Sikkim Alpine University

Syllabus for Ph.D. Entrance Examination

1. RESEARCH METHODOLOGY

UNIT 1: MEANING OF RESEARCH

1. Meaning, aims, nature and scope of research
2. Prerequisites of research
3. Types of research.

UNIT 2: RESEARCH PROBLEM

1. Meaning of research problem, Sources of research problem.
2. Characteristics of a good research problem Hypothesis: Meaning and types of hypothesis.
3. Research proposal or synopsis.

UNIT 3: METHODS OF RESEARCH STUDIES

1. Qualitative and Quantitative research methods.

UNIT 4: REVIEW OF RELATED LITERATURE

1. Purpose of the review.
2. Identification of the related literature.
3. Organizing the related literature.

UNIT 5: DATA COLLECTION (SAMPLING)

1. Population and sample.
2. Characteristics of a good sample
3. Techniques of sample
4. Selection Types of data in research

UNIT 6: TOOLS OF DATA COLLECTION

1. Characteristics of good research
2. Types of data collection tools.

UNIT 7: DESCRIPTIVE STATISTICS

1. Tabulation, Organization, and Graphical Representation of Quantitative data
2. Measures of Central Tendencies: Mean, Median, Mode
3. Measures of Variability: Range, Quartile Deviation, Standard Deviation,

UNIT 8: RESEARCH REPORT

1. Format of the research report
2. Style of writing the report

Reference Books:

1. Best and Kahn, Research Methodology, PHI Limited.

2. Kothari, C.R. Research Methodology (Methods and Techniques), New Age Publisher.

2. DEPARTMENT OF BOTANY

UNIT I: GENERAL STUDIES OF VIRUS, BACTERIA AND FUNGI

Prokaryotic and eukaryotic cellular organization.

1. **Viruses**: General characteristics, nomenclature and classification, structure, transmission and replication, viral diseases.
2. **Bacteria**: Diversity in structure, organization and reproduction, mycoplasma
3. **Fungi**: Distribution, Structure and reproduction. Fungi as biopesticides, biofertilizer, pollution indicators and food.

UNIT II: GENERAL STUDIES OF ALGAE, BRYOPHYTES, PTERIDOPHYTES AND GYMNOSPERMS

1. **Algae**: Thallus organization, cell structure and reproduction.
2. **Bryophytes**: Morphology and reproduction of liverworts, hornworts and mosses.
3. **Pteridophytes**: Morphology and reproduction. Stelar Evolution, heterospory and seed habit.
4. **Gymnosperms: Morphology**, anatomy and reproduction in *Cycas, Pinus, Gnetum*.

UNIT III: TAXONOMY OF ANGIOSPERMS

1. **Species concept**: Taxonomic hierarchy, species, genus, family and other categories, principles used in assessing relationship, delimitations of taxa and attribution of ranks.
2. **Nomenclature:** International Code of Nomenclature (ICN). Principles of ICN. Bionomial nomenclature, typification. Study of the families Malvaceae, Umbelliferae, Asteraceae, Lamiaceae, Liliaceae and Orchidaceae.

UNIT IV: PLANT EMBRYOLOGY AND ANATOMY

1. **Development of male and female gametophyte**: Structure of anther, microsporogenesis megasporogenesis, ovule types, Double fertilization.
2. **Seed and fruit development**: Embryogenesis, apomixes, polyembryony, seed dormancy. **Apical meristem (Shoot and Root)**: Structural organisation, Tunica-corpus theory, Quiescent centre concept and Promeristem concept.
3. **Plant cell wall**: Ultra structure and organization
4. **Leaf Anatomy**: Stomatal types.
5. **Stem and Root Anatomy**: Primary and secondary structure of monocot and dicot.
6. **Xylem:** Tracheids and Vessels. Heart and sapwood.
7. **Phloem**: Ultra structure and function

UNIT V: PLANT PHYSIOLOGY AND BIOCHEMISTRY

1. **Water relations and Mineral Nutrition:** Water potential, Passive &Active transport, Membrane transport proteins & Ion transport in roots
2. **Photosynthesis:** Photosynthetic apparatus and pigments, Photooxidation of Water, mechanism of electron & proton transport, Photophosphorylation. C3, C4 and CAM pathways of carbon assimilation.
3. **Respiration**: Glycolysis, TCA Cycle, ETS and PP pathway.
4. **Nitrogen Metabolism**: Biological nitrogen fixation.
5. **Plant Growth regulators:** Physiological effects of auxins and gibberellins.
6. **Enzymes**: structure and properties, classification, kinetics and mechanism of action, Isoenzymes and Allosteric mechanism.
7. **Biomolecules**: Classification of carbohydrates. Plant storage carbohydrates; cell wall-structure & function. Amino acid classification and protein structures.
8. **Secondary metabolites**: Classification and functions

UNIT VI: CYTOLOGY, GENETICS AND MOLECULAR BIOLOGY

Ultra-structure of plant Cell and its organelles.

1. **Chromosomes**: Ultra structure, centomere, kinetochore complex, centomere proteins (CENPs), sister chromatid cohesion, telomeres and their role in chromosome segregation, chromosomal packaging, gene function and human health.
2. **Structural variations in chromosomes**: Deletion, duplication, inversions and translocations.
3. **Mendelism**: multiple alleles and linkage.
4. **Population genetics**: Hardy-Weinberg concept and its application, Allele frequency, genotype frequency, amino acid variation, Molecular drive, genetic variability in populations and factors responsible for variation.
5. **Gene**: Split genes, gene regulation in prokaryotes and eukaryotes.
6. **Molecular methods for genome analysis**: Physical mapping of genome, Restriction enzyme fingerprinting. Marker sequences, sequencing tag sites (STS) and sequence tag connectors, expressed sequence tags (ESTs), simple sequence length polymorphism and single nucleotide polymorphism, PCR, RAPD, AFLP, ISSR; functional and structural genomics.

UNIT VII: PLANT BREEDING AND BIOTECHNOLOGY

1. **Hybridization**: Conventional breeding methods, Hybridization methods in self- and cross-pollinated crop plants, Backcross method and its importance in crop plants.
2. **Resistance Breeding:** Breeding for resistance to Abiotic stresses – drought resistance, breeding methods and genetics of drought resistance. Breeding for resistance to biotic stresses – diseases resistance, disease development and escape, breeding methods.
3. **Scope of Biotechnology**: Enzymes used in genetic engineering: Restriction Endonucleases, Ligases, Polymerases, Kinases and Phosphatases, DNA Methylases.
4. **Use of vectors in cloning**: Plasmids, Phages, Cosmids, ssDNA vectors. Expression Vectors, Vectors for cloning PCR products, Binary and Shuttle Vectors. Improved *Agrobacterium* based Vectors and Virus based vectors for plants.
5. **of DNA delivery**: PEG mediated DNA uptake, electroporation, Biolistic transfer, Microinjection, organelle transformation, Mechanism of integration of foreign DNA into plant genomes.
6. **Plant Biotechnology**: Germplasm storage and Cryopreservation. Transgenic plants and its application.

UNIT VIII: ENVIRONMENTAL BIOLOGY, EVOLUTION AND PHYTOGEOGRAPHY

1. **Principles**: Interdependence, Biomagnification and Thermodynamics.
2. **Ecosystems**: Concept, Components and types – aquatic and terrestrial, functions, dynamics, energy flow in the ecosystem, trophic levels, food web, food chains, biomes.
3. **Ecological factors**: Climatic, edaphic, physiographic and biotic factors.
4. **Population Ecology**: Growth and characteristics of population, Natality, Mortality, Ecological niche and plant interactions.
5. **Plant Communities**: Methods of studying vegetation - Quadrat, Line and belt methods, Sources, Nature and Impact of - Air, Water, Soil Pollution, Radioactive Pollution, Noise Pollution and Heavy Metal Pollution.
6. **Plant indicators of Pollution**: Bioindicators, Biomonitoring and Bioremediation.
7. **Global Environmental Problems**: Ozone depletion, Global warming, Climatic change.
8. **Environmental Education**: Bio-diversity Hot spots, Management of natural resources, Remote Sensing and Geographical Information System in Ecological Science.

UNIT IX: METHODS IN PLANT SCIENCE

1. **Microscopy**: Principles, Aberrations, different kinds of lens systems, Magnification, Resolution, Contrast, illumination. Dark field, Phase contrast, Polarized, electron microscope - TEM, SEM Stains and staining schedules, Principles and mechanisms of histochemical staining.
2. **Principle, types and applications**: Spectroscopy, chromatography & Electrophoresis - Infrared Spectroscopy, Visible and ultra violet spectrophotometry, Paper chromatography, Thin layer chromatography (TLC), Column chromatography, Adsorption, Gas chromatography, GLC and HPLC. Gel Electrophoresis, Disk Electrophoresis, SDS-PAGE and Immuno electrophoresis.

3. DEPARTMENT OF CHEMISTRY

UNIT 1: INORGANIC CHEMISTRY

1. Chemical periodicity
2. Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules (VSEPR Theory).
3. Concepts of acids and bases, Hard-Soft acid base concept, Non-aqueous solvents.
4. Transition elements and coordination compounds: structure, bonding theories, spectral and magnetic properties, reaction mechanisms.
5. Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications.
6. Organometallic compounds: synthesis, bonding and structure, and reactivity. Organometallics in homogeneous catalysis.
7. Bioinorganic chemistry: porphyrins, metalloenzymes, oxygen transport, electron- transfer reactions; metal complexes in medicine.
8. Characterization of inorganic compounds by IR, Raman, NMR, EPR, UV-vis, microscopic techniques.

UNIT II: 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.
4. Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, benzynes and nitrenes.
5. Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Determination of reaction pathways.
6. Common named reactions and rearrangements – applications in organic synthesis.
7. Pericyclic reactions-electrocyclization, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications of photochemical reactions in organic chemistry.
8. Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms (O, N, S).
9. Structure determination of organic compounds by IR, UV-Vis, 1H & 13C NMR and Mass spectroscopic techniques.

UNIT III: PHYSICAL CHEMISTRY

1. 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.
2. Approximate methods of quantum mechanics: Variational principle; perturbation theory up to second order in energy; applications.
3. Chemical applications of group theory; symmetry elements; point groups; character tables; selection rules.
4. Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules; basic principles of magnetic resonance.
5. Electrochemistry: Nernst equation, redox systems, electrochemical cells; DebyeHuckel theory; electrolytic conductance- Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations.
6. 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.
7. Solid state: Crystal structures; Bragg's law and applications; band structure of solids.

4. DEPARTMENT OF COMMERCE

UNIT I: BUSINESS ENVIRONMENT

1. Second Generation reforms
2. Privatization and Globalization
3. Planning Policy
4. Meaning and definition of Business Environment
5. Liberalization
6. Legal Environment of Business in India
7. Industrial Policy
8. Industrial Growth and Structural Changes
9. Environment protection
10. Economic Policy
11. Economic Environment
12. Consumer Protection
13. Competition Policy

UNIT II: FINANCIAL AND MANAGEMENT ACCOUNTING

1. Valuation of Shares
2. Responsibility Accounting
3. Ratio Analysis
4. Partnership Accounts
5. Liquidation
6. Financial Statements
7. Cost and Management Accounting
8. Capital and Revenue
9. Basic Accounting Concept
10. Advanced Company Accounts

UNIT III: BUSINESS ECONOMICS

1. Utility analysis
2. Price determination in different Market Situations
3. Nature and Uses of Business Economics
4. Laws of Variable Proportion
5. Laws of Returns
6. Elasticity of Demand
7. Demand Analysis
8. Concept of Profit and Wealth Maximization

UNIT IV: BUSINESS STATISTICS AND DATA PROCESSING

1. Sampling Errors
2. Data types
3. Data Processing
4. Data Collection and Analysis
5. Correlation and Regression
6. Computer Application to Functional Areas
7. Analysis and Interpretation of data

UNIT V: BUSINESS MANAGEMENT

1. Staffing
2. Principles of Management
3. Planning Process
4. Organizational Culture and Structure
5. Organising
6. Leadership and Control
7. Decision Making
8. Business Ethics and Corporate Governance

UNIT VI: MARKETING MANAGEMENT

1. Product decision
2. Pricing, Distribution and Promotion
3. Marketing Planning
4. Marketing Mix
5. Marketing Environment
6. Evolution of Marketing
7. Concepts of Marketing

UNIT VII: FINANCIAL MANAGEMENT

1. Working Capital Management
2. Financial and Operating Leverage
3. Dividend Policy
4. Cost of capital
5. Capital Budgeting
6. Capital Structure

UNIT VIII: HUMAN RESOURCE MANAGEMENT

1. Training and Development
2. Succession Planning
3. Role and Functions of HRM
4. Recruitment and Selection
5. Performance Appraisal
6. Industrial Relations
7. HR Planning
8. Compensation

UNIT IX: BANKING AND FINANCIAL INSTITUTION

1. Reserve Bank of India
2. NABARD and Rural Banking
3. Importance of Banking to Business
4. Types of Banks
5. E Banking
6. Development Banking
7. Banking Sector Reforms in India

5. DEPARTMENT OF ECONOMICS

UNIT I: MICROECONOMICS

1. Theory of Consumer Behaviour
2. Theory of Production and Costs
3. Market Structures, competitive and non-competitive equilibria and their efficiency properties
4. General Equilibrium Analysis
5. Efficiency Criteria: Pareto-Optimality, Kaldor – Hicks and Wealth Maximization
6. Welfare Economics: Fundamental Theorems, Social Welfare Function

UNIT II: MACROECONOMICS

1. Determination of output and employment: Classical & Keynesian Approach
2. Consumption Function
3. Investment Function
4. Demand for Money and Supply of Money
5. IS – LM Model Approach
6. Inflation and Phillips Curve Analysis, Business Cycles, Monetary and Fiscal Policy

UNIT III: STATISTICS AND ECONOMETRICS

1. Descriptive Statistics- Measures of Central tendency & dispersions, Correlation, Index Numbers
2. Sampling methods & Sampling Distribution
3. Statistical Inferences, Hypothesis testing
4. Linear Regression Models and their properties – BLUE
5. Simultaneous Equation Models – recursive and non-recursive

UNIT IV: MATHEMATICAL ECONOMICS

1. Sets, functions and continuity, sequence, series
2. Differential Calculus and its Applications
3. Input-Output Model, Linear Programming
4. Difference and Differential equations with applications

UNIT V: GROWTH AND DEVELOPMENT ECONOMICS

1. Theories of Economic Development: Adam Smith, Ricardo, Marx, Schumpeter, Rostow, Balanced & Unbalanced growth, Big Push approach.
2. Models of Economic Growth: Harrod-Domar, Solow, Robinson, Kaldor
3. Indicators of Economic Development: PQLI, HDI, SDGs
4. Poverty and Inequalities – Concepts and Measurement
5. Social Sector Development: Health, Education, Gender

UNIT VI: INDIAN ECONOMY

1. Agriculture: Pattern & Structure of Growth, Major Challenges, Policy Responses
2. Industry: Pattern & Structure of Growth, Major Challenges, Policy Responses, Services: Pattern & Structure of Growth, Major Challenges, Policy Responses
3. Rural Development – Issues, Challenges & Policy Responses, Urban Development – Issues, Challenges and Policy Responses.
4. Foreign Trade: Structure and Direction, BOP, Flow of Foreign Capital, Trade Policies

6. Reforms in Land, Labour and Capital Markets, Centre-State Financial Relations and Finance Commissions of India; FRBM.

7. DEPARTMENT OF ENGLISH

UNIT I: DRAMA

UNIT II- POETRY

UNIT III- FICTION, SHORT STORY

UNIT IV- NON-FICTIONAL PROSE

UNIT V- LITERARY CRITICISM

UNIT VI- POSTCOLONIAL STUDIES

UNIT VII- CULTURAL STUDIES

UNIT VIII- INDIAN LITERATURE IN ENGLISH AND TRANSLATION

UNIT IX- HISTORY OF ENGLISH LANGUAGE

UNIT X- RESEARCH METHODOLOGY

8. DEPARTMENT OF GEOGRAPHY

PHYSICAL GEOGRAPHY

UNIT I: Geomorphology

1. Fundamental Concepts, Theories about origin of Earth, Earth's Interior-Composition and Structure, Continental Drift Theory, Sea Floor Spreading theory, Plate tectonic theory.
2. Major Landforms and forces behind their origin- Mountains, Plateaus and Plains, Geomorphic processes- Weathering, Denudation and erosion, Fluvial, glacial, Aeolian, coastal, karst, Rocks- Origin, Classification and Characteristics, Slope.

UNIT II: Climatology:

1. Structure and Composition of Atmosphere, Atmospheric Pressure and Temperature- Horizontal, Vertical and seasonal distribution, Insolation and heat Budget, Winds Distribution, Atmospheric Disturbance, Atmospheric Moisture- Condensation and Precipitation types.
2. Classification of world climates; Koppen's and Thornthwaite's schemes. Climate change, global warming and global cooling.

ENVIRONMENT AND ENVIRONMENTAL ISSUES:

1. Human and Environmental relationships- Determinism, possibilism and ecology, Exploitation of Natural resources and environmental hazards- soil erosion, Pollutions- air, water and land.
2. Biodiversity and conservation of forests; Forms and functions of ecosystem; Conservation and management of ecosystems.

HUMAN GEOGRAPHY:

Unit I: Economic Geography: World Distribution of resources- renewable and nonrenewable, Distribution of forests & vegetation, fisheries, agriculture & soils and their economic importance.

Unit II: Population Geography: Distribution, Density, Growth, Literacy of Population over world, Trends and patterns of Urbanization.

GEOGRAPHIC THOUGHT:

Unit I: General character of Geographic knowledge during the ancient and medieval period; Foundations of Modern Geography; Determinism and possibilism.

Unit II: Areal differentiation and spatial organization; Geography as a Discipline, Post-Geographies, Marxist and Feminist Geographies.

GEOGRAPHY OF INDIA:

Unit I: Natural Environment-Relief, drainage, climate, vegetation and soil distributions.

Unit II: Population- Distribution, density, growth, sex ratio, migration, literacy, urbanization. Economy- Agriculture (Characteristics, cropping pattern, green revolution and problems of agriculture), Industries (Distribution, Location and Production) Transport- Railways, Roads, Airways and Navigation, Rural and urban Geographies; Himalayas, Plains and Plateaus.

GEOGRAPHY OF WORLD:

Unit I: Location of areas, Natural resources, Demographic and economic resources of continents- Asia, Australia, Europe, North America, South America and Africa.

Unit II: Classification of industries: Weber's and Losch's approaches; Resource based and footloose industries. Transportation, Accessibility and connectivity.

STATISTICAL METHODS:

Unit I: Data sources and types of data; Frequency distribution and cumulative frequency; Measures of central, tendency; Selection of class intervals for mapping; Measures of dispersion and concentration; Standard deviation; Lorenz Curve; Methods of measuring association among different attributes; Simple and Multiple correlation; Regression, scatter plot. Sampling techniques for Geographical analysis.

9. DEPARTMENT OF HISTORY

UNIT I: HISTORY OF ANCIENT INDIA TILL 500 CE

1. Notions of History, Sources: Literature, Epigraphy, Numismatics, Travelogues of foreign travelers Archaeology
2. From Hunting to Food Gathering, Paleolithic or Old Stone Age, Mesolithic or Middle Stone Age, Neolithic or New Stone Age, Chalcolithic Cultures,
3. Harappan Culture: Bronze Age, Town Planning, and Structure, Agriculture, Technology, Craft, Trade and Commerce, Social Organization, Religious Practices, Theories of Decline of Harappan Civilization,
4. The Indo-Aryans, Indo-Aryans: Debates around Language and Culture, Early Vedic Age-Society, Religion, Later Vedic Age-Social Stratification; Varna System, and Gender Relations, Polity, Religion-Jainism and Buddhism.

UNIT II: STATES AND EMPIRE

1. Magadha from city-state to empire, Mauryas: political outline, sphere of influence, nature of administration, internal and foreign trade, Mauryan Empire: Agrarian base, social organization and decline.
2. South India: Early Iron Age cultures, Chera, Chola and Pandyas, Sangam literature, social formation, nature of polity, socio-economic organization, nature of trade and urbanization., Post Mauryan India till the Guptas, From Mauryan Empire to Secondary State, Formations: Satavahanas and Kalinga, Nature of secondary state formations, agrarian base, social organization, Trade and Religious life.
3. Indo-Greeks, Shakas, Parthians, Kushanas and Kshatrapas, Guptas: Political outline, nature of polity, administration, social organization, agriculture, trade, art and literature, why golden age, transition to Early Medieval India.

UNIT III: HISTORY OF EARLY MEDIEVAL INDIA 600 TO 1200 CE

1. Change in Post-Gupta period - Decline of trade, rise of Indian feudalism, Kali age crisis, ruralization of economy, Crisis of early Indian polity, land grants to Brahmans, Bhakti religion as Feudal ideology
2. Historiography, Expansion of agriculture and the formation of regional kingdoms, Emergence of regional languages and literatures, social change: conversion of tribes into castes, assimilation of local and regional cults into Brahmanic Puranic religion, Continuities in trade and commerce,
3. The Emergence of Regional polities: Pallavas, Chalukyas and Pandyas. The emergence of Regional literatures: devotional literature in Tamil of Saiva (Nayanmars) and Vaishnava (Alvars) Saints
4. The Emergence of Regional Architecture: Temple Complexes in South India under Pallavas, Pandyas and Cholas, Regional Polity into Empire: Cholas, Political Outline, Agrarian base, Trade, Commerce and Political Conquest, Art, Architecture and Literature and Decline.

UNIT IV HISTORY OF MEDIEVAL INDIA 1200-1750 CE

1. Sources, Feudalism and debates, Rise of Rajput States, North India and Central Asia from 10th to 12th centuries
2. Turkish advance towards India, Rajput Kingdoms, the Ghaznavids, Ghurids, Muhammad Ghuri and Mahmud Ghazni, Cholas
3. Delhi Sultanate and Mughals: Establishment of Delhi Sultanate rule: the Mamluk dynasty, the Khiljis, the Tughlaqs, the Sayyid and the Lodis.
4. Establishment of Mughal Political Rule: Babur, Humayun, Akbar, Jehangir, Shah Jahan, Aurangzeb and Bahadur Shal I. Religious and Cultural Development

UNIT V: INDIA UNDER EAST INDIA COMPANY

1. Advent of the British, Social-Economic and Political Condition of India on mid-18th Century, Expansion and Consolidation of Colonial Power (Bengal, Mysore, Western India, Awadh, Punjab, and Sindh)
2. Colonial Ideology and State
3. Indigenous and Modern Education
4. Changing Economic Policy**,** Land Revenue Settlement and its Impact, Forest, Commercialization, and Indebtedness, Famines, De-industrialization, and Drain of Wealth, Modern Industry, Trade and Fiscal Policy

UNIT VI: INDIAN NATIONAL MOVEMENT AND THE MAKING OF MODERN INDIA

1. The Revolt of 1857-Cause, Reasons for failure, and its effect
2. Formation of Indian National Congress, Moderate Nationalists: Method of Political Struggle, Demands and Achievements, Moderates and Extremism, Partition of Bengal and its Impact-Swadeshi Movement, Revolutionary Trends, Gandhiji- Philosophy, perspectives and political methods, 1919-Rowlatt Satyagraha and Jallianwala Bagh, Response to 1919.
3. Events-Non-Cooperation-Khilafat Movement, Civil Disobedience Movement, Quit India Movement and INA, Round Table Conferences, Communal Award, Government of India Act 1935, August Offer, Cripps Mission, Demand for Pakistan, Wavell Plan, INA Trials, Naval Mutiny, Cabinet Mission, Mountbatten Plan
4. Historiographical Debate on Nationalism-Cambridge, Nationalist, Marxist and Subaltern School

UNIT VII: SOCIAL REFORM MOVEMENTS IN 19TH CENTURY

1. Brahmo Samaj, Arya Samaj, Ramakrishna Mission and Vivekananda, Reform Movements in South India: Narayana Guru, Jyotiba Phule and Social Reforms in Maharashtra
2. Social Reform Movements in 20th Century: E.V. Ramasamy and Self-Respect Movement in Tamilnadu, B.R. Ambedkar and Annihilation of Caste
3. Social and Religious Reforms among Indian Muslims

UNIT VIII: POST-INDEPENDENT INDIA

1. Partition of India and Independent
2. Integration of Princely States
3. The Making of Indian Constitution
4. Growth of Industries, trade, Road and Transport System during post-independence period.
5. Foreign Policies of India with Pakistan, China, Afghanistan, Burma, Ceylon, Nepal, Bhutan, Growth of Science and Technology in India.

UNIT IX: HISTORY OF MODERN WORLD

1. Growth of Nationalism, The French and American Revolution, Industrial Revolution-causes and impact, Rise of Capitalism and Imperialism,
2. First World War, The League of Nations, Ruse of Fascism and Militarism, Second World War, and the New Political Order, UNO, UN, Non-Aligned Movement and The Third World, Disarmament in Nuclear Age-CTBT, SALT, NTP, Disintegration of the Soviet Union.

UNIT X: RESEARCH METHODOLOGY

1. Aim and Scope of Historical Research, and its Relationship with other Social Sciences
2. Nature of Historical Research-Arts, Science or Social Science, Formulation of Research Problem and Research Design
3. Sources of Research-Primary and Secondary Sources, Methods of Analysis, Causation and Imagination in History
4. Historical Thought, Objectivity and Subjectivity in Research, Modern Historiography.

10.DEPARTMENT OF MANAGEMENT

UNIT-1: ORGANISATIONAL BEHAVIOUR

1. The concept and significance of organisational behaviour – Influence of Socio-Cultural factors on Organisation – Classical, Neo – Classical and
2. Modern Theories of Organizational Structure – Line and Staff Relationship, Delegation and Decentralization, Formal and Informal Groups, Power and Authority, Organizational Roles and Status, Perception, Attitude, Motivation theories, Leadership: nature, style and approaches, Communication, Conflict and Controlling.

UNIT-2: BUSINESS ENVIRONMENT

1. The concept of business environment – Its significance and nature, Changing Dimensions of Business Environment, Indian financial markets and their regulating body- SEBI, Institutional financing bodies and role of RBI in regulating money and economy
2. Indian planning and sectoral development, National Income - Concepts & Measurement, Industrial policy, Monetary and Fiscal Policies and their Impact on Business, EXIM Policy-EPZ
3. Inflationary trends- impacts and analysis, concept of WPI, CPI, International Trade: World Trade, Pattern, Composition, Significant shifts, Volume, Trade in services. India's Position in world trade. Global Environment Changes and Sustainable Development, Biodiversity and its Impact on Business, Pollution and Waste Management.

UNIT-3: MANAGERIAL ECONOMICS:

1. Nature, Scope and Tools of Managerial, Economics, Demand Analysis and Elasticity of Demand, Revenue concepts, Supply and Elasticity of Supply, Utility Analysis and Indifference of Return and Law of variable proportion, Cost, Revenue, Price determination in different market situations: Perfect competition, Monopolistic competition, Monopoly, Price discrimination and Oligopoly, Pricing strategies.
2. Introduction to macro-economics: Structure, National Income Concepts, Government Budget and the Economy, Balance of Payment.

UNIT-4: HUMAN RESOURCE MANAGEMENT

1. Concepts and perspectives in HRM; HRM in changing environment, Human Resource Planning – Objectives, Process and Techniques, Job analysis – Job Description, Selecting Human Resources.
2. Induction, Training and Development. Exit policy and Implications. Performance Appraisal and Evaluation, Potential Assessment, Job Evaluation, Wage Determination, Industrial Relations and Trade Unions, Dispute Resolution and Grievance Management, Labour Welfare and Social Security Measures.

UNIT-5: FINANCIAL MANAGEMENT

1. Nature and Scope, Valuation Concepts and Valuation of Securities, Capital Budgeting Decisions – Risk Analysis, Capital Structure and Cost of Capital, Dividend Policy – Determinants, Long – Term and Short – Term Financing Instruments, Money and Capital Market, Mergers and Acquisitions.
2. Working Capital Management: Determinants and Financing, Cash Management, Inventory Management, Receivables Management.

UNIT-6: MARKETING MANAGEMENT

1. Evolution and Concepts of Marketing, Marketing Mix: Advertising; Personal Selling; Channel Management; Vertical Marketing Systems; Customer Relation Management; Uses of Internet as a Marketing Medium, Advertising and retailing on the net.

2. Marketing Segmentation - Targeting and Positioning; Product Decisions, Product Life Cycle: New Product Development, Branding and Packaging, Pricing Methods, Distribution Decisions, Promotion Decisions, Market Planning, Organizing and Control, Marketing Tasks, Concepts and Tools. New issues in Marketing

UNIT-7: PRODUCTION MANAGEMENT

1. Role and Scope of Production Management; Faculty Location; Layout Planning and Analysis; Production Planning and Control – Production Process Analysis;
2. Demand Forecasting for Operations; Determinants of Product mix; Production Scheduling; Work measurement; Time and Motion Study; Statistical Quality Control.

UNIT-8: COMPUTER IN MANAGEMENT

1. Basics, Computer Application to Functional Areas of Management; Technology issues and Data processing in organizations; Information systems- Data Base Management System;
2. MIS and Decision making; Data Base Management System; System analysis and design; Trends in Information Technology; Internet and Internet based applications.

UNIT-9: BUSINESS MANAGEMENT

1. Nature and Significance of Management, Evolution and its Approaches, Principles of Management, Contribution of Taylor, Fayol and Bernard to Management Science, Social Responsibility of Managers.
2. Planning: Objectives, Strategies, Planning Process and Techniques of Decision Making. Corporate Governance and Business Ethics

UNIT-10: ETHICAL PERSPECTIVE

1. Ethics and Management System; Ethical issues and Analysis in Management; Value based organisations; Personal framework for ethical choices; Ethical pressure on individual in organisations; Gender issues; Ecological consciousness; Environmental ethics; Social responsibilities of business; Corporate governance and ethics.

11. DEPARTMENT OF MATHEMATICS

UNIT I:

1. **Analysis:**
   i. Elementary set theory, finite, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property, supremum, infimum. Sequences and series, convergence, lim sup, lim inf.
   ii. Bolzano Weierstrass theorem, Heine Borel theorem. Continuity, uniform continuity, differentiability, mean value theorem. Sequences and series of functions, uniform convergence.
   iii. Riemann sums and Riemann integral, Improper Integrals. Monotonic functions, types of discontinuity, functions of bounded variation, Lebesgue measure, Lebesgue integral.
   iv. Functions of several variables, directional derivative, partial derivative, derivative as a linear transformation, inverse and implicit function theorems.
   v. Metric spaces, compactness, connectedness. Normed linear Spaces. Spaces of continuous functions as examples.
2. **Complex Analysis:**
   i. Algebra of complex numbers, the complex plane, polynomials, power series, transcendental functions such as exponential, trigonometric and hyperbolic functions.
   ii. Analytic functions, Cauchy-Riemann equations. Contour integral, Cauchy's theorem, Cauchy's integral formula
   iii. Liouville's theorem, Maximum modulus principle, Schwarz lemma, Open mapping theorem.
   iv. Taylor series, Laurent series, calculus of residues. Conformal mappings, Mobius transformations.
3. **Topology:**
   i. Basis, dense sets, subspace and product topology,
   ii. separation axioms, connectedness and compactness.

UNIT II:

1. **Linear Algebra:**
   i. Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations. Algebra of matrices, rank and determinant of matrices, linear equations.
   ii. Eigenvalues and eigenvectors, Cayley-Hamilton theorem. Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms.
   iii. Inner product spaces, orthonormal basis. Quadratic forms, reduction and classification of quadratic forms
2. **Abstract Algebra:**
   i. Permutations, combinations, pigeon-hole principle, inclusion-exclusion principle, derangements. Fundamental theorem of arithmetic, divisibility in Z, congruences, Chinese Remainder Theorem, Euler's Ø- function, primitive roots.
   ii. Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups, permutation groups, Cayley's theorem, class equations, Sylow theorems.
   iii. Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domain, principal ideal domain, Euclidean domain.
   iv. Polynomial rings and irreducibility criteria.
3. **Fields:**
   i. Finite fields, field extensions.
   ii. Galois Theory.

UNIT III

1. **Ordinary Differential Equations (ODEs):**
   i. Existence and uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs.
   ii. General theory of homogenous and non-homogeneous linear ODEs, variation of parameters, Sturm-Liouville boundary value problem, Green's function.
2. **Partial Differential Equations (PDEs):**
   i. Lagrange and Charpit methods for solving first order PDEs, Cauchy problem for first order PDEs.
   ii. Classification of second order PDEs, General solution of higher order PDEs with constant coefficients.
   iii. Method of separation of variables for Laplace, Heat and Wave equations.

UNIT IV

1. **Numerical Analysis:**
   i. Numerical solutions of algebraic equations, Method of iteration and Newton-Raphson method, Rate of convergence,
   ii. Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods, Finite differences, Lagrange, Hermite and spline interpolation,
   iii. Numerical differentiation and integration, Numerical solutions of ODEs using Picard, Euler, modified Euler and Runge-Kutta methods.
2. **Calculus of Variations:**
   i. Variation of a functional, Euler-Lagrange equation, Necessary and sufficient conditions for extrema.
   ii. Variational methods for boundary value problems in ordinary and partial differential equations.
3. **Linear Integral Equations:**
   i. Linear integral equation of the first and second kind of Fredholm and Volterra type, Solutions with separable kernels.
   ii. Characteristic numbers and eigenfunctions, resolvent kernel.

12.DEPARTMENT OF PHYSICS

Unit I:

1. Canonical transformations, generating functions, Poisson brackets, Solving Kepler's problem by HJ method.
2. Contours and contour Integration in complex plane, Cauchy theorem, Cauchy integral Formula, Matrices – eigenvalue problem, diagonalization of matrices, Separation of variables for second order partial differential equations, Gamma and Beta functions.
3. Free energy and its connection with thermodynamic quantities. Classical and quantum statistics. Ideal Bose and Fermi gases. Principle of detailed balance. Blackbody radiation and Planck's distribution law.

Unit II:

1. Wave-particle duality. Schrödinger equation (time-dependent and time-independent). Eigenvalue problems (particle in a box, harmonic oscillator, etc.). Tunneling through a barrier. Wave-function in coordinate and momentum representations. Commutators and Heisenberg uncertainty principle. Dirac notation for state vectors. Motion in a central potential: orbital angular momentum, angular momentum algebra, spin, addition of angular momenta; Hydrogen atom.
2. Gauss's law, Boundary value problems, Multipoles, dielectrics, Biot and Savart law, Ampere's law, Faraday's law, problems. Magnetostatics: Biot-Savart law, Ampere's theorem. Electromagnetic induction. Maxwell's equations in free space and linear isotropic media; boundary conditions on the fields at interfaces. Scalar and vector potentials, gauge invariance.

Unit III:

1. Semiconductor devices (diodes, junctions, transistors, field effect devices, homo- and hetero-junction devices), device structure, device characteristics, frequency dependence and applications. Opto-electronic devices (solar cells, photo-detectors, LEDs). Operational amplifiers and their applications. Digital techniques and applications (registers, counters, comparators and similar circuits). A/D and D/A converters. Microprocessor and microcontroller basics.
2. 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. Superconductivity: type-I and type-II superconductors. Josephson junctions.

Unit IV:

1. Deuteron problem. Evidence of shell structure, single-particle shell model, its validity and limitations. Rotational spectra. Elementary ideas of alpha, beta and gamma decays and their selection rules. Fission and fusion. Nuclear reactions, reaction mechanism, compound nuclei and direct reactions. Classification of fundamental forces. Elementary particles and their quantum numbers (charge, spin, parity, isospin, strangeness, etc.).
2. Quantum states of an electron in an atom. Electron spin. Spectrum of helium and alkali atom. Relativistic corrections for energy levels of hydrogen atom, hyperfine structure and isotopic shift, width of spectrum lines, LS & JJ couplings. Zeeman, Paschen-Bach & Stark effects. Lasers: spontaneous and stimulated emission, Einstein A & B coefficients. Optical pumping, population inversion, rate equation. Modes of resonators and coherence length.

13.DEPARTMENT OF POLITICAL SCIENCE

UNIT I:

1. Nature and Significance of Political Theory, Importance and Limitations of the Classical Tradition.
2. Modern Approaches: Behaviouralism, Post-behaviouralism and Marxism, Civil Society and the State, Citizenship & Nation.

UNIT II:

1. Grounds of Political Obligation**,** Political Disobedience and Resistance**,** Democracy, Liberty and Rights**,** Equality and Justice.
2. Recent trends: Post Modernism & Feminism.

UNIT III:

1. Social and Political Thought of Modern India.
2. Western Political Thought.

UNIT IV:

1. Comparative Government and Politics.
2. International Relations.

UNIT V:

1. Constitution and Political Institutions of India.
2. State and Politics in India, Political Processes and Public Policies in India.

UNIT VI:

1. Local Self-Government: Rural and Urban local government in India, the Balwantrai Mehtha and Ashok Mehtha Committee Reports of 1952 and 1977, the 73rd and 74th Constitutional Amendments.
2. Present status of rural and urban local government in India.

UNIT VII:

1. Instruments of Foreign Policy: Conventional and Nuclear wars, Nuclear Doctrines and Deterrence Theory, Conflict Resolution.
2. Diplomacy - Types, Functions and challenges.

14. DEPARTMENT OF PSYCHOLOGY

UNIT I:

1. Emergence of Psychology: Structuralism, Functionalism, Psychoanalytical, Gestalt, Behaviourism, Humanistic-Existential.
2. Paradigms of Western Psychology.

UNIT II:

1. Psychological Testing: Types of Tests, Test Construction and Standardization,
2. Reliability: Validity, Areas of Testing: Intelligence, creativity, neuropsychological tests, aptitude, Personality assessment. Application in Psychological Testing in various setting.

UNIT III:

1. Cognitive and Social Psychology: Attention, Perception, Learning, Memory and Forgetting.
2. Nature and scope of Social Psychology.
3. Social cognition, Social Influence, Intergroup relations.

UNIT IV:

1. Recent Advances and Emerging Areas in Psychology: Status of Psychology Research in India. Well-being and self-growth
2. Peace Psychology

15.DEPARTMENT OF SOCIOLOGY

UNIT I: BASIC CONCEPTS

1. Society, Culture and Socialization, Social Structure, Status and Role, Community, Association and Institution, Social Groups, Norms, Values, and Sanctions
2. Institutions: Family and marriage, Education, Economy, Polity, Religion, Stratification

UNIT II: CLASSICAL AND MODERN SOCIOLOGICAL THEORIES

1. Karl Marx, Emile Durkheim, Max Weber
2. Structuralism: Radcliffe Brown, Claude Levi Strauss
3. Functionalism: Emile Durkheim, B. Malinowski, Talcott Parsons and Robert K. Merton.
4. Conflict Theories: Marxist and Neo Marxist
5. Critical Theories: Horkheimer, Adorno Marcuse and Habermas
6. Exchange Theories: George C. Homans and Peter Blau
7. Theories of Action: Weber's Theory of Social Action, Symbolic Interactionism
8. Social Constructionist perspective:
    i. Phenomenology: Alfred Schutz, Peter Berger and Thomas Luckman
    ii. Ethnomethodology: Harold Garfinkel and Erving Goffman.

UNIT III: STRUCTURATION, POST MODERNISM, THEORIES OF GLOBALIZATION AND RISK

1. Anthony Giddens
2. Michel Foucault
3. Jacques Derrida
4. Pierre Bourdieu
5. Ulrich Beck
6. Immanuel Wallerstein

UNIT IV: CONCEPTUALIZING INDIAN SOCIETY: THEORETICAL PERSPECTIVES

1. Indological Approach: G. S. Ghurye, Louis Dumont
2. Structural – Functionalism: M. N. Srinivas, S.C. Dube
3. Marxian Perspective: D. P. Mukherjee, A.R Desai
4. Civilizational Perspective: N.K Bose, Surajit Sinha
5. Subaltern Perspective: B.R Ambedkar, David Hardiman

UNIT V: CONTEMPORARY ISSUE OF INDIAN SOCIETY

1. Inequalities: Caste, Class, Gender
2. Disparities and Disharmonies: Religion, Region, Language and Ethnicity
3. Women and Family: Dowry, Domestic Violence, Divorce
4. Problems of the Aged and intergenerational mobility
5. Deviance and Crime: Changing forms of crime and criminals

UNIT VI: CONTEMPORARY DEBATES AND CHALLENGES

1. Nation Building, Secularism and Communalism
2. Globalization and Indian Society: LPG
3. Population, Development, Displacement and Environmental Degradation
4. Social Movements in India
5. Sexual minorities and identity: Problems and Prospects
6. Agrarian distress and Farmers' suicide: Causes and consequences

16. DEPARTMENT OF ZOOLOGY

UNIT-I: MOLECULAR BIOLOGY AND GENETICS

1. Mitochondria and chloroplasts and their genetic organization. Fine structure of gene, Eukaryotic genome organisation (structure of chromatin, coding and non-coding sequences, satellite DNA), DNA damage and repair, DNA replication, amplification and rearrangements. Mechanism of transcription of prokaryotes and eukaryotes, RNA processing, Ribonucleoproteins, Structure of mRNA, Genetic code and protein synthesis. Regulation of gene expression in pro-and eukaryotes, Operon concept, DNA methylation, Transposition, Regulatory sequences and transcription factors, Environmental regulation of gene expression. Genomics, Proteomics.
2. Principles of Mendelian inheritance, chromosome structure and function, Gene Structure, Linkage and genetic mapping, Extrachromosomal inheritance (episomes, mitochondria and chloroplasts), Mutation, DNA damage and repair, chromosome aberrations, Transposons, Sex-linked inheritance and genetic disorders. Genetic and metabolic disorders, Hormonal imbalances.

UNIT-II: METHODS IN BIOLOGY

1. Isolation and purification of RNA, DNA (genomic and plasmid) and proteins, different separation methods, Analysis of RNA, DNA and proteins by one- and two-dimensional gel electrophoresis, Isoelectric focusing gels, Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems. Generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors.
2. Protein sequencing methods, detection of post translation modification of proteins, DNA sequencing methods, strategies for genome sequencing, Methods for analysis of gene expression at RNA and protein level, large scale expression, such as micro array-based techniques, Isolation, separation and analysis of carbohydrate and lipid molecules, RFLP, RAPD and AFLP techniques.

UNIT-III: BASIC IMMUNOLOGY AND IMMUNOTECHNIQUES

1. Antigens, Structure and functions of different clauses of immunoglobulins, Primary and secondary immune response, Lymphocytes and accessory cells, Humoral and cell mediated immunity, Mechanism of immune response and generation of immunological diversity; Genetic control of immune response. Cytokine secretion by TH1 and TH2 subsets, mechanism of cytokine action, process of inflammation - localized and systemic inflammation, anti-inflammatory agents. Immune genes and human diseases Immune tolerance and autoimmunity.
2. Antibody generation, Detection of molecules using ELISA, RIA, western blot, immunoprecipitation, fluocytometry and immunofluorescence microscopy, detection of molecules in living cells, in situ localization by techniques such as FISH and GISH.

UNIT-IV: BIOSTATISTICS

1. Data collection, documentation and presentation of data, classification and tabulation of data. Diagrammatic and Graphical presentation of statistical data, Frequency distribution, Analysis and Interpretation of Data. Central tendency: Mean, Median and Mode. Standard Deviation and error. Concepts of population and sample, need for sampling, census and sample, surveys, sampling and non-sampling errors, sample size determination, finite population, sampling techniques-. Systematic sampling, stratified sampling etc.
2. Difference between parametric and non-parametric statistics. Probability. Level of significance, Simple Correlation, correlation coefficient, simple linear regression. Poisson Distribution. Student 't' test, Chi-square test, Fisher test, Z-test. Analysis of variance: One way ANOVA and Two-way ANOVA.