NIRWAN UNIVERSITY

PAPER I (COMPULSORY)

RESEARCH APPTITUDE

(It may be treated as the guide lines of preparation for the Entrance Test)

I. Application of Statistical Concepts/Procedures: Data: Diagrammatical Representation of data: Probability; Dispersion; Skewness and Kurtosis of Normal Distribution; Other natural distributions, Random Sampling.

II. Testing of Hypothesis Tests, X2 (Chi-square), and F-tests, Analysis of Variance, Covariance, Analysis of Variance, Parameters and variables.

III. Functional Units of a Computer; Operating Systems; Files and Folders, Word Editing and Formatting a Document; Excel sheets & Tables; Editing and Formatting Worksheets, Creating and Printing a Presentation; Producing a Slide Show and function keys; Performing Basic Calculations; Using the Internet and the World Wide Web.

IV. Learning Software Packages Specific to the Subject. Creation of Questionnaire Online, Analysis and Interpretation of Data, Construction of Charts, Diagrams, Sharing of Information Online with Respondents, etc. using the following Online Tools: (i) Google Docs (ii) Google Scholar (iii) Research gates (iv) Survey Moneys.

V. Research and funding Organizations and Important research awards (including awardees), Current areas of research

VI. Higher education, policies and commissions, Science and applications
**PAPER II (ELECTIVE – AS PER DISCIPLINE)**

**MANAGEMENT (FINANCE / ACCOUNTING)**

1. Managerial Economics: Demand analysis, production function, cost-output relations, market structures, pricing theories, advertising, macro-economics, national income concepts, infrastructure-management and policy, Business Environment, Capital Budgeting


3. Accounting standard in India, inflation accounting, human resource accounting, responsibility accounting, social accounting, money and capital market, working of stock exchange in India, NSE, OTCEI, NASDAQ, derivatives and options, Regulatry authorities: SEBI, rating agencies, new instruments, GDRs, ADRs., venture capital funds, mergers and acquisitions, mutual funds, lease financing, factoring, valuation of securities; pricing theories – capital asset pricing model and arbitrage pricing theory, understanding financial statements and analysis thereof, capital budgeting decisions; risk analysis in capital budgeting and long term sources of finance, capital structure – theories and factors, cost of capital, dividend policies – theories and determinants, working capital management- determinants and financing; cash management; inventory management, receivable management, elements of derivatives, corporate risk management, mergers and acquisitions, international financial management.

4. India’s foreign trade and policy; export promotion policies; trade agreements with other countries; policy and performance of export zones and export oriented units, export incentives, international marketing logistics, international logistical structures; export documentation framework; organization of shipping services; chartering practices; marine cargo insurance.

5. International financial environment; foreign exchange markets; determination of exchange rates; exchange risk measurement; international investment; international capital markets; international credit rating agencies and implications of their ratings.

6. WTO and multilateral trade agreements pertaining to trade in goods; trade I services and TRIPS ; multilateral environmental agreements (MEAs); international trade blocks – NAFTA, ASEAN, SAARC, EU, WTO and dispute settlement mechanism. Technology monitoring; emerging opportunities for global business.

7. Concepts – types, characteristics; motivation; competencies and its development; innovation and entrepreneurship; small business- concepts Government policy for promotion of small and
tiny enterprises; process of business opportunity identification; detailed business plan preparation; managing small enterprises; planning for growth; sickness in small enterprises; rehabilitation of sick enterprises; intrapreneurship (Organizational entrepreneurship).

8. Role and scope of production management; facility location; layout planning; and analysis; production planning and control – production process analysis; demand forecasting for operations; determinants of product mix; production scheduling; work measurement; time and motion study; statistical quality control, role and scope of operation research; linear programming; sensitivity analysis; duality; transportation model; inventory control, queueing theory; decision theory; markov analysis; PERT/CPM.

9. Marketing environment and environment scanning; marketing information system and marketing research; understanding consumer and industrial markets; demand measurement and forecasting; market segmentation- targeting and positioning; product decisions, product mix, product life cycle; new product development; branding and packaging; pricing methods and strategies. Promotions decisions- promotion mix; advertising; personal selling; channel management; vertical marketing systems; evaluation and control of marketing effort; marketing of services; customer relation management. Uses of internet as a marketing medium – other related issues like branding, market development, advertising and retailing on the net. New issues in marketing.


11. Concepts of corporate strategy; components of strategy formulation; Ansoffs growth vector; BCG models; porter’s generic strategies; competitor analysis; strategic dimensions and group mapping; industry analysis; strategies in industry evolution, fragmentation, maturity and decline; competitive strategy and corporate strategy; transnationalization of world economy; managing cultural diversity; global entry strategies; globalization of financial system and services; managing international business; competitive advantage of nations; RTP and WTO.

12. 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 individual and firms, deductions 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, method of tax planning, tax consideration in specific business decisions viz make or buy own or lease, retain or replace, export or domestic sales; shout down or closure, expand or contract, invest or disinvest. Computer application in income tax and tax planning.

CHEMISTRY
INORGANIC CHEMISTRY
1. Chemical periodicity
2. Structure and bonding in homo- and heteronuclear molecules, including shapes of Molecules (VSEPR Theory).
4. Main group elements and their compounds: Allotropy, synthesis, structure and Bonding, industrial importance of the compounds.
5. Transition elements and coordination compounds: structure, bonding theories, Spectral and magnetic properties, reaction mechanisms.
6. Inner transition elements: spectral and magnetic properties, redox chemistry, Analytical applications.
8. Cages and metal clusters.
10. Characterization of inorganic compounds by IR, Raman, NMR, EPR, Mossbauer, UV-vis, NQR, MS, electron spectroscopy and microscopic techniques.

PHYSICAL CHEMISTRY
1. Basic principles of quantum mechanics: Postulates; operator algebra; particle-in-a-box, harmonic oscillator and the hydrogen atom, including shapes of atomic orbitals; orbital and spin angular momenta; tunneling.
2. Approximate methods of quantum mechanics: Variational principle; perturbation theory up to second order in energy; applications.
3. Atomic structure and spectroscopy; term symbols; many-electron systems and antisymmetry principle.
4. Chemical applications of group theory; symmetry elements; point groups; character tables; selection rules.
5. Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules; basic principles of magnetic resonance.
6. 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.
7. Statistical thermodynamics: Boltzmann distribution; kinetic theory of gases; partition functions and their relation to thermodynamic quantities – calculations for model systems.
8. Electrochemistry: Nernst equation, redox systems, electrochemical cells; Debye- Hückel theory; electrolytic conductance – Kohlrausch’s law and its applications; ionic equilibria; conductometric and potentiometric titrations.
9. 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.
10. Colloids and surfaces: Stability and properties of colloids; isotherms and surface area; heterogeneous catalysis.
11. Solid state: Crystal structures; Bragg’s law and applications; band structure of solids.

**ORGANIC CHEMISTRY**

1. IUPAC nomenclature of organic molecules including regio- and stereoisomers.
2. Principles of stereochemistry: Configurational and conformational isomerism in Acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction.
3. Aromaticity: Benzenoid and non-benzenoid compounds – generation and reactions.
5. Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Determination of reaction pathways.
7. 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.
10. Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms (O, N, S).
11. Structure determination of organic compounds by IR, UV-Vis, $^1$H & $^{13}$C NMR and Mass spectroscopic techniques.
MATHEMATICS

Abstract Algebra-

Numerical Analysis-

Differential Equation-

Linear Algebra-
Statistics and Probability Theory-
PHYSICS

Mathematical Methods of Physics

Classical Mechanics

Electromagnetic Theory

Quantum Mechanics

Thermodynamic and Statistical Physics

Electronics and Experimental Methods
Data interpretation and analysis. Precision and accuracy. Error analysis, propagation of errors. Least squares fitting.

Atomic & Molecular Physics

Condensed Matter Physics

Nuclear and Particle Physics
ENGLISH

1. Chaucer to Shakespeare
2. Jacobean to Restoration Periods
3. Augustan Age: 18th Century Literature
4. Romantic Period
5. Victorian Period
6. Modern Period
7. Contemporary Period
8. American and other non-British Literatures
9. Literary Theory and Criticism
10. Rhetoric and Prosody
SOCIOLOGY

Classical Sociological Theory
The socio-historical and intellectual background of Sociology; August Comte (Sociology — Positivism — social evolution); Karl Marx (historical and dialectical materialism — class conflict — capital — base and super structure); Emile Durkheim (social Fact — methodology — social solidarity — social change — religion and society); Max Weber (social Action— methodology— authority — class, status and power — religion and economy)

Modern Sociological Theory

Social Research Method
Meaning and nature (social phenomena — scientific enquiry — objectivity and subjectivity — fact and value); Quantitative methods (survey — research design — hypothesis — sampling, techniques of data collection: observation, questionnaire and interview); Qualitative methods (participant observation — case study — content analysis — oral history — life history); Statistical tools (measures of central tendency— measures of dispersion — correlation — test of significance — reliability and validity).

Sociology of India
Approaches to the Study of Indian Society (Indology — Civilizational — Functional — Marxist — Subaltern); People of India (groups and communities— unity and diversity — pluralism); Caste structure and change (Tribe and Caste— forms of caste — caste and social institutions — changes in caste system); Rural social structure (village community — change in village community); Family, kinship and marriage; Religion in India (ideology — organization — religious movement)

Social Stratification
Theories of social stratification (social class — class, status, and party — cultural stratification); Issues in stratification (difference — hierarchy — equality and inequality); Forms of stratification (caste — class — gender — ethnic); Stratification and social mobility in India.

Economy and Society
Theories on economic social relationship; Features of industrial society (factory system — division of labor— bureaucracy — rationality— production relations — surplus value — alienation); Relationships (labor—management—conciliation—adjudication—arbitration—collective bargaining — trade unions — Joint management councils — quality circles); Agriculture, Industry and service sectors; Industrialization and social change in India; Industrial planning.

Political Sociology
Approaches to the study of politics; Concepts (power and authority — consensus and conflict— elites and masses— state and stateless societies); Local, everyday power and wider political system; State and society under capitalism; Citizenship and the welfare state; sovereignty and institutional autonomy; state and society in India; Civil society and social mobilization.

**Sociology of Development**
Conceptual perspectives (economic— human — social — sustainable — ecological notions of development); Theories of underdevelopment (Max Weber — Gunnar Myrdal — Frank — Samir Amin — Wallerstein); Paths of development (modernization — globalization — Socialist — Mixed — Gandhian); Social structure and development; Culture and development

**Family, Kinship and Marriage**
Theories; family (types — characteristics) kinship (incest taboo — honor — descent, residence and inheritance); Marriage patterns (exchange — alliance — bride-wealth — dowry — social reproduction — monogamy — plural marriages); Culture, law and economy; Indian case.
COMPUTER APPLICATIONS

DISCRETE STRUCTURES


Computability: Models of computation—Finite Automata, Pushdown Automata, Non-determinism and NFA, DPDA and PDAs and Languages accepted by these structures. Grammars, Languages, Non-computability and Examples of non-computable problems.


Groups: Finite fields and Error correcting/detecting codes.

COMPUTER ARITHMETIC

Propositional (Boolean) Logic, Predicate Logic, Well-formed-formulae (WFF), Satisfiability and Tautology.


Representation of Integers: Octal, Hex, Decimal, and Binary. 2’s complement and 1’s complement arithmetic. Floating point representation.

PROGRAMMING IN C AND C++

Programming in C: Elements of C—Tokens, identifiers, data types in C. Control structures in C. Sequence, selection and iteration(s). Structured data types in C—arrays, struct, union, string, and pointers.


RELATION DATABASE DESIGN AND SQL

E-R diagrams and their transformation to relational design, normalization—1NF, 2NF, 3NF, BCNF and 4NF. Limitations of 4NF and BCNF. SQL: Data Definition Language (DDL), Data Manipulation Language (DML), Data Control Language (DCL) commands. Database objects like—views, indexes, sequences, synonyms, data dictionary.

DATA AND FILE STRUCTURES

Data, Information, Definition of data structure. Arrays, stacks, queues, linked lists, trees, graphs, priority queues and heaps.


COMPUTER NETWORKS

Network fundamentals: Local Area Networks (LAN), Metropolitan Area Networks (MAN), Wide Area Networks (WAN), Wireless Networks, Inter Networks.

Reference Models: The OSI model, TCP/IP model.


Internetworking: Switch/Hub, Bridge, Router, Gateways, Concatenated virtual circuits, Tunnelling, Fragmentation, Firewalls.


SYSTEM SOFTWARE AND COMPILERS


Loading, linking, relocation, program relocatability. Linkage editing.

Text editors. Programming Environments. Debuggers and program generators.

Compilation and Interpretation. Bootstrap compilers. Phases of compilation process. Lexical analysis. Lex package on Unix system.

Context free grammars. Parsing and parse trees. Representation of parse (derivation) trees as rightmost and leftmost derivations. Bottom up parsers—shift-reduce, operator precedence, and LR. YACC package on Unix system.


OPERATING SYSTEMS (WITH CASE STUDY OF UNIX)

Main functions of operating systems. Multiprogramming, multiprocessing, and multitasking.

*Memory Management*: Virtual memory, paging, fragmentation.

*Concurrent Processing*: Mutual exclusion. Critical regions, lock and unlock.


*UNIX*

The Unix System: File system, process management, bourne shell, shell variables, command line programming.

Filters and Commands: Pr, head, tail, cut, paste, sort, uniq, tr, join, etc., grep, egrep, fgrep, etc., sed, awk, etc.

System Calls (like): Creat, open, close, read, write, iseek, link, unlink, stat, fstat, umask, chmod, exec, fork, wait, system.
SOFTWARE ENGINEERING


- Software Metrics: Software Project Management.

- Software Design: System design, detailed design, function oriented design, object oriented design, user interface design. Design level metrics.

Hindi

हिन्दी भाषा और उसका विकास
अप्रभृत्ति (अवहट्ट सहित) और पूर्वी हिन्दी का सम्बन्ध, काव्यभाषा के रूप में अवधी का उदय और विकास, काव्यभाषा के रूप में ब्रजभाषा का उदय और विकास, साहित्यक हिन्दी के रूप में खड़ी बोली का उदय और विकास, मानक हिन्दी का भाषा वैज्ञानिक विकास (रूपगत), हिन्दी की बोलियाँ — वर्गीकरण तथा क्षेत्र, नामी लिपि का विकास और उसका मानकीकरण।
हिन्दी प्रसार के आन्दोलन, प्रमुख व्यक्तियों तथा संस्थाओं का योगदान, राजभाषा के रूप में हिन्दी।
हिन्दी भाषा-प्रयोग के विविध रूप — बोली, मानकभाषा, सम्पर्कभाषा, राजभाषा और राष्ट्रभाषा, संचार माध्यम और हिन्दी।
हिन्दी साहित्य का इतिहास
हिन्दी साहित्य का इतिहास-दर्शन, हिन्दी साहित्य के इतिहास-लेखन की पद्धतियाँ।
हिन्दी साहित्य के प्रमुख इतिहास प्रारंभ, हिन्दी के प्रमुख साहित्यिक केन्द्र, संस्थाएँ एवं पत्र-पत्रिकाएँ, हिन्दी साहित्य के इतिहास का काल-विभाजन और नामकरण।
आदिकल: हिन्दी साहित्य का आरम्भ कब और कैसे? राजसो-साहित्य, आदिकालीन हिन्दी का जैन साहित्य, सिद्ध और नाथ साहित्य, अमृत खुसरो की हिन्दी कविता, विद्वानति और उनकी पदावली, आरम्भिक गद्य तथा सौंदर्यमय साहित्य।
मध्यकल: भक्ति-आन्दोलन के उदय के सामाजिक-सांस्कृतिक कारण, प्रमुख निर्माणें एवं सम्प्रदाय, वैज्ञानिक भक्ति की सामाजिक-सांस्कृतिक वृद्धि, आलवार सन्त, प्रमुख सम्प्रदाय और आचार्य, भक्ति आन्दोलन का अखिल भारतीय स्वरूप और उसका अन्तःप्रदेशिक पैसाहत्य।
हिन्दी सत्ता काव्य : सत्ता काव्य का वैचारिक आधार, प्रमुख सन्नियुक्त सत्ता कवि क्यों, नानक, दादा, रायवर, सत्ता काव्य की प्रमुख विषयवस्तुएं, भारतीय धर्म साहित्य में सत्ता कवियों का स्थान ।
हिन्दी सूफी काव्य : सूफी काव्य का वैचारिक आधार, हिन्दी के प्रमुख सूफी कवि और काव्य — मुजफ्फर दादा ( चन्दनपुर ), कुरुक्षे ( मिनारियों ), मंजर ( मधुमालों ), मलिक मुहम्मद जायसी ( पदमालद ), सूफी प्रेमगाना का रूप, हिन्दी सूफी काव्य की प्रमुख विषयवस्तुएं ।
हिन्दी कृष्ण काव्य : विविध सम्प्रदाय, वल्लभ सम्प्रदाय, अभासपास, प्रमुख कृष्ण-भक्त कवि और काव्य, सुरदास ( सूरसागर ), नददास ( रास पंचायती ), प्रमाणित परम्परा, गीति परम्परा और हिन्दी कृष्ण काव्य — मीरा और रसबान ।
हिन्दी राम काव्य : विविध सम्प्रदाय, राम भक्ति शाखा के कवि और काव्य, तुलसीदास की प्रमुख कृतियाँ, काव्य रूप और उनका महत्व ।
रीति काल : सामाजिक-सांस्कृतिक परिप्रेक्ष्य, रीतिकाव्य के मूल स्रोत, रीतिकाल की प्रमुख प्रवृत्तियाँ, रीतिकालीन कवियों का आचार्यत्व, रीतिमुक्त काव्याधार, रीतिकाल के प्रमुख कवि : केशवदास, मंत्रालय, भूषण, दिहारीलाल, देव चन्दननंद और पद्मकार, रीतिकाल में लोकजीवन ।
आधुनिक काल : हिन्दी गद्दी का उद्धव और विकास ।
भारतेदू दुर्गा हिन्दी गद्दी, 1857 को राज्य क्षेत्र और सांस्कृतिक पुनर्जीवन, भीमेंद्रु और उनका मण्डल, 19 वीं सदी के उत्तरार्द्ध की हिन्दी पटकारिता ।
हिन्दी गद्दी में : महाबीर प्रसाद हिन्दी और उनका युग, हिन्दी नवजागरण और सरस्वती, मैथिलीशरण गुप्त और राजेंद्र काव्याधार, राजेंद्र काव्याधार के प्रमुख कवि, स्वच्छदनालाभ और उनके प्रमुख कवि ।
छायावाद और उसके बाद : छायावादी काव्य की प्रमुख विषयवस्तुएं, छायावाद के प्रमुख कवि : प्रसाद, निराला, पटन और महावीर, उत्तर छायावादी काव्य और उनके प्रमुख कवि, प्रभावशील काव्य और उनके प्रमुख कवि, विषयवस्तु और नई कविता, नई कविता के कवि, समकालीन कविता, समकालीन साहित्यिक परिवर्तन ।
हिन्दी साहित्य की गद्दी विख्यात ।
हिन्दी उत्पादन : प्रमचन्द पूर्व उत्पादन, प्रमचन्द और उनका युग, प्रमचन्द के परवर दिन के प्रमुख उत्पादनकार : जैनेन्द्र, अजीज, हजारी प्रसाद हिन्दी, यरसल, अमरलाल नगर, फणीश्वरलाल रेणु, भोज सहिन, कृष्ण सेतू, निम्नल बर्मा, नरेश नेहरा, श्रीलाल शुक्ल, राहे मासूम रजा, रामचंद्र राय, भजू मांदरी ।
हिन्दी कहानी : बीसवीं सदी की हिन्दी कहानी और प्रमुख कहानी आदिकाल ।
हिन्दी नाटक : हिन्दी नाटक और रंगमंच, विकास के चरण और प्रमुख नाट्यकृतियाँ : अंधेरा गगरी, चंद्रमुख, अंधामुख, अधेर-अधेर, अंधामुख, हिन्दी एकाकी ।
हिन्दी निबंध : हिन्दी निबंध के प्रकार और प्रमुख निबंधकार : रामचंद्र शुक्ल, हजारीप्रसाद हिन्दी, सुकुमर राय, व्याख्याता मिश्र, हरिचंद्र लाल, रामभानु सिंह ।
हिन्दी आलोचना : हिन्दी आलोचना का विकास और प्रमुख आलोचक : रामचंद्र शुक्ल, नन्दुरारे वाजपेयी, हजारीप्रसाद हिन्दी, रामविलास शामी, डा० नोद्रा, डा० नामवर सिंह, विजयदेव नारायण साही ।
हिन्दी की अन्य गद्दी विख्यात । रेखाचित्र, संस्कृत, या त्रि-साहित्य, आत्मकथा, जीवनी और रिपोर्ट ज्ञ।
काव्यशास्त्र और आलोचना
भरत मुनि का रस सूत्र और उसके प्रमुख व्याख्याकार ।
रस के अभ्यव ।
साधारणीकरण ।
शब्द शक्तियाँ और ध्वनि का स्वरूप ।
अलंकार — यमक, सलेप, वक्रोक्ति, उपमा, रूपक, उत्त्रेक्षा, संदेह, भावितमान, अतिशयोक्ति, अन्योक्ति,
समासोक्ति; अतुलक, विशेषोक्ति, दृष्टान्त, उदाहरण, प्रतिवस्तुपूर्ण; निरर्थना, अर्थात्रत्न्यास, विभावना,
असंगति तथा विरोधभाषा ।
रीति, गुण, बोध ।
भिन्नक, फॉनासी, कल्पनाः, प्रतीक और विम्ब ।
स्वच्छन्दतृतीय और यथार्थवाद, संरचनावाद, उत्तर संरचनावाद, आधुनिकता, उत्तर आधुनिकता ।
समकालीन आलोचना की कविता अवधारणाएँ : विडालना (आयरनी), अजनबीप (एलियनेशन),
विन्दुस्तु (एम्बई), अनाविरोध (पैराइडेस), विखण्डन (डीक्स्ट्रक्शन) ।
वैचारिक पृष्ठभूमि, माहौल, मनोवैश्वर्य, आस्तत्ववाद ।
प्राकृति चित्रण : सामाजिक दृष्टि, नागरुजन, यथार्थ चेतना और लोक-दृष्टि, केदारनाथ अग्रवाल — प्रकृति
जीवन और सौन्दर्य बोध ।
प्रयोगवाद : व्यापक चेतना, अंतर्गत — प्रयोगर्भमिता और काव्य-भावा ।
नब्बी कविता : व्यापक-समर्पण बोध, मुक्तबोध — सामाज-बोध, फैंटसी ।
समकालीन कविता : कला संस्कृति और लोक संस्कृति, रघुवीर सहाय — राजनीतिक चेतना, काव्य-भावा,
कविता नारायण — भिन्नकी चेतना, काव्य-दृष्टि ।
हिन्दी नाटक और भारतेन्दू : भारत-दुर्गा, अंगेय नगरी, यथार्थ बोध ।
प्रसाद के नाटक : छन्दमुख, भृतस्थायिनी, राष्ट्रीय और सांस्कृतिक चेतना, नाट्य-शिल्प ।
प्रसादी नाटक : अंधायु, आधे-अधूरे — आधुनिकता बोध, प्रयोगर्भमिता और नाट्य-भावा ।
निबंध और प्रमुख निबन्धकार : बालकृष्ण भट्ट, रामचन्द्र शुक्ल, विनम्रमण, अनन्तस्वल और शिल्प ।
शुक्लयोग निबंध और निबन्धकार : हजारी प्रसाद द्विवेदी, कुमेरनाथ राय, विद्याधिवास भिवाट, संस्कृति-बोध,
लोक-संस्कृति ।
भक्ति-काव्य : स्वरूप और भेद, निगरूण और समुन्द जा सम्बन्ध : साम्य और वेण्याय।
कवीर : निगरूण का स्वरूप, कवीर के राम और तुलसी के राम में अन्तर, रहस्य साधना, कवीर का समाज दर्शन और उनकी प्रासंगिकता, कवीर : कवि के रूप में।
जापसी : सांस्कृतिक दृष्टि, प्रेम-भावना, पद्मावत में लोक-तत्त्व, सांस्कृति, प्रकृति-चित्रण, सौन्दर्य दृष्टि, रूपक-तत्त्व।
सूरदास : भक्ति-भावना, माधुर्य और श्रृंगार वर्णन, लोक-तत्त्व, सौन्दर्य-बोध, प्रकृति-चित्रण, ध्यानगीत, अंतर्वस्तु और विदाध्यात, गीति-तत्त्व, लीला-भाव, बाल-लीला वर्णन का वैशिष्ट्य।
तुलसीदास : तुलसी की रचनाएँ, भक्ति, दर्शन, मानस की प्रवन्ध कल्पना, मर्यादा भाव, चित्रकूट सभा का महत्त्व, सामाजिक-परिवारिक आदर्श, युग-बोध, रामराज्य की परिकल्पना, तुलसी की काव्य-दृष्टि।
BIOTECHNOLOGY

Unit 1: Methods in Biology

Centrifugation Techniques
Chromatographic Techniques - General principles, TLC, column chromatography, HPLC, Adsorption chromatography, Partition chromatography, Ion exchange chromatography, Exclusion chromatography, GLC, Affinity chromatography.

Electrophoretic Techniques: General principles, Native gels, SDS-PAGE, IEF, 2D gel electrophoresis, Agarose gel electrophoresis, Pulse field gel electrophoresis, Capillary electrophoresis.

Spectroscopic techniques: UV/visible, fluorescence, circular dichroism, NMR, ESR spectroscopy, X-ray diffraction, mass spectrometry.

Radiolabeling techniques: Detection and measurement of radioisotopes, molecular imaging of radioactive material, safety guidelines.

Microscopic techniques: Light microscopy, scanning and transmission electron microscopy, fluorescent and confocal microscopy.

Statistical Methods: Measures of central tendency and dispersion; probability distributions (Binomial, Poisson and normal); Sampling distribution; parametric and non-parametric statistics; Confidence Interval; Errors; Levels of significance; Regression and Correlation; t-test; Analysis of variance and multiple range tests, chi-square test, experimental design, data transformation

Unit 2: Biochemistry and Biophysics
Composition, structure, conformation and function of biomolecules -carbohydrates, lipids, proteins, nucleic acids and vitamins.

Principles of biophysical chemistry (pH, buffer, reaction kinetics).

Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers.

Principles of catalysis and enzymes, enzyme kinetics, enzyme regulation, inhibition, isozymes.

Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds).

Unit 3: Microbiology
Historical perspectives; Pure culture techniques.

General outline and classification of viruses, fungi, bacteria and molecular taxonomy.

Archaea: Halophiles, methanogens, thermophiles.

Microbial growth: Growth curve, measurement of growth, continuous culture, factors affecting growth; culture collection and maintenance of cultures.

Microbial nutrition and metabolism: Metabolic diversity among microorganisms; chemolithotrophy; hydrogen-iron-nitrite-oxidizing bacteria; methanogenesis; fermentation.

Microbes and environment: Nutrient cycles; quorum sensing; biofuels; prebiotics and probiotics.

Microbial diseases: Tuberculosis, AIDS, candidiasis, malaria.

Important diseases of plants: Downy mildew of pearl millet, panama wilt of banana, bacterial leaf blight of rice, TMV.

Antibiotics: Types, mode of action and resistance.
Unit 4: Cell Biology

**Membrane structure and function:** Structure of fluid mosaic model of membrane, lipid bilayer, transport across membrane, mechanism of sorting and regulation of intracellular transport.

**Structural organization and function of intracellular organelles.**

**Organization of chromosomes:** Structure of chromatin and nucleosome, heterochromatin, euchromatin.

**Cell division and cell cycle:** Mitosis and meiosis, cell cycle and regulation.

**Cell signaling:** Peptide and steroid hormones and their receptors, signal transduction pathways, secondary messengers, regulation of signaling pathways.

**Cellular communication:** Cytoskeletal elements, cell adhesion molecules, extracellular matrix, neurotransmission and its regulation.

**Cancer:** Oncogenes, tumor suppressor genes, cancer and cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, chemotherapy.

Unit 5: Molecular Biology and Genetics

**DNA replication, repair and recombination in prokaryotes and eukaryotes:** Mechanism of replications, enzymes, fidelity of replication, DNA damage and repair mechanisms, homologous and site-specific recombination.

**RNA synthesis and processing in prokaryotes and eukaryotes:** Transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing and polyadenylation.

**Protein synthesis and processing in prokaryotes and eukaryotes:** Ribosome, formation of initiation complex, initiation factors, elongation, termination, genetic code, aminoacylation of tRNA, translational inhibitors, Post-translational modification of proteins.

**Control of gene expression at transcription and translation level:** regulating the expression of prokaryotic and eukaryotic genes, role of chromatin in gene expression, DNA methylation, gene silencing.

**Gene mapping methods:** Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants.

**Microbial genetics:** transformation, conjugation, transduction, fine structure analysis of genes.

**Human genetics:** Pedigree analysis, karyotypes, genetic disorders.

**Quantitative genetics:** Polygenic inheritance, heritability and its measurements, QTL mapping.

**Mutation:** Types, causes and detection, mutant types—lethal, conditional, biochemical, loss of function, gain of function, germinal versus somatic mutants, insertional mutagenesis.

**Structural and numerical alterations of chromosomes:** Deletion, duplication, inversion, translocation, ploidy and their genetic implications.

Unit 6: Gene Technology and Bioinformatics

**Isolation, purification, analysis of RNA and DNA (genomic and plasmid).**

**Molecular cloning of DNA and RNA fragments in cloning vectors and expression.**

**Construction of genomic and cDNA libraries and screening.**

**DNA sequencing methods, strategies for genome sequencing.**

**Methods for analysis of gene expression at RNA and protein level, micro array, DNA chips.**

**PCR, RFLP, Southern and Northern blotting, AFLP techniques, Real-time PCR.**

**In situ** localization, FISH and GISH.

**Bioinformatics**

**Biological Databases:** Types, importance and management.
**Sequence Database:** Nucleotide and Protein.

**Bioinformatics Softwares:** Clustal V Multiple Sequence Alignments, ClustalW Version 1.7, RasMol, Oligo, MolScript, TREEVIEW, ALSCRIPT, Genetic Analysis Software, Phylip.

**Computational Biology:** Datamining and Sequence Analysis, Database Similarities Searches, Multiple Sequence Alignment, Phylogenetic Analysis, Predictive methods using Nucleic acid and Protein Sequences, Submitting DNA Sequences to the Databases.

**Unit 7: Immunology and Immunotechnology**

**Innate and adaptive immune system:** Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity. B and T cell epitopes, structure and function of antibody molecules. Generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, humoral and cell-mediated immune responses, primary and secondary immune modulation, the complement system, cell-mediated effector functions, inflammation, hypersensitivity and autoimmunity.

**Immunological techniques:** ODD, immunoelectrophoresis, RIA, ELISA, Immunofluorescence, Western blot.

**Tumor immunology:** Neoplasms, tumor-associated antigens, immune response to tumor antigens, immunologic factors favouring tumor growth, immunotherapy.

**Unit 8: Bioprocess and Microbial Technology**

Primary and secondary metabolites, Batch culture, the growth cycle, effect of nutrients, energetics of growth.

**Design of bioreactors:** Biosensors, scale up of bioreactors

**Transport phenomena in bioprocess:** Mass transfer resistance, oxygen transfer coefficients, biological heat transfer, heat transfer coefficients.

**Downstream processing of biologicals:** Separation of cells, foam separation, flocculation, filtration, plate filters, rotary vacuum filter, centrifugation, Stokes law, basket centrifuge, bowl centrifuge, disintegration of microorganisms, mechanical and non-mechanical methods, membrane filtration, ultra filtration and reverse osmosis, chromatographic techniques, absorption, spray drier, drum dryers, freeze dryers.

**Microbial products:** Microbial production of vitamins, enzymes, organic acids, amino acids, antibiotics, ethanol.

**Microbes for sustainable agriculture:** Biological nitrogen fixation, Biofertilizers, Biological control, Biopesticides.

**Unit 9: Plant Biotechnology**

**Cell and Tissue Culture Technology**

Role of hormones in Callus Induction, Organogenesis, Somatic embryogenesis and synthetic seeds.

**Micropropagation:** Stages and applications.

**Germplasm preservation:** Short and long-term storages, gene banks, applications.

**Haploid Technology:** Methods of haploid culture and applications.

**Protoplast Technology:** Isolation, purification and culture of protoplasts, protoplast fusion and somatic hybridization, applications of somatic hybrids.

**Secondary metabolite production:** Induction of secondary metabolites by plant cell culture; Bioreactor systems for mass cultivation of plant cells.
Seed Biotechnology
Seed development and structure, Hybrid seed production technology: Genetic determinants of flowering, seed development and germination, male sterility and apomixes.

Transgenics

Transgenic plants: Herbicide resistance, resistance against biotic stress- bacterial, viral, fungal and insect resistance, abiotic stress, improved crop productivity, improved nutritional quality.

Molecular pharming

Unit 10: Animal Biotechnology
Culture of animal cells: Primary culture: Isolation of mouse and chick embryos, human biopsies, methods for primary culture, nomenclature of cell lines, sub culture and propagation and routine maintenance.

Cell characterization: cytotoxicity assays, cell quantitation, cell culture contamination: monitoring and eradication, cryopreservation, confocal microscopy. Stem cell culture and its applications

Cell and Tissue engineering: Growth factors for *in situ* tissue regeneration, biomaterials in tissue engineering, approaches for tissue engineering of skin, bone grafts, nerve grafts. Haemoglobin-based blood substitutes, bio artificial or biohybrid organs. Limitations and possibilities of tissue engineering.

*In vitro* fertilization and Embryo transfer: *In vitro* fertilization in Humans, Embryo transfer in Humans, Super ovulation and embryo transfer in farm animals e.g: Cow.


Transgenic animals: Transgenic animals and applications: mice and other animals, Biosafety regulations- guidelines for research in transgenic animals, public awareness of the processes of producing transgenic organisms.
Syllabus for Ph. D. Entrance Exam

BOTANY

UNIT 1: Microbial diversity, Concept, Significance and important contributions. General characteristics, distribution, classification, structure, reproduction, evolutionary trends and importance of viruses, mycoplasmas, bacteria, fungi and algae. Brief account of viroid’s and prions.


UNIT 3: History and scope of Taxonomy, Major and minor categories of classification, Nomenclature, ICBN. Salient features, morphological peculiarities, systematic position and affinities of Magnoliaceae, Casuarinaceae, Aizoaceae, Polygonaceae, Dioscoreaceae, Podostemaceae, Loranthaceae, Santalaceae, Alismataceae, Orchidaceae, Burmanniaceae, Areaceae. Herbarium and importance, IUCN. Economic importance of cereals, pulses, oil yielding crops, fiber yielding crops, spices, beverages and forest products. Ethno botany and IPR, Medicinal plants and their importance.

UNIT 4: Reproductive Biology of Angiosperms: Historical development, microsporogenesis, megasporogenesis, fertilization, endosperm and embryo development, polyembryony and apomixis, experimental embryology. Plant morphogenesis and tissue culture: History of Morphogenesis, Totipotency, plant growth and development, polarity, photo morphogenesis, cellular basis, relative and abnormal growth, differentiation and regeneration. History of tissue culture and importance, methodology and applications of embryo, endosperm and meristematic tip, anther, protoplast and suspension culture, micro propagation, secondary metabolite production.


UNIT 6: Structure, functions and importance of Biomolecules. Solute transport, Plant growth hormones, Phytochrome, Photosynthesis in higher plants, Respiration, Lipid metabolism, Nitrogen metabolism, Physiology of flowering, seed germination, senescence, stress physiology.


EDUCATION

UNIT I Educational Psychology

1. Concept: Meaning, nature scope and function of Psychology, Heredity and environment, Growth and development at different stages
2. 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, Piaget’s Theories of moral development, Pavlov's classical and Skinner's operant conditioning; Learning by insight
3. Factors affecting Learning - Transfer of learning, Memory, forgetting and imagination, Interest, Intelligence, Aptitude, Attitude, creativity, personality,
4. Adjustment and mental health - process of adjustment. conflicts and defence mechanism, mental hygiene and mental health

UNIT II Philosophical & Sociological Foundations –

1. 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.
2. 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.
3. 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
4. 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

1. Introduction to management- Concept, characteristics, functions of Management . Theories
2. Resource Management – Human resource management, records and registers, financial management, material resource management
3. Leadership in Educational Administration: Meaning and Nature of Leadership Theories of Leadership Styles of Leadership Measurements of Leadership, Decision making
4. Quality in Education – TQM, Supervision and inspection, PTA, School climate, challenges in management.

UNIT IV Guidance and Counseling

1. 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,
2. Tools and Techniques of Guidance—Standardized tests (personality inventories, aptitude, intelligence, interest inventories), non-standardized tests (rating scale, interview, questionnaire, case study, anecdotal records)
3. Counselling for Special Education- Hearing impaired, visual impaired, slow learners, learning disability, Physically handicapped, cerebral palsy, ADHD, autism, mentally challenged, gifted.
4. Inclusive Education – Concept, history, need, challenges, infrastructure requirement, teachers role, strategies for inclusive classroom.

UNIT V Educational Evaluation

1. Evaluation – Concept, need and importance, types, principles, Blooms taxonomy
2. Tools of measurement - subjective and objective tools, essay test, objective test, scales, questionnaires, schedules, inventories, performance tests.

**UNIT VI Teacher Education and Higher education**

1. 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
4. Higher Education Management - Types of universities- Central, state and private, University Management and Autonomy, Constitutional Provision and Legislation for Universities
Syllabus for Ph. D. Entrance Exam

FOOD TECHNOLOGY

Unit 1.
Macro/macro nutrients and trace element:- Food sources – general and specific sources. Relevance and essentiality – involvement in biochemical reactions and nutritional implications. Assessment of nutriture and analysis in food materials. Toxicity and deficiency - levels, symptoms, health consequences and their management.

Unit 2.
A. Body composition – Methods of study, compositional changes during life cycle, nutritional disorders, and their effect on body composition.
B. Body fluids and water balance – Body water compartments, regulation of water balance, disorders of water balance.
C. Energy metabolism- Basal and resting metabolism – influencing factors, methods to determine energy requirements & expenditure, thermogenesis, adaptation to altered energy intake. Regulation of food intake.
D. Basis for computation of nutrient requirements, latest concepts in dietary recommendations, RDA – ICMR and WHO their uses & limitations.

Unit 3. Nutrition during life span -
a. Pregnancy – Physiological adjustments, nutritional requirements, nutritional status of Indian Pregnant women, effect of malnutrition on outcome of pregnancy, complications of pregnancy.
b. Lactation – Physiology of lactation, factors affecting lactation, nutritional requirements, effect of lactation on maternal malnutrition and fertility.
c. Infancy – Growth and development, nutritional requirements, feeding pattern, compositional differences between human milk and milk substitute and their suitability for infant feeding. Weaning practices, weaning and supplementary foods.
d. Preschool age - Growth and development, nutritional requirements, special care in feeding preschoolers, nutritional problems specific to this age.
e. School age and adolescent children – Growth and development, nutritional requirements, factors affecting their eating habits, nutritional problems specific to this age.
f. Young adults – Nutritional requirements, nutritional status of Indian adult population, nutritional problems common to this age.

g. Elderly – Nutritional requirements, special needs, nutritional problems.

Unit 4.

b. Nutrition related non-communicable diseases (Indian Perspective) – Demographic, developmental and nutrition transition and its impact on chronic diseases, prevalence and determinants, nutritional management and prevention strategies.

Unit 5. Dietary Management of diseases

a. Medical Nutrition therapy- Febrile conditions, gastro-intestinal disorders, liver diseases, renal disorders.

Unit 6. Nutrition care and Assessment

A. Assessment methods for research and practice – Dietary, anthropometric, clinical, functional, biochemical tests, body composition, as applicable in individuals, populations and specific situations, Integrating assessment data – subjective global assessments.
B. Nutrition in health care – Illness and nutrition status, health professionals and nutrition care, nutrition screening, nutrition care process, ethical issues in nutrition care.

Unit 7.

Processing of foods: Wheat, rice, millets, legumes, fruits and vegetables, fats and oils, sugar and confectionaries, beverages, milk and milk products, eggs, meat and fish.

Unit 8.

A. Concept and meaning of food quality and food Safety. National and international food laws, food standards and Governing bodies. Hazard analysis and critical control points in processing of foods. Quality control in Food industry.
B: Product development and sensory evaluation.

Unit 9.

B: Preservation of foods: Principles and techniques of preservation - Food dehydration and concentration, heat processing, cold preservation, chemicals and irradiation.
Unit 10.

Recent concepts in food science and nutrition: Nutrigenomics, metabolomics, nutrition for space travelers, nutraceuticals, functional foods, genetically modified foods, fat substitutes, emerging food processing technologies {nanotechnology, microencapsulation, biopolymers for packaging, active packaging, edible gums and coatings, pulsed electric fields, supercritical extraction, membrane filtration}. 
Horticulture

Horticulture - Its definition and branches, importance and scope; horticultural and botanical classification; climate and soil for horticultural crops.

Plant propagation-methods and propagating structures; Seed dormancy, Seed germination, principles of orchard establishment.

Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators.

Fertilization and parthenocarpy; medicinal and aromatic plants; importance of plant bio-regulators in horticulture, Irrigation – methods, Fertilizer application in horticultural crops.

Importance of vegetables & spices in human nutrition and national economy, brief about origin, area, production, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting, storage, physiological disorders, disease and pest control and seed production of important vegetable cole crops, Bulb crops, leafy vegetables and fruits.
MICROBIOLOGY

UNIT 1: Microbial Taxonomy and Diversity

Microbial World, Concepts and Scope, Classifying and Naming Microorganisms, ICNB Rules, Major Characteristics used to Classify Microorganisms, Importance and Conservation of Microbial Diversity, Metagenomics, In situ Conservation and Ex situ Conservation, Role of Culture collection centers in conservation.

UNIT 2: Microbial Physiology

Microbial Energetics, Microbial enzymes, Metabolism of Carbohydrate, Alternate pathways of Carbohydrate Metabolism, Gluconeogenesis, Utilization of sugars other than glucose, Lipid metabolism, Nitrogen metabolism, Nucleic acid metabolism, Photosynthetic bacteria, Autotrophic Mechanisms in bacteria, Microbial Stress Responses to different conditions.

UNIT 3: Microbial Genetics


UNIT 4: Immunology

Immunity, Innate immunity: physical, biochemical and genetic factors involved in governing innate immunity, Acquired immunity, humoral or antibody mediated immunity, cell mediated immunity. Immunological disorders: Hypersensitivity Type I to Type IV, Immunodeficiency diseases; AIDS and other acquired or secondary immunodeficiencies, HIV – 1 and associated opportunistic infections, autoimmune diseases, Antigens and Antibodies, Immunogenicity versus Antigenicity, Factors that influence immunogenicity Antigen processing and presentation, properties of antigen, Super antigen, Hapten; Haptens and the study of antigenicity Microbes as antigen Antigen recognition and MHC molecules. Antibodies – structure and function, clonal selection, antibody diversity, monoclonal antibodies and its clinical applications, Antibody engineering (Construction of monoclonal antibodies Lymphoma and other diseases by genetically engineered antibodies).

UNIT 5: Environmental Microbiology

Microbiology of air, water and soil, Sources of water pollution, Biological indicators of water pollution, Water and air borne diseases. Determination of potable quality of water, Microbes in extreme environment and their survival mechanisms, Microbes in the degradation of wastes,
Microbial degradation of pesticides, Xenobiotics, bioremediation - advantages and disadvantages, Geomicrobiology: Microbes in metal extraction, mineral leaching and mining.

UNIT 6: Food Microbiology

Concepts and scope, Detection of food-borne microorganisms, Microbial spoilage of foods, Food poisoning and intoxication, Food borne diseases, Food preservation, Microbial indicators of food safety and quality, Food laws and standards.

UNIT 7: Agricultural Microbiology

Introduction to Agricultural Microbiology, Plant pathology, Diagnosis of plant diseases, Parasitism and disease development, Entry of pathogens to the host, Effect on physiology of host, Plant disease epidemiology, Environment and Plant diseases, Defense Mechanism of Plant Disease, Plant Diseases and their management, Host pathogen interaction, Biofertilizer, PGPR, Biopesticides.

UNIT 8: Medical Microbiology

Milestones in the development of Medical Microbiology, Microbial Infections, Urinary tract infections, Sexually transmissible infection, Oral cavity and respiratory infection, Gastrointestine infection, Nosocomial infections, General concepts for specimen collection and handing of specimen, Epidemiology, Pathogenesis, Spectrum of disease, Laboratory diagnosis and Prevention, Diseases caused by Viruses, Bacteria, Fungi, Chlamydiae, Protozoa and emerging diseases.

UNIT 9: Industrial Microbiology

Concepts and Scope of industrial Microbiology, Fermentation, Development of inocula, Fermenters, Batch and Continuous fermentation, Industrially important microorganisms, strain improvement and preservation, Media for industrial fermentation, sterilization, upstream processing, downstream processing, Industrial production of energy fuels (solvents), organic acids, enzymes (amino acids), food additives, Health care products (antibiotics, vitamins), probiotics, biomass production (SCP), hydrocarbons, recombinant proteins, quality control of fermented products, IPR, Patents, Biosafety and Entrepreneurship.

UNIT 10: Molecular Biology and Genetic Engineering

Concept and scope of Molecular Biology and Genetic engineering, Microbes in Molecular Biology, DNA as Genetic material, DNA replication, Differences in prokaryotic and eukaryotic DNA replication, Protein synthesis, Gene expression, Regulation of gene expression in prokaryotes, eukaryotes and bacteriophages, Gene silencing, Importance of gene cloning and future perspectives, Enzymes in genetic engineering, Cloning vectors, Applications of Genetic Engineering, Antisense technology, Safety of rDNA technology, Restriction and regulation for the release of GMO into Environment, Ethical, Legal, Social and Environmental Issues related to rDNA technology.
PUBLIC ADMINISTRATION

1. SECTION-I (Public Administration)


- Indian Administration—Organisation of the Union Government—Central Secretariat, Ministries and Departments, Cabinet Secretariat, Prime Minister’s Office, Constitutional bodies and Commissions, Regulatory Agencies, NITI Aayog.

- Organisation of the State Government—Secretariat, Role of Chief Secretary, Organisaton of Departments and Directorates.

- Personnel Administration—Bureaucracy, Classification of Services, Recruitment, Recruitment Agencies—Union Public Service Commission, State Public Service Commission, Training, Promotion, Performance Appraisal, Discipline, Morale, Staff Associations, Employer-Employee Relations, Pay Commissions.

- Financial Administration----Budget, Types of Budget, Enactment and Execution of Budget, Parliamentary Committees, Parliamentary Control over Public Expenditure, Audit, Role of Comptroller and Auditor General of India.


- Disaster Management, Sustainable Development, Social Audit, Corporate Governance, Corporate Social Responsibility, and Contemporary Issues in Governance.
Syllabus for Ph.D. Entrance Exam
ZOOLOGY

Unit 1: Systematics and Animal Diversity:
Systematics: Principles of Animal taxonomy, Carl Linnaeus taxonomic hierarchy, binomial nomenclature, species concept and taxonomic procedures; Major and minor phyla-diagnostic features with example for each phylum and their classification.
Non-chordata: Organization of Metazoans; amoeboid, flagellate and ciliary locomotion; hydrostatic movement; patterns of feeding and digestion in lower metazoans, respiratory organs and pigments, osmoregulation, excretory organs; primitive and advanced nervous system, sense organs and their importance; larval forms and importance of invertebrate fossils.
Chordata: Origin of chordates, systematic position of protochordates and vertebrates, nature of vertebrate morphology, homology and analogy, parallelism and convergence; classification of vertebrates, vertebrate integument and its derivatives; evolution of circulatory, respiratory and urinary systems; Development and organization of brain, spinal cord, nervous system and sense organs; Adaptive radiation of vertebrates.

Unit 2: Environmental Biology and Wildlife:
Environment: Abiotic and biotic factors, bio-geochemical cycles, population ecology, demography; air, water and soil pollution; Fresh and marine water ecology; Food chain and food web; Conservation and management of natural resources; Environmental education, Environmental monitoring and EIA; microbial ecology, ecological role of microorganisms.

Unit 3: Developmental Biology - Molecular events during fertilization, nucleo-cytoplasmic interactions in development, cleavage and gastrulation, morphogenetic determinants, laying down embryonic body plan - Drosophila and mammals; competence, determination; induction, early embryogenesis in Drosophila - gap genes, pair rule genes, segment polarity genes and
Homeotic genes, post embryonic development; Role of ecdysone and thyroxin in metamorphosis; sources of cells for regeneration; teratogenesis.

**Unit 4: Biological chemistry** – Chemistry of DNA and RNA, Watson-Crick model of DNA, cyclic nucleotides; vitamins as co-enzymes, trace elements; chemical bonds, Vander-waal’s force, normality and molarity of solutions; chemistry and biological properties of carbohydrates and lipids; nomenclature of enzymes, enzyme dynamics, enzyme inhibition, ribozymes and abzymes; colorimetry, spectrophotometry, TLC, HPLC, electrophoresis, ELISA.

**Unit 5: Applied Zoology**- Insect pests of major crops, plant-insect interaction, insect pest control strategies, IPM; Insect vectors of diseases, epidemiology of - malaria, filariasis, leishmaniasis, Japanese encephalitis, dengue, chikungunya; silkworm races and culture practices, lac culture, venomous insects; fisheries of India, culture practices of-fish, prawn and oyster.

**Unit 6: Basic and advanced genetics**- Mendelian principles in haploid organisms (*Chlamydomonas* and *Neurospora*), tetrad analysis, dominance relationships, allelic variation and gene function, types of mutations, molecular mechanisms of mutations, methods of detection of mutations, P-mediated mutagenesis; genome in prokaryotes and eukaryotes, c-value paradox, split genes, mobile genetic elements, mapping of genome, linkage, molecular markers; comparative genomics of *C. elegans, Drosophila*, mouse and *Homo sapiens*; bacterial transformation, transduction and conjugation; morphogenesis and recombination in bacteriophages.

**Unit 7: Cell and Molecular Biology**– Ultrastructure of cell organelles and their function; biology of cancer; biology of immune system; gene regulation in prokaryotes and eukaryotes; genetic code; DNA replication, transcription and translation in prokaryotes and eukaryotes, molecular mechanisms of DNA repair, principles and applications of recombinant DNA technology.

**Unit 8: Reproductive Biology and Endocrinology**– Functional morphology of female reproductive system - ovary and accessory organs; Functional morphology of male reproductive system - testis and accessory organs; Fertility control methods - barrier, surgical and hormonal;
Structure and function of endocrine organs - adrenal, pituitary, thyroid, parathyroid, pancreas, pineal, hypothalamus, ovary and tests; Mechanism of action of endocrine organs.

**Unit 9: Animal Physiology** - Aerobic and anaerobic break down of glucose, stepwise release of energy and production of ATP, exchange (at respiratory surface) and transport of respiratory gases; Composition of blood, cardiac cycle, ECG; Different modes of nitrogen excretion, molecular organization of sarcomere and mechanism of muscle contraction; transmission of nerve impulse, sensory transduction, tolerance and resistance; osmoregulation in aqueous and terrestrial environment; thermoregulation.

**Unit 10: Organic Evolution**: Darwinism and Neo-Darwinism; Population genetics; Hardy-Weinberg genetic equilibrium and its destabilizing forces; speciation, reproductive isolation, models of speciation, micro and macro-evolution; Neutral theory of evolution, molecular evolution, molecular clock, construction and types of phylogenetic trees.
**Foundations of Yoga:**
Origin of Yoga, History and Development of Yoga, Etymology and Definitions, Evolution of Yoga and Schools of Yoga, Streams of yoga

**Basic Introduction to Yoga Texts:**

Principal Vedas & Upanishads

Shad- Darshanas

Bhagavad Gita

Patanjali Yoga Sutra

Hatha Yoga Texts (Hatha Yoga Pradipika, Gheranda Samhita)