

MANIPUR PUBLIC SERVICE COMMISSION

NOTIFICATION

Imphal, the 5th December 2014

No. 7/15/2014-MPSC (DR): In continuation to this Commission's Notification of even No. dated 08-11-2014, the Scheme of Examination for Lecturers (Higher Secondary) under Education-S Department, Government of Manipur will be as follows :-

SCHEME OF EXAMINATION

PART-A

There shall be a written examination consisting of 200 Multiple Choice Questions carrying 300 marks with 3 (three) hours duration on the following

1. General Studies : (50 Questions)

The questions on General Studies will cover the following topics:-

- i. General Science
- ii. Current Events of National and International Importance
- iii. History of India
- iv. Indian National Movement
- v. Indian Polity and Economy
- vi. World Geography and Population

Question on General Science will cover general appreciation and understanding of Science, including matters of everyday observation and experience, as may be expected of a well-educated person who has not made a special study of any scientific discipline. In History of India, emphasis should be on broad understanding of economic, Social, Cultural and Political aspects of Indian History. In Indian National Movement, the candidates are expected to have a synoptic view of the nature and character of the Indian freedom movement, growth of nationalism and attainment of Independence. In Indian Polity and Economy questions will test knowledge of the candidate pertaining to Indian Polity including the Indian Constitution, Panchayati Raj and community Development, broad features of Indian economy and planning. In world geography and population, only General understanding of the subject will be expected with emphasis on physical/ecological, economic and socio-demographic aspects of Geography of India.

2. **Optional Subject** (150 Questions)

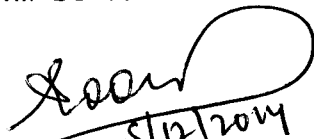
The questions will be from any one of the following Optional Subjects opted by the Candidates:

1.	Anthropology	12.	History
2.	Bengali	13.	Home Science
3.	Botany	14.	Manipuri
4.	Chemistry	15.	Mathematics
5.	Computer Science	16.	Philosophy
6.	Economics	17.	Physics
7.	Education	18.	Political Science & International Relations
8.	English	19.	Sociology
9.	Geography	20.	Statistics
10.	Geology	21.	Zoology
11.	Hindi		

The detailed syllabus of the Optional Subjects is at **Annexure-I**. The questions will be of **Post Graduate Level**.

PART-B

The Interview/ Personality Test carrying **50 marks** will be conducted for the candidates who qualify in the written Examination.


5/12/2014
(Shyam Lal Poonia)
Secretary,

Manipur Public Service Commission

Copy to:-

1. Secretary to Hon'ble Governor of Manipur.
2. Secretary to Hon'ble Chief Minister, Manipur.
3. Chief Secretary (DP), Government of Manipur.
4. Commissioner (Higher & Technical Education), Government of Manipur.
5. PA to Chairman/Member, MPSC
6. Official website of MPSC www.mpscmanipur.gov.in.
7. Notice Board.

Anthropology

Section-A

- 1.1 Meaning and scope Anthropology
- 1.2 Relationship with other disciplines: History, Economics, Sociology, Psychology, Political Science, Life Science, Medical Science.
- 1.3 Main branches of Anthropology, their scope and relevance
 - a) Social-cultural Anthropology
 - b) Physical and biological Anthropology
 - c) Archaeological Anthropology.
- 1.4 Human Evolution and emergence of Man.

Organic Evolution-Theories of evolution in historical perspective, pre-Darwinian, Darwinian and Post-Darwinian period. Modern synthetic theory of evolution; brief outline of terms and concepts of evolutionary biology (Doll's rule, Cope's rule, Gause's rule, parallelism, convergence, adaptive radiation, mosaic evolution); Principles of systematics and taxonomy, major primate taxa, tertiary and quaternary fossil primates, Systematics of Hominoidea and Hominidae, Origin and evolution of man-'*Homo erectus and Homo sapiens*'.

- 1.5 Phylogenetic status, characteristics and distribution of the following:
 - a) Prepleistocene fossil primates-*Oreopithecus*.
 - b) South and East African hominids-Plesianthropus/Australopithecus Africaus, Paranthropus, Australopithecus.
 - c) *Paranthropus-Homo erectus-Homo erectus javanicus, Homo erectus pekinensis*.
 - d) *Homo Heidelbergensis*.
 - e) Neanderthal man-La-chapelle-aus-saints (Classical type), Mt. Carmelites types (Progressive type).
 - f) Rhodesian man
 - g) *Homo sapiens*-Cromogon, Grimaldi, Chancelade.Recent advances in understanding the evolution, distribution and multidisciplinary approach to understand a fossil type in relation to others.

- 1.6 Evolutionary trend and classification of the order Primates, Relationship with other mammals, molecular evolution of Primates, Comparative anatomy of man and apes, primate locomotion;-terrestrial and arboreal adaptation, skeletal changes due to erect posture and its implications.

- 1.7 Cultural Evolution-broad outlines of pre-historic cultures:
 - a) Paleolithic
 - b) Mesolithic
 - c) Neolithic
 - d) Chalcolithic
 - e) Copper-Bronze age

f) Iron age

2.1 Family-Definition and typology of family, household and domestic groups. Basic structure and functions; stability and changes in family. Typological and processual approaches to the study of family. Impact of urbanization, industrialization, education and feminist movements. Universality of family-a critique.

2.2 **Concept of kinship:** Definition of kin, incest prohibition exogamy and endogamy. Principles of descent-types and functions. Political and jural aspects of kinship. Unilineal, bilateral and double descent. Descent, filiation and complementary filiation. Kinship terminology, typology and approaches to the study of terminology Alliance and descent.

2.3 Marriage -Definition, types and variation of marriage systems. Debates on the universal definition of marriage. Regulation of marriage-preferential, prescriptive, proscriptive and open systems. Types and form of marriage Dowry, bride-price, pestation and marriage stability.

3.1 Study of culture, patterns and processes. Concept of culture, patterns of culture, relationships between culture and civilization and society.

3.2 Concept of Social Change and Cultural Change:

3.3 Social structure and social organization, Role-analysis and social network. Institutions, groups community. Social stratification: principles and form, status, class and power, gender. Nature and types of mobility.

3.4 Concept of Society.

3.5 Approaches to the study of culture and society-classical evolutionism, neo-evolutionism, culture ecology, historical particularism and diffusionism, structural-functionalism, culture and personality, transaction-alism, symbolism, cognitive approach and new ethnography, post structuralism and post-modernism.

4.1 Definitions and functions of religion. Anthropological approaches to the study of religion-evolutionary, psychological and functional. Magic, witchcraft and sorcery; definitions and functions and functionaries: priest, saman, medicine man and sorcerers. Symbolism in religion and rituals. Ethnomedicine. Myths and rituals: definitions and approaches to their study-structural, functional and processual Relation with economic and political structures.

5.1 Meaning, scope and relevance, principles governing production, distribution and consumption in communities subsisting on hunting-gathering, fishing, pastoralism, horticulture and other economic pursuits. Formalist and substantivist debate-Dalton, Karl-polyanny and Marx approach and New Economic Anthropology. Exchange: gifts, barter, trade, ceremonial exchange and market economy.

5.2 Theoretical foundations. Types of political organisations-band, tribe, chiefdom, state, concept of power, authority and legitimacy. Social control, law and justice in tribal and peasant societies.

6.1 Concepts of developmental Anthropological perspective. Models of development. Critiques of classical developmental theories. Concepts of planning and planned development. Concept of participatory development. Culture ecology and sustainable development. Displacement and rehabilitation.

7.1 Concept of research in anthropology, subjectivity and reflexivity in terms of gender class, ideology and ethics. Distinction between methodology, methods and techniques. Nature and explanation in anthropological research. Positivist and non-positivist approaches. Comparative methods; nature, purpose and methods of comparison in social and cultural anthropology. Basic techniques of data collection. Interview, participant and other forms of observation, schedules, questionnaire, case-study methods, extended case study methods, life histories and secondary sources, oral history, genealogical method, participatory, learning and assessment (PLA). Participatory rapid assessment (PRA). Analysis, interpretation and presentation of data.

8.1 Concept, scope and major branches of human genetics. Its relationship with other branches of science and medicine.

8.2 Method for study of genetic principles in man-family study (pedigree analysis, twin study, foster child, co-twin method, cytogenetic method, chromosomal and karyotype analysis), biochemical methods, immunological methods, D.N.A. technology and recombinant technologies.

8.3 Twin study method-zygosity, heritability estimates, present status of the twin study method and its applications.

8.4 Mendelian genetics in man-family study, single factor, multifactor, lethal, sub-lethal, and polygenic inheritance in man.

8.5 Concept of genetic polymorphism and selection, Mendelian population, Hardy-Weinberg law; causes and changes which bring down frequency-mutation, isolation, migration, selection, inbreeding and genetic drift. Consanguineous and non-consanguineous mating, genetic load, genetic effect of consanguineous and cousin marriages (statistical and probability methods for study of human genetics).

8.6 Chromosomes and chromosomal aberrations in man, methodology.

a) Numerical and structural aberrations (disorders)

b) Sex chromosomal aberrations-Klinefelter (XXY), Turner (XO), Super female (XXX), intersex, and other syndromic disorders.

c) Autosomal aberrations-Down syndrome, Patau, Edward and Cri-du-chat syndromes.

d) Genetic imprints in human disease, genetic screening, genetic counselling, human DNA profiling, gene mapping and genome study.

8.7 Concept of race in historical and biological perspective. Race and racism, biological basis of morphological variation of non-metric and metric characters. Racial criteria, racial traits in relation to heredity and environment; biological basis of racial classification, racial differentiation and race-crossing in man.

8.8 Ethnic groups of mankind-characteristics and distribution in world, racial classification of human groups. Principal living peoples of world. Their distribution and characteristics.

8.9 Age, sex and population variation in genetic marker-ABO, Rh blood groups, HLA, Hp, transferrin, Gm, blood enzymes. Physiological characteristics-Hb level, body fat, pulse rate, respiratory functions and sensory perceptions in different cultural and socio-economic groups. Impact of smoking air pollutions, alcoholism, drugs and occupational hazards on health.

9.1 Concepts and Methods of Ecological Anthropology. Adaptation-social and cultural Deterministic theories-a critique. Resources-biological, non-biological and sustainable development. Biological adaptation-climatic, environmental, nutritional and genetic.

10.1 Relevance in understanding of contemporary society. Dynamics of ethnicity at rural, tribal, urban and international levels. Ethnic conflicts and political developments. Concept of ethnic boundaries. Ethnicity and concept of nation state.

11.1 Concept of human growth and development-stages of growth-prenatal, natal, infant, childhood, adolescence, maturity, senescence.

Factors affecting growth and development genetic, environmental, biochemical, nutritional, cultural and socio-economic.

- Ageing and senescence. Theories and observations-biological and chronological longevity. Human physique and somatotypes. Methodologies for growth studies.

12.1 Reproductive biology, demography and population study. Reproductive physiology of male and female. Biological aspects of human fertility. Relevance of menarche, menopause and other bio events to fertility. Fertility patterns and differentials.

12.2 Demographic theories-biological, social and cultural.

12.3 Demographic methods-census, registration system, sample methods, dual reporting system.

12.4 Population structures and population dynamics.

12.5 Demographic rates and ratios, life table-structure and utility.

12.6 Biological and socio-ecological factors influencing fecundity, fertility natality and mortality.

- 12.7 Methods of studying population growth.
- 12.8 Biological consequences of population control and family welfare.
- 13.1 Anthropology of sports
- 13.2 Nutritional Anthropology.
- 13.3 Anthropology in designing of defence and other equipments.
- 13.4 Forensic Anthropology.
- 13.5 Methods and principles of personal identification and reconstruction.
- 13.6 Applied human genetics-Paternity diagnosis genetic counselling and eugenics.
- 13.7 DNA technology-prevention and cure of diseases.
- 13.8 Anthro-po-gentics in medicine
- 13.9 Serogenetics and cytogenetics in reproductive biology.
- 13.10 Application of statistical principles in human genetics and Physical Anthropology.

Section-B

1. Evolution of the Indian Culture and Civilization-Pre historic (Paleolithic, Mesolithic and Neolithic), Protohistoric (Indus Civilization). Vedic and post-Vedic beginnings. Contributions of the tribal cultures.
2. Demographic profile of India-Ethnic and linguistic elements in the Indian population and their distribution. Indian population, factors influencing its structure and growth.
3. The basic structure and nature of traditional Indian social system-a critique. Varnasharam, Purushartha, Karma, Rina and Rebirth. Theories on the origin of caste system, Jajmani system. Structural basis of inequality in traditional Indian society. Impact of Buddhism, Jainism, Islam and Christianity on Indian society.
4. Emergence, growth and development of anthropology in India-contributions of the 19th Century and early 20th Century scholar-administrators. Contributions of Indian anthropologists to tribal and caste studies. Contemporary nature of anthropological studies in India.
5. Approaches to the study of Indian society and culture-traditional and contemporary.

5.1 Aspects of Indian village-Social organisations of agriculture, impact of market economy on Indian villages.

5.2 Linguistic and religious minorities-social, political and economic status.

6. Tribal situation in India-biogenetic variability, linguistic and socio-economic characteristics of the tribal populations and their distribution. Problems of the tribal Communities-land alienation, poverty indebtedness, low literacy, poor educational facilities, unemployment, underemployment, health and nutrition. Developmental projects-tribal displacement and problems of rehabilitation: Development of forest policy and tribals, Impact of urbanisation and industrialization on tribal and rural populations.

7. Problems of exploitation and deprivation of Scheduled Castes/Scheduled Tribes and Other Backward Classes. Constitutional safeguards for Scheduled Tribes and Scheduled Castes. Social change and contemporary tribal societies: Impact of modern democratic institutions, development programmes and welfare measures on tribals and weaker sections. Emergence of ethnicity, tribal movements and quest for identity. Pseudo-tribalism.

8. Social change among the tribes during colonial and post-Independent India.

8.1 Impact of Hinduism, Christianity, Islam and other religious on tribal societies.

8.2 Tribe and nation state-a comparative study of tribal communities in India and other countries.

9. History of administration of tribal areas, tribal policies, plans, programmes of tribal development and their implementation. Role of N.G.Os.

9.1 Role of anthropology in tribal and rural development.

9.2 Contributions of anthropology to the understanding of regionalism, communalism and ethnic and political movements.

BENGALI

Section-A

1. Topics from the History of Bangla Language.
 - a) The chronological track from Proto Indo-European to Bangla (Family tree with branches and approximate dates).
 - b) Historical stages of Bangla (Old, Middle, New) and their linguistic features.
 - c) Dialects of Bangla and their distinguishing characteristics.
 - d) Elements of Bangla Vocabulary.
 - e) Forms of Bangla Literary Prose-Sadhu and Chalit.
2. Process of Phonetic Changes in Bangla Language.
Apinihiti (Anaptyxis), Abhishruti (Umlaut), Samibhavan (Assimilation), Svarabhakti / Viprakarsha, Svarasangati (Vowel harmony).
3. Problems of standardization and reform of alphabet and spelling and those of transliteration and Romanization.

Section-B

4. History of Bangla Literature.
 - a) Periodization of Bangla Literature: Old Bangla and Middle Bangla.
 - b) Roots and reasons behind the emergence of modernity in Bangla Literature.
 - c) Evolution of various Middle Bangla forms: Mangal kavyas, Vaishnava lyrics, Adapted narratives (Ramayana, Mahabharata, Bhagavata) and religious biographies.
 - d) Narrative and lyric trends in the nineteenth century Bangla poetry.
 - e) Development of prose.
 - f) Bangla dramatic literature (nineteenth century, Tagore, Post-1944 Bangla drama).
5. Tagore and Post Tagoreans (upto the decade of fifties).
6. Fiction, major authors:
Bankimchandra, Tagore, Saratchandra, Bibhutibhusan, Tarasankar, Manik.
7. Women and Bangla Literature.
 - a) Swarna Kumari Devi, b) Ashapura Devi, c) Mahasweta Devi, d) Rajlakshmi Devi, e) Kabita Singha, f) Nabanita Deb Sen

Section – C

8. **Vaishnava Padavali** (Calcutta University Publication). Phases (Parjayas): Gourchandrika, Purvaraga, Abhisar, Mathur, Prarthona.

9. **Chandimangal: Kalketu** episode by Mukunda (Sahitya Akademi).
10. **Meghnadbadh Kavya** by Michael Madhusudan Dutta - 1st, 2nd and 3rd cantos.
11. **Rajani** by Bankimchandra Chattopadhyay.
12. **Kapalkundala** by Bankimchandra Chattopadhyay.
13. **Samya and Bangadesher Krishak** by Bankimchandra Chattopadhyay.
14. **Punascha** by Rabindranath Tagore.
15. **Bichitra Prabandha** by Rabindranath Tagore.
16. **Chacha Kahini** by Sayed Muztaba Ali.

Section-D

17. **Chandragupta** by Dwijendralal Roy.
18. **Grihadaha** by Saratchandra Chattopadhyay.
19. **Adhunik Bangla Kabita Selected Poems:**
 - i) **Saswati** by Sudhindranath Dutta
 - ii) **Rabindranath** by Achintya Kumar Sengupta
 - iii) **Aami Kabi Jata Kamarer** by Premendra Mitra
 - iv) **Bandir Bandana** by Buddhadeb Basu
 - v) **Amar Koifiat** by Kazi Nazrul Islam
20. **Prabandha Samgraha** by Pramatha Choudhuri:
Selected Essays: Bharatchandra, Birbal, Boipara
21. **Pather Panchali** by Bibhutibhusan Bandyopadhyay
22. a) **Ekaler Galpo Sanchayan** - Vol.- 1 & 2 (Calcutta University Publication).
b) Selected Stories:
 - i) **Payomukham** by Jagadish Gupta
 - ii) **Haraner Natjamai** by Manik Bandyopadhyay
 - iii) **Fossil** by Subodh Ghosh
 - iv) **Tope** by Narayan Gangyopadhyay
 - v) **Adab** by Samaresh Bose
 - vi) **Aswamedher Ghora** by Dipendranath Bandyopadhyay
23. **Shrestha Kavita** by Jibanananda Das.

24. **Jagori** by Satinath Bhaduri.
25. **Ebam Indrajit** by Badal Sircar.

BOTANY

Section-A

1. Microbiology and Plant Pathology: Viruses, bacteria, and plasmids-structure and reproduction. General account of infection, Phytoimmunology. Applications of microbiology in agriculture, industry, medicine and pollution control in air, soil and water.

Important plant diseases caused by viruses, bacteria, mycoplasma, fungi and nematodes. Mode of infection and dissemination. Molecular basis of infection and disease resistance/defence. Physiology of parasitism and control measures. Fungal toxins.

2. Cryptogams: Algae, Fungi, Bryophytes, Pteridophytes-structure and reproduction from evolutionary viewpoint. Distribution of Cryptogams in India and their economic potential.

3. Phanerogams: Gymnosperms: Concept of Progymnosperms. Classification and distribution of Gymnosperms. Salient features of Cycadales, Coniferales and Gnetales, their structures and reproduction. General account of Cycadofilicales, Bennettitales and Cordaitales.

Angiosperms: Systematics, anatomy, embryology, palynology and phylogeny.

Comparative account of various systems of Angiosperm Classification. Study of angiospermic families–Magnoliaceae, Ranunculaceae, Brassicaceae (Cruciferae), Rosaceae, Leguminosae, Euphorbiaceae, Malvaceae, Dipterocarpaceae, Apiaceae (Umbelliferae), Asclepiadaceae, Verbenaceae, Solanaceae, Rubiaceae, Cucurbitaceae, Asteraceae (Composite), Poaceae (Gramineae), Arecaceae (Palmae), Liliaceae, Musaceae, Orchidaceae.

Stomata and their types. Anomalous secondary growth, Anatomy of C 3 and C 4 plants.

Development of male and female gametophytes, pollination, fertilization. Endosperm–its development and function. Patterns of embryo development. Polymbryony, apomixis, Applications of palynology.

4. Plant Utility and Exploitation:

Origin of cultivated plants, Vavilov's centres of origin. Plants as sources for food, fodder, fibres, spices, beverages, drugs, narcotics, insecticides, timber, gums, resins and dyes.

Latex, cellulose Starch and their products. Perfumery. Importance of Ethnobotany in Indian context. Energy plantation. Botanical Gardens and Herbaria.

5. Morphogenesis: Totipotency, polarity, symmetry and differentiation. Cell, tissue, organ and protoplast culture. Somatic hybrids and Cybrids.

Section-B

6. Cell Biology: Techniques of Cell Biology. Prokaryotic and eukaryotic cells - structural and ultrastructural details. Structure and function of extracellular matrix or ECM (cell wall) and membranes-cell adhesion, membrane transport and vesicular transport. Structure and function of cell organelles (chloroplasts, mitochondria, ER, ribosomes, endosomes, lysosomes, peroxisomes, hydrogenosome). Nucleus, nucleolus, nuclear pore complex. Chromatin and nucleosome. Cell signalling and cell receptors. Signal transduction (G-1 proteins, etc.). Mitosis and meiosis; molecular basis of cell cycle. Numerical and structural variations in chromosomes and their significance. Study of polytene, lampbrush and B-chromosomes—structure, behaviour and significance.

7. Genetics, Molecular Biology and Evolution: Development of genetics, and gene versus allele concepts (Pseudoalleles). Quantitative genetics and multiple factors. Linkage and crossing over—methods of gene mapping including molecular maps (idea of mapping function). Sex chromosomes and sexlinked inheritance, sex determination and molecular basis of sex differentiation. Mutation (biochemical and molecular basis). Cytoplasmic inheritance and cytoplasmic genes (including genetics of male sterility). Prions and prion hypothesis. Structure and synthesis of nucleic acids and proteins. Genetic code and regulation of gene expression. Multigene families. Organic evolution-evidences, mechanism and theories. Role of RNA in origin and evolution.

8. Plant Breeding, Biotechnology and Biostatistics: Methods of plant breeding -- introduction, selection and hybridization (pedigree, backcross, mass selection, bulk method). Male sterility and heterosis breeding. Use of apomixis in plant breeding. Micropropagation and genetic engineering—methods of transfer of genes and transgenic crops; development and use of molecular markers in plant breeding. Standard deviation and coefficient of variation (CV). Tests of significance (Z-test, t-test and chi-square tests). Probability and distributions (normal, binomial and Poisson distributions). Correlation and regression.

9. Physiology and Biochemistry: Water relations, Mineral nutrition and ion transport, mineral deficiencies. Photosynthesis—photochemical reactions, photophosphorylation and carbon pathways including C₃ pathway (photorespiration), C₃, C₄ and CAM pathways. Respiration (anaerobic and aerobic, including fermentation—electron transport chain and oxidative phosphorylation. Chemiosmotic theory and ATP synthesis. Nitrogen fixation and nitrogen metabolism. Enzymes, coenzymes, energy transfer and energy conservation. Importance of secondary metabolites. Pigments as photoreceptors (plastidial pigments and phytochrome). Photoperiodism and flowering, vernalization, senescence. Growth substances-their chemical nature, role and applications in agri-horticulture, growth indices, growth movements. Stress physiology (heat, water, salinity, metal). Fruit and seed physiology. Dormancy, storage and germination of seed. Fruit ripening -- its molecular basis and manipulation.

10. Ecology and Plant Geography: Ecological factors. Concepts and dynamics of community. Plant succession. Concepts of biosphere. Ecosystems and their conservation. Pollution and its control (including phytoremediation). Forest types of India -- afforestation, deforestation and social forestry. Endangered plants, endemism and Red Data Books. Biodiversity. Convention of Biological Diversity, Sovereign Rights and Intellectual Property Rights. Biogeochemical cells. Global warming.

CHEMISTRY

Section-A

1. Atomic structure

Quantum theory, Heisenberg's uncertainty principle, Schrodinger wave equation (time independent). Interpretation of wave function, particle in one-dimensional box, quantum numbers, hydrogen atom wave functions. Shapes of s, p and d orbitals.

2. Chemical bonding

Ionic bond, characteristics of ionic compounds, factors affecting stability of ionic compounds, lattice energy, Born-Haber cycle; covalent bond and its general characteristics, polarities of bonds in molecules and their dipole moments. Valence bond theory, concept of resonance and resonance energy. Molecular orbital theory (LCAO method); bonding in homonuclear molecules: H_2^+ , H_2 to Ne_2 , NO, CO, HF, CN, CN^- , BeH_2 and CO_2 . Comparison of valence bond and molecular orbital theories, bond order, bond strength and bond length.

3. Solid State

Forms of solids, law of constancy of interfacial angles, crystal systems and crystal classes (crystallographic groups). Designation of crystal faces, lattice structures and unit cell. Laws of rational indices. Bragg's law. X-ray diffraction by crystals. Close packing, radius ratio rules, calculation of some limiting radius ratio values. Structures of NaCl, ZnS, CsCl, CaF_2 , CdI_2 and rutile. Imperfections in crystals, stoichiometric and nonstoichiometric defects, impurity defects, semi-conductors. Elementary study of liquid crystals.

4. The gaseous state

Equation of state for real gases, intermolecular interactions, liquefaction of gases and critical phenomena, Maxwell's distribution of speeds, intermolecular collisions, collisions on the wall and effusion.

5. Thermodynamics and statistical thermodynamics

Thermodynamic systems, states and processes, work, heat and internal energy; first law of thermodynamics, work done on the systems and heat absorbed in different types of processes; calorimetry, energy and enthalpy changes in various processes and their temperature dependence.

Second law of thermodynamics; entropy as a state function, entropy changes in various process, entropy-reversibility and irreversibility, Free energy functions; criteria for equilibrium, relation between equilibrium constant and thermodynamic quantities; Nernst heat theorem and third law of thermodynamics.

Micro and macro states; canonical ensemble and canonical partition function; electronic, rotational and vibrational partition functions and thermodynamic quantities; chemical equilibrium in ideal gas reactions.

6. Phase equilibria and solutions

Phase equilibria in pure substances; Clausius-Clapeyron equation; phase diagram for a pure substance; phase equilibria in binary systems, partially miscible liquids—upper and lower critical solution temperatures; partial molar quantities, their significance and determination; excess thermodynamic functions and their determination.

7. Electrochemistry

Debye-Huckel theory of strong electrolytes and Debye-Huckel limiting Law for various equilibrium and transport properties.

Galvanic cells, concentration cells; electrochemical series, measurement of e.m.f. of cells and its applications fuel cells and batteries.

Processes at electrodes; double layer at the interface; rate of charge transfer, current density; overpotential; electroanalytical techniques—voltameter, polarography, amperometry, cyclic-voltametry, ion selective electrodes and their use.

8. Chemical kinetics

Concentration dependence of rate of reaction; differential and integral rate equations for zeroth, first, second and fractional order reactions. Rate equations involving reverse, parallel, consecutive and chain reactions; effect of temperature and pressure on rate constant. Study of fast reactions by stop-flow and relaxation methods. Collisions and transition state theories.

9. Photochemistry

Absorption of light; decay of excited state by different routes; photochemical reactions between hydrogen and halogens and their quantum yields.

10. Surface phenomena and catalysis

Absorption from gases and solutions on solid adsorbents, adsorption isotherms,—Langmuir and B.E.T. isotherms; determination of surface area, characteristics and mechanism of reaction on heterogeneous catalysts.

11. Bio-inorganic chemistry

Metal ions in biological systems and their role in ion-transport across the membranes (molecular mechanism), ionophores, photosynthesis—PSI, PSII; nitrogen fixation, oxygen-uptake proteins, cytochromes and ferredoxins.

12. Coordination chemistry

(a) Electronic configurations; introduction to theories of bonding in transition metal complexes. Valence bond theory, crystal field theory and its modifications; applications of theories in the explanation of magnetism and electronic spectra of metal complexes.

(b) Isomerism in coordination compounds. IUPAC nomenclature of coordination compounds; stereochemistry of complexes with 4 and 6 coordination numbers; chelate effect and polynuclear complexes; trans effect and its theories; kinetics of substitution reactions in square-planar complexes; thermodynamic and kinetic stability of complexes.

(c) Synthesis and structures of metal carbonyls; carboxylate anions, carbonyl hydrides and metal nitrosyl compounds.

(d) Complexes with aromatic systems, synthesis, structure and bonding in metal olefin complexes, alkyne complexes and cyclopentadienyl complexes; coordinative unsaturation, oxidative addition reactions, insertion reactions, fluxional molecules and their characterization. Compounds with metal-metal bonds and metal atom clusters.

13. General chemistry of 'f' block elements

Lanthanides and actinides; separation, oxidation states, magnetic and spectral properties; lanthanide contraction.

14. Non-Aqueous Solvents

Reactions in liquid NH_3 , HF , SO_2 and H_2SO_4 . Failure of solvent system concept, coordination model of non-aqueous solvents. Some highly acidic media, fluorosulphuric acid and super acids.

Section-B

15. **Delocalised covalent bonding:** Aromaticity, anti-aromaticity; annulenes, azulenes, tropolones, kekulene, fulvenes, sydnones.

16(a) **Reaction mechanisms** : General methods (both kinetic and non-kinetic) of study of mechanism or organic reactions illustrated by examples—use of isotopes, cross-over experiment, intermediate trapping, stereochemistry; energy diagrams of simple organic reactions—transition states and intermediates; energy of activation; thermodynamic control and kinetic control of reactions.

(b) **Reactive intermediates:** Generation, geometry, stability and reactions of carbonium and carbonium ions, carbanions, free radicals, carbenes, benzyne and nitrenes.

(c) **Substitution reactions:** S_N1 , S_N2 , S_{Ni} , $SN1'$, $SN2'$, SNi' and $SRN1$ mechanisms; neighbouring group participation; electrophilic and nucleophilic reactions of aromatic compound including simple heterocyclic compounds—pyrrole, furan thiophene, indole.

(d) **Elimination reactions:** $E1$, $E2$ and $E1_{cb}$ mechanism; orientation in $E2$ reactions—Saytzeff and Hoffmann; pyrolytic **syn** elimination—acetate pyrolysis, Chugaev and Cope eliminations.

(e) **Addition reactions:** - Electrophilic addition to $C=C$ and $C\equiv C$; nucleophilic addition to $C=O$, $C\equiv N$, conjugated olefins and carbonyls.

(f) **Rearrangements:** Pinacol-pinacolone, Hoffmann, Beckmann, Baeyer–Villiger, Favorskii, Fries, Claisen, Cope, Stevens and Wagner-Meerwein rearrangements.

17. **Pericyclic reactions:** Classification and examples; Woodward-Hoffmann rules—electrocyclic reactions, cycloaddition reactions [2+2 and 4+2] and sigmatropic shifts [1, 3; 3, 3 and 1, 5] FMO approach.

18. **Chemistry and mechanism of reactions :** Aldol condensation (including directed aldol condensation), Claisen condensation, Dieckmann, Perkin, Knoevenagel, Wittig, Clemmensen, Wolff-Kishner, Cannizzaro and von Richter reactions; Stobbe, benzoin and acyloin condensations; Fischer indole synthesis, Skraup synthesis, Bischler-Napieralski, Sandmeyer, Reimer-Tiemann and Reformatsky reactions.

19. Polymeric Systems

(a) **Physical chemistry of polymers:** Polymer solutions and their thermodynamic properties; number and weight average molecular weights of polymers. Determination of molecular weights by sedimentation, light scattering, osmotic pressure, viscosity, end group analysis methods.

(b) **Preparation and properties of polymers:** Organic polymers—polyethylene, polystyrene, polyvinyl chloride, Teflon, nylon, terylene, synthetic and natural rubber. Inorganic polymers—phosphonitrilic halides, borazines, silicones and silicates.

(c) **Biopolymers:** Basic bonding in proteins, DNA and RNA.

20. **Synthetic uses of reagents :** OsO_4 , HIO_4 , CrO_3 , $Pb(OAc)_4$, SeO_2 , NBS, B_2H_6 , Na-Liquid NH_3 , $LiAlH_4$ $NaBH_4$ $n-BuLi$, MCPBA.

21. **Photochemist:** Photochemical reactions of simple organic compounds, excited and ground states, singlet and triplet states, Norrish-Type I and Type II reactions.

22. Principles of spectroscopy and applications in structure elucidation

(a) **Rotational spectra**—diatomic molecules; isotopic substitution and rotational constants.

(b) **Vibrational spectra**—diatomic molecules, linear triatomic molecules, specific frequencies of functional groups in polyatomic molecules.

(c) **Electronic spectra**: Singlet and triplet states. $n \rightarrow \pi^*$ and $\pi \rightarrow \pi^*$ transitions; application to conjugated double bonds and conjugated carbonyls—Woodward-Fieser rules.

(d) **Nuclear magnetic resonance**: Isochronous and anisochronous protons; chemical shift and coupling constants; Application of ^1H NMR to simple organic molecules.

(e) **Mass spectra**: Parent peak, base peak, daughter peak, metastable peak, fragmentation of simple organic cleavage, McLafferty rearrangement. molecules;

(f) **Electron spin resonance**: Inorganic complexes and free radicals.

COMPUTER SCIENCE

Section-A

1. Formal Languages and Automata Theory

Finite state machines, push down automata, Finite automata, context free language, context sensitive language, Turing machine, Decision question and undecided problems.

2. Computer Organisation

Functional components, CPU design, Memory organization and I/O organization.

3. Operating Systems.

Process management, Memory management, File management I/O management.

4. Software Engineering

Life cycle model, function oriented design, object oriented design, User interface design, coding and Testing, software requirement, project management, software reliability and Maintenance.

Section-B

5. Data Structures

Continuous and Non-continuous data structures, Dynamic storage allocations, File organization techniques.

6. Principle of Programming Languages.

Various programming paradigms Syntax, Semantics, Block structure, Scoping, Binding, Object oriented programming, Functional programming, Logic and concurrent programming.

7. Database Management

Concept, Data independence, Different models, Storage organization, query languages, Normal forms, Decomposition, Security, concurrency, Recovery.

8. Data communication and computer Networks

Basics of digital communication, Network architecture, physical layer, Medium access protocols, Data-link layer, Network layer, Transport layer and Application layer.

Economics

Section-A

1. Ricardian, Marshallian and Walrasian approaches to price determination. Types of Markets and price determination. Criteria or Welfare improvement. Alternate theories of distribution.

2. Functions of money-Measurement of price level changes-Money and real balances-Monetary standards-High-powered money and the Quantity theory of money, its variants and critiques thereof-Demand for and supply of money-The money multiplier. Theories of determination of interest rate-Interest and prices-Theories of inflation and control of inflation.

3. Full employment and Says' Law-underemployment equilibrium-Keynes' Theory of employment (and income) determination-Critiques of Keynesian Theory.

4. The modern monetary system-Banks, non-bank financial intermediaries, Discount House, and Central Bank. Structure of Money and financial markets and control. Money market instruments, bills and bonds. Real and nominal interest rates. Goals and instruments of monetary management in closed and open economies. Relation between the Central Bank and the Treasury. Proposal for ceiling on growth rate of money.

5. Public finance and its role in market economy in stabilisation, supply stability, allocative efficiency, distribution and development. Sources of revenue-Forms of Taxes and subsidies, their incidence and effects; Limits to taxation, loans, crowding-out effects, and limits to borrowing. Types of budget deficits-Public expenditure and its effects.

6. International Economics

(i) Old and New theories of International Trade.

a) Comparative advantage, Terms of trade and offer curve.

b) Product cycle and Strategic trade theories.

c) "Trade as an engine of growth" and theories of underdevelopment in an open economy.

(ii) Forms of protection.

(iii) Balance of Payments Adjustments Alternative Approaches.

a) Price versus income, income adjustments under fixed exchange rates.

- b) Theories of policy mix.
 - c) Exchange rate adjustments under capital mobility.
 - d) Floating Rates and their implications for developing countries; Currency Boards.
- (iv) (a) IMF and the World Bank.
- (b) W.T.O.
- (c) Trade Blocks and monetary unions.

7. Growth and development.

(i) Theories of growth : Classical and neo-classical theories; The Harrod model; economic development under surplus Labour; wage-goods as a constraint on growth; relative importance of physical and human capitals in growth; innovations and development; Productivity, its growth and source of changes thereof. Factors determining savings to income ratio and the capital-out put ratio.

(ii) Main features of growth: Changes in Sectoral compositions of income; Changes in occupational distribution; changes in income distribution; changes in consumption levels and patterns; changes in savings and investment and in pattern of investment. Case for and against industrialization. Significance of agriculture in developing countries.

(iii) Relation between state, planning and growth, Changing roles of market and plans in growth economic policy and growth.

(iv) Role of foreign capital and technology in growth. The significance of multi-nationals.

(v) Welfare indicators and measures of growth-Human development indices-The basic needs approach.

(vi) Concept of sustainable development; convergence of levels of living of developed and developing countries; meaning of self-reliance in growth and development.

Section-B

8. Evolution of the Indian Economy till independence. The Colonial Heritage : Land System & Agriculture, Taxes, Money and credit, Trade, Exchange Rate, the "Drain of Wealth controversy" of late 19th Century. Randade's critique of Laissez-Faire; Swadeshi movement; Gandhi and Hind Swaraj.

9. Indian Economics in Post-Independent Era-Contributions of Vakil, Gadgil and Rao. National and percapita Income; Patterns, Trends, Aggregate and sectoral-composition and changes therein. Broad factors determining National Income and its distribution; Measures of poverty. Trends in below poverty-line proportion.

10. Employment: Factors determining employment in short and long periods. Role of capital, wage-goods, wage-rate and technology. Measures of unemployment. Relation between income, poverty and employment, and issues of distribution and social justice.

Agriculture-Institutional set-up of land system size of agriculture holdings and efficiency-Green Revolution and technological changes-Agricultural prices and terms of trade-Role of public distribution and farm-subsidies on agricultural prices and production. Employment and poverty in agriculture-Rural wages-employment schemes-growth experience-land reforms. Regional disparities in agricultural growth. Role of Agriculture in export.

11. Industry: Industrial system of India: Trends in Composition and growth. Role of public and private sectors, Role of small and cottage industries. Indian industrial Strategy-Capital versus consumer goods, wage-goods versus luxuries, capital-intensive versus labour-intensive techniques, import-substituting versus export promotion. Sickness and high-cost Industrial policies and their effects. Recent moves for liberalisation and their effects on Indian industry.

12. Money and banking: The monetary institutions of India: Factors determining demand for and supply of money. Sources of Reserve money-money multiplier-Techniques of money supply regulation under open economy. Functioning of money market in India. Budget deficit and money supply. Issues in Reform of Monetary and Banking Systems.

13. Index numbers of price levels-Course of Price level in post-Independence period-sources and causes of inflation-role of monetary and supply factors in price level determination-policies towards control of inflation. Effects of inflation under open economy.

14. Trade, balance of payments and exchange: Foreign trade of India; composition and direction shifts in trade policy from import substitution to export promotion. Impact of liberalisation on pattern of trade. India's external Borrowings-the Debt problem. Exchange rate of the rupee; Devaluations, depreciations and their effects on balance of payments-Gold imports and Gold policy-convertibility on current and capital accounts-rupee in an open economy. Integration of Indian economy with world economy-India and the WTO.

15. Public Finance and Fiscal Policy : Characteristics of and trends in India's Public Finance-Role of Taxes, (direct and indirect) and subsidies-Fiscal and monetary deficits-public expenditures and their significance-Public Finance and Inflation-Limiting Government's debt-Recent fiscal policies and their effects.

16. Economic Planning in India-Trends in Savings and investment-Trends in Savings to Income and capital-output ratios-Productivity, its sources, growth and trends-growth versus distribution-Transition from Central Planning to indicative planning-relation between Market and Plan-strategies for Growth, social justice and Plans. Planning and increasing the growth rate.

Education

Section-A

1. Meaning, definition and scope of education. Aims – individual, social, liberal and vocational and Harmonious development of education, Aims of education in a democracy.
2. School and community – their relation, functions and responsibilities.
3. Curriculum, Definition and types of curricula, defects of present curriculum, principles of curriculum construction, Importance of correlation of studies. Co-curricular activities and their values in education.
4. Freedom and discipline – Importance of freedom in education, Free-discipline, relation between freedom and discipline, Discipline meaning types and its importance, Reward and punishment.
5. Teacher – Qualities of a teacher importance of his personality. Functions of school teacher. Maternal Education needed for teaching.
6. Theories of play – play methods in education.
7. Education for National integration and international understanding.

Section-B

8. Psychology – its meaning, scope of definition, its importance in education, Methods of educational psychology.
9. Physical basis of mental life – Importance of sensation, perception and conception.
10. Adolescence – its significance and problems.
11. Emotions and instincts – their importance in education, Importance of needs, drives and motives.
12. Learning – its meaning and importance, laws of learning, efficiency in learning.
13. Image and imagination, its importance in education.
14. Memory – meaning and types of memory, cause of forgetting, attention and its relation to interest.
15. Intelligence – its meaning and nature.

16. Statistics in education – Calculation of mean, medium and mode, standard deviation and quartile deviation, Coefficient of correlation by rank, difference method.

Section-C

17. Charter Act of 1813.

18. Anglicist – classicist controversy Macculay's minute and Lord Bentinck's resolution of 1835.

19. Wood's Despatch of 1854 – its impact on Indian education.

20. Indian Education Commission of 1882 – primary and secondary education.

21. Lord Curzon's educational policy – Primary, Secondary and University education.

22. Gokhale's Bill on primary education - resolution of 1913.

23. Hartog committees report of 1929.

24. Wardha Scheme of Education 1937, its implementation in India.

25. Universalisation of Elementary Education (UEE) in Manipur under EGS & AIE and SSA.

26. Adult Education – Problems in the implementation of Adult Education Programme – Objectives and aims of NAEP (now AEP).

English

Section-A

1. William Shakespeare : **King Lear** and **The Tempest**.

2. John Donne. The following poems :

- Canonization;
- Death be not proud;
- The Good Morrow;
- On his Mistress going to bed;
- The Relic;

3. John Milton : **Paradise Lost**, I, II, IV, IX

4. Alexander Pope. **The Rape of the Lock**.

5. William Wordsworth. The following poems:

- Ode on Intimations of Immortality.
- Tintern Abbey.
- Three years she grew.
- She dwelt among untrodden ways.
- Michael.
- Resolution and Independence.
- The World is too much with us.
- Milton, thou shouldst be living at this hour.
- Upon Westminster Bridge.

6. Alfred Tennyson : **In Memoriam**.

7. Henrik Ibsen : **A Doll's House**.

Section-B

1. Jonathan Swift. **Gulliver's Travels.**
2. Jane Austen. **Pride and Prejudice.**
3. Henry Fielding. **Tom Jones.**
4. Charles Dickens. **Hard Times.**
5. George Eliot. **The Mill on the Floss.**
6. Thomas Hardy. **Tess of the d'Urbervilles.**
7. Mark Twain. **The Adventures of Huckleberry Finn.**

Section-C

8. William Butler Yeats. The following poems:

- Easter 1916
- The Second Coming
- A Prayer for my daughter.
- Sailing to Byzantium.
- The Tower.
- Among School Children.
- Leda and the Swan.
- Meru
- Lapis Lazuli
- The Second Coming
- Byzantium.

9. T.S. Eliot. The following poems :

- The Love Song of J.Alfred Prufrock
- Journey of the Magi.

- Burnt Norton.

10. W.H. Auden. The following poems :

- Partition

- Musee des Beaux Arts

- in Memory of W.B. Yeats

- Lay your sleeping head, my love

- The Unknown Citizen

- Consider

- Mundus Et Infans

- The Shield of Achilles

- September 1, 1939

- Petition.

11. John Osborne : **Look Back in Anger.**

12. Samuel Beckett. **Waiting for Godot.**

13. Philip Larkin. The following poems :

- Next

- Please

- Deceptions

- Afternoons

- Days

- Mr. Bleaney

14. A.K. Ramanujan. The following poems :

- Looking for a Causim on a Swing

- A River

- Of Mothers, among other Things
- Love Poem for a Wife 1
- Small-Scale Reflections on a Great House
- Obituary

(All these poems are available in the anthology Ten Twentieth Century Indian Poets, edited by R. Parthasarthy, published by Oxford University Press, New Delhi).

Section-D

15. Joseph Conrad. **Lord Jim**
16. James Joyce. **Portrait of the Artist as a Young Man.**
17. D.H. Lawrence. **Sons and Lovers.**
18. E.M. Forster. **A Passage to India.**
19. Virginia Woolf. **Mrs Dalloway.**
20. Raja Rao. **Kanthapura.**
21. V.S. Naipal. **A House for Mr. Biswas.**

Geography

Section-A

Physical Geography

i) **Geomorphology:** Factors controlling landform development; endogenetic and exogenetic forces; origin and evolution of the earth's crust; physical conditions of the earth's interior; geosynclines; continental drift; isostasy; sea-floor spreading; plate tectonics; mountain building; volcanicity; earthquakes; concepts of geomorphic cycles; landforms associated with fluvial, arid, glacial, coastal and karst cycle; groundwater; Applied Geomorphology.

ii) **Climatology:** Temperature and pressure belts of the world; heat budget of the earth; atmospheric circulation; planetary and local winds; monsoons and jet streams; air masses and fronts; temperate and tropical cyclones; types and distribution of precipitation; Koppen's and Thornthwaite's classification of world climate; hydrological cycle; climatic change.

iii) **Oceanography:** Bottom topography of the Atlantic, Indian and Pacific Oceans; temperature and salinity of the oceans; ocean deposits; ocean currents and tides; marine resources—biotic, mineral and energy resources; coral reefs; sea-level changes.

iv) **Biogeography:** Genesis of soils; classification and distribution of soils; soil profile; soil erosion and conservation; factors influencing world distribution of plants and animals; problems of deforestation and conservation measures; social forestry, agro-forestry.

v) **Environmental Geography:** Human ecological adaptations; transformation of nature by man; environmental degradation and conservation; ecosystems and their management; global ecological imbalances—problems of pollution, global warming, reduction in bio-diversity and depletion of forests.

Section-B

Human Geography

i) **Perspectives in Human Geography:** A real differentiation; regional synthesis; dichotomy and dualism; environmentalism; quantitative revolution and locational analysis; radical, behavioral, human and welfare approaches; cultural regions of the world human and welfare approaches; cultural regions of the world; human development indicators.

ii) **Economic Geography :** World economic development—measurement and problems; world resources and their distribution; energy crisis; the limits to growth;

world agriculture–typology of agricultural regions; agricultural inputs and productivity; food and nutrition problems; famine–causes, effects and remedies; world industries–location patterns and problems; patterns of world trade.

iii) **Population and Settlement Geography:** Growth and distribution of world population; demographic attributes; causes and consequences of migration; concepts of over–, under– and optimum population; world population problems.

Types and patterns of rural settlements; hierarchy of urban settlements; concept of primate city and rank-size rule; functional classification of towns; sphere of urban influence; rural-urban fringe; satellite town; problems of urbanisation.

iv) **Regional Planning:** Concept of a region; types of regions and methods of regionalisation; growth centres and growth poles; regional imbalances; environmental issues in regional planning; planning for sustainable development.

v) **Models, Theories and Laws in Human Geography:** System analysis in Human Geography; Malthusian, Marxian and Demographic Transition models; Central Place theories of Christaller and Losch; Von Thunen’s model of agricultural location; Weber’s model of industrial location; Rostov’s model of stages of growth. Heart-land and Rimland theories; laws of international boundaries and frontiers.

Geography of India Section-C

i) **Physical Setting:** Space relationship of India with neighboring countries; structure and relief; drainage system and watersheds; physiographic regions; mechanism of Indian monsoons; tropical cyclones and western disturbances; floods and droughts; climatic regions; natural vegetation, soil types and their distributions.

ii) **Resources:** Land, surface and groundwater, energy, minerals, and biotic resources, their distribution, utilization and conservation; energy crisis.

iii) **Agriculture:** Infrastructure–irrigation, seeds, fertilizers, power; institutional factors–land holdings, land tenure and land reforms; agricultural productivity, agricultural intensity, crop combination, land capability; agro-and social forestry; green revolution and its socio-economic and ecological implications; significance of dry farming; livestock resources and white revolution; blue revolution; agricultural regionalisation; agro-climatic zones.

iv) **Industry:** Evolution of industries; locational factors of cotton, jute, iron and steel, fertiliser, paper, drugs and pharmaceutical, automobile and cottage industries; industrial complexes and industrial regionalisation; new industrial policy; multinationals and liberalisation.

v) **Transport, Communication and Trade:** Road, railway, waterway, airway and pipeline networks and their complementary roles in regional development; growing importance of ports on national and foreign trade, trade balance; free trade and export promotion zones; developments in communication technology and its impact on economy and society.

Section-D

i) **Cultural Setting:** Racial and ethnic diversities; major tribes, tribal areas and their problems; role of language, religion and tradition in the formation of cultural regions; growth, distribution and density of population; demographic attributes—sex-ratio, age structure, literacy rate, work-force, dependency ratio and longevity; migration (inter-regional, intra-regional and international) and associated problems, population problems and policies.

ii) **Settlements:** Types, patterns and morphology of rural settlements; urban development; census definition of urban areas; morphology of Indian cities; functional classification of Indian cities; conurbations and metropolitan regions; urban sprawl; slums and associated problems; town planning; problems of urbanisation.

iii) **Regional Development and Planning:** Experience of regional planning in India; Five Year Plans; integrated rural development programmes; panchayati raj and decentralised planning; command area development; watershed management; planning for backward area, desert drought-prone, hill and tribal area development; multi-level planning; geography and regional planning.

iv) **Political Aspects:** Geographical basis of Indian federalism; state reorganisation; regional consciousness and national integration; international boundary of India and related issues; disputes on sharing of water resources; India and geopolitics of the Indian Ocean.

v) **Contemporary Issues:** Environmental hazards—landslides, earthquakes, floods and droughts, epidemics; issues related to environmental pollution; changes in patterns of land use; principles of environmental impact assessment and environmental management; population explosion and food security; environmental degradation; problems of agrarian and industrial unrest; regional disparities in economic development; concept of sustainable growth and development.

GEOLOGY

Section-A

(i) General Geology

The Solar System, meteorites, origin and interior of the earth. Radioactivity and age of earth; Volcanoes- causes and products, volcanic belts. Earthquakes-causes, effects, earthquake belts, seismicity of India, intensity and magnitude, seismographs. Island arcs, deep sea trenches and mid-ocean ridges. Continental drift-evidences and mechanics; seafloor spreading, plate tectonics. Isostasy, orogeny and epeirogeny. Continents and oceans.

(ii) Geomorphology and Remote Sensing

Basic concepts of geomorphology. Weathering and mass wasting. Landforms, slopes and drainage. Geomorphic cycles and their interpretation. Morphology and its relation to structures and lithology. Applications of geomorphology in mineral prospecting, civil engineering, hydrology and environmental studies. Geomorphology of Indian subcontinent.

Aerial photographs and their interpretation-merits and limitations. The Electromagnetic Spectrum. Orbiting satellites and sensor systems. Indian Remote Sensing Satellites. Satellites data products. Applications of remote sensing in geology. The Geographic Information System and its applications. Global Positioning System.

(iii) Structural geology

Principles of geologic mapping and map reading, projection diagrams, stress and strain ellipsoid and stress-strain relationships of elastic, plastic and viscous materials. Strain markers in deformed rocks. Behavior of minerals and rocks under deformation conditions. Folds and faults classification and mechanics. Structural analysis of folds, foliations, lineations, joints and faults, unconformities. Superposed deformation. Time-relationship between crystallization and deformation. Introduction to petrofabrics.

Section-B

(iv) Paleontology

Species- definition and nomenclature. Megafossils and Microfossils. Modes of preservation of fossils. Different kinds of microfossils. Application of microfossils in correlation, petroleum exploration, paleoclimatic and paleoceanographic studies. Morphology, geological history and evolutionary trend in Cephalopoda, Trilobita, Brachiopoda, Echinoidea and Anthozoa. Stratigraphic utility of Ammonoidea, Trilobita and Graptoloidea. Evolutionary trend in Hominidae, Equidae and Proboscidae. Siwalik fauna. Gondwana flora and its importance.

(v) Stratigraphy and Geology of India

Classification of stratigraphic sequences: lithostratigraphic, biostratigraphic, chronostratigraphic and magnetostratigraphic and their interrelationships. Distribution and classification of Precambrian rocks of India. Study of stratigraphic distribution and lithology of Phanerozoic rocks of India with reference to fauna, flora and economic importance. Major boundary problems- Cambrian/Precambrian, Permian/Triassic, Cretaceous/Tertiary and Pliocene/Pleistocene. Study of climatic conditions, paleogeography and igneous activity in the Indian subcontinent in the geological past. Tectonic framework of India. Evolution of the Himalayas.

(vi) Hydrogeology and Engineering Geology: Hydrologic cycle and genetic classification of water. Movement of subsurface water. Springs. Porosity, permeability, hydraulic conductivity, transmissivity and storage coefficient, classification of aquifers. Water-bearing characteristics of rocks. Groundwater chemistry. Salt water intrusion. Types of wells. Drainage basin morphometry. Exploration for groundwater. Groundwater recharge. Problems and management of groundwater. Rainwater harvesting. Engineering properties of rocks. Geological investigations for dams, tunnels and bridges. Rock as construction material. Alkali-aggregate reaction. Landslides-causes, prevention and rehabilitation. Earthquake-resistant structures.

Section-C

(vii) Mineralogy

Classification of crystals into systems and classes of symmetry. International system of crystallographic notation. Use of projection diagrams to represent crystal symmetry. Crystal defects. Elements of X-ray crystallography.

Petrological microscope and accessories. Optical properties of common rock forming minerals. Pleochroism, extinction angle, double refraction, birefringence, twinning and dispersion in minerals.

Physical and chemical characters of rock forming silicate mineral groups. Structural classification of silicates. Common minerals of igneous and metamorphic rocks. Minerals of the carbonate, phosphate, sulphide and halide groups.

(viii) Igneous and Metamorphic Petrology

Generation and crystallisation of magma. Crystallisation of albite-anorthite, diopside-anorthite and diopside-wollastonite-silica systems. Reaction principle. Magmatic differentiation and assimilation. Petrogenetic significance of the textures and structures of igneous rocks. Petrography and petrogenesis of granite, syenite, diorite, basic and ultrabasic groups, charnockite, anorthosite and alkaline rocks. Carbonatites. Deccan volcanic province.

Types and agents of metamorphism. Metamorphic grades and zones. Phase rule. Facies of regional and contact metamorphism. ACF and AKF diagrams. Textures and structures of metamorphic rocks. Metamorphism of arenaceous, argillaceous and basic rocks. Mineral assemblages Retrograde metamorphism. Metasomatism and granitisation, migmatites, Granulite terrains of India.

(ix) **Sedimentology**

Sedimentary rocks: Processes of formation. diagenesis and lithification. Properties of sediments. Clastic and non-clastic rocks-their classification, petrography and depositional environment. Sedimentary facies and provenance. Sedimentary structures and their significance. Heavy minerals and their significance. Sedimentary basins of India.

Section-D

(x) **Economic Geology**

Ore, ore minerals and gangue, tenor of ore, classification of ore deposits. Process of formation of mineral deposits. Controls of ore localisation. Ore textures and structures. Metallogenic epochs and provinces. Geology of the important Indian deposits of aluminium, chromium, copper, gold, iron, lead zinc, manganese, titanium, uranium and thorium and industrial minerals. Deposits of coal and petroleum in India. National Mineral Policy. Conservation and utilization of mineral resources. Marine mineral resources and Law of Sea.

(xi) **Mining Geology**

Methods of prospecting-geological, geophysical, geochemical and geobotanical. Techniques of sampling. Estimation of reserves of ore. Methods of exploration and mining metallic ores, industrial minerals and marine mineral resources. Mineral beneficiation and ore dressing.

(xii) **Geochemistry and Environmental Geology**

Cosmic abundance of elements. Composition of the planets and meteorites. Structure and composition of earth and distribution of elements. Trace elements. Elements of crystal chemistry-types of chemical bonds, coordination number. Isomorphism and polymorphism. Elementary thermodynamics.

Natural hazards-floods, landslides, coastal erosion, earthquakes and volcanic activity and mitigation. Environmental impact of urbanization, open cast mining, industrial and radioactive waste disposal, use of fertilizers, dumping of mine waste and fly-ash. Pollution of ground and surface water, marine pollution Environment protection-legislative measures in India.

Hindi

Section-A

1. History of Hindi Language and Nagari Lipi.

I. Grammatical and applied forms of Apbhransh, Awahatta & Arambhik Hindi.

II. Development of Braj and Awadhi as literary language during medieval period.

III. Early form of Khari-boli in Siddha-Nath Sahitya, Khusero, Sant Sahitaya, Rahim etc. and Dakhni Hindi.

IV. Development of Khari-boli and Nagari Lipi during 19th Century.

V. Standardisation of Hindi Bhasha & Nagari Lipi.

VI. Development of Hindi as national Language during freedom movement.

VII. The development of Hindi as a National Language of Union of India.

VIII. Scientific & Technical development of Hindi Language.

IX. Prominent dialects of Hindi and their inter relationship.

X. Salient features of Nagari Lipi and the efforts for its reform & Standard form of Hindi.

XI. Grammatical structure of Standard Hindi.

Section-B

2. History of Hindi Literature.

I. The relevance and importance of Hindi literature and tradition of writing History of Hindi Literature.

II. Literary trends of the following four periods of history of Hindi Literature.

A : Adikal-Sidh, Nath and Raso Sahitya.

Prominent poets-Chandvardai, Khusaro, Hemchandra, Vidyapati.

B : Bhaktikal-Sant Kavyadhara, Sufi Kavyadhara, Krishna Bhaktidhara and Ram Bhaktidhara.

Prominent Poets-Kabir, Jayasi, Sur & Tulsi.

C: Ritikal-Ritikavya, Ritibaddhakavya & Riti Mukta Kavya.

Prominent Poets-Keshav, Bihari, Padmakar and Ghananand.

D : Adhunik Kal

a. Renaissance, the development of Prose, Bharatendu Mandal.

b. Prominent Writers : Bharatendu, Bal Krishna Bhatt & Pratap Narain Mishra.

c. Prominent trends of modern Hindi Poetry : Chhayavad, Pragativad, Proyogvad, Nai Kavita, Navgeet and Contemporary poetry and Janvadi Kavita.

Prominent Poets : Maithili Sharan Gupta, Prasad, Nirala, Mahadevi, Dinkar, Agyeya, Muktibodh, Nagarjun.

III. Katha Sahitya

A. Upanyas & Realism

B. The origin and development of Hindi Novels.

C. Prominent Novelists : Premchand, Jainendra, Yashpal, Renu and Bhisim Sahani.

D. The origin and development of Hindi short story.

E. Prominent short Story Writers : Premchand, Prasad, Agyeya, Mohan Rakesh & Krishna Shobti.

IV. Drama & Theatre

A. The origin & Development of Hindi Drama.

B. Prominent Dramatists : Bharatendu, Prasad, Jagdish Chandra Mathur, Ram Kumar Verma, Mohan Rakesh.

C. The development of Hindi Theatre.

V. Criticism

A : The origin and development of Hindi criticism : Saiddhantik, Vyavharik, Pragativadi, Manovishleshanvadi & Nai Alochana.

B : Prominent critics : Ramchandra Shukla, Hajari Prasad Dwivedi, Ram Vilas Sharma & Nagendra.

VI. The other forms of Hindi prose-Lalit Nibandh, Rekhachitra, Sansmaran, Yatra-vrittant.

Section-C

3. Kabir : Kabir Granthawali, Ed, Shyam Sundar Das (First hundred Sakhis.)
4. Surdas : Bhramar Gitsar, Ed. Ramchandra Shukla (First hundred Padas)
5. Tulsidas : Ramchrit Manas (Sundar Kand) Kavitawali (Uttar Kand).
6. Jayasi : Padmawat Ed. Shyam Sundar Das (Sinhali Dwip Khand & Nagmativiyog Khand)
7. Bihari : Bihari Ratnakar Ed. Jagannath Prasad Ratnakar (First 100 Dohas)
8. Maithili Sharan Gupta : Bharat Bharati
9. Prasad : Kamayani (Chinta and Sharddha Sarg)
10. Nirala : Rag-Virag, Ed. Ram Vilas Sharma (Ram Ki Shakti Puja & Kukurmutta).
11. Dinkar : Kurushetra
12. Agyeya : Angan Ke Par Dwar (Asadhya Vina)
13. Muktiboth : Brahma Rakshas
14. Nagarjun : Badal Ko Ghirte Dekha Hai, Akal Ke Bad, Harijan Gatha.

Section-D

15. Bharatendu : Bharat Durdasha
16. Mohan Rakesh : Ashad Ka Ek Din
17. Ramchandra Shukla : Chintamani (Part I)
(Kavita Kya Hai] Shraddha Aur Bhakti)

18. Dr. Satyendra : Nibandh Nilaya-Bal Krishna Bhatt, Premchand, Gulab Rai, Hajari Prasad Dwivedi, Ram Vilas Sharma, Agyeya, Kuber Nath Rai.
19. Premchand : Godan, Premchand ki Sarvashreshtha Kahaniyan, Ed. Amrit Rai, Manjusha - Premchand ki Sarvashreshtha Kahaniyan, Ed. Amrit Rai
20. Prasad : Skandgupta
21. Yashpal : Divya
22. Phaniswar Nath Renu : Maila Anchal
23. Mannu Bhandari : Mahabhoj
24. Rajendra Yadav : Ek Dunia Samanantar (All Stories)

History

Section-A

1. Sources and approaches to study of early Indian history.
2. Early pastoral and agricultural communities. The archaeological evidence.
3. The Indus Civilization: its origins, nature and decline.
4. Patterns of settlement, economy, social organization and religion in India (c. 2000 to 500 B.C.): archaeological perspectives.
5. Evolution of north Indian society and culture: evidence of Vedic texts (Samhitas to Sutras).
6. Teachings of Mahavira and Buddha. Contemporary society. Early phase of state formation and urbanization.
7. Rise of Magadha; the Mauryan Empire. Ashoka's inscriptions; **his dhamma**. Nature of the Mauryan state.
- 8-9 Post-Mauryan period in northern and peninsular India: Political and administrative history, Society, economy, culture and religion. Tamilaham and its society: the Sangam texts.
- 10-11 India in the Gupta and post-Gupta period (to c. 750): Political history of northern and peninsular India; **Samanta** system and changes in political structure; economy; social structure; culture; religion.
12. Themes in early Indian cultural history: languages and texts; major stages in the evolution of art and architecture; major philosophical thinkers and schools; ideas in science and mathematics.

Section-B

13. India, 750-1200: Polity, society and economy. Major dynasties and political structures in North India. Agrarian structures. "Indian feudalism". Rise of Rajputs. The Imperial Cholas and their contemporaries in Peninsular India. Village communities in the South. Conditions of women. Commerce mercantile groups and guilds; towns. Problem of coinage. Arab conquest of Sind; the Ghaznavide Empire.
14. India, 750-1200: Culture, Literature, Kalhana, historian. Styles of temple architecture; sculpture. Religious thought and institutions: Sankaracharya's vedanta. Ramanuja. Growth of Bhakti, Islam and its arrival in India. Sufism. Indian science. Alberuni and his study of Indian science and civilization.

15. The 13th Century. The Ghorian invasions. Factors behind Ghorian success. Economic, social and cultural consequences. Foundation of Delhi Sultanate. The "slave" Dynasty. Iltutmish; Balban. "The Khalji Revolution". Early Sultanate architecture.

16. The 14th Century. Alauddin Khalji's conquests, agrarian and economic measures. Muhammad Tughluq's major "projects". Firuz Tughluq's concessions and public works. Decline of the Sultanate. Foreign contacts: Ibn Battuta.

17. Economy, society and culture in the 13th and 14th centuries. Caste and slavery under Sultanate. Technological changes. Sultanate architecture. [Persian literature: Amir Khusrau, Historiography; Ziya Barani. Evolution of a composite culture. Sufism in North India. Lingayats. Bhakti schools in the south.

18. The 15th and early 16th Century (Political History). Rise of Provincial Dynasties: Bengal, Kashmir (Zainul Abedin), Gujarat, Malwa, Bahmanids. The Vijayanagara Empire. Lodis. Mughal Empire, First phase: Babur, Humayun. The Sur Empire: Sher Shah's administration. The Portuguese colonial enterprise.

19. The 15th and early 16th Century (society, economy and culture). Regional cultures and literatures. Provincial architectural styles. Society, culture, literature and the arts in Vijayanagara Empire.

Monotheistic movements: Kabir and Guru Nanak. Bhakti Movements: Chaitanya. Sufism in its pantheistic phase.

20. Akbar: His conquests and consolidation of empire. Establishment of **jagir** and **mansab** systems. His Rajput policy. Evolution of religious and social outlook. Theory of **Sulh-i-kul** and religious policy. Abul Fazl, thinker and historian. Court patronage of art and technology.

21. Mughal empire in the 17th Century. Major policies (administrative and religious) of Jahangir, Shahjahan and Aurangzeb. The Empire and the Zamindars. Nature of the Mughal state. Late 17th Century crisis: Revolts. The Ahom kingdom, Shivaji and the early Maratha kingdom.

22. Economy and society, 16th and 17th Centuries. Population. Agricultural and craft production. Towns, commerce with Europe through Dutch, English and French companies- a "trade revolution". Indian mercantile classes. Banking, insurance and credit systems. Conditions of peasants, famines. Condition of Women.

23. Culture during Mughal Empire. Persian literature (including historical works). Hindi and religious literatures. Mughal architecture. Mughal painting. Provincial schools of architecture and painting. Classical music. Science and technology. Sawai Jai Singh, astronomer. Mystic eclecticism: Dara Shukoh. Vaishnav **Bhakti**. Maharashtra Dharma. Evolution of the Sikh community (Khalsa).

24. First half of 18th Century: Factors behind decline of the Mughal Empire. The regional principalities (Nizam's Deccan, Bengal, Awadh). Rise of Maratha ascendancy under the Peshwas. The Maratha fiscal and financial system. Emergency of Afghan Power. Panipat, 1761. Internal weakness, political cultural and economic, on eve of the British conquest.

Section-C

25. Establishment of British rule in India: Factors behind British success against Indian powers-Mysore, Maratha Confederacy and the Punjab as major powers in resistance; Policy of subsidiary Alliance and Doctrine of Lapse.

26. Colonial Economy: Tribute system. Drain of wealth and "deindustrialisation", Fiscal pressures and revenue settlements (Zamindari, Ryotwari and Mahalwari settlements); Structure of the British raj up to 1857 (including the Acts of 1773 and 1784 and administrative organisation).

27. Resistance to colonial rule: Early uprisings; Causes, nature and impact of the Revolt of 1857; Reorganisation of the Raj, 1858 and after.

28. Socio-cultural impact of colonial rule: Official social reform measures (1828-57); Orientalist-Anglicist controversy; coming of English education and the press; Christian missionary activities; Bengal Renaissance; Social and religious reform movements in Bengal and other areas; Women as focus of social reform.

29. Economy 1858-1914: Railways; Commercialisation of Indian agriculture; Growth of landless labourers and rural indebtedness; Famines; India as market for British industry; Customs removal, exchange and countervailing excise; Limited growth of modern industry.

30. Early Indian Nationalism: Social background; Formation of national associations; Peasant and tribal uprising during the early nationalist era; Foundation of the Indian National Congress; The Moderate phase of the Congress; Growth of Extremism; The Indian Council Act of 1909; Home Rule Movement; The Government of India Act of 1919.

31. Inter-War economy of India: Industries and problem of Protection; Agricultural distress; the Great Depression; Ottawa agreements and Discriminatory Protection; the growth of trade unions; The Kisan Movement; The economic programme of the Congress' Karachi resolution, 1931.

32. Nationalism under Gandhi's leadership: Gandhi's career, thought and methods of mass mobilisation; Rowlatt Satyagraha, Khilafat- Non Cooperation Movement, Civil Disobedience Movement, 1940 Satyagraha and Quit India Movement; State People's Movement.

33. Other strands of the National Movement:

a) Revolutionary movements since 1905; (b) Constitutional politics; Swarajists, Liberals, Responsive Cooperation; (c) Ideas of Jawharlal Nehru, (d) The Left (Socialists and Communists); (e) Subhas Chandra Bose and the Indian National Army; (f) Communal strands: Muslim League and Hindu Mahasabha; (g) Women in the National Movement.

34. Literary and cultural movements: Tagore, Premchand, Subramanyam Bharati, Iqbal as examples only; New trends in art; Film industry; Writers' Organisations and Theatre Associations.

35. Towards Freedom: The Act of 1935; Congress Ministries, 1937-1939; The Pakistan Movement; Post-1945 upsurge (RIN Mutiny, Telangana uprising etc.); Constitutional negotiations and the Transfer of Power, 15 August 1947.

36. First phase of Independence (1947-64): Facing the consequences of Partition; Gandhiji's murder; economic dislocation; Integration of States; The democratic constitution, 1950; Agrarian reforms; Building an industrial welfare state; Planning and industrialisation; Foreign policy of Non-alignment; Relations with neighbors.

Section-D

37. Enlightenment and Modern ideas

1. Renaissance Background
2. Major Ideas of Enlightenment: Kant, Rousseau
3. Spread of Enlightenment outside Europe
4. Rise of socialist ideas (to Marx)

38. Origins of Modern Politics

1. European States System
2. American Revolution and the Constitution.
3. French revolution and after math, 1789-1815.
4. British Democratic Politics, 1815-1850; Parliamentary Reformers, Free Traders, chartists.

39. Industrialization

1. English Industrial Revolution: Causes and Impact on Society
2. Industrialization in other countries: USA, Germany, Russia, Japan
3. Socialist Industrialization: Soviet and Chinese.

40. Nation-State System

1. Rise of Nationalism in 19th century
2. Nationalism: state-building in Germany and Italy
3. Disintegration of Empires through the emergence of nationalities.

41. Imperialism and Colonialism

1. Colonial System (Exploitation of New World, Trans-Atlantic Slave Trade, Tribute from Asian Conquests)
2. Types of Empire: of settlement and non-settlement: Latin America, South Africa, Indonesia, Australia.
3. Imperialism and Free Trade: The New Imperialism

42. Revolution and Counter-Revolution

1. 19th Century European revolutions
2. The Russian Revolution of 1917-1921
3. Fascist Counter-Revolution, Italy and Germany.
4. The Chinese Revolution of 1949

43. World Wars

1. 1st and 2nd World Wars as Total Wars: Societal Implications
2. World War I: Causes and Consequences
3. World War II: Political Consequence

44. Cold War

1. Emergence of Two Blocs

2. Integration of West Europe and US Strategy; Communist East Europe

3. Emergence of Third World and Non-Alignment

4. UN and Dispute Resolution

45. Colonial Liberation

1. Latin America-Bolivar

2. Arab World-Egypt

3. Africa-Apartheid to Democracy

4. South-East Asia-Vietnam

46. Decolonization and Underdevelopment

1. Decolonization: Break up of colonial Empires: British, French, Dutch

2. Factors constraining Development: Latin America, Africa

47. Unification of Europe

1. Post War Foundations: NATO and European Community

2. Consolidation and Expansion of European Community/European Union.

48. Soviet Disintegration and the Unipolar World

1. Factors in the collapse of Soviet communism and the Soviet Union, 1985-1991

2. Political Changes in East Europe 1989-1992

3. End of the Cold War and US Ascendancy in the World

4. Globalization.

Home Science

Section – A

1. **Food Science and Food Processing:**
 - a. Food groups; Food processing methods and its effects. Energy value of foods and energy expenditure of individuals.
 - b. Principles and methods of food preservation, food spoilage and food poisoning.
 - c. Food adulteration, quality control, quality standards, Sensory evaluation of foods, sanitation and safety of foods, packaging of processed food.
 - d. Quantity Cookery: Large scale preparation, delivery & service of food, Cost Control, Accounting.
2. **Human Nutrition:**
 - a. Carbohydrates, Protein, Fats, Minerals, Vitamins - Definition, classification, digestion, metabolism, water balance, acid base equilibrium.
 - b. Balanced diet. Recommended Dietary Allowances for Indians. Meal planning for various age groups, Nutrition, Exercise and Physical fitness.
 - c. Nutritional disorders, etiology, symptoms treatment, prevention & prophylactic measures and dietary management.

Section – B

3. **Diet Therapy :**
 - a. Therapeutic adaptation of normal diets, Dietary management of underweight, overweight, fevers, infections,
 - b. Dietary management of diabetes mellitus, cardiovascular diseases, gastrointestinal diseases, liver diseases and renal disorders; Role of dietary fiber & antioxidant in the management of diseases
 - c. Nutrition, dietary management and counselling for other health conditions-arthritis, cancer & HIV/AIDS etc.
4. **Community Nutrition:**
 - a. Assessment of nutritional status, prevention of malnutrition among vulnerable groups. Food and Nutrition security.
 - b. Current nutritional problems in India and measures to combat them. Food and Nutrition Policy and National nutrition programs.
 - c. Nutrition education and developing nutrition educational program, dietary counselling

Section – C

5. **Textile Science :**

- a. Fiber to fabric: stages and technological processes in textile manufacture;
- b. Identification of textile fibers and blends, textile finishes, fabric geometry and
- c. Detergents and laundering of fabrics; laundry equipments: use and care; stain removal, dry cleaning, disinfection and storage of clothes.

6. Textile Designing :

- a. Principles of textile designing: classification and design development, Computer aided textile designing. Weaving principles and basic weaves. Dyeing and printing.
- b. Selection of textile design for apparel, home furnishing and other household articles.
- c. Traditional Indian textiles, costumes and embroideries.

Section – D

7. Clothing Construction:

- a. Clothing construction, requirements and factors in selection, care and use of clothing for different age groups and activities.
- b. Equipment and accessories used in clothing construction; wardrobe planning, Fashion designing, fashion illustration.
- c. Consumer textiles, consumer behaviour.

8. Apparel Manufacturing:

- a. Garment industry: planning, banking credit and support;
- b. Factory and labour laws, trade globalisation and its impact.
- c. Retailing and merchandising: concepts and principles; marketing trends, sale promotion techniques; export and import procedures.

Section – E

9. Child Development:

- a. Heredity, environment and other factors influencing child development; prenatal and postnatal care of mother and child. Infant stimulation, development and growth promotion.
- b. Early childhood care and education: objectives and maintenance of ECCE centres. Values of play for young children. Physical, motor, cognitive and language development and fostering creativity in children with special needs – identification, education and rehabilitation; behavioural problems in children.
- c. Rights of children, child abuse, girl child education.

10. Youth Development:

- a. Late childhood and adolescent development. Pubertal growth and related developmental changes.
- b. Sex education; self-concept and personality development.

- c. Problems of adolescents, guidance and counselling for adolescents.

Section –F

- 11. Marriage & Family Relationships :**
 - a. Preparation for marriage; goals and adjustments in marriage and family life; family life cycle stages, role of families in socialisation and transmission of cultural values
 - b. Marital harmony, Planned Parenthood, premarital and marital counselling; family disorganisation.
 - c. Government policies, schemes and programmes for children, women and family welfare.

- 12. Adulthood & Ageing:**
 - a. Changing needs and challenges of senior citizens in India, midlife changes.
 - b. Mental health and well-being.
 - c. Intergenerational interaction: role of families and educational institutions.

Section – G

- 13. Family Resource Management:**
 - a. Concepts and principles of management; time and energy management, work simplification. Decision making processes.
 - b. Housing and building materials, important features of house planning, housing schemes of Government and other agencies.
 - c. Household equipment, uses, care and safety aspects.
 - d. Environmental issues and protection and conservation.

- 14. Family Finance and Consumer Education:**
 - a. Family finance, budgeting, records and account keeping, planning for family's financial security.
 - b. Consumer education: consumer rights, responsibilities, protection.

Section - H

- 15. Interior Design:**
 - a. Principles of art and design, application for interior designing, interior space planning. Computer aided interior designing.
 - b. Selection and arrangement of furniture, fixtures and furnishing - flooring and floor coverings; kitchen layout.

- 16. Extension Management:**

- a. Communication: functions, channels, skills, models and barriers. Preparation and use of Audio visual aids in communication, use of information technology in communication.
- b. Leadership: concept, qualities, significance of leadership development.
- c. Role of extension agencies for planning and implementing community programmes. Impact of information technology on quality of life of family and community, community participation and resources mobilisation.
- d. Social marketing, entrepreneurial skills and entrepreneurship development. Role of women entrepreneur in social and economic development, Government policies and recent programmes for empowerment of women.

MANIPURI

Section-A

Language:

a) General characteristics of Manipuri Language and history of its development; its importance and status among the Tibeto-Burman Languages of North-East India; recent development in the study of Manipuri language; evolution and study of old Manipuri script.

b) Significant features of Manipuri language:

i) Phonology-Phoneme-vowels, consonants juncture, tone, consonant cluster and its occurrence, syllable-its structure, pattern and types.

ii) Morphology: Word-class, root and its types; affix and its types; grammatical categories-gender, number, person, case, tense and aspects, process of compounding (samās and sandhi).

iii) Syntax: Word order: types of sentences, phrase and clause structures.

Section-B

a) Literary History of Manipuri:

Early period (upto 17th century)-Social and cultural background; Themes, diction and style of the works.

Medieval period (18th and 19th century)- Social, religious and political background; Themes, diction and style of the works.

Modern period-Growth of major literary forms; change of Themes, diction and style.

b) Manipuri Folk Literature :

Legend, Folktale, Folksong, Ballad, Proverb and Riddle.

c) Aspects of Manipuri Culture:

Pre-Hindu Manipuri Faith; Advent of Hinduism and the process of syncreticism.

Performing arts-Lai Haraoba, Maha Ras; Indigenous games-Sagol Kangjei, Khong Kangjei, Kang.

This paper will require first hand reading of the texts prescribed and will be designed to test the candidate's critical ability to assess them.

Section-C

Old and Medieval Manipuri Literature

a) Old Manipuri Literature

1. O. Bhogeswar Singh (Ed.) : Numit Kappa
2. M. Gourachandra Singh (Ed.) : Thawanthaba Hiran
3. N. Khelchandra Singh (Ed.) : Naothingkhong Phambal Kaba
4. M. Chandra Singh (Ed.) : Panthoibi Khonggul

b) Medieval Manipuri Literature :

1. M. Chandra Singh (Ed.) : Samsok Ngamba
2. R.K.Snahal Singh (Ed.) : Ramayana Adi Kanda
3. N. Khelchandra Singh (Ed.) : Dhananjay Laibu Ningba
4. O. Bhogeswar Singh (Ed.) : Chandrakirti Jila Chatpa

Section-D

Modern Manipuri Literature :

a) Poetry and Epic :

(I) Poetry :

a) Manipuri Sheireng (Pub) Manipuri Sahitya Parishad, 1988 (ed.)

Kh. Chaoba Singh : Pi Thadoi, Lamgi Chekla Amada, Loktak Mapanda

Dr. L. Kamal Singh : Nirjanata, Nirab Rajani

A. Minaketan Singh : Kamalda, Nonggumlakkhoda

L. Samarendra Singh : Ingagi Nong, Mamang Leikai Thambal Satle

E. Nilakanta Singh : Manipur, Lamangnaba

Shri Biren : Tangkhul Hui

Th. Ibopishak : Anouba Thunglaba Jiba

b) Kanchi Sheireng. (Pub) Manipur University 1998 (ed.)

Dr. L. Kamal Singh : Biswa-Prem

Shri Biren : Chaphadraba Laigi Yen

Th. Ibopishak : Norok Patal Prithivi

(II) Epic :

1. A. Dorendrajit Singh : Kangsa Bodha

2. H. Anganghal Singh : Khamba-Thoibi Sheireng (San-Senba, Lei-Langba, Shamu Khonggi Bichar)

(III) Drama :

1. S. Lalit Singh : Areppa Marup

2. G.C. Tongbra : Matric Pass

3. A. Samarendra : Judge Sahebki Imung

b) Novel, Short-story and Prose :

(I) Novel :

1. Dr. L. Kamal Singh : Madhabi

2. H. Anganghal Singh : Jahera

3. H. Guno Singh : Laman

4. Pacha Meetei : Imphal Amasung, Magi Ishing, Nungsitki Phibam

(II) Short-story :

a) Kanchi Warimacha (Pub) Manipur University 1997 (ed.)

R.K. Shitaljit Singh : Kamala Kamala

M.K. Binodini : Eigi Thahoudraba Heitup Lalu

Kh. Prakash : Wanom Shareng

b) Parishadki Khangatlaba Warimacha (Pub) Manipuri Sahitya Parishad 1994 (ed.)

S. Nilbir Shastri : Loukhatpa

R.K. Elangba : Karinunggi

c) Anouba Manipuri Warimacha (Pub) The Cultural Forum Manipur 1992 (ed.)

N. Kunjamohon Singh : Ijat Tanba

E. Dinamani : Nongthak Khongnang

(III) **Prose :**

a) Warenggi Saklon [Due Part (Pub) The Cultural Forum Manipur 1992 (ed.)

Kh. Chaoba Singh : Khamba-Thoibigi Wari Amasung Mahakavya

b) Kanchi Wareng (Pub) Manipur University 1998 (ed.)

B. Manisana Shastri : Phajaba

Ch. Manihar Singh : Lai-Haraoba

c) Apunba Wareng. (Pub) Manipur University, 1986 (ed.)

Ch. Pishak Singh : Samaj Amasung, Sanskriti

M.K. Binodini : Thoibidu Warouhouida

Eric Newton : Kalagi Mahousa (translated by I.R. Babu)

d) Manipuri Wareng (Pub) The Cultural Forum Manipur 1999 (ed.)

S. Krishnamohan Singh : Lan

Mathematics

Section-A

Linear Algebra

Vector, space, linear dependence and independence, subspaces, bases, dimensions. Finite dimensional vector spaces.

Matrices, Cayley-Hamilton theorem, eigenvalues and eigenvectors, matrix of linear transformation, row and column reduction, Echelon form, equivalence, congruences and similarity, reduction to canonical form, rank, orthogonal, symmetrical, skew symmetrical, unitary, hermitian, skew-hermitian forms—their eigenvalues. Orthogonal and unitary reduction of quadratic and hermitian forms, positive definite quadratic forms.

Calculus

Real numbers, limits, continuity, differentiability, mean-value theorems, Taylor's theorem with remainders, indeterminate forms, maximas and minima, asymptotes. Functions of several variables: continuity, differentiability, partial derivatives, maxima and minima, Lagrange's method of multipliers, Jacobian. Riemann's definition of definite integrals, indefinite integrals, infinite and improper integrals, beta and gamma functions. Double and triple integrals (evaluation techniques only). Areas, surface and volumes, centre of gravity.

Analytic Geometry:

Cartesian and polar coordinates in two and three dimensions, second degree equations in two and three dimensions, reduction to canonical forms, straight lines, shortest distance between two skew lines, plane, sphere, cone, cylinder., paraboloid, ellipsoid, hyperboloid of one and two sheets and their properties.

Section-B

Ordinary Differential Equations:

Formulation of differential equations, order and degree, equations of first order and first degree, integrating factor, equations of first order but not of first degree, Clairaut's equation, singular solution.

Higher order linear equations, with constant coefficients, complementary function and particular integral, general solution, Euler-Cauchy equation.

Second order linear equations with variable coefficients, determination of complete solution when one solution is known, method of variation of parameters.

Dynamics, Statics and Hydrostatics:

Degree of freedom and constraints, rectilinear motion, simple harmonic motion, motion in a plane, projectiles, constrained motion, work and energy, conservation of energy, motion under impulsive forces, Kepler's laws, orbits under central forces, motion of varying mass, motion under resistance.

Equilibrium of a system of particles, work and potential energy, friction, common catenary, principle of virtual work, stability of equilibrium, equilibrium of forces in three dimensions.

Pressure of heavy fluids, equilibrium of fluids under given system of forces Bernoulli's equation, centre of pressure, thrust on curved surfaces, equilibrium of floating bodies, stability of equilibrium, metacentre, pressure of gases.

Vector Analysis:

Scalar and vector fields, triple, products, differentiation of vector function of a scalar variable, Gradient, divergence and curl in cartesian, cylindrical and spherical coordinates and their physical interpretations. Higher order derivatives, vector identities and vector equations.

Application to Geometry: Curves in space, curvature and torsion. Serret-Frenet's formulae, Gauss and Stokes' theorems, Green's identities.

Section-C

Algebra:

Groups, subgroups, normal subgroups, homomorphism of groups quotient groups basic isomorphism theorems, Sylow's group, permutation groups, Cayley theorem. Rings and ideals, principal ideal domains, unique factorization domains and Euclidean domains. Field extensions, finite fields.

Real Analysis:

Real number system, ordered sets, bounds, ordered field, real number system as an ordered field with least upper bound property, cauchy sequence, completeness, Continuity and uniform continuity of functions, properties of continuous functions on compact sets. Riemann integral, improper integrals, absolute and conditional convergence of series of real and complex terms, rearrangement of series. Uniform convergence, continuity, differentiability and inerrability for sequences and series of functions. Differentiation of functions of several variables, change in the order of partial derivatives, implicit function theorem, maxima and minima. Multiple integrals.

Complex Analysis: Analytic function, Cauchy-Riemann equations, Cauchy's theorem, Cauchy's integral formula, power series, Taylor's series, Laurent's Series, Singularities, Cauchy's residue theorem, contour integration. Conformal mapping, bilinear transformations.

Linear Programming:

Linear programming problems, basic solution, basic feasible solution and optimal solution, graphical method and Simplex method of solutions. Duality.

Transportation and assignment problems. Travelling salesman problems.

Section-D

Partial differential equations:

Curves and surfaces in three dimensions, formulation of partial differential equations, solutions of equations of type $dx/p=dy/q=dz/r$; orthogonal trajectories, Pfaffian differential equations; partial differential equations of the first order, solution by Cauchy's method of characteristics; Charpit's method of solutions, linear partial differential equations of the second order with constant coefficients, equations of vibrating string, heat equation, Laplace equation.

Numerical Analysis and Computer programming:

Numerical methods: Solution of algebraic and transcendental equations of one variable by bisection, Regula-Falsi and Newton-Raphson methods, solution of system of linear equations by Gaussian elimination and Gauss-Jordan (direct) methods, Gauss-Seidel (iterative) method. Newton's (Forward and backward) and Lagrange's method of interpolation.

Numerical integration: Simpson's one-third rule, trapezoidal rule, Gaussian quadrature formula.

Numerical solution of ordinary differential equations: Euler and Runge-Kutta methods.

Computer Programming: Storage of numbers in Computers, bits, bytes and words, binary system. arithmetic and logical operations on numbers. Bitwise operations. AND, OR, XOR, NOT, and shift/rotate operators. Octal and Hexadecimal Systems. Conversion to and from decimal Systems.

Representation of unsigned integers, signed integers and reals, double precision reals and long integers.

Algorithms and flow charts for solving numerical analysis problems.

Developing simple programs in Basic for problems involving techniques covered in the numerical analysis.

Mechanics and Fluid Dynamics:

Generalised coordinates, constraints, holonomic and non-holonomic, systems. D'Alembert's principle and Lagrange's equations, Hamilton equations, moment of inertia, motion of rigid bodies in two dimensions.

Equation of continuity, Euler's equation of motion for inviscid flow, stream-lines, path of a particle, potential flow, two-dimensional and axisymmetric motion, sources and sinks, vortex motion, flow past a cylinder and a sphere, method of images. Navier-Stokes equation for a viscous fluid.

Philosophy

History and Problems of Philosophy

Section-A

1. Plato : Theory of Ideas.
2. Aristotle : Form, Matter and causation.
3. Descartes : Cartesian Method and certain knowledge, God, Mind-Body Dualism.
4. Spinoza : Substance, Attributes and Modes, Pantheism; Bondage and Freedom.
5. Leibnitz : Monads; Theory of Perception God.
6. Locke : Theory of Knowledge, Rejection of Innate Ideas; substance and qualities.
7. Berkeley : Immaterialism, God, Criticism of representative Theory of Perception.
8. Hume : Theory of knowledge, Scepticism Self, Causality.
9. Kant : Distinctions between synthetic and analytic judgements and between apriori and aposteriori judgements, Space, Time Categories, Possibility of Synthetic Apriori Judgements, Ideas of Reason and Antinomies; Criticism of the Proofs for the Existence of God.
10. Hegel : Dialectical Method, Absolute Idealism.
11. Precursors of Linguistic Analysis : Moore (Defence of common sense, Reputation of idealism), Russell (Theory of Descriptions).
12. Logical Atomism : Atomic Facts, Atomic sentences, Logical Constructions and Incomplete Symbols (Russell), Distinction of saying and showing (Wittgenstein)
13. Logical Positivism : Verification theory and rejection of Metaphysics, Linguistic Theory of Necessary Propositions.
14. Phenomenology : Husserl.
15. Existentialism : Kierkegaard, Sartre.
16. Quine : Radical empiricism.
17. Strawson : theory of person.

Section-'B'

1. Carvaka : Theory of Knowledge, Materialism.

2. Jainism : Theory of Reality, Saptabhangi Naya, Bondage and Liberation.
3. Buddhism : Pratityasamutpada, Ksanikavýds, Ñairātmyavāda, Schools of Buddhism, Sautrantika Theory of Pramana, Ideal of Bodhisattva.
4. Samkhya : Prakriti, Purusa, Theory of Causation, Liberation.
5. Naya-Vāisesika : Theory of Pramāna, Self, Liberation, God and Proofs of God's Existence, Categories, Theory of Causation, Atomistic theory of Creation.
6. Mimānsā : Theory of Knowledge.
7. Vedānta : Schools of Vedāntā Sankara, Rāmānuja, Madhva (Brahman, Isvara, Ātman, Jiva, Jagat, Māyā, Avidyā Adhyāsā, Moksā).

Section-C

Socio-Political Philosophy

1. Political Ideals : Equality, Justice, Liberty.
2. Sovereignty (Austin, Boidin, Laski, Kautilya).
3. Individual and State.
4. Democracy; Concept and forms.
5. Socialism and Marxism.
6. Humanism.
7. Secularism.
8. Theories of punishment.
9. Co-existence and violence; Sarvoday.
10. Gender-Equality.
11. Scientific Temper and Progress.
12. Philosophy of Ecology.

Section-D

Philosophy of Religion

1. Notions of God : Personalistic, Imparsonalistic, Naturalistic.
2. Proofs of the Existence of God and their criticisms.

3. Immortality of Soul.
4. Liberation.
5. Problem of Evil.
6. Religious Knowledge : Reason, Revelation and Mysticism.
7. Religion without God.
8. Religion and Morality.

Physics

Section-A

1. Classical Mechanics

(a) Particle dynamics

Centre of mass and laboratory coordinates, conservation of linear and angular momentum. The rocket equation. Rutherford scattering, Galilean transformation, inertial and non-inertial frames, rotating frames, centrifugal and Coriolis forces, Foucault pendulum.

(b) System of particles

Constraints, degrees of freedom, generalised coordinates and momenta. Lagrange's equation and applications to linear harmonic oscillator, simple pendulum and central force problems. Cyclic coordinates, Hamiltonian Lagrange's equation from Hamilton's principle.

(c) Rigid body dynamics

Eulerian angles, inertia tensor, principal moments of inertia. Euler's equation of motion of a rigid body, force-free motion of a rigid body. Gyroscope.

2. Special Relativity, Waves & Geometrical Optics

(a) Special Relativity

Michelson-Morley experiment and its implications. Lorentz transformations-length contraction, time dilation, addition of velocities, aberration and Doppler effect, mass-energy relation, simple applications to a decay process. Minkowski diagram, four dimensional momentum vector. Covariance of equations of physics.

(b) Waves

Simple harmonic motion, damped oscillation, forced oscillation and resonance. Beats. Stationary waves in a string. Pulses and wave packets. Phase and group velocities. Reflection and Refraction from Huygens' principle.

(c) Geometrical Optics

Laws of reflection and refraction from Fermat's principle. Matrix method in paraxial optic-thin lens formula, nodal planes, system of two thin lenses, chromatic and spherical aberrations.

3. Physical Optics

(a) Interference

Interference of light-Young's experiment, Newton's rings, interference by thin films, Michelson interferometer. Multiple beam interference and Fabry-Perot interferometer. Holography and simple applications.

(b) Diffraction

Fraunhofer diffraction-single slit, double slit, diffraction grating, resolving power. Fresnel diffraction: - half-period zones and zones plates. Fresnel integrals. Application of Cornu's spiral to the analysis of diffraction at a straight edge and by a long narrow slit. Diffraction by a circular aperture and the Airy pattern.

(c) Polarisation and Modern Optics

Production and detection of linearly and circularly polarised light. Double refraction, quarter wave plate. Optical activity. Principles of fibre optics attenuation; pulse dispersion in step index and parabolic index fibres; material dispersion, single mode fibres. Lasers-Einstein A and B coefficients. Ruby and He-Ne lasers. Characteristics of laser light-spatial and temporal coherence. Focussing of laser beams. Three-level scheme for laser operation.

Section-B

4. Electricity and Magnetism

(a) Electrostatics and Magnetostatics

Laplace and Poisson equations in electrostatics and their applications. Energy of a system of charges, multipole expansion of scalar potential. Method of images and its applications. Potential and field due to a dipole, force and torque on a dipole in an external field. Dielectrics, polarisation. Solutions to boundary-value problems-conducting and dielectric spheres in a uniform electric field. Magnetic shell, uniformly magnetised sphere. Ferromagnetic materials, hysteresis, energy loss.

(b) Current Electricity

Kirchhoff's laws and their applications. Biot-Savart law, Ampere's law, Faraday's law, Lenz' law. Self-and mutual-inductances. Mean and rms values in AC circuits. LR CR and LCR circuits- series and parallel resonance. Quality factor. Principle of transformer.

5. Electromagnetic Theory & Black Body Radiation

(a) Electromagnetic Theory

Displacement current and Maxwell's equations. Wave equations in vacuum, Poynting theorem. Vector and scalar potentials. Gauge invariance, Lorentz and Coulomb gauges. Electromagnetic field tensor, covariance of Maxwell's equations. Wave equations in isotropic dielectrics, reflection and refraction at the boundary of two

dielectrics. Fresnel's relations. Normal and anomalous dispersion. Rayleigh scattering.

(b) **Blackbody radiation**

Blackbody radiation and Planck radiation law- Stefan-Boltzmann law, Wien displacement law and Rayleigh-Jeans law. Planck mass, Planck length, Planck time, Planck temperature and Planck energy.

6. Thermal and Statistical Physics

(a) **Thermodynamics**

Laws of thermodynamics, reversible and irreversible processes, entropy. Isothermal, adiabatic, isobaric, isochoric processes and entropy change. Otto and Diesel engines, Gibbs' phase rule and chemical potential. van der Waals equation of state of a real gas, critical constants. Maxwell-Boltzmann distribution of molecular velocities, transport phenomena, equipartition and virial theorems. Dulong-Petit, Einstein, and Debye's theories of specific heat of solids. Maxwell relations and applications. Clausius-Clapeyron equation. Adiabatic demagnetisation, Joule-Kelvin effect and liquefaction of gases.

(b) **Statistical Physics**

Saha ionization formula. Bose-Einstein condensation. Thermodynamic behaviour of an ideal Fermi gas, Chandrasekhar limit, elementary ideas about neutron stars and pulsars. Brownian motion as a random walk, diffusion process. Concept of negative temperatures.

Section-C

7. Quantum Mechanics I

Wave-particle duality. Schrodinger equation and expectation values. Uncertainty principle. Solutions of the one-dimensional Schrodinger equation free particle (Gaussian wave-packet), particle in a box, particle in a finite well, linear harmonic oscillator. Reflection and transmission by a potential step and by a rectangular barrier. Use of WKB formula for the life-time calculation in the alpha-decay problem.

8. Quantum Mechanics II & Atomic Physics

(a) **Quantum Mechanics II**

Particle in a three dimensional box, density of states, free electron theory of metals. The angular momentum problem. The hydrogen atom. The spin half problem and properties of Pauli spin matrices.

(b) **Atomic Physics**

Stern-Gerlach experiment, electron spin, fine structure of hydrogen atom. L-S coupling, J-J coupling. Spectroscopic notation of atomic states. Zeeman effect. Frank-Condon principle and applications.

9. Molecular Physics

Elementary theory of rotational, vibrational and electronic spectra of diatomic molecules. Raman effect and molecular structure. Laser Raman spectroscopy. Importance of neutral hydrogen atom, molecular hydrogen and molecular hydrogen ion in astronomy. Fluorescence and Phosphorescence. Elementary theory and applications of NMR. Elementary ideas about Lamb shift and its significance.

Section-B

4. Nuclear Physics

Basic nuclear properties-size, binding energy, angular momentum, parity, magnetic moment. Semi-empirical mass formula and applications. Mass parabolas. Ground state of a deuteron magnetic moment and non-central forces. Meson theory of nuclear forces. Salient features of nuclear forces. Shell model of the nucleus-success and limitations. Violation of parity in beta decay. Gamma decay and internal conversion. Elementary ideas about Mossbauer spectroscopy. Q-value of nuclear reactions. Nuclear fission and fusion, energy production in stars. Nuclear reactors.

10. Particle Physics & Solid State Physics

(a) Particle Physics

Classification of elementary particles and their interactions. Conservation laws. Quark structure of hadrons. Field quanta of electroweak and strong interactions. Elementary ideas about Unification of Forces. Physics of neutrinos.

(b) Solid State Physics

Cubic crystal structure. Band theory of solids- conductors, insulators and semiconductors. Elements of superconductivity, Meissner effect, Josephson junctions and applications. Elementary ideas about high temperature superconductivity.

11. Electronics

Intrinsic and extrinsic semiconductors-p-n-p and n-p-n transistors. Amplifiers and oscillators. Op-amps. FET, JFET and MOSFET. Digital electronics-Boolean identities, De Morgan's laws, Logic gates and truth tables. Simple logic circuits. Thermistors, solar cells. Fundamentals of microprocessors and digital computers.

Political Science

Political Theory and Indian Politics

Section-A

1. Approaches to the study of political theory: historical, normative and empirical.
2. Theories of state: Social contract, Liberal, Neo-liberal, Marxist, communitarian, post-colonial.
3. State Sovereignty: Marxist and pluralistic theories; globalisation and the State.
4. Democracy and Human Rights: Democratic theory-classical and contemporary. Theories of Human Rights; Theories of Justice, Equality and Revolution, political obligation; New Social Movements.
5. Theories of Political Culture; Culture and politics in Third World countries.
6. Theories of Political Economy-Classical and contemporary.
7. Political Ideologies: Nature of Ideology; Liberalism, Socialism, Marxism, Fascism, Gandhism and Anarchism.
8. Theories of Power and Hegemony: Pareto, Mosca, Mitchels, C. Wright Mills, Weber, Gramsci, Hannah Arendt.
9. Indian Political Thought: Manu, Kautilya M.N. Roy Gandhi Ambedkar and E V Ramswami Naicker.
10. Political Thought: Plato, Aristotle, Machiavelli, Hobbes, J S Mill, Hegel and Marx, Lenin, Rosa Luxemburg and Mao Zedong.

Section-B

Indian Government and Politics

1. Indian Nationalism: Dadabhai Naoroji, Tilak, Savarkar, Gandhi, Jayaprakash Narain, Nehru, Subhas Bose, Ambedkar, Ram Manohar Lohia.
2. Nature and struggle of Indian freedom struggle : From constitutionalism to Mass Satyagraha, Revolutionary movements Non Co-operation, Civil disobedience and Quit India, Indian Naval uprising, Indian National Army; role of women in freedom struggle.
3. Socio- economic dimensions of the nationalist movement: The communal question and the demand for partition; backward caste movements, Trade union and Peasant movements, Civil rights movement.

4. Landmarks in Constitutional Development during British Rule: Morley-Minto Reforms; Montagu-Chelmsford Reforms; Simon Commission; Government of India Act, 1935; Cripps Mission: Indian Independence Act, 1947.
5. Salient Features of the Indian Constitution: The Preamble, Fundamental Rights and Duties, Directive Principles; federalism, parliamentary system; amending procedures; judicial review.
6. The Executive System in theory and practice: President, Prime Minister and the Council of Ministers; Governor, Chief Minister and the State Council of Ministers. The Bureaucracy.
7. Role and function of the Parliament and Parliamentary Committee-Lok Sabha and Rajya Sabha; changing socio economic profile.
8. The Supreme Court and the High Courts; Judicial Activism; PIL.
9. Statutory institutions/commissions-UPSC, Election Commission, Comptroller and Auditor General, Backward Classes Commission, National Commission for women; National Human Rights Commission; Minorities Commission.
10. Party system: ideology and social base of parties; fragmentation and regionalisation. Pressure groups; patterns of coalition politics; trends in electoral behavior.
11. Class, caste, ethnicity and gender in Indian politics; politics of regionalism, communalism, backward class and Dalit movements, Tribal people movements, struggle for gender justice.
12. Planning and Economic Development: Role of the Planning Commission; Planning in the era of liberalisation; political dimensions of economic reforms.
13. Grassroots democracy: Panchayati Raj and municipal government; significance of 73rd and 74th Amendments. Grass root movement and women's empowerment.

Section-C

Comparative Analysis and International Politics

1. Approaches to the study of comparative politics: traditional approaches; political economy, political sociology or political system approaches; Nature of political process in the Third World.
2. The Modern State: Evolution, the contemporary trends in the advanced industrial countries and the third world.
3. Development: Strategies and contemporary discourse.
4. Concepts of International politics: Power, national interest, balance of power, national security, collective security and peace.

5. Theories of International politics Marxist, Realist, Systems, Decision-making and Game Theory.
6. Determinants of foreign policy: Domestic compulsions, geopolitics, geo-economics and global order.
7. Origin and contemporary relevance of the Cold War, nature of the post-cold war global order.
8. Major issues of world politics : Cuban Missile Crisis; Vietnam War, Oil Crisis, Afghan Civil War, Gulf War, Collapse of the Soviet Union, Yugoslav Crisis.
9. Non-alignment: Concept and movement; Third World Movements for global justice, Non-alignment in the post-cold war era.
10. The evolution of the international economic system-from Bretton woods to WTO, the North-South dimension.
11. International organisations UN and its specialized agencies: International Court of Justice; ILO, UNICEF, WHO UNESCO.
12. Regional, organizations such as the ASEAN, APEC, EU, SAARC, NAFTA
13. Contemporary Global Concerns: Democracy, Human Rights, Ecology, Gender Justice, Global commons, Communication.

Section-D

India and the World

1. Indian Foreign Policy: Historical origins, determinants; the institutions of policy-making; continuity and change.
2. India and the Non-Alignment Movement: Evolution and contemporary relevance. Socio- political basis of non-alignment-domestic and global.
3. Major issues in Indian foreign policy: Sino-Indian Border War (1962); Indo-Pakistan War (1971) and the liberation of Bangladesh; IPKF in Sri Lanka; India as military nuclear power (1998).
4. Conflict and co-operation in South Asia: India's relations with Pakistan, Sri Lanka, Bangladesh, Nepal. Regional co-operation and SAARC. Kashmir question in India's foreign policy.
5. India's relation with Africa and Latin America.
6. India and South East Asia; ASEAN.
7. India and the major powers: USA, EU, China, Japan and Russia.

8. India and the UN System: India's role in UN Peace Keeping and global disarmament.
9. India and the emerging international economic order; multilateral agencies-WTO, IMF, IBRD, ADB.
10. India and the question of nuclear weapons: NPT and CTBT.

Sociology

Section-A

General Sociology/Foundations of Sociology/Fundamentals of Sociology

1. Sociology-The Discipline:

Sociology as a science and as an interpretative discipline; impact of industrial and French Revolution on the emergence of sociology; sociology and its relationship with history, economics, political science, psychology and anthropology.

2. Scientific Study of Social Phenomena: Problem of objectivity and value neutrality; issue of measurement in social science; elements of scientific method-concepts, theory and fact, hypothesis; research designs-descriptive, exploratory and experimental

3. Techniques of data collection and analysis:

Participant and quasi-participant observation; interview, questionnaire and schedule case study, sampling-size, reliability and validity, scaling techniques-social distance and Likert scale.

4. Pioneering contributions to Sociology:

- a) Karl Marx: Historical materialism, mode of production, alienation and class struggle.
- b) Emile Durkheim: Division of labour, social fact, religion and society.
- c) Max Weber: Social action, ideal types, authority, bureaucracy, protestant ethic and the spirit of capitalism.
- d) Talcott Parsons: Social system, pattern variables.
- e) Robert K. Merton: Latent and manifest functions, anomie, conformity and deviance, reference groups.

5. Marriage and Family:

Types and forms of marriage; family-structure and function; personality and socialization; Social control; family, lineage, descent and property; changing structure of family marriage and sex roles in modern society; divorce and its implications; gender issues; role conflicts.

6. Social Stratification:

Concepts-hierarchy, inequality and stratification; theories of stratification-Marx, Davis and Moore and Melvin Tumin's critique; forms and functions; class-different

conceptions of class; class-in-itself and class-for-itself; caste and class; caste as a class.

7. Social Mobility:

Types of mobility-open and closed models; intra-and inter-generational mobility; vertical and horizontal mobility; social mobility and social change.

8. Economic System:

Sociological dimensions of economic life; the impact of economic processes on the larger society; social aspects of division of labour and types of exchange; features of pre-industrial and industrial economic system; industrialisation and social change; social determinants of economic development.

9. Political System:

The nature of power-personal power, community power, power of the elite, class power, organisational power, power of the un-organised masses; authority and legitimacy; pressure groups and political parties; voting behaviour; modes of political participation-democratic and authoritarian forms.

10. Educational System:

Education and Culture; equality of educational opportunity; social aspects of mass education; problems of universalisation of primary education; role of community and state intervention in education; education as an instrument of social control and social change; education and modernisation.

11. Religion:

Origins of religious beliefs in pre-modern societies; the sacred and the profane; social functions and dysfunctions of religion; monistic and pluralistic religion; organised and unorganised religions; semitism and antisemitism; religion, sect and cults; magic, religion and science.

12. Science & Technology:

Ethos of science; social responsibility of science; social control of science; social consequences of science and technology; technology and social change.

13. Social Movements:

Concepts of social movements; genesis of social movements; ideology and social movement; social movement and social change; types of social movements.

14. Social change and Development:

Continuity and change as fact and as value; theories of social change-Marx, Parsons and Sorokin; directed social change; social policy and social development.

Section-B

Study of Indian Society

1. Historical Moorings of the Indian Society:

Traditional Hindu social organisation; socio-cultural dynamics through the ages; impact of Buddhism, Islam, and the West, factors in continuity and change.

2. Caste System:

Origin of the caste system; cultural and structural views about caste; mobility in caste; caste among Muslims and Christians; change and persistence of caste in modern India; issues of equality and social justice; views of Gandhi and Ambedkar on caste; caste on and Indian polity; Backward Classes Movement; Mandal Commission Report and issues of social backwardness and social justice; emergence of Dalit consciousness.

3. Class Structure:

Class structure in India, agrarian and industrial class structure; emergence of middle class; emergence of classes among tribes; elite formation in India.

4. Marriage, Family and Kinship:

Marriage among different ethnic groups, its changing trends and its future; family-its structural and functional aspects-its changing forms; regional variations in kinship systems and its socio-cultural correlates; impact of legislation and socio-economic change on marriage and family; generation gap.

5. Agrarian Social Structure:

Peasant society and agrarian systems; land tenure systems-historical perspectives, social consequences of land reforms and green revolution; feudalism-semi-feudalism debates; emerging agrarian class structure; agrarian unrest.

6. Industry and Society:

Path of industrialisation, occupational diversification, trade unions and human relations; market economy and its social consequences; economic reforms liberalisation, privatisation and globalisation.

7. Political Processes:

Working of the democratic political system in a traditional society; political parties and their social base; social structural origins of political elites and their orientations; regionalism, pluralism and national unity; decentralisation of power; panchayati raj and nagarpalikas and 73rd and 74th constitutional amendments.

8. Education:

Directive Principles of State Policy and primary education; education; educational inequality and change; education and social mobility; the role of community and state intervention in education; universalisation of primary education; Total Literacy Campaigns; educational problems of disadvantaged groups.

9. Religion and Society:

Size, growth and regional distribution of different religious groups; educational levels of different groups; problems of religious minorities; communal tensions; secularism; conversions; religious fundamentalism.

10. Tribal Societies:

Distinctive features of tribal communities and their geographical spread; problems of tribal communities-land alienation, poverty, indebtedness, health and nutrition, education; tribal development efforts after independence; tribal policy-isolation, assimilation and integration; issues of tribal identity.

11. Population Dynamics:

Population size, growth, composition and distribution; components of population growth; birth rate, death rate and migration; determinants and consequences of population growth; issues of age at marriage, sex ratio, infant mortality rate; population policy and family welfare programmes.

12. Dimensions of Development:

Strategy and ideology of planning; poverty, indebtedness and bonded labour; strategies of rural development-poverty alleviation programmes; environment, housing, slums, and unemployment; programmes for urban development.

13. Social Change:

Endogenous and exogenous sources of change and resistance to change; processes of change-sanskritisation and modernisation; agents of change-mass media, education and communication; problems of change and modernisation; structural contradictions and breakdowns.

14. Social Movements:

Reform Movements: Arya Samaj, Satya Sadhak Samaj, Sri Narayanguru Dharma Paripalana Sabha, and Ram Krishna Mission.

Peasant movements-Kisan Sabha, Telengana, Naxalbari.

Backward Castes Movement: Self-respect Movement, backward castes mobilisation in North India.

15. Women and society:

Demographic profile of women; special problems-dowry, atrocities, discrimination; existing programmes for women and their impact. Situational analysis of children; child welfare programmes.

16. Social Problems:

Prostitution, AIDS, alcoholism, drug addiction, corruption.

Statistics

Section-A

Probability:

Sample space and events, probability measure and probability space, random variable as a measurable function, distribution function of a random variable, discrete and continuous-type random variable probability mass function, probability density function, vector-valued random variable, marginal and conditional distributions, stochastic independence of events and of random variables, expectation and moments of a random variable, conditional expectation, convergence of a sequence of random variable in distribution, in probability, in p -th mean and almost everywhere, their criteria and inter-relations, Borel-Cantelli lemma, Chebyshev's and Khinchine's weak laws of large numbers, strong law of large numbers and Kolmogorov's theorems, Glivenko-Cantelli theorem, probability generating function, characteristic function, inversion theorem, Laplace transform, related uniqueness and continuity theorems, determination of distribution by its moments. Linderberg and Levy forms of central limit theorem, standard discrete and continuous probability distributions, their inter-relations and limiting cases, simple properties of finite Markov chains.

Statistical Inference

Consistency, unbiasedness, efficiency, sufficiency, minimal sufficiency, completeness, ancillary statistic, factorization theorem, exponential family of distribution and its properties, uniformly minimum variance unbiased (UMVU) estimation, Rao-Blackwell and Lehmann-Scheffe theorems, Cramer-Rao inequality for single and several-parameter family of distributions, minimum variance bound estimator and its properties, modifications and extensions of Cramer-Rao inequality, Chapman-Robbins inequality, Bhattacharyya's bounds, estimation by methods of moments, maximum likelihood, least squares, minimum chi-square and modified minimum chi-square, properties of maximum likelihood and other estimators, idea of asymptotic efficiency, idea of prior and posterior distributions, Bayes estimators.

Non-randomised and randomised tests, critical function, MP tests, Neyman-Pearson lemma, UMP tests, monotone likelihood ratio, generalised Neyman-Pearson lemma, similar and unbiased tests, UMPU tests for single and several-parameter families of distributions, likelihood ratio test and its large sample properties, chi-square goodness of fit test and its asymptotic distribution.

Confidence bounds and its relation with tests, uniformly most accurate (UMA) and UMA unbiased confidence bounds.

Kolmogorov's test for goodness of fit and its consistency, sign test and its optimality. Wilcoxon signed-ranks test and its consistency, Kolmogorov-Smirnov two-sample test, run test, Wilcoxon-Mann-Whitney test and median test, their consistency and asymptotic normality.

Wald's SPRT and its properties, OC and ASN functions, Wald's fundamental identity, sequential estimation.

Linear Inference and Multivariate Analysis

Linear statistical models, theory of least squares and analysis of variance, Gauss-Markoff theory, normal equations, least squares estimates and their precision, test of significance and interval estimates based on least squares theory in one-way, two-way and three-way classified data, regression analysis, linear regression, curvilinear regression and orthogonal polynomials, multiple regression, multiple and partial correlations, regression diagnostics and sensitivity analysis, calibration problems, estimation of variance and covariance components, MINQUE theory, multivariate normal distribution, Mahalanobis, D² and Hotelling's T² statistics and their applications and properties, discriminant analysis, canonical correlations, one-way MANOVA, principal component analysis, elements of factor analysis.

Sampling Theory and Design of Experiments

An outline of fixed-population and super-population approaches, distinctive features of finite population sampling, probability sampling designs, simple random sampling with and without replacement, stratified random sampling, systematic sampling and its efficacy for structural populations, cluster sampling, two-stage and multi-stage sampling, ratio and regression, methods of estimation involving one or more auxiliary variables, two-phase sampling, probability proportional to size sampling with and without replacement, the Hansen-Hurwitz and the Horvitz-Thompson estimators, non-negative variance estimation with reference to the Horvitz-Thompson estimator, non-sampling errors, Warner's randomised response technique for sensitive characteristics.

Fixed effects model (two-way classification) random and mixed effects models (two-way classification per cell), CRD, RBD, LSD and their analyses, incomplete block designs, concepts of orthogonality and balance, BIBD, missing plot technique, factorial designs : 2ⁿ, 3² and 3³, confounding in factorial experiments, split-plot and simple lattice designs.

Section-B

I. Industrial Statistics

Process and product control, general theory of control charts, different types of control charts for variables and attributes, \bar{X} , R, s, p, np and c charts, cumulative sum chart, V-mask, single, double, multiple and sequential sampling plans for attributes, OC, ASN, AOQ and ATI curves, concepts of producer's and consumer's risks, AQL, LTPD and AOQL, sampling plans for variables, use of Dodge-Romig and Military Standard tables.

Concepts of reliability, maintainability and availability, reliability of series and parallel systems and other simple configurations, renewal density and renewal function, survival models (exponential), Weibull, lognormal, Rayleigh, and bath-tub), different types of redundancy and use of redundancy in reliability improvement,

Problems in life-testing, censored and truncated experiments for exponential models.

II. Optimization Techniques

Different, types of models in Operational Research, their construction and general methods of solution, simulation and Monte-Carlo methods, the structure and formulation of linear programming (LP) problem, simple LP model and its graphical solution, the simplex procedure, the two-phase method and the M-technique with artificial variables, the duality theory of LP and its economic interpretation, sensitivity analysis, transportation and assignment problems, rectangular games, two-person zero-sum games, methods of solution (graphical and algebraic).

Replacement of failing or deteriorating items, group and individual replacement policies, concept of scientific inventory management and analytical structure of inventory problems, simple models with deterministic and stochastic demand with and without lead time, storage models with particular reference to dam type.

Homogeneous discrete-time Markov chains, transition probability matrix, classification of states and ergodic theorems, homogeneous continuous-time Markov chains, Poisson process, elements of queueing theory, M/M/1, M/M/K, G/M/1 and M/G/1 queues.

Solution of statistical problems on computers using well known statistical software packages like SPSS.

III. Quantitative Economics and Official Statistics

Determination of trend, seasonal and cyclical components, Box-Jenkins method, tests for stationery of series, ARIMA models and determination of orders of autoregressive and moving average components, forecasting.

Commonly used index numbers-Laspeyre's, Paashe's and Fisher's ideal index numbers, chain-base index number uses and limitations of index numbers, index number of wholesale prices, consumer price index number, index numbers of agricultural and industrial production, test for index numbers like proportionality test, time-reversal test, factor-reversal test, circular test and dimensional invariance test.

General linear model, ordinary least squares and generalised least squares methods of estimation, problem of multicollinearity, consequences and solutions of multicollinearity, autocorrelation and its consequences, heteroscedasticity of disturbances and its testing, test for independence of disturbances, Zellner's seemingly unrelated regression equation model and its estimation, concept of structure and model for simultaneous equations, problem of identification-rank and order conditions of identifiability, two-stage least squares method of estimation.

Present official statistical system in India relating to population, agriculture, industrial production, trade and prices, methods of collection of official statistics, their reliability and limitation and the principal publications containing such statistics, various official agencies responsible for data collection and their main functions.

IV. Demography and Psychometry

Demographic data from census, registration, NSS and other surveys, and their limitation and uses, definition, construction and uses of vital rates and ratios, measures of fertility, reproduction rates, morbidity rate, standardized death rate, complete and abridged life tables, construction of life tables from vital statistics and census returns, uses of life tables, logistic and other population growth curves, fitting a logistic curve, population projection, stable population quasi-stable population techniques in estimation of demographic parameters, morbidity and its measurement, standard classification by cause of death, health surveys and use of hospital statistics.

Methods of standardisation of scales and tests, Z-scores, standard scores, T-scores, percentile scores, intelligence quotient and its measurement and uses, validity of test scores and its determination, use of factor analysis and path analysis in psychometry.

Zoology

Section-A

1. Non-chordata and chordata:

- (a) Classification and relationship of various phyla upto sub-classes; Acoelomata and Coelomata; Protostomes and Deuterostomes, Bilateria and Radiata; Status of Protista, Parazoa, Onychophora and Hemichordata; Symmetry.
- (b) *Protozoa*: Locomotion, nutrition, reproduction; evolution of sex; General features and life history of Paramecium, Monocystis, Plasmodium, and Leishmania.
- (c) *Porifera*: Skeleton, canal system and reproduction.
- (d) *Coelenterata*: Polymorphism, defensive structures and their mechanism; coral reefs and their formation; metagenesis; general features and life history of Obelia and Aurelia.
- (e) *Platyhelminthes*: Parasitic adaptation; general features and life history of Fasciola and Taenia and their relation to man.
- (f) *Nemathelminthes*: General features, life history and parasitic adaptation of *Ascaris*; nemathelminths in relation to man.
- (g) *Annelida*: Coelom and metamerism; modes of life in polychaetes; general features and life history of nereis (*Neanthes*), earthworm (*Pheretima*) and leech (*Hirudinaria*).
- (h) *Arthropoda*: Larval forms and parasitism in Crustacea; vision and respiration in arthropods (prawn, cockroach and scorpion); modification of mouth parts in insects (cockroach, mosquito, housefly, honey bee and butterfly); metamorphosis in insects and its hormonal regulation; social organization in insects (termites and honey bees).
- (i) *Mollusca*: Feeding, respiration, locomotion, shell diversity; general features and life history of Lamellidens, Pila and Sepia, torsion and detorsion in gastropods.
- (j) *Echinodermata*: Feeding, respiration, locomotion larval forms; general features and life history of Asterias.
- (k) *Protochordata*: Origin of chordates; general features and life history of Branchiostoma and Herdmania.
- (l) *Pisces*: Scales, respiration, locomotion, migration.
- (m) *Amphibia*: Origin of tetrapods; parental care, pedomorphosis.

- (n) *Reptilia*: Origin of reptiles; skull types; status of Sphenodon and crocodyles.
- (o) *Aves*: Origin of birds; flight adaptation, migration.
- (p) *Mammalia* : Origin of mammals; definition; general features of egg-laying mammals, pouched-mammals, aquatic mammals and primates; endocrine glands and other hormone producing structures (pituitary, thyroid, parathyroid, adrenal, pancreas, gonads) and their interrelationships.
- (q) Comparative functional anatomy of various systems of vertebrates (integument and its derivatives, endoskeleton, locomotory organs, digestive system, respiratory system, circulatory system including heart and aortic arches; urino-genital system, brain and sense organs (eye and ear).

Section- B

1. Ecology:

- (a) Biosphere: Biogeochemical cycles, green-houses effect, ozone layer and its impact; ecological succession, biomes and ecotones.
- (b) Population, characteristics, population dynamics, population stabilization.
- (c) Conservation of natural resources- mineral mining, fisheries, aquaculture; forestry; grassland; wildlife (Project Tiger); sustainable production in agriculture-integrated pest management.
- (d) Environmental biodegradation; pollution and its impact on biosphere and its prevention.

II. Ethology:

- (a) Behaviour: Sensory filtering, responsiveness, sign stimuli, learning, instinct, habituation, conditioning, imprinting.
- (b) Role of hormones in drive; role of pheromones in alarm spreading; crypsis, predator detection, predator tactics, social behaviour in insects and primates; courtship (*Drosophila*, 3-spine stickleback and birds).
- (c) Orientation, navigation, homing; biological rhythms; biological clock, tidal, seasonal and circadian rhythms.
- (d) Methods of studying animal behaviour.

III. Economic Zoology:

- (a) Apiculture, sericulture, lac culture, carp culture, pearl culture, prawn culture.
- (b) Major infectious and communicable diseases (small pox, plague, malaria, tuberculosis, cholera and AIDS) their vectors, pathogens and prevention.
- (c) Cattle and livestock diseases, their pathogens (helminths) and vectors (ticks, mites, Tabanus, Stomoxys)
- (d) Pests of sugar cane (*Pyrrilla perpusiella*), oil seed (*Achaea janata*) and rice (*Sitophilus oryzae*).

IV. Biostatistics:

Designing of experiments; null hypothesis; correlation, regression, distribution and measure of central tendency, chi square, student t-test, F-test (one-way & two-way F-test).

V. Instrumental methods:

- (a) Spectrophotometry, flame photometry, Geiger-Muller counter, scintillation counting.
- (b) Electron microscopy (TEM, SEM).

Section-C

I. Cell Biology:

- (a) Structure and function of cell and its organelles (nucleus, plasma membrane, mitochondria, Golgi bodies, endoplasmic reticulum, ribosomes and lysosomes), cell division (mitosis and meiosis), mitotic spindle and mitotic apparatus, chromosome movement.
- (b) Watson-Crick model of DNA, replication of DNA, protein synthesis, transcription and transcription factors.

II. Genetics

- a) Gene structure and functions; genetic code.
- (b) Sex chromosomes and sex determination in *Drosophilla*, nematodes and man.
- (c) Mendel's laws of inheritance, recombination, linkage, linkage-maps, multiple alleles, cistron concept; genetics of blood groups.

- (d) Mutations and mutagenesis: radiation and chemical.
- (e) Cloning technology, plasmids and cosmids as vectors, transgenics, transposons, DNA sequence cloning and whole animal cloning (Principles and methodology).
- (f) Regulation and gene expression in pro-and eu-karyotes.
- (g) Signal transduction; pedigree-analysis; congenital diseases in man.
- (h) Human genome mapping; DNA finger-printing.

III. Evolution

- (a) Origin of life
- (b) Natural selection, role of mutation in evolution, mimicry, variation, isolation, speciation.
- (c) Fossils and fossilization; evolution of horse, elephant and man.
- (d) Hardy-Weinberg Law, causes of change in gene frequency.
- (e) Continental drift and distribution of animals.

IV. Systematics

- (a) Zoological nomenclature; international code; cladistics.

Section-D

I. Biochemistry

- (a) Structure and role of carbohydrates, fats, lipids, proteins, aminoacids, nucleic acids; saturated and unsaturated fattyacids, cholesterol.
- (b) Glycolysis and Krebs cycle, oxidation and reduction, oxidative phosphorylation; energy conservation and release, ATP, cyclic AMP-its structure and role.
- (c) Hormone classification (steroid and peptide hormones), biosynthesis and function.
- (d) Enzymes: types and mechanisms of action; immunoglobulin and immunity; vitamins and co-enzymes.
- (e) Bioenergetics.

II Physiology (with special reference to mammals)

- (a) Composition and constituents of blood; blood groups and Rh factor in man; coagulation, factors and mechanism of coagulation; acid-base balance, thermo regulation.
- (b) Oxygen and carbon dioxide transport; haemoglobin: constituents and role in regulation.
- (c) Nutritive requirements; role of salivary glands, liver, pancreas and intestinal glands in digestion and absorption.
- (d) Excretory products; nephron and regulation of urine formation; osmoregulation.
- (e) Types of muscles, mechanism of contraction of skeletal muscles.
- (f) Neuron, nerve impulse-its conduction and synaptic transmission; neurotransmitters.
- (g) Vision, hearing and olfaction in man.
- (h) Mechanism of hormone action.
- (i) Physiology of reproduction, role of hormones and pheromones.

III. Developmental Biology

- (a) Differentiation from gamete to neurula stage; dedifferentiation; metaplasia, induction, morphogenesis and morphogen; fate maps of gastrulae in frog and chick; organogenesis of eye and heart, placentation in mammals.
- (b) Role of cytoplasm in and genetic control of development; cell lineage; causation of metamorphosis in frog and insects; paedogenesis and neoteny; growth, degrowth and cell death; ageing; blastogenesis; regeneration; teratogenesis; neoplasia.
- (c) Invasiveness of placenta; in vitro fertilization; embryo transfer, cloning.
- (d) Baer's law; evo-devo concept.