function, Partial differential equations, Elements of computational techniques, Tensors. Classical Mechanics: Newton's laws, Central force motions, two body Collisions - scattering in lab and C.m. frames , Rigid body dynamics, Non-inertial frames and pseudo forces, Lagrangian and Hamiltonian formalism, small oscillations, normal modes, Special theory of relativity, Lorentz transformations, relativistic kinematics. Electromagnetic Theory: Laplace and Poisson equations, boundary value problems, Maxwell's equations in free space and linear isotropic media, Scalar/ vector potentials, gauge invariance, Dispersion relations in plasma, Lorentz invariance of Maxwell's equations, Transmission lines and wave guides, Radiation-from moving charges and dipoles, Retarded potentials. Quantum Mechanics: Schrödinger's equation and its Applications for simple problems, Heisenberg uncertainty principle, Dirac notation , Motion in a central potential, angular momentum algebra, Hydrogen atom, Approximation methods, Fermi's golden rule, Pauli exclusion principle, Elementary theory of scattering, Klein-Gordon and Dirac equations. Thermodynamic and Statistical Physics: Laws of thermodynamics, Thermodynamic potentials, Maxwell relations, chemical potential, phase equilibria, micro- and macro-states, Micro-canonical, canonical and grand-canonical ensembles and partition functions, Free energy and its connection with thermodynamic quantities, Classical / quantum statistics, Bose and Fermi gases, Diamagnetism, Para magnetism, and ferromagnetism, Bose-Einstein condensation, Diffusion equation, , Nonequilibrium processes. Electronics and Experimental Methods: Semiconductor devices, frequency dependence and application, Opto-electronic devices, Operational amplifiers and their applications, Digital techniques and applications, Microprocessor and microcontroller basics. Atomic & Molecular Physics: Spectrum of He and alkali atoms, LS & JJ couplings, Zeeman, Paschen-Bach & Stark effects, E.S.R. and N.M.R., chemical shift, Frank-Condon principle, Born-Oppenheimer approximation, Diatomic molecules, spectra, Lasers. Condensed Matter Physics: Bravais lattices, Reciprocal lattice, Diffraction and the structure factor, bonding of solids, Elastic properties, phonons, lattice specific heat, Free electron theory and electronic specific heat, Response and relaxation phenomena, Hall effect , Periodic potential, Type-I and type-II superconductors, Josephson junctions, Super fluidity, Defects and dislocations. Nuclear and Particle Physics: Binding energy, semi empirical mass formula, liquid drop model, Nature of the nuclear force, form of nucleon-nucleon potential, charge-independence and charge-symmetry of nuclear forces, Deuteron problem, Shell structure, single-particle shell model, Rotational spectra, Fission and fusion,

Classification of fundamental forces, Quark model, C, P, and T invariance, Weak interactions.

SYLLABUS FOR PH.D. ENTRANCE EXAM

PAPER – II (CHEMISTRY)

Inorganic Chemistry and Analytical chemistry:

Chemical periodicity, Structure and bonding in homo and hetero nuclear molecules, including shapes of molecules (VSEPR Theory), Concepts of acids and bases, Hard-Soft acid base concept, Non-aqueous solvents, Main group elements and their compounds: Allotropy, synthesis, structure and bonding, industrial importance of the compounds, Transition elements and coordination compounds: structure, bonding theories, spectral and magnetic properties, reaction mechanisms, Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications, Organometallic compounds: synthesis, bonding and structure,and reactivity. Organometallics in homogeneous catalysis, Cages and metal clusters, Analytical chemistry- separation, spectroscopic, electro- and thermo analytical methods, Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron- transfer reactions; nitrogen fixation, metal complexes in medicine, Characterization of inorganic compounds by IR, Raman, NMR, EPR, Mossbauer, UV-vis, NQR, MS, electron spectroscopy and microscopic techniques, Nuclear chemistry: nuclear reactions, fission and fusion, radio-
analytical techniques and activation analysis.

Organic Chemistry:

IUPAC nomenclature of organic molecules including regio- and stereoisomers, Principles of stereochemistry: Configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction, Aromaticity: Benzenoid and non-benzenoid compounds - generation and reactions, Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, benzynes and nitrenes,. Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Determination of reaction pathways, Common named reactions and rearrangements - applications in organic synthesis,. Organic transformations and reagents: Functional group interconversion including oxidations and reductions; common catalysts and reagents (organic, inorganic, organometallic and enzymatic). Chemo, regio and stereoselective transformations, Concepts in organic synthesis: Retrosynthesis, disconnection, synthons, linear and convergent synthesis, umpolung of reactivity and protecting groups,. Asymmetric synthesis:

Chiral auxiliaries, methods of asymmetric induction - substrate, reagent and catalyst controlled reactions; determination of enantiomeric and diastereomeric excess; enantio-discrimination.Resolution

- optical and kinetic, Pericyclic reactions - electrocyclization, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications ofphotochemical reactions in organic chemistry, Synthesis and reactivity of common heterocyclic compounds containing one or two hetero atoms (O, N, S), Chemistry of natural products: Carbohydrates, proteins and peptides, fatty acids, nucleic acids, terpenes, steroids and alkaloids.Biogenesis of terpenoids and alkaloids, Structure determination of organic compounds by IR, UV-Vis, 1 H & 13 C NMR and Mass spectroscopic techniques.

Physical Chemistry:

Basic principles of quantum mechanics: Postulates; operator algebra; exactly- solvable systems: particle-in-a-box, harmonic oscillator and the hydrogen atom, including shapes of atomic orbitals; orbital and spin angular momenta; tunneling, Approximate methods of quantum mechanics: Variational principle; perturbation theory up to second order in energy; applications,. Atomic structure and spectroscopy; term symbols; many-electron systems and anti-symmetry principle, Chemical bonding in diatomics; elementary concepts of MO and VB theories; Huckel theory for conjugated p-electron systems, Chemical applications of group theory; symmetry elements; point groups; character tables; selection rules, Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities- selection rules; basic principles of magnetic resonance, Chemical thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell's relations; spontaneity and equilibria; temperature and pressure dependence of thermodynamic quantities; Le Chatelier principle; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions,. Statistical thermodynamics: Boltzmann distribution; kinetic theory of gases; partition functions and their relation to thermodynamic quantities - calculations for model systems, Electrochemistry: Nernst equation, redox systems, electrochemical cells; Debye Huckel theory; electrolytic conductance - Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations, Chemical kinetics: Empirical rate laws and temperature dependence; complex reactions; steady state approximation; determination of reaction mechanisms; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions, Colloids and surfaces: Stability and properties of colloids; isotherms and surface area; heterogeneous catalysis, Solid state: Crystal structures; Bragg's law and applications; band structure of solids, Polymer chemistry: Molar masses; kinetics of polymerization, Data analysis: Mean and standard deviation; absolute and relative errors; linear regression; covariance and correlation coefficient.

SYLLABUS FOR PH.D. ENTRANCE EXAM

PAPER – II (MATHEMATICS)

Unit-I Real Analysis and Linear Algebra

Elementary set theory, finite, countable, and uncountable sets, Real number system, Archimedean property, supremum, infimum, Sequence and series, convergence, limsup, liminf.

Bolzano Weierstrass theorem, Heine Borel theorem

Continuity, uniform continuity, differentiability, mean value theorem.

Sequences and series of functions, uniform convergence.

Finite dimensional vector spaces over real or complex fields; Linear transformations and their matrix representations, rank and nullity;

Systems of linear equations, characteristic polynomial, eigenvalues and eigenvectors, diagonalization, minimal polynomial, Cayley-Hamilton Theorem.

Finite dimensional inner product spaces, Gram-Schmidt orthonormalization process, symmetric, skew-symmetric, Hermitian, skew-Hermitian, normal, orthogonal and unitary matrices; diagonalization by a unitary matrix.

Unit-II Complex Analysis and Algebra

Functions of a complex variable: continuity, differentiability, analytic functions, harmonic functions;

Complex integration: Cauchy's integral theorem and formula; Liouville's theorem, maximum modulus principle, Morera's theorem;

Zeros and singularities; Power series, radius of convergence, Taylor's series and Laurent's series;

Residue theorem and applications for evaluating real integrals; Rouche's theorem, Argument principle, Schwarz lemma;

Groups, subgroups, normal subgroups, quotient groups, homomorphisms, automorphisms; cyclic groups, permutation groups.

Group action, Sylow's theorems and their applications;

Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domains, Principle ideal domains, Euclidean domains, polynomial rings, Eisenstein's irreducibility criterion;

Fields, finite fields, field extensions, algebraic extensions, algebraically closed fields.

Unit-III Ordinary Differential Equations and partial Differential Equations

First order ordinary differential equations, existence and uniqueness theorems for initial value problems.

Linear ordinary differential equations of higher order with constant coefficients; Second order linear ordinary differential equations with variable coefficients.

Cauchy-Euler equation, method of Laplace transforms for solving ordinary differential equations.

Method of characteristics for first order linear and quasilinear partial differential equations.

Second order partial differential equations in two independent variables: classification and canonical forms, method of separation of variables for Laplace equation in Cartesian and polar coordinates, heat and wave equations in one space variable.

Wave equation: Cauchy problem and D'Alembert formula, domains of dependence and influence, nonhomogeneous wave equation; Heat equation: Cauchy problem; Laplace and Fourier transform methods.

Unit-IV Linear Programming

Linear programming models, convex sets, extreme points; Basic feasible solution, graphical method, simplex method, two phase methods, revised simplex method.

Balanced and unbalanced transportation problems, Initial basic feasible solution of balanced transportation problems (least cost method, north-west corner rule, Vogel's approximation method).

Optimal solution, modified distribution method; Solving assignment problems, Hungarian method.

Unit-V Calculus of Variations and Linear Integral equations

Variation of a functional, Euler-Lagrange equation, Necessary and sufficient conditions for extrema.

Variational methods for boundary value problems in ordinary and partial differential equations**.**

Linear integral equation of the first and second kind of Fredholm and Volterra type, Solutions with separable kernels. Characteristic numbers and eigenfunctions, resolvent kernel.

SYLLABUS FOR PH.D. ENTRANCE EXAM
PAPER – II (COMPUTER APPLICATION)

Set Theory & Algebra: Sets; Relations; Functions; Groups; Partial Orders; Lattice; Boolean Algebra. Digital Logic: Logic functions, Minimization, Design and synthesis of combinational and sequential circuits; Number representation. Computer Organization and Architecture: Machine instructions and addressing modes, ALU and data-path, CPU control design, Memory interface, I/O interface (Interrupt and DMA mode), Instruction pipelining, Cache and main memory, Secondary storage, 8085 microprocessor. Programming and Data Structures: Programming in C/C++; Functions, Recursion, Parameter passing, Scope, Binding; Abstract data types, Arrays, Stacks, Queues, Linked Lists, Trees, Binary search trees, Binary heaps. Algorithms: Divide & conquer, Branch & bound, Dynamic programming, Greedy techniques, NP-Hard & NP Complete. Theory of Computation: Regular languages and finite automata, Context free languages and Pushdown automata Compiler Design: Lexical analysis, Parsing, Syntax directed translation Operating Systems: Processes, Threads, Interprocess communication, Concurrency, Semaphores, Synchronization, Deadlock, CPU scheduling, Memory management and virtual memory, File systems, I/O systems, Protection and security. Databases: ER-model, Database design (integrity constraints, normal forms), Query languages (SQL). Information Systems and Software Engineering: information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project, design, coding, testing, implementation, maintenance. Computer Networks: ISO/OSI stack, LAN technologies (Ethernet), Flow and error control techniques, TCP/UDP and sockets, IP(v4), Application layer protocols, Basic concepts of hubs, switches, gateways, and routers. Network security – basic concepts of public key and private key cryptography, digital signature, firewalls.

SYLLABUS FOR PH.D. ENTRANCE EXAM

PAPER – II (ENGLISH)

ENGLISH LITERATURE

- Chaucer to Shakespeare age
- Jacobean to Restoration period
- Romantic period
- Victorian age
- Modern and Post-Modern period
- American and Common Wealth Literature
- Literary Theory and Criticism
- Indian Writing in English
- Cultural Studies
- Gender Studies
- Rhetoric and Prosody

NOTE: All the important writers, poets, dramatists and their major works should be studied properly

English Language Teaching

- ELT: an introduction (History, Evolution, Theories, Pedagogy, Problems, Prospects,and Future)
- Characteristics of Language
- Difference between Animal and Human Communication
- Language Acquisition and Language Learning
- Listening/Speaking/Reading/Writing/Vocabulary/Grammar
- English for Academic and Specific Purposes
- Teaching Methods, Techniques and Approaches
- Basic Concepts of Language Testing and Assessment
- Basic Concepts in Linguistics
- Phonetics and Phonology
- Morphology
- Syntax
- Semantics
- Historical Linguistics
- Sociolinguistics
- Pragmatics