

DETAILED SYLLABUS FOR COMMON ENTRANCE TEST FOR ADMISSION TO M.PHIL, PRE. Ph.D. AND AWARD OF UNIVERSITY RESEARCH SCHOLARSHIP

i) DEPARTMENT OF GEOGRAPHY

1. Geomorphology : Fundamental concepts; Diastrophism forces; tectonics; concept of geomorphic cycle; Landforms associated with fluvial, glacial, arid, coastal and karst cycles.
2. Climatology: Composition and structure of the atmosphere; Heat budget of the earth; Distribution of temperature; Atmosphere pressure and general circulation of winds; Monsoon and jet stream; Tropical and temperate cyclones; Classification of world climates; Koppen's and Thornthwaite's schemes.
3. Geographical Thought : General character of Geographic knowledge during the ancient and medieval period; foundations of Modern Geography; Determinism and possibilism; Areal differentiation and spatial organization
4. Population Geography: Patterns of world distribution; Growth and density of population; Patterns and processes of migration; Demographic transition.
Settlement Geography: Site, situation, types, size, spacing and internal morphology or rural and urban settlement hierarchy; Christaller's Central place theory; August Losch's theory of market centres.
5. Economic Geography: Sectors of Economy: primary Secondary, Tertiary and quaternary, Natural resource; renewable and non-renewable. Measurement of agricultural productivity and efficiency; Crop combination and diversification; Von Thunen's Model.
6. Political Geography: Heartland and Rim-land theories; Boundaries and frontiers; nature of Administrative areas and Geography of Public policy and finance.
7. Social Geography: Ethnicity; dialect; language, caste and religion; Concept of social being.
8. Geography of India: Physiographic divisions; Climate: and Microclimate Vegetations types and vegetation regions; Major soil types; Patterns; Mineral and power resources; major industries and industrial regions; Water shed map of India
9. Regional Planning : Regional Concept; in Geography; Concept of Planning region; Types of regions; Method of regional delineation; Regional planning in India; Indicators of development; Regional Imbalances; Evolution, Nature and scope of town planning with special reference to India, and fundamental of town and country planning.
10. Statistical Methods: Data source 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 attributes; simple and Multiple correlation; Regression.
Nearest-neighbour analysis: Scaling techniques: Rank score; weighted score; Sampling techniques for Geographical analysis.

Note: There will be 100 questions in all (with 10 questions from each section) of multiple choice type carrying 1 mark each. The examination duration will be of 2 hours duration

ii) DEPARTMENT OF PUBLIC ADMINISTRATION

Administrative Theory and Thoughts : (25 marks)

Evolution of Public Administration- Meaning, Nature, Scope and Significance; Public Administration; Public Administrative Science or an Art, New Public Administration.

Organization-Bases & Principles, Formal and Informal, Classical and Neo-Classical Theory; Contribution of Henri Fayol, Luther Gulick and M.P. Follet.

Scientific Management and Human Relations Theories-contribution of F.W. Taylor and Elton Mayo respectively. Bureaucratic Theory of Max Weber and Karl Marx.

Decision Making Theory of Herbert Simon. Theories of Motivation : Contribution of Abraham Maslow, Herzberg and McGregor.

Control over Public Administration-Executive, Legislative and Judicial, Delegated Legislation, Administrative Adjudication. Citizen and Administration, Responsive Administration.

Indian Administration (25 marks)

Evolution of Indian Administration, Features of Indian Administration; Federal and unitary aspects of Indian administration; Role of Administration in Socio-Economic development.

Administration at Central Level.

- i. Political Executive : Role of President and Prime Minister in the Emerging Scenario.
- ii. Administrative machinery : Role of Cabinet Secretariat and Cabinet, Secretary-A Critical analysis; Central Secretariat, P.M. office, Ministries of Finance, Home, External Affairs and Defence.

Administration at State Level (25 marks)

- i. Political Executive -Governor and Chief Minister-their roles.
- ii. Administrative Machinery : State Secretariat and Role of Chief Secretary.
- iii. Depts. of Education, Agriculture, Home, Labour and Employment in Haryana.
- iv. Central-State Relations Problems and Prospects.

Divisional Commissioner, Deputy Commissioner, D.D. P.O. District Police Administration, Administration of Food and Supply D.R.D.A. Democratic decentralization; Gandhian Concept of Panchayati Raj, Panchayati Raj institutions and their role in Development, working of Urban Local Government, Town and Country Planning HUDA.

Issue in Indian Administration :

- i. Administration Reforms in India.
- ii. Generalists specialists controversy in Administration
- iii. Ethics in Administration
- iv. Redressal of Citizens Grievance- Lokpal and Lok Ayuka, Lok Adalat, District Consumer Forum.

Development Administration**(25 marks)**

Development : Concept, Dimensions and Approaches, Development Administration Concept, nature, scope and pre-requisites, Evolution of Development, Administration, Role of Development Administration in developing countries.

Administrative Development : Concept and its objective, Distinction between Development Administration and Administration of Development; Institutional and Organisational arrangements for improving Administrative capability. Ecology of Administration; Interaction with political, socio-cultural and Economic System.

Bureaucracy and Development : Influence of Social background on Development Administration, Representative Bureaucracy Neutral Versus committed Bureaucracy, Role of Bureaucracy with special reference to policy formulation and Implementation, Relationship of Bureaucrats and Politicians.

Public Policy : Formulation and Implementation, Development Planning, Planning process-Formulation, Implementation and Evaluation; Planning Machinery at Centre, State and Local Levels. Programmes and Projects Formulation and Implementation.

Citizens participation in Development Administration, Specialised Agencies for Development, Role of Voluntary Agencies in Development Administration, Public Relations and Development Administration, Sustainable Development.

iii) DEPARTMENT OF POLITICAL SCIENCE**1. Political Theory and Thought (20 marks)**

Ancient Indian Political Thought : Kautilya and Shanti Parva.

Greek Political Thought: Plato and Aristotle.

European Thought-I: Machiavelli, Hobbes, Locke, Rousseau.

European Thought-II Bentham, J.S. Mill, Hegel, Marx and Green.

Contemporary Political Thought-I : Lenin, Mao, Gramsci.

Contemporary Political Thought-II: Rawls, Nozic and Communitarians.

Modern Indian Thought: Gandhi, M.N. Roy Aurobindo Ghosh, Jai Prakash Narain, Ambedkar, Savarkar.

Liberalism and Marxism.

Individual and Social Justice.

Role of Ideology.

2. Comparative Politics and Political Analysis (20 marks)

Evolution of Comparative Politics as a discipline; nature and scope.

Approaches to the Study of Comparative Politics: Traditional, Structural-Functional, Systems and Marxist.

Constitutionalism : Concepts, Problems and Limitations.

Forms of Government: Unitary-Federal, Parliamentary-Presidential.

Organs of Government : Executive, Legislature, Judiciary-their interrelationship in comparative perspective with special reference to India, U.K., U.S.A. & Switzerland

Party System and Pressure Groups; Electoral Systems.

Bureaucracy-types and roles.

Political Development and Political Modernization.

Political Culture, Political Socialization and Political Communication.

Political Elite, Elitist Theory of Democracy.

Power, Authority and Legitimacy.

Revolution : Theories and Types.

Dependency : Development and Under Development.

3. Indian Government and Politics (20 marks)

National Movement, Constitutional Developments and the Making of Indian Constitution.

Ideological Bases of the Indian Constitution, Preamble, Fundamental Rights and Duties and Directive Principles.

Constitution as Instrument of Socio-Economic Change, Constitutional Amendments and Review.

Structure and Process-I : President, Prime Minister, Council of Minister, working of the Parliamentary System.

Structure and Process-II : Governor, Chief Minister, Council of Ministers, State Legislature.

Panchayati Raj Institutions: Rural and Urban, their working.

Federalism : Theory and Practice in India; Demands for Autonomy and Separatist Movements, Emerging trends in Centre-State Relations, State Politics.

Judiciary : Supreme Court, High Courts, Judicial Review, Judicial Activism including Public Interest Litigation Cases, Judicial Reforms.

Political Parties, Pressure Groups, Public Opinion, Media; Subaltern and Peasant Movements.

Elections, Electoral Behaviour, Election Commission and Electoral Reforms.

Class, Caste, Gender and Dalit Politics, Regionalism, Problems of National Integration and Nation Building.

4. Public Administration (20 marks)

Development of Public Administration as a discipline; Approaches to the study of Public Administration : Decision-making, Ecological and systems; Development Administration.

Theories of organization.

Principles of organization : Line and staff, unity of command, hierarchy, span of control, centralization and decentralization. Types of organization : formal and informal; Forms of organization; department, public corporation and board.

Chief Executive : Types, functions and roles.

Personnel administration: Recruitment, Training, Promotion, Discipline, Morale;

Employee-Employer Relations.

Bureaucracy : Theories, Types and Roles; Max Weber and his critics, Civil servant-Minister relationship.

Leadership, its role in decision-making; Communication.

Financial administration : Budget, Audit, Control over finance with special reference to India and U.K.

Good Governance; Problems of Administrative Corruption; Transparency and Accountability; Right to Information.

Grievance Redressal Institutions : Ombudsman, Lokpal and Lokayukta.

Impact of Liberalization on Public Administration.

5. International Relations

(20 marks)

Contending Theories and Approaches to the Study of International Relations; Idealist, Realist, Systems, Game, Communication and Decision-making.

Power, Interest and Ideology in International Relations; Elements of Power : Acquisition, Use and limitations of power, Perception, Formulation and Promotion of National Interest, Meaning, Role and Relevance of Ideology in International Relations.

Arms and Wars : Nature, causes and types of wars/conflicts including ethnic disputes; conventional, Nuclear/bio-chemical wars; deterrence, Arms race, Arms control and Disarmament.

Peaceful settlement of disputes, conflict resolution, Diplomacy, World-order and Peace studies.

Cold war, Alliances, Non-alignment, End of Cold war, Globalization.

Rights and Duties of states in international law, intervention, Theory law, prevention and abolition of war.

Political Economy of International Relations; New International Economic Order, North-South Dialogue, South-South Cooperation, WTO, New-colonialism and Dependency.

Regional and sub-regional organizations especially SAARC, ASEAN, OPEC, OAS, United Nations: Aims, Objectives, Structure and Evaluation of the working of U.N.; Peace and Development perspectives; Charter Revision; Power-struggle and Diplomacy within UN, financing and Peace-Keeping operations.

Determinants and Compulsions of India's Foreign Policy; India's Nuclear Policy.

India's Relations with Neighbours and USA.

India's Role in the UN. Indian Ocean as a zone of peace.

iv) DEPARTMENT OF SOCIOLOGY

Total marks : 100 marks

(Part- I- 40 marks)

(Part- II- 30 marks)

(Part- II- 30 marks)

Note :

Question paper consisting of 100 marks covering three aspects of UGC Net Syllabus will be divided into three parts. Part-I will consist of 40 marks, Part-II and Part-III will consist of 30 marks each respectively. Part-I will deal with Conceptual Understanding of Sociology, Part-II will cover Sociology Theory and Part-III will deal with the Methodology, Altogether.

Part-I Conceptual Understanding of Sociology

1. Nature of Sociology
 - Defination
 - Sociological Perspective
2. Basic Concepts
 - Community
 - Institutions
 - Association
 - Culture
 - Norms and Values
3. Social Structure
 - Status and role, their interrelationship
 - Multiple roles, Role set, Status set, Status sequence
4. Social Group
 - Meaning
 - Types : Primary -Secondary, Formal-Information, Ingroup-Outgroup, Reference group
5. Social Institutions
 - Marriage
 - Family
 - Education
 - Economy
 - Polity
 - Religion
6. Socialization
 - Agencies & Theories of Socialization
7. Social Stratification

Forms of Stratification

Caste, Class, Gender, Ethnicity

Theories of Stratification

Social Mobility

8. Social Change

Concepts & Types : Evolution, Diffusion, Progress, Revolution

Transformation; Theories of Social Change : Dialectical & Cyclical

Part-II Sociological Theories

1. Structural

Nadel

Radcliffe Brown

Levi-Strauss

2. Functional

Malinowski

Durkheim

Parsons

Merton

3. Interactionist

Social action : Max Weber, Pareto

Symbolic interactionism : G.H. Mead, Blumer

4. Conflict

Karl Marx

Dahrendorf

Coser

Collins

Part-III- Methodology

1. Meaning & Nature of Social Research

Nature of Social Phenomena

The scientific method

The problems in the study of social phenomena : Objectivity & Subjectivity

Fact and Value

2. Quantitative Methods

Survey

Research Design and its types

Hypothesis

Techniques of data collection : Observation, Questionnaire, Schedule

Interview

3. Qualitative Methods
 - Participant observation
 - Case Study
 - Content analysis
 - Statistics in Social Research
 - Mean, Median, Mode
 - Reliability and Validity

v) **DEPARTMENT OF JOURNALISM & MASS COMMUNICATION**

Unit - I (10 marks)

Communication and Journalism - Basic terms, Concepts and definition, Nature and process

Types of Communication

Mass communication - Nature of media and content

Mass communication in India - Reach, Access and nature of audience

Unit - II (10 marks)

Role of media of society

Characteristics of India society - Demographic and sociological impact of media in general

Mass media effects- Studies and their limitations

Impact of media on specific audiences - Women, children, etc.

Mass campaigns for specific issues - Social concerns, environment, human rights, gender equality

The press, radio television, cinema and traditional form of communication

Unit - III (10 marks)

Journalism as a profession

Journalists - Their role and responsibilities

Indian Constitution and freedom of press

Research restrictions

Ethics and journalism

Careers in Journalism and mass media

Training - Problems, perception and response by the industry

Media management - Principles and practices

Professional organizations in Media

Media Laws in India

Unit - IV**(10 marks)**

History of Print and Broadcast media in general with particular reference to India
Post-independent development in print

Newspaper - English and Indian language press - major landmarks

Magazines - Their role, book phase and contemporary situation

Small newspapers - Problems and prospects

Press Commission. Press Councils - Their recommendations and status

Development of Radio after independence - Extension role, radio rural forum and local broadcasting - General and specific audience programmes

Development of television - Perception, initial development and experimental approach: SITE phase and evolution: Expansion of television - Post -Asiad phase, issues concerns and debates over a period of time

Committees in Broadcasting-Background, Recommendations and implementation

Cinema - Historical overview and contemporary analysis - Commercial, parallel and documentary genres - Problems and prospects for the film industry

Unit - V**(10 marks)**

Communication and theories of social change

Role of media in social change - Dominant paradigms

Critique of the Dominant paradigm and alternative conception

Development initiatives -State, market and the third force (NGO sector)

Participatory approaches and community media - Ownership and management perspectives

Unit - VI**(10 marks)**

Introduction of research methods and process

Mass communication research - Historical overview

Administrative and critical traditions

Effects research - Strengths and Limitations

Communication research in India -Landmark studies related to SITE

Content analysis - Quantitative and qualitative approaches

Market research and its relationship to communication particularly advertisement

Sampling techniques - Strengths and limitations

Statistical methods of analysis -Basics

Unit - VII**(10 marks)**

Colonial structures of communication
 Decolonization and aspirations and aspirations of nations
 Conflicts related to media coverage and representation
 International news agencies - Critique
 MacBride Commission - Recommendations and policy options
 Contemporary issues related to transnational broadcasting and its impact on culture, various perspectives and cultural impact.
 Convergence of media - Problems and options
 Media Policies in an International Context
 India's positions and approach to international communications issues

Unit - VIII**(10 marks)**

Radio & TV and Video as Media of Communication
 Grammar of TV & Radio and Video
 The production team
 Role of Producer
 Different types of programmes
 Writing for Radio
 Writings for TV - Researching for Scripts
 The Visual Language
 Camera Movements
 Basic Theories of Compositions - Cues and Commands
 Formats for Radio-Television - Cues and Commands
 Editing Theory an Practice
 Sound Design, Microphones, Sets and Lighting
 Satellite, Cable television, Computers, Microchips

Unit - IX**(10 marks)**

Advertising
 Marketing
 Ad Copy and Layout
 Public Relations
 Public Opinion
 Propaganda

Unit - X**(10 marks)**

The Techniques
 Different forms of Writing
 Printing Technology and Production methods
 New agencies
 Syndicates and Freelancing
 Specialized area of Journalism

- vi) **DEPARTMENT OF BIOCHEMISTRY**
- vii) **DEPARTMENT OF BIOTECHNOLOGY**
- viii) **DEPARTMENT OF BOTANY**
- ix) **DEPARTMENT OF ZOOLOGY**
- x) **DEPARTMENT OF GENETICS**

**DETAILED SYLLABUS FOR COMMON ENTRANCE TEST FOR URS/PREPh.D
 TEST IN THE DEPARTMENTS OF BIOCHEMISTRY, BIOTECHNOLOGY,
 BOTANY, GENETICS, MICROBIOLOGY AND ZOOLOGY**

1. MOLECULES AND THEIR INTERACTION RELAVENT TO BIOLOGY 10

- A. Structure of atoms, molecules and chemical bonds.
- B. Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins).
- C. Stablizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.).
- D. Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).
- E. Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers.
- F. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes.
- G. Conformation of proteins (Ramachandran plot, secondary, tertiary and quaternary structure; domains; motif and folds).
- H. Conformation of nucleic acids (A-, B-, Z-,DNA), t-RNA, micro-RNA).
- I. Stability of protein and nucleic acid structures.
- J. Metabolism of carbohydrates, lipids, amino acids, nucleotides and vitamins.

2. CELLULAR ORGANIZATION

7

- A. Membrane structure and function: Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, ion pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.

- B. Structural organization and function of intracellular organelles: Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility.
- C. Organization of genes and chromosomes: Operon, interrupted genes, gene families, structure of chromatin and chromosomes, unique and repetitive DNA, heterochromatin, euchromatin, transposons.
- D. Cell division and cell cycle: Mitosis and meiosis, their regulation, steps in cell cycle, and control of cell cycle.
- E. Microbial Physiology: Growth, yield and characteristics, strategies of cell division, stress response.

3. FUNDAMENTAL PROCESSES

7

- A. DNA replication, repair and recombination: Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms.
- B. RNA synthesis and processing: Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases, capping, elongation and termination, RNA processing, RNA editing, splicing, polyadenylation, structure and function of different types of RNA, RNA transport.
- C. Protein synthesis and processing: Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, translational proof-reading, translational inhibitors, post- translational modification of proteins.
- D. Control of gene expression at transcription and translation level: Regulation of phages, viruses, prokaryotic and eukaryotic gene expression, role of chromatin in regulating gene expression and gene silencing.

4. CELL COMMUNICATION AND CELL SIGNALING

7

- A. Host parasite interaction: Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alteration of host cell behavior by pathogens, virus-induced cell transformation, pathogen-induced diseases in animals and plants, cell-cell fusion in both normal and abnormal cells.
- B. Cell signaling: Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component signaling systems, bacterial chemotaxis and quorum sensing.
- C. Cellular communication: Regulation of hematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation.
- D. Cancer: Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells

with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth.

- E. 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, Toll-like receptors, cell-mediated effector functions, inflammation, hypersensitivity and autoimmunity, immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, congenital and acquired immunodeficiencies, vaccines.

5. DEVELOPMENTAL BIOLOGY

5

- A. Basic concepts of development: Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development.
- B. Gametogenesis, fertilization and early development: Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination.
- C. Morphogenesis and organogenesis in animals: Cell aggregation and differentiation in Dictyostelium; axes and pattern formation in Drosophila, amphibia and chick; organogenesis - vulva formation in Caenorhabditis elegans; eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development-larval formation, metamorphosis; environmental regulation of normal development; sex determination.
- D. Morphogenesis and organogenesis in plants: Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in Arabidopsis and Antirrhinum.
- E. Programmed cell death, aging and senescence.

NOTE 1: For students of Botany (Plant Sciences), syllabus of System Physiology-Animal will be considered deleted and 10 marks meant for System Physiology-Plant shall be doubled.

The same criteria shall be applicable on students of Zoology (Animal Sciences) i.e. System Physiology, Plant will be considered as deleted and 10 marks of System Physiology, Animal shall be doubled.

NOTE 2: For students of Life Sciences subjects other than Botany (Plant Sciences) or Zoology (Animal Sciences), there will be 50% choice of questions from system Physiology-Plant and System Physiology-Animal i.e. they will be required to attempt 10 questions out of 20 questions from each system of Physiology.

6. SYSTEM PHYSIOLOGY - PLANT 10

- A. Photosynthesis: Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO₂ fixation-C₃, C₄ and CAM pathways.
- B. Respiration and photorespiration: Citric acid cycle; plant mitochondrial electron transport and ATP synthesis; alternate oxidase; photorespiratory pathway.
- C. Nitrogen metabolism: Nitrate and ammonium assimilation; amino acid biosynthesis.
- D. Plant hormones: Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action.
- E. Sensory photobiology: Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks.
- F. Solute transport and photoassimilate translocation: Uptake, transport and translocation of water, ions, solutes and macromolecules from soil, through cells, across membranes, through xylem and phloem; transpiration; mechanisms of loading and unloading of photoassimilates.
- G. Secondary metabolites - Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles.
- H. Stress physiology: Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses; mechanisms of resistance to biotic stress and tolerance to abiotic stress.

7. SYSTEM PHYSIOLOGY - ANIMAL 10

- A. Blood and circulation: Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis.
- B. Cardiovascular System: Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG - its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above.
- C. Respiratory system: Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration.
- D. Nervous system: Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture.
- E. Sense organs: Vision, hearing and tactile response.

- F. Excretory system: Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance.
- G. Thermoregulation: Comfort zone, body temperature - physical, chemical, neural regulation, acclimatization.
- H. Stress and adaptation
- I. Digestive system: Digestion, absorption, energy balance, BMR.
- J. Endocrinology and reproduction: Endocrine glands, basic mechanism of hormone action, hormones and diseases; reproductive processes, neuroendocrine regulation.

8. INHERITANCE BIOLOGY

7

- A. Mendelian principles: Dominance, segregation, independent assortment, deviation from Mendelian inheritance.
- B. Concept of gene: Allele, multiple alleles, pseudoallele, complementation tests.
- C. Extensions of Mendelian principles: Codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters.
- D. Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants.
- E. Extra chromosomal inheritance: Inheritance of mitochondrial and chloroplast genes, maternal inheritance.
- F. Microbial genetics: Methods of genetic transfers - transformation, conjugation, transduction and sex-duction, mapping genes by interrupted mating, fine structure analysis of genes.
- G. Human genetics: Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.
- H. Quantitative genetics: Polygenic inheritance, heritability and its measurements, QTL mapping.
- I. Mutation: Types, causes and detection, mutant types - lethal, conditional, biochemical, loss of function, gain of function, germinal versus somatic mutants, insertional mutagenesis.
- J. Structural and numerical alterations of chromosomes: Deletion, duplication, inversion, translocation, ploidy and their genetic implications.
- K. Recombination: Homologous and non-homologous recombination, including transposition, site-specific recombination.

9. DIVERSITY OF LIFE FORMS

7

- A. Principles and methods of taxonomy: Concepts of species and hierarchical taxa, biological nomenclature, classical and quantitative methods of taxonomy of plants, animals and microorganisms.

- B. Levels of structural organization: Unicellular, colonial and multicellular forms; levels of organization of tissues, organs and systems; comparative anatomy.
- C. Outline classification of plants, animals and microorganisms: Important criteria used for classification in each taxon; classification of plants, animals and microorganisms; evolutionary relationships among taxa.
- D. Natural history of Indian subcontinent: Major habitat types of the subcontinent, geographic origins and migrations of species; common Indian mammals, birds; seasonality and phenology of the subcontinent.
- E. Organisms of health and agricultural importance: Common parasites and pathogens of humans, domestic animals and crops.

10. ECOLOGICAL PRINCIPLES

7

- A. The Environment: Physical environment; biotic environment; biotic and abiotic interactions.
- B. Habitat and niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.
- C. Population ecology: Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection); concept of metapopulation - demes and dispersal, interdemetic extinctions, age structured populations.
- D. Species interactions: Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis.
- E. Community ecology: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones.
- F. Ecological succession: Types; mechanisms; changes involved in succession; concept of climax.
- G. Ecosystem: Structure and function; energy flow and mineral cycling (CNP); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine).
- H. Biogeography: Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.
- I. Applied ecology: Environmental pollution; global environmental change; biodiversity-status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches.
- J. Conservation biology: Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).

11. EVOLUTION AND BEHAVIOUR**6**

- A. Emergence of evolutionary thoughts: Lamarck; Darwin-concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; spontaneity of mutations; the evolutionary synthesis.
- B. Origin of cells and unicellular evolution: Origin of basic biological molecules; abiotic synthesis of organic monomers and polymers; concept of Oparin and Haldane; experiment of Miller (1953); the first cell; evolution of prokaryotes; origin of eukaryotic cells; evolution of unicellular eukaryotes; anaerobic metabolism, photosynthesis and aerobic metabolism.
- C. Paleontology and evolutionary history: The evolutionary time scale; eras, periods and epoch; major events in the evolutionary time scale; origins of unicellular and multicellular organisms; major groups of plants and animals; stages in primate evolution including Homo.
- D. Molecular Evolution: Concepts of neutral evolution, molecular divergence and molecular clocks; molecular tools in phylogeny, classification and identification; protein and nucleotide sequence analysis; origin of new genes and proteins; gene duplication and divergence.
- E. The Mechanisms: Population genetics - populations, gene pool, gene frequency; Hardy-Weinberg law; concepts and rate of change in gene frequency through natural selection, migration and random genetic drift; adaptive radiation and modifications; isolating mechanisms; speciation; allopatricity and sympatricity; convergent evolution; sexual selection; co-evolution.
- F. Brain, Behavior and Evolution: Approaches and methods in study of behavior; proximate and ultimate causation; altruism and evolution-group selection, kin selection, reciprocal altruism; neural basis of learning, memory, cognition, sleep and arousal; biological clocks; development of behavior; social communication; social dominance; use of space and territoriality; mating systems, parental investment and reproductive success; parental care; aggressive behavior; habitat selection and optimality in foraging; migration, orientation and navigation; domestication and behavioral changes.

12. APPLIED BIOLOGY:**7**

- A. Microbial fermentation and production of small and macro molecules.
- B. Application of immunological principles (vaccines, diagnostics). tissue and cell culture methods for plants and animals.
- C. Transgenic animals and plants, molecular approaches to diagnosis and strain identification.
- D. Genomics and its application to health and agriculture, including gene therapy.
- E. Bioresource and uses of biodiversity.
- F. Breeding in plants and animals, including marker - assisted selection.
- G. Bioremediation and phytoremediation.
- H. Biosensors.

13. METHODS IN BIOLOGY**10**

- A. Molecular biology and recombinant DNA methods: 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; expression of recombinant proteins using bacterial, animal and plant vectors; isolation of specific nucleic acid sequences; generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors; in vitro mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms; 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 analysis, such as micro array based techniques; isolation, separation and analysis of carbohydrate and lipid molecules; RFLP, RAPD and AFLP techniques
- B. Histochemical and immunotechniques: Antibody generation, detection of molecules using ELISA, RIA, western blot, immunoprecipitation, flow cytometry and immunofluorescence microscopy, detection of molecules in living cells, in situ localization by techniques such as FISH and GISH.
- C. Biophysical methods: Analysis of biomolecules using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy, structure determination using X-ray diffraction and NMR; analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods.
- D. Statistical Methods: Measures of central tendency and dispersal; probability distributions (Binomial, Poisson and normal); sampling distribution; difference between parametric and non-parametric statistics; confidence interval; errors; levels of significance; regression and correlation; t-test; analysis of variance; χ^2 test; basic introduction to Multivariate statistics, etc.
- E. Radiolabeling techniques: Properties of different types of radioisotopes normally used in biology, their detection and measurement; incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, safety guidelines.
- F. Microscopic techniques: Visualization of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze-fracture methods for EM, image processing methods in microscopy.
- G. Electrophysiological methods: Single neuron recording, patch-clamp recording, ECG, Brain activity recording, lesion and stimulation of brain, pharmacological testing, PET, MRI, fMRI, CAT.
- H. Methods in field biology: Methods of estimating population density of animals and plants, ranging patterns through direct, indirect and remote observations, sampling methods in the study of behavior, habitat characterization-ground and remote sensing methods.
- I. Computational methods: Nucleic acid and protein sequence databases; data mining methods for sequence analysis, web-based tools for sequence searches, motif analysis and presentation.

xi) DEPARTMENT OF FOOD TECHNOLOGY**Unit 1 : Introductory Food Technology****(15 marks)**

Introduction to food technology. Food processing industries/institutions/food scientists of importance in India. Food attributes *viz.* colour, texture, flavour, nutritive value and consumer preferences. Causes of food spoilage, sources of microbial contamination of foods, food borne illnesses, water activity and its relation to spoilage of foods. Spoilage of processed products and their detection. Principles and methods of food preservation. Composition and related quality factors for processing. Methods of food preservation. Composition and related quality factors for processing. Methods of food preservation and heat processing, pasteurization, canning, dehydration, freezing, fermentation, irradiation and chemical additives. Refrigerated and modified atmosphere storage. Aseptic preservation, hurdle technology, hydrostatic pressure technology, microwave processing etc.. Use of non-thermal technologies (microfiltration, bacto-fugation, ultra high voltage electric fields, irradiation, thermosonication), alternate-thermal technologies (ohmic heating, dielectric heating, infrared and induction heating) and biological technologies (antibacterial enzymes, proteins and peptides) in food processing.

Unit 2 : Fruits and Vegetable Processing**(15 marks)**

Post harvest handling and storage of fresh fruits and vegetables. Preparation of fruits and vegetables for processing. Minimally processed products. Thermal processing and process time evaluation for canned products, process optimization, aseptic canning, methods for canning of different fruits, and vegetables; Dehydration and associated quality changes during drying and storage of dehydrated products. Solar drying. Intermediate moisture in foods. Preparation and utilization of fruits and vegetables juices in non-fermented/ fermented/ aerated beverages. Membrane technology. Chemistry and manufacture of pectin, role in gel formation and products like jellies and marmalades. Technology of preservatives, pickles, chutney's and sauces. Nature and control of spoilage in these products. By products utilization of fruits and vegetable processing industry. FPO and related formalities to obtain it. Processing methods of frozen fruits and vegetables, IQF products, packaging, storage and thawing. Tomato products such as juice, puree, paste, soup, sauce and ketchup. Other convenience foods from fruits and vegetables.

Unit 3: Cereals, Pulses and Oil seeds Processing**(15 marks)**

Structure of different grains like wheat, rice, barley, oat, maize and millets etc. Milling of grains. Wheat flour/semolina and its use in traditional/non-traditional foods like breads, biscuits, cakes, doughnuts, buns, pasta goods, extruded, breakfast and snack

foods. Preparation of vital wheat gluten and its utilization. Instant ready mixtures. Milling and parboiling of rice; by-products of rice milling and their utilization. Processed products from rice. Pearling, malting, brewing and preparation of malted milk feeds from barley. Milling of oats and its processing into flakes, porridge, oatmeal etc. Wet and dry milling of corn, manufacture of corn flakes, corn syrup, corn starch, corn steep liquor and germ oil.

Structure and composition of pulses and their importance in Indian diet. Milling and processing of pulses viz. germination, cooking, roasting, frying, canning and fermentation. Use in traditional products, protein concentrates and isolates. Oilseeds: edible oilseeds, composition and importance in India. Oilseed processing. Oil extraction and its processing. Production, packaging and storage of vanaspati, peanut butter, protein concentrates, isolates and their use in high protein foods. Export of oilseed cakes. International market and consumer preferences for quality in cakes for use in textured vegetable proteins.

Unit 4 : Technology of Milk and Milk Products (15 marks)

Milk and Milk production in India. Importance of milk processing plants in the country. Handling and maintenance of dairy plant equipment. Dairy plant operations viz. receiving, separation, clarification, pasteurization, standardization, homogenization, sterilization, storage, transport and distribution of milk. Problems of milk supply in India. UHT, toned, humanized, fortified, reconstituted and flavored milks. Technology of fermented milks. Milk products processing viz. cream, butter, *ghee*, cheese, condensed milk, evaporated milk, whole and skimmed milk powder, ice-cream, butter oil, *khoa*, *channa*, *paneer* and similar products. Judging and grading of milk products. Cheese spreads by spray and roller drying techniques. Insanitization viz. selection and use of dairy cleaner and sanitizer. In plant cleaning system. Scope and functioning of milk supply schemes and various national and international organizations. Specifications and standards in milk processing industry. Dairy plant sanitation and waste disposal.

Unit 5: Technology of Meat / Fish / Poultry Products (10 marks)

Scope of meat, fish and poultry processing industry in India. Chemistry and microscopic structure of meat tissue. Antemortem inspection. Slaughter and dressing of various animals and poultry birds. Postmortem examination. Rigor mortis. Retail and wholesale cuts. Factors affecting meat quality. Curing, smoking, freezing, canning and dehydration of meat, poultry and their products. Sausage making. Microbial factors influencing keeping quality of meat. Processing and preservation of fish and its products. Handling, canning, smoking and freezing of fresh water fish and its products. Utilization of byproducts. Zoonotic diseases. Structure and composition of egg and factors effecting quality. Quality measurement. Preservation of eggs using oil coating,

refrigeration, thermostabilization and antibiotics. Packing, storage and transportation of eggs. Technology of egg products viz. egg powder, albumen, flakes and calcium tablets. Industrial and food user physiological conditions and quality of fish products.

Unit 6 : Food Quality Management (10 marks)

Objectives, importance and functions of quality control. Quality systems and tools used for quality assurance including control charts, acceptance and auditing inspections, critical control points, reliability, safety, recall and liability. The principles and practices of food plant sanitation. Food and hygiene regulations. Environment and waster management. Total quality management, good management practices, HACCP and codex in food. International and National food laws. US-FDA/ISO-9000 etc. Food adulteration, food safety. Sensory evaluation, panel screening, selection methods. Sensory and instrumental analysis quality control. Quality control of food at all stages and for packaging materials.

Unit 7 : Food Engineering/Packaging and Labeling (10 marks)

Unit operations of food processing, machineries for various unit operations, energy balance in food processing. Packaging materials viz. properties and testing procedures, packaging of fresh and processed foods. Shelf life studies. Recent trends in packaging aseptic, modified atmosphere, vacuum and gas packaging etc. Nutritional labeling requirements of foods. Requirements and functions of containers. Principles of package design.

Unit 8 : Food Biotechnology (10 marks)

Role of biotechnology in productivity of plants, livestock and microbes of improved nutrition and quality. Use of biotechnology in production of food additives. Use of biotechnologically improved enzymes in food processing industry, biomass production using industrial wastes. Consumer concerns about risks and values, Biotechnology and food safety. Future of biotechnology in India.

xii) DEPARTMENT OF ENVIRONMENTAL SCIENCES

Unit-I

Fundamentals of Environmental Chemistry: Stoichiometry, Gibb's energy, Chemical potential, chemical-equilibria, acid- base reactions, solubility product, solubility of gases in water. (5 marks)

Chemical composition of Air : Classificaiton of elements, chemical speciation, Particles, ions and radicals in the atmosphere, Chemical processes for formation inorganic and organic particulate matter. (5 marks)

Water Chemistry: Chemistry of water, concept of DO, BOD, COD, Water treatment : sedimentation, coagulation, filtration and advance treatment. Redox potential.

(5 marks)

Toxic Chemicals in the environment- Air, Water and their effect. Pesticides in water; Bio- chemical aspects of Arsenic, Cadmium, Lead, Mercury, Carbon Monoxide, O₃ and PAN , Pesticides, Insecticides, MIC. Carcinogens in the air. (5 marks)

Principles of Analytical Methods : Titrimetry, Gravimetry, Colourimetry, Spectrophotometry, Chromatography, Gas Chromatography, Atomic Absorption Spectrophotometry, GLC, HPLC, Electrophoresis, X-ray fluorescence, X-ray diffraction, Flame photometry. (5 marks)

Unit-II

Ecosystems: Structure and functions, abiotic and biotic components, energy flows, Food chains, Food web, Ecological pyramids- types. (5 marks)

Population Ecology: Ecological Succession, Population, Community ecology, Parasitism, Prey-predator relationships. (5 marks)

Common flora and fauna in India

Aquatic : Phytoplankton, Zooplankton and Macrophytes

Terrestrial : Forests (5 marks)

Endangered and Threatened Species

Biodiversity and its conservation : Definition, 'Hotspots' of Biodiversity, Strategies for Biodiversity conservation. National Parks, Sanctuaries and biosphere reserves, Gene pool. (5 marks)

Natural Resources: Hydro- energy, Tidal energy, thermal energy conversion, wind energy, Geo-thermal energy, Solar energy, Nuclear energy, Bio-energy, Energy use pattern in different parts of the world. (5 marks)

Unit-III

Environmental Geosciences-Fundamental concepts.

The earth systems and Biosphere : Conservation of matter in. various Geo-spheres- lithosphere, hydrosphere, atmosphere and biosphere. Energy budget of the earth, Earth's thermal environment and seasons, ecosystems flow of energy and matter. Coexistence in communities, food webs. (5 marks)

Earth's Processes and Geological Hazards : Earth's processes; concept of residence time and rates of natural cycles. Catastrophic geological hazards. Study of floods, landslides, earthquakes, volcanism and avalanche. (5 marks)

Mineral Resources and Environment : Resources and Reserves, Minerals. and Population, oceans as new areas for exploration of mineral resources, ocean ore and recycling of resources. (5 marks)

Water Resources and Environment : Global Water Balance, Ice sheets and fluctuations of sea levels, 'Origin and composition of seawater, hydrological cycle, factors influencing the surface water. (5 marks)

Environmental Geochemistry : Concept of major, trace and REE, Classification of trace elements, mobility of trace elements, Geochemical cycles, bio-geochemical factors in environmental health, Human use of trace elements and health effects.

(5 marks)

Unit-IV

Environmental Biotechnology: Scope of environmental biotechnology, Biodegradation of macromolecules, biodegradation of xenobiotics, vermicomposting, Heavy metal pollution, bioremediation of metal contaminated soils, spilled oil and grease deposits and synthetic pesticides, biofertilizers. (5 Marks)

Biosensors: Biosensors to detect environmental pollutants. Microorganisms and organic pollutants, extremophiles, fermentation technology (Bioreactors). (5 marks)

Genetic Engineering: Basic techniques in genetic engineering: Genetic manipulation, Restriction endonucleases, Introduction of cloned genes into new hosts using plasmid and phage vector systems. RFLP, Polymerase chain reaction.

(5 marks)

Environmental Genomics: Environmental genomics/metagenomics-a general account, Microbes and environmental management, basic concept of genetic engineering of plants and its applications- herbicide and stress tolerant plant, biotechnology strategies in forestry and wasteland management, biotechnology in biodiversity conservation: gene banks, germplasm conservation and DNA Banks, Genetically modified organisms. (5 marks)

Biosafety: Biosafety- a general account, ethanol fermentation, biotechnological approaches for solid waste management, Phytotechnology- terrestrial and aquatic phytosystems, metal phytoremediation, nutrient film techniques, algal treatment systems. (5 marks)

xiii) DEPARTMENT OF COMPUTER SCIENCE

Computer Organisation and Arithmetic : Propositional (Boolean) Logic, Predicate Logic, Well-formed-formulae (WFF), Tautology, Logic Families : TTL, ECL and CMOS gate, Boolean algebra and Minimization of Boolean functions, Flip-Flops : types a race around conditions and comparisons, Design of Combinational and sequential circuit. Number systems, floating point representation. Instruction Formats, Addressing Modes, Memory types and organisation, Interfacing Peripheral devices.

(10 marks)

Programming Languages : Programming Language concepts, paradigms and models, Data types, operations, Expressions, Assignment, Flow on control-Control structures, I/O statements, User defined and built in functions, Parameter parsing. Principles, classes, inheritance, polymorphism, dynamic binding, reference semantics

and their implementation, Object-Oriented paradigm with reference to Java, C++.

(5 marks)

Data Structure : Data, Information, arrays, linked lists, stacks, queues, trees, graphs, hashing, searching techniques, B-trees and B+ trees, divide and conquer method, greedy method, dynamic programming, branch & bound. **(10 marks)**

System programming and Compiler : Assembly language fundamentals, Assemblers, Macros and Macro processors. Loading, Linking, relocation, linkage, relocation, linkage editing, Text editors, Debuggers and program generation. Compilation and interpretation : Bootstrap compiler precedence grammar, LR. Intermediate codes, Codes generations, Code optimization, push down automata turing machine.

(08 marks)

Software Engineering : System development life cycle : Steps, Waterfall model, Prototypes, and Spiral model. Software metrics : Software Project Management, Software Design : System design, detailed design, function oriented design. Object oriented design, user interface design, and Design level metrics. Coding and Testing : Testing level metrics, Software quality and reliability Clean room approach, software re-engineering. **(09 marks)**

Computer Graphics : Display systems, Input devices, 2D geometry, Graphic operations, 3 D Graphics, Animation, Graphic Standard, Application Concepts Storage devices, Input tools, graphic procedures, multimedia. **(08 marks)**

Unit-III

Data Base : Concepts of Data base, ER diagram, Data Models, Design of Relational Database, Normalization, SWL and QBE, Query Processing and Optimization. Centralized and Distributed Database, Security, Concurrency and Recovery in Centralized and Distributed Databases Systems. Object Oriented Database Management System (Concepts, Composite object, Integratoin with RDBMS applications), Oracle.

(10 marks)

Data Warehousing : Environment, Architecture of database warehouse, methodology, analysis, design ,construction and administration. **(08 marks)**

Data Mining : Extracting models and patterns from large databbase data mining techniques, classification, regression, clustering, summarization, dependency modelling, link analysis, sequencing analysis, mining scientific and busines data.

(07 marks)

UNIT-IV

Computer Network : Network fundamentals, Reference Models, Data Communication, Internetworking; Switch, Hub, Bridge, Router, Gateways, Concatenated virtual circuits, Tunnelling, ragmentation, Firewalls, Routing, Virtual

circuits and datagrams, Routing algorithm, Congestion control, Network Security.
(09 marks)

Web-developments : HTML, DHTML, XML, Scripting, Servlets, Applets.

(09 marks)

Operating System : Main functions, Multiprogramming, Multiprocessing and Multitasking Memory Management, Virtual memory, Paging, Fragmentation. Concurrent Processing : Mutual exclusion, Critical regions, lock and unlock. Scheduling : CPU scheduling, I/O scheduling, Resource scheduling, Deadlock and scheduling, algorithm, Banker's algorithm for deadlock handling. UNIX : Operating system, structure of UNIX operating system, UNIX Commands, Interfacing with UNIX, Editors and Compilers for UNIX, LEX and YACC, File system, System calls, Filters, shell Programming.
(07 marks)

xiv) DEPARTMENT OF PHARMACEUTICAL SCIENCES

Natural Products : (10 marks)

Pharmacognosy & Phytochemistry - Chemistry, tests, isolation, characterization and estimation of phytopharmaceuticals belonging to the group of Alkaloids, Glycosides, Terpenoids, Steroids, Bioflavonoids, Purines, Guggul lipids. Pharmacognosy of crude drugs that contain the above constituents. Standardization of raw materials and herbal products. WHO guidelines. Quantitative microscopy including modern techniques used for evaluation. Biotechnological principles and techniques for plant development, Tissue culture.

Pharmacology : (15 marks)

General pharmacological principles including Toxicology. Drug interaction. Pharmacology of drugs acting on Central nervous system, Cardiovascular system, Autonomic nervous system, Gastro intestinal system and Respiratory system. Pharmacology of Autocoids, Hormones, Hormone antagonists, chemotherapeutic agents including anticancer drugs. Bioassays, Immuno Pharmacology. Drugs acting on the blood & blood forming organs. Drugs acting on the renal system.

Medicinal Chemistry : (15 marks)

Structure, nomenclature, classification, synthesis, SAR and metabolism of the following category of drugs, which are official in Indian Pharmacopoeia and British Pharmacopoeia. Introduction to drug design. Stereochemistry of drug molecules. Hypnotics and Sedatives, Analgesics, NSAIDS, Neuroleptics, Antidepressants, Anxiolytics, Anticonvulsants, Antihistaminics, Local Anaesthetics, Cardio Vascular drugs - Antianginal agents Vasodilators, Adrenergic & Cholinergic drugs, Cardiotonic agents, Diuretics, Anti-hypertensive drugs, Hypoglycemic agents, Antilipemic agents, Coagulants, Anticoagulants, Antiplatelet agents. Chemotherapeutic agents -

Antibiotics, Antibacterials, Sulphadruugs. Antiprotozoal drugs, Antiviral, Antitubercular, Antimalarial, Anticancer, Antiamoebic drugs. Diagnostic agents. Preparation and storage and uses of official Radiopharmaceuticals, Vitamins and Hormones. Eicosanoids and their application.

Pharmaceutics : (10 marks)

Development, manufacturing standards Q.C. limits, labeling, as per the pharmacopoeial requirements. Storage of different dosage forms and new drug delivery systems. Biopharmaceutics and Pharmacokinetics and their importance in formulation. Formulation and preparation of cosmetics - lipstick, shampoo, creams, nail preparations and dentifrices. Pharmaceutical calculations.

Pharmaceutical Jurisprudence : (10 marks)

Drugs and cosmetics Act and rules with respect to manufacture, sales and storage. Pharmacy Act. Pharmaceutical ethics.

Pharmaceutical Analysis : (10 marks)

Principles, instrumentation and applications of the following: Absorption spectroscopy (UV, visible & IR). Fluorimetry, Flame photometry, Potentiometry. Conductometry and Polarography. Pharmacopoeial assays. Principles of NMR, ESR, Mass spectroscopy. X-ray diffraction analysis and different chromatographic methods.

Biochemistry : (10 marks)

Biochemical role of hormones, Vitamins, Enzymes, Nucleic acids, Bioenergetics. General principles of immunology. Immunological. Metabolism of carbohydrate, lipids, proteins. Methods to determine, kidney & liver function. Lipid profiles.

Microbiology : (10 marks)

Principles and methods of microbiological assays of the Pharmacopoeia. Methods of preparation of official sera and vaccines. Serological and diagnostics tests. Applications of microorganisms in Bio Conversions and in Pharmaceutical industry.

Clinical Pharmacy : (10 marks)

Therapeutic Drug Monitoring Dosage regimen in Pregnancy and Lactation, Pediatrics and Geriatrics. Renal and hepatic impairment. Drug - Drug interactions and Drug - food interactions, Adverse Drug reactions. Medication History, interview and Patient counseling.

xv) DEPARTMENT OF IMSAR

PART-I

UNIT-I

(10 Marks)

Managerial Economics –Demand Analysis; Production Function; Cost-Output Relations; Market Structures; Pricing Theories; Advertising; Macro-Economics; National Income Concepts; Infrastructure – Management and Policy.

UNIT-II**(10 Marks)**

The concept and significance of organizational behavior – Skills and roles in an organization – Classical, Neo-classical and modern theories of organizational structure – Organisational design – Understanding and Managing individual behavior personality – Perception – Values – Attitudes – Learning – Motivation.

Understanding and managing group behavior; Inter-personal and group dynamics; Communication; Leadership; Managing change; Managing conflicts.

Organisational Development.

UNIT-III**(10 Marks)**

Concepts and perspectives in HRM; HRM in changing environment; Human Resource Planning – Objectives, Process and Techniques; Job Analysis – Job Description; Selecting Human Resources; 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-IV**(10 Marks)**

Nature, scope and objectives of Financial Management; Time Value of Money; Analysis and Interpretation of Financial Statements; Capital Budgeting Methods including Risk Analysis Techniques; Capital Structure – Theories and Factors; Cost of Capital; Dividend Policies – Theories and Determinants; New Financial Instruments and Elements of Derivatives; Working Capital Management – Determinants and Estimation; Money Market and Capital Market.

UNIT-V**(10 Marks)**

Marketing Environment and Environment Scanning; Marketing Information Systems 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.

Promotion 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.

UNIT-VI

(10 Marks)

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 Operations Research; Linear Programming; Sensitivity Analysis; Duality; Transportation Model; Inventory Control; Queueing Theory; Decision Theory; Markov Analysis; PERT/CPM

PART-II

SECTION –A

20 Marks

Measures of Central Tendency and Dispersion; Probability Theory; Probability Distributions – Binomial, Poisson, Normal and Exponential; Correlation and Regression Analysis; Sampling Theory; Sampling Distribution; Tests of Hypothesis; Large and Small Samples; t, z, F, Chi-Square tests.

SECTION-B

(20 Marks)

Use of Computers in Managerial Applications; Knowledge of MS Office and SPSS.

xvi) DEPARTMENT OF VISUAL ARTS

Art Introduction & Appreciation

(10 marks)

Knowledge of principal elements, perspective values, fundamentals of paintings, Visual principles, Form, Space, illusion, image, Chronology of the development of Ideas. Visual reality, conceptual reality. Tradition and the gradual development of the art of combing the elements of ideas of different visual arts specialization.

Methods & Materials

(10 marks)

Media and materials and their use, sketching and drawing, Application of materials, oil painting - Alla Prima and old master process, glazing and scumbling, priming of canvas, different types of oil, brushing etc. Tempera and Gouache and their uses in painting in both traditional and non-traditional art. Wash method on paper and silk, acrylic, pastel, mied media, water colour mural and mural techniques- Fresco secco and Buono fresco, Ajanta and different modern media relief and mixed media in mural.

College, Encaustic Wax

Supports in painting (Canvas, paper, wood, silk etc.)

types of paintings, open air paintings, portrait paintings, study of head and full length figures, male and female. Landscape paintings, patronised art, paintings under different art movements, still life, thematic, abstract etc.

Principles of compositions, reflection of artists personal views, development of concept. Process of creative paintings. Expression of ideas under some aesthetical and philosophical views. Artistic expression during different social and structural changes. Art and Changes.

Application of techniques, colours and colour theory and the application of colour theory in art activities. Colour harmony, traditional application of colour and the application of colour with reasoning.

Colour preparation, texture, technical aspect of pigment.

Sources and influences of various traditions. Study and understanding of artistic value, construction of forms, shapes, planes, volume and totality, understanding of two and three dimensional approaches and the purpose.

Art Appreciation

(30 marks)

Relevance of the study of aesthetics in Fine Arts/Visual Arts. The early Philosophical thoughts in Indian Culture. Nature and function of works of art in society. Concepts of Rasa, Sadanga, Dhvani, Alankara, etc. in traditional art. Concept of art and beauty, idea, imagination, intuition forms and content, sublime, sympathy, empathy, creativity allegory, myth, Philosophy and aesthetical views of Kant, Hegel, etc.

History of Art

(50 marks)

Pre-historic Indian Painting, Classical Indian Paintings, Mural (Ajanta, Bagh) and later Mural traditions, Manuscript Painting, Miniature Painting, Folk and Tribal Paintings.

Nandalal and his disciple {Ramkinkar, Binod, Bihari, Dhirendrakrishana Dev Varma etc.)

Amrita Shergil, Academic Realism, Calcutta Group (Paritosh Sen, Gobardhan Ash, Nirode Majumdar, Pradosh Dasgupta, Hemanta Mishra etc.)

Major trends in contemporary Indian Art since, 1947.

Major phases in Western Painting, Greco-Roman, Byzantine, Gothic, Renaissance (background of Renaissance. Humanism and the intentions and discoveries of the evolution of personal style of Early Renaissance and High Renaissance), Baroque and Rococo (background, conception with some important artists activities).

Neo-classicism, Romanticism, Neo-Realism, Impressionism, Post-impressionism, Cubism, Fauvism, Futurism, Dadaism, Surrealism, Abstract Art Abstract Expressionism Op, Pop, Neo-figuration, Art in Post. Modern Time.

xvii) DEPARTMENT OF DEFENCE STUDIES**UNIT-A****Theories and Concepts -****20 Marks**

1. Defence and Strategic Studies : Assumptions and Approaches
2. (a) The concepts of Nation. State and Nation-State
(b) Theories and elements of State
(c) National Power and its components
3. (A) Key concepts of security (a) national Security (b) Regional Security
© Comprehensive Security (d) Common Security (e) Equal Security.
(B) National Security objectives : Core values. National interests.
(C) Challenges to Security : Individual, Sub-National, Regional and International levels.
4. Non-Alignment, balance of Power. Collective Security ad balance of Terror concept, development and relevance.
5. Concepts of Geopolitics and Geo-strategy : Theories of Holford Mackinder and Carl Houshofer.
6. Defence and Security Policies : Concept. Formulation, objectives and linkages.
7. National Security Organizations in India : (a) Higher Defence Structure in India (b) National Security Council (c) Para-military and civil defence (d) Civil-military relations.
8. Deterrence and Détente : Concept. Theories of nuclear deterrence and their current relevance.
9. Contribution to strategic thought by Kautilya, Mao, Jomini, Clausewitz. Douhet and Alfred Mahan.

UNIT-B**Problems of Peace and Security -****20 Marks**

1. War: (a) Theories and causes of war. (b) Principles of war
(c) Contemporary warfare : Conventional Warfare in Nuclear age, Limited war, Revolutionary warfare, Low Intensity operations, Guerrilla Warfare, Insurgency and Counter Insurgency.
2. Armaments : Arms Race, Arms Aid, Arms Trade, Arms Proliferation.
3. Military alliances and pacts, Peace treaties, Defence cooperation, strategic Partnership and security dialogue.
4. Problem of system of Governance and Human Rights.
5. Terrorism : Comcept and kinds (National, International and Cross border).
6. Conflicting Ideologies : Militarism, Nationalism, Fundamentalism, Separatism, Irredentism.
7. Nuclear Proliferation & CPT, CTBT, MTCR, NMD.
8. Industrial Military Complex.

UNIT-C**Global Security Issues - 20 Marks**

1. End of cold war and emergence of new world order.
2. Military, nuclear and missile capabilities of China, Pakistan and India.
3. Re-structuring of UNO.
4. Environmental issues : Global warming, desertification, Acid rains, Industrial pollution, deforestation.
5. Military Geography & Defence Problems; Nature of boundaries, terrain
(a) Sino-Indian and Indo-Pak border disputes and India's Continental Strategy with her neighbours (b) Sri lanka ethnic Conflict (c) Domestic unrest in Afghanistan (d) West-Asian Crisis (e) Developments in Central Asian republics (f) Ethnic issues in Yugoslavia (g) Crisis in Chechenia.

6. Organized Crimes : Money Laundering, Narco-trafficking.
7. Militarisation of Indian ocean and India's national, maritime and security interests in the Indian Ocean region. India's Maritime Strategy for the 21st Century.
8. Issues of Logistics: Resources, Supply chain, Transportation and Communication.
9. Problems of refugees : (a) Causes of migration (b) Population in border areas and border security.

UNIT-D

Issues in Conflict Resolution-

20 Marks

1. Origin, type and structure of conflict at inter-state level.
2. Images, belief systems and International conflicts.
3. Techniques of conflict prevention.
4. Conflict management: Pacific solution of International Disputes, Coercive methods and war as an instrument.
5. International Humanitarian Laws and laws of Armed Conflicts.
6. Confidence Building Measures : Concept, kinds and utility.
7. IGOs & NGOs in conflict resolution : Peace making, Peace keeping and Peace building.
8. Techniques of preservation of peace : Collective security system, Pacific settlement, Enforcement action, Regional Security arrangements, Disarmament.

UNIT-E

Economic, Science & Technology Issues and National Security - 20 Marks

1. Broad survey of technological changes from industrial revolution to information revolution.
2. Economic Theories of Defence
3. (a) Basics of Defence Planning (b) Determinants of Defence expenditure and Defence budgeting.
4. National Security and International Trade regime (WTO, TRIPS, TRIMS, NAFTA, SAPTA).
5. (a) India's nuclear and space power programmes (b) India's energy scenario.
6. Research and Development : (a) Relevance of science and technology in National security (b) Impact of Information technology : Revolution in Military Affairs (RMA) (c) Choice of Weapon systems.
7. Impact of economic liberalization and globalization: (a) Defence production in India (Role of DPSU's and Ordnance factories (b) Defence and development and peace and development dichotomies.
8. Issues of mobilization of resources during war and peace.
9. Transfer of technology: Dual use and critical technologies and their impact on national security.