APPENDIX- 4

PLAN OF EXAMINATION :

The competitive examination for the Combined State / Upper Subordinate Services (General Recruitment / Physically Handicapped Backlog / Special Recruitment) Examination, 2018 and Assistant Conservator of Forest / Range Forest Officer Services Examination, 2018 comprise three successive stages viz :-

(1) Preliminary Examination (Objective Type & Multiple choice). 2- Main Examination (Conventional Type, i.e. Written examination). 3- Viva- Voce (Personality Test).

PRELIMINARY EXAMINATION

The Preliminary examination for the Combined State / Upper Subordinate Services (General Recruitment / Physically Handicapped – Backlog / Special Recruitment) Examination and Assistant Conservator of Forest / Range Forest Officer Services Examination will consist of two compulsory papers of which answer sheet be on OMR sheets. The syllabus for Combined State / Upper Subordinate Services (General Recruitment / Physically Handicapped – Backlog / Special Recruitment) Examination and Assistant Conservator of Forest / Range Forest Officer Services Examination is mentioned in Appendix-5 of this advertisement. The papers shall be 200 marks each and of two hours durations. Both the papers shall be objective Type & multiple choice in which there shall be 150-100 questions Respectively. The timing of paper I will be from 9.30 to 11.30 A.M. and paper II from 2.30 to 4.30 P.M.

Note : (1) Paper-II of the Preliminary Examination will be a qualifying paper with minimum qualifying marks fixed at 33%. (2) It is mandatory for the Candidates to appear in both the papers of Preliminary Examination for the purpose of evaluation. Therefore a candidate will be disqualified in case he does not appear in both in papers. (3) The merit of the Candidates will be determined on the basis of marks obtained in Paper-I of the Preliminary Examination.

SUBJECTS FOR THE COMBINED STATE / UPPER SUBORDINATE SERVICES (GENERAL RECRUITMENT / PHYSICALLY HANDICAPPED – BACKLOG / SPECIAL RECRUITMENT) MAIN (WRITTEN) EXAMINATION : The Written examination will consist of the following compulsory and optional subjects. The syllabus whereof is mentioned in Appendix-6 of this advertisement. The candidates have to select any one subject from the list of optional subjects for main examination which will consist of two papers.

(A) COMPULSORY SUBJECTS

1. General Hindi	**150 marks**
2. Essay	**150 marks**
3. General Studies (First Paper)	**200 marks**
4. General Studies (Second Paper)	**200 marks**
5. General Studies (Third Paper)	**200 marks**
6. General Studies (Fourth Paper)	**200 marks**

Compulsory Subject viz: General Hindi, Essay and General Studies (First, Second, Third and Fourth papers) Papers Shall be Conventional type and for solving the questions three hours time is allowed. For optional Question papers three hours time is allowed. Two hundred maximum marks has been allotted for each optional question paper.

Note : 1. Timing of examination paper of 3 hours i.e. 9.30 am to 12.30 pm & 2 pm to 5 pm. 2. A candidate shall be required to obtain such minimum marks in the compulsory paper of General Hindi, as may be determined by the Government or the Commission, as the case may be. There shall be Two sections in all the question papers of Optional subject and each section will include Four questions. Candidates are required to answer only Five questions while they must select minimum Two questions from each section.

(B) OPTIONAL SUBJECTS ARE AS BELOW

1. Agriculture & Veterinary Science
2. Zoology
3. Chemistry
4. Physics
5. Mathematics
6. Geography
7. Economics
8. Sociology
9. Philiosophy
10. Geology
11. Psychology
12. Botany
13. Law
14. Animal Husbandry
15. Statistics
16. Defence Studies
17. Management
18. Political Science & International Relations
19. History
20. Social Work
21. Anthropology
22. Civil Engineering
23. Mechanical Engineering
24. Electrical Engineering
25. English Lit.
26. Urdu Lit.
27. Arabic Lit.
28. Hindi Lit.
29. Persian Lit.
30. Sanskrit Lit.
31. Commerce & Accountancy
32. Public Administration
33. Agricultural Engineering
34. Medical Science

(C) PERSONALITY TEST (VIVA-VOCE) TOTAL MARKS 100

The test will relate to the matter of general interest keeping the matter of academic interest in view and for general awareness, intelligence, character, expression power/personality and general suitability for the service.

Appendix-5

Syllabus for Preliminary Examination Pertaining to the Combined State / Upper Subordinate Services (General Recruitment / Physically Handicapped-Backlog / Special Recruitment) Examination and Assistant Conservator of Forest / Range Forest Officer Services Examination both.

Paper-I

General Studies-I

Duration: Two hours
Marks - 200

* Current events of national and international importance.
* History of India and Indian National Movement.
* India and World geography - Physical, Social, Economic geography of India and the World.
* Indian Polity and governance - Constitution, Political System, Panchayati Raj, Public Policy, Rights Issues etc.
* Economic and Social Development - Sustainable Development, Poverty Inclusion, Demographics, Social Sector Initiatives, etc.
* General Issues on Environmental ecology, Bio-diversity and Climate Change- that do not require subject specialization.
* General Science

Current events of national and international Importance:- On Current Events of National and International Importance, candidates will be expected to have knowledge about them.

History of India & Indian National Movement:- In History emphasis should be on broad understanding social, economic and political aspects of Indian History. In the Indian National Movement, the candidates are expected to have synoptic view of nature and character of the freedom movement, growth of nationalism and attainment of Independence.

India and World Geography - Physical, Social, Economic geography of India and the World: In World Geography only general understanding of the subject will be expected. Questions on the Geography of India will relate to Physical, Social & Economic Geography of India.

Indian Polity and Governance - Constitution, Political System, Panchayati Raj, Public Policy, Rights Issues, etc.:- In Indian Polity, Economic and Culture, questions will test knowledge of country's political system including Panchayati Raj and Community Development, broad features of Economic policy in India and Indian Culture.

Economic and Social Development - Sustainable Development, Poverty, Inclusion, Demographics, Social Sector Initiatives, etc.:- The candidates will be tested with respect to problems and relationship between Population, Environment and Urbanisation. General Issues on Environmental ecology, Bio-diversity and Climate Change - that do not require subject specialization, General awareness of the subject is expected from candidates.

General Science:- Questions on General Science will cover general appreciation and understanding of Science including matters of every day observation and experience, as may be expected of a well educated person, who has not made a special study of any scientific discipline.

Note:- Candidates are expected to have general awareness about the above subjects with special reference to Uttar Pradesh.

Paper-II

General Studies-II

Duration : Two hours
Marks - 200

- Comprehension.
- Interpersonal skills including communication skills.
- Logical reasoning and analytical ability.
- Decision making and problem solving.
- General mental ability
- Elementary Mathematics upto Class X level-Arithmatic, Algebra, Geometry and Statistics.
- General English upto Class X level.
- General Hindi upto Class X level.

Elementary Mathematics (Upto Class X Level)

1. Arithmetic:- (i) Number systems: Natural Numbers, Integers, Rational and Irrational numbers, Real numbers, Divisors of an Ineger, prime Integers, L.C.M. and H.C.F. of integers and their Interrelationship.
(ii) Average (iii) Ratio and proportion (iv) Percentage (v) Profit and Loss (vi) Simple and Compound Interests (vii) Work and Time (viii) Speed, Time and Distance

2. Algebra :- (i) Factors of polynomials, L.C.M. and H.C.F. of polynomials and their Interrelationship, Remainder theorem, simultaneous linear equations, quadratic equations. (ii) Set Theory:- Set, null set, subsets and proper subsets of a set, operations (Union, Intersections, difference, symmetric difference) between sets, venn diagram.

3. Geometry:- (i) Constructions and theorems regarding triangle, rectangle, square, trapezium and circles, their perimeter and area. (ii) Volume and surface area of sphere, right circular cylinder, right circular Cone and Cube.

4. Statistics:- Collection of data, Classification of data, frequency, frequency distribution, tabulation, cumulative frequency. Representation of data - Bar diagram, Pie chart, histogram, frequency polygon, cumulative frequency curves (ogives), Measures of Central tendency: Arithmetic Mean, Median and Mode.

General English Upto Class X Level

1. Comprehension
2. Active Voice and Passive Voice
3. Parts of Speech
4. Transformation of Sentences
5. Direct and Indirect Speech
6. Punctuation and Spellings
7. Words meanings
8. Vocabulary & Usage
9. Idioms and Phrases
10. Fill in the Blanks

सामान्य हिन्दी (हाईस्कूल स्तर तक) के पाठ्यक्रम में सम्मिलित किये जाने वाले विषय

(1) हिन्दी वर्णमाला, विराम चिन्ह
(2) शब्द रचना, वाक्य रचना, अर्थ
(3) शब्द–रूप
(4) संधि, समास
(5) क्रियायें
(6) अनेकार्थी शब्द
(7) विलोम शब्द
(8) पर्यायवाची शब्द
(9) मुहावरे एवं लोकोक्तियां
(10) तत्सम एवं तद्भव, देशज, विदेशी (शब्द भंडार)
(11) वर्तनी
(12) अर्थबोध
(13) हिन्दी भाषा के प्रयोग में होने वाली अशुद्धियाँ
(14) उ0प्र0 की मुख्य बोलियाँ

APPENDIX- 6

RULES AND SYLLABUS FOR THE COMBINED STATE / UPPER SUBORDINATE SERVICES (GENERAL RECRUITMENT / PHYSICALLY HANDICAPPED-BACKLOG / SPECIAL RECRUITMENT) MAIN (WRITTEN) EXAMINATION

1. No candidate shall be admitted to the examination unless he holds a certificate of admission from the Commission. The decision of the Commission as to the eligibility or otherwise of a candidate for admission to the examination shall be final. **2. CANDIDATES ARE WARNED THAT THEY SHOULD NOT WRITE THEIR ROLL-NUMBERS ANYWHERE EXCEPT IN THE SPACE PROVIDED ON THE COVER OF THEIR ANSWER BOOK/BOOKS OTHERWISE THEY WILL BE PENALISED BY A DEDUCTION OF MARKS. ALSO THEY SHOULD NOT WRITE, THEIR NAMES ANY-WHERE OTHERWISE THEY MAY BE DISQUALIFIED. 3.** If a Candidate's handwriting is not easily legible, deduction may be made from the total marks. **4.** A candidate may answer question papers in English Roman Script or Hindi in Devnagri Script or in Urdu in Persian script provided that the language papers as a whole must be answered in any of the above script unless it is otherwise indicated in question paper. **5.** The question papers shall be in English in Roman Script and Hindi in Devnagri Script. **6.** The standard of knowledge required of candidates in compulsory and optional subjects will be such as a young man holding a Bachelor's Degree of a University is expected to have except where the syllabus indicating otherwise.

सामान्य हिन्दी

(1) दिये हुए गद्य खण्ड का अवबोध एवं प्रश्नोत्तर। (2) संक्षेपण। (3) सरकारी एवं अर्धसरकारी पत्र लेखन, तार लेखन, कार्यालय आदेश, अधिसूचना, परिपत्र। (4) शब्द ज्ञान एवं प्रयोग। (अ) उपसर्ग एवं प्रत्यय प्रयोग, (ब) विलोम शब्द, (स) वाक्यांश के लिए एकशब्द, (द) वर्तनी एवं वाक्य शुद्धि, (5) लोकोक्ति एवं मुहावरे।

ESSAY

There will be three sections in the question paper of **Essay.** Candidates will have to select one topic from each section and they are required to write essay in 700 words on each topic. In the three sections, topics of essay will be based on following sphere :

Section A : (1) Literature and Culture. **(2)** Social sphere. **(3)** Political sphere.

Section B: (1) Science, Environment and Technology. **(2)** Economic Sphere **(3)** Agriculture, Industry and Trade.

Section C: (1) National and International Events. **(2)** Natural Calamities, Land slide, Earthquake, Deluge, Drought etc. **(3)** National Development programmes and projects.

GENERAL STUDIES-I

1- History of Indian Culture will cover the salient aspects of Art Forms, literature and Architecture from ancient to modern times.
2- Modern Indian history (from A.D.1757 to A.D. 1947): Significant events, personalities and issues, etc.
3- The Freedom Struggle- its various stages and important contributors/contributions from different parts of the country.
4- Post-independence consolidation and reorganization within the country (till 1965A.D.).
5- History of the world will include events from 18th century to middle of the 20th century such as French revolution of 1789, industrial revolution, World Wars, redraw of national boundaries, Socialism, Nazism, Fascism etc-their forms and effect on the society.
6- Salient features of Indian Society and culture.
7- Role of Women in society and women's organization, population and associated issues, poverty and developmental issues, urbanization, their problems and their remedies.
8- Meaning of liberalization, privatization and globalization and their effects on economy, polity and social structure.
9- Social empowernment, communalism, regionalism & secularism.
10- Distribution of major natural resources of World- Water, Soils, Forests in reference to South and South-East Asia with special reference to India. Factors responsible for the location of industries (with special reference to India).
11- Salient features of Physical Geography- Earthquake, Tsunami, Volcanic activity, Cyclone, Ocean Currents, winds and glaciers.
12- Oceanic resources of India and their potential.
13- Human migration-refugee problem of the World with focus on India.
14- Frontiers and boundaries with reference to Indian sub-continent.
15- Population and Settlements- Types and Patterns, Urbanization, Smart Cities and Smart Villages.

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16- Specific knowledge of Uttar Pradesh – History, Culture, Art, Architecture, Festival, Folk-Dance, Literature, Regional Languages, Heritage, Social Customs and Tourism.
17- Specific knowledge of U.P.- Geography- Human and Natural Resources, Climate, Soils, Forest, Wild-Life, Mines and Minerals, Sources of Irrigation.

GENERAL STUDIES-II

1- Indian Constitution- historical underpinnings, evolution, features, amendments, significant provisions and basis structure, Role of Supreme Court in evolution of basic provisions of Constitution.
2- Functions and responsibilities of the Union and the States: issues and challenges pertaining to the federal structure, devolution of powers and finances up to local levels and challenges therein .
3- Role of Finance Commission in Centre- State financial relations.
4- Separation of powers, dispute redressal mechanisms and institutions. Emergence and use of alternative dispute redressal mechanisms.
5- Comparison of the Indian constitutional scheme with that of other major democratic countries.
6- Parliament and State legislatures- structure, functioning, conduct of business, powers and privileges and concerned issues.
7- Structure, organization and functioning of the Executive and the Judiciary: Ministries and Departments of the Government, Pressure groups and formal/informal associations and their role in the Polity. Public Interest Litigation (PIL).
8- Salient features of the Reperesentation of People's Act.
9- Appointment to various Constitutional posts, Powers, functions and their responsibilities.
10- Statutory, regulatory and various quasi-judicial bodies including NITI Aayog, their features and functioning.
11- Government policies and interventions for development in various sectors and issues arising out of their design, implementation and Information Communication Technology (ICT).
12- Development processes- the role of Non Governmental Organizations (NGOs), Self Help Groups (SHGs), various groups and associations, donors, charities, institutional and other stakeholders.
13- Welfare schemes for vulnerable sections of the population by the Centre and States and the performance of these schemes, mechanisms, laws, institutions and Bodies constituted for the protection and betterment of these vulnerable sections.
14- Issues relating to development and management of Social Sector/Services relating to Health, Education , Human Resources.
15- Issues relating to poverty and hunger, their implication on body politic.
16- Important aspects of governance. Transparency and accountability, e-governance applications, models, successes, limitations, and potential, citizens, charters and institutional measures.
17- Role of Civil Services in a democracy in the context of emerging trends.
18- India and its relationship with neighbouring Countries.
19- Bilateral, Regional and Global groupings and agreements involving India and/ or affecting India's interest.
20- Effect of policies and politics of developed and developing countries on India's interests- Indian diaspora.
21- Important International Institutions, Agencies their structure, mandate and functioning.
22- Specific knowledge of Uttar Pradesh regarding Political, Administrative, Revenue and Judicial System.
23- Current affairs and events of Regional, State, National and International importance.

GENERAL STUDIES-III

1- Economic planning in India, objectives and achievements. Role of NITI Aayog, Pursuit of Sustainable Development Goals (SDG's).
2- Issues of Poverty, Unemployment, Social justice and inclusive growth.
3- Components of Government Budgets and Financial System.
4- Major Crops, Different types of irrigation and irrigation systems, storage, transport and marketing of agricultural produce, e-technology in the aid of farmers.
5- Issues related to direct and indirect farm subsidies and minimum support prices, Public Distribution System- objectives, functioning, Limitations, revamping, issues of buffer stocks and food security, Technology missions in agriculture.
6- Food processing and related industries in India- scope and significance, location, upstream and downstream requirements, supply chain management.
7- Land reforms in India since independence.
8- Effects of liberalization and globalization on the economy, changes in industrial policy and their effects on industrial growth.
9- Infrastructure: Energy, Ports, Roads, Airports, Railways etc.
10- Science and Technology-developments and applications in everyday life and in National Security, India's Science and Technology policy.
11- Achievements of Indians in science & technology, indigenization of technology. Developments of New technologies, transfer of technology, dual and critical use technologies.
12- Awareness in the fields of Information and Communication Technology (ICT) and Space Technology, Computers, Energy resources, nano- technology, microbiology, bio-technology. Issues relating to intellectual property rights (IPR), and digital rights.
13- Environmental security and Ecosystems, Conservation of Wild life, Biodiversity, Environmental pollution and degradation, environmental impact assessment,
14- Disaster as a Non-traditional security and safety challenge, disaster mitigation and management.
15- Challenges of International Security: Issues of Nuclear proliferation, Causes and spread of extremism, Communication networks, role of media and social networking, Basics of cyber security, money laundering and human trafficking.
16- India's internal security challenges: Terrorism, corruption, insurgency and organized crimes.
17- Role, kind and mandate of security forces, Higher defense organizations in India
18- Specific knowledge of Uttar Pradesh Economy:-
Overview of UP Economy: State Budgets. Importance of Agriculture, Industry, Infrastructure and physical resources. Human Resources and Skill development. Government Programmes and Welfare Schemes.
19- Issues in Agriculture, Horticulture, Forestry and Animal Husbandry.
20- Law and Order and Civil Defence with special reference to U.P.

GENERAL STUDIES-IV

• Ethics and Human Interface: Essence, determinants and consequences of Ethics in human action, dimensions of ethics, ethics in private and public relationships. Human Values-lessons from the lives and teachings of great leaders, reformers and administrators, role of family, society and educational institutions in inculcating values.
• Attitude: Content, structure, function, its influence and relation with thought and behavior, moral and political attitudes, social influence and persuasion.
• Aptitude and foundational values for Civil Service, integrity, impartiality and non-partisanship, objectivity, dedication to public services, empathy, tolerance and compassion towards the weaker-sections.
• Emotional Intelligence- concept and dimensions, its utility and application in administration and governance.
• Contributions of moral thinkers and philosophers from India and world.
• Public/Civil Service values and ethics in Public Administration: status and problems, ethical concerns and dilemmas in government and private institutions, laws, rules, regulations and conscience as sources of ethical guidance, accountability and ethical governance, strengthening of moral values in governance, ethical issues in international relations and funding, corporate governance.
• Probity in Governance: concept of public service, philosophical basis of governance and probity, information sharing and transparency in government. Right to Information, codes of ethics, codes of conduct, citizen's charter, work culture, quality of service delivery, utilization of public funds, challenges of corruption.
• Case studies on above issues.

1. AGRICULTURE : PAPER-I (SECTION - A)

Ecology and its relevance. Natural resources and their conservation management. Environmental factors of crop distribution and production. Climatic elements as factor of crop growth. Impact of environment of changes on cropping pattern. Environmental pollution and associated hazards to crops, animals and human. Cropping patterns in different agro climatic zones of U.P. Impact of high yielding and short duration varieties on shifts in cropping patterns. Concepts of multiple, multistory, relay and intercropping and their importance in relation to sustainable crop production. Package of practices for production of important cereals, pulses, oilseeds, fibre, sugar and cash crops grown during Kharif and Rabi seasons in different regions of U.P. Important features, scopes and propagation of various type of forestry plants with reference to agro, forestry and social forestry, Weeds, their characteristics, dissemination, association with various field crops and their multiplication, cultural, biological and chemical control. Processes and factors of soil formation. Classification of Indian soils including modern concepts. Mineral and organic constituent of soils and their role in maintaining soil productivity. Problems soils, extent and distribution in India and their reclamation. Essential plant nutrients and other beneficial elements in soils and plants, their occurrence, factors affecting their distribution, function and cycling. Symbiotic and non symbiotic nitrogen fixation. Principles of soil fertility and its evaluation for judicious fertilizer use. Soil conservation planning on water shed basis, erosion and run off management in hills, foothills and valley lands and factors affecting them. Dryland agriculture and its problems. Technology for stabilishing agriculture production in rainsed agriculture area of U.P. Necessity and scope of organic farming.

SECTION – B

Water use efficiency in relation to crop production. Criteria for scheduling irrigations, ways and means of reducing run off losses of irrigation water. Drainage of water-logged soils. Farm management its scope, importance and characteristics, farm planning and budgeting. Economics of different types of farming systems. Marketing and pricing of agricultural inputs and outputs, price fluctuations and their cost. Role of co-operatives in agricultural economy, Types and system of farming and factors affecting them Agricultural extension, its importance and role, method of evaluation of extension programmes, diffusion, communication and adoption of innovations, people's participation and production and motivation. Farm mechanization and its role in agricultural production and rural employment. Training programme for extension workers and farmers, Extension systems and programmes. Training & Visits. KVK. KGK, NATP and IVLP.

AGRICULTURE
PAPER-II (SECTION-A)

Heredity and variation, Mendel's law of inheritance, Chromosomal theory of inheritance, Cytoplasmic inheritance, Sex linked, Sex influenced and sex limited characters. Spontaneous and induced mutations. Role of chemicals in mutation. Origin and domestication of field crops. Morphological patterns of variations in varieties and related species of important field crop. Cause and utilization of variation in crops improvement. Application of the principles of plant breeding to the improvement of major field crops, Methods of breeding to self and cross-pollinated crops. Introduction, selection, hybridization, male sterility and self incompatibility, utilization of mutation and polyploidy in breeding. Seed technology and its importance, production, processing, storage and testing of seeds. Role of national and state seed organization in production, processing and marketing of improved seeds. Physiology and its significance in agriculture, Physical properties and chemical constitution of protoplasm, inhibition, surface tension, diffusion and osmosis. Absorption and translocation of water, transpiration and water economy.

SECTION – B

Enzymes and plant pigments, Photosynthesis – modern concepts and factors effecting the process. Aerobic and anaerobic respiration, Growth and development. Photoperiodisms and vernalization. Plant growth regulators and their mechanism of action & importance in crop production. Climatic requirements and cultivation of major fruits, vegetable and ornamental crops; package of practices and the scientific basis for the same. Pre and post harvest physiology of fruits and vegetables crops, Principles and methods of preservation of fruits and vegetables. Processing techniques and equipment. Landscape and Floriculture including raising of ornamental plants. Garden and its parts, Design and layout of gardens, Diseases and pests of vegetables, fruits and ornamental crops of U.P. and measures to control plant diseases. Integrated management of pests and diseases. Pesticides and their formulations, plant protection equipment, their care and maintenance. Storage pest of cereals and pulses, hygiene of storage, godowns, preservation and remedial measures, Food production and consumption trends In India, National and International food policies, Procurements, distribution, processing and production constraints.

2. ZOOLOGY
PAPER-I
(Non Chordata, Chordata, Ecology, Ethology, Biostatistics and Economic Zoology)
Section-A- Non-chordata and chordata

1. Animal Divercity: General survey, Classification and Interrelationships of following Phyla.
2. Protozoa: Locomotion, Nutrition and Reproduction, Human parasitic protozoa and diseases.
3. Porifera: Canal system; Skeleton and Reproduction.
4. Cnidaria: Polymorphism; Coral reefs; Metagenesis.
5. Platyhelminthes: Parasitic adaptations and host-parasite relationships.
6. Annelida: Adaptive radiation in Polychaeta.
7. Arthopoda: Larval forms and parasitism in crustacean; Appendages of prawn; Vision

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and respiration in Arthopoda; Social life and metamorphosis in insects.
8. Mollusca: Respiration, Pearl formation.
9. Echinodermata: General organization, larval forms and affinities.
10. Chordata: Origin; Origin of tetrapods.
11. Pisces: Respiration; Migration; Lung fishes.
12. Amphibia: Neoteny and paedogenesis; parental care.
13. Reptilia: Skull type; Dinosaurs
14. Aves: Aerial adaptations, Migration, Respiration, Flightless birds.
15. Mammalia: Dentition; Prototheria and Metatheria; Skin derivatives of Eutheria.

SECTION-B- Ecology, Ethology, Biostatistics and Economic Zoology

1. Ecology: Abiotic and biotic factors; Interspecific and intraspecific relations, Ecological succession; Different types of biomes; Biogeochemical cycles; Food web; Ozone layer and Biosphere; Pollution of air, water and land.
2. Ethology: Types of animal behaviour; Role of hormones and pheromones in behaviour; Methods of studying Animal behaviour; Biological Rhythms.
3. Biostatistics: Sampling methods; frequency distribution and measures of central tendency; standard deviation and standard error; correlation and regression; chi- square and t-tests.
4. Economic Zoology: Insect pests of crops (Paddy, Gram and Sugarcane) and stored grains; Apiculture, Sericulture, Lac culture; Pisciculture and Oyster culture.

ZOOLOGY
PAPER-II
(Cell Biology, Genetics, Evolution and Systematics, Biochemistry, Physiology and Developmental Biology)

SECTION-A: Cell Biology, Genetics, Evolution and Systematics

1. Cell Biology: Prokaryotic and Eukaryotic cells, Electron microscopic structure of eukaryotic cells; Cell membrane- structure, functions and transport mechanisms cell organelles- structure and function; Cytoskeleton; Cell cycle; Cell division-Mitosis and Meiosis; Spindle formation and chromosome movement. 2. Genetics: Mendelian laws of inheritance; Structure of eukaryotic chromosome; giant and lamp- brush chromosomes; Linkage; concept of gene, gene mapping; Sex chromosomes and sex determination; Sex linked traits; Gene interactions (codominance, multiple alleles, Lethal genes, Epistatic and Hypostatic genes, Polygenic inheritance); Variation-its types and sources; chromosomal and gene mutations; Human genetic diseases (Sickle cell anaemia, Down's, Turner's and Klenefelter's syndromes); Regulation of gene expression in prokaryotes and eukaryotes; Recombinant DNA technology-basic principles, tools, vectors and applications; Transgenic animals. 3. Evolution: Origin of life- Theories and experimental evidence; Evolution- theories; Natural selection; Variation; Calculating allele frequencies (Hardy-Weinberg Method); Concept of species and sub-species; Mechanisms of speciation, Island species; Crypsis- Overview and varieties of crypsis. 4. Systematics: Principles of Taxonomy; Zoological nomenclature; Fossils; Geological eras; Phylogeny of horse and elephant; Origin and evolution of man; Continental distribution of animals; Zoogeographical realms of the world and their characteristic fauna.

SECTION-B- Biochemistry, Physiology and Development Biology

Biochemistry: Structure, classification and biological functions of Carbohydrates, Proteins, Lipids and Nucleic acids, Watson and Crick model of DNA; Genetic code; Protein- biosynthesis; Biological oxidations; High energy compounds; Electron transport chain; Oxidative phosphorylation; Glycolysis and Krebs/TCA cycle; Enzymes-Nomenclature, classification, Factors affecting enzyme activity and mechanism of action, Vitamins- dietary sources, biochemical functions, deficiency symptoms, Hypervitaminosis A; Innate and Aquired immunity; immune cells; Immunoglobulins; cytokines (Interleukins). 2. Physiology (with special reference to mammals): Homeostasis; open and closed circulatory system, Neurogenic and Myogenic hearts; Blood composition, functions clotting and blood-groups; Oxygen and carbon dioxide transport; The cardiac cycle; Neural and Hormonal regulation of heart rate; Mechanism of breathing and its regulation, formation of urine; Homeostatic functions of kidney; Thermoregulation in thermoconformer and thermoregulator animals; Nerve impulse-axonal and synaptic transmission; neurotransmitters; Digestion and absorption of carbohydrate, protein, fats and nucleic acid, control of secretion of digestive juices; Muscle-types, structure and mechanism of contraction; structure and functions of human eye and ear; the mechanism of photoreception, hearing and balance; Hormones-Endocrine, Paracrine and Autocrine; Types of hormone; Mechanisms of hormone action; Types of hormone receptors; Roles of hypothalamus, pituitary, thyroid, parathyroid, pancreas, adrenal, gonad and pineal hormones; Regulation of Menstrual cycle; Menarche and Menopause. 3. Development Biology: Gametogenesis, fertilization, cleavage and gastrulation in Branchiostoma, frog and chick; Types of eggs; Fate maps of gastrula of frog and chick; Metamorphosis in frog and insects and its hormonal control; Formation of extra embryonic membrance in chicks; Types of placenta in mammals, Organiser phenomenon, Organogenesis of brain, eye and heart; Regeneration; Genetic control of development.

3. CHEMISTRY: PAPER-I

Atomic Structure: de Broglie equation, Heisenberg's uncertainty principle, quantum mechanical operators and the Schrodinger wave equation, physical significance of wave function and its characteristics (normalized orthogonal), radial distribution and shapes of s.p. & d orbitals, particle in one-dimensional box, quantization of electronic energies (qualitative treatment of hydrogen atom), Pauli's Exclusion principle. Hund's rule of maximum multiplicity. Aufbau principle, electronic configuration of atoms, Long form of periodic table including translawrencium elements. Periodicity in properties of the elements such as atomic and ionic ionization potential, electron affinity, eletronegativity and hydration energy.
Nuclear and Radiation Chemistry: nuclear forces, nuclear stability, N/P ratio, nuclear binding energy, Artificial transmutation of elements and nuclear reactions, nuclear fission & fusion, Kinetics of radioactive decay, radioactive isotopes and their applications. Radio carbon dating. Elementary ideas of radiation chemistry.
Chemical Bonding: Valence bond theory (Heitler-London and Pauling- Slater theories), hybridization, VSEPR theory and molecular orbital energy level diagrams for homo and hetero nuclear diatomic molecules, bond order, bond length and bond strength, sigma and pi bonds, hydrogen bond, characteristics of ionic compounds, Lattice energy, born-haber cycle, Characteristics of covalent bond.
Chemistry of s- and p-Block Elements: General properties of s-and p- Block elements, chemical reactivity of elements and group trends. Chemical behaviour with respect of their hydrides, halides and oxides.
Chemistry of Transition Elements: General Characteristics, variable oxidation states, complex formation, colour, magnetic and catalytic properties, Comparative study of 4d and 5d transition elements with 3d analogues with respect to their ionic radii, oxidation states and magnetic properties.
Chemistry of Lanthanides and Actinides: Lanthanides contraction, oxidation states, Principles of separation of lanthanides and actinides. Magnetic and spectral properties of their compounds.
Coordination Chemistry: Werner's Theory of coordination compounds. IUPAC system of nomenclature, effective atomic number (EAN), Isomerism in coordination compounds. Valence bond theory and its limitations. Crystal field theory. Crystal field splitting of d-orbitals in octahedral, tetrahedral and square planar complexes. Δ Value and factors affecting its magnitude, calculation of Crystal field stabilization energies (CFSE) for d1 to d9 weak and strong field. Octahedral complexes, spectrochemical series electronic spectra of d transition metal complexes, types of electronic transitions, selection rules for electronic transitions.
Bio-Inorganic Chemistry: Essential and trace elements in biological processes, Metalloporphyrins with special reference to haemoglobin and myoglobin, Biological role of alkali and alkaline earth metal ions with special reference to calcium ion.
Preparation, Properties and Uses of the following Inorganic Compounds: Heavy Water, Boric acid, diborance, hydrazine, hydroxylamine, potassium dichromate, potassium permanganate, Ce (IV) sulphate and titanium (III) sulphate.
Polymers: Molecular weight of polymers by sedimentation, light scattering viscosity and osmotic pressure methods, Number average and weight average molecular weights, elasticity and crystallinity of polymers, Borazines: Silicons and phosphonitrillic halide polymers.
Chemical Thermodynamics: Thermodynamic functions, first and second Laws of thermodynamics, heats of formation neutralization and combustion, Hess's Law of heat summation, variation of entropy with change of temperature, pressure and volume, Gibbs-Helmholtz equation, criteria of equlibirium and spontaneity, application of thermodynamics to various physico- chemical processes, concept of chemical potential Gibbs-Duhem equation. Classius-Clapeyron equation. Thermodynamic treatment of colligative properties of dilute solutions.
Chemical Kinetics: Order and molecularity of reaction, Rate constant and specific rate constant, zero-order, first order and second order reactions, half life period. Methods for determining the order of a reaction, temperature coefficient, Arrhenius equation, Energy of activation, Collision theory of reaction rate. Steady state approximations. Transition state theory of reaction rates, kinetics of side, reversible and consecutive reactions.
Phase Equilibria: Phase, Components, degrees of freedom, phase diagram of one component (water and sulphur) and two component (Pb-Ag) systems, Nernst's distribution law, Applications of distribution law:
Electrochemistry: Theory of strong electrolytes, Debye-Huckel theory of activity coefficient laws of electrolytic conduction, transport number and its determination by Hittorf's method and moving boundary method. Electrodes and Electrode potential, Hydrogen electrode, Calomel electrode. E-M-F of galvanic cells, concentration cells with and without transference, liquid junction potential and fuel cell.
Solid State Chemistry: Elements of symmetry in crystals, space lattice and unit cell. The close packing of sphares, hexagonal close packing, cubic close packing and body centered cubic packing, co-ordination number and redus ratio effect. Bragg's law of X-ray diffraction, powder pattern method of crystalline structure of NaCl, KCl and ZnS.
Surface Chemistry: Coagulation, Hardy-Schulze Rule, Stability of colloids and origin of charge on colloids, Electrokinetic potential, adsorption, Various types of adsorption isotherms, catalysis, enzyme catalysis (Michelis-Menten equation).
Spectra: Raman Spectra: Raman effect, stokes and antistokes lines and their intensity difference. Rule of mutual exclusion. Electronic Spectra, Electronic transitions, Frank condom Principle, Phosphorescene and fluorescence.
Equilibrium: Equilbrium in physical and chemical process, dynamic nature of equilibrium, law of chemical equilibrium, equilibrium constant, factors affecting equilibrium, Le-chatelier's principle, strong and weak electrolytes, common ion effect, ionization of polybasic acids, acid strength, concept of pH and hydrolysis of salts, buffer solutions, Henderson's equation, solubility and solubility product of sparingly soluble salts.

CHEMISTRY PAPER-II

1. General Organic Chemistry
Hyperconjugation, Delocalisation and their applications, Electrophiles, Nucleophiles, Hydrogen Bonding, and Aromaticity and Antiaromaticity.
2. Reaction Mechanism:
(i) General methods of study of mechanism of organic reactions: Kinetic Isotope effect, Crossover Experiment, Intermediate trapping, and Thermodynamic vs Kinetic control of reactions.
(ii) Reactive Intermediates: Generation, geometry, nature, (electrophilic or nucleophilic character), reactions and stability of carbocations, carbanions, free radicals, carbenes and benzynes.
(iii) Addition Reactions: Electrophilic addition to carbon- Carbon double bond with bromine and carbenes, hydroboration-Oxidation, oxymercuration- demercuration, addition of peracids (formation of oxiranes) and iodolactonisation.
1,2 and 1,4 addition of conjugated diene with bromine, free radical addition of HBr.
Nucleophilic addition to carbonyl group with carbon, oxygen, sulphur and nitrogen nucleophiles.
(iv) Elimination Reactions: E1, E2 and E1 cb reaction mechanism, orientation in E2 reaction (Saytzeff and Hofmann), Cope elimination.
(v) Substitution Reactions:
(a) SN1, SN2 mechanism
(b) Electrophilic aromatic substitution reactions: orientation and reactivity in monosubstituted benzenes.
3. Reactions and Rearrangements:
(i) Reactions: Aldol condensation, Claisen condensation, Knoevenagel reaction, Witting reaction, Michael addition, Mannich reaction, Perkin reaction, Riemer- tiemann reaction, Cannizzaro reaction and Benzoin condensation.
(ii) Rearrangements: Pinacol-Pinacolone, Hoffman, Beckmann, Curtius rearrangements and Rearrangement given by carbocations.
4. Stereochemistry:
Optical activity due to chiral centre, R-S nomenclature of compounds having chiral centre (one or two chiral centres). Properties of enantiomers and diastereomers, Separation of racemic mixture using chemical method.
Geometrical isomerism: E-Z nomenclature,
Conformation of open-chain compounds (n-butane, 2-fluoroethanol, 1,2-ethanediol, 1,2-difluoroethane) Cyclohexane and monosubstituted and disubstituted cyclohexanes.
5. Spectroscopy
(i) UV Spectroscopy: Types of electronic transitions, chromophore, auxochrome, bathochromic and hypsochromic shift, Woodward-Fieser rule for the calculation of ʎmax conjugated polyenes and carbonyl compounds.
(ii) Infra-red Specroscopy: Factors affecting vibrational frequencies.
(iii) 1HNMR Spectroscopy: Basic principles, chemical shift, spin-spin interaction and

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coupling constant.
Problems based on UV, IR and 1HNMR Spectroscopy of simple organic compounds.

6. Organic Polymers:
Mechanism of polymerization, Polymers of industrial importance (Polyamides, Polyesters, Orlon, PVC, Teflon, SBR, NBR).

7. Carbohydrates
Chemistry of Monosaccharides (Glucose and Fructose), Ring structure of glucose and fructose, Mutarotation, Epimerisation, Amadori rearrangement, Disaccharides (Maltose and Sucrose).

8. Pericyclic Reactions
Classification and examples, Woodward-Hoffmann Rule, Electrocyclic Reactions and Cycloaddition reactions ([2+2] and [4+2] cycloaddition reaction)

9. Heterocyclic Compounds :
Preparations, Aromaticity and Reactions of Pyrrole, Furan and Thiophene.

10. Environmental Chemistry
Air pollutants and their toxic effects, Depletion of Ozone layer, Oxides of nitrogen, Fluorocarbons and their effect on ozone layer, Greenhouse effect, Acid rain.

4. PHYSICS: PAPER-I:

Mechanics, Thermal Physics, Waves & Oscillations and Optics

1. Mechanics: Conservation law, collisions, impact parameter, scattering cross- section, centre of mass and lab systems with transformation of physical quantities, Rutheford Scattering. Motion of a rocket under constant force field. Rotating frames of reference, Coriolis force, Motion of rigid bodies, Dynamics of rotating bodies. Inertia tensor, Moment of inertia, Moment of inertia of sphere, ring cylinder, disc. Angular momentum. Torque and precession of a top. Gyroscope. Central forces, Motion under inverse square law. Kepler's Laws. Motion of Satellites (including geostationary). Elastic constants and their inter-relationship, Galilean Relativity. Special Theory of Relativity. Michelson-Morely Experiment, Lorentz Transformations-addition of velocities. Variation of mass with velocity. Mass- Energy equivalence. Fluid dynamics. Streamline and turbulent flow, Reynold number, Viscosity, Poiseulle's formula for the flow of liquid through narrow tubes, Bernoulli's equation with simple applications.

2. Thermal physics: Laws of thermodynamics, Entropy, Canot's cycle, Isothermal and Adiabatic changes, thermodynamic Potentials, Helmboltz and Gibbs functions. Maxwell's relations. The Clausius-Clapeyron equation, reversible cell, joule-Kelvin effect, Stefan Boltzmann Law, Kinetic Theory of Gasses, Maxwell's Distribution Law of velocities, Equipartition of energy, specific heats of gases, mean free path, Brownian Motion, Black Body radiation, specific heat of solids, Einstein and Debye theories. Weins Law, Planck's Law, solar constant. Saha's theory of thermal ionization and stellar spectra, Production of low temperatures using adiabatic demagnetization and dilution refrigeration. Concept of negative temperature.

3. Waves and Oscillations: Simple harmonic motion, mass, spring and LC circuits. Stationary and progressive waves, Damped harmonic motion, forced oscillation and Resonance, Sharpness of resonance, Wave equation, Harmonic solutions, Plane and Spherical waves, Superposition of waves. Two Prependicular simple harmonic motions. Lissajous figures, fourier analysis of periodic waves-square and triangular waves. Phase and Group velocities, Beats.

4. Optics: Huygen's principle, Division of amplitude and wave front, Fresnel Biprism, Newton's rings, Michelson interferometer, Fabry-Perot inter-ferometer. Diffraction-Fresnel and Fraunhoffer's Diffraction as a Fourier Transformation. Fresnel and Fraunhoffer diffraction by rectangular and circular apertures. Diffraction by straight edge, Single and multiple slits.
Resolving power of grating and optical instruments. Rayleigh crirterion. Polarization, Production and Detection of polarized light (Linear, circular and elliptical) Brewster's law, Huygen's theory of double refraction, optical rotation, polarimeters. Laser sources (Helium-Neon, Ruby and semi conductor diode). Concept of spatial and temporal coherence. Holography, theory and application, Doppler effect.

Physics PAPER-II:

Electricity and Magnetism, Modern physics and Electronics

1. Electricity and Magnetism: Coulomb's Law, Electric Field, Gauss's Law and applications, Electric Potential, Poisson and Laplace equations for homogeneous dielectric, uncharged conducting sphere in a uniform field, point charge and infinite conducting plane. Bio-Savart law and applications. Ampere's circuital law and its applications, Magnetic induction and field strength, Magnetic shell, Magnetic field on the axis of circular coil, Helmholtz coil, Electromagnetic induction, Faraday's and Lenz's law, self and mutual inductances. Current electricity, Kirchoff's laws and its applications; Wheatstone bridge, Kelvin's double bridge, Carey foster's bridge Alternating currents L.C.R. Circuits, series and parallel resonance circuits, quality factor. Maxwell's equations and electromagnetic waves. Transverse nature of electromagnetic waves, Poynting vector Magnetic fields in Matter. Dia, para, Ferro, Antiferro and Ferrimagnetism (Qualitative approach only). Hysteresis.

2. Modern Physics: Bohr's theory of hydrogen atom, Electron spin, Stern-Gerlach experiment and spatial quantization, Vector model of the atom spectral terms, Optical and X-Ray Spectra, fine structure of spectral lines. J-J and L-S coupling Zeeman effect. Pauli's exclusion principle, spectral terms of two equivalent and non-equivalent electrons. Gross and fine structure of electronic band spectra. Raman effect, Photoelectric effect, Compton effect. De-Broglie waves. Wave Particle duality, uncertainty principle, postulates of quantum machanics. Schrodinger wave equation and application. (i) particle in a box. (ii) motion across a step potential, One dimensional harmonic oscillator, eigen values and eigen functions. Radioactivity, Alpha, Beta and Gamma Radiations. Elementary theory of the Alpha Decay. Nuclear binding energy. Mass spectroscopy, semi empirical mass formula. Nuclear fission and fusion. Elementary Reactor Physics, Elementary particles and their classification, strong and weak interactions. Particle accelerators, cyclotron. Linear accelerators. Elementary ideas of superconductivity.

3. Electronics: Classification of solids into conductors, insulators and semiconductors on the basis of energy bands. Intrinsic and extrinsic semiconductors, P.N. junction, Reverse and forward based P.N. junction, Thermistor, Zener diode, solar cell. Use of diodes and transistors for rectification, amplification, oscillation, modulation and detection of r.f. waves. Transistor receiver. Boolean Algebra, Logic Gates and their truth table, some applications, Adder and subtractor.

5. MATHEMATICS: PAPER-I

1 Linear Algebra and Matrix : Vector spaces, Sub Spaces, basis and dimensions, Quotient. space, co-ordinates, linear transformation, rank and nullity of a linear transformation, matrix representation of linear transformation, linear functionals, dual space, transpose of a linear transformation, characteristic values, annihilating polynomials, Cayley-Hamilton theorem, Inner product spaces, Cauchy-Schwarz inequality, Orthogonal vectors, orthogonal complements, orthonormal sets and bases, Bessel's inequality of finite dimensional spaces, Gram-Schmidt orthogonalisation process.
Rank of Matrix, Echelon form, Equivalence, congruence and similarity, Reduction to canonical form, orthogonal, symmetrical, skew-symmetrical, Hermitian and skew-Hermitian matrices, their eigen values, orthogonal and unitary reduction of quadratic and Hermitian form, Positive definite quadratic forms, simultaneous reduction.

2. Calculus : Limits, continuity, differentiability, mean value theorems, Taylor's theorem, indeterminate forms, maxima and minima, tangent and normal, Asymptotes, curvature, envelope and evolute, curve tracing, continuity and differentiability of function of several variables Interchangeability of partial derivatives, Implicit functions theorem, double and tripple integrals. (techniques only), application of Beta and Gamma functions, areas, surface and volumes, centre of gravity.

3. Analytical Geometry of two and three dimensions: General equation of second degree, system of conics, confocal conics, polar equation of conics and its properties. Three dimensional co-ordinates, plane, straight line, sphere, cone and cylinder. Central conicoids, paraboloids, plane section of conicoids, generating lines, confocal conicoids.

4. Ordinary differential equations: Order and Degree of a differential equation, linear, and exact differential equations of first order and first degree, , equations of first order but not of first degree, Singular solutions, Orthogonal trajectories, Higher order linear equations with constant coefficients, Complementary functions and particular integrals.
Second order linear differential equations with variable coefficients: use of known solution to find another, normal form, method of undetermined coefficients method of variation of parameters.

5. Vector and Tensor Analysis: Vector Algebra, Differentiation and integration of vector function of a scalar variable gradient, divergence and curl in cartesian, cylindrical and spherical coordinates and their physical interpretation, Higher order derivates, vector identities and, vector equations, Gauss and stoke's theorems, Curves in Space, curvature and torsion, Serret-Frenet's formulae.
Definition of Tensor, Transformation of coordinates, contravariant and covariant tensors, addition and outer product of tensors. Contraction of tensors, inner product tensor, fundamental tensors, Christoffel symbols, covariant differentiation, gradiant, divergence and curl in tensor notation.

6. Statics and Dynamics: Virtual work, stability of equilibrium. Catenary, Catenary of uniform strength, equilibrium of forces in three dimensions.
Rectilinear motion, simple harmonic motion, velocities and accelerations along radial and transverse directions and along tangential and normal directions, Motion in resisting Medium, constrained motion, motion under impulsive forces, Kepler's laws, orbits under central forces, motion of varying mass.

MATHEMATICS

Paper-II

1. Algebra: Groups, Cyclic groups, subgroups, Cosets of a subgroup, Lagrange's theorem, Normal subgroups, Homomorphism of groups, Factor groups, basic Isomorphism theorems, Permutation groups, Cayley's theorem.
Rings, Subrings, Ideals, Integral domains, Fields of quotients of an integral domain, Euclidean domains, Principal ideal domains, Polynomial rings over a field, Unique factorization domains.

2. Real Analysis : Metric spaces and their topology with special reference to sequence, Convergent sequence, Cauchy sequences, Cauchy's criterion of convergence, infinite series and their convergence, nth term test, series of positive terms, Ratio and root tests, limit comparison tests, logarithmic ratio test, condensation test, Absolute and conditional convergence of general series in R, Abel's Dirichlet's theorems. Uniform convergence of sequences and series of functions over an interval, Weierstrass M-test, Abel's and Dirichlet's tests, continuity of limit function. Term by term integrability and differentiability. Riemann's theory of integration for bounded functions, integrability of continuous functions. Fundamental theorem of calculus. Improper integrals and conditions for their existence, ע — test.

3. Complex Analysis: Analytic functions, Cauchy-Riemann equations, Cauchy's theorem, Cauchy's integral formula, Power series representation of an analytic function. Taylor's series. Laurent's series, Classification of singularities, Cauchy's Residue theorem, Contour integration.

4. Partial Differential Equations: Formation of partial differential equations. Integrals of partial differential equations of first order, Solutions of quasi linear partial differential equations of first order, Charpit's method for non-linear partial differential equations of first order, Linear Partial differential equations of the second order with constant coefficients and their canonical forms, Equation of vibrating string. Heat equation. Laplace equation and their solutions.

5. Mechanics: Generalized co-ordinates, generalized velocities, Holonomic and non-holonomic systems, D'Alembert's principle and Lagrange's equations of motion for holonomic systems in a conservative field, generalized momenta, Hamilton's equations. Moments and products of inertia, Pricipal axes, Moment of inertia about a line with direction cosines (l,m,n), Momental ellipsoid, Motion of rigid bodies in two dimensions.

6. Hydrodynamics: Equation of continuity, Velocity Potential, Stream lines, Path Lines, Momentum and energy.
Inviscid flow theory: Euler's and Bernoulli's equations of motion. Two dimensional fluid motion, Complex potential, Momentum and energy, Sources and Sinks, Doublets and their images with respect line and circle.

7. Numerical Analysis: Solution of algebraic and transcendental equations of one variable by bisection, Regula-Falsi and Newton-Raphson methods and order of their convergence. Interpolation (Newton's and Lagrange's) and Numerical differentiation formula with error terms.
Numerical Integration: Trapezoidal and Simpson's rules.
Numerical solutions of Ordinary differential Equations: Euler's method.
Rune-Kutta method.

6. GEOGRAPHY: PAPER-I

SECTION-A – PHYSICAL GEOGRAPHY

1. Geomophology: Origin and structure of the Earth, Earth movements, Plate tectonics and Mountain Building, Isostasy; Vulcansim; Weathering and Erosion; Cycle of Erosion, Evolution of landforms; fluvial, glacial, aeolion, marine and karst Rejuvenation and Polycyclic Land form features.

2. Climatology: Composition and structure of Atmoshphere, Insolation and Heat Budget Atmospheric pressure and winds; Moisture and Precipitation; Air masses and Fronts Cyclone: Origine, Movements and associated weather; Classification of world climates Koppen and Thomthwaite.

3. Oceanography: Configuration of Ocean floor, Salinity, Ocean Currents, Tides Ocean deposits and coral reefs.

4. Soil and Vegetation: Soils-geneisis; classification and world distribution, Soil-Vegetation Symbiosis; Biotic Communities and Succession.

5. Ecosystem: Concept of Ecosystem, structure and functioning of Ecosystem, Types of Ecosystem; Major Biomes; Man's impact on the Ecosystem and Global Ecological issues.

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SECTION-B – HUMAN GEOGRAPHY

6. Evolution of Geographical Thought: Contributions of Indian, German, French, British and Soviet Geographers; Traditional Paradigms:- Determinism, Possiblism, Regionalishm and Contemporary Paradigms of Geography – positivism and quantitative revolution, models and systems in Geography, Recent trends in geographic thought with special reference to behavioural radical, humanism, post-modernism in Feminism and ecological paradigms.

7. Human Geography: Human habitat in major natural regions; Emergence of Man and Races of Mankind; Cultural evolution and stages; Major cultural realms, Growth and Distribution of population; International migration; Demorgraphic Transition and contemporary population problems.

8. Settlement Geography: Concept of Settlement Geography; Rural settlements – Nature; Origin, Types and patterns; Urban settlements: Origin, Patterns, Processes and consequences, Central place theory; Classification of towns; Hierarchy of Urban Centres, Morphology of Towns; Rural-Urban nexus, Umiand and urban finges; Futuristic trends.

9. Economic Geography: Fundamental concepts; Concepts of Resources: Classification, Conservation and Management; Nature and Types of Agriculture, Agricultural land use; Location theories; World Agricultural Regions; Major crops; Mineral and Power Resources; Occurrence, Reserve, Utilization and Production patterns; World Energy crisis and search for alternatives; Industries- Theories of Industrial location, Major industrial regions; Major Industries- Iron & Steel. Paper, Textiles. Petro- Chemicals, Automobiles, Ship building- their location patterns, International Trade, Trade Blocks, Trade routes; Ports and Global Trade Centres; Globalization and World Economic Development Patterns, Concepts and approaches to Sustainable Development.

10. Political Geography: Concept of Nation and State; Frontiers, Boundaries and Buffer zones; Concepts of Heartland and Rimland; Federalism, Contemporary world Geo-political issues.

GEOGRAPHY: PAPER-II – GEOGRAPHY OF INDIA

SECTION (A) PHYSICAL & HUMAN GEOGRAPHY

1. Physical Features: Geological systems and structure: Relief and drainage, soils and natural vegetation; soil degradation and deforestation, origin and mechanism of Indian Monsoon, climatic region, physiographic region.

2. Wild Life, National Park, Sanctuaries, biospheric reserves, biodiversity hot-spots.

3. Wetland, tourism- resource and economy, natural hazards, disasters and management, environmental issues.

4. Population and Settlements- Distribution and growth, structural characteristics of population, Rural Settlements- types, patterns and morphology, urban settlement- criteria and classification of urban Settlement, hierarchy and umland, Urbanisastion, Urban Policy, Urban Planning, role of Small Towns, Smart City and Smart Village.

5. Political organization: historical perspective on unity and diversity, states reorganization; regional consciousness and national integration, geographical basis of Centre-State relations, International Boundaries of India and related geo-political issues, India and the geopolitics of Indian ocean, India and the SAARC.

SECTION (B) ECONOMIC & REGIONAL GEOGRAPHY

6. Agriculture: Salient Features of Indian Agriculture, problem of wastelands and their reclamation, cropping patterns and intensity, agricultural efficiency and productivity, impact of green revolution, agricultural regions, agro-ecological regions, land holding patterns, land reforms, crop combination regions, modernization of agriculture and agricultural planning.

7. Resources: Distributional patterns, reserves and production trends, complementarity of minerals, energy resources- coal, petroleum, hydro-power, mulitipurpose river valley projects, energy crisis and search for alternatives, marine resources and biotic resources.

8. Industries: Industrial development, major Industries- Iron & Steel, Textiles, Paper, Cement, Fertilizers, Sugar and Petro-Chemicals, Industrial Complexes and regions, industrial policy.

9. Transport and Trade: Railways and Roads networks, problems and prospects of Civil Aviation and Water Transport; Inter-Regional Trade International trade, Major Ports and Trade Centres.

10. Regional Development and Planning: Problems of regional development and planning strategies, multi- level planning, planning regions, planning for Metropolitan, Tribal, Hilly, Drought-prone Regions, Watershed Management, Regional disparities in development, Five Year Plans and planning for sustainable development.

7. Economics: Paper I – Economic Theory

Section-A

1. Equilibrium in Economics, Consumer Behaviour- Cardinal and Ordinal Approaches, Consumer Equilibrium, Price Effect, Law of Demand, Elasticity of Demand and its Types, Consumer's Surplus.
2. Theory of Production: Production Function, Laws of Returns, Producer's Equilibrium, Cost Curves and Revenue Curves.
3. Market Structure: Price Determination under Perfect Competition, Monopoly, Monopolistic Competition, duopoly, oligopoly.
4. Pricing of Factors of production: Wages, Rent, Interest & Profit, Macro Theories of Distribution- Ricardo, Marx, Kaldor.
5. Welfare Economics: Pareto Optimality, Compensation Principle- Kaldor, Hicks, Scitovsky, Social Welfare Function.
6. National Income: Concept, Components and Methods, Theories of Employment, Income and Interest Rate Determination- Classical, Keynesian and Post- Keynesian (IS-LM) Approaches, Theories of Trade Cycles.
7. Money: Quantity Theory of Money-Various Versions (including Don Patinkon, Milton Friedman), Theory of Money Supply, Money Multiplier, Theories of Inflation- Types & Control.
8. Monetary and Banking System: Central Bank, Commercial Banks, Money and Capital Markets- Functions, Creation and Control, Techniques of Monetary Management.

Section-B

1. Measures of Economic Development, Process of Economic Development of Developing Countries- Myrdal & Kuznets.
2. Planning and Economic Development: Changing Role of Planning and Markets, Public-Private Partnership.
3. Theories of Economic Growth- Harrod & Domar Models, Lewis Model of Development, Stages of Growth-Rostow, Balanced & Unbalanced Growth Theories.
4. Human Capital and Economic Growth, Research & Development and Economic Growth, Low Level Equilibrium Trap, Critical Minimum Effort Thesis.
5. Public Finance: Public Goods and Externalities, Public Expenditure- Theories and Effects, Theories of Taxation, Incidence, Impact and Shifting of Taxes, Effects of Taxation.
6. Fiscal policy and Economic Development, Types of Budget Deficits and their Effects on the Economy, Public Debt and its Management.
7. Theories of International Trade- Comparative Advantage, Terms of Trade and Offer Curve, Gains from Trade, Trade as an Engine of Growth.
8. Theories of Exchange Rate Determination, Balance of Payments Adjustment: Alternative Approaches, Free Trade vs. Protection, Tariffs and Quota, Foreign Debt and Debt Management, International Monetary and Trade Institutions.

Economics: Paper II- Indian Economy

Section A

1. Basic Characteristics of Under-development & Indian Economy- National Income and Per Capita Income: Pattern, Trends, Aggregate and Sectoral Composition etc. Income Inequalities and Regional Imbalances in India.
2. Population Growth and Economic Development, Censuses of India, Characteristics of India's Population, Demographic Dividend and Population Policy, Human Resource Development in India. Urbanisation and Economic Development in India, Gender & Development.
3. Infrastructure and Economic Development in India- Recent Strategy & Performance, Urban Infrastructure Development & Private Public Partnership, Energy Sector- Sources of Energy: Conventional and Non- Conventional Energy, Energy Crisis.
4. Natural Resources in India and Economic Development, Ecological Imbalances and Environmental Pollution, Environmental Degradation and Measures to Control.
5. Indian Agriculture : Production and Productivity, Changes in Cropping Pattern, Institutional Reforms in Agriculture, New Agricultural Strategy, Agricultural Credit and Subsidies, Food Processing, Agricultural Price Policy, Food Security, WTO and Indian Agriculture.
6. Industrial Growth and Structure in India: Strategy of Industrialization, Privatization, Disinvestment, MSMEs, Industrial Policy Resolutions and Changes therein, Foreign Capital, Technology and Growth of Indian Industry, Labour Reforms in India.
7. Services Sector & its Development in India- Its Importance & Performance, International Comparisons.

Section B

1. Monetary Institutions of India- RBI, Commercial Banks, Banking & Non-Banking Financial Institutions, Objectives And Techniques of Monetary Policy in India, Role of RBI under New Regime, E-Banking in India.
2. Budgetary Trends and Fiscal Policy in India, Trend of Major Sources of Public Revenue and Public Expenditure of the Union Government & Government of Uttar Pradesh. Various Deficits in the Union Budget and Fiscal Consolidation, Indian Tax Structure, GST in india , FRBM Act, Fiscal Federalism and Centre- State Financial Relations in India.
3. Foreign Trade of India- Volume, Composition & Direction, Balance of Payments Position, Foreign Trade Policy & measures, Convertibility of Rupee, Agri- Export Zones, SEZ etc.
4. Indian Economy & WTO- Issues & Progress. Implications of TRIPs, TRIMs, GATS etc. on Indian Economy, Foreign Capital in India, Fdi (Single Brand & Multi Brand), FII etc. Make in India, Start Ups Programmes.
5. Economic Planning in India Rationale, Performance and Evaluation, Decentralized Planning, NITI Aayog: Its Functions & Working, Relation between Planning & Market for Growth and Development, Swadeshi Approach.
6. Rural Development and Transformation in India- Various Programmes, MGNREGA, Skill Development Programme: Mission & Achievements.
7. New Economic Policy-Second Generation Reforms, Poverty & Unemployment Nexus in India, Poverty Alleviation Programmes, Rural Wages and Rural Employment, Progress of Economic Reforms in India, Recent Initiatives by the Union Government.

8. SOCIOLOGY: PAPER-I

GENERAL SOCIOLOGY (SECTION-A)

1. Fundamentals of Sociology and Study of Social Phenomena : Emergence of Sociology, its nature and scope. Methods of study; Problems of objectivity and issues of measurement in Social Science; Sampling and its types: Research Design: Descriptive, Exploratory and Experimental, Techniques of data collection: Observation, Interview schedule and questionnaire. 2. Theoretical Perspectives- Functionalism: Redcliffe Brown, Malinowski and Merton, Conflict Theory: Karl Marx, Ralf Dahrendorf and Lewis Coser. Symbolic Interactionism: C.H. Cooley, G.H. Mead and Herbert Blumer, Structuralism: Levi Strauss, S.F. Nadel, Parsons and Merton. 3. Pioneers In Sociology; A Comte-Positivism and Hierarchy of Sciences. H Spencer – Organic analogy and the doctrine of evolution. K. Marx- Dialectical materialism and alienation. E. Durkheim-Division of labour, Sociology of religion, Max Weber-Social action and ideal type. 4. Social Stratification and Differentiation: Concept, Theories of Stratification: Marx, Weber, Davis and Moore, Forms of stratification, Caste and Class. Status and Role, Social Mobilities: types, Occupational Mobility, intra-Generational and inter-Generational Mobilities.

SECTION-B

5. Marriage, Family and Kinship: Types and forms of marriage, impact of social legislation on Marriage, Family: Structure and functions; Changing patterns of family; Family decent and kinship: Marriage and sex roles in modern society. 6. Social Change and Development: Concept, Theories and Factors of Social Change, Social movement and change. State intervention. Social policy and development programme, Strategies of rural transformation: Community development programme. I.R.D.P., TRYSEM and Jawahar Rojgar Yojana, Inclusive and sustainable Development. 7. Economic and Political System: Concept of property, Social dimensions of division of labour. Types of exchange. Industrialisation, Urbanisation and Social Development, Nature of Power: Personal and Community, Elite, Class. Modes of political participation-Democratic and Authoritarian. 8. Religion, Science and Technology: Concept, Role and religious belief in traditional and modern societies. Ethos of science, Social responsibility and control of science; Social consequences of science and technology. 9. Population and Society: Population size, Trends, Composition, Growth by Migration, population Problems in India, Population Education.

SOCIOLOGY: PAPER-II

Indian Social System (Section-A)

1. Bases of Indian Society: Traditional Indian Social Organisation: Dharma, Doctrine of Karma. Ashram Vyavastha, Purushartha and Sanskars; Socio-Cultural Dynamics: impact of Buddhism, Islam and the west. Factors responsible for continuity and change. **2. Social Stratification:** Caste system: Origin, Structural and Cultural views. Changing patterns of Caste; Caste and class: Issues of equality and social justice; - Agrarian and industrial Class structure in India, Emergence of middle classes. Classes among the Tribes, Emergence and growth of Dalit consciousness. **3. Marriage Family and Kinship:** Marriage among different ethnic groups and its changing trends and future; **Family:** it's structural and functional aspects and their Changing Pattern, Impact of legislations and socio-economic changes on marriage and family, **Kinship:** Regional variations in kinship system and its changing aspects. **4. Economic and Political System:** Jajmani System, land tenure system, Social and economic consequences of land reforms, liberalization and globalization; Social Determinats of economic development, Green revolution, functioning of democraitic political system. Political parties and their compostion,

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Structural change and orientation among political elites, Decentralisation of power and political participation, Political implications of development. 5. Education and Society: Dimensions of education in traditional and modern societies, Educational inequalities and change; Education and social mobility. Problems of education among the weaker sections of society.

SECTION-B

6. Tribal, Rural and Urban Social Organisation: Distinctive features of tribal communities and their distribution; Tribe and caste, Processes of change: Acculturation, Assimilation and integration. Problems of tribals: social identity, Socio-cultural dimensions of village community; traditional power structure, Democratisation and leadership, Community development programme and Panchayti Raj, New strategies for rural transformation, change in Kinship, caste and occupation in urban areas. Class structure and mobility in urban community; Ethnic diversity and community intergration, urban neighbourhood, rural urban differences, Demographic and socio-cultural practices. **7. Religion and Society:** Size, Growth and Regional distribution of different religious groups; inter religious interaction and its manifestations, Problems of conversion, Community tensions, Secularism, Minority status and religious fundamentalism. **8. Population Dynamics:** Socio-cultrual aspects of sex, Age, Marital status, Feritility and mortality. Socio-psychological, cultural and economic problems of population explosion, Population policy and family welfare programme; Determinants of population growth. **9. Women and Society:** Demographic profile of women, Changes in their status; Special problems-dowry, atrocities, discrimination; welfare programmes for women & children, Domestic Violence Act–2005, Sexual Harassment at Workplace- 2013. **10. Dimensions of Change and Development:** Social change and Indices of modernisation, Sources of social change: Endogenous and Exogenous, Processes of Social Change: Sanskritisation, Westernisation, Secularisation and Modernisation, Agents of change: Mass Media, Education and communication, problems of modernization and planned change, Strategy and ideology of planning. Five year plans. Poverty alleviation programme; Environment, Unemployment and programme for Urban Development; social movement with special reference to Social reform, peasant, Backward Classes, Women and Dalit Movements.

9. PHILOSOPHY: PAPER-I (History and Problems of Philosophy)

(SECTION-A)

1. Plato: Theory of ideas 2. Aristotle : Form, matter and Causation. 3. Descartes: Method, soul, God, Mind-Body dualism. 4. Spinoza : Substance, Attributes and Modes, Pantheism. 5. Leibnitz: Monads, God. 6. Locke : Theory of knowledge, Rejection of Innate ideas, Substance and Qualities. 7. Berkeley : Refutation of Abstract Idea, Refutation of Matter, Refutation of the distinction between Primary and Secondary Qualities, Idealism. 8. Hume: Theory of knowledge, Scepticism, Self, Causality. 9. Kant: Apriori and Aposteriori Knowledge, Analytic and Synthetic Judgements, possibility of Synthetic Apriori Judgement, Space, Time, Categories, Ideas of Reason, Criticism of the proofs for the existence of God 10. Hegel: Dialectical Method, Absolute Idealism. 11 (a) Moore: Defence of Common sense, Refutation of Idealism. 11 (b) Russell : Theory of Descriptions, Incomplete Symbols, Logical Atomism : Atomic Facts. 12. Wittgenstein: Elementary Propositions, Picture Theory of Meaning, Distinction of Saying and Showing. 13. Logical Positivism : Verification Theory, Rejection of Metaphysics, Linguistic Theory of Necessary Propositions. 14. Phenomenology : Husserl Phenomological Method, Intentionality of Consciousness. 15. Existentialism: (Kiecrkegaard and Sartre)- Existence and Essence, Freedom and Choice, Responsibility and Authenitc Existence. 16. Quine : Radical Translation. 17. Strawson : Theory of Person.

(SECTION-B)

1. Carvaka: Theory of knowledge, Materialism. 2. Jainism : Theory of Reality. Syadvada and Saptabhanginaya Bondage and Liberation. 3. Buddhism : Pratityasamutpada, Ksanikavada, Nairatmyavada, Schools of Budhism. 4. Sankhya-Yoga : Prakriti, Purusa, Theory of Causation, Liberation, Ashtanga-yoga, Cittabhumi, Ishvara. 5. Nyaya- Vaisesika : Pramanas, Self, Liberation, Nature of God and proofs for existence of God, Categories, Theory of causation, Atomism. 6. Mimamsa : Theory of Knowledge, Prama, Pramanas, Svatahpramanyavada, 7. Vedanta : Sankara, Ramauja and Madhva (Brahma, Isvara, Atma, Jiva, Jagata, Maya, Avidya, Adhyasa, Moksha).

Pholisophy : PAPER-II (Socio Political Pholisophy and Philosophy of Religion)

(SECTION-A)

1. Social and Political Ideals: Equality, Justice, Liberty **2.** Sovereignty **3.** Individual and State **4.** Democracy: Concept and forms **5.** Socialism and Marxism **6.** Humanism **7.** Secularism **8.** Multiculturalism **9**. Theories of Punishment **10.** Violence, Non-violence, Sarvodaya **11.** Gender-Equality **12.** Scientific Temper and Progress **13.** Philosophy of Ecology.

SECTION-B

1. Religion : Theology and Philosophy of Religion. **2.** Religion and Morality **3.** Notions of God; Personalistic, Impersonalistic, Natuaralistic. **4.** Proofs for the existence of God. **5.** Immoratility of Soul **6.** Liberation **7.** Religious Knowledge; Reason, Revelation and Mysticism **8.** Religion without God **9.** Problem of Evil **10.** Religious Tolerance.

10. GEOLOGY: PAPER-I

General Geology, Geomorphology, Structural Geology, Palaeontology and Stratigraphy.

(i) General Geology: Origin of the Universe Planets of the Solar System. Interior of the Earth. Dating of rocks by various methods and Age of the Earth, Volcanoes: their types, causes and products, volcanic belts. Earthquakes: causes, effects and distribution. Island Arcs, Deep Sea trenches and Mid- Oceanic Ridges. Continental drift, Sea-floor spreading and Plate Tectonics. Origin of Continents and Oceans.

(ii) Geomorphology: Weathering and Erosion Geomorphic processes, Geomorphic cycles. Topography and its relation to structures and Lithology. Drainage patterns and their significance. Geomorphic features of India. Aeolian, Fluvial, Glacial, Coastal and Karst processes and landforms.

(iii) Structural Geology: Concept of Stress and strain, strain markers, Strain in 2- and 3-dimensions and their significance. Geometry and classification of Folds, Faults, joints. Types and significance of Unconformities, Linear and Planar structures, and their significance. Major Tectonic features of India.

(iv) Palaeontology: Micro- and mega-fossils, Index fossils, Derived fossils and their significance, Modes of preservation of fossils. Morphology, evolutionary trends and Geological distribution of Bivalves, Gastropods, Ammonoids, Brachiopods, Trilobites, Echinoids and Corals. Vertebrate life through ages. Evolution of Horse and Elephant, Gondwana flora and their palaeontogical significance.

(v) Stratigraphy: Principles of Stratigraphy, stratigraphic classification, Nomenclature, Geological Time scale. Study of geological systems of India in terms of Lithology, distribution, fossil contents and economic importance (Dharvar Supergroup, Cuddapah Supergroup, Vindhyan Supergroup, Gondwana Supergroup, Deccan Traps, Siwalik Supergroup).

GEOLOGY: PAPER-II

Crystallography, Mineralogy, Petrology, Economic Geology and Applied Geology

(i) Crystallography: Crystalline and Non-Crystalline Solids, Space Groups, Space Lattice, Classification of Crystais in 32 classes of symmetry, Miller, Weiss Notations and Harman Mauguin symbols, Axial character, Symmetry elements and forms present in the Normal class of Cubic, Tetragonal, Hexagonal, Orthorhombic, Monoclinic and Triclinic Systems, Twinning and Twin laws, Crystal defects, Applications of X-ray diffraction techniques in crystallography.

(ii) Optical Mineralogy: General principles of optics, Isotropism and anisotropism, Properties of Minerals in Plane polarized light and between crossed polars, Concepts of optical indicatrix. Dispersion in minerals.

(iii) Mineralogy: Elements of Crystal chemistry, Types of bondings, ionic radii, coordination number, isomorphism, polymorphism and pseudomorphism, Structural classification of silicates, Physical, chemical, and optical properties of rock- forming minerals (Olivien Pyroxene, Amphiboles, Feldspars, Feldspathoids, Silica, Garnets, Mica and Alumino- silicate group).

(iv) Petrology : Magma its generation and physical properties one, two and three component phase diagrams (Silica, Albite-Anorthilte, Periclase- Silica, Diopside- Albite-Anorthite systems) and their significance. Bowen's Reaction Principle, magmatic differentiation and assimilation. Texture, structure and classification of igneous rocks. Petrology of some igneous rocks (Granite, Basalts, Alkaline rocks, Ultramafic rocks, Anorthote and Chamockites) with Indian examples. Process of formation of sedimentary rocks, Diagenesis and lithification. Textures and structures of sedimentary rocks and their significance. Classification of sedimentary rocks (clastic and non-clastic). Heavy minarals and their significance, Elementary concepts of depositional environments, Sedimentry facies and provenance. Petrography of important sedimentary rocks (Conglomerate, Breccia, Sandstone Greywacke, shale, Limestone and B.H.Q.). Wentworht's Scale. Metamorphic processes and types of metamorphism. Metamorphic grades, zones and facies, ACF, AKF and AFM diagrams. Texture, structures and nomenclature of metamorphic rocks, Anatexis. Petrography and petrogenesis of important metamorphic rocks. Description of Zeolite, Greenschist, Amphibolite Granulite and Eclogite Facies Rocks.

(v) Economic Geology: Ore Mineral, Gangue and Tenor. Processes of formation of mineral deposits. Common forms and structures of ore bodies, Classification of ore deposits. Control of ore localization. Metallogeny. Study of important metallic and non-metallic mineral deposits. Oil and natural gas deposits, and Coal fields of India, Mineral resources of Uttar Pradesh. Mineral economics. National Mineral Policy. Conservation and utilization of minerals.

(vi) Applied Geology: Essentials of prospecting and Exploration techniques. Principal methods of Mining. Sampling, Mineral beneficiation. Geological considerations in Engineering works, Dams, Tunnels, Bridges and Roads. Elements of Soil and Groundwater Geology. Use of Aerial Photographs and Satellite imageries in geological investigations.

11. PSYCHOLOGY: PAPER - I

BASIC PSYCHOLOGICAL PROCESSES

1. Psychology: Introduction: Overview of the subject matter, Place of psychology in science, Theoretical approaches: S-R humanisitic, Cognitive, information processing,

2. Methods: methods of data collection Natural observation, Interview, Case study, Tests, scales and Questionnaires.

3. Biological bases of behavior: Outline of central, peripheral and autonomic nervous systems, Localization of functions in the brain, hemispheric specificity, nerve impulse and its conduction, receptor system, Endocrine system and its role in physical growth and personality make up.

4. Origin and development of behavior: Genetic bases, Evironmental factors, child rearing, deprivation, cultural factors, Motor and skill development, language development.

5. Attention and Perceptual Processes: Classical psychophysics and signal detection theory. Attentional processes, selective Attention and sustained attention, Perceptual organization, Perception of form, colour and depth. Perceptual- constancy, the stability-instability paradox, Perceptual sensitivity and perceptual defence.

6. Learning Processes: Conditioning: Classical instrumental and observational, Verbal learning, Methods and Processes, extinction, discrimination and generalization.

7. Memory: Encoding; structural, phonological and semantic dual encoding, Sensory memory, STM, LTM including episodic, semantic and procedural , Constructive Memory, Theories of forgetting.

8. Problem Solving, Reasoning and Thinking: Process and determinants of problem solving, Inductive, and deductive reasoning, hypothesis testing, Language and thought; Whorfian view- point and its critique, Information processing in thinking.

9. Emotions : Nature and development, Theories of emotion; physiological, cognitive and opponent- process, Indicators of emotion, recognition of emotion.

10. Motivation: Criteria of motivated Behaviour, Motivation: Processes and Types, Measurement of motivation, Extrinsic versus intrinsic motivation.

11. Individual differences in psychological functions: General mental ability, theoretical approaches: Spearman, Thurstone, Guilford, Jensen, Vernon, Sternberg, J.P Das and Piaget, Creativity and creative thinking.

PSYCHOLOGY- PAPER-II

Psychology In the Applied Settings

1. Psychology as an Applied Science: Applied versus basic science, Nature and fields of psychology, social community, industry, school, health and environment.

2. Individual Differences and Measurement: Nature and sources of individual differences, Psychological scaling, test construction and standardization, Reliability and validity, Norms, Cross-Validation.

3. Assessment of Personality: Issues in personality assessment, self-report measures projective techniques, response styles; familiarity with important personality measures like TAT. Rorschach and MMPI.

4. Psychological Disorders and Mental Health: Classification of Psychological disorders (DSM-IV), symptoms and etiology of psychoneurotic, psychotic and psychosomatic disorders; coping with stress and mental health.

5. Social Problems and Psychology: Attitude and Prejudice, Cognitive and Motivational Roots, Reducing Social Prejudice, Social Conflicts; Causes and Resolution.

6. Social Influence: Influence, control and power, Basis of influence; Social facilitation, Ledership in group, Group factors in performance.

7. Psychology in Industry and Organisation: personnel selection, Training and Performance Appraisal, job attitudes and job behavior, Motivational patterns in organizations, Organisational communication, organisational effectiveness.

8. Psychology In School Setting: School as an agent to socialization; learning; motivational and emotional problems of school children, factors influencing academic achievement; interventions for improving school performance, Education of specific categories of children.

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9. Psychology In the Clinical setting: Nature and goals of Psychotherapy, Psychoanalytic persens- centered therapy, group and behavior therapies, community mental health, IIIness prevention and Health promotion .

10. Environmental Psychology: Role of environment in behavior, personal space, effects of noise pollution, crowd and atmoshpheric pollution , Interventions for reducing adverse impacts.

12. BOTANY: PAPER-I

Microbiology, Pathology, Plant Diversity, Morphogenesis

Microbiology: Microbial diversity elementary idea of Microbiology of Air, Water and Soil, a general-account of Microbial infection and immunity, application of Microbiology with reference to Agriculture, Industry Medicine and Environment.

Plant Pathology: Mode of infection, defence mechanism, control of plant diseases, Important plant diseases caused by viruses, bacteria, fungi and nematodes with special relerence to tobacco mosaic, leaf curl of papaya, cirtrus canker, rust of wheat, smut of barley, late blight of potato, red rot of sugarcane, ear cockle of wheat, ergot of bajara, stem gall of coriander and wilt of arhar.

Plant Diversity: Classification, structure, reproduction, life cycles and economic importance of viruses, bacteria, algae, fungi, bryophytes, pteridophytes and gymnosperms including fossils.

Morphology: Morphology of root, stem, leaf, flower and fruits, secondary growth.

Embryology: Microsporogenesis and male gametophyte, megasporogenesis and female gametophyte, fertilization, embryo and endosperm development.

Taxonomy: Principles of taxonomy, systems of classification of angiosperms (Bentham and Hooker, Takhtajan), rules of botanical nomenclature, chemotaxonomy distinguishing features of families- Ranunculaceae, Magnoliaceae, Brassicaceae, Malvaceae, Fabaceae, Rosaceae, Apiaceae, Cucurbitaceae, Asteraceae, Rubiaceae Apocyanaceae, Solanaceae, Acanthaceae, Varbenaceae, Lamiaceae Euphorbiaceae, Arecaceae, Orchidaceae, Poasceae.

Morphogenesis: Correlation, Polarity, Symmetry, totipotency, differentation and regeneration of tissues and organs; methods and applications of cell tissue, organ and protoplast cultures, somaclonal variations, somatic hybrid and cybrids.

BOTANY: PAPER-II

Cell Biology, Genetics, Physiology, Biochemistry, Ecology and Economic Botony

Cell Biology: Cell as structural and functional unit of life, Ultra structure of eucaryotic and prokaryotic cells, structure and functions of plasma membrane, endoplasmic reticulum, chloroplasts, mitochondria, ribosomes, golgibodies, and nucleolus: Cell cycle, mitosis and meiosis, Chromosomal morphology and chemistry, numerical and structural changes in chromosomes and their cytological and genetical effects.

Genetics: Mendel's Law of inheritance, interaction of genes, linkage and crossing over, genetic recombination in fungi, cyanobacteria, bacteria and viruses, gene mapping, sex linkage, determination of sex, cytoplasmic inheritance of plastid; gene concept, genetic code.

Moleculr Genetics: Moleculr genetics-DNA as genetic material. Structure and replication of DNA, role of nucleic acids in protein synthesis (transcription and translation) and regulation of gene expression, mutation and evolution, DNA damage and repair, gene amplification, gene rearrangement, oncogene, genetic engineering- restriction enzyme, cloning vectors (pBR 322, PTi lambda phage), gene transfer, recombinant DNA, application of genetic engineering in human welfare,

Physiology and Biochemistry: Water relations of plants, absorption, conduction of water and transpiration; mineral nutrition and ion transport, translocation of phyotosynthates, essential micro- and macroelements and their function, chemistry and classification of carbohydrates; photosynthesis-mechanism, factors affecting photosynthesis, C3 and C4 carbon fixation cycle, photorespiration; plant respiration and fermentation, enzymes and coenzymes, mechanism of enzyme action: secondary metabolites (alkaloids, steroids, terpenes, lipids), nitrogen fixation and nitrogen metabolism, structure of protein and its synthesis:

Plant Growth: Plant growth-growth, Movements and senescence, growth hormones and growth regulators their structure, role and importance in agriculture and horticulture; physiology of flowering, sexual incompatibility, seed germination and dormancy.

Ecology: Scope of ecology, ecological factors, plant communities and plant succession, concept of biosphere, ecosystem-structure and functions, abiotic and biotic components, flow of energy in the ecosystem, applied aspects of ecology, natural resources and their conservation, endangered, threatened and endemic taxa, pollution and its control.

Economic Botany: Plants as sources of food, fibre, timber, drugs, rubber, beverage, spices, resin and gums, dyes, essential oils, pesticides and biofertilizers, ornamental plants, energy plantation and petrocrops.

13. LAW: PAPER-I

Part-A (Constitutional Law and Administrative Law)

1. Constitution: Constitutional Law, Constitutional Conventions; Constitutionalism

2. Salient features of Indian Constitution and its Nature.

3. Federalism: Presidential and Parliamentary form of Government; Separation of Powers; Rule of Law.

4. Fundamental Rights: Nature and its relationship with Directive Principles of State Policy and Fundamental Duties, Fundamental Rights and Human Rights with special reference to Right to equality, Right to Speech and expression, Right to life and personal liberty, Religious, Cultural and Educational Right, Right to Constitutional remedies, Right to information, Right to Free and Compulsory Education and Right of women and children.

5. Constitutional Position of the President and relations with the Council of Ministers. Consitutional position of Governor and their powers.

6. The Supreme Court and High Courts: their powers and jurisdiction; Public Interest Litigation.

7. Distribution of Legislative powers between the Union and States, Administrative and financial relations between Union, States and Local Bodies

8. Principles of Natural Justice: Emerging trends and judicial approach

9. Delegated legislation: Its Consitutionality and judicial and legislative controls

10. Services under the Union and States: Recruitment, conditions of service and Constitutional safe guard; Union Public Service Commission and State Public Service Commission; Powers and Functions

11. Emergency Provisions

12. Election Commission: Power and Functions

13. Parliamentary Privileges and Immunities

14. Amendment of the Constitution

15. Ombudsman: Lok Pal, Lok Ayukt etc.

Part- B (International Law)

1. Nature of International Law

2. Source: Treaty, Custom, General principles of law recognized by civilized nations, subsidiary means for the determination of law

3. Relationship between International Law and Municipal Law, Provisions in Indian Constitution for promotion of International peace and Security and Legislation for giving effect to International agreements

4. State Recognition and State Succession

5. Territory of States: modes of acquisition and loss of territory

6. Sea: Inland waters; Territorial Sea; Contiguous Zone; Continental Shelf; Exclusive Economic Zone and Ocean beyond national jurisdiction

7. Air space and aerial navigation

8. Outer space: Exploration and use of outer space

9. Individuals: Nationality, Statelessness, Fundamental principles of International humanterian Law- International conventions and contemprorary development, Human Rights and its enforcement in Municipal Law: National Human Rights Commission.

10. Jurisdiction of States: basis of jurisdiction and immunity from jurisdiction

11. Extradition and Asylum

12. Diplomatic and Consular Agents

13. Treaties: Formation, application and termination

14. State Responsibility

15. United Nations: Purposes and principles; principal organs and their powers and functions

16. Peaceful means for settlement of International disputes

17. Lawful recourse to force: aggression, self-defence and interventions

18. Legality of the use of Nuclear Weapons; Ban on testing of Nuclear and Chemical Weapons; Nuclear Non-proliferation Treaty, CTST.

19. International Terrorism, State sponsored terrorism, International criminal Court

20. New International Economic order and Monetary Law: WTO, TRIPS, GATT, IMF and World Bank.

Law PAPER-II

1-A- LAW OF CRIMES: (a) Concept of Crimes, Elements, Preparations, and attempt to commit crime. (b) (1) Indian Penal Code, 1860

i. General exceptions
ii. Joint and Constructive liability
iii. Abetment
iv. Criminal conspiracy.
v. Offences against the state
vi. Offences against Public Tranquility
vii. Offences against Human Body
viii. Offences against Property
ix. Offences against Women
x. Defamation
xi. Protection of Civil Rights Act, 1955
xii. Prevention of Corruption Act, 1988

B. LAW OF TORTS:

i. Nature of tortious liability
ii. Liability based upon fault and strict liability
iii. Statutory liability
iv. Vicarious liability including State liability
v. General Defences
vi. Joint tort feasors
vii. Negligence
viii. Remedies.
ix. Defamation
x. Nuisance
xi. Conspiracy
xii. False imprisonment and malicious prosecution.

C. Law of Contracts and Mercantile Law:

i. Nature and formation of contract / E- contract
ii. Standard form of Contract
iii. Factors vitiating consent
iv. Void, Voidable, illegal and unenforceable contracts
v. Performance of contracts.
vi. Dissolution of contractual obligations
vii. Frustration of contracts
viii. Quasi contracts
ix. Remedies for breach of contract
x. Contract Indemnity, Guarantee and Insurance
xi. Contract of Agency,
xii. Sale of Goods and hire purchase
xiii. Formation, Liability and Dissolution of Partnership
xiv. Negotiable Instruments Act 1881

D. Contemporary Legal Developments:

i. Concept of Public Interest Litigation and Environmental Law
ii. Right to Information Act-2005
iii. Alternative Disputes Resolution- Concept, Types and Prospect
iv. Aims, objectives and Salient features of the competition Law 2002
v. Doctrine of Plea bargaining
vi. Offences under the Information and Technology Act, 2000 specially Civil Liability (Sections 43 to 64) and Criminal Liability (Section 65 to 75).

14. ANIMAL HUSBANDARY AND VETERINARY SCIENCE

PAPER-I

SECTION-A

A. Animal Nutrition: Digestion of feed in ruminants and nonruminants Nutrient requirements for milk production. Nutrient and their functions in Animal body. Classification of feed stuffs, feeding standards, Principles of rationing and computation of balance ration, Conservation of fooder as silage and hay, treatment of poor quality roughages, Role of enzymes in digestion, minerals in feeds, sources, deficiency symptom, function, Vitamins: sources, function and deficiency syndrome. Role of Harmones in production and reproduction, Metabolism of carbohydrates, proteins and lipids, Feed supplements and feed additive- function and deficiency syndrome. Use of Probiotics and Prebiotics in dairy animals and poultry nutritions; Digestion trials, feeding of animals under stress conditions, feeding of calves, heifers, Bulf and cows/buffaloes before and after parturition. Interrelationship of vitamins with mineral, Evaluation of energy and protein-proximate analysis of feeds. Requirement and formulation of feeds for layers and broilers.

B. Animal Physiology and Environmental Physiology: Adoption, Mechanism of acclemetization, growth, measures of growth, methods of controlling, stress due to temperature during winter and summer. Animal digestions and absorption of carbohydrates, protein and fats in ruminents and nonruminents. Male and female reproductive organ and function, physiology of milk secretion, ejection, holdup of milk.

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Spermatogenisms and oogenesis, collection of semen. Evalutation, dilution and preservative. Deep frozen semen, semen dilutors. A.I. methods, hormonal control of memory glance, effect of heat stress on production, reproduction, meat quality, Parturition, distokia, retention of placenta.

SECTION-B

A. LIVESTOCK PRODUCTION AND MANAGEMENT: Comparison of Dairy Farming in India with developed countries. Dairying, commercial Dairy farming, under mixed and specialized system, starting an organization of dairy farming, procurement of goods in dairy farming. Factors determing the efficiency of dairy animals, herd recording, budgeting, Pricing policy, Personnel Management. Houseing of dairy animal and poultry, Management of livestock- dairy calves, heifers, milks, stud, bulf, Maintenance of records. Milking system- method and principles, clean milk production, economics of dairy and poultry farming. General problems of cattle, sheep, goat, pigs and poultry management. Gokul Mission, N.D.P. Package of common management practices for dairy, cost of milk production and posture management.

B. Milk and Milk products Technology: procurement and transportation of milk. Reception and Quality testing of milk, Definition, composition and food value of milk. Physico-Chemical properties of milk. Chilling, filteration, clarification, separation and standardization of milk. Homogenization, pasteurization and sterilization of milk. Packaging and distribution of milk. Defects in milk, their causes and prevention, Toned milk, standardized milk, Toned milk, double toned milk, reconstituted milk, recombined milk, flavoured milk and filled milk. Cleaning and sanitization of dairy equipments. Culture and its propogation. Preparation, packaging, yield and composition of Khoa, Chhena, Paneer, Dahi, Lassi, Srikhand and Kulfi. Manufacturing and grading of Ghee. Production and quality testing of Icecream, Butter, Cheese, Condensed, Evaporated and Dry Milk. BIS and FSSAI, Standards of Milk and Milk Products. Utilization of Dairy by-products- whey, buttermilk, skim milk.

ANIMAL HUSBANDARY AND VETERINARY SCIENCE

PAPER-II

SECTION-A

a. General Genetics and Animal Breeding: Role of livestock in National Economy, relationship of plant with Animal. Livestock and milk production statistics, heredity and variation, Mendal's Law of inheritance, sex linked, sex influenced and sex limited heredity. Mutation. Cytoplasmic inheritance, conservation of germ plasm, breeds of cattle, buffaloes, goats, sheep, pig and poultry. Coefficient of relationship, Inbreeding Coefficient, methods of selection, selection index. Method and system of breeding, collection, evaluation, dilution and preservation of semen. Methods of A.I. Gene and Genolipic frequency. Hardy weinberg law; population versus individual gene and Genotipic frequency, Qualitative and quantitative traits.

b. ANIMAL HEALTH AND HYGIENE: Anatomy of ox and fowl, Histological techniques, freezing, paraffining embedding of tissues, storing and preparation of blood film, Histological stain ed embryology of cow. Physiology of blood and its; circulation, digestion, respiration, excretion: endocrine gland in health and diseases. General Veterinary hygiene with respect of water, air and habitate.

SECTION-B

c. ANIMAL DISEASES: Immunity and vaccination, Principles and methods of Immunization, classification of diseases, diseases of cattle, buffalo, sheep and goat. Etiology, symptoms and diagnosis, treatment, prevention, and control of various disease, like Anthrax, H.S., B.Q., Mastits. T.B., Johnes disease, food and mouth disease, Rinder pest, cow pox, Faciolopsis, Actinobacilosis, Actinomycosis, Trypanosomiasis, Pyroplasmosis, Trichomoniasis, Anaplasmosis, Milk fever. Tympanitis, Naval ill, Diseases of poultry- Etiology, symptoms, diagnosis, treatment prevention and control of various disease, Ranikhet, Fowlpox, Fowltyphyd Pullorum disease, Coxidiosis, Aviam Leusocis complex. Disease of Swine: Swine fever Hogeholera, Manz.

d. VETERINARY PUBLIC HEALTH: Zoonosis, Classification definition, role of animals and birds in transmission of zoonotic disease, Veterinary Jurisprudence – Rules and regulations for improvement of animals and animals product and prevention of animal diseases, Materials and methods for collection of samples for veterolegal, investigation. Duties and role of veterinarian in slaughter houses to provide meat under hygienic condition. By-products of Slaughter Houses and their economic utilization.

e. EXTENSION: Basic philosophy, objectives, concept and principles of extension, methods adopted to educate farmers under rural conditions, Transfer of technology and its feed back Problems and constraints in transfer of technology in animal husbandry programmes for rural development.

15. Statistics: Paper-I

Probability theory and statistical Application

Group – A- PROBABILITY THEORY : Sample space and events, Classical and Axiomatic Definitions of probability, Laws of total probability, Conditional Probability, Independence of Events, Theorem of Compound Probability Bayes. Theorem and its Applications. Random Variable Discrete and Continuous. Distribution Function; Elementary Properties of Distribution Function, Bivariate Distribution and associated Marginal and Conditional Distributions. Mathematical Expectation and Conditional Expectation, Moments, Moment Generating and Characteristic Functions. Markov and Chebyshev Inequalities, Convergence in probability, Weak Law of Large Numbers and Central Limit Theorem for independently and Identically Distributed Random Variables, Some Standard Discrete and Continuous Distributions, Viz, Bionomial, Poisson, Hypergeometric, Geometric Negative Bionomial, Multinomial, Uniform, Normal, Exponential, Gamma, Beta and Cauchy Bivariate Normal Distribution.

GROUP-B, STATISTICAL APPLICATIONS: Method of least Squares Correlation and Linear Regression, Product Moment correlation, Rank Correlation, Intra-Class Correlation and Correlation Ratio, Partial and Multiple correlation and Regression for Three Variables. One- Way and Two-Way Analysis of Variance with equal number of Observations per Cell Design of Experiments-Basic Principles of Design of Experiment, Completely Randomized Design, Randomized Block Design, Latin Square Design, 2^2 and 2^3 Factorial Experiments, Missing Plot Technique Sources of Demographic Data, Stable and Stationary Populations, Measures of Fertility and Mortality, Life Tables, Simple Population Growth Models. Index Numbers and Their Uses, Index Numbers due to laspeyre, Paasche, Marshall- Edgeworth and Fisher, Tests for Index Numbers, Construction of Price Index Number and Cost of Living Index Number. Time- Series and its Components, Determination of Trend and Seasonal Indices, Periodogram and Correlogram Analysis, Variate Difference Method.

STATISTICS: PAPER-II

STATISTICAL INFERENCE AND MANAGEMENT

GROUP-A-STATISTICAL INFERENCE: Properties of Estimators, Consistency, Unbiasedness, Efficiency, Sufficiency, Cramer-Rao Inequality for Minimum Variance Unbased Estimator, Rao-Blackwell Theorem. Estimation Procedures, Method of Moments and Method of Maximum Likelihood, Interval Estimation Simple and Composite Hypotheses, Two Kinds of Errors, Critical Region, Level of Significance size and Power Function, Unbiased Tests, Most- Powerful and Uniformly Most Powerful Tests, Neyman-Pearson Lemma and its Application, Likelihood Ratio Test. Tests based on t, Chi-Squiare, z and F-distributions. Large Sample Tests. Distributions of order Statistics and Range, Non-Parametric Tests, Viz… Sign Test, Median Test, Run Test, Wilcoxon-Mann - Whitney Test.

GROUP-B-STATISTICAL MANAGEMENT: Nature of Operations Research Problems, Linear Programming Problem and the Graphical Solution in simple Cases, Simplex method, Dual of Linear Programming Problem Assignment and Transportation Problems, Zero sum two-person game, Pure and Mixed Strategies, Value of a Game. Fundamental Theorem, Solution of 2x2 Games, Nature and Scope of Sample Survey, Sampling Vs. Complete Enumeration, Simple Random Sampling from Finite Populations with and without Replacement, Stratified Sampling and Allocation Principles, Cluster Sampling with Equal Cluster Size. Ratio, Product and Regression Methods of Estimation and Double Sampling, Two Stage Sampling with Equal First Stage Units, Systematic Sampling. Statistical-Quality Control, Charts for variables and Attributes.

Acceptance-Sampling, OC, ASN and ATI Curves, Producers risk and Consumer's risk. Concept of AQL, AOQL and LTPD, Single and Double Sampling Plans Scaling Procedures, Scaling of Test items Test Scores, Theory of Tests, Parallel Tests, True Score, Reliability and Validity of Tests.

16. DEFENCE STUDIES:

PAPER-I: (Evolution of Strategic Thought)

SECTION-A

1. Concept and Theories:

(a) Concepts and compoments of Strategic Thought.

(b) Societal relations and its relevance for conflict at Inter-State level.

(c) War-Principles and Causes: Psychological Dimensions; Conventional Warfare in the Nuclear Age; Limited War: NBC Warfare and Low Intensity Conflict (L.I.C.)

2. Strategic Thinkers:

(A) **Upto 19th Century A.D.**

(a) Manu and Kautiylya — Philosophy of war.

(b) Machiavelli — The Renaissance of Art of War.

(c) Jomini — Concept of Mass Army, Strategy, Tactics and Logistics

(d) Clausewitz — On war and its relationship with politics, strategy and Tactics

(B) **19th Century to World War – II**

(e) Engles & Marx — Military concept of Social Revolutions

(f) Ludendroff — German Concept of Total War

(g) Lenin, Trotsky & Stalin — Soviet Concept of War

(h) Liddel Hart — The Doctrine of Limited Liability and Mobile Defence.

(I)J.F.C. Fuller — Concept of Mobile Warfare, Advent of Tanks and decline of Trench Warfare.

3. Theories of Sea, Land, Air and Revolutionary Warfare:

(j) A.T. Mahan – Theory of Sea Power, Continental Doctrine and Naval Strategy

(k) Halford Mackinder – Heart Land Theory

(l) Douhet, Mitchell and Servesky – Theories of Air Warfare

(m) Mao-Tse-Tung & Che Guevara – Concept of Revolution and Strategy and Tactics of Guearilla Warfare.

4. Economic aspects of Military Power:

(a) Economic theories of defence.

(b) War potential of nation – states and techniques of resource mobilization in times of war.

(c) Post-war Economy and Re-construction.

(d) Arms Aid, Arms Trade and Donor – Recipient behavior.

5. World Wars:

(a) Weapons, Doctrines and Tactics.

(b) Causes of World War-I

(c) Revolution in Arms and technical advances in Land, Sea and Air Warfare.

(d) Technological developments during the Inter-war period (1918-1939)

(e) Allied Strategy during World War-II

(f) Introduction of Hi-tech Weapons and Revolution in Delivery Systems during First & Second World Wars.

SECTION-B

6. Past World War-II, Conventional, Nuclear Weapons and Doctrines:

(a) Introduction of Weapons of Mass Destruction - Conventional, Nuclear, Biological and Chemical

(b) Theories of Nuclear Warfare – Preventive War, Pre – emptive attack, Massive Retaliation, Counter force, Flexible Respond, MAD and MAS.

(c) Concept and theory of Conventional Deterrence.

(d) Concept and Theories of Nuclear deterrence with reference to the views of Liddel Hart, Andre Beaufre, Y. Harkabi, Henary Kissinger and K.Subrahmanyam.

7. Arms Control and Disarmament:

(a) Concepts, Objectives, Conditions and Elements.

(b) Approaches.

(c) Effects on economic development

8. Revolution in Military Affairs:

(a) Emergence of New Technologies.

(b) Revolution in Small Arms and Low Intensity Conflicts.

(c) Emergence of new tactics and use of Improvised Explosive Devices (IEDs) and its impact.

9. Conflict Resolution:

(a) Conflict: Origin, Type and Structure.

(b) Theories and methods of Conflict Resolution.

(c) Techniques of Confidence Building Measures.

(d) Instruments of International Peace: Peace Making, Peace Keeping and Peace Building.

10. Peace Thinkers:

(a) Mahatma Gandhi – on Conflict Resolution, War and International Security.

(b) Jawaharlal Nehru – on National Security, Development and Non – alignment.

DEFENCE STUDIES:

PAPER-II National Security

SECTION-A

1. Introduction:

a. Key Concepts of Nation, State and Nation State

b. Theories of Origin of State

c. Origin, Concept, objectives and approaches of National Security.

2. Security Dimentions: Internal Security, External Security, Human Security, Comprehensive Security, Common Security, Equal Security and Cyber Security.

Contd...

3. Security Level: Individual, Sub-national, National, Regional and International.
4. National Power:
a. Conceptual framework of National Power
b. The imprecision of Power as a concept
c. Power profile of Nation – States
d. Tangible and Intangible Elements of National Power
e. Foundations and Limitations of National Power
5. Threat Spectrum:
a. Concept of Threats and Challenges.
b. National Security Paradigm.
c. Threat Perception (Internal and External)
d. Threat Assessment and Threat Analyses
6. Alternate Models of Security:
a. Balance of Power
b. Balance of Terror
c. Collective Defence
d. Collective Security
e. Non-alignment
7. Security Management:
a. Concept, Components and Formulation of Security and Defence Polices and Doctrines and their Linkages.
b. National Values, National Interest and Strategic Culture.
c. Crisis / Emergency Management of critical infrastructure, vulnerability analyses and protection.
d. Disaster Management – Concept & Significance, Natural and Man- made disasters and National Disaster Management Policy.
8. Security Concerns:
a. Traditional: Territorial Integrity and Disputes
b. Non-traditional: (i) Governance (ii) Insurgency (iii) Terrorism.
c. Sources of Social Instability: (i) Economic Vulnerality (ii) Religious Fundamentalism (iii) Sectarian Fanaticism (iv) Ethnic and Linguistic Parochialism (v) Denial of Human Rights (vi) Oppression of Minorities.
9. Arms Proliferation:
a. Arms Proliferation as a constraint to National, Regional and International Security
b. Proliferation of Small Arms and Light Weapons in Southern Asia
c. Proliferation of Nuclear Weapons

SECTION-B

10. India's Quest for Security:
a. Historical Legacy, Geo-political and Geo-strategical considerations
b. Contours of India's Defence Policy – (i) Between 1858-1947 (ii) 1947-1962 (iii) 1962 – 1971 (iv) 1971 – till date
c. India's Security Concerns vis-a-vis Pakistan and China (till date)
11. India's National Security Problematics:
(a) India in the world strategic arena – contemporary trends; Challenges to India's Security in extended neighbourhood.
(b) Pakistan's conventional, nuclear and missile programmes and their impact on India's security.
(c) India- China boundary dispute: positions and polemics, efforts for the settlement of the boundary dispute, frame work of Co-operative Security between India and China.
(d) India's mutuality of strategic and other interests with Bangladesh, Nepal, Bhutan, Myanmar, Sri-Lanka, Maldives and Afghanistan.
(e) Role of extra- regional powers in the post – cold war South Asian and Asia–Pacific Strategic Milieu and India's considerations
(f) Need for confidence and security building measures for India and its South Asian neighbors
(g) South Asian Association for Regional Cooperation as a model of Regional Security
12. Science, Technology and India's Security:
(a) India's Scientific and Technological base for National Defence.
(b) Need for India's Integrated Science Policy
(c) India's defence Industrialization and achievements.
(d) Progress on India's Research and Development (R & D) and technological development for security.
(e) Requirement of investment for Defence and role of Corporate Industry, Public – Private Partnership and foreign investment
(f) India's Space Programme and Achievements
13. India's Nuclear policy and options:
(a) India's need for Nuclear Power
(b) India's Nuclear break throughs and achievements
(c) India's Nuclear Doctrine
(d) India's Missile Programme
14. Indian Ocean and India's Security considerations:
(a) Strategic Environment in and around the Indian Ocean Region
(b) India's Security problems in relation to the Indian Ocean Region
(c) India's Maritime Security and its need for naval power projections.
(d) India's Coastal Management and Recommendations
15. Internal Security of India:
(a) Low Intensity Conflicts in India with special reference to Jammu and Kashmir and North East Region
(b) Identification of the problems of Internal Security and conditions for the use of Military: Pros and cons.
(c) Importance of information Security in Internal Security.
(d) Intelligence and its relevance for National Security, use of ICT and recommendations.
16. India's over-all security perspectives and defence preparedness
17. Imperatives of India's National Security Strategy

17. MANAGEMENT PAPER-I

The candidates are expected to be acquainted with various aspects of Management. They should be able to apply theory to practice in the context of world business, in general and business function in India, in particular. For this, they are expected to be well conversant with the environment, in which business functions in India. They should also be able to display knowledge and application of managerial tools of analysis and decision-making in various functional areas.

1. Management Concepts and Evolution, Concept and significance of Management; Management as science or art; distinction between management and administration; Role and Responsibilities of management; Principle of management; Evolution of management thought- classical school, Neo-classical School, modern management school.

2. Planning and Decision Making; Planning-nature, type, significance and limitations; Plans objectives; policies; procedures; planning premises; Forecasting, Techniques of forecasting and limitation. Decision making – types, process; Rational decision making and its limitations. Concept of bounded rationality.

3. Organization and Organizational Behaviour; Organisation-concept, Types, divisions and levels, Span of management; Authority and responsibility; Authority types, sources, Delegation of authority, principles and obstacles to delegation; Centralisation and decentralization of authority; Organisational behaviour- concept and significance, individual and group behaviour. Organisational Change, resistance to change; conflict management

4. Directing-principles and techniques, Motivation-Maslow, Hezberg, McLelland, McGregor, Contingency theories; MBO. Leadership, types, Traits of successful leader, Various theories of leadership; Communication-Process, Levels and types, barriers to communication, Measures for effective communication, Role of technology in communication.

5. Controlling-Process; Pre-requisites for effectives controlling, Methods of controlling, budgetary and non budgetary methods, Coordination, Concept, Techniques and barriers to Co-ordination.

6. Business Environment, Interplay between business unit and environment, ethics and corporate governance; Monetary Policy, Fiscal Policy, Foreign Capital and Foreign Collaboration; Strategy, concept levels, SWOT analysis core competency and synergy, Porter's Five Forces Model and Value Chain Analysis, BCG Matrix.

MANAGEMENT PAPER-II

SECTION-I MARKETING MANAGEMENT

Concept of Marketing, Marketing Mix; Marketing Research; Marketing Environment; Marketing Plan; Market Segmentation; Market Target and Positioning; Product Strategies, Product Life-Cycle; Consumer Behaviour; Brand Management; Sales Promotion, Advertising, Management of Sales Force, Pricing Decision, Marketing Channel-Retail Management, Internet Marketing, Customer Relationship Management, Rural Marketing in India; International Marketing; Marketing Audit and Control; Ethics in Marketing.

SECTION-II PRODUCTION MANAGEMENT

Meaning and Nature of Production Management; Type of Production Systems; Production Planning and Control, Lean Manufacturing and Flexible Systems; Ranking, Loading and Scheduling for different production system; Site Selection and Plant Location, Plant Layout and Material Handling; Production Design, Inventory Management; Supply Chain Management; Enterprise Resource Planning; Total Quality Management, Six Sigma, PERT and CPM, Waste Management.

SECTION-III- FINANCIAL MANAGEMENT

Meaning and Scope, Estimating the firm's financial requirements; Capital Structure determination; Cost of Capital; Working Capital Management; Capital Market, Regulatory Role of SEBI, Venture Capital, Mutual Fund; Divident Policy; Net Banking and NPA Management; Corporate Restructuring, Merger and Acquisition; Investment Decision, Risk Analysis; Lease Financing; Foreign Exchange Market.

SECTION-IV- HUMAN RESOURCE MANAGEMENT

Nature of Human Resource Management, Scope of Human Resource Management; Job Analysis and Job Design; Recruitment and Selection; Training and Development; Career Planning; 360 degree Performance Apprisal; Worker's Participation in Management; ESOPs; Trade Union in India; Safety, Welfare, Strike, Lay-Off, Lock-out and Reconciliation; HR Audit; Flexible Working Condition; Work from Home; Valuntary Retirement Scheme (VRS); Outsourcing.

18. POLITICAL SCIENCE AND INTERNATIONAL RELATIONS: PAPER-I

SECTION-A

Political Theory- Definition, Nature and Scope of Political Science,
Approches to the study of Political Science-Traditional, Behavioural, Systems and Marxist
State- Definition, Theories of origin and theories related to the functions-Liberal, Individualistic, Socialistic.
Sovereignty-Meaning, Types and theories.
Rights- Meaning, Kinds and theories
Liberty- Meaning, Kinds, and theories.
Justice- Meaning, Kinds, and Theories; relation between equality and liberty.
Democracy- Meaning, types, Theories-Liberal, Socialist and Marxist.
Forms of Government: Democrative & Authoritatrian- Unitary and Federal, Parliamentary and Presidential
Political Institutions- Legislature, Executive, and Judiciary.
Political parties and Pressure groups, Electoral Systems.
Political Philosophy –
(A) Indian Political Thinkers- Manu, Kautilya, Gandhi, M.N. Roy, Ambedkar
(B) Western Political Thought- Plato, Aristotle, Machiavelli, Hobbes, Locke, Rousseau, Mill, Hegel, Green, Marx, Laski, Gramci, Hanna Arendt

SECTION-B

Indian Government and Politics

Indian Nationalism-Causes for the Rise of Nationalism, Bang Bhang Movement, Non-Cooperation Movement and Civil disobedience movement
Making of the Indian Constitution- Legacy of British Rule, Salient features of the constitution, Fundamental Rights, Fundamental duties, Directive principles of state policy.
Amendment of the Constitution,
Union Government- President, Prime Minister and Council of Ministers, Parvument of the Supreme Court.
State Government- Governor, Chief Minister and Council of Ministers, State Legislature, High Court.
Centre-State Relations.
Local Self Government – Municipality, Municipal Corporation, and 74th Amendment. Panchayati Raj and 73rd Amendment.
Political Process- Caste, Regionalism, Linguism, Communalism in Politics,
Political Parties, Pressure groups and their Role, National Integration
Union Public Service Commission, State Public Service Commission, Election commission, Niti Ayog, Human Rights Commission.

POLITICAL SCIENCE AND INTERNATIONAL RELATIONS: PAPER-II

SECTION-A

International Relations – Meaning, Nature and Scope
Theories of International and Relations – Idealists, Realist, Systems and Decision making theories
Factors determining foreign Policy- National Interest and Ideology

Contd...

Means of National Interest- Nationalism, Imperialism, Colonialism.
Principles of Balance of Power, and Collective Security.
Role of International Law and Diplomacy in Internatinal Relations.
U.N.: Organization and Role
Changing International Political order in the post- Cold war Period Arms race and Arms Control
Role and Relevance of Non- Aligned Movement.
Regional Organizations-E.U., A.S.E.A.N., A.P.E.C., S.A.A.R.C.
New International Economic Order- W.T.O., Liberalization, Privatization and Globalization
Contemporary issues in International Politics- Human Rights, Environment, Terrorism, Nuclear Proliferation.

SECTON-B

1- Foreign Policies of America, Russia and China
2- India's Foreign Policy and relations with America, Russia and China
3- India's Relations with Neighbouring Countries
4- Palestine Problem and Arab- Israel Conflict
5- Role of Third World in International Relations
6- North- South dialogue, South- South Cooperation.
7- Indian Ocean- Problems and prospects.

19. HISTORY:

PAPER-I (SECTION-A)

1. Sources and approaches to study of early Indian History. **2.** Early pastoral and agricultural communities. The Archaeological evidence. (Neolithic and Chalcaolithic Cluture) **3.** The Indus civilization: its origin, nature and decline. **4.** Patterns of settlement, economy, social organization and religion in India (c. 2000 to 500 B.C.): archaeological perspectives. **5.** Evolutions of North Indian society and culture: evidence of Vedic Texts (Samhitas of 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 dharma and nature of the Mauryan State. **8-9** Post- Mauryan Period in Northern and Peninsular India. Political and Administrative History. Society, Economy, Culture and Religion. Tamilakam and its society and Sangam Texts. **10-11** Changes in the Gupta and post-Gupta period (upto 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. Major dynasties and Political structures in North India from 750A.D. to 1200 A.D. Rise of Rajput Dynasties and the imperial Cholas.
14. Arab Conquest of Sindh and the Ghaznavide Empire; Advent of Islam and Sufism Alberuni and his study of India Science and Civilisation.
15. India 750 A.D. – 1200 A.D.: Economy, Society, Literature, Major Historical works, Styles of Architecture, Religious thought and Institutions, Growth of Bhakti Movement.
16. The Ghorain invasions, Economic, Social and Cultural consequences and the foundation of the Sultanat.
17. The Sultanat period and Political Dynasties: Slaves, Khaljis, Tughlaqs, Syeds and Lodis; major historical sources including foreign travelers accounts; Society and Culture during the Sultanat Period.
18. Rise of Provincial Dynasties: Bahmani and Vijaynagar.
19. The Mughal Period: Babar, Humayun; Sur Period: Akbar, Jahangir, Shahjahan, Aurangzeb, decline of the Mughal Empire; Society, Culture, Administration, Economic changes; Arrival of Europeon Trading Companies.
20. Shivaji, Peshwas and Rise of Marathas; the Rise of Sikh Power, third battle of Panipat.
21. Sources of Mughal Period: Persian and indigenous; accounts of Foreign travelers.

History Paper-II

Section-A

1. Establishment of British Rule in India: East India Company and its relations with the Regional Powers. **2.** Colonial Economy: Tribute System, Drain of wealth an "Deindustrialization". Fiscal and Land Revenue Settlements (Zamindari, Ryotwari and Mahalwari settlements). Administrative Policies and Structure of the British Raj upto 1857 (including constitutional developments) **3.** Resistance to Colonial Rule: Early uprisings; causes, nature and impact of the Revolt of 1857, Reorganization of the Raj in 1858 and after. **4.** Socio-cultural impact of colonial rule: Official social reform measures; Orientalist-Anglicist Controversy; coming of English Education and the Press; Christian Missionary activities; Social and Religious Reform Movements in Bengal and other part of the country. **5.** Economic policies 1858-1914. Railways Commercialization of Indian Agriculture; Growth of landless labourers and rural indebtedness; Famines; India as market for British Industry and drain theory **6.** Early Indian nationalism; Social background; Formation of political associations; Peasant and tribal uprisings during the early nationalist era; Foundation of the Indian National Congress; The moderate phase of the Congress; Growth of Extremism, Anti-partitions; and Swadeshi Movement, Birth of Muslim League. The Indian Councils Act of 1909; the Government of India Act of 1919. **7.** 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; Peasant movements. **8.** Home Rule Movement nationalism under Gandhi's leadership: Gandhi's thoughts, and methods of mass mobilization, and different movements; States people's Movement and other strands of the National Movement: (a) Revolutionary movements in India and Abroad; (b) Swarajists, Liberals, Responsive cooperation; (c) Emergence of Leftism in India (d) Subhash Chandra Bose and the Indian National Army. **9.** Growth of Communalism; Causes and Developments, Muslim League, Hindu Mahasabha etc.; Women and National Movement. **10.** Literary and cultural developments: Tagore, Premchand, Subramanayam Bharti, Iqbal as examples only, **11.** Towards freedom: The Act of 1935; Congress Ministries, 1937-1939, The Pakistan movement, **12.** Post-1945 upsurge (RIN Mutiny, Telangana uprising etc.): Constitutional negotiations and the Transfer of power; Freedom and Partition.

SECTION-B

13. Renaissance, Reformation and Counter Reformation, Age of Enlightenment; Major ideas of Enlightenment, Kant, Rousseau etc.; Spread of Enlightenment outside Europe, Rise of Socialist ideas.
14. Origins of Modern Politics-European States System; American Revolution; French Revolution and its aftermath, (1789-1815).
15. Industrialization: Industrial Revolution: Causes and Impact on Society: Industrialization in other countries.
16. Nation-State System-Rise of Nationalism in 19th Century: Unification of Germany and Italy: Disintegration of Empires through the emergence of nationalities.
17. Imperialism and Colonialism: Trans-Atlantic slave Trade, Asian Conquest; Types of Empire: Settlement and non-settlement; Latin America, South Africa, Indonesia, Australia.
18. Revolutions and Counter-Revolutions- 19th Century European revolutions; The Russian Revolution of 1917-1921; Fascist Counter-Revolution, Italy and Germany; the Chinese Revolution of 1949.
19. World Wars (First and Second)- Causes and consequences and various developments.
20. Cold War- Emergence of two Blocs and other related developments. Emergence of Third World and Non-Alignment; UNO and Dispute Resolution.
21. Colonies and Liberation- Latin America- Bolivia; Arab World- Egypt; South Africa- Apartheid Policy and Democracy; South- East Asia- Vietnam.
22. Decolonization and underdevelopment –Break up of Colonial Empires; British, French, Dutch; Factors Constraining Development: Latin America, Africa, Asia.
23. Soviet Disintegration and the Unipolar World- Causes, Consequences and other developments; Globalization.

20. SOCIAL WORK

PAPER-I

Foundations of Social Work : Concepts, Historical Development, Philosophy and Methods.

Part-I

Social Work: Concepts, Definitions and allied concepts – Social Service, Social Welfare, Social Security and Social Reform: Objectives, Assumptions; Principles and Functions, Social Work and Social justice; Social Work and Human Rights, Common Base of Social Work Practice; Philosophy and Values; Social Work as a Profession in India.
Historical Development: U.K., U.S.A. and India.
Social Case Work: Concept, Objectives, Components, Processes and Client-Worker Relationship.
Social Group Work: Concept, Objectives, Principles, Skills and Role of Social Group Worker.

Part-II

Community Organization: Concept, Steps and Procedures, Principles, Community Planning and Community Integration, Role of Community Organizer. Community Organization and Community Development.
Social Welfare Administration: Concept, Definitions and Social Welfare Administration as a Method of Social Work: Related Concepts – Social Administration and Public Administration, 'POSDCORB' Decision Making Process, Organizational Development and Cost Benefit Analysis, Transparency and Accountability Team Building and Leadership.
Social Work Research: Concept, Social Research and Social Work Research, Steps of Social Research – Research Design, Sampling, Sources, Tools and Methods of Data Collection, Processing of Data, Data Analysis and Report Writing, Participatory Research.
Social Action: Concept, Models and Strategies, Social Action and Social Movement, Advocacy, Lobbying and Networking, Approaches of Sarvodaya, Antoyodaya and Lok-Shakti.
Dimensions of Social Work Practice: Integrated, Ecological, System Change, Radical and Generalist.

Social Work

Paper-II

Understanding Social Problems and Social Work Interventions

Part-I

Social Problem: Concept and Approaches to the Study of Social Problem.
Social Work Intervention: Concept, Need, Significance and Approaches.
Family and Related Problems
Family: Concept and Types
Related Problems- Dowry, Child Marriage, Divorce, Domestic Violence, Issue related to Live-in – Relationships, Families with Working Couples, Gender Inequality, Emigrant Heads of Households.
Nature and Techniques of Social Work Intervention in these areas.
Weaker Sections and Related Problems
Weaker Sections: Concept and Characteristics
Problems Related to: SCs/STs/OBCs/Denotified Tribes.
Nature and Techniques of Social Work Intervention in these Areas.
Concepts, Issues and Problems Related to: Casteism, Communalism, Ethnicity, Terrorism, Displacement and Environment Degradation.
Nature and Techniques of Social Work Intervention in these Areas
Concepts, Issues and Problems Related to Deviance: Truancy, Vagrancy, Juvenile, Delinquency, Crime, White Collar Crime, Organized Crime, Prostitution, Cyber-Crime, Suicide and AIDS.
Nature and Techniques of Social Work Intervention in these areas
Concepts, Issues and Problems Related to Social Vices:
Alcoholism, Drug- Addiction, Beggary, Corruption, Nature and Techniques of Social Work Intervention in these Areas.
Concepts, Issues and Problems Related to Social Structure: Poverty, Unemployment, Bonded Labour, Child Labour, Unorganized Labour, Female Foeticide.
Nature and Techniques of Social Work Intervention in these areas
Welfare State: Concept and Characteristics.
Central Social Welfare Board: Structure and Functions.

PART-II

Fields of Social Work Intervention: Concept, Constitutional and Legislative Response, Policies and Programmes-
Child Development, Youth Development, Women Empowerment, Development of Weaker Sections, Welfare of Senior Citizens, Welfare of Persons with Disabilities, Rural Development, Urban Community Development, Medical and Psychiatric Social Work, Industrial Social Work, Correctional Social Work, School Social Work, Urban Slums.

21. Anthropology – PAPER-I

1.1 Anthropology: Its meaning, scope and development.
1.2 Relationship with other disciplines: History, Economics, Sociology, Psychology, Political Science, Life Sciences, Medical Sciences.
1.3 Main branches of Anthropology: their scope and relevance.
2.1 Human Evolution and emergence of Man: Organic Evolution; Theories of evolution- Pre- Darwinian, Darwinian and Post- Darwinian Period. Modern Synthetic Theory of evolution.
2.2 Principles of systematic and taxonomy: Major primate taxa, Systematics of Hominoidea and Hominidae; Comparative Anatomy of man and Apes; Skeletal changes due to erect posture and its implications.
2.3 Origin and Evolution of Man: Phylogenetic status, characteristics and distribution of the following: Prepleistocence fossil primate-Oreopithecus, South and East African Hominids-Pleasianthropus, Australopithecus africanus, plesianthropus, Australopithecus robustus

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and related species.
3.1 Emergence of Homo: Homo erectus and contemporaries
3.2 Neanderthal Man in Europe: La-Chapelle-aux-Saints (Classical type). Mt. Carmelites (Progressive type).
3.3 Rhodesian man.
3.4 Homo sapiens sapiens (Upper Pleistocene), Cromagnon Man, Chancelade and Grimaldi.
4.1 Human Genetics: Meaning, scope and branches, its relationship with other sciences.
4.2 Methods for the study of genetic principles in man-family study (Pedigree analysis, Twin study, Foster child, co-twin method, cytogenetic method, Immunological method, D.N.A. technology.
4.3 Mendelian Genetics in man-family study, single factor, multi factor, polygenic inheritance in man, concept of genetic polymorphism and selection. Mendelian populations- Hardy-Weinberg Law, Inbreeding, Genetic Load, Genetic implications of Consanguineous and cousin marriages.
4.4 Chromosomes and Chromosomal aberrations in man; Genetic counseling.
5. Concept of Race: Race and racism, racial classification; Ethnic groups of mankind:- characteristics and distribution.
6. Ecological Anthropology: Concept and methods; Bio-cultural adaptation.
7.1 Human Growth and Development: Concept and factors affecting growth and development, methods of growth studies.
7.2 Biological and Socio-ecological factors influencing fecundity, fertility, natality and mortality.
8. Applications of Physical Anthropology and Human Genetics.
9.1 Principles of Prehistoric Archaeology: Broad outlines of prehistoric cultures- i. Palaeolithic, ii. Mesolithic, iii. Neolithic, iv. Chalcolithic, v. Copper-Bronze age.
9.2 Dating Methods: Relative and Absolute.
10.1 The Nature of Culture: Concept and characteristics of culture and civilization; ethnocentrism and cultural relativism.
10.2 The nature of society: Concept of Society; Society and Culture; Social Institutions; Social Groups; and Social Stratification.
10.3 Marriage: Definition and Universality; Laws of marriage (endogamy, exogamy, hypergamy, hypogamy, incest taboo); Types of marriage (monogamy, polygamy); Functions of marriage; Marriage regulations (Preferential); Marriage payments (bride wealth and dowry).
10.4 Family, Household and Domestic Group: Definition and universality; functions and Types (from the perspectives of structure, blood relation, marriage, residence and succession); Impact of urbanization.
10.5 Kinship: Consanguinity and Affinity; Principles and types of descent (Unilineal, Double, Bilaterial, Ambilineal); Forms of descent groups (Lineage, clan, phratry, moiety and kindred); Kinship terminology (descriptive and classificatory).
11. Economic Organization: Meaning, Scope and relevance of economic anthropology; Formalist and Substantivist debate; Principles governing Production, Distribution and Exchange (reciprocity, redistribution and market) in communities subsisting on hunting and gathering fishing, swiddening, pastoralism, Horticulture and Agriculture.
12. Political Organization: Band, tribe, chiefdom, kingdom and state; concepts of power, Authority, Legitimacy; Social Control, Law and justice in simple societies.
13. Religion: Anthropological approaches to the study of religion (evolutionary, psychological and functional) monotheism and polytheism; myths and rituals; forms of magico-religious beliefs in tribal and peasant societies (animism, animatism, fetishism, naturalism and totemism); religion, magic and science distinguished, magico religious functionaries (priest, shaman, medicine man, sorcerer and witch).
14. Anthropological theories:
i. Classical evolutionism- Tylor, Morgan and Frazer.
ii. Diffusionism- British, German and American.
iii. Functionalism- Malinowski, Structural functionalism- Radcliffe- Brown.
iv. Structuralism- Levi-Strauss.
v. Culture and Personality- Benedict, Mead, Linton, Kardiner and Cora-du-Bois.
vi. Neo-evolutionism- Childe, White, Steward.
vii. Cultural Materialism (Harris).
15.1 Research Methods in Cultural Anthropology: Field work tradition in anthropology; Distinction between technique, method and methodology; Tools of Data collection- Observation, Interview, Schedule, Questionnaire, Case history, Case study and Genealogy; Secondary sources of information.
15.2 Controlled comparison and cross cultural study.

Anthropology – Paper-II

1. Emergence and Development of the Indian Culture and Civilization: Prehistoric (Paleolithic, Mesolithic and Neolithic-Chalcolithic); Protohistoric (Indus Civilization).
2. Demographic profile of India: Ethnic and linguistic elements in the Indian population and their distribution.
3. The structure and function of traditional social system: Vernasharam, Purushartha, Karma, Rina and Rebirth.
4. Caste system in India: Structure and characteristics; Varna and Caste, Dominant Caste, Caste mobility, Jajmani system, Tribe-caste continuum.
5. Sacred Complex and Nature-Man-Spirit Complex.
6. Impact of Buddhism, Jainism, Islam and Christianity on Indian society including tribals.
7. Emergence, growth and development of antroprology in india: contribution of early Scholars- Administrators. Contribution of Indian Anthropologists to Tribal- Caste studies.
8. Aspect of Indian Village: Social, economic, polity and religion, Changing patterns of settlement and inter-caste relations. Sanskritization, Westernization and Modernization. Panchayati Raj and Social change.
9.1 Tribal situation in India: Linguistic and socio-economic characteristics of the Tribal populations and their distribution, Bio-genetic variability.
9.2 Problems of tribal communities: Land alienation, poverty, indebtedness, low literacy, poor educational facilities, unemployment, health and nutrition.
9.3 Developmental projects and their impact on tribal displacement and problems of rehabilitation, New forest policy and tribals. Impact of Urbanization and Industrialization on tribal populations.
10.1 Problems of exploitation and deprivation of Scheduled Castes, Scheduled Tribes and Other Backward Classes. Constitutional safeguards for Scheduled Tribes and Scheduled Castes.
10.2 Social change and contemporary tribal societies: Impact of modern democratic institutions, development programmes and welfare measure on tribals and weaker sections and women participation.
10.3 The concept of Ethnicity: Ethnic conflicts and political developments, Unrest among tribal communities; Pseudo-tribalism; Social change among the tribes during colonial and post- independent India.
11. History of Administration of Tribal Areas: Tribal policies, plans, programmes of tribal development and their implementation.
12. Role of N.G.O. in tribal development.
13. Role of anthropology in tribal and rural development.

22. CIVIL ENGINEERING:

PAPER-I

PART-A

(a) Theory of Structures: Simple stress and strain, Elastic constants, Axially loaded compression members, Shear force and bending moment, Theory of simple bending, Shear stress distributions across sections, Beams of uniform strength.
Deflection of beams: Mecaulay's method, Mohr's moment area method, Conjugate beam method, Unit load method, Elastic stability of columns,
Castiglianio's theorems I and II, unit load method of consistent deformation applied to beams and pin jointed trusses. Slope-deflection and moment distribution methods.
Rolling loads and influences lines: Influence lines for shear Force and Bending moment at a section of a beam. Criteria for maximum shear force and bending moment in beams traversed by a system of moving loads. Influences lines for simply supported plane pin jointed trusses.
Arches: Three hinged, two hinged and fixed arches, rib shortening and temperature effects.
Matrix mehods of analysis: Force method and displacement method of analysis of indeterminate beams and rigid frames.
Plastic-analysis of beams and frames: Theory of plastic bending, Plastic analysis statical method, Mechanism method.
Unsymmetrical bending: Moment of inertia, position of Neutral axis and Principal axes, Calculation of bending stresses.
(b) Design of Concrete structures: Concept of mix design. Reinforced concrete: Working stress and limit state method of design. Recommendation of B.I.S. Codes. Design of one- way and two-way slabs, stair-case, slabs, simple and continuous beams of rectangular, T and L sections. Compression members under direct load with or without eccentricity.
Cantilever and Counter-fort type retaining walls.
Water Tanks: Design requirements for rectangular and circular tanks resting on ground.
Prestressed Concrete: Methods and systems of prestressing, anchorages, Analysis and design of sections for flexure based on working stress, loss of prestress. Earthquake Resistant Design of Buildings as per BIS codes.
Introduction to computer aided design of structure
(c) Steel Structural : Factors of safety and load factors. Riveted, bolted and welded joints and connections. Design of tension and compression members, beams of built up section, riveted and welded plate girders, gantry girders, stancheons with battens and lacings.

PART-B

(a) Fluid Mechanics: Fluid properties, types of fluids and their role in fluid motion.
Kinematics and dynamics of fluids flow: velocity and acceleration, stream lines, equation of continuity, irrotational and rotational flow, velocity potential and stream functions.
Continuity, momentum, energy equations Navier Stokes equation, Euler's equation of motion Bernoulli's equation. Applications to fluid flow problems e.g. pipe flow, sluice gates, weirs, etc.
Laminar Flow: Laminar and turbulent boundary layer on a flat plate, laminar sub-layer, smooth and rough boundaries, submerged flow, drag and lift forces.
Turbulent flow through pipes: Characteristics of turbulent flow, velocity distribution and variation of pipe friction factor, Hydraulic grade line and total energy line.
(b) Hydraulics: Uniform and non-uniform flows, momentum and energy correction factors, specific energy and specific force, critical depth, gradually varied flow, classification of surface profiles, control section, step method of integration of varied flow equations, rapidly varied flow, hydraulic jump. Surges.
Hydraulic Machines and Hydropower: Hydraulic turbines and their classification, choice of turbines, performance parameters, controls, Characteristics, specific speed, Principles of hydropower development.
(c) Geotechnical Engineering: Soil types and structure, gradation and particle size distribution, Atterberg's limits.
Flow through porous media: Effective stress and pore water Pressure, permeability concept, field and laboratory determination of permeability, Seepage pressure, quick sand condition.
Compaction of soil: Laboratory and field tests. Compressibility and consolidation theory, consolidation settlement analysis. Shear strength determination Mohr coulomb theory.
Stress distribution in soils Boussinesque and Westergaard's analysis, Earth pressure theory and analysis for retaining walls, application for sheet piles and Braced excavation.
Bearing capacity of soil: Approaches for analysis, fields tests, settlement analysis, stability of slopes.
Foundation: Type and selection criteria for foundation of structures, Design criteria for foundation, Analysis of distribution of stress for footings and pile, pile group action, pile load tests.
Subsuface exploration of soils, Ground improvement and soil stablisation techniques.

CIVIL ENGINEERING:

PAPER-II

PART-A

(a) Construction Technology, Planning and Management:
Building Materials: Physical Properties of construction materials with respect to their use, Stones, Bricks, Tiles, Lime, Cement, Mortars, Concrete,
Timber: Properties, defects and common preservation treatments, Ferro cement, fibre reinforced cement High strength concrete.
Use and selection of materials for various uses e.g. Low cost housing, mass housing, High rise buildings.
Building Constructions: Masonry Constructions using Brick, stone construction detailing and strength characteristics.
Paints, varnishes, plastics, water proofing and damp proofing materials, Detailing of walls, floors, roofs staircases doors and windows. Plastering, pointing , flooring , roofing and construction features.Common repairs in buildings.
Principle of planning of buildings for residents and specific use, Building code provisions and use.
Basic principles of detailed and Approximate estimating, specifications, rate analysis, principles of valuation of real property. Machinery for earthwork, concreting and their specific uses, Factors affecting selection of construction equipments, operating cost of equipments.

Contd...

Construction activity, schedules, organizations, Quality assurance principles. Basic principle of network, CPM and PERT uses in construction monitoring, Cost optimization and resource allocation. Basic principles of Economic analysis and methods.
Project Profitability: Basic principles of financial planning, simple toll fixation criterions.
(b) Surveying: Common methods and instruments for distance and angle measurement for Civil Engg.works, their use in plane table, traverse survey, leveling, triangulation, contouring and topographical maps. Basic principles of photogrammetry and remote sensing. Introduction to Geographical information system.
(c) Highway Engineering: Principles of Highway alignments, classification and geometrical design, elements and standards for roads.
Pavement structure for flexible and rigid pavements, Design principles and methodology.
Construction methods and materials for stabilized soil, WBM, Bituminous works and CC roads.
Surface and sub-surface drainage arrangements for roads, culvert structures.
Pavement distresses and strengthening by overlays.
Traffic surveys and their application in traffic planning, Typical design features for channelized, intersection rotary etc., signal designs, standard traffic signs and markings.
(d) Railway Engineering: Permanent way, ballast, sleeper, chair and fastenings, points crossings, different types of turn outs, cross-over, setting out of points, Maintenances of track, super elevation, creep of rails, ruling gradients, track resistance, tractive effort, curve resistance, Station yards and station, station buildings, platform sidings turn outs, Signals and interlocking, Level Crossings.

PART- B

(a) Water Resources Engineering:
Hydrology: Hydrologic cycle, precipitation, evaporation , transpiration, infiltration, overland flow, hydrograph, flood frequency analysis, flood routing through a reservoir, channel flow routing- Muskingam method.
Ground Water flow: Specific yield, storage coefficient, coefficient of permeability, confined and unconfined aquifers, radial flow into a well under confined and unconfined conditions. Open wells and Tubewells.
Ground and surface water resources, single and multipurpose projects, storage capacity of reservoirs, reservoir losses, reservoir sedimentation.
Water requirements of crops, consumptive use, duty and delta, irrigation methods and their efficiencies.
Canals: Distribution systems for canal irrigation, canal capacity, canal losses, alignment of main and distributory canals, most efficient section, lined canals and their design, regime theory, critical shear stress, bed load.
Water logging: causes and control, salinity.
Canal structures: Design of head regulators, canal falls, aqueducts, metering flumes and canal outlets.
Diversion head work: Principles and design of weirs on permeable and impermeable foundation, Khosla's theory.
Storage works: Types of dams, design, principle of gravity and earth dams, stability analysis.
Spillways: Spillway types, energy dissipation.
River training: Objectives of river training, methods of river training and bank protection.
(b) Environmental Engineering:
Water Supply: predicting demand for water, impurities of water and their significance, physical, chemical and bacteriological analysis, waterborne diseases, standards for potable water.
Intake of Water: Water treatments: principles of coagulation, flocculation and sedimentation, slow, rapid and pressure filters, chlorination, softening, removal of tests, odour and salinity.
Sewerage Systems: Domestic and industrial wastes, storm sewage, separate and combined systems, flow through sewers, design of sewers.
Sewage Characterisation: BOD,COD, solids, dissolved oxygen, nitrogen and TOC. Standards of disposal in normal water course and on land.
Sewage Treatment: Working principle, units, chambers, sedimentation tank, trickling filters, oxidation ponds, activated sludge process, septic tank, disposal of sludge, recycling of waste water.
Solid waste management: Collection and disposal in rural and urban contexts, management of solid waste.
Environmental pollution: Sustainable development, Radioactive wastes and disposal. Environmental impact assessment for thermal power plants, mines, river valley projects. Air and water pollution control acts.

23. MECHANICAL ENGINEERING: PAPER-I

(PART-A)

1. **Theory of Mechines:** Kinematic and dynamic anyalysis of planer mechanisms, belt and chain drives, gears and gear train, cams, flywheel and governors. Balancing of rotating and reciprocating masses, single and multi cylinder Engines.
2. **Mechanical Vibrations:** Vibrating systems, single degree freedom systems, natural frequency, damped and forced vibrations, resonance, force transmissibility, two degree of freedom systems, vibration absorbers, whirling of shafts and critical speeds.
3. **Mechanics of Solids:** Stress and strain, elastic constants, uniaxial loading, thermal stress, two dimensional stress analysis, principal stresses, generalised Hook's law, total and distorsion strain energy, theories of failures, bending and shear stresses in beams, Torsion of shafts, Close coiled Helical springs, Thin and thick pressure versels, rotating discs, Buckling of columns.
4. **Engineering Materials:** Basic concept of structure of solids, crystalline materials, crystal defects, alloys and binary phase diagrams, structures and properties of common engineering materials. Basics of polymers, ceramics and composite materials; Iron-Carbon equilibrium diagram, heat treatment of steels.

(PART-B)

5. **Manufacturing Science:** Machine tool Engineering, Merchant's force analysis, Taylor's tool life equation, conventional machining, NC and CNC machining Processes, jigs and fixtures, standard forming and welding processes.
6. **Non Convensional Machining Processes:** EDM, ECM, Ultrasonic machining, water jet machining etc, application of lasers and plasmas, energy rate calculations. Metrology: concept of fits and tolerances, tools and gauges, comparators, inspection of length, position, profile and surface finish.
7. **Manufacturing Management:** Product development, value analysis, Break-even analysis, forecasting techniques, Operation Scheduling, Capacity Planning, Assembly line balancing, CPM and PERT, Inventory control, ABC Analysis, EOQ model, material requirement planning, job design, job standards, method study and work measurements.
8. **Quality Management:** Quality analysis, control charts, acceptance, sampling, total quality management, Operations research, linear programming, graphical and simplex methods, Transportation and assignment models, single Serve queueing model, Value Engineering.

MECHANICAL ENGINEERING: PAPER-II

(PART-A)

1. **Thermodynamics:** Laws of thermodynamics and their applications; T-ds equations, Maxwell and Clapeyron equation and their uses; Availability and irreversibility.
2. **Fluid Mechanics:** Properties and classification of fluids, Manometry, forces on immersed sunfaces, stability of floating bodies, Kinematics and dynamics of incompressible fluids. Laminar and turbulent boundary layer flows. Bernoulli's equation, fully developed flow through pipes.
3. **Heat Transfer:** Modes of heat transfer, One dimensional steady and unsteady conduction. Heat transfer through extended surfaces. Free and forced convective heat transfer, Empirical correlations in laminar and turbulent flows, Heat Exchangers, Radiation heat transfer laws, shape factor, heat exchange between black and gray surfaces.
4. **Refrigeration and Air Conditioning:** Vapour compression, vapour absorption, steam jet and air refrigeration systems, Desirable properties of refrigerants, eco- friendly refrigerants, Analysis of compressors, condensers, expansion valves and evaporaters.

(PART- B)

5. **I.C Engines:** Classification, Thermodynamic cycles of operation, Performance Calculations, Heat balance sheet, Combustion in S.I and C.I Engines, normal and abnormal combustion, knocking and detonation. Effect of variables on knocking and detonation, Fuels used in S.I and C.I Engines, Fuel injection, carburetion and multi point fuels injection (MPFI) Supercharging, Engine cooling, Emission and Control, Turboprop and Rocket Engines.
6. **Steam Engineering:** Modern steam Generators, Rankine cycle, Modified Rankine cycle and analysis, Natural and artificial draught, flow of steam in convergent and divergent nozzles, pressure at throat for maximum discharge, super saturated flow in nozzles, Wilson line.
7. **Turbomachines:** Classification, Continuity, momentum and energy equations, Flow analysis in axial and centrifugal compressors and turbines, Dimensional analysis and modelling. Performance of Pumps, Compressors and turbines.
8. **Power Plant Engineering:** Site selection for Steam, Hydro Nuclear and Gas Power Plants, dust removal equipments, fuel handling and cooling water system. Thermodynamic analysis of steam and gas turbine power plants, governing of turbines. Solar, Wind and Nuclear Power Plants, Economic power generation.

24. ELECTRICAL ENGINEERING:

PAPER-I

(IE.M. Theory: Analysis of Electrostatic and magetostatic Fields, Laplace, Poisson & Maxwell's equation. Electromagnetic wave equations. Poynting's Theorem. Waves on transmission lines. Wave-guides. Microwave resonators.
(ii) Networks & Systems: Systems and signals, Network Theorems and their applications. Transient and steady-state analysis of systems. Transform techniques and circuit analysis, Coupled circuits. Resonant circuits, Balanced three-phase circuits. Network functions. Two-port network. Network parameters. Elements of network synthesis. Elementary active networks.
(iii) Electrical & Electronic Measurement & Instrumentation: Basic methods of Measurement. Error analysis, Electrical Standards. Measurement of voltage, current, power, energy, power-factor, resistance, inductance, capacitance, frequency and loss-angles. Indicating instruments. DC and AC Bridges, Electronic measuring instruments. Multi-meter, digital voltmeter, frequency counter, Q-meter, oscilloscope, techniques, special purpose CRO's. Transducers and their classifications. Thermo-couple, thermistor, RTD, LVDT, strain-gauges. Piezo-electric transducers etc., Application of tranducers in the measurement of non-electrical quantities like pressure, temperature, displacement, velocity acceleration, flow-rate etc.; Data-acquisition systems.
(iv) Analog & Digital Electronics: semiconductors, semiconductor diodes & zener-diode, Bi-polar junction transistor and their parameters. Transistor biasing, analysis of all types of amplifiers including feedback and D.C. amplifiers; Operational amplifiers and their application; Feedback oscillators: Colpitts and Hartley types, waveform generators; Multi-vibrators; Boolean algebra. Logic gates Combinational and sequential digital circuits. Semiconductor memories. A/D & D/A converters; Microprocessor. Number system and codes, elements of microprocessors & their important applications.
(v) Electrical Machines: D.C. Machines: commutation and armature reaction, characteristics and performance of motors and generators; Applications, starting and speed control. Synchronous generators: Armature reaction, voltage regulation, parallel operation. Single- and Three-phase Induction motors: Principle of operation, performance characteristics, starting, speed control. Synchronous Motors: Principle of operation, performance analysis, Hunting, Synchronous condenser. Transformers: Construction, phasor diagram, equivalent circuit, voltage regulation, Performance, Auto-transformers, instrument transformers. Three-phase transformers.
(vi) Material Science: Theory of Semiconductors, Conductors and insulators. Superconductivity. Various insulators used for Electrical and Electronic applications. Different magnetic materials, properties and applications. Hall Effect.

ELECTRICAL ENGINEERING:

PAPER-II: (SECTION-A)

1. Control Engineering: Mathematical Modeling of physical dynamic systems. Block diagram and signal flowgraph. Transfer function. Time-response and frequency-response of linear systems. Error evaluation, Bode Plot, Polar Plot and Nichol's chart, Gain Margin and Phase Margin, Stability of linear feedback control systems. Routh-Hurwitz and Nyquist criteria. Root locus technique. Design of compensators. State variable methods in system modeling, analysis and design. Controllability and Observability and their testing methods. Pole placement, design using state variables feedback. Control system components (Potentiometers, Tachometers, Synchros & Servomotors).
2. Industrial Electronics: Various power semiconductor devices. Thyristor & its protection and series-parallel operation. Single-phase and poly-phase uncontrolled rectifiers. Smoothing filters, D.C. regulated power supplies. Controlled converters and inverters, choppers. Cyclo-converters, A.C. voltage regulators. Application to variable speed drives. Induction and Dielectric heating.

SECTION-B: (HEAVY CURRENT)

(3) Electrical Machines: (I Fundamentals of Electro-Mechanical energy conversion. Analysis of Electro-Magnetic torque and induced voltages. The general torque equation. **(ii).** Three- Phase Induction motors: Concept of revolving field. Induction motor as transformer. Phasor diagram and equivalent circuit. Performance evaluation. Correlation of induction motor operation with basic torque relations. Torque-speed characteristics. Circle diagram, starting and speed-control methods. **(iii).** Synchronous Machines: Generation of e.m.f.; Equivalent circuit, Experimental determimation of leakage and synchronous reactances. Theory of salient-pole machines. Power equation. Parallel operation. Transient and sub-transient reactances and time constants. Synchronous motor. Phasor diagram and equivalent circuit. Performance, V-curves. Power factor

Contd...

control, hunting. **(iv).** Special Machines: Two-phase A.C. servomotors.-Equivalent circuit and performance; Stepper motors. Methods of operation, Drive amplifiers. Half stepping. Reluctance type steppor motor, Principles and working of universal motor. Single-phase A.C. compersated series motor.

(4) Electric Drives: Fundamentals of electric drive, Rating estimation. Electric braking. Electro-mechanical transients during starting and braking, time and energy calculations. Load equalization. Solid-State control of D.C., Three-phase Induction and Synchronous motors. Applications of electric motors.

(5) Electric Traction: Various Systems of track electrification and their comparison. Mechanics of train movement. Estimation of tractive effort and energy requirement. Electrification and their comparison, Traction motors and their characteristics.

(6) Power System and Protection: (a). Types of Power Station. Selection of site. General layout of Thermal, Hydro and Nuclear Stations. Economics of different types. Base load and peak load of stations. Pumped-storage Plants. **(b).** Transmission and Distribution: A.C. and D.C. Transmission systems. Transmission line parameters and calculations. Performance of Short, Medium and Long transmission lines, A-, B-, C-, D-parameters. Insulators. Mechanical design of overehead transmission lines and Sag calculation, Corona and its effects, Radio interference. EHVAC and HVDC transmission lines, under-ground cables. Per unit representation of power system. Symmetrical and unsymmetrical fault analysis. Symmetrical components and their application to fault analysis. Load flow analysis using Gauss-Seidel and Newtor-Raphson methods. Fast de-coupled load flow. Steady-state and transient stability. Equal area criterion, Economic operation of power system, incremental fuel costs and fuel rate. Penalty factors. ALFC and AVR control for real-time operation of inter-connected power system. **(c).** Protection: Principle of arc extinction, Classification of circuit breakers. Restriking phenomenon. Calculation of restriking and recovery voltages. Interruption of small inductive and capacitive currents Testing of Circuit Breakers. **(d).** Relaying Principles: Primary and back-Up relaying, over-current, differential, impedance, and direction relaying principles. Constructional details. Protection schemes for transmission line, transformer, generator, and bus protection. Current and potential transformer and their applications in relaying. Traveling waves. Protection against surges, Surge impedance.

(OR)

SECTION-C (Light Current)

(7) Communication System: Amplitude, Frequency and Phase modulation and their comparison, Generation and detection of amplitude, frequency, phase and pulse modulated signals. Modulators and demodulators, Noise problems, Channel efficiency. Sampling theorem. Sound and vision broadcost, transmitting and receiving systems. Antennas and feeders. Transmission lines at Audio, Radio and ultra-high frequencies. Fiber-optics and optical communication systems. Digital communications, pulse code modulation. Data communication, satellite communication. Computer communication system- LAN, ISDN etc. Electronic Exchanges. (a) Microwaves: Electromagetic waves, unguided media, wave guides. Cavity resonators and Microwave tubes, Magnetrons, Klystrons and TVVT. Solid-State microwave devices. Microwave amplifiers. Microwave receivers. Microwave filters and measurements. Microwave antennas.

25. English Literature

Paper-I

Answers must be written in English.

Section-A

Candidates will be required to show adequate knowledge of the following topics and movements:

The Renaissance: Elizabethan and Jacobean Drama; Metaphysical Poetry; The Epic and the Mock-epic; Neo-classicism; Satire; The Romantic Movement; The Rise of the Novel; The Victorian Age.

Section-B

Texts for detailed study are listed below:

1. William Shakespeare: Twelfth Night, King Henry IV, Pt I, Macbeth and the Tempest.
2. John Donne. The following poems: “Canonization”, “Death be not proud”, “The Good Morrow” and “The Relic”.
3. John Milton: Paradise Lost, Book-I
4. John Dryden: All for Love
5. Alexander Pope: The Rape of the Lock
6. William Wordsworth. The following poems: “Tintern Abbey”, “Three Years She Grew”, “Michael” and “Milton, Thou Shouldst be Living at This Hour”
7. P B Shelley: “To a Skylark” and “Ode to the West Wind”
8. Alfred Tennyson: “Ulysses” and “Lotos Eaters”
9. Robert Browning: “My Last Duchess” and “The Lost Leader”
10. Francis Bacon: “Of Studies” and “Of Truth”
11. Charles Lamb: “ Dream Children” and “Poor Relations”

Section-C

Text for non-detailed study are listed below:

1. Jane Austen. Pride and Prejudice.
2. Charles Dickens. Great Expectations.
3. Thomas Hardy: Far from the Madding Crowd
4. Mark Twain: The Adventures of Huckleberry Finn.

English Literature

Paper-II

Answers must be written in English.

Section-A

Candidates will be required to show adequate knowledge of the following topics and movements:

Pre-Raphaelite Movement, Modernism; Poets of the Thirties; The stream-of-consciousness Novel; Absurd Drama; Colonialism and Post-Colonialism; Indian Writing in English; Feminist approaches to Literature.

Section-B

Texts for detailed study are listed below:

1. William Butler Yeats. The following poems: “The Second Coming”, “Sailing to Byzantium”, “A Prayer for my Daughter”, “Meru” and “Lapis Lazuli”
2. T.S. Eliot, The following poems: “The Love Song of J. Alfred Prufrock” and “Journey of the Magi”
3. W.H. Auden. The following Poems: “The Unknown Citizen” and “In Memory of W.B. Yeats”
4. Philip Larkin. The Following poems: “Afternoons” and “Deceptions”
5. Sylvia Plath. The following poems: “Mirror” and “Daddy”
6. Derek Walcott. The Following Poems: “A Far Cry from Africa” and “Sea Grapes”
7. Nissim Ezekiel. The following poems “Background, Casually”, “Night of the Scorpion”
8. A.K. Ramanujan. The following poems: “Looking for a Cousin on a Swing”, “On The Death of a Poem”
9. John Osborne: Look Back in Anger.
10. Eugene O'Neill: Desire Under the Elms
11. Girish Karnad: Hayavadana
12. Thomas Carlyle: “Hero as a Poet”
13. John Ruskin: “ The Veins of Wealth” (Essay II from Unto This Last)

Section-C

Texts for non-detailed study are listed below:

1. Graham Greene: The Power and the Glory
2. William Golding: Lord of the Flies
3. Raja Rao: Kanthapura.
4. Nathaniel Hawthorne: The Scarlet Letter

26. URDU LITERATURE PAPER - FIRST:

PART-A

(1) Development of Urdu language, (a) Western Hindi and its dialects mainly khari Boli, Braj Bhasha and Haryanvi. (b) Persio- Arabic elements in Urdu. (c) Urdu Language from 1600 AD to 1900 AD (d) Different theories of the origin of Urdu language. (2) (a) Development of Urdu Literature in Deccan (b) Two classical Schools of Urdu Poetry-Delhi & Lucknow. (c) Development of Urdu prose upto Ghalib (3) (a) Aligarh movement. Progressive movement and their impact on Urdu Literature. (b) Urdu Literature after independence.

Part-B

(1) Important genesis of poetry- Ghazal, Qasida, Marsiya, Masnavi Rubai, Qata, Nazm. Blank Verse. Free Verse (2) Different Kinds of prose –Destan, Novel short Story. Drama. Literary Criticism. Biography, Essay. Khaka and Inshaiya (3) Role of Urdu literature in freedom movement.

URDU LITERATURE

PAPER-SECOND

This paper will require first hand reading of the texts prescribed and will be designed to test the candidates critical ability.

PART-A (PROSE)

(1) Meer Amman: Bagh- O- Bahar. (2) Ghalib: Intekhab-E-Ghalib. Pub: Urdu Academy, Lucknow. (3) Hali: Muqaddam-E-Sher-O-Shairi. (4) Ruswa: Umrao Jan Ada (5) Prem Chand: Prem Chand ke Numainda Afsaney, Ed. Prof. Qamer Rais. (6) Abul Kalam Azad: Ghubar-e-Khatir. (7) Imtiaz AliTaj: Anarkali. (8) Qurratul Ain Hyder: Akhir-e-Shab ke Hamsafar, Mohammad Hasan: Zahak.

PART-B (POETRY)

(9) Meer: Intakhab-Kalam-E-Meer, Ed: Abdul Haq, (10) Sauda: Qasaid-E-Sauda (including Hajuviyat)-Pub. U.P. Urdu Academy (11) Ghalib: Diwan-e-Ghalib.(only Redeef Alif and noon) (12) Iqbal: Kulliyat-e-Iqbal (Bal-E-Gibrail only) (13) Josh Malihabadi: Saf-o-Subu (14), Firaq Gorakhpuri: Gul-e-Naghma. (15) Faiz: Dste-Saba, (16) Akhatar-ul-Iman: Treek Saiyyara, Bint-E-Lamhat.

27. ARABIC : PAPER-I

1. (a) Origin and development of the language in outline. **(b)** Significant features of the grammar of the language and Rhetoric **The following topics.**

* Afal-e-naqesah
* Huroof-e-jaar wa majroor
* Izafat
* Sifat wa mausuf
* Mubtada wa khabar
* Mafail-e-khamsah
* Istearah, Tashbih, Kinayah, Tazad
* Husn-e-Taleel
* Bahr-e-Ramal
* Bahr-e-Hazaj
* Bahr-e-Mutaqarib

2. Literary History and Literary Criticism : Literary movement. Socio-cultural influence (Classical Background) and modern trends. Origin & Development of modern literary genres including novel, short story, drama & essay.

ARABIC: PAPER-II

This paper will require first-hand reading of the text prescribed and will be designed to test the candidate critical ability.

SECTION-A : Poets

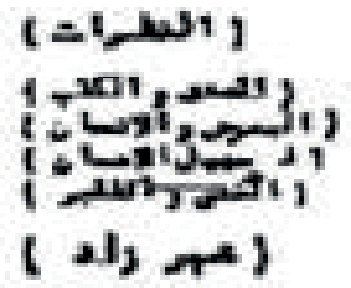
1. Imraul Qais : His Mullaqah: (Complete)
“Qifa Nabki min Zikra Habibbin wa Manzili”
2. Zuhair bin Abi Sulma : His Mullaqah (complete)
“A min Ummi Aufa Diminatum lam takallami”
3. Al- Khansa : The following two elegies from her Diwan
i) Ta' azzara Bial-majd (Complete)
ii) Uzakkiruni (Complete)
4. Hasan bin Thabit : The following Qasaid from his Diwan: Qasida No. I to IV
5. Umar bin Abi Rabiyah : The following four Ghazals from his Diwan:
i) Fa jamma Tawaqafana (Complete)
ii) Lalita Hindan (complete)
iii) Aman Aal Niam (complete)
iv) Kitab (complete)
6. Al-Farazdaq : The following 4 Qasaid from his Diwan
i) In praise of Umar bin Abd al-Aziz (complete)
ii) In praise of Zain al-Abidin Ali bin Hasan (complete)
(iii) Wa Atlasa Assalin Wa Kana Sahiba (Complete)
iv) WA Kumin Tanamuha li Adhyal Ainan (Complete)
7. Abu Tammam : The following two from his Diwan:
i) Yarudahu Aba-hasan (complete)
ii) Al wa'z wa al Zuhd (Complete)
8. Ahamad al Shawqi : The following four Qasaid from his Diwan (Al-shawqiat):
i) Masjid Aya Sufiyah (Vol. II) (complete)
ii) Ghaba Bulunia (vol.II) (Complete)
iii) Salamun Min Saba (Vol. II) (complete)
iv) Al- Hamziah al- Nabawiyah (Vol.I) (complete)

SECTION-B : Authors

1. Ibn ul Maqaffa : “Kalila wa Dimna” Chapter (Complete) (excluding Muqaddamah)
“Al-Asad Wa Al-Thaur”
2. Ibu Khaldun : Muqadamah, 39 Pages, part Six from the first chapter: From “Al fasl al-

Contd...

Sadis to wa min
Faruihi aljabr- wa - al Muqabilah".
3. Al-manfaluti : Al- Nazarat Vol 1 Egypt 1950
The following stories:
i) Al-sidq wa al - kizb
ii) Al-Bauz wa al Insan
iii) Fi sabit Al - Ihsan
iv) Al-ghani wa al - Faqir
4. Ahamd Amin : Hayati (Autobiography complete)
5. Taufiq al - Hakim : Drama: "Shahr Zad (complete)



SECTION-C

Translation from Urdu to Arabic.

Note: Candidates will be required to answer some questions carrying not less than 10 per cent marks in Arabic also.

28. हिन्दी साहित्य प्रथम प्रश्न पत्र

भाग–1 हिन्दी भाषा तथा नागरी लिपि का इतिहास– 1. पालि, प्राकृत एवं अपभ्रंश तथा पुरानी हिन्दी का संक्षिप्त परिचय। **2.** मध्यकाल में ब्रज और अवधी का काव्य भाषा के रूप में विकास। **3.** खड़ी बोली साहित्यिक भाषा के रूप में विकास। **4.** राजभाषा, सम्पर्क भाषा, राष्ट्रभाषा एवं मानक भाषा के रूप मे हिन्दी। **5.** वैज्ञानिक और तकनीकी क्षेत्र में हिन्दी भाषा की स्थिति। **6.** हिन्दी भाषा का क्षेत्र और अवधी, ब्रज, खड़ी बोली, भोजपुरी, बुन्देली का क्षेत्र एवं भाषिक विशेषताएं। **7.** मानक हिन्दी का व्याकरणिक स्वरूप। **8.** नागरी लिपि का उद्भव और विकास, देवनागरी लिपि की वैज्ञानिकता, समस्यायें और समाधान । **9.** हिन्दी शब्द – सम्पदा।

(भाग–2 हिन्दी साहित्य का इतिहास)

1. हिन्दी साहित्य के इतिहास लेखन की परम्परा। 2. हिन्दी साहित्य के इतिहास में काल– विभाजन तथा नामकरण । **3.** आदिकाल, भक्तिकाल, रीतिकाल, आधुनिक काल की प्रमुख प्रवृतियां। **4.** आधुनिक कालः पुनर्जागरण और भारतेन्दु युग, द्विवेदी युग, छायावाद, प्रगतिवाद, प्रयोगवाद, नयी कविता एवं परवर्ती काव्यधारायें।

(क) हिन्दी उपन्यास, हिन्दी कहानी, हिन्दी नाटक एवं रंगमंचः उद्भव –विकास एवं इनकी अधुनातन प्रवृत्तियां **(ख) हिन्दी निबन्ध तथा अन्य गद्य विधायेंः** जीवनी, आत्मकथा, रेखाचित्र, संस्मरण यात्रा वृतांन्त। (ग) हिन्दी आलोचना का प्रांरम्भ और विकास। प्रमुख आलोचक : रामचंद्र शुक्ल, नन्ददुलारे बाजपेयी, हजारी प्रसाद द्विवेदी, नगेन्द्र, रामविलास शर्मा, नामवर सिंह, रामस्वरूप चतुर्वेदी।

हिन्दी साहित्यः द्वितीय प्रश्न पत्र,
(भाग– प्रथम)

इस प्रश्न–पत्र में निर्धारित रचनाओं में से व्याख्या एवं उन पर आलोचनात्मक प्रश्न पूछे जायेंगे। कबीर **ग्रन्थावली, सम्पादक –**श्याम सुन्दर दास, साखी संख्या 1 से 100 तक और पद संख्या 1 से 20 तक।
सूरदास (भ्रमरगीत सार) सम्पादक–रामचन्द्र शुक्ल, पद संख्या 51 से 100 (कुल 50 पद)
तुलसीदास– रामचरितमानस उत्तरकाण्ड– (दोहा संख्या– 75 से अन्त तक) । जायसी (पदमावत),
सम्पादक – रामचन्द्र शुक्ल (सिंहलदीप खण्ड और नागमती वियोग खण्ड), बिहारी संग्रह (प्रारम्भ से 100 दोहे तक) हिन्दी परिषद प्रकाशन, इलाहाबाद।
जयशंकर प्रसाद – कामायनी – (श्रद्धा और इड़ा सर्ग) सुमित्रानन्दन पन्त– नौका बिहार, परिवर्तन, निराला – **राम की शक्ति पूजा, अज्ञेय –** असाध्यवीणा, मुक्ति बोध– अन्धेरे में, नागार्जुन–बादल को घिरते देखा है, अकाल के बाद।

(भाग द्वितीय)

नाटक– भारतेन्दु हरिश्चन्द्र **–** अन्धेर नगरी, जयशंकर प्रसाद–स्कन्द गुप्त,
निबन्ध– रामचन्द्र शुक्ल, चिन्तामणि भाग–एक (कविता क्या है, श्रद्धा और भक्ति)। हजारी प्रसाद द्विवेदी –कुटुज (निबन्ध)
उपन्यास– प्रेमचन्द्र–गोदान, फणीश्वरनाथ रेणु– मैला आंचल।
हिन्दी की कहानियां– 1– प्रेमचन्द्र– मॉ, 2– जयशंकर प्रसाद– आकाशदीप, 3–अज्ञेय–रोज, 4– राजेन्द्र यादव– जहां लक्ष्मी कैद है, 5– उषा प्रियम्बदा–वापसी।

29. PERSIAN : PAPER-I

Unit-1 - 1. Short essay in Persian (Compulsory.)
Unit-II - 2. (a) Origin and development of the language. (Old Persian, Pahlavi, Modern Persian). (b) Applied Grammar. **(c)** Rhetorics. **(d)** Prosody (Bahr-i-Hazaj Kamil, Bahr-i-Motaqarib Mahzuf/ Maqsur, Bahr-i-Rajaz Kamil). Asbab, Autad, Fawasil, Haruf-i-Qafia.
Unit-III - 3. Literary History, Criticism, Movements; Socio-cultural influences, Modern Trends. **(a) Samanid Period:** (Important Poets and Writers) **(b) Ghazanavid Period :** (Firdausi) Rumi, Masud Sad-i-Salman, Tarikh-i-Baihaqi). **(c) Saljuquid Period :** (Anwari Attar, Khayyam, Kimya-i-Saadat, Chahar Maqala, Siyasat Nama). **(d) Ilkhanid Period :** (Sa'di, Rumi, 'Jame'-ut-Tawarikh, Tarikh-i-Jahan Kusha). **(e) Timurid Period :** (Hafiz, Salman Saoji, Khaju-i-Kirmani, Zafar Nama-i-Sharfuddin Yazdi, Tazkira-Daulat Shah Samarqandi, Jami) **(f) Indo-Persian Literature :** (Aufi, Khusrau, Faizi, Urfi, Naziri, Abul Fazl, Tarikh-i-Firuz Shahi of Barani, Chahar Chaman of Brahman, Ghalib, Iqbal). **(g) Safavid to Modern Period :** (Mohtashim Kashi, Qaani, Malik-ushshu'ara Bahar, Nimayushij, Parwin E'tesami, Simin Behbahani' Sadiq Hedayat, Jamalzada, Hejazi, Sabk-i-Khurasani, Sabk-i-Eraqi, Sabk-i-Hindi, Islamic Revolution of Iran).
Unit-IV - 4 Translation of ten out of fifteen simple sentences of Urdu into Persian (Compulsory).

PERSIAN: PAPER-II

The paper will require first hand reading of the texts prescribed and will be designed to test the candidates critical ability.
Unit-I - Prose - 1. Translation from the following texts : (a) Nizami Aruzi Samarqandi, Chahar Maqala (Dabiri and Sha'iri). **(b)** Saadi Shirazi Gulistan (Der Sirat-i-Padshahan and Dar Akhlaq-i- Derwishan) **(c)** Ziauddin Barani, Tarikh-i-Firuz Shahi (Wasaya-i-Sultan Balban be Ferzand-o-Wali Ahd-i-Khud). **(d)** Sadiq Hidayat Dash Akul, Talab-i-Amorzish, Girdab).
Unit-II - 2. Critical and biographical questions about the prescribed authors and their works (4 questions).
Unit-III - Poetry - 3. Explanation from the following texts : (a) Firdausi. Shahnamah (Dastan-i- Rustam-o-Sohrab and Dastan-i-Bizan-o-Maniza). **(b)** UmarKhayyam. Ruba' yat (Radif Alif) **(c)** Maulana Rum, Mathnavi (Hikayat-i-Shaban-o-Musa and Hikayat-i-Baqqalo-Tuti). **(d)**. Amir Khusrau. Ghaziliyat (Radif Alif). **(e)** Hafiz-i-Shirazi. Ghaziliyat (Radif Alif). **(f)** Urfii- Shirazi. Qasidas(Dar tausif-i-Kashmir and Madh-i-Shahzada Salim). **(g)** Bahar-e-Mashhadi Diwani-Bahar (Jughd-i-Jang, Shabahang, Damawandiyeh, Wataniyeh).
Unit-iv - 4. Critical and Biographical questions regarding the poets and their work prescribed (4 questions)
Unit-v - 5. Translation of an unseen Passage from English into Persian.

30. SANSKRIT LITERATURE: PAPER-1

SECTION- A Linguistics

Origin and development of language, Classification of languages, Indo-European and Middle Indo-Aryan Languages, Semantics: Trends and Reasons, Phonology, Phonetic changes, Human Vocal Organs with special reference to Sanskrit phonology, Points of Pronunciation and prayatnas of Sanskrit sounds, Comparision of Vedic and Classical Sanskrit languages.

SECTION-B Sanskrit Grammar

सन्धि, समास, कृदन्त, तद्धित, स्त्रीप्रत्यय एवं कारक from the Laghusiddhanta- Kaumudi.

SECTION-C Indian Philosophy

General study of Indian Philosophy based on the following texts:- तर्कभाशा – केषव मिश्र (अनुमानपर्यन्त), सांख्यकारिका– ईष्वरकृश्ण, वेदान्तसार– सदानन्द, कठोपनिशद्–प्रथम अध्याय– द्वितीया वल्ली, श्रीमद्भगवद्गीता – द्वितीय अध्याय।

SECTION-D Sanskrit Poetics

(I) General Study of the Dhvani Theory and its kinds according to ध्वन्यालोक– प्रथम उद्योत of Anandavardhana.
(II) The following topics from the काव्यप्रकाष of Mammata: काव्यप्रयोजन, काव्यलक्षण, काव्यहेतु, काव्यभेद, शब्दषक्तियॉ, रससिद्धान्त, गुण तथा अनुप्रास, श्लेष, यमक, उपमा, रूपक, उत्प्रेक्षा, अपह्नति, अतिषयोक्ति, व्यतिरेक, अर्थान्तरन्यास, विभावना, विषेशोक्ति, स्वभावोक्ति, समासोक्ति, अप्रस्तुतप्रषंसा, दृश्टान्त, दीपक एवं परिसंख्या अलंकार।

SECTION-E Essay in Sanskrit

The Essay in Sanskrit should not be less than 250 words.

SANSKRIT LITERATURE PAPER- II

SECTION-A (Prose & Poetry)

First hand reading of the following texts: 1- कादम्बरी (षुकनासोपदेष), 2. षिवराजविजयम् (प्रथम निःष्वास), 3. नलचम्पू (प्रथम उच्छवास), 4. मेघदूतम् (पूर्वमेघ), किरातार्जुनीयम् (प्रथम सर्ग), 6. नीतिषतकम्। {One Question on above carrying 25 marks will be answered in Sanskrit}

SECTION-B (Sanskrit Drama)

Textual study of the following works: 1. अभिज्ञानषाकुन्तलम् (चतुर्थ अंक), 2. उत्तररामचरितम् (तृतीय अंक), 3. प्रतिमानाटकम् (प्रथम एवं द्वितीय अंक), 4. मृच्छकटिकम् (प्रथम अंक)।

SECTION- C (Technical Terms)

Knowledge of the following Sanskrit technical terms: महाकाव्य, खण्डकाव्य, कथा, आख्यायिका, चम्पू, प्रस्तावना, विश्कम्भक, प्रवेषक, सूत्रधार, वस्तूभेद, नायक भेद, विदूशक, पताकास्थानक, अर्थप्रकृतियॉ, कार्यावस्थाऍ, पंचसन्धियॉ, नियतश्राव्य, स्वगत, जनान्तिक, आकाषभाशित, नेपथ्य, नाटक प्रकरण एवं नाटिका।

SECTION-D (History of Sanskrit Literature)

General Study of Veda and Vedangas. Origin, development and characteristics of the following Literary genesis: आर्श महाकाव्य, महाकाव्य, गद्यकाव्य, गीतिकाव्य, नाटक एवं कथा साहित्य- Note: In this section one question carrying 25 marks will be answered in the form of short note on particular work/author.

SECTION-E - Translation from Hindi to Sanskrit.

31. Commerce and Accountancy

Paper-1

Accounting and Financial Management

Part-I : Accounting

1. Nature, concepts and branches of accounting, relationship between financial, cost and management accounting, advantages and limitations of accounting. Disclosure of Accounting Practices (AS-I)
2. Royalty-types, Accounting treatment for different royalties.
3. Hire Purchase System-Concept and features, Accounting process in the books of hire vendor and purchaser. Hire purchase Vs installment payment system.
4. Branch Accounting- dependent, independent and foreign branches; Accounting treatment branch account, final account, stock and debtor systems, wholesale price basis.
5. Problems of amalgamation and reconstruction (AS-14), Accounting of holding companies, Cash flow statement (AS-3)
6. Nature and functions of cost accounting, inventory valuation methods, construction of cost sheet; marginal costing- concept, significance, marginal Vs absorption costing, contribution, profit volume ratio and margin of safety.

Part-II: Financial Management

1. Nature, scope and objectives of Financial Management; Capital Budgeting decisions importance, process, limitations, methods-payback period, net present value, internal rate of return and average rate of return.
2. Sources of short, medium and long term funds, preference and equity shares, debenture and bond financing.
3. Working capital management-classification, dangers of inadequate working capital, approaches to estimation of working capital requirement, tools of cash, inventory and receivables management.
4. Cost of capital- Classification and determination, computation of weighted average cost of capital, leverage and its types.
5. Dividend policy- determinants, Walter, Gordan, Modigliani & Miller approaches, advantages and disadvantages of stable dividend policy.
6. Indian capital market- main attributes, distinction between capital and money markets, defects of capital market, working of Indian stock Exchanges, SEBI as a regulator.

Commerce and Accountancy

Paper-II

Organizational Behaviour and Human Resource Management
Part-I: Organizational Behaviour
1. Nature and concept of organization, Organizational theories- classical, neo-classical, bureaucratic and system approaches, merits and demerits of centralization and decentralization.
2. Basis and Sources of power, power structure, barriers and politics.
3. Organizational Goals-Primary, Secondary, Single and multiple goals; displacement, succession, expansion and multiplication of goals.
4. Organization-Types, Structure, line and staff, functional, committee, matrix, and project, formal and informal organization, organizational conflict- causes, cures.
5. Organizational Change- Nature, Significance, causes, cures, Resistance to change and adaptation.

Part-II Human Resource Management

1. HRM- Concept, objectives, significance, functions and challenges to HR Managers.
2. Recruitment and selection, methods of training, executive development programmes.
3. Motivation- Concept, theories- Maslow's Need Hierarchy, Herzberg's health & hygiene and Alderman's Z theory. Determinants of morale, morale and productivity.
4. Leadership- types and styles, Wages- methods of wage payment, wage differential and wage policy in India.
5. Industrial Relations-Nature, objectives, Scope and significance.
6. Collective Bargaining- Concept, features and requirements for successful bargaining; Worker's participation in management- levels and forms of participation, worker's participation in India.
7. Industrial disputes- reasons of industrial disputes, strike, lockout, prevention and settlement of industrial disputes; Trade Union- concept, types and trade union movement in India.

32. PUBLIC ADMINISTRATION: PAPER-I-Administrative Theory

I. Basic concept: Meaning, Scope and significance of Public Administation; Evalution of Pubic Administration as discipline (New Public Admn., New Public Management and New Public Services), Public and Private Administration; its role in developed and developing societies; Ecology of Administration-Social Political, Economic and Culture.
II. Theories of Administration: Classical theory (Henri Fayol, Luther Gulick and others);

Contd...

Scientific management (Taylor and his associates): Bureaucreatic theory (Max Weber and his critics); Human Relations theory (Elton Mayo and his colleagues); Systems approach (Chester Bamard).

III. Principles of Organisation: Hierarchy; Unity of Command, Span of Control, Power, Authority and Responsibility. Coordination; Communication, Supervision, Centralisation, Decentralisation and Delegation.

IV. Administrative Behaviour: Decision Making with special reference to the contribution of Herbert Simon, Theories of Communication, Morale, Motivation and Leadership.

V. Structure of Organisation: Chief Executive and his/her functions Line, Staff and Auxiliary Agencies, Departments, Corporation, Companies, Boards and Commissions, Headquarters and field relationship.

VI. Personnel Administration: Bureaucracy and Civil Services, Classification, Recruitment, Training, Career Development, Performance Appraisal, Promotion; Pay Structuring; Service conditions; Integrity and Discipline, Employer-Employee realations; Retirement benefits; Generalists and Specialists; Neutrality and Anoymity.

VII. Financial Administration: Concepts of Budget, Preparation, enactment and execution of the Budget; Performance Budgeting, Zero Base Budgeting, Accounts and Audit.

VIII. Accountability and Control: Concepts of Accountability and control, Control over Administration; Legislative, Executive, Judicial and Citizen control.

IX. Administrative Reforms: Concepts and processes, O & M, Work study and its techniques, Problems and prospects.

X. Administrative Law: Concepts and significance, Delegated Legislation, Meaning, types advantages, limitations and safeguards, Administrative Tribunals.

XI. Comparative and Development Administration: Meaning, nature and scope; Contribution of Fred Riggs with special reference to the Prismatic-Sala Model; Concepts Scope and significance of development Administration, Political, Economic and socio-cultural context of Development Administration, Concepts of Administrative Development.

XII. Public Policy: Concepts and significance, Theories of public, public policy formulation, execution and evaluation.

PUBLIC ADMINISTRATION: PAPER-II

INDIAN ADMINISTRATION

I. Evolution of Indian Administration: Major Characteristics of Mauryan, Mughal and British Periods.

II. Constitutional Setting: Parliamentary Democracy; Federalism; Secularism, Socialism.

III. Poitical Executive at the Union Level: President, Prime Minister, Council of Ministers: Cabinet Committees.

IV. Structure of control Administration: Central Secretariat; Cabinet secretariat Ministries and Departments, Boards and Commissions, Field Organizations.

V. Central- State Relations: Legislative, Administrative and Financial.

VI. Public Services: All India, Central and State Services. Union and State Public Service Commissions: Training of Civil Servants.

VII. Machinary for Planning: Plan formulation at the national level; NITI Aayog, National Development Council, Planning Machinery at the State and District levels.

VIII. Public Sector Undertakings: Forms, Top-level Managements, control and Problems.

IX. Control over Public Expenditure: Parliamentary Control; Role of the Finance Ministry, Comptroller and Auditor General.

X. Administration of Law and Order: Role of Central and State Agencies in Maintenance of Law and Order.

XI. State Administration: Governor, Chief Minister, Council of Ministers, Chief Secretary, Secretariat; Directorates.

XII. District Administration: Role and importance, District Magistate / Collector, Land Revenue, Law and Order and Developmental functions, District Rural Development Angency, Special Programmes of Rural Areas.

XIII. Local Administration: Panchayti Raj and Urban Local Government, Features, forms and problems, Autonomy of Local Bodies.

XIV. Administration for Welfare: Administration for the welfare of weaker sections with particular reference to Scheduled Castes, Scheduled Tribes; Programme for the welfare of Women.

XV. Issue Areas in Indian Administration: Relationship between political and permanent Executives, Generalists and Specialists in Administration, Integrity in Administration, People's Participation in Administration, Redressal of Citizen's Grievances; Lok Pal and Lok Ayuktas; Administration Reforms in India.

33. AGRICULTURAL ENGINEERING

PAPER-I

(a) Thermodynamics and Heat Engines: concept of energy, temperature and heat equations; laws of thermodynamics, pure substances and their properties; entropy; Rankine, air standard otto, diesel and joule cycles; indicator diagrams.

(b) Farm Power: sources and status of power in India; farm power and agricultural productivity relationship; construction and operation features of IC engines, various systems of an IC engine viz carburetion, ignition, cooling, lubrication, valves and valve timing; special features of Diesel engines; Tractors and their classification, power transmission systems and devices, repair and maintenance; Tractor testing and tractor economics; power tillers- their economics and suitability, energy in agriculture.

(c) Farm Machinery: design, construction, operation, repair and maintenance of tillage tools, implements and equipment viz. Mould board and disk ploughs; hoe, harrow and cultivator; seeding and planting machines; weeders, sprayers and dusters; harvesters, threshers and combines; soil and crop factors influencing machine performance and energy requirement; selection of farm machines, economics of agricultural mechanization.

(d) Mass Transfer: thermal properties of materials, steady state and transient heat conduction, natural and forced convection; boiling, condensation, thermal radiation exchange; heat exchangers; heat and mass transfer analogy, Fick's laws of diffusion, psychrometrics; analysis of heat and mass transfer processes; instrument and measurement systems.

(e) Process and Food Engineering: protected cultivation- green house concept, structures and instruments; unit operations in post harvest processing (cleaning, grading, drying, size reduction, evaporation, pasteurization, distillation etc.); processing of cereals, pulses, oilseeds, fruits & vegetables, animal feed, spices, dairy products, meat etc. design of processing equipment and processing systems; Milking Machines.

(f) Storage and Handling: changes in stored products during storage; storage of food grains and their products, perishables (vegetable fruits, dairy product, meat, eggs); storage system- airtight ventilated, refrigerated, modified atmospheric and controlled atmospheric storages; packaging; conveyors; design and management of storage and handling systems.

AGRICULTURAL ENGINEERING

PAPER- II

(a) Fluid Mechanics: fluid properties, units and dimensions; surface tension and capillarity, equation of continuity, Bernoulli equation, laminar and turbulent flow, steady and unsteady flow, flow of fluids in pipes and open channels, design of open channels for non erosive and non silting valocities, most economical cross section, measurement of irrigation water and other water measuring devices viz. Weirs, notches, orifices and flumes.

(b) Surveying and Levelling: linear measurements; survey methods and devices used; principle of levelling; differential and profile levelling; contouring and characteristics of contour lines; land levelling and grading; earth work estimation; earth moving machineries.

(c) Soil and Water Conservation Engineering: forms of precipitation; hydrologic cycle; point rainfall analysis, frequency analysis; agricultural watershed and its management; water management in agri-horti-acquaculture system, mechanics of water and wind erosion; Rational method of prediction of peak runoff; concept of unit hydrograph and instantaneous hydrograph; factors affecting erosion and run off; water erosion control measures- contour cultivation, strip cropping, terracing, including afforestation and pastures; design of gully control structures- temporary and permanent; stream bank erosion; flood routing, flood amelioration by upstream watershed management; wind erosion control measures and sand dune stabilization.

(d) Pumps: design, construction and performance characteristics; selection, installation, servicing and maintenance of different pumps (reciprocating, centrifugal, gear, turbine, submersible, propeller, jet); hydraulic ram; renewable and non-renewable power sources for pumping; solar pumps.

(e) Irrigation Engineering: water wealth and irrigation in India; soil water plant relationship; basic soil physical properties influencing soil water relationship; forms and occurrence of soil water; methods and devices for soil moisture measurement; water requirement of crops; irrigation scheduling; irrigation methods viz flood, border, furrow, sprinkler and drip irrigation, their hydraulics and design; concept of irrigation efficiencies; water conveyance and control; design of canals, Lacey and Kennedy's theories.

(f) Drainage Engineering: drainage needs and its benefits; Darcy's Law, hydraulic conductivity; drainage coefficient; drainage methods, surface drainage (drainage of flat and sloping lands); design of open ditches their alignment and construction; designs and layout of subsurface drains; depth and spacing of drains and drainage outlets; installation of drains and drainage wells; drainage of salt affected areas.

(g) Rural Engineering: building materials and their properties; farmstead planning, factor affecting location of farmstead; design of dairy barns, poultry housing, Planning and Design of rural houses, farm roads, village drainage; waste disposal and sanitary structures; cost estimates; rural electrification; integrated rural energy planning and development.

34. MEDICAL SCIENCE

PAPER- I

1. Human Anatomy:

Gross anatomy, applied anatomy, blood supply and lymphatic drainage of tongue, thyroid, mammary gland, stomach, liver, prostate, gonads, uterus, Heart and lungs.

Applied anatomy including blood and nerve supply of upper and lower limbs and joints of shoulder, hip and knee.

Applied anatomy of diaphragm, perineum and inguinal region.

Applied anatomy of kidney, urinary bladder, uterine tubes and vas deferens.

Embryology: Placenta and placental barrier. Development of heart, gut, kidney, uterus, ovary, testis and their common congenital abnormalities.

Central and peripheral autonomic nervous system: Gross and clinical anatomy of ventricles of brain, circulation of cerebrospinal fluid; Neural pathways and lesions of cutaneous sensations, hearing and vision; Cranial nerves, distribution and clinical significance; Components of autonomic nervous system, Internal capsule and cerebral cortex.

2- HUMAN PHYSIOLOGY

Blood-

IMMUNITY, THROMBOCYTOPENIA

CVS_CARDIC CYCLE,

RESPIRATION-OBSTRUCTIVE DISEASES, ACID BASE BALANCE

KIDNEY- MICTURATION REFLEX,

GIT- PEPTIC ULCER, LIVER FAILURE, JAUNDICE (OBSTRUCTIVE, HEPATIC, HEMOLYTIC) ACUTE PANCRETITIS)

ENDOCRINE – GOITER, OSTEOMALACIA, MASTER GLAND

CNS- CEREBRAL STROKE, PARKINSON'S

DISEASE, HEMIPLEGIA PARAPLEGIA

SPECIAL SENSES—NIGHT BLINDNESS, CATRACT, MYOPIA, HYPERMETROPIA, AMBLAYOPIA

REPRODUCTION – PREGNANCY TESTS, LACTATION, AMENORRHOEA, STERLITY IN MALE & FEMALE, OVULATION, SPERM COUNT

3. Biochemistry:

1. Organ function tests-liver, Kidney, thyroid.
2. Protein synthesis.
3. Vitamins and minerals.
4. Polymerase chain reaction (PCR)
5. Enzymes & Biomarkers
6. Diabetes Mellitus & Blood Sugar Level.
7. DNA Replication.
8. RNA Transcription
9. DNA Repair Mechanism.
10. Lipid Profile
11. Nutrition
12. Hemoglobin.
13. Free Radical & Antioxidants.

4. Pathology:

Inflammation and repair, disturbances of growth and cancer, Pathogenesis and histopathology of rheumatic and ischemic heart disease, Diabetes mellitus. Differentiation between benign and malignant tumours. Pathogenesis and histopathology of bronchogenic carcinoma, carcinoma breast, oral cancer, cancer cervix, leukemia, Etiology, pathogenesis and histopathology of – cirrhosis liver, glomerulonephritis, tuberculosis. Anemia, Thalassemia, Fatty liver, Cholelithiasis, Inflammatory, Bowel Disease, Autoimmunity, Stem cell.

5. Mecrobiology:

Humoral and cell mediated immunity, Koch's postulates

Diseases caused by and laboratory diagnosis of –

Meningococcus, Salmonella Shigella, Herpes, Dengue, Polio, Bacteriophages, Influenza virus, Japanese encephalitis virus, Tuberculosis, HIV/AIDS, Malaria, E. histolytica, Giardia

Contd...

Candida, Cryptococcus, Aspergillus.

6. Pharmacology:

- Drug Nomenclature
- Adverse Drug Reactions
- Drug Act & Drug Schedules
- Drug Clinical trial
- Drug Life,
- Drug Advertisement
- Drug Addiction
- Pharmaco Vegilance Programme
- Prescription Writing
- Side effects of the following drugs:
  Antipyretics and analgesics, Antibiotics,
  Antimalaria, Antikala-azar, Antidiabetics,
  Antihypertensive, Antiviral, Antiparasitic, Antifungal,
  Immunosuppressants
  Anticancer. Anti-diarrheal, Antitubercular, Diuretics.

7. Forensic Medicine and Toxicology:

Medical Ethics and Law, Medico legal aspect of pregnancy, delivery and abortion; Sexual offences, Forensic examination of injuries and wounds; Examination of blood and seminal stains; poisoning, sedative overdose, hanging, drowning, burns, DNA and finger print study.

Medical Science- Paper –II

1. General Medicine:

A) Aetiology, Clinical features, diagnosis and principals of management (including prevention) of: Tetanus, Rabies, HIV / AIDS, Dengue, Japanese Encephalitis, Typhoid, Leprosy, Tuberculosis, Malaria, Indian Kala-azar, Rheumatic Heart disease.

B) Aetiology, Clinical features, diagnosis and principals of management of: Ischemic Heart Disease, Hypertension, Diabetes Mellitus, Hypothyroidism, Hyper thyroidism, Epilepsy, Bronchial Asthma, Chronic Obstructive Lung Disease (COPD), Pleural Effusion, Viral Hepatitis and Cirrhosis of Liver, Peptic Ulcer Disease, Pneumonia, Occupational Lung disease.

C) Aetiology, Clinical features, diagnosis and principals of management of:
Glomurulonephritis, Nephrotic / Nephritic Syndrome, Renal Failure, Hyponatremia, Anemia, Thalassemia, Haemophillia, Leukaemia, Lymphoma, Rheumatoid Arthritis, Osteoporosis, Urinary Tract Infections, Meningitis, Encephalitis.

D) Medical Emergencies: Heat stroke, Drowning, Carbon monoxide poisoning, Organo-phosphorus poisoning, Aluminium phosphoid poisoning.

E) Anxiety, Psychosis, Schizophrenia, **Dementia**

F) Medico-legal aspect of Hanging, Alcoholism,

G) Investigative Procedures in Medicine: Ultrasonography, CT Scan, MRI, Echocardiography, **Endoscopy, Bone Marrow aspiration, CSF examination, Complete Blood Count.**

2. Pediatrics:

Immunization, Baby friendly hospital, Breast feeding, congenital cyanotic heart disease, respiratory distress syndrome, broncho-pneumonias, Neonatal hyperbilirubinemia, Kernicterus. IMNCI classification and management, PEM grading and management, ARI and Diarrhea of under five years children and their management.

3. Dermatology:

Psoriasi, scabies, eczema, vitiligo, Stevan Johnson's syndrome and TEN, Lichen Planus, Leprosy, Bacterial viral and fungal infections of skin.

4. General Surgery:

Clinical features, causes, diagnosis and principles of management of cleft palate, harelip.
Laryngeal tumor, oral and esophageal tumors.
Peripheral arterial diseases, varicose veins,
Tumours of Thyroid, Adrenal Glands, Breast Abscess, cancer, fibroadenoma and adenosis
Bleeding peptic ulcer, tuberculosis of bowel, ulcerative colitis, cancer stomach.
Renal mass, Cancer Prostate, Benign Prostatic Hyperplasia (BPH).
Haemothorax, stones of Gall bladder, Kidney, Ureter and Urinary Bladder.
Management of surgical conditions of Rectum, Anus and Anal canal, Gall bladder and Bile ducts.
Portal hypertension, liver abscess, peritonitis, Peri Ampullary Carcinoma Fractures of spine, Colles' fracture and bone tumors.
Endoscopy.
Laparoscopic Surgery.
Advance Trauma Life Support System (ATLS)
Surgical Ethics.

5. Obstetrics and Gynaecology including Family Planning:

Fertilization and Implantation, Development, Function and Abnormalities of placenta.
Diagnosis of pregnancy, Antenatal care.
Labour management, complications of 3rd stage, Antepartum and postpartum hemorrhage, resuscitation of the newborn, Management of abnormal lie and difficult labour, Management of small for date, Fetal growth restriction or premature newborn.
Diagnosis and management of anemia, Preeclampsia and Eeclampsia of pregnancy, Management of Rh-Negative, Diabetes with pregnancy, multiple pregnancy. Birth injuries.
Management of Abortion, Ectopic pregnancy.
Intra-uterine devices, pills, tubectomy and vasectomy, Medical termination of pregnancy including legal aspects.
Development of genital organs, Congenital anomalies of uterus and their treatment.
Vaginal discharge, pelvic pain, infertility, Abnormal uterine bleeding (AUB), Fibroid and prolapsed of uterus.
Management of Post- menopausal Syndrom.
Cancer cervix, Carcinoma body of uterus and ovary.

6. Community Medicine (Preventive & Social Medicine)

1. Concepts of health and disease
2. Principles, methods, approach and measurement of Epidemiology
3. Food and nutrition security, Nutritional Diseases / disorders & National Nutritional Programmes.
4. Components of environment, pollution related disesses, and Total Sanitary Campaign, Management of Hospital and Industrial waste, Nosocomial Infections.
5. Health Information System, Basics of Medical Statistics, Demography and Information, education & communication
6. Health management and administration: Techniques, Tools, Programme implementation and Evaluation.
7. Critical appraisal of Health Care Delivery System
8. Objectives, Components, Goals and Status of Reproductive and child Health, National health Mission Millennium and Sustainable Developments Goals.
9. Objectives, components and critical appraisal of National Health Programmes: i) For Communicable Diseases (RNTCP, NVBDCP, AIDS), ii) Non-communicable Diseases (National Programme for Control of Non-communicable Diseases, National Mental Health programmes, Geriatric Mental Health)
10. Occupational Health
11. Disaster Management and Health Management in fairs and festivals
12. Policies, acts and legislations related to health
13. National and International Health Organizations.

APPENDIX-7

PLAN OF EXAMINATION AND SYLLABUS for Main (Written) Examination of Assistant Conservator of Forest / Range Forest Officer Services Examination.

Plan of Main (Written) Examination

S.N.	Question Paper	Time Period	Marks
01	Paper-I General Hindi and Essay (Conventional Type)	3 hours	200
02	Paper-II General Studies-Ist Paper (Objective Type)	2 hours	200
03	Paper-III General Studies-IInd Paper (Objective Type)	2 hours	200
04	Paper-IV Optional Subject-I (First Question Paper) (Conventional Type)	3 hours	200
	Paper-V Optional Subject-I (Second Question Paper) (Conventional Type)	3 hours	200
05	Paper-VI Optional Subject-II (First Question Paper) (Conventional Type)	3 hours	200
	Paper-VII Optional Subject-II (Second Question Paper) (Conventional Type)	3 hours	200
	Total Marks of all the question papers		**1400**

Personality Test (Interview) - 150 Marks
Grand Total - 1400 + 150 = 1550 Marks

Any two subjects to be selected from the following list of the optional subjects-

1. Agriculture
2. Agriculture Engineering
3. Botany
4. Chemistry
5. Chemical Engineering
6. Civil Engineering
7. Forestry
8. Geology
9. Mathematics
10. Mechanical Engineering
11. Physics
12. Statistics
13. Zoology
14. Animal Husbandry and Veterinary Science
15. Horticulture
16. Environmental Science.

Provided that the candidates will not be allowed to offer the following combination of subjects-
(a) Agriculture, Agriculture Engineering and Horticulture
(b) Mathematics and Statistics
(c) Chemistry and Chemical Engineering
(d) of the Engineering Subjects viz. Agriculture Engineering, Chemical Engineering, Civil Engineering and mechanical Engineering not more than one subject.

Note- The standard and syllabus of the subjects mentioned above are given in this advertisement under schedule to the **appendix-8**.

APPENDIX -8

General Instructions and Syllabus for Main (Written) Examination of Assistant Conservator of Forest / Range Forest Officer Services Examination

1. All the question papers for the examination will be of conventional (essay) type but general studies will be objective type.
2. All question papers must be answered in Hindi or English. Question papers will be set in Hindi and English.
3. The duration of each of the papers referred to above will be three hours but general studies will be two hours.

Personality Test

The candidate will be interviewed by a board of competent and unbased observers. Personality test will be 150 Marks.

Schedule

The standard of papers in General Hindi and General Studies will be such as may expected of a Science or Engineering Graduate of an Indian University.

The Scope of the Syllabus for optional subject papers for the examination is broadily of the Honour's Degree level i.e. available higher than the Bachelor's Degree and lower than the Master's Degree. In the case of Engineering subject, the level corresponds to the Bachelor's Degree. There shall be no practical exam. in any subject.

OPTIONAL SUBJECTS

Total number of questions in the question papers of optional subjects will be eight. All questions will carry equal marks. Each paper will be divided into two parts, viz. Part A and Part B, each part containing four questions. Out of eight questions, five questions are to be attempted. One question in each part will be compulsory. Candidates will be required to answer three more questions out of the remaining six questions, taking at least one question from each part. In this way, at least two questions will be attempted from each part i.e. one compulsory question plus one more.

सामान्य हिन्दी एवं निबन्ध

प्रथम खण्ड — सामान्य हिन्दी — निर्धारित अंक 100

1. अपठित गद्यांश का संक्षेपण, उससे सम्बन्धित प्रश्न, रेखांकित अंशों की व्याख्या एवं उसका उपयुक्त शीर्षक।
2. शासकीय, अर्द्धशासकीय, वैयक्तिक तथा व्यवसायिक समस्याओं के निराकरण हेतु सम्बन्धित को सम्बोधित पत्र, कार्यालय आदेश, अधिसूचना और परिपत्र सम्बन्धी पत्रलेखन / आलेखन।
3. अनेकार्थी शब्द, विलोम शब्द, पर्यायवाची शब्द, तत्सम एवं तद्भव, क्षेत्रीय, विदेशी (शब्द भण्डार), वर्तनी, अर्थबोध, शब्द–रूप, संधि, समास, क्रियायें, हिन्दी वर्णमाला, विराम चिन्ह, शब्द रचना, वाक्य रचना, अर्थ, मुहावरे एवं लोकोक्तियाँ, उ.प्र. की मुख्य बोलियाँ तथा हिन्दी भाषा के प्रयोग में होने वाली अशुद्धियाँ।

द्वितीय खण्ड — हिन्दी निबन्ध — निर्धारित अंक 100

इसके अन्तर्गत दो उपखण्ड होंगे। प्रत्येक उपखण्ड से एक–एक निबन्ध (कुल मिलाकर दो निबन्ध) लिखने होंगे। प्रत्येक निबन्ध की विस्तार सीमा 700 शब्द होगी। निबन्ध हेतु निम्नवत् क्षेत्र होंगेः–

(अ) (i) साहित्य, संस्कृति (ii) राष्ट्रीय विकास योजनायें / क्रियान्वयन (iii) कृषि, उद्योग एवं व्यापार।
(ब) (i) विज्ञान, पर्यावरण (ii) प्राकृतिक आपदायें एवं उनके निवारण (iii) राष्ट्रीय, अन्तर्राष्ट्रीय, सामयिक सामाजिक समस्यायें / निदान।

General Studies, Paper-I

1. History of India - Ancient, Mediaeval, Modern
2. Indian National Movement and Indian Culture.
3. Population, Environment and Urbanization in Indian Context.

Contd...

4. World Geography, Geography of India and its natural resources.
5. Current events of national and International Importance.
6. Indian Agriculture, Trade and Commerce.
7. Specific Knowledge of U.P. regarding education, Cultural, Agricultural, Trade, Commerce, the methods of living and Social Customs.

History of India and Indian culture will cover the broad history of the country from about the middle of the nineteenth century and would also include questions on Gandhi, Tagore and Nehru. The part on current events of national and international Importance will include questions also on sports and games.

General Studies, Paper-II

1. Indian Polity
2. Indian Economy
3. General Science (Role of Science and technology in the development of India including science in every day life)
4. General Mental ability.
5. Statistical Analysis, Graphs and Diagrams.

The part relating to Indian polity will include questions on the political system in India and Indian constitution. The Indian economy will cover broad features of economic policy in India. The part relating to role and impact of science and technology in the development of India, questions will be asked to test the candidates awareness in this field. Emphasis will be on the applied aspects. The part relating to statistical analysis, graphs and diagrams will include exercise to test the candidates ability to draw common sense conclusions from information presented in statistical graphical or diagrammatical form and to point out deficiencies limitation or inconsistencies there in.

OPTIONAL SUBJECTS

Total number of questions in the question papers of optional subjects will be eight. All questions will carry equal marks. Each paper will be divided into two parts, viz. Part A and Part B, each part containing four questions. Out of eight questions, five questions are to be attempted. One question in each part will be compulsory. Candidates will be required to answer three more questions out of the remaining six questions, taking at least one question from each part. In this way, at least two questions will be attempted from each Part i.e. one compulsory question plus one more.

AGRICULTURE
PAPER-I

Ecology and its relevance to man, natural resources, their sustainable management and conservation, Physical and Social environment as factors of crop distribution and production Climatic elements as factors of crop growth, Impact of changing environment on cropping pattern as indicators of environments. Environmental pollution and associated hazards to crops, animals, and humans.

Cropping pattern in different agro-climatic zones of the country, Impact of high-yielding and short-duration varieties on shifts in cropping pattern. Concepts of multiple cropping, multi-storey, relay and inter-cropping, and their importance in relation to food production. Package of practices for production of important cereals, pulses, oil seeds, fibres, sugar, commercial and fodder crops grown during Kharif and Rabi seasons in different regions of the country.

Important features, scops and propagation of various types of forestry plantations such as extension, social forestry, agro-forestry and natural forests.

Weeds, their characteristics, dissemination and association with various crops; their multiplications; cultural, biological and chemical control of weeds. Soil-physical, chemical and biological properties, Processes and factors of soil formation. Modern classification of Indian soils, Mineral and organic constituents of soils and their role in maintaining soil productivity. Essential plant nutrients and other beneficial elements in soils and plants. Principles of soil fertility and its evaluation for judicious fertiliser use, integrated nutrient management. Losses of nitrogen in soil, nitrogen-use efficiency in submerged rice soils, nitrogen fixation in soils. Fixation of phosphorus and potassium in soils and the scope for their efficient use. Problem soils and their reclamation methods.

Soil conservation planning on watershed basis, Erosion and run-off management in hilly, foot hills and valley lands; processes and factors affecting them. Dry land agriculture and its problems. Technology of stabilising agriculture production in rain fed agriculture area.

Water-use efficiency in relation to crop production, criteria for scheduling irregations, ways and means of reducing run-off losses of irrigation water. Drip and sprinkler irrigation. Drainage of water- logged soils, quality of irrigation water, effect of industrial effluents on soils and water pollution.

Farm management, scope, important and characteristics, farm planning. Optimum resources use and budgeting. Economics of different types of farming systems.

Marketing and pricing of agricultural inputs and outputs, price fluctuations and their cost; role of co-operatives in agricultural economy; types and systems of farming and factors affecting them.

Agricultural extension, its importance and role, methods of evaluation of extension, programmes, socio-economic survey and status of big, small and marginal farmers and landless agricultural laborers; farm mechanization and its role in agricultural production and rural employment. Training programmes for extension workers; lab-to-land programmes.

AGRICULTURE
PAPER-II

Cell Theory, cell structure, cell organelles and their function, cell division, nucleic acids-structure and function, gene structure and function. Laws of heredity, their significance in plant breeding, Chromosome structure, chromosomal aberrations, linkage and cross-over and their significance in recombination breeding. Polyploidy, euploids and aneuploids, Mutation-micro and macro-and their role in crop improvement, variation components of variation. Heritability, sterility and incompatibility, classification and their application in crop improvement, Cytoplasmic inheritance, sex-linked, sex-influenced and sex-limited characters.

History of plant breeding, Modes of reproduction, selfing and crossing techniques, Origin and evolution of crop plants, centre of origin, law of homologous series, crop genetic resources-conservation and utilization, Application of principles of plant breeding to the Improvement of major field crops. Pure-line selection, pedigree, mass and recurrent selections, combining ability, its significance in plant breeding. Hybrid vigour and its exploitation, backcross method of breeding, breeding for disease and pest resistance, role of interspecific and intergeneric hybridization. Role of biotechnology in plant breeding. Improved varieties, hybrids, composites of various crop plants.

Seed technology, its importance. Different kinds of seeds and their seed production and processing techniques. Role of public and private sectors in seed production, processing and marketing in India.

Physiology and its significance in agriculture, imbibition, surface tension, diffusion and osmosis. Absorption and translocation of water, transpiration and water economy.

Enzymes and plant pigments; photosynthesis-modern concepts and factors affecting the process, aerobic and nonaerobic respiration; c, c and CAM mechanisms, Carbohydrate, protein and fat metabolism.

Growth and development; photoperiodism and vernalization. Auxins, hormones and other plant regulators and their mechanism of action and importance in agriculture. Physiology of seed development and germination; dormancy. Climatic requirements and cultivation of major fruits, plants, vegetables crops and flower plants; the package of practices and their scientific basis. Handling and marketing problems of fruit and vegetables. Principal methods of preservation of Important fruits and vegetable products, processing techniques and equipment. Role of fruits and vegetables in human nutrition. Raising of ornamental plants and design and layout of lawns and gardens.

Diseases and pests of field vegetables, orchard and plantation crops of India. Causes and classification of plant pests and diseases. Principles of control of plant pests and diseases. Biological control of pests and diseases. Integrated pest and disease management. Epidemiology and forecasting. Pesticides, their formulations and modes of action. Compatibility with rhizobial Inoculants. Microbial Toxins, Storage pests and diseases of cereals and pulses and their control.

Food production and consumption trends in India. National and International food policies. Production, procurement, distribution and processing constraints. Relation of food production to national dietary pattern, major deficiencies of calorie and protein.

AGRICULTURAL ENGINEERING
PAPER-I
SECTION A

1. Soil and Water Conservation: Scope of - Soil and water conservation. Mechanics and types of erosion, their causes. Mechanics and types of erosion, their causes. Rainfall, runoff and sedimentation relationships and their measurement. Soil erosion control measures-biological and engineering including stream bank protection-vegetative, barriers, contour bunds, contour trenches, contour stone walls, contour ditches, terraces, outlets and grassed waterways. Gully control structures-temporary and permanent-design of permanent soil conservation structures such as chute, drop and drop inlet spiliways. Design of farm, ponds and percolation ponds. Principles-of flood control-flood routing. Watershed Management-investigation, planning and implementation-selection of priority areas and water shed work plan, water harvesting and moisture conservation. Land development-levelling, estimation of earth volumes and costing. Wind Erosion process-design of shelter belts and wind brakes and their management. Forest (Conservation) Act.

2. Aerial Photography and Remote Sensing: Basic characteristics of photographic images, interpretation keys, equipment for interpretation, imagery interpretation for land use, geology soil and forestry.

Remote sensing-merits and demerits of conventional and remote sensing approaches. Types of satellite images, fundamentals of satellite image interpretation, techniques of visual and digital interpretations for soil, water and land use management. Use of GIS in planning and development of watersheds, forests including forest cover, water resources etc.

SECTION B

3. Irrigation and Drainage: Sources of water for irrigation. Planning and design of minor irrigation projects. Techniques of measuring soil moisture-laboratory and in situ, soil-water plant relationships. Water requirement of crops. Planning conjunctive use of surface and ground water. Measurement of irrigation water, measuring devices-orifices, weirs and flumes. Methods of irrigation-surface, sprinkler and drip, fertigation. Irrigation efficiencies and their estimation. Design and construction of canals, field channels, underground pipelines, head-gates, diversion boxes and structures for road crossing.

Occurence of ground water, hydraulics of wells, types of wells (tube wells and open wells) and their construction. Well development and testing. Pumps-types, selection and installation. Rehabilitation of sick and failed wells.

Drainage causes of water logging and salt problems. Methods of drainage-drainage of irrigated and unirrigated lands, design of surface, sub-surface and vertical drainage systems. Improvement and utilization of poor quality water. Reclamation of saline and alkali soils. Economics of irrigation and drainage systems. Use of waste water for irrigation-standards of waste water for sustained irrigation, feasibility and economics.

4. Agricultural Structures: Site selection, design and construction of farmstead-farm house, cattle shed, dairy barn, poultry shed, hog housing, machinery and implement shed, storage structures for food grains, feed and forage. Design and construction of fences and farm roads. Structures for plant environment-green houses, poly houses and shade houses. Commonbuilding materials used in construction-timber, brick, stone, tiles, concrete etc. and their properties. Water supply, drainage and sanitation systems.

AGRICULTURAL ENGINEERING
PAPER-II
SECTION 'A'

1. Farm power and machinery: Agricultural mechanization and its scope. Sources of farm power-animate and electromechanical, Thermodynamics, construction and working of internal combustion engines. Fuel, ignition, lubrication, cooling and governing system of IC engines. Different types of tractors and power tillers. Power transmission, ground drive, power take off (p.t.o.) and control system. Operation and maintenance of farm machinery for primary and secondary tillage. Traction theory, Sowing transplanting and interculture implements and tools. Plant protection equipment-spraying and dusting. Harvesting, threshing and combining equipment. Machinery for earth moving and land development-methods and cost estimation. Ergonomics of man-machine system. Machinery for horticulture and agro-forestry, feeds and forages. Haulage of agricultural and forest produce.

2. Agro-energy: Energy requirements of agricultural operations and agroprocessing. Selection, Installation, safety and maintenance of electric motors for agricultural applications. Solar (thermal and photovoltic), wind and biogas energy and their utilization in agriculture, gasification of biomass for running IC engines and for electric power generation. Energy efficient cooking stoves and alternate cooking fuels. Distribution of electricity for agricultural and agro-industrial applications.

Section 'B'

3. Agricultural Process Engineering: Post harvest technology of crops and its scope. Engineering properties of agricultural produces and by products. Unit operations cleaning grading, size reduction, densification, concentration, drying/dehydration, evaporation, filtration, freezing and packaging of agricultural produces and by-products. Material handling equipment-belt and screw conveyors, bucket elevators, their capacity and power requirement.

Processing of milk and dairy products- homogenisation, cream separation, pasteurization, sterilization, spray and roller drying, butter making, Ice cream, cheese and shrikhand manufacture. Waste and by product utilization rice husk, rice bran, sugarcane bagasse, Plant residues and coir pith.

4. Instrumentation and computer applications in Agricultural Engineering:

Contd...

Electronic devices and other characteristics rectifiers, amplifiers, oscillators, multivibrators, Digital circuits-sequential and combinational system. Application of microprocessors in data acquisition and control of agricultural engineering processes-measurement systems for level, flow, strain, force, torque, power, pressure, vacuum and temperature. Computer-intruduction, input/outputdevies, central processing unit, memory devices, operating systems, processors, keyboards and printers. Algorithms, flowchart specification, programme translation and problem analysis in Agricultural Engineering. Multimedia and Audio-Visual aids.

BOTANY

PAPER-I

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 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 view point. Distribution of Cryptogams in India and their economic potential.

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

Angiosperms: Systmatics, anatomy, embryology, palynology and phylogeny. Comparative account of various systems of Angiosperm Classification. Study of angiospermic families-Magnoliaceae, Ranunculaceae, Brassicaceae (Cruciferae), Rosacea 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 C3 and C4 plants.

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

4. Plant Utility and Exploitation: Origin of cultivated plants, Vavilovs centres of origin. Plants as sources for food, fooder, fibres, spices, beverages, drugs, narcotics, insecticides, timber, gums, resins and dyes. Latex, cellulose Strach 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.

BOTANY

PAPER-II

1. Cell Biology: Techniques of Cell Biology, Prokaryotic and eukaryotic cells- structural and Ultrastructural details. Structure and function of extracellular matrix of ECM (cell wall) and membranes-cell adhesion, membrane transport and vesicular transport-structure and function of cell organelles (chloroplasts, mitochondria, ER, ribosome's, 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.

2. Genetics, Molecular Biology and Evolution : Development of genetics, and geneversus 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 protines. Genetic code and regulation of gene expression. Multigene families.

Organic evolution-evidences, mechanism and theories. Role of RNA in origin and evolution.

3. Plant Breeding, Biotechnology an Bio-statistics: Methods of plant breeding introduction, selection and hybridisation' (pedigree, backcross, mass selection, bulk method). Male sterility and heterosis breeding. Use of apomixes in plant breeding. Micropropagation and genetic 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.

4. Physiology and Biochemistry: Water relations, Mineral nutrition and ion transport, miniral deficiencies. Photosynthesis-photochemical reactions, photophosphory-lation and corbon pathways including C pathway (photorespiration), C, C and CAM pathways. Respiration (anaerobic and aerobic, including fermentation)-electron transport chain and oxidative phosporylation, 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.

5. 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

PAPER-I

1. Atomic Structure

Quantum theory, Heisenberg's uncertainity principle, Schordinger 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: H2+, H2 to Ne2 NO, CO, HF, CN, CN, BeH2 and CO2. 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 interfacil 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, radious ratio rules, calculation of some limiting radius ration values. Structures of NaCl, ZnS, CsCl, CaF2, Cdl2 and rutile. Imperfection in crystals, stoichiometric and nonstoichiometric defects. Impurity defects, semi-conductors, Elementary study of liquid crystals.

4. The gaseous state

Education of state for real gases, Intermolecular Interactions, liquification of gases and critical phenomena, Maxwell's distribution of speeds, intermolecular collisions, collisions of 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 esnemble 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; Clauslus-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. Electrochemisty- Debye-Huckel theory of strong electrolytes and Debye-Huckel limiting Law for various equilibrium and transport properties.

Galvanic cells, concentration cells; electro-chemical 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; over-potential; electra-analytical techniques-voltameter, polarography, ampero-metry, cyclic-votametry, ion selective electrodes and their use.

8. Chemical Kinetics

Concentration dependence of rate of reaction; defferential 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

Adsorption from gases and, solutions on solid absorbents, 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 of 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 spactra 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 reaction in square-planer complexes; thermodynamic and kinetic stability of complexes.

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

(d) Complexes with aromatic systems, synthesis, structure and bonding in metal olefin complexs, alkyne complexes and cyclopentadienyl complexes; coordi-native 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

Reaction 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, fluoro-sulphuric acid and super acids.

CHEMISTRY

PAPER-II

1. Delocalised covalent bonding: Aromaticity, anti-aromaticity; annulenes, azulenes, tropolones, kekulene, fulvenes, sydones.

2. (a) Reaction mechanisms: General methods (both kinetic and non-kinetic) of study of mechanism or organic reactions illustrated by examples-use of isotope 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, benzynes and niternes.

(c) Substitution reactions: SN1, SN2, SNi, 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 E1cb mechanism; orientation in E2 reactions-Saytzeff and Hotfmann; pyrolytic syn elimination-acetate pyrolysis, Chugaev and Cope eliminations.

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

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

3. 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.

4. Chemistry and mechanism of reactions:

Aldol condensation (including directed aldol condensation), Claisen condensation, Dleckmann, Perkin, Knoevenagel, Witting, 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.

5. Polymeric Systems

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

(b) Preparation and properties of polymers:

Organic polymers-polyethylene, polystyrene, polvinyl 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.

6. Synthetic uses of reagents: OsO_4, HIO_4, Cro_3, $Pb(OAc)_4$, SeO2, NBS, B_2H_6, Na-Liquid NH_3, LiA1H4$NaBH_4$n-BuLi, MCPBA.

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

8. 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->p* and p->p* transitions; application to conjugated double bonds and conjugated carbonyls-Woodward Fieser rules.

d) Nuclear magnetic resonance: Isochronous and anisochronous protons; chemical shift and coupling constant; Application of H' NMR to simple organic molecules.

e) Mass spectra: Parent peak, base peak, daughter peak, matastable peak, fragmentation of simple organic molecule a cleavage, Mc-Latterly rearrangement.

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

CHEMICAL ENGINEERING
PAPER-I
Section A

a) Fluid and Particle Dynamics

Viscosity of fluids, Laminar and turbulent flows, Equation of continuity and Navier-Strokes equation- Bernoulli's theorem. Flow meters. Fluid drag and pressure drop due to friction Reynold's Number and friction factor-effect of pipe roughness. Economic pipe diameter. Pumps, water, air/stream jet ejectors, compressors, blowers and fans, agitation and mixing of liquids, Mixing of solids and pastes. Crushing and Grinding Principles and equipment. Rittinger's and Bond's laws. Filtration and filtration equipment. Fluid- particle mechanics-free and hindered setting. Fluidisation and minimum fluidisation velocity, concepts of compressible and incompressible flow. Transport of solids.

b) Mass Transfer

Molecular diffusion coefficient, First and second law and diffusion, mass transfer coefflecients, film and penetration theories of mass transfer, Distillation, simple distillation, relative volatility, fractional distillation, plate and packed columns of distillation. Calculation of packed columns for distillation. Calculation of theoretical number of plates. Liquid-liquid equilibria. Extraction-theory and practice;' design of gas-absorption columns, Drying, Humidification, dehumidi-fication, Crystallisation, Design of equipment.

c) Heat Transfer

Conduction, thermal conductivity, extended surface heat transfer.

Convection-free and forced. Heat transfer coefficients-Nusselt Number. LMTD and effectiveness. NTU methods for the design of Double Pipe and Shell & Tube Heat Exchangers, Analogy between heat and momentum transfer, Boiling and condensation heat transfer, single and multiple-effect evaporators. Radiation-. Stefan-Boltzman Law, emissivity and absorptivity. Calculation of heat load of a furnace, Solar heaters.

SECTION-B

d) Novel Separation Processes:

Equilibrium separation processesion exchange, osmosis, electro-dialysis, reverse osmosis, ultra-filtration and other membrane processes, Molecular distillation. Super critical fluid extraction.

e) Process Equipment design: Factors affecting vessel design criteria Cost considerations, Design of storage vessels-vertical, horizontal spherical, under-ground tanks for atmospheric and higher pressure. Design of closures flat and eliptical head. Design of supports. Materials of construction-characteristics and selection.

f) Process Dynamics and Control: Measuring instruments of process variable like level, pressure, flow, temperature pH and concentration with indication in visual/ pneumatic/analog/ digital signal forms. Control variable, manipulative variable and load variables. Linear control theory-Laplace, transforms. PID controllers. Block diagram representation, Transient and frequency response, stability of closed loop system. Advanced control strategies. Computer based process control.

CHEMICAL ENGINEERING
PAPER II
SECTION-A

(a) Material and Energy Balances

Material and energy balance calculations in processes with recycle/bypass/purge, Combustion of solid/liquid/gaseous fuels, stoichiometric relationships and excess air requirements. Adiabatic flame temperature.

(b) Chemical Engineering Thermodynamics Laws of thermodynamics. PVT relationship for pure components and mixture, Energy functions and inter-relatioships-Maxwells relations, Fugacity, activity and chemical potential. Vapourliquid equilibria, for ideal/non-ideal, single and multi component systems. Criteria for chemical reaction equilibrium, equilibrium constant and equilibrium conversions, Thermodynamic cycles-refrigeration and power.

(c) Chemical Reaction Engineering

Batch reactors-kinetics of homogeneous reactions and interpretation of kinetic data. Ideal flow reactors-CSTR, plug flow reactors and their performance equations. Temperature effects and run-away reactions. Heterogeneous reactions-catalystic and non-catalystic and gas-solid and gas-liquid reactions. Interinsic kinetics and global rate concept.

Importance of interphase and intraparticle mass transfer on performance.

Effective-nessfactor. Isothermal and non isothermal reactors and reactor stability.

SECTION-B

(d) Chemical Technology

Natural organic products-Wood and wood-based chemicals, pulp and paper, Agro-industries- sugar, Edible oils extraction (Including tree based seeds), Soaps and detergents, Essential oils- Biomass gasification (including biogas), Coal and coal chemical, Petroleum and Natural gas- Petroleum refining (Atmospheric distillation/cracking/reforming) Petrochemical industries- Polyethylene's (LDPE/HDPE/LLDPE), Polyvinyl Chloride, Polystyrene, Ammonia manufacture, Cement and lime industries, Paints and varnishes. Glass and ceramics Fermentation-alcohol and antibiotics.

(e) Environmental Engineering and Safety Ecology and Environment. Sources of pollutants in air and water, Green house effect, ozone layer depletion, acid rain. Micrometeorology and dispersion of pollutants in environment, Measurement techniques of pollutant levels and their control strategies. Solid wastes, their hazards and their disposal techniques, Design and performance analysis of pollution control equipment. Fire and explosion hazards rating HAZOP and HAZAN, Emergency planning, disaster management, Environmental legislations-water, air environment protection Acts. Forest (Conservation) Act.

(f) Process Engineering Economics

Fixed and working capital requirement for a process industry and estimation methods. Cost estimation and comparison of alternatives. Net present value by discounted cash flow. Pay back analysis. IRR, Depreciation, taxes and insurance, Break-even point analysis. Project scheduling-PERT and CPM, Profit and loss account, balance sheet and financial statement. Plant location and plant layout including piping.

CIVIL ENGINEERING
PAPER-1
Part-A

ENGINEERING MECHANICS, STRENGTH OF MATERIALS AND STRUCTURAL ANALYSIS, ENGINEERING MECHANICS:

Units and Dimensions, SI Units, Vectors, Concept of Force, Concept of particle and rigid body. Concurrent, Non-Concurrent- and parallel forces in a plane, moment of force and Varignon's theorem, free body diagram, conditions of equilibrium Principle of virtual work, equivalent force system.

First and Second Moment of area, Mass moment of Inertia, Static Friction, Inclined Plane and bearings, Kinematics and Kinetics, Kinematics In Cartesian and Polar Coordinates, motion under uniform and nonuniform acceleration, motion under gravity, Kinetics of particle: Momentum and Energy principles, D'Alembert's Principle, Collision of elastic bodies, rotation of rigid bodies, simple harmonic motion, Flywheel.

STRENGTH OF MATERIALS:

Simple Stress and Strain, Elastic constants, axially loaded compression members, Shear force and bending moment, theory of simple bending, Shear Stress distribution across cross sections, Beams of uniform strength, Leaf Spring, Strain Energy in direct stress, bending & shear. Deflection of beams; Mecaulay's method, Mohr's Moment area method, Conjugate beam method, unit load method, Torsion of Shafts, Transmission of power, close coiled helical springs, Elastic stability of columns, Euler's Rankin's and Secant formulae. Principal Stresses and Strains in two dimensions, Mohr's Circle, Theories of Elastic Failure, Thin and Thick cylinder; Stresses due to internal and external pressure.-Lame's equations.

STRUCTURAL ANALYSIS:

Castiglianios theroems I and II, Unit load method of consistent deformation applied to beams and pin jointed trusses. Slope-deflection, moment distribution, Kani's method of analysis and column Analogy method applied to indeterminate beams and rigid frames. Rolling loads and influences lines: Influences lines for Shear Force and Bending moment at a section of beam. Criteria for maximum shear force and bending Moment In beams traversed by a system of moving loads. Influences lines for simply supported plane pin jointed trusses.

Arches: Three hinged, two hinged and fixed arches, rib shortening and temperature effects, influence lines in arches.

Matrix methods of analysis: Force method and displacement method of analysis of indeterminate beams and rigid frames.

Plastic Analysis of beams and frames: Theory of plastic bending, plastic analysis, statical method, Mechanism method. Unsymmetrical bending: Moment of inertia, product of inertia, position of Neutral Axis and Principle axis, calculation of bending stresses.

PART-B

DESIGN OF STRUCTURES: STEEL, CONCRETE AND MASONRY STRUCTURES.

STRUCTURAL STEEL DESIGN:

Structural Steel: Factors of safety and load factors, Rivetted, bolted and welded joints and connections. Design of tension and compression member, beams of built up section, rivetted and welded plate girders, gantry girders, stancheons with battens and lacings, slab and gussetted column bases. Design of highway and railway bridges: Through and deck type plate girder, Warren girder, Pratt truss.

DESIGN OF CONCRETE AND MASONRY STRUCTURES:

Concept of mix design, Reinforces Concrete: Working Stress and Limit State method of design-recommendations of I.S codes, design of one way and two way slabs, stair-case slabs, simple and continuous beams of rectangular, T and L sections, Compression members under direct load with or without eccentricity, Isolated and combined footings. Cantilever and counterfort type retaining walls, Water tanks: Design requirements for rectangular and circular tanks resting on ground. Prestressed concrete; Methods and systems of prestressing, anchorages, analysis and design of sections for flexure beed on workingstress loss of prestress, Disign of brick masonry as per I.S. Codes Design of masonry retaining walls.

PART-C

FLUID MECHANICS, OPEN CHANNEL FLOW AND HYDRAULIC MACHINES

Fluid Mechanics: Fluid properties and their role in fluid motion, fluid statics including forces acting on plane and curve surfaces, Kinematics and Dynamics of Fluid flow: Velocity and accelerations, stream lines, equation of continuity, irrotational and rotational flow, velocity potential and stream functions, flownet, methods of drawing flownet, sources and sinks, flow separation, free and forced vortices.

Control volume equation, continuity, momentum, energy and moment of momentum equations from control volume equation, Navier-Strokes equation, Euler's equation of motion, application to fluid flow problems, pipe flow, plane, curved, stationary and moving vanes, sluice gates, weirs, orifice meters and Venturi meters.

Dimensional Analysis and Similitude: Buckingham's Pi-theorem, dimensionless parameters, similitude theory, model laws, undistorted and distorted models.

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Laminar Flow: Laminar flow between parallel, stationary and moving plates, flow through tube. **Boundary Layer:** Laminar and turbulent boundary layer on a flat plate, laminar sub-layer, smooth and rough boundaries, drag and lift.

Turbulent flow through pipes: Characteristics of turbulent flow, velocity distribution and variation of pipe friction factor, hydraulic grade line and total energy line, siphons, expansion and contractions in pipes, pipe networks, water hammer in pipes and surge tanks.

Open Channel Flow: Uniform and nonuniform flows, momentum and energy correction factors, Specific energy and specific force, critical depth, resistance equations and variation of roughness coefficient, rapidly varied flow, flow in contractions, flow at sudden drop, hydraulic jump and its applications surges and waves, gradually varied flow, classification of surface profiles, control section, step method of Integration of varied flow equation, moving surges and hydraulic bore.

HYDRAULIC MACHINES AND HYDROPOWER:

Centrifugal pumps-Types, characteristics, Net Positive Suction-height (NPSH), specific speed, Pumps in parallel.

Reciprocating pumps, Air vessels, Hydraulic ram, efficiency parameters, Rotary and positive displacement pumps, diaphragm and jet pumps, Hydraulic turbines, types classification, Choice of turbines, performance parameters, controls, characteristics, specific speed. Principles of hydropower development. Type, layouts and Component works, surge tanks,'types and choice, Flow duration curves and dependable flow. Storage and pondage, Pumped storage plants, Special features of mini, micro-hydel plants.

Part-D

GEO TECHNICAL ENGINEERING

Types of soil, phase relationships, consistency limits particles size distribution, classifications of soil, structure and clay mineralogy. Capillary water and structural water, effectives trees and pore water pressure, Darcy's Law, factors affecting permeability, determination of permeability, permeability of stratified soil deposits.

Seepage pressure quick sand condition, compressibility and consoli-dation, Terzaghi's theory of one dimensional consolidation, consolidation test.

Compaction of soil, field control of compaction, Total stress and effective stress parameters, pore pressure coefficients. Shear strength of soils, Mohr Coulomb failure theory, Shear tests.

Earth pressure at rest, active and passive pressure, Rankin's theory, Coulomb's wedge theory, earth pressure on retaining wall, sheetpile walls, Braced excavation, Bearing capacity, Terzaghi and other important theories, net and gross bearing pressure.

Immediate and consolidation settlement. Stability of slope, Total Stress and Effective Stress methods, Conventional methods of slices, stability number.

Subsurface exploration, methods of boring, sampling, penetration tests, pressure meter tests, Essential features of foundation, types of foundation, design criteria, choice of type of foundation, stress distribution in soils, Boussinessq's theory, Newmarks chart, pressure bulb, contact pressure, applicability of different bearing capacity theories, evaluation of bearing capacity from field tests, allowable bearing capacity, Settlement analysis, allowable settlement. Proportioning of footing, Isolated and combined footings, rafts, Buoyancy rafts, Pile foundation, types of piles, plies capacity, static and dynamic analysis, design, of pile groups, pile load test, settlement of piles, lateral capacity, Foundation for Bridges. Ground improvement techniques-preloading sand drains, stone column, grouting, soil stabilisation.

CIVIL ENGINEERING

PAPER- II

Part-A

CONSTRUCTION TECHNOLOGY, EQUIPMENT, PLANNING AND MANAGEMENT

1. Construction Technology:

Engineering Materials: Physical properties of construction materials: Stones, Bricks and Tiles; Lime, Cement and Surkhi Mortars; Lime concrete and Cement concrete, Properties of freshly, mixed and hardened concrete, flooring Tiles, use of ferro-cement, fibre-reinforced and polymer concrete, high strength concrete and light weight concrete. Timber: Properties and uses; defects in timber; seasoning and preservation of timber, Plastics, rubber and damp-proofing materials, termite proofing, Materials for Low cost housing.

Construction: Building components and their functions; Brick masonry: Bonds, jointing, Stone masonry, Design of Brick masonry walls as per I.S. codes, factors of safety, serviceability and strength requirements; plastering, pointing, Types of Floors & Roofs, Ventilators, Repairs in buildings, Functional planning of building; Building orientation, circulation, grouping of areas, privacy concept and design of energy efficient building; provisions of National Building Code, Building estimates and specifications; Cost of works; valuation.

2. Construction Equipment:

Standard and special types of equipment, Preventive maintenance and repair, factors affecting the selection of equipment, economical life, time and motion study, capital and maintenance cost.

Concreting equipments: Weigh batcher, mixer, vibration, batching plant, Concrete pump.

Earth-work equipment: Power shovel hoe, bulldozer, dumper, trailers, and tractors, rollers, sheep foot roller.

3. Construction Planning and Management: Construction activity, schedules, Job layout, bar charts, organization of contracting firms, project control and supervision. Cost reduction measures.

New-work analysis: CPM and PERT analysis, Float times, cashing of activities, contraction of network for cost optimization, up dating, cost analysis and resource allocation.

Elements of Engineering Economics, methods of appraisal, present worth, annual cost, benefit-cost, incremental analysis. Economy of scale and size. Choosing between alternativesincluding levels of investments, project profitability.

Part-B

SURVEY AND TRANSPORTATION ENGINEERING

Survey: Common methods of distance and angle measurements, plane Table survey, levelling traverse survey, triangulation survey, corrections, and adjustments, contouring, topographical map. Surveying instruments for above purposes Techeometry, Circular and transition curves, Principles of photogrammetry.

Railway: Permanent way, sleepers, rail fastenings, ballast, points and crossings, design of turn outs, stations and yards, turn-tables, signals, and interlocking, level-crossing, Construction and maintenance of permanent ways: Supereleviation, creep of rail, ruling gradient, track resistance, tractive effort, relaying of track.

Highway Engineering: Principles of highway planning, Highway alignments, Geometrical design:, Cross section, camber, superelevation, horizontal and vertical curves. Classification of roads: low cost roads, flexible pavements, rigid pavements, Design of pavements and their construction, evaluation of pavement failure and strengthening.

Drainage of roads: Surface and subsurface drainage.

Traffic Engineering: Forecasting techniques, origin and destination survey, highway capacity, Channelised and unchannelised Intersections, rotary design elements, markings, sign, signals, street lighting; Traffic surveys, Principle of highway financing.

Part-C

HYDROLOGY, WATER RESOURCES AND ENGINEERING

Hydrology: Hydrologilcal cycle, precipitation, evaporation, transpiration, depression storage, infiltration, overland flow, hydrograph, flood frequency analysis, flood estimation, flood routing through a reservoir, channel flow routing- Muskingam method.

Ground water flow: Specific yield, storage coefficient of permeability, confined and unconfined aquifers, aquifers, aquitards, radial flow into a well under confined and unconfined conditions, tube wells, pumping and recuperation tests, ground water potential.

WATER RESOURCES ENGINEERING:

Ground and surface water resource, single and multipurpose projects, storage capacity of reservoirs, reservoir losses, reservoir sedimentation, economics of water resources projects.

IRRIGATION ENGINEERING: Water requirements of crops: consumptive use, quality of water for irrigation duty and delta, irrigation methods and their efficiencies.

Canals: Distribution systems for canal irrigation, canal capacity, canal losses, alignment of main and distributory canals, most efficient section, lined canals, their design, regime theory, critical shear stress, bed load, local and suspended load transport, cost analysis of lined and unlied canals, drain-age behind lining.

Water logging: causes and control, drain-age system design, salinity.

Canal structures: Design of cross regulators, head regulators, canal falls, aqueducts, metering flumes and canal outlets.

Diversion head work: Principles and design of weirs of permeable and impermeable foundation, Khosle's theory, energy dissipation, stilling basin, sediment excluders.

Storage Works: Types of dams, design, principles of rigid gravity and earth dams, stability analysis, foundation treatment, joints and galleries, control of seepage. Spillways: Spillway types, crest gates, energy dissipation. River training: Objectives of river training, methods of river training.

Part-D

ENVIRONMENTAL ENGINEERING

Water Supply: Estimation of surface and subsurface water resources, predicting demand for, water, impurities of water and their significance, physical, chemical and bacteriological analysis, waterborne diseases, standards for potable water.

Intake of water: Pumping and gravity schemes. Water treatment: Principles of coagulation, flocculation and sedimentation; slow-, rapid-, pressure-, filters; chlorination, softening, removal of taste, odour and salinity.

Water storage and distribution: Storage and balancing reservoirs; types, location and capacity. Distribution system; layout, hydraulics of pipe lines, pipe fittings, valves including check and pressure reducing valves, meters, analysis of distribution systems, leak detection, maintenance of distribution systems, pumping stations and their operations.

Sewerage systems: Domestic and Industrial wastes, storm sewage-separate and combined systems, flow through sewers, design of sewers, sewer appurtenances, manholes, in lets, junctions, siphon, Plumbing in Public buildings.

Sewage characterisation: BOD, COD, solids, dissolved oxygen, nitrogen and TOC, Standards of disposal in normal water course and on land.

Sewage treatment: Working principles, units, chambers, sedimentation tanks, trickling filters, oxidation ponds, activated sludge process, septic tank; disposal of sludge, recycling of waste water.

Solid waste: Collection and disposal in rural and urban contexts, management of long-term ill-effects.

Environmental pollution: Sustainable development. Radioactive wastes and disposal, Environmental impact assessment for thermal power plants, mines, river valley projects, Air pollution, Pollution control acts.

FORESTRY

PAPER-I

SECTION A

1. Silviculture-General:

General Silviculture Principles:

Ecological and physiological factors influencing vegetation, natural and artificial regeneration of forests; methods of propagation, grafting techniques; site factors; nursery and planting techniques-nursery beds, poly-bags and maintenance, water budgeting, grading and hardening of seedlings; special approaches; establishment and tending.

2. Silviculture-Systems:

Clear felling, uniform shelter wood selection, coppice and conversion systems, Management of silviculture systems of temperate, subtropical, humid tropical, dry tropical and coastal tropical forests with special reference to plantation silviculture, choice of species, establishment and management of standards, enrichment methods, technical constraints, intensive mechanized methods, aerial seeding, thinning.

3. Silviculture Mangrove and Cold desert; Mangrove:

Habitat and characteristics, mangrove, plantation-establishment and rehabilitation of degraded mangrove formations; silvicultural systems for mangrove; protection of habitats against natural disasters, Cold desert Characteristics, identification and management of species.

4. Silviculture of trees:

Traditional and recent advances in tropical silvicultural research and practices. Silviculture of some of the economically important species in India such as Acacia catechu, Acacia nilotica, Acacia auriculiformis, Albizzia lebbeck, Albizzia procera, Anthocephalus Cadamba, Anogeissus, latifokia. Azadirachta indica, Bamboo spp, Butea monosperma, Cassia siamea, Casuarina equisetifolia, Cedrus deodara, Chukrasia tabularis, Dalbergia sisoo, Dipterocarpus spp, Ernblica officindils, Eucalyptus spp, Gmelina Arborea, Hardwickia binata, Largerstroemia Lanceolata, Pinus roxburghi, Populus spp, Pterocarpus marsupium, Prosopis juliflora, Santalum album, Samecarpus anacrdium, Shorea robusta, Salmalla malabaricum, Tectona grandis, Terminalis tomemtosa, Tamarindus Indica.

SECTION- B

1. Agroforestry, Social Forestry, Joint Forest Management and Tribology:

Agroforestry- Scope and necessity; role in the life of people and domestic animals and in integrated land use, planning especially related to (i) soil and water conservation; (ii) water recharge; (iii) nutrient availability to crops; (iv) nature and eco-system preservation including ecological balances through pest-predator relationships and (v) Providing opportunities for enhancing biodiversity, medicinal and other flora and fauna. Agro forestry systems under different agro ecological zones; selection of species and role of

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multipurpose trees and NTFPs, techniques, food, fodder and fuel security. Research and Extension needs.

Social/Urban Forestry: Objectives, scope and necessity; people's participation.

JFM- Principles, objectives, methodology, scope, benefits and role of NGOs.

Tribology: Tribal scene in India; tribes, concept of races, Principles of social grouping, stages of tribal economy, education, cultural tradition, customs, ethos and participation in forestry programmes.

2. Forest Soils, Soil Conservation Watershed Management:

Forests Soils: Classification, factors affecting soil formation; physical, chemical and biological properties.

Soil Conservation: definition, causes for erosion; typeswind and water erosion; conservation and management of eroded soils/areas, wind breaks, shelter belts; sand dunes; reclamation of saline and alkaline soils, water logged and other waste lands. Role of forests in conserving soils. Maintenance and build up of soil organic matter, provision of loppings for green leaf manuring; forest leaf litter and composting; Role of micro-organisms in ameliorating soils; N and C cycles, VAM.

Watershed Management: Concepts of watershed; role of mini-forests and forest trees in overall resource management, forest hydrology, watershed development in respect of torrent control, river channel stabilization, avalanche and landslide controls, rehabilitation of degraded areas; hilly and mountain areas; watershed management and environmental functions of forests; water-harvesting and conservation; ground water recharge and watershed management; role of integrating forest trees, horticultural crops, field crops, grass and fodders.

3. Environmental Conservation and biodiversity:

Environment: Components and Importance, principles of conservation, impact of deforestation; forest fires and various human activities like mining, construction and developmental projects, population growth on environment.

Pollution: Types, Global warming, green house effects, ozone layer depletion, acid rain, impact and control measures, environmental monitoring; concept of sustainable development, Role of trees and forests in environmental conservation; control and prevention of air, water and noise pollution. Environmental policy and legislation in India, Environmental impact Assessment, Economics assessment of water shed development vis-a-vis ecological and environmental protection.

4. Tree Improvement and Seed Technology: General concept of tree improvement, methods and techniques, variation and its use, provenance, seed source, exotics; quantitative aspects of forest tree improvement, seed production and seed orchards, progeny tests, use of tree improvement in natural forest and stand improvement, genetic testing programming, selection and breeding for resistance to diseases, insects, and adverse environment: the genetic base, forest genetic resources and gene conservation in situ and ex-situ, Cost benefit ratio, economic evaluation.

FORESTRY
PAPER- II
SECTION-A

1. Forest Management and Management Systems:

Objective and principles; techniques; stand structure and dynamics, sustained yield relation; rotation, normal forest, growing stock; regulation of yield; management of forest plantations, commercial forests, forest cover monitoring. Approaches viz., (i) site-specific planning, (ii) strategic planning, (iii) Approval, sanction and expenditure, (iv) Monitoring (v) Reporting and governance. Details of steps involved such as formation of Village Forest Committees, Joint Forest Participatory Management.

2. Forest Working Plan:

Forest planning, evaluation and monitoring tools and approaches for integrated planning; multipurpose development of forest resources and forest industries development; working plans and working schemes, their role in nature conservation, bio-diversity and other dimensions; preparation and control. Divisional Working Plans, Annual Plan of Operations.

3. Forest Mensuration and Remote Sensing: Methods of measuring- diameter, girth, height and volume of trees; form-factor; volume estimation of stand, current annual increment; mean annual increment, Sampling methods and sample plots. Yield calculation; yield and stand tables, forest cover monitoring through remote sensing; Geographic Information Systems for management and modelling.

4. Surveying and Forest Engineering:

Forest Surveying: different methods of surveying, maps and map reading, Basic principles of forest engineering. Building materials and construction. Roads and Bridges, General principles, objects, types, simple design and construction of timber bridges.

SECTION-B

1. Forest Ecology and Ethnobotany:

Forest Ecology: Biotic and abiotic components, forest eco-systems; forest community concepts; vegetation concepts, ecological succession and climax, primary productivity, nutrient cycling and water relations; physiology in stress environments (drought, water logging salinity and alkalinity). Forest types in India, identification of species, composition and associations; dendrology, taxonomic classification, principles and establishment of herbaria and arboreta. Conservation of forest ecosystems. Clonal parks.

Role of Ethnobotany in Indian Systems of Medicine; Ayurveda and Unani: Introduction, nomenclature, habitat, distribution and botanical features of medicinal and aromatic plants. Factors affecting action and toxicity of drug plants and their chemical constituents.

2. Forest Resources and Utilization: Environmentally sound forest harvesting practices; logging and extraction techniques and principles transportation systems, storage and sale; Non-Timber Forest Products (NTFPs) -definition and scope; gums, resins, oleoresins, fibres, oil seeds nuts, rubber, canes, bamboos, medicinal plants, charcoal, lac and shellac, katha and Bidi leaves, collection; processing and disposal, need and importance of wood, seasoning and preservation; general principles of seasoning, air and kiln seasoning, solar dehumidification, steam heated and electrical kilns, Composite wood; adhesives-manufacture, properties, uses, plywood manufacture- properties, uses, fibre boards-manufacture properties, uses; particle boards-manufacture; properties, uses, Present status of composite wood industry in India and future expansion plans. Pulp-paper and rayon; present position of supply of raw material to industry, wood substitution, utilization of plantation wood; problems and possibilities.

Anatomical structure of wood, defects and abnormalities of wood, timber identification general principles.

3. Forest Protection & wildlife Biology: Injuries to forest-abiotic and biotic, destructive agencies, insect-pests and disease, effects of air pollution on forests and forest die back, Susceptibility of forests to damage, nature of damage, cause, prevention, protective measures and benefits due to chemical and biological control. General forest protection against fire, equipment and methods, controlled use of fire, economic and environmental costs; timber salvage operations after natural disasters, Role of afforestation and forest regeneration in absorption of CO_2, Rotational and controlled grazing, different methods of control against grazing and browsing animals; effect of wild animals on forest regeneration, human impacts; encroachment, poaching, grazing, live fencing, theft, shifting cultivation and control.

4. Forest Economics and Legislation:

Forest economics: Fundamental principles, cost-benefit analysis; estimation of demand and supply; analysis of trends in the national and international market and changes in production and consumption patterns; assessment and projection of market structures; role of private sector and co-operatives; role of corporate financing. Socio-economic analysis of forest productivity and attitudes; valuation of forest goods and service.

Legislation-History of forest development; Indian Forest Policy of 1894, 1952 and 1990, National Forest Policy, 1988 of People's involvement, Joint Forest Management, Involvement of women; Forestry policies and Issues related to land use, timber and non-timber products, sustainable forest manage-ment; industrialisation policies; institutional and structural changes. Decentralization and Forestry Public Administration, Forest laws, necessity; general principles, Indian Forest Act 1927; Forest Conservation Act, 1980; Wildlife Protection Act 1972 and their amendments; Application of Indian Penal Code to Forestry, Scope and objectives of Forest Inventory.

GEOLOGY
PAPER-I
SECTION-A

(i) General Geology:

The Solar System, meteorities, 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, seismongraphs, Island arcs, deep sea trenches and mid-ocean ridges, Continental drift-evidences and mechanics; sea-floor 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 sub-continent. 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, Behaviour 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, Timerelationship 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 micro fossils. Application of microfossils in correlation, petroleum exploration, paleo-climatic and pale oceanographic studies, Morphology, geological history and evolutionary trend in Cephalopoda, Trilobita, Brachiopoda, Echi-noidea and Anthozoa, Stratigraphic utility of Ammonoidea, Trilobita and Graptoloidea, Evolutionary trend in Hominidae, Equidae and Probo-scidae. Siwalik fauna, Gondwana flora and its importance.

(v) Stratigraphy and Geology of India:

Classification of Stratigraphic sequences: Lithostratigraphic, biostratigraphic, chronostratigraphic and magnetostratigraphic and the interrelation-ships, 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, Ground-water 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.

GEOLOGY
PAPER-II
SECTION-A

(i) 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 caronate, phosphate, sulphide and halide groups.

(ii) Igneous and Metamorphic Petrology Generation and crystallisation of magma. Crystallisation of albite-anorthite, diopside-anorthite and diopsidewollastonite-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, Minerals assemblages, Retrograde metamorphism, Metasomatism and granitisation, migmatities, granulite terrains of India.

(iii) Sedimentology:

Sedimentary rocks : Processes of formation, diagenesis and lithification, Properties of sediments, Clastic and nonclastic rocks-their classification petrography and depositional

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environment, Sedimentary facies and provenance. Sedimenetary structures and their significance. Heavy minerals and their significance, Sedimentary basins of India.

SECTION-B

(iv) Economic Geology

Ore, ore minerals and gangue, tenor of ore, classification of ore deposits. Process of formation of minerals deposits, Controls of ore locallisation. 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.

(v) Mining Geology:

Methods of prospecting-Geological, geophysical, geo-chemical and geo-botanical, Techniques of sampling. Estimation of reserves of ore, Methods of exploration and mining metalic ores. Industrial minerals and marine mineral resources, Mineral beneficiation and ore dressing.

(vi) 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.

MATHEMATICS
PAPER-I
Section-A

Linear Algebra:

Vector, space, linear dependence and independence, subspaces, bases, dimensions. Finite dimensional vector spaces. Matrices, Cayley-Hamilition theorem, eigen-values and eigenvectors, matrix of linear transformation, row and column reduction, Echelon form, equivalences, congruences and similarity, reduction to cannonical form, rank, orthogonal, symmetrical, skew symmetrical, unitary, hermitian, skew-hermitian forms- their eigenvalues. Orthogonal and unitary reduction of quadratic and hermitian forms, positive definite quardratic forms.

Calculus

Real numbers, limits, continuity, differentiability, mean-value theorems, Taylor's theorem with remainders, indeterminate forms, maxima 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.

Analytical Geometry

Cartesian and polar coordinates in two and three dimensions, second degree equations in-two and three dimensions; reduction to cannonical 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, Clariaut'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, meta-centre, 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 torision. Serret-Frenet's formulae, Gauss and Stokes' theorems, Green's identities.

MATHEMATICS
PAPER-II
SECTION-A

Algebra:

Groups, sub-groups, normal subgroups, homomorphism of groups, quotient groups, basic isomorphism theorems, Sylovi'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 integrability 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-B

Partial differential equations:

Curves and surfaces in three dimensions, formulation of partial differentiation equations, solutions of equations of type dx/p=dy/q=dz/r; orthogonal trajectories, Pfaffian differential equations; partial differential equation 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, tranpezodial rule, Gaussian quadrature formula. Numerical solution of ordinary differential equations: Euler and Runge Kuttamethods, Computer Programming: Storage of numbers in computers, bits, bytes and words, binary system, arithmetic and logical operations on numbers, Bitwise operations. AND, OR, SOR, NOT, and shift/ rotate operators, Octal and Hexadecimal Systems, Conversion to and form 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 motion for inviscid flow, stream-lines, path of a particle, potential flow, two-dimensional and axisymetric motion, sources and sinks, vortex motion, flow past a cylinder and a sphere, method of images, Navier-Stokes equation for a viscous fluid.

MECHANICAL ENGINEERING
PAPER-I

1. Theory of Machines

Kinematic and dynamic analysis of planar mechanisms, Cams, Gears and gear trains, Flywheels, Governors, Balancing of rigid rotors, Balancing of single and multi-cylinder engines, Linear vibration analysis of mechanical systems (single degree and two degrees of freedom), Critical speeds and whirling of shafts, Automatic Controls, Belts and chain drives. Hydrodynamic bearings.

2. Mechanics of Solids

Stress and strain in two dimensions, Principal stresses and strains, Mohr's construction, linear elastic materials, isotropy and anisotropy, Stress-strain relations, unilaxial loading, thermal stresses, Beams: Banding moment and shear force diagrams, bending stresses and deflection of beams, Shear stress distribution. Torsion of shafts, helical springs, Combined stresses, Thick and thin walled pressure vessels. Struts and columns. Strain energy concepts ad theories of failure. Rotating discs. Shrink fits.

3. Engineering Materials

Basic concepts on structure of solids, crystalline materials, Defects in crystalline materials, Alloys anc, binary phase diagrams, structure and properties of common engineering materials. Heat treatment of steels, plastics, Ceramics and composite. Materials, common applications of various materials.

4. Manufacturing Science

Merchant's force analysis, Taylor's tool life equation, machinability and machining economics, Rigid, small and flexible automation, NC, CNC. Recent machining methods-EDM, ECM and ultrasonic. Application of lasers and plasmas, analysis of forming processes. High energy rate forming Jigs, fixtures, tools and gauges, Inspection of length, position, profile and surface finish.

5. MANUFACTURING MANAGEMENT

Production Planning and Control, Forecasting-moving average exponential smoothing, Operations scheduling assembly line balancing. Product development, Breakeven analysis, Capacity planning, PERT and CPM, Control Operations: Inventory control-ABC analysis, EOQ model, Materials requirement planning, Job design, Job standards, work Measurement, Quality management- Quality control Operations Research: Linear programming-Graphical and Simplex methods, Transportation and assignment models, Single server queuing model. Value Engineering; Value analysis, for cost/value, Total quality management and forecasting techniques. Project management.

6. ELEMENTS OF COMPUTATION

Computer Organisation, Flow charting, Features of Common Computer Languages FORTRAN, d Base-III, Lotus 1-2-3, C and elementary programmings.

MECHANICAL ENGINEERING
PAPER-II

1. THERMODYNAMICS:

Basic concept, Open and closed systems, Applications of Thermo-dynamic Laws., Gas equations, Clapeyron equation, Availability, Irreversibility and T ds relations.

2. I.C. Engines:

Fuels and Combustion: Spark Ignition and compression ignition engines, four stroke engine and two stroke engines, mechanical, thermal and volumetric efficiency, Heat balance.

Combustion process in S.I. and C.I. engines, pre-ignition detonation in S.I. engine Diesel knock in C.I. engine, Choice of engine fuels, Octane and Cetane ratings. Alternate fuels Carburration and Fuel injection, Engine emissions and control, Solid, liquid and gaseous fuels, stoichometric air requirements and excess air factor, fuel gas analysis, higher and lower . calorific values and their measurements.

3. HEAT TRANSFER, REFRIGERATION AND AIR CONDITIONING:

One and two dimensional heat conduction. Heat transfer from extended surfaces, heat transfer by forced and free convection, Heat exchangers, Fundamentals for diffusive and connective mass transfer, Radiation laws, heat exchange between black and non black surfaces, Network Analysis, Heat pump, refrigeration cycles and systems, Condensers, evaporators and expansion devices and controls, Properties and choice of refrigerant, Refrigeration Systems and components, psychometrics, comfort indices, cooling loading calculations, solar refrigeration.

4. TURBO-MACHINES AND POWER PLANTS:

Continuity, momentum and Energy Equations. Adiabatic and Isentropic flow, fanno lines, Raylegh lines, Theory and design of axial flow turbines and compressors, Flow through turbo-machine balde, cascades, centrifugal compressor. Dimensional analysis and

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modelling. Selection of site for steam, hydro nuclear and stand-by power plants, Selection base and peak load power plants, Modern High Pressure, High duty boilers, Draft and dust removal equipment, Fuel and cooling water systems, heat balance, station and plant heat rates, operation and maintenance of various power plants, preventive maintenance, economics of power generation.

PHYSICS
PAPER-I
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 Coriolls forces; Foucault pendulum.

(b) System of particles

Constraints, degrees of freedom, generalised coordinates and momenta, Lagranje'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 application 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 Huygen's principle.

(c) Geometrical Optics

Laws of reflection and refraction from Format'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. Fersnel integrals, Application of Cornu's spiral to the analysis of diffraction at a straight edge and by a long narrow slit. Deffraction 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 Magneto-statics

Laplace and Poisson equations in electrostatics and their applications. Energy of a system of charges, multiple 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. EectromagneticTheory & 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, cavariance of Maxwell's equations, Wave equations in Isotropic dielectrics, reflection and refraction at the boundary of two dielectrics. Fresnel' relations, Normal and anamalous 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, Gibb's phase rule and chemical potential. Van der Waals equation of state of real gas, critical constants, Maxwell-Boltzman 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 liquefication 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.

PHYSICS
PAPER-II
SECTION-A

1. Quantum Mechanics: Wave-particle duality, Schroedinger equation and expectation values. Uncertainty principle, Solutions of the one-dimensional Schroedinger 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.

2. 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-Gerlack 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.

3. 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 Phos-phorescence, 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 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.

5. Particle Physics & Solid State Physics:

(a) Particle Physics

Classification of elementary particles and their interactions, Conservation laws, Quark structure of hadrons, Field quanta of electro-weak 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, Joseph-son junctions and applications, Elementary ideas about high temperature superconductivity.

6. 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.

STATISTICS
PAPER-I

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, Bhattacharya's bounds, estimation by methods of moments, maximum likelihood, least squares, minimum chisquare 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 rotates 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, Kolmogororv'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; D^2 and hotelling's T^2 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 estimator. Non-negative variance estimation with reference to the Horvitz Thompson estimators, non-sampling errors, Warner's randomised response technique for

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sensitive characteristics.
Fixed effects model (two-way classification) random and mixed effects models (two-way classification with equal number of observation per cell), CRD, RBD, LSD and their analysis; incomplete block designs, concepts of chronogonality and balance, BIBD, missing plot technique, factorial designs: 2n, 3^2 and 3^3, confounding in factorial experiments, split-plot and simple lattice designs.

STATISTICS
PAPER- II

I. Industrial Statistics

Process and product control, general theory of control charts, different types of control charts for variables and attributes, X, R, s, p, nn and c charts, cumulative sum chart, V-mask, single, double, multiple and sequential sampling plans for attribute, OC, ASN, AQQ and ATI curves concepts of producer's and consumer's risks, AQL, LTPD and AOQL, sampling plans for variables, use of Dodge-Roming 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, method 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 queuing 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, Peashe's and Fisher's ideal Index numbers, chain-base index numbers, 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 multi-collinearity, consequences and solutions of multi-collinearty, 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 sytem 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 theory, uses of stable population and 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.
Method 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
PAPER-I
Sectlon-A

I. Non-chordata and chordata

(a) Classification and relationship of various phyla up-to sub-classes; Acoelomata and Coelomata; Protostomes and Deuterostomes, Bilateralia and Radiata; Status of Protista, Parazoa, Onychophora and Hemichordata; Symmetry.
(b) Protozoa: Locomotion, nutrition, reproduction; evolution of sex; general features and life history of Paramaecium, Monocystis, Plasmodium and Leisismania.
(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 metarnerism; modes of life in polychaetes; general features and life history of nereis (Neanthes), earthworm (Pheretima) and leach (Hirundaria).
(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 Herdamania.
(I) Pisces: Scales, respiration, locomotion, migration.
(m) Amphibia: Origin of tetrapods; parental care, paedomorphosis.
(n) Reptilia: Origin of reptiles; skull types; status of Sphenodon and crocodiles.
(o) Aves: Origin of birds; flight adaptation, migration.
(p) Mammalia: Origin of mammals; dentition; 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; urinogenital system, brain and sense organs (eye and ear).

Section-B

I. Ecology:

(a) Biosphere: Biogeochemical cycles, green-houses effect, ozone layer and its impact; ecological succession, biomes and ecotomes.
(b) Population, characteristics, population dynamics, population stabilization.
(c)Conservation of natural resources mineral mining, fisheries, acquaculture; 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 (Pyrilla perpusiella), oil seed (Achaea Janata) and rice (Silophilus 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).

ZOOLOGY
PAPER-II
Section-A

I. Cell Biology:

(a) Structure and function of cell an its organelles (nucleus, plasma membrane, mitochondria, Golgibodies, endoplasmic reticulum ribosomes and lysosomes), cell division (mitosis and melosis), mitutic 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, recombiriation, 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 fingerprinting.

III. Evolution

(a) Origin of life.
(b) Natural selection, role of mutation in evolution, mimicry, variation, isolation, speciation.
(c)Fossils and fossllization; 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-B

I. Biochemistry

(a) Structure and role of carbohydrates, fats, lipids, proteins, aminoacids, nucleic acids; saturated and unsaturated fatty acids, 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 phermones.

III. Developmental Biology

(a) Differentiation from gamete to neurula stage; dedifferentation; metaplasia, induction,

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morphogenesis and morphogon; 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.

Animal Husbandry and Vet. Science

Paper-I

Section-A

Livestock industry - its scope and potential.
Human population in relation to wild life.
Significance of wild life.
Animal Genetics and Breeding
Animal Genetics: Mendelian inheritance, Expression of genes, linkage and crossing over, Sex influenced and sex linked characters. Chromosomal aberration and gene structure, DNA as genetic material, recombinant DNA technology, mutation Quantitative vs Qualitative traits. Forces changing gene frequency.
Animal Breeding: Breeding systems-Inbreeding, out breeding, up grading, hybridization, Cross breeding and out crossing system, selection and their merits, Genetic improvement of cattle, buffaloes, sheep, goat, swine, horses, Poultry and wild animals.
Adaptation to the environment
Thermal balance in animals, direct and indirect effects of weather on animals, Loss of water from body, Growth rate and body weight. Photo sensitive disorder.

Section-B

Animal diseases:
Immunity and vaccination: Principles and method of immunization of animals against specific diseases.
Herd immunity, disease free zone, zero disease concept.
Diseases of cattle, Cow, Buffalo, sheep, goats and wild animals-Etiology symptoms, diagnosis, prevention, control and treatment of Antrax, Haemorrhagic Septicaemia, Black quarter, mastitis, tuberculosis, John's disease, foot and mouth disease, Rinder pest, Rabies, Trypnosomiasis, milk fever and trympanitis, diseases of newly born calf. Disease of poultry - Etiology Symtoms, diagnosis, prevention, control and treatment of Ranikhet disease, Fowl pox, Anian leucosis complex, Marek's diseases and Gumboro Disease.
Diseases of swine- swine fever, and hog cholera, diseases of Dog- Canine distemper, Parvo disease, Rabies in pets in relation to human health.
Veterinary Public Health- Zoonosis and zoonotic disease. Veterinary Jurisprudence- rule and regulations for improvement of animals, quality and prevention of animal disease, Materials and methods for collection and samples for veterolegal investigation.
Extention- Principles of extention, different methods adopted to educate the farmers under rural conditions.
Generation of technology- Its transfer and feed back. Problems and constrains in transfer of technology Animal husbandry programmes for rural development.

Animal Husbandry and Vet. Science

Paper-II

Section-A

A- Animal Nutrition: General nutritional considerations, Energy and Protein nutrition, Mineral and vitamin nutrition, Hormones and additives. Evaluation of nutritional value of feeds. Ruminant and non-ruminant nutrition of animals. Meeting nutritional requirement of various classes of animals. Digestion, metabolism and absorption of nutrients in different types of animals grazing habit and food intake.

B- Animal Physiology

Physiological mechanisms and livestock product, Growth rate & animals production. Nervous and hormonal controlling mechanism, Physiology of Reproduction. Lactation and egg laying. Physiology of digestive system of various classes of animals including wild animals, Semen evaluation, preservation & artificial insemination in various classes of animals.

Section-B

A- Livestock production & Management-

General care and management of livestock - Cattle, buffalo, Goats, Sheep, Pigs and Poultry. General care and management of wild animals. Feeding and management of livestock and wild animals and under drought, Flood and other natural disaster.
Classification, grading and marketing of livestock and their products.

Milk and milk products-

Milk-Collection, transportation of raw milk, quality testing and grading of raw milk, milk pasteurization, standardization, & Homogenization. Reconstituted and recombined milk.
Milk Product technology- Production, Processing, Storage, distribution and marketing of milk products such as butter, Ghee, Khoa, Chhena, Cheese, condensed and dried milk, Ice-cream, yoghurt, Dahi and Srikhand and their testing and grading, BIS specification, legal standards, quality control and nutritive properties of various milk products.
Milk by product technology - whey products, butter milk, Lactose, and casein.

Horticulture "Fruit and Plantation Crops"

Paper-I

Section 'A'

Definition of horticulture and its branches. Importance and scope of fruits and plantation crops in India. Area and production of different fruit crops. Geographical Classification of fruit crops. Nutritional garden. Planning and establishment of orchard. High density planting. Propagation methods and use of root stock. Micro-propagation, Nursery management, Methods of training and pruning. Use of Phytohormone in fruit production.

Section "B"

Package of practices for the cultivation of major fruits-- Mango, Banana, Citrus, Grape, Guava, Litchi and Papaya and Minor Fruits-- Pineapple, pomegranate, Bael, Aonla, Ber, Karaunda, Phalsa and Jackfruit and Plantation crops- Coffee, Tea and Coconut. Principles of fruit preservation. Preparation of Jam, Jelly and marmalade.

Horticulture"Vegetables and Ornamental crops"

Paper-II

Section "A"

Importance and scope of vegetable and ornamental crops. Vegetable garden, Classification of vegetable crops. Area, Production and Package of practices:- Tomato, Brinjal, Chilli, Okra, Watermelon, Muskmelon, Bottlegourd, Bittergourd, Cabbage, Cauliflower, Onion, Garlic, Beans, French bean, Pea, Potato, Elephant foot, Carrot, Radish, Amaranthus and Palak. Use of phytohormones in vegetable production. Organic production of vegetable. Protected cultivation of vegetables. OFF season vegetable production. Fertigation. Principles of vegetable preservation. Drying, Dehydration and canning of vegetables.

Section "B'

Importance of floriculture and ornamental gardens. Planning of ornamental garden. Style of garden and components of a garden. Use of trees, Shrubs and Climbers, Palm, Succulents and seasonal flowers in the garden. Package of practices for rose, Jasmine, Carnation, Marigold, Tuberose and gladiolus. Use of phytohormones in ornamental crops. Loose, cut and dry flowers. Medicinal and aromatic plant and spices.

Environmental Science

Paper First

Part-A

- Basics of Environmental Science, Definition meaning and Scope. Importance of the study of Environmental Science. Environmental Segments: Geosphere, lithosphere, Hydrosphere, atmosphere and biosphere- their spread, composition and Inter-relationships.
- **Environmental and ecological principles:** Ecological terminology and definitions, level of organization, habitat and niche, individual, species, population. Community, biome and ecosystem organization.
- **Ecological Succession:** Hydrarch and xerarch, concept of climax and seral communities
- **Concept of ecosystem:** biotic and abiotic components, structural and functional attributes of ecosystem, productivity, energy flow, food chain, food web and ecological pyramids, terrestrial and aquatic ecosystems. Biogeochemical cycles of C, N and P and hydrological cycle.

Part-B

- **Natural resources:-** water--its sources, surface and ground water, global distribution and uses of water, water crisis and conservational strategies.
- Soil and land, resources of India and its uses, conservational strategies and Integrated land use planning.
- **Minerals and matters-** their uses and mining operations.
- Forest resources of India, forest cover, community and social forestry, afforestation programmes, forest conservation Act and national forest conservation strategy.
- Biodiversity and its significance, Keystone species and hot spots, measurements of biodiversity, cause of biodiversity loss, conservation of biodiversity -in-situ and ex-situ conservation. Biological diversity Act.
- Wildlife sanctuaries and national parks in India, Wildlife conservation Act, concept of biosphere reserves.
- Renewable and non renewable sources of energy and its optimization.

Environmental Science

Paper- Second

Part-A

- Environmental disruptions, soil erosion, deforestation, drought, flood, fire and desertification- processes, causal factors and their mitigative measures.
- Environmental pollution: Air pollution-sources, effects on plants, animal, man and monuments and their Control measures, Air quality standards.
- Water pollution, types and major sources of water pollutants, effects of water pollutants on physico-chemical and biological properties of water bodies, process and control of eutrophication, water born diseases with special reference to water pollution.
- Types and major sources of soil pollutants, effects of soil pollutants on fertility and biological properties of soil.
- Major sources of noise pollution, effects of noise on human health.
- Anthropogenic and other biotic activities grazing, burning and mining etc. and their impact on environment and agriculture, effect of industrialization on environment.
- Introduction to global environmental problems viz: acid rain, ozone depletion, green house gases, Global warming and climatic changes.
- Solid waste disposal and its effects on surrounding environment and management, waste management in domestic, industrial and urban areas, energy generation from wastes.

Part-B

- Introduction and scope of environmental management, environmental ethics and dharma of ecology.
- Basic concepts of sustainable development, industrial ecology and recycling industry.
- Basic environmental laws and acts viz: Environmental protection Act, Air Act, Water Act.
- National and international Environmental conservation strategies and organizations.
- Population and Environment, concept of carrying capacity and population regulation.
- Natural Disasters: causes and effects of cyclone, tornadoes, earthquake, avalanches, land slides and volcanoes, disaster warning, mitigation, preparedness and management.
- Environmental education and awareness, concept and practice of restoration ecology.
- Current Environmental issues and priorities in India for environmental management.

Secretary