

ANNEXURE-II

SCHEME AND SYLLABUS FOR RECRUITMENTS NOTIFIED VIDE NOTIFICATION NO. 12/2004

POST CODE NO. 1 : ASST. B.C. WELFARE OFFICERS

POST CODE NO. 2 : ASST. SOCIAL WELFARE OFFICERS

POST CODE NO. 3 : ASST. TRIBAL WELFARE OFFICERS

SCHEME

Part-A: Written (Objective type) Examination				
Paper-1	General Studies	150 Marks	150 Questions	150 Minutes
Paper-2	Subject	300 Marks	150 Questions	150 Minutes
Part-B: Oral Test (Interview)		50 Marks		

SYLLABUS

PAPER-1 GENERAL STUDIES

1. SCIENCE AND TECHNOLOGY:
 - a) General Science and Technology
 - b) Role and impact of science and Technology on India's development.
(Questions will cover general appreciation and understanding of matters of everyday observation and experience as may be expected of a well-educated person who has not made a special study of science and technology disciplines).
2. INDIAN HISTORY AND CULTURE:
 - a) Modern Indian History from 19th century to the present
 - b) Nationalist Movement and Constitutional development
 - c) Indian culture and Heritage including architecture, Fine Arts, dance forms, music, paintings, Folk arts and performing arts.
 - d) History of Andhradesa Society, Culture, Geography and Economic development.
3. INDIAN POLITY:

General and broad understanding of the structural (institutions) and functional (processes) aspects of Indian Political system.
4. INDIAN ECONOMY AND GEOGRAPHY OF INDIA:
 - (a) Structure of National economy
 - (b) Economic development (including planning) since independence
 - (c) Economic Reforms
 - (d) Physical, economic and social Geography of India.
5. CURRENT EVENTS:

Current Events of Regional, National and International importance.
6. GENERAL MENTAL ABILITY: (Reasoning and analytical abilities)

PAPER-2 SUBJECT

LIST OF OPTIONAL SUBJECTS

The candidates have to choose one Optional subject from the following:

Code No.	Subject:	Code No.	Subject:
1.	English Literature	15.	Sociology
2.	Hindi Literature	16.	Agriculture
3.	Telugu Literature	17.	Animal Husbandry & Veterinary Science
4.	Urdu Literature	18.	Botany
5.	Anthropology	19.	Chemistry
6.	Commerce	20.	Geology
7.	Economics	21.	Mathematics
8.	Geography	22.	Physics
9.	History	23.	Statistics
10.	Law	24.	Zoology
11.	Philosophy	25.	Civil Engineering
12.	Political Science	26.	Electrical Engineering
13.	Psychology	27.	Electronics & Telecommunication
14.	Public Administration	28.	Mechanical Engineering

1. ENGLISH LITERATURE

History of Literature and Literary criticism:

1. Salient Features of Literary ages: Elizabethan – Restoration – Augustan (18th Century) Victorian – Modern.
2. Literary movements; classical, Neo-classical, Romantic, Pre-Raphaelite
3. Literary forms and concepts; Satire, Sonnet, Ode, Elegy, Mock-Heroic poem, Dramatic Monologue Stream of consciousness, Technique, Realism, Existentialism, Modernism, Expressionism, Freudianism, Feminism.
4. Discussion of a General or Literary topic.
5. Critical appreciation of an unseen poem.
6. A critical note on two out of four literary works: Keats – Ode to Autumn; Shakespeare – Macbeth; Dr. Johnson – Preface to Shakespeare; Matthew Arnold – The study of Poetry; Anand – Untouchable; R.K. Narayan – The Financial Expert; Thomas Hardy – Tess; T.S. Eliot Prufrock; William Golding – Lord of the Flies; Chinua Achebe – Things Fall Apart; Hemingway – The Old Man and the Sea.

(English Literature)

1. Critical comment on the two out of four of the following passages: (Celebrated lines to be given from the following works):
 - a. Wordsworth – Immortality Ode.
 - b. Shelley – Ode to the West Wind.
 - c. Keats – Ode to A Nightingale, Grecian Urn, Eve of St. Agnes.
 - d. Browning – My last Duchess, Andrea del Sarto.
 - e. Philip Larkin – Church – Going
 - f. Robert Frost – Birches
 - g. Nissim Ezekiel – Night of the Scorpion
 - h. Derek Walcott – A Far cry from Africa.
2. Critical study of:
 - a. Shakespeare – Hamlet, Twelfth Night.
 - b. Shaw – Saint Joan
 - c. T.S. Eliot – Murder in the Cathedral
 - d. Samuel Beckett – Waiting for Godot.
 - e. Eugene O'Neill – Desire under the Elms
 - f. Girish Karnad – Hayavadana
 - g. Wole Soyinka – The Lion and the Jewel.

3. Poetry:
- Milton – Paradise Lost, Book-1
 - Coleridge – The Rhyme of the Ancient Mariner.
 - Matthew Arnold – Dover Beach
 - Tennyson – Lotos-Eaters; Ulysses
 - W.B. Yeats – Second Coming; Easter 1916
 - Sylvia Plath – Daddy; Lady Lazarus
 - A.D. Hope – Australia
 - A.K. Ramanujan – Small-Scale Reflections on a Great House
4. Novels:
- Jane Austen – Emma
 - Dickens – Hard Times
 - D.H. Lawrence – Sons and Lovers
 - E.M. Forster – A Passage to India
 - Arun Joshi – The Strange Case of Billy Biswas
 - Anita Desai – Fire on the Mountain
 - V.S. Naipaul – The Mimic Men
 - Saul Bellow – Herzog

2. HINDI LITERATURE

HINDI LITERATURE – TEXTS (PROSE, POETRY AND DRAMA)

(A) TEXTS FOR ANNOTATIONS AND CRITICAL QUESTIONS:

i) MEDIEVAL POETRY:

KABIR	-	Kabir Grandhawali by Syamsundardas (First 100 Dohas)
SURDAS	-	Bramarageet Saar, Ed. Ramachandra Shukla (First 100 Padas)
TULASIDAS	-	Vinaya Patrika (101 to 150 Padas)

ii) MODERN POETRY:

Jayashankar Prasad	-	Kamayani (Chinta, Sradhaa and Ida only)
Sumitranandan Pant	-	Ragvirag (First 15 Poems)
Suryakant Tripathi Nirala	-	Ram Ki Shaktipuja

(B) TEXTS FOR CRITICAL QUESTIONS ONLY: (No Annotations from these texts)

- Chintamani Part-I (Utsaah, Sradha-Bhakti, Kavita Kya Hai?
Kavya mein Lok Mangal Ki Saadhanaavasta)
- Godan (Premchand – Novel)
- Maila Anchal (Phaniswarnath Renu – Novel)
- Manasa Sarovar by PREMCHAND Bhag-1 (First 12 short stories only)
- Ateet Ke Chalchitra – Mahadevi Varma (First six sketches)
- Chandra Gupta – (Jaishankar Prasad – Drama)

HINDI LANGUAGE: HISTORY OF HINDI LANGUAGE, LITERATURE AND CRITICISM

A) HISTORY OF HINDI LANGUAGE:

- General classification of the historical periods of Language – Pracheen Arya Bhasha Kall, Madhya Kaleen Arya Bhasha Kaal, Navya Kaleen Arya Bhashayen.
- Hindi dialects and Evolution of Khadiboli.
- Standardization of Hindi Language and Deva Nagari Script.
- Hindi as Rastra Bhasha – Sampark Bhasha – Raja Bhasha (Official Language) – Development and its needs.
- Significant Grammatical features of Modern Hindi and structure of modern Hindi Language.

B) *HISTORY OF HINDI LITERATURE:*

1. Main Characteristics of the Major periods of Hindi Literature – Adikal, Bhaktikal, Ritikal and Adhunik Kal.
2. Significant features of the Main literary trends and tendencies in Modern Hindi Poetry – Chayavad, Rahasyavad, Proyogvad, Pragativad and Nayee Kavita.
3. Origin and development of Literary Genres in Hindi.
 1. Novel
 2. Short Story
 3. Drama
 4. One Act Play
 5. Rekha Chitra
 6. Nibandh

C) *INDIAN POETICS AND LITERARY CRITICISM:*

1. Bharatiya Kavya Saastra Ke Vikas Ki Roop-Rekha
2. Bharatiya Kavya Saastra ke Sampraday-Ras, Alankar, Riti, Dwani.
3. Definition and Scope of Criticism.
4. Types of Criticism.
5. Contribution of the following critics to the Hindi Criticism:
Ramachandra Shukla, Nandadulare Vajapeyee, Hazaari Prasad Dwivedi, Dr. Nagendra and Dr. Ram Vilas Sharma.

3. TELUGU LITERATURE

4. URDU LITERATURE

Functional Urdu and General History of Urdu Language and Literature:

1. Functional Grammar
2. Discussion of a General Literary topic
3. Translation from English to Urdu
4. Explanation of Couplets from Ghazals of modern and medieval poets
5. General History of Urdu Language and Literature
 - a) Arrival of Aryans – Indo Aryan Language – Prakrit and Appa bharansh – Western Hindi and its dialects, Development of Urdu 1200 to 1700 A.D.
 - b) Development of Urdu at Gujrath and Deccan, Delhi School, Lucknow School, Fort William College, Aligarh Movement Jamia Osmania, Progressive Movement, Modern Literary Movements.
 - c) Critical notes on the following:
Ameer Khusru, Bhauddin Bajan, Khoob Mohammed Chishti, Shamsul Ushshaq, Ibrahim Adil Shah Sani, Mohammed Quli Qutub Shah, Wajhi, Ghau-Wasi, Nusrati, Wali, Siraj, Mir Sauda, Mir Hasan, Anees, Mir Aman, Ratan Nath Sarshar, Sir Syed, Hali, Nazeer Ahmed, Mohammed Hussain Azad, Shibli, Ruswa, Iqbal, Abul Kalam Azad, Premchand, Fani Hasrath, Bedi, Krishan Chander, Abdul Haq, Dr. Zore, Sarwasi, Josh, Rasheed Ahmed Siddiqui, Firaq, Faiz, N.M. Rashid, Meeraji, Nasir Kazimi.

Books recommended for History of Language and Literature:

1. *Dr. Jameel Jalibi: Tareekh-e-Adeb-e-Urdu Vol-I&II.*
2. *Ram babu Saxena: Tareekh-e-Adab-e-Urdu*
3. *Dr. Ajaz Hussain: Mukhtasar Tareekh-e-Adad-e-Urdu.*

Detailed study of literature and literary criticism:

1. Fiction:
 - a) Nazeer Ahmed: Ibnul Waqt
 - b) Premchand: Gowdan
 - c) Mirza Hadi Ruswa: Umrao Jan Ada
 - d) Krishan Chander: Shikast

2. Essay, Drama and Letters:
 - a) Rasheed Ahmed Siddiqui: Ganjhaye Granmaya
 - b) Imtiaz Ali Taj: Anarkali
 - c) Abul Kalam Azad: Gubar-e-Khatir
3. Poetry:
 - a) Mir Hasan: Sehra Bayan
 - b) Mir: Intekhab-e-kalam-e-Mir (Ed.by: Hamidi Kashmiri)
 - c) Ghalib: Diwan-e-Ghalib (Radeef Alif)
 - d) Jadeed Urdu Nazm: Published by Department of Urdu, Osmania University
 - e) Jadeed Urdu Ghazal: Published by Department of Urdu, Osmania University
4. Literary Criticism:
 - a) Definition and scope of Criticism.
 - b) Various approaches to Literature
 - c) Contribution of the following critics: Hali, Niaz, Aale Ahmed Suroor, Ehtisham Hussain, Shamsur Rahman Faruqi, Gopichand Narang.

5. ANTHROPOLOGY

Section-1.

Section-1 is compulsory; candidates have to choose between Section-2 (A) and Section-2 (B) and answer questions from either A or B. Section-1 carries 100 marks. Section-2 carries 50 marks. Total 150 marks, Paper-II (150 marks)

1. Definitions and Scope of Anthropology:

Main branches of Anthropology: Social Anthropology, Physical/biological Anthropology, Archaeological/Palaeo Anthropology, Linguistic Anthropology, Ecological Anthropology, Applied-Action-Development Anthropology, Ethno Archaeology, Environmental Archaeology, Applied Physical Anthropology and Human Genetics.

2. Anthropology – its relationship with other branches in Anthropology and also other disciplines – Like History, Sociology, Political Science, Psychology in Social Sciences, Zoology and Botany in life Sciences, Medicine and Physical Science and Earth Sciences.

3. Basic concepts and definitions:

Social & Cultural: (a) Culture (b) Society (c) Community (d) Civilisation (e) Institution (f) Association (g) Group (h) Band (i) Tribe (j) Caste (k) Values (l) Norms (m) Custom (n) Mores (o) Folkways (p) Structure (q) Function (r) Status (s) Role.

Physical/Biological: (a) Evolution (b) Adaptive radiation (c) Phylogeny (d) Human genetics (e) Gene (f) Genetic polymorphism (g) Mutation (h) Inbreeding (i) Colour Blindness (j) Zygote (k) Race (l) DNA (m) Sickle Cell (n) Genetic drift (o) Anthropometry (p) Somatometry (q) Dermatoglyphics (r) Gerontology

Archaeological Anthropology: (a) Site (b) Artifact (c) Assemblage (d) Tradition (e) Phase (f) Abbevillian (g) Acheulian (h) Mousterian (i) Levalloisian (j) Clactonian (k) Bio-archaeology (l) Analytical Archaeology (m) Processual Archaeology (n) Pleistocene (o) Glacier (p) Pluvial (q) Chronology (r) Fertile crescent (s) Microlith

4. **Marriage Family and Kinship:**

- a) Incest Taboo-Exogamy
- b) Universal Definition of Marriage
- c) Forms of Marriage
- d) Functions of Marriage
- e) Preferential and prescriptive forms of marital alliances and their theoretical implications
- f) Marriage payments: Bride price, Dowry, Prestation
- g) Marital Instability – Divorce and Remarriage

Family:

- a) Definition and Universality of family
- b) Functions and typologies of families
- c) Hindu joint family – Stability and change, Impact of urbanisation, industrialisation and modernisation.

Kinship:

- a) Definition of Kinship and Descent
- b) Kinship terminology – Criteria of analysis and major kinship terminological systems
- c) Kinship behaviour (usages)

- d) Descent – Rules of descent, descent groups – structure and functions; Descent and residential patterns
- e) Concept of domestic groups.

5. Economic and Political Anthropology:

- a) Different levels of economies – Hunting – Gathering, Fishing, Pastoral, Shifting Cultivation, Horticulture and settled Farming systems with special reference to Indian Tribes.
- b) Substantivist and formalist approaches to the understanding of economic processes.
- c) Primitive forms of a exchange
- d) Culture – Entrepreneurship and modernisation of traditional economic systems.
- e) Incipient Legal and Political systems
- f) Primitive forms of government, statutory Panchayat and its impact on traditional Political systems
- g) Tribal law and justice.

6. Religion and Magic:

Conceptual differences between magic, science and religion; sympathetic and contagious magic; magic, witchcraft and sorcery. Theories of the origin of religion; animism, animatism, manaism and primitive monotheism.

Myth and Ritual: Totem and taboo and their ritual and secular importance.

Religious functionaries: Priest, Shaman, Medicine-Man-their role and status; Man-nature – Spirit complex.

7. Medical Anthropology – Meaning and Scope – Ethno-Medicine; Concept of disease and treatment in traditional societies Cultural dimensions of food, health and nutrition.

8. Anthropology and Development – Anthropological approaches to development, planning and execution; Sustainable development, Modernisation, Economic development and Culture change, Development, displacement and rehabilitation.

9. Field work and Anthropology – participant and Non-participant observation, Case study, Interview, questionnaire and schedule, Genealogical method, participatory Rapid Assessment Techniques (PRA) and Rapid Rural Appraisal (RRA)

Section-2(A).

1. Theory of Organic evolution; Principles of Evolution; Lamarckism, Darwinism and synthetic theory; nature, nurture and culture; nutritional, ecological and cultural factors in evolution; micro-evolution and ongoing human evolution.

2. **Primates:** Classification of the Order Primates and their features; relationship of primates with other mammals; Comparative anatomy of Man and Apes. Primate Locomotion, arboreal and terrestrial adaptation.

3. **Meocene fossils:** Dryopethecus, Rama Pethecus.

4. Fossil Homonids – Distribution, Physical features, Phylogenetic position of the following:

- a) Austrolopethecence
- b) Home Habelis
- c) Homo Erectus – Homocrectus Javanicus Homo Erectus Pekinensus
- d) Swans comb Man and Heidelberg Man
- e) Neanderthal Man – Classical and Progressive types
- f) Homo Sapiens: Cromagnon, Grimaldi, Chancelade

5. Human Genetics:

- a) Meaning and scope, its relation with other sciences and medicine
- b) Methods for genetic study of Man – Pedigree analysis, twin method, Family fosterchild, Cotwin, biochemical methods, Chromosomal analysis, ammunological method and recombinant technology
- c) Genetic Polymorphism and selection. Mendelian population – Hardy Weinberg Law. Causes and changes in gene frequency – migration, mutation, genetic drift, inbreeding, selection – statistical approach – Consanguineous and non-consanguineous matings, Genetic load, Genetic effect of consanguineous and cousin marriages.
- d) Chromosomal Disorders – Kleinefelter, Turner, Down, Patau, Edward and Crui-de-chat syndromes, Genetic imprinting on human diseases, Gene therapy, Genetic screening and counselling for Genetic disorders.

6. **Race:** Concept of race; criteria of classification of races and distribution of races; morphological, serological and genetic and environmental factors in the formation of races; racial classification of Indian population and their distribution.

7. **Human Growth and Development:** Prenatal, infant, childhood, adolescence, maturity, gerontology; factors affecting growth and development genetical, biochemical, nutritional and cultural.

8. **Applied Physical Anthropology:** Role of Physical Anthropology in the realms of Family Welfare, Nutrition, Public health, Industry, Sports, Criminal investigations, designing of defence and other equipments.

Section-2(B).

1. Meaning of evolution, evolutionist theories – unilineal, multilinear and universal theories; Neo-evolutionist theories – Gordon V. Childe, Julian Steward, Leslie White.

2. Diffusionist theory of culture – British, German and American diffusionist schools - Geographical and Environmental determinants of culture – Culture-area theory.

3. **Functional School in Anthropology:** Meaning of functionalism, Structural and functional analysis of society and culture – Radcliffe – Brown and Malinowski.

4. Psychological approaches of the study of culture – Culture patterns, culture configurations, Culture-Personality, modal personality.

5. Culture and cognition; Anthropological symbolism.

1. Growth of Anthropology in India – Contributions by foreign and Indian Anthropologists and administrators of 19th and 20th centuries.

2. Evolution of Indian Culture and Civilisation:

- a) Pre-historical cultures – Typo – Technological, Economic, Social, Chronological divisions; Characteristic features and distribution of Lower Palaeolithic, Middle Palaeolithic and Upper Palaeolithic cultures in India; Emergence of early farming and village communities (Mesolithic and Neolithic) in India.
- b) Process of urbanisation: Indus civilisation, origin, development and fall, distribution and features of Indus valley civilisation; Vedic and post Vedic cultures in India.
- c) Vedic and Post Vedic cultures in India contributions of tribal cultures to Vedic and Post Vedic beginnings.

3. Impact of Buddhism, Jainism, Islam and Christianity on Indian Society.

4. Ethnic, Linguistic and religious diversities in Indian population.

5. Basis of Indian Social system; Varna and Jati Purusharthas and Ashramas; Karma, Rina and Rebirth; Joint family.

6. Theories of origin of caste system; variations in caste structure over different regions of India; Caste and Village economy and Jajmani system; Caste and Politics Concept of dominant Caste.

7. Tribes –characteristics, Biogenetic variability, Linguistic socio-economic characteristics, Distribution of Tribal societies; Tribe-caste continuum.

8. Social and cultural processes: Little Traditions, Great Traditions; Universalisation, Parochialisation, Sanskritisation, Westernisation.

9. **Tribal problems:** Land alienation, poverty indebtedness, low literacy, un-employment and under employment, health and mal-nutrition, forest policy and tribal problems; Displacement and problems of rehabilitation; Impact of urbanisation and industrialisation on tribal population; Tribal movements and revolts.

10. History of administration of tribal areas – Policies, Plans, Programmes of tribal development and their implementation, Tribal sub-plans, Role of statutory panchayats and N.G.Os.

11. Scheduled castes and their distribution; Social and Economic disabilities – Poverty, Deprivation and Exploitation.

12. Constitutional safeguards for Scheduled Tribes and Scheduled Castes; Special Programmes for the welfare and development of Scheduled castes.

13. Cultural factors in tribal and rural development – Role of Anthropology in Tribal and Rural Development in India.

6. COMMERCE

ACCOUNTING AND FINANCE

Part-1: Accounting, Auditing and Taxation:

Accounting as a Financial and Management information system-Impact of behavioral sciences – Accounting Standards and conventions.

Methods of accounting of changing price levels with particular reference to current purchasing power (CPP) accounting Advanced problems of company accounting – Amalgamation absorption and reconstruction of companies-Accounting of holding Companies valuation of shares and goodwill-Human Resources Accounting.

Nature and functions of Cost Accounting-Classification of costs-techniques of segregating semi-variable costs into fixed and variable components-job costing-FIFO and weighted average methods of calculating equivalent units of production-Marginal costing Cost-Volume profit relationship their Algebraic formulae and graphical representation shut down points Reconciliation of cost and financial accounts-Techniques of cost control and cost reduction-Budgetary control-Flexible Budgets standard costing and variance analysis – Responsibility accounting-Bases of charging over-heads and their inherent fallacy-costing for pricing decisions.

Income Tax Act, 1961 (as amended up-to-date) – Definitions – charge of Income Tax – Exemptions – Provisions relating to Heads of Income – Depreciation and savings deductions – Simple problems of computation of Income of an individual (under the various heads) and assessable income-tax planning Income-Tax authorities.

Auditing – Definition – Significance – Different types of Audit Programming the audit work – Vouching – Valuation and verification of all types of assets and liabilities – Audit of limited companies – Appointment, Status, Rights, Duties and Liabilities of an Auditor – Auditors report Investigation.

Part-II: Business Finance and Financial Institutions:

Financial Management – Definition and Scope – Corporate Finance – its goals capital structure theories – Capital budgeting (including problems) – Techniques – Rules of the thumbs and Discounted cash flow approaches – incorporating uncertainty in investment decisions – Designing and optimal capital structure – Weighted average cost of capital – Modighani and Miller models (including problems) – Short-term, Intermediate and Long-term finance and the sources of raising them – Norms and guidelines regarding debt – equity ratios – Dividend theories and dividend policies in practice – Determinants of an optional dividend policy – working capital management (including problems) – Structure of working capital and the variable of affecting the level of difference of components – Cash flow approach of fore-casting working capital needs – Credit management and credit policy – Consideration of tax in relation to financial planning and cash flow statements – Profiles of working capital in Indian industries – Statement of changes in financial position (including problems).

Indian money market – Constituents and their deficiencies – Reserve Bank of India – Functions – An assessment of its monetary and credit policies – Commercial Banks – Role and their functioning – Narasimham Committee Recommendations – Indian Capital Market – Constituents functions and working of All India term financial institutions such as IDBI, IFCI, ICICI, UTI – Stock Exchanges – Functions and their regulation by agencies like SBBI.

ORGANISATION THEORY AND INDUSTRIAL RELATIONS:

Part-1: Organisation Theory:

Nature and Concept of Organisation – Approaches to the study of organisation theory – Formal and informal organisations – Functions and limitations – Principles of organisation – Organisation goals and its different types.

Organisational structure – Authority – Power and influence – Delegation – Centralisation and decentralisation – Line staff functional Matrix – Project and Bureaucratic structures. Decision making process and limits to rationality – Simon March approach.

Motivation – Theoretical and empirical foundations of Maslow, Mc. Gregor, Herzberg, Likert, Vroom, Porter and Lawler models – morale and productivity – Leadership – Theories and styles – Communication in organisations.

Conflicts and its management in organisation – Management of change – Resistance to change and Methods to overcome – Organisational change, adaptation, growth and development – Organisational control and effectiveness – Organisational culture and its significance

Part-II: Industrial Relations:

Industrial Relations – Nature and Scope – Industrial Labour in India – Theories of Trade Unionism – Trade Union movement in India, its growth and structure – outside leadership – union Management conflict and co-operation – collective bargaining – approaches, conditions, limitations and its effectness in Indian conditions workers education and other problems – workers participation in Management, philosophy, rationale, present day state of affairs.

Industrial Disputes – Definition – Preventive measures & settlement machinery in India – Absenteeism and labour turnover in Indian Industries – Wage concepts – Wage differentials and wage policy in India – Labour welfare measures – Indian Labour conference International Labour organisation and India.

7. ECONOMICS

1. Methodology in Economics. The framework of an economy. National Income Accounting – Estimation of National Income.

2. Economic Choice: Consumer behaviour, producer behaviour, market forms and distribution

3. Determination of income and employment: Investment decisions. Macro economic models of income, distribution and growth.

4. Banking: Supply of money and near money; Central Banking – Objectives, instruments of credit policy in a developing economy.

5. Public Finance: Principles of taxation and Public expenditure – Functional Finance – Budgetary and Fiscal policy in a developing economy – Public debt and its effects on economy.

6. International trade: Tariffs, exchange rates – convertibility – Balance of Payments – Monetary and Banking Institutions.

1. The Indian economy: Guiding principles of Indian economic policy – Planned growth and distributive justice. Eradication of poverty. Institutional framework of the Indian economy – Federal structure of the Government – Agricultural and Industrial Sector. National Income of India, its Sectorial and regional distribution.

Magnitude and incidence of poverty (rural & urban)

2. Agriculture: Agricultural policy; Land Reforms – Technological change – Relationship with the industrial sector.

3. Industry: Industrial policy – Public and Private sector – Regional distribution of Industry – Industrial Infrastructure – Aspects of economic liberalisation.

4. Pricing policies of Agricultural and Industrial outputs – Administered prices – Procurement and Public Distribution.

5. Budgetary trends and Fiscal policy.

6. Monetary and credit trends and policies – Banking and non-banking financial institutions.

7. Foreign trade and Balance of payments (Before and after economic reforms)

8. Indian Planning: Objectives, strategy, experience and problems.

9. Andhra Pradesh Economy: Structure of the A.P. economy – State Income - its sectorial and regional distribution and extent of poverty – Regional imbalances State of agriculture – Agricultural inputs and technology – Subsidies – State of industry – Infrastructure – Industrial sickness – State finances and budgetary policy – World Bank Aid and state economy.

8. GEOGRAPHY

Section-A -Map Work: Map Location – India/World:

- i. Mountains, Plateaus and Plains, Isotherms, Isohyets
- ii. Rivers
- iii. Vegetation types and forests
- iv. Wild Life sanctuaries
- v. Industrial towns
- vi. Mining Centres
- vii. Tourist Centres
- viii. Ports, Harbours and Airports
- ix. Important Road, Railway and Sea routes
- x. Capital Cities
- xi. Seas, Islands and Peninsulas
- xii. Ocean currents

Section-B: Principles of Physical Geography:

Geomorphology: Origin and evolution of the earth, earth movements continental Drift Theory, Plate Tectonics, Isostasy, Major land forms, Endogenetic and Exogenetic forces – Earth quakes and volcanism, Weathering and erosion, Concept of Cycle of erosion – Davis and Penck, Arid, Fluvial, Glacial, Karst and Marine landforms, Rejuvenated and poly cyclic landforms.

Climatology: Structure and composition of the atmosphere, Temperature, Humidity, precipitation, pressure and winds. Jetstreams, Heat balance, Airmasses and fronts, Tropical and Temperate cyclones, climatic classifications – Koppen and Thornthwaite, Hydrological cycle.

Oceanography: Movements of Ocean Water – Tides and Ocean currents, Hypsographic Curve, Salinity, Coral reefs, Ocean deposits, Marine resources.

Soils, Vegetation & Eco-System: Soils – Types and world distribution, Major biotic regions of the world – Savanna and Monsoon biomes, concept of Ecosystem – interrelations and energy flows, Man's impact on ecosystem.

Human and Economic Geography:

1. Development of Geographical thought, Dualism in Geography – Determinism and possibilism, Quantitative and Behavioural revolution in geography.
2. Population – Growth and Distribution, Major Cultural Realms of the world, Population movements – factors and consequences with reference to India.
3. Settlements – Rural and Urban, Central Place Theory, Rank-size Rule, Primate City, Urban Growth Theories, Morphology of Indian Cities, Rural – Urban Fringe, Urbanisation in India and Andhra Pradesh.
4. Concept of Heartland and Rimland, Geopolities of Indian Ocean Region, Major International Trade Routes, Transportation in India – Roads and Railways.
5. Theory of Agricultural Location, Typology and World Agricultural Regions, Agricultural Efficiency and crop combination, Major agricultural regions of the world with reference to India, Green Revolution in India.
6. Theories of Industrial Location, Major industrial regions of the world factors influencing the location and growth of Cotton-Textiles, Sugar, Cement, Iron & Steel Industry in India.

7. World distributions of the resources – Coal, Petroleum and Forest, Resource Utilisation – Conservation of resources – Land, Water, Mineral, Forest and Energy, Major Power and Irrigation Projects in Andhra Pradesh.

8. Regional disparities – Identification of flood and drought prone areas in India, Regional Planning in Andhra Pradesh.

9. HISTORY

Section-A (Ancient India)

1. Indus civilization – origin extent: characteristic features or main features, causes of decline and its significance.
2. The Vedic Age; Distinction between Indus civilization and Vedic civilization. Political, social and economic pattern. Religious ideas and rituals, Vedic texts and later Vedic civilization – social and political pattern.
3. Emergence of religious movements, (Jainism, Buddhism and other sects) socio-economic conditions in 6th century B.C. Rise of Magadha imperialism.
4. Mauryan empire: Sources, Administration socio-economic conditions. Ashoka's policy reforms and principle of Dharma, extent and fall of the empire. Art and Ashoka's edicts.
5. Political and economic history northern and southern India 200 BC to 300 AD. Languages like Sanskrit, Prakrit and Tamil, Economy and Society, Kanishka – Rise of Mahayana and (theistic cults). Development of Art (Gandhara, Mathura and other schools) cultural contacts with central Asia.
6. Gupta period: Socio-economic conditions Gupta's Administration. Significance of literature, art and religion, contacts with South Asia.
7. Post Gupta period (500 – 750 AD) History of Pushyabhutis. The later Guptas, India with 7th century AD, Harshavardhana and his times. Pulekesin II. Eastern Chalukyas, Rise of Veera Saiva Movement. The Pallavas – Chola Administration, Art. The Arab conquests.
8. Brief review of science and technology, education and learning.

Section-B – Medieval India (750 AD to 1765 AD) (India, 750 AD to 1200 AD)

1. History of Rajputs – Social, Land structure, its impact on society.
2. Trade and Commerce.
3. Literature Art and Architecture. The Bhakti cult. Religious movements in 15th and 16th centuries.
4. Maritime activities, contacts with the Arabs, cultural impacts.
5. Rastrakutas their role in history, contributions to art and culture.
6. Indian society its conditions on the eve of Mahmed Gazini expeditions AL-Birunis findings.
7. Delhi Sultanate (India 1200 AD to 1765 AD). Circumstances its impact on the Indian society.
8. Role of Khilgi: Significance and implications: Administration economic regulations or Market regulations and their impact on State.
9. Reforms of Mohammed bin Thugluq, Implications of his policies and principles on the State. Role of Firozshah.
10. Disintegration of the Delhi sultanate, causes its effects on the Indian Policy.
11. Nature and character of State. Agrarian Structure and relations, growth of urban centres, trade and commerce, position of artisans and peasants , new crafts, Industry and technology, Indian medicine.
12. Influence of Islam on Indian culture. Religious movements – nature and significance of Bhakti saints. Role of the vaishnave revivalist movement, social and religious significance of chaitanya movement. Impact of Hindu society and on muslim social life.
13. The vijayanagara empire, (1336 AD) Sources its origin and growth and their contribution to Art, literature and culture. Socio-economic conditions, Administration fall of Vijayanagara Empire.
14. Sources of history, Important chronicles, Travellers Accounts.
15. The great Mughals (1526-1707) political history. Political and social conditions in Hindustan on the eve of Babur's invasion. Establishment of the Portuguese control in the Indian ocean, its political and economic consequences.
16. Sher Shah sur Administration, political, revenue and military administration.
17. Akbar: Political unification; Munsabdari and Jagir systems central and provincial Administration – Land Revenue and Religious policy. Relations with the non-muslims, military organization.
18. Growth of regional languages and literature in the medeival period. Development of Art and architecture.
19. Aurangazeb's religious policy, expansion in Deccan, revolts against Aurangazeb – character and consequences.
20. Growth of urban centres, Industrial economy. The mughals and the European trading companies.

21. Indian economy during 16th and 17th centuries – Advent of Europeans. Growth of towns in 18th century.
22. Rise of Shivaji, his conflict with Mughals, Administration of Shivaji Maratha power (1707-1761) Maratha political structure under the first three Peshwas, Chauth and Sardeshmukhi, Third Battle of Panipat its causes and effects.
23. Disintegration of the Mughal Empire, emergence of the new regional states.

Section-A - MODERN INDIA (1757 – 1947 AD)

1. Factors leading for the British supremacy and consequence of India with special reference to Bengal, Maharashtra and Sind, Carnatic and Mysore Wars. Resistance of Indian Powers and causes of their failures.
2. Stages of colonialism – changes in administrative structure and Policies, Revenue, Judicial and Social and Educational and their Linkages with British colonial interests.
3. Economic policies of British and their impact, commercialization of Agriculture, Rural indebtedness, growth of Agricultural labour, Decline of handicraft industries. Growth of modern industry and rise of a capitalist class.
4. Christian missionary activities. Social reform movements in India during 19th century, “Renaissance” caste movements in general with special reference to South India and Maharashtra, tribal revolts, specially in central and eastern India.
5. Civil rebellions, Revolt of 1857, Civil rebellions and peasant revolts with special reference to Indigo revolt. Deccan riots and Mopla uprising.
6. Rise and growth of Indian National Movements – specific basis of Indian Nationalism policies, early nationalists and militant nationalist. Rise and growth of communalism. Emergence of Gandhiji in Indian politics and his techniques of mass mobilisation, non-cooperation, civil disobedience and Quit India movement. Trade Union and left wing movements, Constitutional changes, 1909 to 1935. Indian National Army, Naval Mutiny of 1947, the partition of India and achievements of freedom.

SECTION – B : WORLD HISTORY (1500 – 1950 A.D.)

1. Geographical discoveries – end of Feudalism and beginnings of Capitalism.
2. Renaissance and Reformation in Europe. Emergence of the National States.
3. Commercial revolution in Western Europe – Mercantilism.
4. The Thirty Years – Wars – its significance in European History.
5. Industrial Revolution its impact.
6. The emergence of a scientific view of the world. The age of enlightenment.
7. The American Revolution – Its significance.
8. The French Revolution and Napoleonic era (1789 – 1815). Its significance on world history.
9. The growth of liberalism and democracy in Western Europe (1815 – 1914).
10. Socialist and Labour movements in Europe, consolidation of large nation states – the unification of Italy – the founding of the German Empire.
11. The American Civil War.
12. Imperialism and Colonialism in Asia and Africa during the 19th and 20th Centuries.
13. China and the Western powers modernization of Japan and its emergence as a great power.
14. The European powers and the Ottoman empire (1815 – 1914)
15. First World War – Europe the eve of the first world war – The economic and social impact of the war – The Peace of Paris 1919.
16. The Russian Revolution 1917 – Economic and social reconstruction in Soviet Union.
17. Rise of Nazism in Germany.
18. Rise of Nationalist movements in Indonesia, China and Indo-China.
19. Rise and establishment of Communism in China.
20. Awakening in the Arab World – Struggle for freedom and reform in Egypt Emergence of modern Turkey under Kemal Atatürk – The Rise of Arab nationalism.
21. World Depression of 1929 – 32. New Deal of Franklin D. Roosevelt.
22. Second World War causes and results, U.N.O. Aims and objectives and its impact.
23. Non-alignment, origin – Development relevance of the movement.

10. LAW

INDIAN CONSTITUTIONAL LAW:

1. Nature of the Constitution – Distinctive Features of Federal character.
2. Fundamental Rights – Relationship with Directive Principles
 - a) Right to Equality – Reservations
 - b) Freedom of speech and Expression
 - c) Rights to Life and personal liberty

- d) Rights of the accused person – preventive detention
- e) Religious, cultural and Educational Rights – Minority Rights

3. Directive Principles of State Policy.
4. Fundamental Duties.
5. President and his powers.
6. Council of Ministers – Ministerial responsibility.
7. Governor and his powers.
8. Supreme Court and High Courts – their powers and functions.
9. Distribution of legislative powers between the Union and the States.
10. Administrative and Financial relations between the Union and the States
11. Trade, Commerce and inter-course in India.
12. Union Public Service commission and State Public Service commission – their powers and Functions.
13. Delegated legislation – Legislative and Judicial control over delegated legislation – Judicial review of administrative action.
14. Principles of Natural justice.
15. Emergency provisions.
16. Amendment of the Constitution – Basic structure theory.

INTERNATIONAL LAW:

1. Nature of International Law.
2. Relationship between Municipal Law and International Law.
3. Sources of International Law – Treaty, Custom, General principles of Law, Judicial decisions – Resolutions of organs of International organizations.
4. Recognition of states and governments – Effects of non-recognition.
5. State succession – theories.
6. State Territory and Jurisdiction.
7. Law of the sea – Territorial sea, continental shelf, EEZ and open sea beyond national jurisdiction.
8. Air space and outer space.
9. State Responsibility.
10. Place of Individuals – Nationality, Statelessness, Extradition and Asylum.
11. Human Rights – Universal Declaration of Human Rights, covenants on Human Rights, 1966 – Procedure for Enforcement – Regional conventions for the protection of Human Rights.
12. Diplomatic Missions – Privileges and immunities.
13. Treaties – Formation, ratification and termination/.
14. United Nations Organisation – its principal organs – Powers and functions.
15. Lawful recourses to use of force – Self-defence, intervention.
16. Legality of use of Nuclear weapons.

LAW – JURISPRUDENCE SECTION – A

1. Nature and scope of jurisprudence
2. Schools of Jurisprudence
 - A) Historical
 - B) Analytical
 - C) Philosophical
 - D) Sociological
3. Theories of Law
Austinian, Neo-Austinian, Hart Kersanian, Natural Law etc.
4. Sources of Law
Meaning of the term sources of law
 - A) Custom
 - B) Legislation – Supreme and Subordinate Legislation Delegated Legislation
 - C) Precedent:-
 - a) Nature and authority of Precedent
 - b) Ratio – desidendi, stare-decisis
 - c) Judges as a Law makers – Judicial activism
 - d) Doctrine of prospective over ruling
5. Various Legal concepts
 - A) Rights and Duties
 - B) Ownership and possession
 - C) Persons – corporate personality
 - D) Civil and Criminal liability
 - E) Liability – Strict liability – vicarious liability
 - F) Property and obligation

GENERAL PRINCIPLES OF CONTRACT

(Section 1 to 75 of the Indian Contract Act)

1. Formation Contract
2. Offer and acceptance
3. Consideration
4. Void, voidable, illegal and unenforceable agreements
5. Free consent etc.
6. Performance of contracts
7. Discharge of contract – Frustration of contract
8. Remedies of Breach of contract
9. Quasi – contracts

SECTION – B

LAW OF TORTS

1. Nature of tortious liability
2. Theory of Fault – Conditions of liability – Defences
3. Statutory liability
4. Vicarious liability
5. Strict liability – Rule in Rylands v. Fletcher
6. State liability
7. Joint – tortfeasors
8. Negligence
9. Liability of occupiers
10. Detinue and conversion
11. Nuisance – Public and private
12. False imprisonment and Malicious prosecution
13. Defamation
14. Nervous shock
15. Trespass

LAW OF CRIMES

1. Concept of crime – actus reus and Mens rea - Mens rea in statutory offences
2. Joint Liability (Sec. 4-38) Group Liability (Sec.149)
3. General exceptions (Secs.76-106)
4. Abetment and criminal conspiracy
5. Offences against the state-offences against Public Tranquility (Ch. VIII)
6. Offences by or relating to public servants (Chap.IX)
7. Offences affecting Human Body
8. Offences against property – Theft, Extortion, robbery and dacoity, criminal breach of trust, criminal misappropriation of property, Mischief, criminal trespass, House trespass and House breaking
9. Offences relating to documents – forgery
10. Offences relating to Marriage (Ch.XX)
11. Defamation
12. Protection of Civil Rights Act, 1955
13. Dowry Prohibition Act, 1961
14. Prevention of Food Adulteration Act, 1956.

11. PHILOSOPHY

SECTION - A – WESTERN

1. Plato: Theory of knowledge.
Doctrine of Ideas.
2. Aristotle: Form, matter and causation.
3. Descartes: Cartesian method and certain knowledge Mind-Body problem: God:
4. Spinoza: Substance, Attributes and modes, Pantheism.
5. Leibnitz: Monads: Theory of perception: God.
6. Locke: Theory of knowledge: Rejection of innate ideas: Substance and qualities.
7. Berkeley: Criticism of Abstract ideas: Criticism of substance and attributes–God.
8. Hume: Theory of knowledge: Scepticism: Self and causality.

9. Kant: Transcendental Aesthetics, Transcendental Logic Space & Time, metaphysics.
10. Hegel: Dialectical method: Absolute idealism.
11. Logical Atomism: Atomic Facts: Atomic sentences, Logical constructions and incomplete symbols – (Russell). Distinction of saying and showing (Wittgenstein).
12. Logical positivism: Verification of theory and rejection of metaphysics: Linguistic theory of Necessary propositions.
13. Phenomenology – Husserl.
14. Existentialism: - Kierkegaard: Sartre.

SECTION - B – INDIAN

1. Charvaka:- Theory of knowledge: Materialism.
2. Jainism:- Theory of Reality: Saptabhangi. Naya Bondage and liberation.
3. Buddhism:- The Four Noble Truths – Philosophical implications of Buddhas ethical teaching.
4. Samkhya:- Prakriti: Purusha: Theory of causation.
5. Yoga:- Yoga Psychology – Eight limbs of yoga.
6. Nyaya:- Vaisheshika – theory of pramana, liberation, Proofs for the existence of God, categories: theory of causation: Atomic theory of creation.
7. Mimamsa:- Theory of knowledge.
8. Vedanta:- Schools of Vedanta: Sankara, Ramanuja, Madhva (Brahman: Ishwara:Atman: Jiva: Jagat: Maya: Avidya: Adhyasa: Moksha).
9. Vivekanda:- Practical Vedanta: Universal Religion.
10. Mahatma Gandhi:- Concept of Non-violence, Satyagraha – Ends and Means.
11. Sri Aurobindo:- Nature of Reality: Satchidananda: Supermind: Cosmic evolution: Integral yoga:
12. Radhakrishna:- His idealistic views, its difference from classical vendanta.

SECTION - A – ETHICS

1. The conception of Good, Right and their relation.
2. Psychological Hedonism.
3. Utilitarianism (Bentham and J.S. Mill)
4. Kantian Ethics.
5. Moral Judgements: Descriptivism: Prescriptivism: Emotivism:
6. Nishkama Karma: Sthitaprajna.
7. Jaina Ethics: Anuvratas and Mahavratas.
8. The Buddhist conception of Mahakaruna.

SECTION – B – LOGIC

1. Laws of thought.
2. Logical division and definition.
3. Classification of propositions: Traditional and modern.
4. Syllogism: Figures and moods, Rules of Syllogism (General and Specific) – Formal Fallacies.
5. Rules of Quantification:

SECTION – C- Philosophy of Religion

1. Nature and scope of philosophy of Religion.
2. Proofs for the existence of God and their Criticism.
3. Immortality of soul.
4. Moksha – Paths Leading to Moksha.
5. Religious Knowledge – Reason: Revelation and Mysticism.
6. Religion and morality.

SECTION – D : Socio- Political Philosophy

1. Political Ideal: Equality, Justice: Liberty.
2. Sovereignty: Austin: Bodin, Laski, Kautilya
3. Individual and state.
4. Democracy: Concept and forms:
5. Socialism and Marxism.
6. Humanism.
7. Secularism
8. Theories of punishment.
9. Co-existence and violence: Sarvodaya.
10. Gender – Equality.
11. Scientific temper and progress.
12. Philosophy of Ecology.

12. POLITICAL SCIENCE

1. Nature and scope of Political Science, Approaches to the study of political science – Behavioural, systems and structural – Functional and Marxist approaches.
 2. Emergence and nature of modern state, Sovereignty, Monism and Pluralism: concepts of power, Authority and Legitimacy.
 3. Law-kinds and sources of Law: Rule of law. Law and liberty, Liberty and Equality, their relationship.
Rights and Duties of citizen. Justice – Kinds of Justice – Human rights – Its significance.
 4. Ideologies regarding the sphere of state activity liberalism, Fascism, Idealism, Utilitarianism, Anarchism, Socialism, communism and Sarvodaya. State as an instrument of socio-economic change: Changing role of the State in the context of Globalization.
 5. Political Institutions and their functioning:
 - a) Executive – Presidential Parliamentary and Plural executive. Rise of executive in modern times.
 - b) Legislature – Unicameral and Bicameral legislatures, Functions and crisis of accountability, decline of legislature.
 - c) Judiciary – Functions of Judiciary, Independence of Judiciary.
 6. Political parties, its basis, functions and classifications.
Pressure groups – role, functions and influence on policymaking process.
 7. Federalism – different models; recent trends in the working of Modern federations.
 8. Political process: Political socialization Political culture, Political development and Political modernization.
 9. Constitutionalism; Nature, Growth and Trends.
1.
 - a) Indian Political thought – Manu, Kautilya, Gandhi and Ambedkar.
 - b) Western Political thought – Plato, Aristotle, Hobbes, Locke, Rousseau and Karl Marx.
 2.
 - a) Philosophical foundations of Indian Constitution; Fundamental Rights and Directive principles of State Policy.
 - b) Federalism – Union – State relations; recent trends.
 - c) Parliament, Union Executive, Judiciary, Judicial Review, Judicial Behaviour and Judicial Activism.
 - d) Party System, Elections and Electoral System, Coalition system.
 - e) Impact of Socio-economic factors in Indian Politics – Tribal, Regional Caste, Language and Religious reassertions and Environmental movements.
 3. Political process in Western and Non-Western societies: Military and Politics; Problems and prospects of democracy in the developing societies; Globalization – its impact on the Third world.
 4.
 - a) Factors culminating in the out break of First World War, Second World War and their impact.
 - b) The UNO, Origin, aims and objectives – its role in Uni-polar world.
 - c) The Cold war, origin, evolution, impact on international relations – End of cold war.
 - d) The new international economic order – North South dialogue, WTO-its impact on international relations – Earth Summit – RIO Declaration.
 - e) Non-alignment – Its role and relevance in the changing global order. India's foreign policy – its determinants.

13. PSYCHOLOGY

1. Scientific approach to Psychology.
Roots of modern psychology
Impact of other sciences on the development of psychology
2. Nature of psychological research:
Methods of psychological research – Observational method Survey methods – questionnaire and interview.
Case history method
Experimental method.
Advantages and limitations of various methods.

3. Origin and development of behaviour:
 - Genes and their role
 - Constitutional and endocrinal functions
 - Early childhood experiences and their impact on development
 - The concept of maturation
 - The characteristics of the developmental processes
 - Experimental studies on the role of heredity and environment
 - Nature-nurture controversy
 - The role of social and cultural factors in the process of development.
4. Cognitive processes:
 - Perception
 - Organic basis of the perceptual process
 - Psychophysical laws
 - Gestalt Theory of perception
 - Perceptual constancies
 - Perceptual abnormalities
 - Perceptual defence
 - Effect of need on perception, perception and personality.
5. Learning:
 - Thorndike's laws of learning
 - Classical and instrumental conditioning
 - Skinner's concept of reinforcement
 - Hull's drive reduction theory
 - Cognitive theories of learning – Tolman and Razran
 - Gestalt approach to learning
 - Programmed learning
6. Memory:
 - Measurement of memory
 - Early experiments – Ebbinghaus
 - Short – term memory and long – term memory Forgetting
 - Methods of improving memory.
7. Thinking:
 - Language and thought
 - Convergent and divergent thinking
 - Concept formation
 - Problem solving
 - Theories of the development of thinking in children.
8. Intelligence:
 - Binet's contribution
 - Theories of intelligence
 - Measurement of intelligence
 - Intelligence tests
 - Aptitude and its measurement
 - The concept of social intelligence.
9. Motivation:
 - Motivation – need, drive
 - Theories of motivation – psychoanalytical theory, need hierarchy theory.
 - Level of aspiration and achievement motivation.
10. Personality:
 - The concept of personality
 - Trait and type approaches
 - Factorial and dimensional approaches
 - Theories of personality – Field, Allport, Cattell, Lewin
 - Social learning theories
 - The Indian approach to the study of personality
 - The concept of Gunas
 - Measurement of personality
 - The role of projective tests.

11. Attitudes and values:
 Formation of attitudes
 Theories of attitudes
 Theories of attitude change
 Attitude scales
 Values
 Motivational Properties of values.
12. Recent trends:
 Psychology and the computer
 Cybernetic model of behaviour
 Simulation studies in psychology
 Altered states of consciousness – sleep, dream, meditation, hypnotic trance, drug induced changes
 Sensory deprivation.
 Human problems in aviation and in space flight.
13. Models of man:
 The mechanical man
 The organic man
 The organizational man
 The Humanistic man
 An integrated model of man.
1. Individual differences:
 Types of psychological tests. Construction of psychological tests. Requirements of a good psychological test. Limitations of psychological tests.
2. Psychological Adjustment:
 The concept of adjustment. Barriers to adjustment.
 Reactions to adjustment
 Defence mechanisms
 The concept of mental health
 Community mental health.
3. Psychological disorder:
 Classification of disorders
 Neurotic, psychotic and psycho physiological disorders
 Psychopathic personality
 The problems of anxiety, depression and stress.
4. Therapeutic approaches:
 Psychoanalytic
 Behaviour therapy
 Client-centered therapy
 Cognitive therapy
 Rational-emotive therapy
 Group therapy.
5. Application of psychology to industrial and organizational problems:
 Personnel selection
 Training and training methods
 Theories of work motivation
 Job designing
 Man-machine systems
 Leadership and its training.
6. Small groups:
 Properties of group
 Groups at work
 Group cohesiveness
 Interaction process analysis
 Interpersonal relations.

7. Social Change:
 Characteristics of social change
 Psychological basis of change
 Planning for change
 Change proneness
 Resistance to change
 Problems of change in the rural context.
8. School Psychology:
 The learner
 School as an agent of socialization. Problems relating to adolescents in learning
 Gifted children
 Creativity
 Retarded children and problems related to their training.
9. Disadvantaged Groups:
 Types of disadvantages – Social, cultural and economic
 Psychological consequences of disadvantage
 Deprivation
 Educating the disadvantaged groups
 Problems of motivating the disadvantaged.
10. Social integration:
 Prejudice its nature and manifestation
 Ethnic prejudice
 Amelioration of prejudice
 Social tensions – their causes and consequences
 Reducing social tensions
 Strategies to achieve social integration
 National character.
11. Psychology and Economic development:
 Identification and promotion of entrepreneurship
 Technological change and its impact on human behaviour.
12. Management of information and Communication:
 Psychological factors information management
 Information overload
 Psychological basis of effective communication
 Mass media and its role in social change
 Impact of television
 Psychological basis of effective advertisement.
13. Problems of contemporary society:
 Stress
 Management of stress
 Alcoholism
 Drug addiction
 Juvenile delinquency
 Rehabilitation of the deviant
 Aging and problems of the aged.

14. PUBLIC ADMINISTRATION

1. **Public Administration:** Basic premises Nature, Scope and Significance of Public Administration, Its role in developing societies, Ecology of administration – Social, Economic, Cultural, Political & Legal; Evolution of Public Administration as a discipline, New Public Administration.
2. **Theories of Organisation:** Scientific Management (Few Taylor), The Bureaucratic theory of Organisation (Max weber), Classical theory of organization (Henry Fayol, Zulter Gullick & Others), Human Relation Theory, Behavioural approach.
3. **Principles of Organisation:** Hierarchy, Span of Control, Unity of Command, Authority and Responsibility, Coordination, Supervision, Centralisation and De-centralisation, Delegation.
4. **Administrative Behaviour:** Decision making with special reference to Herbert Simon's contribution, Theories of Leadership, Communication, Motivation (Maslow and Herzberg)

5. **Structures of Organisations:** Chief Executive, Types of Chief Executives and their functions, Line, Staff and Auxillary Agencies, Departments, Corporations, Companies, Boards and Commissions, Headquarters and Field Relationship.
 6. **Personnel Administration:** Bureaucracy and Civil Service, Recruitment, Training, Performance Appraisal, Promotion, Pay and Service Conditions, Discipline, Generalists and Specialists, Neutrality and Integrity in Administration.
 7. **Financial Administration:** Concept of Budget, Preparation and Execution of Budget, Legislative Control, Accounting and Auditing.
 8. **Accountability and Control:** The concept of Accountability and Control, Legislative, Executive and Judicial Control over Administration.
 9. **Comparative and Development Administration:** Nature and Scope of Comparative and Development Administration, Contribution of Fred Rigg's with particular reference to Prismatic Society and Sala Model.
 10. **Public Policy:** The Relivance of Policy-making in Public Admn. and Formulation of Publicity Policy and implementation.
1. **Environmental Setting:** Constitutional Frame work Federalism, Parliamentary Democracy.
 2. **Political Executives at Central State Levels.**
 3. **Structure of Administration:** Cabinet Secretariat, State Secretariat, Ministries and Departments.
 4. **Public Services:** All India Services, Central and State and Local Services, Union and State Public Service Commissions.
 5. **Centre-State Relations:** Legislature, Administrative and Financial.
 6. **Machinery For Planning:** Plan formulation at National level, Planning Commission, National Development Council, Planning Machinery at State and District levels.
 7. **Control of Public Expenditure:** Parliamentary Control, Role of Finance Ministry, Comptroller and Auditor General.
 8. **District and Local Administration:** Role of District Collector, Special Rural Development Programmes, D.R.D.A., Panchayati Raj, Urban Local Governments. Urban Development Authorities 73rd and 74th Constitutional Amendments.
 9. **Administration for Welfare:** Administration of Welfare measure for Scheduled Castes, Scheduled Tribes, Empowerment of Women.
 10. **Issues Areas in Indian Administration:** Relationship between Political and Permanent Executives, People's participation in Administration, Redressal of Citizens Grievances Administrative Reforms in India.

15. SOCIOLOGY

General Sociology

1. **Scientific Study of Social Phenomena:** The emergence of Sociology and its relationship with other Social Sciences. Sociology as a Science; Science and Social behaviour; the problem of objectivity; the scientific method and design of Sociological Research; techniques of data collection and measurement including participant and non-participant observation, interview schedules and questionnaires and measurement of attitudes. Sampling, Reliability and validity.
2. **Pioneering contributions to Sociology:** The seminal ideas of Durkheim, Weber, Radcliffe Brown, Malinowski, Parsons, Merton and Marx.
 - a) Durkheim: Division of labour, Social fact, religion and society.
 - b) Max Weber: Social action, types of authority, Bureaucracy, Protestant ethic and the spirit of capitalism, ideal types, Social action.
 - c) Karl Marx: Historical materialism, mode of production, alienation and class struggle.
 - d) Tarcott Parson: Social system and pattern variables.
 - e) Robert K. Merton: Latent and manifest functions, anomic, Conformity and deviance, reference groups.
3. **The individual and society:** Individual behaviour, Social interaction, society and social groups, Social system, Status and role; culture, personality and socialization and social control, role conflict.
4. **Social Stratification and Mobility:** Social differentiation and stratification, Attributes of social stratification, theories of stratification, different conceptions of class and caste; Class and Society, types of mobility, intergenerational mobility, Intra generational mobility, Horizontal mobility, open and closed models of mobility.

5. **Family, Marriage and Kinship:** Structure and functions of family; structural principles of kinship, family and descent. Types and forms of marriage Change in marriage and family, marriage and divorce.
6. **Formal organizations:** Elements of formal and informal structures; bureaucracy, modes of participation – democratic and authoritarian forms; voluntary associations.
7. **Economic System:** Concepts of property; social dimensions of division of labour and types of exchange; social aspects of pre-industrial and industrial economic system; Industrialization and change; Changes in the spheres of familial, educational, religious, political and stratificational, Social determinants and consequences of economic development
8. **Political System:** The nature of Social power – Community power structure, power of the elite, class power, organizational power, power of unorganized masses, power, authority and legitimacy, power in democracy and in totalitarian Society; Political parties and voting behaviour; Democratic and authoritarian modes of Political Participation.
9. **Educational System:** Social origins of students and teachers, Stratification and education, equality of educational opportunity, Social aspects of mass education, Problems of Universalization of primary education; role of community and state intervention in education, education as a medium of cultural reproduction, Indoctrination, education and modernization, education and social control, education and social change.
10. **Religion:** Origins of religious beliefs in premodern Societies, the sacred and the profane; social functions and dysfunctions of religion. Religion, magic and science, Monistic and pluralistic religion, organized and unorganized religions and changes in religion; concept of secularization.
11. **Social change and Development:** Social structure and social change. Continuity and change as fact and as value. Processes of change, Factors of Social change, Theories of change; types of Social change, Social disorganization and social movement; Types of social movements, Social movement and change, Social policy and social development.

SOCIETY OF INDIA

1. **Historical Foundations of the Indian Society:** Traditional Hindu Social organization, Socio-cultural dynamics through the ages, especially the impact of Buddhism, Islam and modern West; factors in continuity and change.
2. **Social stratification:** Caste system and its transformation aspects of ritual, economic and caste status; cultural and structural views about caste, mobility in caste, issues of equality and social justice, caste among the Hindus and non-Hindus; casteism, the Backward Classes and the Scheduled Castes; untouchability and its eradication; agrarian and industrial class structure.
3. **Family, marriage and Kinship:** Religious variations in kinship system and its socio-cultural correlates; changing aspects of Kinship; The Joint family-its structural and functional aspects and its changing form and disorganization; Marriage among different ethnic groups and economic categories, its changing trend and its future; impact of legislation and socio-economic change upon family and Marriage; intergenerational gap and youth unrest; changing status of women.
4. **Economic System:** The Jajmani System and its bearing on the traditional society; market economy and its social consequences; Occupational diversification and social structure; professions, Trade Unions; Social determinants and consequences of economic development; economic inequalities; exploitation and corruption.
5. **Political System:** The functioning of the democratic political system in a traditional society; Political parties and their social composition; Social structural origins of political elites and their social orientations, decentralization of power and political participation. Panchayat Raj and Nagarpalikas and 73rd and 74th Constitutional amendments.
6. **Educational System:** Education and society in the traditional and in the modern contexts; Sociological factors for educational inequality; Education and social mobility; Educational problems of women, the Backward Classes, Scheduled Castes and Scheduled Tribes. Directive principles of State policy and Primary education, Total literacy campaigns.
7. **Religion:** Demographic dimensions, geographical distribution; and neighbourhood living pattern of major religious categories; interreligious interaction and its manifestation in the problems of conversion; Minority status and communal tensions; secularism; Tribal Societies and their integration; distinctive features of Tribal communities; Tribe and Caste; acculturation and integration.
8. **Rural social system and community development;** Socio-Cultural dimensions of the village community; Traditional Power structure, democratization and leadership, poverty, indebtedness and bonded labour, social consequences of land reforms. Community Development programmes and other planned development projects; Green Revolution; new strategies; to rural development.

9. **Urban social organisation:** Continuity and change in the traditional bases of social organisation namely family, marriage, kinship, caste and religions in the urban context; stratification and mobility in urban communities; ethnic diversity and community integration; urban neighbourhoods, rural-urban differences in demographic and socio-cultural characteristics and their social consequences. Urbanization in India, Urban environment, housing, slums and unemployment, programmes for urban development.
10. **Population Dynamics:** Socio-cultural aspects of sex and Age structure; Marital status, fertility and mortality: the problems of population explosion; Socio-psychological, cultural and economic factors in the adoption of family planning practices
11. **Social change and modernization:** Problem of role conflict, youth unrest – intergenerational gap-changing status of women. Major sources of social change and Resistance to change; Impact of West, reform movements; social movements; industrialization and urbanization; pressure groups, factors of planned change – Five year plans, legislative and executive measures; process of change; sanskritization, Westernization and modernization – Means of Modernization, Mass media and education; problems of change and modernization – structural contradictions and breakdowns; current social Evils – Corruption and Nepotism, smuggling – Black money.

16. AGRICULTURE

Importance of agriculture in national economy, Agriculture development in India, Agro-climatic Zones of India and A.P. Major constraints in limiting to crop production, Ecology and relevance to Man-Management of national resources; Environmental variables and agro-ecosystem; Weather aberrations and their effect on crops, Environmental pollution – air water and soil – its effect on crops, animals and humans.

Cropping patterns in different agro-climatic zones of A.P. – concepts of multiple cropping, multistory, relay and intercropping – Farming systems – Planning of components and productivity. Sustainable agriculture and organic farming – relevance in modern agriculture – Principles and potentials to attain sustainability, Package of practices for production of important\ cereals, pulses, oilseeds, fibres, sugar and commercial crops grown in A.P.

Weeds-their characteristics, and dissemination, Crop-weed association and allelopathy, weed management in different crops.

Dry land agriculture and its problems- management of land and water in dry climate. Soil erosion-types, Soil conservation, watershed management – objectives and approaches.

Crop water requirements – methods of assessment – water use efficiency- water management practices in important field and horticultural crops of A.P. Drainage - water logging, methods of field drainage.

Importance of social, farm and agro forestry. Choice of tree species, Principles of general silviculture.

Soil and its components – Process and factors of soil formation, soil classification, land capability classification, Aerial photography and remote sensing and their application in agriculture. Essential plant nutrients and other beneficial elements in soil, their occurrences, factors affecting their distribution, functions and nutrient cycling in soil. Symbiotic and non-symbiotic nitrogen fixation. Principles of soil fertility and its evaluation for judicious fertilizer use integrated nutrient management.

Farm management – importance, economic principles, farm planning and budgeting, farm business analysis and farm efficiency measures, Agricultural marketing institutions – commercial agricultural and agri-business management. International trade – nature and scope – GATT/WTO.

Concept, meaning, principles, scope and importance of Agriculture extension, Models of organizing Agriculture extension. Rural development and poverty alleviation programmes. Training to Extension workers, farmers, farm women and youth, Agricultural extension management.

PAPER - II

Physical and chemical basis of heredity, chromosomal structure, genes/operan concept; Mendelion laws of inheritance, cytoplasmic inheritance, Linkage and crossing over, Genetic mechanisms of sex determination, Inheritance of Quantitative characters, Mutations – spontaneous and induced.

Biodiversity and centres of origin of cultivated crops, Assessment of variability – additive, dominance and epistasis.

Application of the Principles of plant breeding to the improvement of major field crops, methods of breeding self and cross-pollinated crops. Introduction, Selection, Hybridization, Heterosis and its exploitation. Male stability and self incompatibility, utilization of mutation and polyploidy in breeding, Breeding for biotic and abiotic stresses.

Seed technology and importance – seed quality concepts, Hybrid seed production in important crops, Seed certification standards, intellectual property rights, patency and plant breeders rights.

Importance of plant physiology in Agriculture, Physiological basis of crop yield; Structure and function of cell organells; Photosynthesis, respiration and transpiration; structure and functions of proteins, nuclic acids, crop water relations, Role of macro and micro nutrients and their deficiency symptoms.

Plant biotechnology – Achievements and potentialities. Genetic engineering and production of transgenic plants.

Growth and development, photo periodism and vernalization, Hormones, plant growth regulators and their role in agriculture.

Role of fruits and vegetables in human nutrition and national economy; Climatic requirements and cultivation practices for major fruits, vegetables and plantation crops; Green house production of flowers and vegetable crops; Handling and marketing problems of fruits and vegetables; Principal methods of preservation of fruits and vegetables; Important fruit and vegetable products. Ornamental and landscape gardening – types of ornamental gardens, Design and layout of lawns and gardens.

Pests and diseases of field, vegetable, orchard and plantation crops and their management; Causes and classification of plant diseases. Principles of plant disease management – avoidance, exclusion, eradication, immunization and protection; Biological control of pests and diseases. Integrated management of pests and diseases; Pesticides – classification and their formulations; Recent methods of pest/disease control. Stored grain pests and their preventive and curative measures.

17. ANIMAL HUSBANDRY AND VETERINARY SCIENCE

General : Role of livestock in Indian Agriculture, Origin, domestication and classification of livestock, contribution of Livestock to state and National Economy.

Animal Nutrition:

Energy sources, energy metalolism and requirements for maintenance and production of milk, meat, eggs and wool, Evaluation of feeds as source of energy. Protein sources, protein metabolism and synthesis-Protein requirements, Energy Protein ratios, Role of minerals and trace elements – sources, functions and requirements, Role of vitamins, Hormones and growth slimilators – Sources, functions and requirements.

Ruminant Nutrition – Nutrient requirements for calves, heifers dry and mich cows and buffaloes, use of non protein nitrogenous substances in Ruminants.

Classification and evaluation of feeds and fodders roughages and Concentrates. Conservation of feeds and utilization of Agro Industrial by products. Feeding standards for different categories of livestock

Nutrients and their metalolism in poultry for egg and meat production.

Nutrient requirement for sheep, goat and swine for maintenance and production. Formulation of economic rations for livestock. Methods of improvements of Nutritive value of straws. Role of Biotechnology in Animal Nutrition.

Animal genetics and Breeding:

Mitosis and Meiosis, Mendelian Principles, gene expression, Linkage and crossing over, sex determination, sex controlled inheritance. Blood groups and polymorphism. Chromosomal aberrations, structure of gene, DNA and RNA. Genetic Code and Protein synthesis. Recombinant DNA Technology – Mutations.

Qualitative Vs quantitative traits – Hardy-weinberg law, gene and genotype frequency, Factors affecting gene frequency, random drift, Breeding value, dominance and epistatic deviations, partitioning of variance geno-type and environment interaction.

Resemblance between relatives – Heritability, repeatability and genetic and phenotypic correlations – methods of estimation. Aids to selection, progeny testing Methods of selection for multiple traits construction of selection indices – Indirect selection and correlated response – systems of breeding – inbreeding- upgrading, crossbreeding and synthesis of breeds. Crossing of inbredlines for commercial production. Selection for general and specific combining abilities. Inbreeding depression and heterosis. Important breeds of livestock. Breeding programmes for livestock improvement. Role of Biotechnology in animal improvement – cloning and production of transgenic animals.

Livestock production and Management:

Systems of farming – Comparison of specialized and mixed farming. Starting of livestock farms with different species – requirements. Herd recording organisation of farm routines. Summer management of livestock. Organisation of Farm inputs – commercial farming for Milk, Meat, Egg and Wool production – Management of livestock during natural calamities – clean milk production Livestock development programmes including operation flood and Technology mission for dairy development.

Transport of animals for different purposes.

Livestock Products Technology :

Milk and Milk products – Organisation of milk procurement, collection and transport. Testing of raw milk for quality. Processing of pasteurized, Sterilized UHT standardized, recombined reconstituted flavoured and special milks production of different types of Indian milk products, Production Practices for cheese, butter, condensed dried milk and frozen products.

By product utilization Judging of milk products, PFA, BIS and Agmark standards for milk and milk products.

Meat and meat products – Antemortem, care and management of meat animals, Stunning, slaughter and dressing operations, Abattoir requirements and designs – Meat inspection procedures and judgement of meat cuts – Duties and functions of Veterinarians in wholesome meat production, spoilage of meat and control measures post slaughter physico chemical changes in meat and factors that influence them – Adulteration of meat and its detection – Regulatory provisions in meat trade and industry.

Physical and chemical characteristics of meat. Methods of preservation of meat. Packaging of meat and meat products. Slaughter house by-products and their utilization – Structure, composition and nutritive value of eggs – Chemical composition and nutritive value of poultry meat – Slaughtering techniques, inspection and preservation of poultry meat and its products. Legal and BIS standards, Rabbit meat production Extension and economics.

Basic philosophy, objectives, concepts and principles of Extension and Economics. Extension education methods – Transfer of Technology and feed back programmes for rural development in respect of Animal Husbandry – conduct of training programmes – Statistics of livestock population and production in India and Andhra Pradesh. Economics of milk, meat, egg, and wool production. Marketing and distribution of livestock and livestock products – Entrepreneurial development for livestock industry – Preparation and evaluation of project reports for starting Commercial Livestock enterprises.

Anatomy and Physiology :

Staining tissues. Preparation and processing of tissues. Microscopy. Bright field microscope and Electron microscope. Cytology – structure of cell. Comparative histology of organs. Embryology of vertebrates with special reference to aves and domestic animals. Gametogenesis. Organogenesis. Paranasal sinuses of ox. Structures involved in anesthesia. Regional anatomy of nerves. Surface anatomy of visceral organs. Anatomy of fowl. Blood cell formation. Hemoglobin synthesis and chemistry. Coagulation of blood. Haemorrhagic disorders. Anticoagulants. Blood groups. Blood volume. Plasma expanders. Biochemical tests and their significance in disease diagnosis.

Physiology of heart, cardiac cycle, heart sounds, heart beats, electrocardiograms, Metabolism of cardiac muscle. Blood pressure and hypertension. Coronary and pulmonary circulation. Vasomotor regulation and shock. Mechanism of respiration. Neural control of respiration. Structure and function of kidney. Methods of studying renal function. Urinary excretion in chicken. Sweat glands and their function. Biochemical tests for urinary dysfunction. Functional disorders of endocrine glands, their symptoms and diagnosis. Synthesis of hormones.

Pharmacology and Animal Re-production :

Cellular level of pharmacodynamics and pharmacokinetics. Modern concepts of anaesthesia. Antimicrobials and principles of chemotherapy in microbial infections. Use of hormones in therapeutics. Chemotherapy of parasitic infection. Chemotherapy of neoplastic diseases.

Prenatal and postnatal growth, maturation, growth curves, factors affecting growth and conformation. Hormonal control of mammary development, milk secretion and ejection, male and female reproductive organs, their function. Digestive organs and their function.

Mechanisms of adaptation. Environmental factors and regulatory mechanism involved in animal behaviour, Methods of controlling climatic stress. Off-season breeding in buffaloes. Components of semen, Chemical and Physical properties of semen ejaculate, factors affecting semen in vivo and in vitro, Factors affecting semen production and quality. Preservation of semen. Composition of diluents. Deep freezing techniques in cows, sheep goats, swine and poultry. Detection of oestrus and time of insemination for better conception. Multiple ovulation and embryo transfer, Embryo biotechnology

Veterinary public health:

Assessment of pollution of water, air and soil. Animal housing requirements for specific categories of domestic animals viz. pregnant cows and sows, milking cows and broiler birds. Importance of hygiene. Public health aspects of milk and meat production and processing.

Classification and definition of zoonoses, role of animals and birds in transmission of zoonotic diseases. Occupational zoonotic diseases. Principles of epidemiology. Application of epidemiological measures in the study of diseases and disease control, epidemiological features of air, water and food borne infections including milk and meat borne diseases.

Veterinary jurisprudence – Rules and regulations for improvement of animal quality and prevention of animal diseases, state and central rules for prevention of animal and animal product borne diseases – SPCA – Veterolegal cases – certificates, materials and methods of collection of samples for veterolegal investigation.

Veterinary medicine, surgery and gynecology:

Pathogenesis, symptoms, postmortem lesions, diagnosis and control of infectious disease of cattle, buffaloes, sheep goats, pigs and poultry. Etiology, symptoms, diagnosis and treatment of non specific conditions like impaction, bloat, diarrhoea, indigestion, dehydration, stroke and poisoning. Diagnosis and treatment of neurological disorders. Principles and methods of immunisation of animals against specific diseases, herd immunity, disease – free zones, Zero-disease concept, chemoprophylaxis, Common parasites occurring in livestock and poultry. Pathogenesis, symptoms and control measures of common parasitic diseases of livestock and poultry.

Anesthesia, local regional and general, preanesthetic medication, symptoms and surgical interference in fractures and dislocation, hernia, choking, abomasal displacement, rumenotomy, castration, dystocia, caesarian operations.

Disease investigation techniques – Materials for laboratory investigation. Establishment of animal health centres and veterinary polyclinics.

18. BOTANY

Microbiology, Pathology, Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms, Taxonomy of Angiosperones, Anatomy, Morphogenesis, Embryology & Palynology.

MICROBIOLOGY:

Viruses, Bacteria, Plasmids, General account of infection and immunology, structure, classification, reproduction and physiology. Importance of microbes in agriculture, industry and medicine. Biological control of pollution using micro-organisms.

PATHOLOGY:

Plant diseases caused by viruses, bacteria, mycoplasma, actinomycetes, fungi and nematodes. Modes of infection, dissemination, Physiology of parasitism and methods of control. Different fungal toxins. Mechanism of action of Biocides.

ALGAE:

Principles of algal classification; thallus organisation in algae. Types of life cycles in algae. Phylogeny and interrelationships of various groups of algae. Economic importance of algae.

FUNGI:

General characters of fungi and their classification. Structure, reproduction, life cycles, phylogeny and inter-relationships and affinities of the main groups of fungi viz., Myxomycetes, Omycetes, Zygomycetes, Ascomycetes, Basidiomycetes, Deuteromycetes, Economic importance of fungi, Symbiotic fungi, the lichens, Mycorrhizae.

BRYOPHYTES:

General account and classification of bryophytes. Comparative study of structure and development of sporophytes in bryophytes. Ecology and economic importance of bryophytes.

PTERIDOPHYTES:

General account and classification of pteridophytes – Evolution of stelar systems in pteridophytes. Telome-theory, heterospory and seed habit. Ecology and economic importance of pteridophytes.

GYMNOSPERMS:

Classification and distribution of living gymnosperms, origin and evolutionary tendencies in gymnosperms vis-à-vis pteridophytes and angiosperms – General account of fossil gymnosperms; pteridospermales (Cycadofilicales), Corditales, Bennettitales and their affinities and inter relationship. Taxonomic and economic importance of gymnosperms.

TAMONOMY OF ANGIOSPERMS:

A comparative study of the systems of classification; Bentham and Hooker, Engler and Prantl and Hutchinson. Modern trends in biosystematics with reference to phytochemical, cytological, palynological, embryological and anatomical criteria. Taxonomic and economic importance of Magnoliaceae, Ranunculaceae Cruciferae, Malvaceae, Rosaceae, Leguminosae, Umbelliferae, Asclepiadaceae, Verbenaceae, Euphorbiaceae, Liliaceae, Orchidaceae, Palmae and Poaceae.

ANATOMY:

Plant meristems, Normal and Anomalous secondary growth in stem and root. Anatomy of wood. Anatomy of C₃ and C₄ plants. Stomatal types.

MORPHOGENESIS:

Polarity, symmetry and totipotency – Differentiation and dedifferentiation of cells and organs. Factors of morphogenesis. Methodology and applications of cell, tissue, organ and protoplast cultures from vegetative and reproductive parts; Somatic hybrids.

EMBRYOLOGY AND PALYNOLOGY:

Development of male and female gametophyte, double fertilization, endosperm formation, embryo and its main types. Apomixis and polyembryony. Seed structure. Palynology with reference to overall Pollen morphology of angiosperms. Aspects and applications of aerology and Mellitopalynology.

Cell biology, Genetics & evolution, Physiology, Ecology, Economic botany, Ethnobotany.

CELL BIOLOGY:

Modern tools and techniques in the study of cytology. Prokaryotic and eukaryotic cells. Structural and ultra-structural functions of a) Plasma membrane b) Endoplasmic reticulum c) Golgi apparatus d) Mitochondria e) Ribosomes f) Plastids g) Microbodies h) Nucleus.

Chemical nature of Chromosomes, Polytene and lamp brush chromosomes. Numerical and structural variations in chromosomes and their significance. Detailed study of cell cycle – mitosis and meiosis.

GENETICS & EVOLUTION:

Pre and post Mendelian concept of genetics, development of gene concept Nucleic acids their structure and role in reproduction and protein synthesis, genetic code and gene regulation. Mechanism of microbial recombination, Mutation, its roles in evolution; Multiple factor inheritance, linkage and crossing-over, methods of gene mapping, Sex chromosomes and sex linked inheritance, cytoplasmic inheritance, Genetic engineering, Organic evolution, evidence, mechanism and theories.

PHYSIOLOGY:

Detailed study of Water Relations. Study of macro and micro nutrients, criteria for essentiality, availability, uptake and role. Photosynthesis – mechanism and importance, photosystem I & II Calvin cycle, C₄ pathway, CAM Pathway, Photorespiration, Respiration and fermentation. Nitrogen fixation and nitrogen metabolism, Protein synthesis. Enzymes, classification and mode of action. Growth indices, growth movements, Senescence. Growth substances their chemical nature role and application in agrichorticulture, Parthenocampy and fruit ripening. Seed-dormancy, storage and germination.

ECOLOGY:

Structure function and dynamics of ecosystems. Plant communities and succession. Conservation of ecosystems; pollution and its control. Forest types of India. Afforestation deforestation and social forestry. Forest management – use of resources. Endangered plants.

ECONOMIC BOTANY:

Origin of cultivated plants. Study of plants as sources of food, fodder and forage, wood and timber, fibre, paper, rubber, beverages, drugs, narcotics, resins and gums essential oils, dyes, medicines, insecticides and pesticides. Energy plantation.

ETHNOBOTANY:

Its scope. Medicoethnobotany and ethnoagriculture. Conservation and propagation of medicinal plants used by various tribal communities of A.P.

19. CHEMISTRY

1. Atomic structure and chemical bonding:

Quantum theory, Heisenberg's uncertainty principle, Schrodinger's wave equation (time independent), particle in a one dimensional box, quantum numbers, hydrogen atoms wave functions, shapes of orbitals. Valence bond and molecular orbital theories. Resonance and resonance energy Sigma and Pi bonds (non-mathematical approach).

2. Thermodynamics:

Laws of thermodynamics and their application to Physico-chemical processes. Laws of thermochemistry. Kirchoff's equation. Spontaneous and non-spontaneous changes. Second law of thermodynamics. Entropy changes in gases for reversible and irreversible processes. Third law of thermodynamics. Gibbs-Helmholtz equation. Vanthoff's reaction isochore. Thermodynamic criteria for equilibrium. Free energy changes in chemical reaction and equilibrium constant.

3. Solid State:

Forms of solids. Crystal systems and crystal classification. Designation of crystal faces. Lattice structure and unit cell. Bragg's law. X-Ray diffraction by crystals. Defects in crystals. Elementary idea of liquid crystals.

4. Chemical Kinetics:

Order and molecularity of reactions. Rate equations of Zero, first and second order reactions. Effect of temperature, concentration and catalyst on the rate of a reaction. Collision theory and absolute reaction rates of bimolecular reactions. Kinetics of polymerization. Homogeneous and heterogeneous reactions.

5. Photochemistry:

Lambert-Beer's law. Grothus-Draper law. Einsteins law of photochemical equivalence. Quantum yield and its application. Photo physical and photo chemical processes – Joblensky diagram.

6. Ionic equilibria:

Ostwald's dilution law and its verification. Theory of strong electrolytes. Debye-Huckel's theory. Ionic activities and activity efficients. Common ion effect. Solubility product and its applications. Electrolysis conductance and its theory and applications. Laws of electrolysis.

7. Electromotive force:

Reversible and irreversible cells. e.m.f. and its measurement. Types of cells. Single electrode potentials and their applications. Theory and applications of over voltages. Dropping Mercury Electorde (DME).

8. Reactions in non-aqueous media:

Liquid ammonia and liquid sulphur dioxide. Pearson's theory of hard and soft acids and bases.

9. d-Block elements:

Electronic configuration – variable oxidation states. Magnetic properties. Ability to form complexes. Absorption spectra (including charge transfer spectra). Metal-metal bonds and metal atom clusters. A comparative study of physical and chemical properties of the first, second and third transition series.

Lanthanides and actinides:

Methods of separation of lanthanides. Oxidation states and magnetic properties. Synthesis of actinides and actinide contraction.

10. Co-ordination chemistry:

Theories of bonding – valence bond theory. Crystal field theory and its limitation. Molecular orbital theory. Stability of coordination compounds. Factors effecting the stability constants. Determination of stability constants by potention-metric and spectro photometric methods.

11. Organometallic compounds:

Nature of the metal-carbon bond. Organometallic compounds of aluminium, Zinc and mercury. Olefinic complexes of palladium (II) and platinum (II). Their preparation, properties and bonding.

12. Molecular spectroscopy:

Type of spectra and their origin. Measurement of spectra.

a) Vibrational spectroscopy:

i) Infra Red Spectra: Calculation of force constants. Modes of vibrations in linear and non linear molecules. Vibrational frequencies of some important groups. Applications of IR spectroscopy in structure elucidation.

ii) Raman spectra: Origin and measurement. Differences between IR and Raman spectra.

b) Electronic spectroscopy:

UV and visible spectra. Types of electronic transitions in molecules. Absorptions due to multiple bonds and the effect of conjugation on them. Applications of UV-visible spectroscopy in the study of organic molecules. Charge transer spectra.

PAPER-II

1. Structure, reactivity and nomenclature of organic molecules:

Covalent character of organic compounds. Single and multiple bonds. Types of organic reactions and reagents with examples. Homolytic and heterolytic cleavage of bonds.

Inductive, electromeric, conjugative and hyperconjugative effects on the physical and chemical properties of organic compounds with suitable examples Dipole momemnts.

IUPAC and Chemical Abstract systems of nomenclature of organic compounds.

2. Stereo Chemistry:

Concept of isomerism and isomers. Elements of symmetry. Criteria for optical activity. Symmetry operations (C_n and S_n symmetry elements). Symmetric, dissymmetric and asymmetric molecules with examples.

DL and RS nomenclature of chiral molecules. Asymmetric induction. Cram's rule. Stereo selective and stereo specific synthesis. E, Z-nomenclature of unsaturated systems. Physical and chemical properties, relative reactivity, stability and interconversion of E,Z-isomers.

Stereo chemistry of oximes.

3. Reaction mechanisms:

General methods of study of organic reaction mechanism. Formation and stability of reactive intermediates. Viz. carbocations, carbanions, freeradicals, carbenes, nitrenes and benzyenes.

S_N1 and S_N2 mechanisms. E_1 , E_2 and E_1c_b mechanism of elimination reactions. Electrophilic addition to carbon – carbon double bonds. Addition to carbon-oxygen double bonds. Michael addition. Aromatic electrophilic and nucleophilic substitution.

4. Pericyclic reaction:

Classification and examples. An elementary study of woodward-Hofmann Rules.

5. Carbohydrates:

Classification. Structure elucidation of open chain and cyclic structures of D-glucose and D-fructose. Inter-conversion of monosaccharides. Determination of the configuration of D-glucose.

6. Amino acids, polypeptides and proteins:

Classification of amino acids. Synthesis of natural amino acids (general methods) properties of amino acids. Structural studies of polypeptides. Synthesis of poly peptides primary and secondary structures of proteins.

7. Aromatic and heterocyclic compounds:

Theory of aromaticity. Frost-Musulin diagrams of cyclobutadiene and benzene. Synthesis and reactions of furan, pyrrole, thiophene and pyridine. A comparative study of their aromatic character.

8. Chemistry of the following name reactions:

Aldol condensation, dieckmann reaction, Claisen condensation, perkin reaction, Beckman rearrangement and Cannizzaro reaction, reimer – Tiemann reaction.

9. Reagents in organic synthesis:

Use of the following reagents in organic synthesis:

Ozone, periodic acid, NBS, diborane, Sodium in liquid ammonia, $NaBH_4$ and $LiAlH_4$.

10. Chemistry of Natural products:

Isolation and structural features of the following natural products:

Citral, nicotine, papavarine and Vitamin-C.

11. NMR Spectroscopy:

Introduction to proton magnetic Resonance spectroscopy – Principles. Chemical shifts, shielding and deshielding effects, Splitting of signals, Coupling constants.

Application of PMR to the study of simple organic molecules.

12. Polymer chemistry:

Physical chemistry of polymers. End group analysis, sedimentation, light scattering and viscosity of polymers. Ziegler-Natta catalysis. Study of addition and condensation polymerization. Stereo chemistry of polymers. Inorganic polymers.

20. GEOLOGY

(General Geology, Geo-morphology, Structural Geology, Stratigraphy and Palaeontology)

i) General Geology:

Origin and interior of the earth. Dating of the rocks by various methods and age of the Earth. Volcanoes, Earthquakes, Geo-synclines, Isostasy, Continental drift and Mountain building activity. Sea floor spreading and plate tectonics.

ii) Geomorphology:

Land forms, their types and development. Weathering, Transport and Erosion. Geomorphic processes, such as Fluvial, Fluvio-marine, Marine, Glacial and Eolian. Topography and its relation to structures and lithology.

iii) Structural Geology:

Concepts of stress and strain. Description, terminology and nomenclature of folds. Mechanics of folding, classification, genesis and dynamic significance of joints. Classification of unconformities. Description, classification and genesis of faults. Mechanism and recognition of faults in the fields. Foliation and lineation. Tectonic framework of India.

iv) Stratigraphy:

Principles of stratigraphy. Stratigraphic classification and nomenclature. Standard stratigraphic scale. Detailed study of various geological systems of Indian sub-continent. Boundary problems in stratigraphy. Paleogeography and evolution of Indian sub-continent through Phanerozoic time.

v) Palaeontology:

Origin and evolution of life. Fossils, their modes of formation and utility. Morphology, classification and evolutionary trends of Branchiopods, Lemnibranchs, gastropods, Ammonoids, Trilobites, Echinoids and Corals. Microfossils and their application. Evolutionary history of Man, Horse & Elephant. A brief study of Gondwana flora.

PAPER-II

(Crystallography, Mineralogy, Petrology and Economic Geology)

i) Crystallography:

Crystalline and non-crystalline substances. Concept of symmetry, point group, lattice and space groups. 32 classes of crystal symmetry. Stereographic projections and their use. Twinning, crystal growth and irregularities.

ii) Mineralogy:

Types of bondings, ionic radii, coordination number. Isomorphism, polymorphism and pseudomorphism. Structure and classification of silicates. Detailed study of rock forming minerals. General principles of Optics. Nicol prism. Isotropism and Anisotropism. Dispersion, pleochroism, Birefringence optical indicatrix. Optic sign – Acute and obtuse bisectrix – $2V$ angle.

iii) Petrology:

Simple phase diagrams of single, binary, ternary and quaternary silicate systems, with reference to petrogenesis. Magmas, their generation in the crust and mantle their emplacement and their relation to paleo-tectonics. Magmatic crystallization, differentiation and assimilation. Bowen's Reaction principle classification of Igneous rocks.

Process and formation of sedimentary rocks. Diagenesis and lithification. Textures and structures. Heavy minerals and their significance. Classification of Sedimentary rocks.

Role of T P and fluids in metamorphism. Metamorphic facies. Relationship among metamorphism, anatexis and granitization. Types of metamorphism.

Petrogenic aspects of important rocks of India, such as Deccan Traps, the layered intrusions, charnockites khondalites and gondites.

iv) Economic Geology:

Concepts of ore. Ore mineral and gangue. Tenor of ores. Process of formation of mineral deposits. Physico-chemical controls of deposition. Geological setting, characteristic features and genesis of metallic and non-metallic mineral deposits in India. Occurrence and distribution of fuels – coal, petroleum and Atomic minerals. Exploration techniques for surface and subsurface mineral deposits. Sampling, Assaying and evaluation of ore bodies.

Geological investigation for the construction of dams, Bridges, Highways and Tunnels.
Ground water exploration and management, water pollution.
Geological interpretation of air photos and imagery.

21. MATHEMATICS

The candidate has to answer 10 questions choosing atleast 2 questions from each Sections I – IV. Five questions will be from each section. Each question carries 15 marks.

Section-I – Algebra:

Groups – subgroups – normal subgroups – quotient groups – homomorphism and isomorphism theorems – cyclic groups – permutation groups – Cayley’s theorem.

Rings – subrings – integral domain – fields – ideals quotient ring – maximal and prime ideals – Euclidean rings – polynomial rings – Unique factorization domains – principal ideal domains.

Section-II – Linear Algebra:

Vector spaces – subspaces – linear independence and dependence – Bases and dimension – Finite – dimensional vector spaces and their properties.

Linear transformations – Rank and nullity of a linear transformation – Cayley – Hamilton theorem – Matrix of a linear transformation – eigen values and eigen vectors – Canonical forms.

Inner product spaces – Orthonormal basis – Quadratic forms.

Section-III – Differential equations:

Order and degree of a differential equation – Formation of a differential equation – Differential equations of first order and first degree – Linear differential equations with constant and variable coefficients – Total differential equations.

Formation of partial differential equations – Equations of first order – Charpit’s methods.

Section-IV – Geometry:

General equation of second degree in two variables – Tracing of conics.

Plane, straight lines in space – sphere – Cone.

Curves in space – curvature – Torsion – Serret – Frenet formulae.

The candidate has to answer 10 questions choosing atleast TWO questions from each of the Sections 1 to IV. FOUR questions will be given from each of the Sections I,II and III and EIGHT questions will be given from Section IV with two questions from the four topics given in that section.

Section-I – Real Analysis:

Real number system \mathbb{R} – Open and closed sets in \mathbb{R} - Compact sets – sequences in \mathbb{R} and their convergence – Series of real numbers – Tests of convergence – absolute and conditional convergence – rearrangements of series.

Limits and continuity of a real valued function properties of continuous functions – Differentiation – Mean value theorems – Applications.

Riemann integration – conditions for Riemann integrability – improper integrals.

Section-II – Complex Analysis:

Complex numbers and their geometric representation – limits and continuity of functions of a Complex variable – Analytic functions – Cauchy Riemann equations – Complex integration – Cauchy's theorem – Cauchy's integral formula – Power series – Taylor's and Laurent's series – Types of singularities – Calculus of residues and application to evaluation of definite integrals.

Section-III – Vector calculus:

Differentiation of a vector valued function – Gradient of a scalar function – Divergence and curl of a vector function in Cartesian and polar coordinates.

Green's theorem – Gauss and Stoke's theorems and their applications to evaluation of double and triple integrals.

Section-IV:

- a) Transform Calculus: Laplace Transforms – Inverse Laplace transforms – solving differential equations using Laplace transforms. Fourier and Hankel transforms.
- b) Numerical Analysis: transcendental and Polynomial equations – Regula Falsi method – Newton Raphson method Interpolation – numerical differentiation – numerical intergration – Runga Kutta method.
- c) Number Theory: Fundamental theorem of arithmetic – congruences and their applications – Fermat's and Wilson's theorems – solution of linear congruences – Chinese remainder theorem.
- d) Linear Programming: Formation of linear programming problem – Graphical solution – Dual problem – simplex method – Transportation problem.

22. PHYSICS

(Mechanics and relativity, Waves and Oscillations, Thermal Physics, Optics)

1. Mechanics and Relativeity:

Newtons laws of motion, force and potential energy, conservative force. Conservation laws – collisions – impact parameter, scattering cross-section Laboratory and Centre of mass reference frames. Transformations between them. Rutherford scatterering. Motion of a rocket. Rigid body dynamics – Moment of inertia of simple regular bodies, rotating frames of reference – coriolis force. Angular momentum, torque, precession of a top, gyroscope. Central forces – motion under inverse square law – gravitational force, Kepler's laws. Motion of satellites. Motion of fluids – streamline and turbulent flow. Bernoulli's equation with simple applications – Reynolds number.

Galelean relativity, special theory of relativity – Time duration and length contraction Michelson – Morley experiment, Lorentz transformations, addition of velocities, variation of mass with velocity – mass energy equivalence.

2. Waves and Oscillations:

Oscillations, Simple harmonic motion, progressive and stationary waves. Damped harmonic Oscillator, Forced oscillations and resonance. Wave equation, harmonic solutions. Plane and spherical waves, superposition of waves and beats, phase velocity, group velocity, Doppler effect.

3. Thermal Physics:

Laws of thermodynamics, carnot's cycle. Isothermal and adiabatic processes. Thermodynamic potentials, Maxwells relations. Claussius – clapeyrons equation joule – Thomson effect. Kinetic theory of gases. Maxwell's velocity distribution, equipartition theorem, specific heat of gases. Mean free path. Brownian motion, specific heat of solids – Einstein and Debye's theories. Black body radiation Wien's, Rayleigh-jeans and plancks laws. Solar constant, Sahas theory of thermal ionization – stellar spectra, production of low temperature – adiabatic demagnetization – negative temperature. Vander waals equation, critical constants.

4. Optics:

Huygens principle interference, young's experiment interference in thin films, Newton's rings. Michelson's interferometer. Diffraction – Fresnel and Fraunhoffer diffraction. Diffraction by straight edge, circular and rectangular apperture, single and double slits, plane grating, Dispersive power

Resolving power, Rayleigh's criterion. X-ray diffraction and Bragg's law. Polarisation – Plane, Polarisation by reflection, circular, elliptic polarisation, double refraction, Nicol prism, quarter and half wave plates. Laser principle – spontaneous and stimulated emission of Radiation. He-Ne, Ruby and semiconductor diode lasers. Coherence. Diffraction as Fourier transformation. Holography and applications.

(Electricity & Magnetism, Modern Physics and Electronics)

1. Electricity and Magnetism:

Coulomb's Law, Electric field, Gauss's Law, electric potential. Poisson's and Laplace equations and solutions for homogeneous dielectric, uncharged conducting sphere in a uniform field, point charge and infinite conducting plane. Magnetic shell, magnetic induction and field strength Biot Savart's law and applications. Electromagnetic induction, Faraday's and Lenz's laws. Self and mutual inductance, induction coil and transformer.

Alternating currents L-R, C-R, L-C-R circuits. Series and parallel resonance, Q-factor. Electromagnetic waves – Maxwell's equations. Transverse nature of e-m waves, Poynting vector.

Magnetic materials – Dia, para, ferro, antiferro and ferri magnetism (Qualitative features only). Langevin's theory of paramagnetism, Weiss theory of ferromagnetism. Ferro magnetic Domains Hysteresis, Nuclear magnetism. Dielectric materials – Capacitive with dielectric material as medium; electric polarisation; electronic, ionic, electric polarisabilities and their variations with temperature.

2. Modern Physics:

Bohr's model, Sommerfeld extension. Explanation of atomic spectra. Stern-Gerlach experiment, space quantization, electron spin, vector atom model, spectral terms, fine structure of spectral lines. J-J and L-S coupling schemes. Pauli's exclusion principle, spectral terms of two equivalent and non-equivalent electrons, Zeeman, Paschenback effects, Stark effect. Characteristic X-rays, Moseley's Law. Gross and fine structure of Band spectra, Raman effect.

Black body radiation, Wien, Rayleigh Jeans and Planck's Laws of radiation. Photo electric effect and Einstein's Explanation, Compton effect, de Broglie hypothesis. Wave-particle duality, uncertainty principle, Schrodinger equation, eigen functions and eigen values. Physical meaning of eigen function, Solution of Schrodinger equation for 1) particle in a box 2) potential step 3) harmonic oscillator 4) hydrogen atom.

Radioactivity – alpha, beta and gamma rays, Gamow's theory of alpha decay. Laws of radioactivity. Radioactive equilibrium. Artificial radioactivity – Rutherford's experiment, discovery of Neutron. Mass spectrometers. Nuclear binding energy, semi-empirical mass formula. Nuclear fission, nuclear reactors. Nuclear fusion, fusion cycles. Elementary particles and their classification. Strong, Weak and electromagnetic interactions. Particle accelerators – Cyclotron and linear accelerators. Basic experimental ideas of superconductivity.

3. Electronics:

Band theory of solids – Conductors, insulators and semi conductors. Intrinsic and extrinsic semi conductors; p-n junction diode, forward and reverse bias. Diode as a rectifier. Transistor – different configurations of transistor, Transistor parameter amplifier. Transistor oscillator. Modulation and detection. Transistor receiver. Basic principle of television. Digital principles – Logic gates – AND, OR NOT, XOR gates – truth tables.

23. STATISTICS

Attempt any 5 questions choosing at most 2 from each Section. Four questions of equal weightage will be set in each section.

Section-A: Probability and Distributions

Sample space and events, Probability space, Statistical independence, Random variable, Discrete and continuous random variables. Probability density and distribution functions, marginal and conditional distribution, functions of random variables, expectation and moments, conditional expectation, correlation coefficient, convergence in probability, almost sure, Markov, Chebychev and Kolmogorov inequalities, Borel-Cantelli lemma, weak and strong Laws of large numbers, probability generating and characteristic functions; Uniqueness and continuity theorems. Lindeberg-Levy Central limit theorem. Standard discrete and continuous probability distributions, their interrelations including limiting cases. Exact Sampling distributions – t, F and Chi-square, Distributions of order statistics.

Section-B: Statistical Inference

Properties of estimates, consistency, unbiasedness, efficiency, sufficiency and completeness, Cramer-Rao bound, Minimum variance unbiased estimation, Rao-Black well and Lehmann-Sehffe's theorems methods of estimation by moments, maximum likelihood and minimum Chi-square. Properties of maximum likelihood estimators, confidence interval for of standards distributions.

Simple and composite hypotheses, statistical tests, critical region, two kinds of error, power function unbiased tests, most powerful and uniformly most powerful tests, Neyman-pearson, Lemma, Optimal tests for simple hypotheses concerning one parameter, monotone likelihood ratio property and its use in constructing UMP test, likelihood ratio criterion and its asymptotic distribution, chi-square and Kolmogorv tests for goodness of fit. Run test for randomness, Sign test for Location, Wilcoxon-Mann-Whitney test and Kol mogor – Simirnov test for the two sample problem and tests of independence based on sparmants next correction Distribution-free confidence intervals for quantiles and confidence bands for ditribution functions.

Notions of a sequential test, Walds SPRT, its CC and ASN functions, with applications to standard distributions.

Section-C: Multivariate Analysis

Theory of least squares, Gauss-Markoff theory, normal equations, least square estimates and their precision, Tests of significance and intervals – estimates based on least square theory. Regression Analysis, linear regression, estimates and tests about correlation and regression coefficient, curvi-linear regression, and orthogonal polynomials, test for linearity of regression-Multivariate normal distribution, multiple regression, multiple and partial correlations and tests for them. Mahalanobis D^2 and Hotelling T^2 statistics and their applications (derivations of distribution of D^2 and T^2 excluded). Fisher's discriminant analyses.

Attempt any 5 questions choosing atleast one question from each section. Three questions of equal weight will be set in each section.

Section-A – Sampling Theory

Nature and scope of sampling, simple random sampling, sampling from finite population with a without replacement, estimation of the standard errors, sampling with equal probabilities, PPS sampling, Stratified random sampling, systematic sampling, two-stage and multistage sampling, multiphase and cluster sampling schemes.

Estimation of population total and mean, use of biased and unbiased estimates, Standard errors of estimates, cost and variance functions, ratio and regression estimates and their relative efficiency, planning and organization of sample survey with special reference to recent large scale surveys conducted in India.

Section-B – Design of Experiments

Analysis of variance of one way, two-way and three-way classified data with and without interactions. Principles of experimental designs, CRD, RBD, LSD, Missing-plot technique, Factorial experiments, 2^n and 3^n designs. General theory of total and partial confounding and fractional replication. Analysis of split-plot, BIBD and PBIBD.

Section-C – Industrial Statistics

Concept and importance of quality control, different types of control charts, X,R,P & C charts; cumulative-sum control charts.

Sampling inspection Vs 100 per cent inspection. Concepts of producer's risk and consumer's risk. Single, double, multiple and sequential sampling plans for attributes; OC, ASN curves, Rectifying sampling plans, AOQ and ATI curves; sampling plans for variables.

Definition of Reliability, Life distribution, failure rate and bath-tub failure curve; exponential and Weibull models. Reliability of series, Parallel and K out of n systems.

Section-D – Operations Research

Homogenous discrete-time Markov chains, transition probability matrix, classification of states; stationary distribution, Birth and death process. Elements of queueing theory, M/M/1 and M/M/K queues; G/M/1 and M/G/1 - queues.

The structure and formulation of linear programming problem. The simplex method, two phase simplex method and charne's method with Artificial variables. Transportation and Assignment problems.

Introduction to computers and elements of Fortran IV Programming, Formats for input and output statements, specification and logical statements and sub-routines. Application to some simple statistical problems.

24. ZOOLOGY

(Non-Chordata, Chordata, ethology & Biostatistics)

Protozoa:

General Organisation and Classification; Locomotory organelles; Pathogenic protozoa of human importance (i.e.)

Trypanosoma, Leishmania, Entamoeba, Histolytica, Giardia, Malarial Parasites.

Porifera:

Various types of canal system, Histological structure and their functions; Reproduction and development of sponges, systematic position and affinities of sponges; development of spicules.

Coelenterata:

General Organisation and Classification; Aurelia; Coral reef formation in Actinoptera, general organisation and phylogenetic relationship of ctenophore, polymorphism in Hydrozoa.

Platyhelminthes:

General Organisation and Classification; Planaria; Fasciola; Taenia, general outline of the life cycle of parasites of human importance, Host-parasitic interactions.

Nemathelminthes:

Parasitic Nematodes of human importance i.e., Ascaris, Oxyuris, Anncylostoma, Strongyloides plant parasitic nematodes with specific examples.

Annelia:

General Organisation and Classification; Nereis; Leech; types of Nephridia, Coelome and Coelomoducts; Regeneration in Polychaetes, affinities, Trochophore larva.

Arthropoda:

Outline classification (up to orders) Palaemon; scorpion; Insect mouth parts, respiration, metamorphosis, social use in insects, harmful and useful insects and economic importance, vectors - flies, lice, bugs, ticks and mosquitoes; Structure and systematic position of onychophora.

Mollusca:

Classification, Unio; Perna; torsion and detorsion, Distinctive features of Cephalopoda; pearl formation in Mollusca.

Chinodermata:

Classification; star fish; water vascular system, larval forms and their revolutionary significance.

Hermichodata:

General organisation; systematic position and affinities of Balanoglossus.

Chordata:

Origin of Chordates, general organisation, Ascidian and classification of Urochordata, Sessile and Pelagic tunicates, Mucous and mode of feeding, affinities, Retrogressive metamorphosis.

General organisation of Cephalochordata; Branchiostoma.

Introduction to Agnatha. General Organisation and classification of Cyclostomata; affinities. General introduction of Craniata, Dog fish; any Bony fish.

Systematic position and significance of coelocanthini, Dipnoi, the conquest of land, origin and evolution of Amphibia and classification; Anatomical peculiarities and affinities of Urodele and parental care in Amphibia.

Reptiles:

Origin of reptiles general organisation of Chelonia, squamata, Rhynchocephalia and Crocodilia. Fossil Reptiles, poisonous and non-poisonous snakes of India.

Birds:

Origin and evolution of birds, migration of birds, adaption for flight, economic importance of birds.

Mammals:

Prototheria, Metatheria and Eutheria, phylogenetic relations of prototheria & Methatheria, adaptive radiations in marsupials, Aquatic and aerial adaptations in mammals, Oestrous cycle and Placentation in mammals, distinctive features of Primates.

Comparative account of various systems of vertebrates.

Ethology:

Introduction and History of ethology, Ethology Vs behaviourism; Instinct Vs learning, Communication by means of Pheromon Domec language of honey bees Forging and predation; Defensive secretions in insects. Social behaviour in insects.

Biostatistics:

Methods of sampling, frequency distribution and Measures of central tendency; Standard deviation, Standard error; correlation and regression and T-test, F-test, X 2 test.

(Cell Biology, Physiology, Genetics, Embryology, Histology, Evolution, Ecology and Zoogeography)**Cell Biology:**

Prokaryotic and Eukaryotic cells, cell membrane, Endoplasmic reticulum, Golgi Complex, Lysosomes, Mitochondrion, Microsome, Peroxisomes, Nucleus, Nucleolus, Centrioles, Cilia, Flagella, Microtubules, Chemical components and molecular models of cell membrane. Passive active and ionic transport. Transport protiens, carrier and fixed pore mechanism cell coat and cell recognition. Cell surface receptors and mechanism of signal transduction (Steroid, Cyclic AMP and Ca^{+2}). Ultra structure of a muscle and nerve fibre, ultra structure and chemical composition of a chromosome, hetero and euchromatin, polytene and lambrush chromosomes, chromosomal aberration and variation cell cycle and chemical events of cell cycle, cell division mitosis & meosis, cancerous cells and lymphocytes.

Physiology:

Nutritional types, Essential nutrients, types of food, vitamins, minerals, balanced diet. Digestion and absorption. Endocrine regulation of gastro intestinal movements and secretions. Breathing movements, Respiratory pigments and transport of respiratory gases, Muscle contraction – Muscle proteins and theories of muscle contraction. Nerve impulse – Propagation and mechanism of

synaptic transmission. Electrical and chemical theories and neurotransmitters. Physiology of vision, auditing, olfaction and taste. Excretion – Formation of nitrogenous excretory products. Osmoregulation in fresh water, marine water and terrestrial animals. Cellular metabolism – Carbohydrate and protein metabolism. Enumeration of endocrine glands and their hormones, chemical nature and mechanism of action of hormones.

Genetics:

Principles of mendelian inheritance (mono, di and tri hybrid ratios) phenomenon of linkage and chromosome mapping, sex linkage, crossing over, sex determination and genic balance, extra chromosomal inheritance, concept of multiple alleles, blood groups and RH factors; Inborn errors metabolism, one gene one polypeptide hypothesis, structure and chemistry of DNA and RNA, point mutation, genetic code and protein synthesis. Eugenics; Gene cloning, genetic engineering, gene transfer and immunogenetics.

Embryology:

Gametogenesis; Fertilization, Cleavage, Gastrulation, extra embryonic membranes placenta, organogenesis of central nervous system, heart, kidney, Regeneration, Carcinogenic development.

Histology:

Histology of Blood, lymphoid tissues, cartilage, bone, skin, stomach, intestine, liver, pancreas, lung, kidney, testis and ovary of chordates.

Evolution:

Prebiotic and early evolutions in primordial atmosphere origin of life concept of organic evolution. Lamarckism, Darwinism and Deveries theory, modern concept of recapitulation hypothesis, Homology and Analogy, paleontological evidence and evolution, Dating of fossils, Ancestry of man, Neo-Lamarckism and Neo-Darwinism, Isolating mechanism. Reproductive isolation, speciation, Mutation, Genetic drift, Gene frequencies and basic concept of Hard Weinberg law.

Ecology:

Introduction of ecology, the scope of ecology, factors of the environment in relation to the organism, heat, light, mechanical factors oxygen and carbon dioxide, inorganic salts and biotic factors, the concept of an ecosystem fresh water, marine and terrestrial ecosystem, energy flow in eco-system, energy fixation by autotrophs, Food chains and Food Web, Biogeochemical cycles, Water cycle, carbon cycle, general features of community, Nitrogen cycle, population attributes, definition and size communities, ecological succession, pollution, ecology in relation to man.

Zoogeography:

General principles of animal distribution, Barriers, continuous and discontinuous, continental drift, zoogeographic realms, Insular, fauna, wildlife protection, mimicry and colouration.

25. CIVIL ENGINEERING

Note: *Candidates shall have the option to answer questions from any two parts.*

Section (A): Strength of Materials, Theory of Structures and Designs.

- a) Strength of materials: Simple stresses and strains, principal stresses and strains, shear force and bending moment of beams, Derivation of $M/I = f_b / y = E/R$, Deflection of beams, Direct and bending stresses, torsion of circular shafts, columns and struts.
- b) Theory of structures: Castigliano's I and II theorems, slope deflection, moment distribution and Kani's methods of analysis applied for indeterminate beams and rigid frames.
Rolling loads: Propositions for the maximum bending moment at any given section and under any given load, Equivalent uniformly distributed load, influence line for uniformly distributed load shorter than span for maximum bending moment and shear force, Maximum bending moment for series of point loads travelling the girder, Influence lines for tresses.
Arches: Three hinged and two hinged parabolic arches influence lines for three hinged arches.
- c) Steel structures: Design of simple, compound beams and laced and batten columns. Design of column bases and footings, Design of highway and railway bridges through and deck type plate girders, warren girders and pratt truss.

- d) Limit state method: Design of singly, doubly reinforced and T-beams, Design of lintel one way and two way slab, Design of long and short columns, design of rectangular and combined footings.
- e) Pre-stressing concrete: Methods of pre-stressing, pre-tensioned and post-tensioned numbers, analysis and design of sections for flexures, losses in pre-stressing.

Section (B) Soil Mechanics and Foundation Engineering

- a) Soil Mechanics: Definitions and relationships, particle size distribution, Atterburg limits, Permeability and permeability tests, Seepage pressure, quick sand condition, Laplace equation, Flow net, construction, properties, uses and applications.
- b) One dimensional consolidation, coefficient of compressibility consolidation settlement, pre-consolidation pressure, one dimensional consolidation equation, consolidation test, compaction, Field compaction method, proctor's and modified compaction test, field compaction control, factors affecting compaction.
- c) Shear strength, Mohr's Coulomb failure theory, effective stress, Direct shear test, Triaxial compression test and vane shear test, Rankine's theory of active and passive earth pressures, Retaining walls, Horizontal and sloping back fill, Coulomb's Wedge theory and Rankine's construction.
- d) Infinite and finite slopes, Swedish circle method, Friction circle method, Taylor's Stability number, Bearing capacity, definitions, Terzaghi's analysis for shallow footing, general and local shear failure, Terzaghi's semi empirical equations for square and circular footings, effect of water table on bearing capacity.
- e) Types of selection of footing, Raft, pile and floating foundations, settlement, computation for immediate and consolidation settlement, Boussinesq equation for stress under point load and uniformly distributed load, pressure bulb, vertical pressure under uniformly distributed load on circular area, Newmark influence chart.

Section (C) Fluid Mechanics:

Fluid properties, Fluid Statics – Forces on flat plate and curved surfaces.

Kinematics and Dynamics of Fluid flow, stream lines, equation of continuity, stream function and velocity potential function, flow nets, types of flows.

Euler's equation of motion, Energy and Momentum equations and their applications to pipe flow, free and forced vortices, venturimeters, and Notches & Weirs.

Laminar flow through circular tubes, Reynold's experiments, Flow through pipes, hydraulic gradient and total energy lines, pipes in series and parallel, siphon, Minor losses in pipes.

Open channel Flow, uniform and non-uniform flows, best hydraulic sections, specific energy and critical depth, Rapidly varied flow – hydraulic jump and its applications, Gradually varied flow – differential equations, classification of surface profiles.

Boundary layers – development of b.L. flow, laminar and turbulent boundary layers, laminar sub-layer, smooth and rough boundaries, drag and lift.

Dimensional analysis and similitude: Types of similarities, model studies, undistorted and distorted models, Buckingham II-theorem – applications.

Section (D): Computer Programming:

Type of computers – components of computer, historical development of computing systems. Different languages, Flow charts.

Fortran/Basic programming, constants & Variables, expressions, arithmetic statements, library functions.

Control statements, GO TO statements – Un conditional and computed, IF statements, DO statements.

Subroutines and Function sub-programmes – Arguments, CALL statement RETURN statement, Declaration statements.

Input and output statements, and Quoted Formats, FORMAT statements, Field specification, Stop and END statements.

Subscripted Variables, Arrays, DIMENSION statement, Simple applications of computer programming in civil engineering.

Note: A candidate shall answer questions from any two parts.

PART–A: Building Materials, Construction and Surveying:

Building materials: Timber, stones, bricks, sand, limes, cement, paints, varnishes and damp proofing material.

Brick work for walls, types of brick bonds, design of brick masonry walls as per IS code, detailing of walls, floors, roofs, ceilings, stair cases, doors and windows, finishing of buildings – plastering, pointing and painting – IS codes.

Use of Ferro cement, fiber – reinforced and polymer concrete in construction, building estimates and specifications.

Construction Scheduling, PERT and CPM methods.

General surveying – chain and compass survey, plane table survey – in combination with one another.

Levelling and contouring:- Fly levelling, reciprocal levelling, net levels, Reduction of levels, curvature and refraction corrections, characteristics of contours – estimation of earth work.

Theodolite survey: Temporary and Permanent adjustments, Traverse survey, computation of areas by co-ordinate system, theory of simple circular curve by linear and instrumental methods.

Tachometry: Stadia wires, Fixed and mobile wires, Tachometric tables, tachometric alidade, Reduction by calculations.

PART–B: Water resources and Irrigation Engineering:

Hydrology: Hydrologic cycle, precipitation, evaporation, transpiration, infiltration. Run-off hydrograph, unit hydrograph, flood estimation frequency analysis.

Ground Water: Ground water resources, specific yield, storage coefficient of permeability, confined and unconfined aquifers, radial flow into a well under confined and unconfined conditions, recuperation tests.

Water Resources Planning: Single and multipurpose projects, storage capacity, zones of storage, reservoir losses, reservoir sedimentation, flood routing through reservoirs, economics of water resources projects.

Water Requirement of Crops: Consumptive use of water, Duty and Delta, frequency of irrigation, efficiency of irrigation, Irrigation methods.

Storage Works: Types of Dams and their characteristics, Gravity dams principles of design, criteria for stability, control of seepage, Earth dams – Design principles, spillways – types and their suitability, energy dissipation, crest gates.

Canals: Alignment of canals types of canals, design of unlined canals Lacey's regime theory, cross masonry works – canal falls, Cross Drainage works – Aqueducts and super passages.

Diversion Works: Components of Diversion scheme, Weirs on permeable foundations – Bligh's and Khosla's theories – Design principles.

PART–C: Environmental Engineering:

- a) Water Supply: Protected Water Supply Scheme, Rate of demand, Population forecast, Analysis of water, Hydrogen-ion concentration, Sedimentation, Coagulation Chlorination, Methods of disinfection, Break point chlorination, Slow sand, Rapid sand and Pressure filters.
- b) Hardness of Water: Removal of temporary and permanent hardness, Distribution systems of water, pipe appurtenances, Analysis of distribution system using Hardy cross method, general principle of optimal design based on cost and head loss ratio criterion, Maintenances of distribution systems, pumping station and their operation.
- c) Sanitary Engineering: Methods of carrying refuses, systems of swarage, Sewers of different materials and shapes, self cleansing velocity, purification of natural streams, empirical formulae used in the design of sewers, deep man holes and their location, Automatic flushing tank, Different types of traps and classification.
- d) Quality of Sewage: Primary treatment to sewage, carbon cycle, B.O.D., C.O.D., and dissolved oxygen, Grit chamber, Detritus tank, skimming tank, sludge digestion process, contact beds, septic tank, imhoff tank, Activated sludge process, sludge volume index.
- e) Sources, effects and remedial measures of water, Air and Noise pollutions, particulate and Dust collection devices like internal separators, wet collection devices and electrostatic precipitators.

PART–D: Transportation Engineering:

- a) Road development in India, Road planning, High way alignments, width of pavement, camber, types of gradient, Resistance to traction, sight distances, Super elevation and centrifugal ratio, circular, compound, vertical, reverse and transition curves.
- b) Types of Road: Water Bound Macadam Road, Bituminous and cement concrete Roads, Flexible and rigid pavements, types of study for traffic, Road parking, Road accidents and traffic regulation, inter sections and rotary.

- c) Permanent Ways: Rails, creep of rails, blast, sleepers, Fastenings and Fixtures, Gauges, Trunouts, Crossings, Types of crossings, Railway track, drainage, Maintenance of track components, Traffic signals.
- d) Station yards and Machinery, station buildings, Platform sidings, turn tables, signal and inter locking, level crossing and necessary precautions.
- e) Development of Air Port: Take off and landing distances, characteristics of jet air craft, selection of site for air port, Survey for selection of site, Wind rose diagram, Run way width, length and design criteria, standard for general aviation.

26. ELECTRICAL ENGINEERING

I. Electrical Circuits:

Basic electrical laws, Analysis of DC networks, transient response of RLC networks excited by impulse, step, ramp and sinusoidal excitations. Transform methods, transfer functions, poles and zeros steady state AC networks, frequency domain analysis, resonance, coupled circuits, two port networks, three phase networks, power in a.c. networks, power measurement in 3-phase networks.

II. E.M. Theory :

Electro static and electro magnetic fields, vector methods, Fields in dielectric, conducting and magnetic materials, Laplace and Poisson's equation. Time varying fields, Maxwell's equation, Poynting Theory, properties of transmission lines.

III. Electrical measurement and Instruments:

Electrical standards, Error analysis, Measurement of current, voltage, power, energy, power factor, resistance, inductance capacitance frequency and loss angle. Indicating instruments, extension of range of instruments, DC and AC bridges. Electronic measuring instruments. Electronic multimeter, CRO, frequency counter, digital voltmeter, transducers, Thermocouples, Thermistor, LVDT, strain gauges, Piezo electric crystal, Measurement of non-electrical quantities like, pressure, velocity, temperature, flow rate, displacement acceleration and strain.

IV. Control Systems

Open and closed loop control systems, Mathematical modeling, block diagram, signal flow graphs, time response and frequency response of linear systems, error constants and series Rootlocus technique, Bodeplot, polar plot, M-circles, N-circles, Nichol's charts, stability, Routh Hurwitz criteria. Nyquist stability criteria, compensators, design in frequency domain. Control system components. Servo motors, synchros, tacho generator, error detector. State variable approach, modeling, state transition matrix, transfer function, response.

V. Electronics:

Solid state devices and circuits. Small and large signal-amplifiers with and without feedback at audio and radio frequency, multistage amplifiers. Operational amplifiers and applications. Integrated circuits oscillators, RC, LC and crystal oscillators wave form generators, multi-vibrators – Digital circuits, Logic gates, Boolean algebra combinational and sequential circuits. A to D and D to A converters Micro processors (8085) instruction set, memories, interfacing programmable peripheral devices – Number system flow charts – expressions and statements in C – language – simple programs for engineering application.

I. D.C. ELECTRICAL MACHINES :

Fundamentals of electro mechanical energy conversion, constructional features of D.C. Machines, emf equation types and characteristics of generators application, Torque in DC motor, types of DC motors, applications. Testing of D.C. motors, efficiency, and starting and speed control.

II. TRANSFORMERS:

Construction – Principle of operation of 1-phase transformers – Vector diagram on No Load and – Load – Parallel operation – Regulation – efficiency – Equivalent circuit 3 phase transformer connections – Scott connection.

III. INDUCTION MOTORS:

Production of rotating magnetic field, production of torque types of motors equivalent circuits, Circle diagram, torque slip characteristics, starting and maximum torque, speed control, principle of single phase induction motors, Applications.

IV. SYNCHRONOUS MACHINES :

Generation of emf in 3 phase AC Generator, Armature reaction, regulation by Synchronous impedance and Ampere turn methods, parallel operation, transient and sub-transient reactances, theory of salient pole machines.

Synchronous Motor: Torque production, performance characteristics, methods of starting, V-Curves, synchronous condenser.

Special Machines: Stepper motor, Methods of operation, Amplidyne and metadyne-applications.

V. ELECTRICAL POWER GENERATION:

General layout – Types of power stations, economics of different types, base load and peak load stations, load factor and its effects, pumped storage schemes.

VI. POWER TRANSMISSION :

Calculation of line parameters, concepts of short, medium and long transmission lines, ABCD parameters, insulators, Corona, P.U. quantities, fault calculations, symmetrical components load flow analysis using Gauss Seidal, New-ton Raphson, methods, economic operation, stability, steady state and transient stability, equal area criterion, ALFC and AVR control for real time operation of interconnected systems.

VII. POWER SYSTEM PROTECTION :

Principles of arc quenching, circuit breaker classification, Recovery and restriking voltages, relaying principles over current, directional over current relays-generator and transformer protection using differential relays-line protection using distance relays Surge phenomena in transmission lines – Travelling wave theory, protection against surges.

VIII. UTILISATION :

Industrial Drives – Motors for various drives – Braking methods – Speed control of motors – Economics of rail traction – Mechanics of train movement – Estimation of power and energy requirements – Illumination – Laws Factory lighting – Street lighting – Induction and dielectric heating.

27. ELECTRONICS & TELECOMMUNICATIONS

- A) Computer Programming: Number systems, Binary, Octal, Hexadecimal, Decimal and their conversions, fixed and floating point representation of numbers; concept of flow charts and Algorithms, Control and Decision Statements, Loops, Subroutines.
- B) Network Theory: Kircheff's Laws, Node and Loop analysis, Ideal sources, Network Theorems, Thevinin's, Norton's Reciprocity, Superposition and Max. Power Transfer Theorems, Applications to simple R.L.C. Networks.
Linear time invariant circuits, Integro differential equations equations in RLC networks, Initial conditions for inductors and capacitors, Response of networks to step, impulse, sinusoidal and exponential excitations, steady state analysis, Vector representation, series and parallel resonance, Quality factor and bandwidth.
Problems with initial conditions and switches, zero input and zero state response, Time constants for RC and RL networks.
- C) Network solutions using laplace Transform Techniques, complex frequency, properties of Laplace Transforms, initial and final value theorems, Laplace Transforms of periodic signals, Inverse Laplace Transform.
Fourier series, Exponential and Trigonometric Fourier series, Fourier Transforms, Properties, Parseval's Theorem.
Convolution integral, Response to arbitrary excitation, Graphical representation of convolution integral.
Two port network parameters, Z, Y, Z ABCD parameters, applications to Network Analysis, Interconnection of two port networks, services parallel and cascade connections.

Network Functions, Driving point and Transfer functions, properties, Time domain response from pole zero plot. Complex frequency(s) plane.
Characteristic impedance, image impedance, image transfer constant, inserties loss.

- D) **Semi Conductor Devices:**
PN Junction, NPN and PNP transistors, small signal model determination of h-parameters, Analysis using h-parameters, CE, CB and CC configurations, Transistor biasing circuits, Transistor as a switch.
Field effect Transistor, JFET, MOSFET, Cathod. Ray Oscilloscope and applications. Transistor as amplifier, Gain Bandwidth, Three amplifier configurations, Multi stage amplifiers. Operational amplifiers, principles, characteristics, Comparator, Integrator, Differentiator, Summing, Adder, Subtractor, log amplifier.

A) Electromagnetic theory :

Coulomb's Law, Gauss's Law, Electric field due to charge, Electric flux density, Poisson's and Laplace's equations, Energy and potential, conductors, Dielectric, Boundary conditions. Biot Savort's Law, Amper's Law, Stokes Theorem, Faraday's Law.
Maxwell's equations, interprelation, uniform plane wave, wave motion in free space, pointing vector.

B) Pulse and Digital Circuits :

Wave shaping, RC RL circuits, Non-linear diode wave shaping circuits, diode clamping. Multivibrator circuits, Astable, Monostable Schmitt Trigger Circuits, Blocking Oscillator. Sweep Generator, Bootstrap and Miller Voltage Sweep Circuits, Linear current sweeps. Logic Circuits : AND, OR, NOT, NAND and NOR gate circuits, DTL, TTL, MOS, CMOS, NAND, NOR circuits, realization of various flip flops.
Square wave generator, pulse generator.

C) Communication Systems:

Modulation techniques, Amplitude, Modulation, generation and demodulation, DSB Waves. Phase and Frequency modulation, narrow band and wide band FM, transmission bandwidth, generation and demodulation of FM Waves.
Pulse Modulation, Sampling, TDM, PPM, PCM, Characteristics of ASK, FSK, PSK, Signals. AM and FM Transmitters and Receiver circuits, communication receivers, SSB transmitters and receivers, super hetrodyne receivers, IF, AGC, tracking and alignment, receiver measurements.

D) Control Systems:

Open loop and closed loop systems, signal flow graphs, Transfer functions and impulse reponse.
Routh Hurwitz criterion for stability, Root locus, techniques, effect of location of roots in system response.
Frequency Response Plots, Bode Plots, Nyquist criterion for stability. Gain and phase margin, Compensation, using Bode Plots, Lag and Lead compensation.
Effect of feed back, sensitivity. Control system components; potentio meters, servomotors, synchros, error-sensing devices.

E) Transmission Lines & Antennas:

Reflection of E.M. Waves, standing waves, transmission line equations, Input impedance, reflection coefficient, VSWR, properties of $\lambda/4$, $\lambda/2$ lines, short-circuited stubs, impedance matching.
Principle of radiation, Vector potential, Linear Arrays, Broad Side and End fire Array, multiplication of Antenna patters.
Antenna characteristics – Gain, radiation pattern, side lobe level directivity.

F) Microwaves:

Propagation of E.W.Waves through parallel plate and rectangular, circular wave guides, T.E., T.M., modes cavity, Resonators, Resonant frequency and quality factors.
Microwave Tubes, Klystron Amplifier, Reflex, Klystron, Magnetron, Travelling wave Tube.
Microwave components – Directional couplers, circulators, isolators, Ferrite Components.
Microwave Measurements – VSWR, Impedance and Reflection measurements, slotted line techniques.

28. MECHANICAL ENGINEERING

Theory of Machines

Constrained motion, plane mechanisms, velocity and acceleration analyses, instantaneous centre, flywheels and their applications, balancing of reciprocating and rotating masses, planar cams and followers, tooth profiles, types of gears, fixed axis and planetary gear, drives principles of gyroscope vibration of free and forced one degree of freedom systems with and without damping, transmissibility and vibration isolation, critical speed of shaft.

Mechanics of solids

Stress and strain in two dimensions, Mohr's circle, theories of failure. Bending moment and shear force diagrams. Deflection of simple beams, Buckling of columns, torsion in shafts, thin and thick cylinders, shrink fit and thermal stresses.

Machine design

Material and manufacturing considerations in design, design for static and dynamic loading, fatigue strength, stress concentration, factor of safety, design of bolted riveted and welded joints, power screws, helical springs, hydrodynamic lubrication and journal bearing, rolling element bearings, design of spur gears, design of shifts, keys and couplings, clutches and brakes, belt and rope drives.

Manufacturing process

Classification of manufacturing process. Casting casting defects, investment casting, die casting, centrifugal and continuous casting. Metal forming: hot and cold working. Unconventional machining and forming methods. Powder metallurgy. Welding. Jigs and fixtures, gauges and comparators. Metal cutting: Mechanics of orthogonal cutting, machinability, economics of machining, chip formation, forces, power and surface finish in turning, milling and shaping operations. Grinding, wheel wear mechanism in grinding.

Metallurgy and Material Science

Phase diagram of Binary alloys, Iron-Iron Carbide diagram. Construction and Interpretation of T.T.T. curve for steels. Case hardening, Age hardening. Alloy steels. Mechanism of fatigue and creep. Types of failures Diffusion.

Production management

Production planning and control, Forecasting assembly line balancing Product, development. Production control charts. Break-even-analysis, PERT and CPM. Control operations: Inventory control – ABC analysis, EOQ model. MRP-II, JIT work study, value engineering. Linear programming, graphical and simplex methods and queuing (Single server, Poisson Queue) theory. Maintenance engineering Quality assurance control charts for variables and attributes.

Thermodynamics

Reversible and irreversible processes. Thermodynamic systems. Applications of First and Second law of thermodynamics. Concept of entropy. Availability and unavailable energies.

Tds relations, Properties of pure substances.

I.C. Engines. Fuels and Combustion

Thermodynamic analysis of cycles. SI and CI engines. 4 stroke and 2 stroke engines. Performance testing and heat balance of IC engines. Detonation and knocking phenomena in I.C. engines. Carburetion and fuel injection systems. Engine emissions and control.

Heat Transfer, Refrigeration and Air Conditioning.

Modes of heat transfer, One dimensional steady and unsteady conduction, Heat transfer with fins, Convective heat transfer, Forced Convection over flat plate and through tubes, Free Convection over vertical flat plate and cylinders, Radiative heat transfer – Black and Gray surfaces, Shape factors. Heat Exchanger performance – LMTD and NTU method.

Refrigeration cycles and systems. Vapour compression, Vapourabsorption and Air Refrigeration systems. COP of a Refrigerator. Condensers, Evaporators and Expansion devices and Controls.

Psychrometry and Psychrometric processes. Comfort conditions. Estimation of cooling and heating load.

Fluid mechanics and turbomachinery

Continuity, Momentum and Energy equations. Adiabatic and isentropic flow. Flow through turbo machinery passages. Classification of turbo machines. Fans, Blowers and Compressors. Axial and Centrifugal machines. Steam and Gas Turbines. Pumps and Hydraulic Turbines. Model tests. Work done and Efficiencies. Specific speed.

Energy Systems

Types of Power plants. Thermal, Hydro, Nuclear and gas Turbine Power plants. Layout and Selection of a Power plant. Power plant Economics. Cost of electrical energy. Importance of Renewable Energy sources. Solar, Wind, Bio-mass and Ocean Energy Technologies, Solar thermal and Solar photovoltaic power generation.

☆☆☆☆☆

SCHEME

Part-A: Written (Objective type) Examination				
Paper-1	General Studies	150 Marks	150 Questions	150 Minutes
Paper-2	Subject (Economics OR Maths OR Statistics OR Commerce OR Agriculture OR Botany OR Chemistry OR Geology OR Physics OR Zoology)	300 Marks	150 Questions	150 Minutes
Part-B: Oral Test (Interview)		50 Marks		

SYLLABUS

PAPER-1 GENERAL STUDIES

1. SCIENCE AND TECHNOLOGY:
 - c) General Science and Technology
 - d) Role and impact of science and Technology on India's development.(Questions will cover general appreciation and understanding of matters of everyday observation and experience as may be expected of a well-educated person who has not made a special study of science and technology disciplines).
2. INDIAN HISTORY AND CULTURE:
 - e) Modern Indian History from 19th century to the present
 - f) Nationalist Movement and Constitutional development
 - g) Indian culture and Heritage including architecture, Fine Arts, dance forms, music, paintings, Folk arts and performing arts.
 - h) History of Andhradesa Society, Culture, Geography and Economic development.
3. INDIAN POLITY:
General and broad understanding of the structural (institutions) and functional (processes) aspects of Indian Political system.
4. INDIAN ECONOMY AND GEOGRAPHY OF INDIA:
 - (a) Structure of National economy
 - (b) Economic development (including planning) since independence
 - (c) Economic Reforms
 - (d) Physical, economic and social Geography of India.
5. CURRENT EVENTS:
Current Events of Regional, National and International importance.
6. GENERAL MENTAL ABILITY: (Reasoning and analytical abilities)

PAPER-2 SUBJECT

1. COMMERCE

ACCOUNTING AND FINANCE

Part-1: Accounting, Auditing and Taxation:

Accounting as a Financial and Management information system-Impact of behavioral sciences – Accounting Standards and conventions.

Methods of accounting of changing price levels with particular reference to current purchasing power (CPP) accounting Advanced problems of company accounting – Amalgamation absorption and reconstruction of companies-Accounting of holding Companies valuation of shares and goodwill-Human Resources Accounting.

Nature and functions of Cost Accounting-Classification of costs-techniques of segregating semi-variable costs into fixed and variable components-job costing-FIFO and weighted average methods of calculating equivalent units of production-Marginal costing Cost-Volume profit relationship their Algebraic formulae and graphical representation shut down points Reconciliation of cost and financial accounts-Techniques of cost control and cost reduction-Budgetary control-Flexible Budgets

standard costing and variance analysis – Responsibility accounting-Bases of charging over-heads and their inherent fallacy-costing for pricing decisions.

Income Tax Act, 1961 (as amended up-to-date) – Definitions – charge of Income Tax – Exemptions – Provisions relating to Heads of Income – Depreciation and savings deductions – Simple problems of computation of Income of an individual (under the various heads) and assessable income-tax planning Income-Tax authorities.

Auditing – Definition – Significance – Different types of Audit Programming the audit work – Vouching – Valuation and verification of all types of assets and liabilities – Audit of limited companies – Appointment, Status, Rights, Duties and Liabilities of an Auditor – Auditors report Investigation.

Part-II: Business Finance and Financial Institutions:

Financial Management – Definition and Scope – Corporate Finance – its goals capital structure theories – Capital budgeting (including problems) – Techniques – Rules of the thumbs and Discounted cash flow approaches – incorporating uncertainty in investment decisions – Designing and optimal capital structure – Weighted average cost of capital – Modighani and Miller models (including problems) – Short-term, Intermediate and Long-term finance and the sources of raising them – Norms and guidelines regarding debt – equity ratios – Dividend theories and dividend policies in practice – Determinants of an optional dividend policy – working capital management (including problems) – Structure of working capital and the variable of affecting the level of difference of components – Cash flow approach of fore-casting working capital needs – Credit management and credit policy – Consideration of tax in relation to financial planning and cash flow statements – Profiles of working capital in Indian industries – Statement of changes in financial position (including problems).

Indian money market – Constituents and their deficiencies – Reserve Bank of India – Functions – An assessment of its monetary and credit policies – Commercial Banks – Role and their functioning – Narasimham Committee Recommendations – Indian Capital Market – Constituents functions and working of All India term financial institutions such as IDBI, IFCI, ICICI, UTI – Stock Exchanges – Functions and their regulation by agencies like SBBI.

OGNAISATION THEORY AND INDUSTRIAL RELATIONS:

Part-1: Organisation Theory:

Nature and Concept of Organisation – Approaches to the study of organisation theory – Formal and informal organisations – Functions and limitations – Principles of organisation – Organisation goals and its different types.

Organisational structure – Authority – Power and influence – Delegation – Centralisation and decentralisation – Line staff functional Matrix – Project and Bureaucratic structures. Decision making process and limits to rationality – Simon March approach.

Motivation – Theoretical and empirical foundations of Maslow, Mc. Gregor, Herzberg, Likert, Vroom, Porter and Lawler models – morale and productivity – Leadership – Theories and styles – Communication in organisations.

Conflicts and its management in organisation – Management of change – Resistance to change and Methods to overcome – Organisational change, adaptation, growth and development – Organisational control and effectiveness – Organisational culture and its significance

Part-II: Industrial Relations:

Industrial Relations – Nature and Scope – Industrial Labour in India – Theories of Trade Unionism – Trade Union movement in India, its growth and structure – outside leadership – union Management conflict and co-operation – collective bargaining – approaches, conditions, limitations and its effectness in Indian conditions workers education and other problems – workers participation in Management, philosophy, rationale, present day state of affairs.

Industrial Disputes – Definition – Preventive measures & settlement machinery in India – Absenteeism and labour turnover in Indian Industries – Wage concepts – Wage differentials and wage policy in India – Labour welfare measures – Indian Labour conference International Labour organisation and India.

2. ECONOMICS

1. Methodology in Economics. The framework of an economy. National Income Accounting – Estimation of National Income.
2. Economic Choice: Consumer behaviour, producer behaviour, market forms and distribution
3. Determination of income and employment: Investment decisions. Macro economic models of income, distribution and growth.
4. Banking: Supply of money and near money; Central Banking – Objectives, instruments of credit policy in a developing economy.
5. Public Finance: Principles of taxation and Public expenditure – Functional Finance – Budgetary and Fiscal policy in a developing economy – Public debt and its effects on economy.
6. International trade: Tariffs, exchange rates – convertibility – Balance of Payments – Monetary and Banking Institutions.

1. The Indian economy: Guiding principles of Indian economic policy – Planned growth and distributive justice. Eradication of poverty. Institutional framework of the Indian economy – Federal structure of the Government – Agricultural and Industrial Sector. National Income of India, its Sectorial and regional distribution.

Magnitude and incidence of poverty (rural & urban)

2. Agriculture: Agricultural policy; Land Reforms – Technological change – Relationship with the industrial sector.
3. Industry: Industrial policy – Public and Private sector – Regional distribution of Industry – Industrial Infrastructure – Aspects of economic liberalisation.
4. Pricing policies of Agricultural and Industrial outputs – Administered prices – Procurement and Public Distribution.
5. Budgetary trends and Fiscal policy.
6. Monetary and credit trends and policies – Banking and non-banking financial institutions.
7. Foreign trade and Balance of payments (Before and after economic reforms)
8. Indian Planning: Objectives, strategy, experience and problems.
9. Andhra Pradesh Economy: Structure of the A.P. economy – State Income - its sectorial and regional distribution and extent of poverty – Regional imbalances State of agriculture – Agricultural inputs and technology – Subsidies – State of industry – Infrastructure – Industrial sickness – State finances and budgetary policy – World Bank Aid and state economy.

3. AGRICULTURE

Importance of agriculture in national economy, Agriculture development in India, Agro-climatic Zones of India and A.P. Major constraints in limiting to crop production, Ecology and relevance to Man-Management of national resources; Environmental variables and agro-ecosystem; Weather aberrations and their effect on crops, Environmental pollution – air water and soil – its effect on crops, animals and humans.

Cropping patterns in different agro-climatic zones of A.P. – concepts of multiple cropping, multistory, relay and intercropping – Farming systems – Planning of components and productivity. Sustainable agriculture and organic farming – relevance in modern agriculture – Principles and potentials to attain sustainability, Package of practices for production of important\ cereals, pulses, oilseeds, fibres, sugar and commercial crops grown in A.P.

Weeds-their characteristics, and dissemination, Crop-weed association and allelopathy, weed management in different crops.

Dry land agriculture and its problems- management of land and water in dry climate. Soil erosion-types, Soil conservation, watershed management – objectives and approaches.

Crop water requirements – methods of assessment – water use efficiency- water management practices in important field and horticultural crops of A.P. Drainage - water logging, methods of field drainage.

Importance of social, farm and agro forestry. Choice of tree species, Principles of general silviculture.

Soil and its components – Process and factors of soil formation, soil classification, land capability classification, Aerial photography and remote sensing and their application in agriculture. Essential plant nutrients and other beneficial elements in soil, their occurrences, factors affecting their distribution, functions and nutrient cycling in soil. Symbiotic and non-symbiotic nitrogen fixation. Principles of soil fertility and its evaluation for judicious fertilizer use integrated nutrient management.

Farm management – importance, economic principles, farm planning and budgeting, farm business analysis and farm efficiency measures, Agricultural marketing institutions – commercial agricultural and agri-business management. International trade – nature and scope – GATT/WTO.

Concept, meaning, principles, scope and importance of Agriculture extension, Models of organizing Agriculture extension. Rural development and poverty alleviation programmes. Training to Extension workers, farmers, farm women and youth, Agricultural extension management.

PAPER - II

Physical and chemical basis of heredity, chromosomal structure, genes/operan concept; Mendelion laws of inheritance, cytoplasmic inheritance, Linkage and crossing over, Genetic mechanisms of sex determination, Inheritance of Quantitative characters, Mutations – spontaneous and induced.

Biodiversity and centres of origin of cultivated crops, Assessment of variability – additive, dominance and epistasis.

Application of the Principles of plant breeding to the improvement of major field crops, methods of breeding self and cross-pollinated crops. Introduction, Selection, Hybridization, Heterosis and its exploitation. Male stability and self incompatibility, utilization of mutation and polyploidy in breeding, Breeding for biotic and abiotic stresses.

Seed technology and importance – seed quality concepts, Hybrid seed production in important crops, Seed certification standards, intellectual property rights, patency and plant breeders rights.

Importance of plant physiology in Agriculture, Physiological basis of crop yield; Structure and function of cell organells; Photosynthesis, respiration and transpiration; structure and functions of proteins, nuclic acids, crop water relations, Role of macro and micro nutrients and their deficiency symptoms.

Plant biotechnology – Achievements and potentialities. Genetic engineering and production of transgenic plants.

Growth and development, photo periodism and vernalization, Hormones, plant growth regulators and their role in agriculture.

Role of fruits and vegetables in human nutrition and national economy; Climatic requirements and cultivation practices for major fruits, vegetables and plantation crops; Green house production of flowers and vegetable crops; Handling and marketing problems of fruits and vegetables; Principal methods of preservation of fruits and vegetables; Important fruit and vegetable products. Ornamental and landscape gardening – types of ornamental gardens, Design and layout of lawns and gardens.

Pests and diseases of field, vegetable, orchard and plantation crops and their management; Causes and classification of plant diseases. Principles of plant disease management – avoidance, exclusion, eradication, immunization and protection; Biological control of pests and diseases. Integrated management of pests and diseases; Pesticides – classification and their formulations; Recent methods of pest/disease control. Stored grain pests and their preventive and curative measures.

4. BOTANY

Microbiology, Pathology, Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms, Taxonomy of Angiosperones, Anatomy, Morphogenesis, Embryology & Palynology.

MICROBIOLOGY:

Viruses, Bacteria, Plasmids, General account of infection and immunology, structure, classification, reproduction and physiology. Importance of microbes in agriculture, industry and medicine. Biological control of pollution using micro-organisms.

PATHOLOGY:

Plant diseases caused by viruses, bacteria, mycoplasma, actinomycetes, fungi and nematodes. Modes of infection, dissemination, Physiology of parasitism and methods of control. Different fungal toxins. Mechanism of action of Biocides.

ALGAE:

Principles of algal classification; thallus organisation in algae. Types of life cycles in algae. Phylogeny and interrelationships of various groups of algae. Economic importance of algae.

FUNGI:

General characters of fungi and their classification. Structure, reproduction, life cycles, phylogeny and inter-relationships and affinities of the main groups of fungi viz., Myxomycetes, Omycetes, Zygomycetes, Ascomycetes, Basidiomycetes, Deuteromycetes, Economic importance of fungi, Symbiotic fungi, the lichens, Mycorrhizae.

BRYOPHYTES:

General account and classification of bryophytes. Comparative study of structure and development of sporophytes in bryophytes. Ecology and economic importance of bryophytes.

PTERIDOPHYTES:

General account and classification of pteridophytes – Evolution of stelar systems in pteridophytes. Telome-theory, heterospory and seed habit. Ecology and economic importance of pteridophytes.

GYMNOSPERMS:

Classification and distribution of living gymnosperms, origin and evolutionary tendencies in gymnosperms vis-à-vis pteridophytes and angiosperms – General account of fossil gymnosperms; pteridospermales (Cycadofilicales), Corditales, Bennettitales and their affinities and inter relationship. Taxonomic and economic importance of gymnosperms.

TAMONOMY OF ANGIOSPERMS:

A comparative study of the systems of classification; Bentham and Hooker, Engler and Prantl and Hutchinson. Modern trends in biosystematics with reference to phytochemical, cytological, palynological, embryological and anatomical criteria. Taxonomic and economic importance of Magnoliaceae, Ranunculaceae Cruciferae, Malvaceae, Rosaceae, Leguminosae, Umbelliferae, Asclepiadaceae, Verbenaceae, Euphorbiaceae, Liliaceae, Orchidaceae, Palmae and Poaceae.

ANATOMY:

Plant meristems, Normal and Anomalous secondary growth in stem and root. Anatomy of wood. Anatomy of C₃ and C₄ plants. Stomatal types.

MORPHOGENESIS:

Polarity, symmetry and totipotency – Differentiation and dedifferentiation of cells and organs. Factors of morphogenesis. Methodology and applications of cell, tissue, organ and protoplast cultures from vegetative and reproductive parts; Somatic hybrids.

EMBRYOLOGY AND PALYNOLOGY:

Development of male and female gametophyte, double fertilization, endosperm formation, embryo and its main types. Apomixis and polyembryony. Seed structure. Palynology with reference to overall Pollen morphology of angiosperms. Aspects and applications of aerology and Mellitopalynology.

Cell biology, Genetics & evolution, Physiology, Ecology, Economic botany, Ethnobotany.

CELL BIOLOGY:

Modern tools and techniques in the study of cytology. Prokaryotic and eukaryotic cells. Structural and ultra-structural functions of a) Plasma membrane b) Endoplasmic reticulum c) Golgi apparatus d) Mitochondria e) Ribosomes f) Plastids g) Microbodies h) Nucleus.

Chemical nature of Chromosomes, Polytene and lamp brush chromosomes. Numerical and structural variations in chromosomes and their significance. Detailed study of cell cycle – mitosis and meiosis.

GENETICS & EVOLUTION:

Pre and post Mendelian concept of genetics, development of gene concept Nucleic acids their structure and role in reproduction and protein synthesis, genetic code and gene regulation. Mechanism of microbial recombination, Mutation, its roles in evolution; Multiple factor inheritance, linkage and crossing-over, methods of gene mapping, Sex chromosomes and sex linked inheritance, cytoplasmic inheritance, Genetic engineering, Organic evolution, evidence, mechanism and theories.

PHYSIOLOGY:

Detailed study of Water Relations. Study of macro and micro nutrients, criteria for essentiality, availability, uptake and role. Photosynthesis – mechanism and importance, photosystem I & II Calvin cycle, C₄ pathway, CAM Pathway, Photorespiration, Respiration and fermentation. Nitrogen fixation and nitrogen metabolism, Protein synthesis. Enzymes, classification and mode of action. Growth indices, growth movements, Senescence. Growth substances their chemical nature role and application in agrhorticulture, Parthenocarp and fruit ripening. Seed-dormancy, storage and germination.

ECOLOGY:

Structure function and dynamics of ecosystems. Plant communities and succession. Conservation of ecosystems; pollution and its control. Forest types of India. Afforestation deforestation and social forestry. Forest management – use of resources. Endangered plants.

ECONOMIC BOTANY:

Origin of cultivated plants. Study of plants as sources of food, fodder and forage, wood and timber, fibre, paper, rubber, beverages, drugs, narcotics, resins and gums essential oils, dyes, medicines, insecticides and pesticides. Energy plantation.

ETHNOBOTANY:

Its scope. Medicoethnobotany and ethnoagriculture. Conservation and propagation of medicinal plants used by various tribal communities of A.P.

5. CHEMISTRY

1. Atomic structure and chemical bonding:

Quantum theory, Heisenberg's uncertainty principle, Schrodinger's wave equation (time independent), particle in a one dimensional box, quantum numbers, hydrogen atoms wave functions, shapes of orbitals. Valence bond and molecular orbital theories. Resonance and resonance energy Sigma and Pi bonds (non-mathematical approach).

2. Thermodynamics:

Laws of thermodynamics and their application to Physico-chemical processes. Laws of thermochemistry. Kirchoff's equation. Spontaneous and non-spontaneous changes. Second law of thermodynamics. Entropy changes in gases for reversible and irreversible processes. Third law of thermodynamics. Gibbs-Helmholtz equation. Vanthoff's reaction isochore. Thermodynamic criteria for equilibrium. Free energy changes in chemical reaction and equilibrium constant.

3. Solid State:

Forms of solids. Crystal systems and crystal classification. Designation of crystal faces. Lattice structure and unit cell. Bragg's law. X-Ray diffraction by crystals. Defects in crystals. Elementary idea of liquid crystals.

4. Chemical Kinetics:

Order and molecularity of reactions. Rate equations of Zero, first and second order reactions. Effect of temperature, concentration and catalyst on the rate of a reaction. Collision theory and absolute reaction rates of bimolecular reactions. Kinetics of polymerization. Homogeneous and heterogeneous reactions.

5. Photochemistry:

Lambert-Beer's law. Grothus-Draper law. Einsteins law of photochemical equivalence. Quantum yield and its application. Photo physical and photo chemical processes – Joblensky diagram.

6. Ionic equilibria:

Ostwald's dilution law and its verification. Theory of strong electrolytes. Debye-Huckel's theory. Ionic activities and activity efficients. Common ion effect. Solubility product and its applications. Electrolysis conductance and its theory and applications. Laws of electrolysis.

7. Electromotive force:

Reversible and irreversible cells. e.m.f. and its measurement. Types of cells. Single electrode potentials and their applications. Theory and applications of over voltages. Dropping Mercury Electorde (DME).

8. Reactions in non-aqueous media:

Liquid ammonia and liquid sulphur dioxide. Pearson's theory of hard and soft acids and bases.

9. d-Block elements:

Electronic configuration – variable oxidation states. Magnetic properties. Ability to form complexes. Absorption spectra (including charge transfer spectra). Metal-metal bonds and metal atom clusters. A comparative study of physical and chemical properties of the first, second and third transition series.

Lanthanides and actinides:

Methods of separation of lanthanides. Oxidation states and magnetic properties. Synthesis of actinides and actinide contraction.

10. Co-ordination chemistry:

Theories of bonding – valence bond theory. Crystal field theory and its limitation. Molecular orbital theory. Stability of coordination compounds. Factors effecting the stability constants. Determination of stability constants by potentio-metric and spectro photometric methods.

11. Organometallic compounds:

Nature of the metal-carbon bond. Organometallic compounds of aluminium, Zinc and mercury. Olefinic complexes of palladium (II) and platinum (II). Their preparation, properties and bonding.

12. Molecular spectroscopy:

Type of spectra and their origin. Measurement of spectra.

a) Vibrational spectroscopy:

i) Infra Red Spectra: Calculation of force constants. Modes of vibrations in linear and non linear molecules. Vibrational frequencies of some important groups. Applications of IR spectroscopy in structure elucidation.

ii) Raman spectra: Origin and measurement. Differences between IR and Raman spectra.

b) Electronic spectroscopy:

UV and visible spectra. Types of electronic transitions in molecules. Absorptions due to multiple bonds and the effect of conjugation on them. Applications of UV-visible spectroscopy in the study of organic molecules. Charge transer spectra.

PAPER-II

1. Structure, reactivity and nomenclature of organic molecules:

Covalent character of organic compounds. Single and multiple bonds. Types of organic reactions and reagents with examples. Homolytic and heterolytic cleavage of bonds.

Inductive, electromeric, conjugative and hyperconjugative effects on the physical and chemical properties of organic compounds with suitable examples Dipole momemts.

IUPAC and Chemical Abstract systems of nomenclature of organic compounds.

2. Stereo Chemistry:

Concept of isomerism and isomers. Elements of symmetry. Criteria for optical activity. Symmetry operations (C_n and S_n symmetry elements). Symmetric, dissymmetric and asymmetric molecules with examples.

DL and RS nomenclature of chiral molecules. Asymmetric induction. Cram's rule. Stereo selective and stereo specific synthesis. E, Z-nomenclature of unsaturated systems. Physical and chemical properties, relative reactivity, stability and interconversion of E,Z-isomers.

Stereo chemistry of oximes.

3. Reaction mechanisms:

General methods of study of organic reaction mechanism. Formation and stability of reactive intermediates. Viz. carbocations, carbanions, freeradicals, carbenes, nitrenes and benzynes.

S_N1 and S_N2 mechanisms. E_1 , E_2 and E_1c_b mechanism of elimination reactions. Electrophilic addition to carbon – carbon double bonds. Addition to carbon-oxygen double bonds. Michael addition. Aromatic electrophilic and nucleophilic substitution.

4. Pericyclic reaction:

Classification and examples. An elementary study of Woodward-Hofmann Rules.

5. Carbohydrates:

Classification. Structure elucidation of open chain and cyclic structures of D-glucose and D-fructose. Inter-conversion of monosaccharides. Determination of the configuration of D-glucose.

6. Amino acids, polypeptides and proteins:

Classification of amino acids. Synthesis of natural amino acids (general methods) properties of amino acids. Structural studies of polypeptides. Synthesis of poly peptides primary and secondary structures of proteins.

7. Aromatic and heterocyclic compounds:

Theory of aromaticity. Frost-Musulin diagrams of cyclobutadiene and benzene. Synthesis and reactions of furan, pyrrole, thiophene and pyridine. A comparative study of their aromatic character.

8. Chemistry of the following name reactions:

Aldol condensation, Dieckmann reaction, Claisen condensation, Perkin reaction, Beckmann rearrangement and Cannizzaro reaction, Reimer – Tiemann reaction.

9. Reagents in organic synthesis:

Use of the following reagents in organic synthesis:

Ozone, periodic acid, NBS, diborane, Sodium in liquid ammonia, $NaBH_4$ and $LiAlH_4$.

10. Chemistry of Natural products:

Isolation and structural features of the following natural products:

Citral, nicotine, papaverine and Vitamin-C.

11. NMR Spectroscopy:

Introduction to proton magnetic Resonance spectroscopy – Principles. Chemical shifts, shielding and deshielding effects, Splitting of signals, Coupling constants.

Application of PMR to the study of simple organic molecules.

12. Polymer chemistry:

Physical chemistry of polymers. End group analysis, sedimentation, light scattering and viscosity of polymers. Ziegler-Natta catalysis. Study of addition and condensation polymerization. Stereo chemistry of polymers. Inorganic polymers.

6. GEOLOGY

(General Geology, Geo-morphology, Structural Geology, Stratigraphy and Palaeontology)

i) General Geology:

Origin and interior of the earth. Dating of the rocks by various methods and age of the Earth. Volcanoes, Earthquakes, Geo-synclines, Isostasy, Continental drift and Mountain building activity. Sea floor spreading and plate tectonics.

ii) Geomorphology:

Land forms, their types and development. Weathering, Transport and Erosion. Geomorphic processes, such as Fluvial, Fluvio-marine, Marine, Glacial and Eolian. Topography and its relation to structures and lithology.

iii) Structural Geology:

Concepts of stress and strain. Description, terminology and nomenclature of folds. Mechanics of folding, classification, genesis and dynamic significance of joints. Classification of unconformities. Description, classification and genesis of faults. Mechanism and recognition of faults in the fields. Foliation and lineation. Tectonic frame work of India.

iv) Stratigraphy:

Principles of stratigraphy. Stratigraphic classification and nomenclature. Standard stratigraphic scale. Detailed study of various geological systems of Indian sub-continent. Boundary problems in stratigraphy. Paleogeography and evolution of Indian sub-continent through phanerozoic time.

v) Palaeontology:

Origin and evolution of life. Fossils, their modes of formation and utility. Morphology, classification and evolutionary trends of Branchiopods, Lemnibranchs, gastropods, Ammonoids, Trilobites, Echinoids and Corals. Microfossils and their application. Evolutionary history of Man, Horse & Elephant. A brief study of Gondwana flora.

PAPER-II

(Crystallography, Mineralogy, Petrology and Economic Geology)

i) Crystallography:

Crystalline and non-crystalline substances. Concept of symmetry, point group, lattice and space groups. 32 classes of crystal symmetry. Stereographic projections and their use. Twinning, crystal growth and irregularities.

ii) Mineralogy:

Types of bondings, ionic radii, coordination number. Isomorphism, polymorphism and pseudomorphism. Structure and classification of silicates. Detailed study of rock forming minerals. General principles of Optics. Nicol prism. Isotropism and Anisotropism. Dispersion, pleochroism, Birefringence optical indicatrix. Optic sign – Acute and obtuse bisectrix – $2V$ angle.

iii) Petrology:

Simple phase diagrams of single, binary, ternary and quaternary silicate systems, with reference to petrogenesis. Magmas, their generation in the crust and mantle their emplacement and their relation to paleo-tectonics. Magmatic crystallization, differentiation and assimilation. Bowen's Reaction principle classification of Igneous rocks.

Process and formation of sedimentary rocks. Diagenesis and lithification. Textures and structures. Heavy minerals and their significance. Classification of Sedimentary rocks.

Role of T P and fluids in metamorphism. Metamorphic facies. Relationship among metamorphism, anatexis and granulization. Types of metamorphism.

Petrogenic aspects of important rocks of India, such as Deccan Traps, the layered intrusions, charnockites khondalites and gondites.

iv) Economic Geology:

Concepts of ore. Ore mineral and gangue. Tenor of ores. Process of formation of mineral deposits. Physico-chemical controls of deposition. Geological setting, characteristic features and genesis of metallic and non-metallic mineral deposits in India. Occurrence and distribution of fuels – coal, petroleum and Atomic minerals. Exploration techniques for surface and subsurface mineral deposits. Sampling, Assaying and evaluation of ore bodies.

Geological investigation for the construction of dams, Bridges, Highways and Tunnels.
Ground water exploration and management, water pollution.
Geological interpretation of air photos and imagery.

7. MATHEMATICS

The candidate has to answer 10 questions choosing atleast 2 questions from each Sections I – IV. Five questions will be from each section. Each question carries 15 marks.

Section-I – Algebra:

Groups – subgroups – normal subgroups – quotient groups – homomorphism and isomorphism theorems – cyclic groups – permutation groups – Cayley's theorem.

Rings – subrings – integral domain – fields – ideals quotient ring – maximal and prime ideals – Euclidean rings – polynomial rings – Unique factorization domains – principal ideal domains.

Section-II – Linear Algebra:

Vector spaces – subspaces – linear independence and dependence – Bases and dimension – Finite – dimensional vector spaces and their properties.

Linear transformations – Rank and nullity of a linear transformation – Cayley – Hamilton theorem – Matrix of a linear transformation – eigen values and eigen vectors – Canonical forms.

Inner product spaces – Orthonormal basis – Quadratic forms.

Section-III – Differential equations:

Order and degree of a differential equation – Formation of a differential equation – Differential equations of first order and first degree – Linear differential equations with constant and variable coefficients – Total differential equations.

Formation of partial differential equations – Equations of first order – Charpit's methods.

Section-IV – Geometry:

General equation of second degree in two variables – Tracing of conics.

Plane, straight lines in space – sphere – Cone.

Curves in space – curvature – Torsion – Serret – Frenet formulae.

The candidate has to answer 10 questions choosing atleast TWO questions from each of the Sections 1 to IV. FOUR questions will be given from each of the Sections I,II and III and EIGHT questions will be given from Section IV with two questions from the four topics given in that section.

Section-I – Real Analysis:

Real number system \mathbb{R} – Open and closed sets in \mathbb{R} - Compact sets – sequences in \mathbb{R} and their convergence – Series of real numbers – Tests of convergence – absolute and conditional convergence – rearrangements of series.

Limits and continuity of a real valued function properties of continuous functions – Differentiation – Mean value theorems – Applications.

Riemann integration – conditions for Riemann integrability – improper integrals.

Section-II – Complex Analysis:

Complex numbers and their geometric representation – limits and continuity of functions of a Complex variable – Analytic functions – Cauchy Riemann equations – Complex integration – Cauchy's theorem – Cauchy's integral formula – Power series – Taylor's and Laurent's series – Types of singularities – Calculus of residues and application to evaluation of definite integrals.

Section-III – Vector calculus:

Differentiation of a vector valued function – Gradient of a scalar function – Divergence and curl of a vector function in Cartesian and polar coordinates.

Green's theorem – Gauss and Stoke's theorems and their applications to evaluation of double and triple integrals.

Section-IV:

- e) Transform Calculus: Laplace Transforms – Inverse Laplace transforms – solving differential equations using Laplace transforms. Fourier and Hankel transforms.
- f) Numerical Analysis: transcendental and Polynomial equations – Regula Falsi method – Newton Raphson method Interpolation – numerical differentiation – numerical intergration – Runga Kutta method.
- g) Number Theory: Fundamental theorem of arithmetic – congruences and their applications – Fermat's and Wilson's theorems – solution of linear congruences – Chinese remainder theorem.
- h) Linear Programming: Formation of linear programming problem – Graphical solution – Dual problem – simplex method – Transportation problem.

8. PHYSICS

(Mechanics and relativity, Waves and Oscillations, Thermal Physics, Optics)

1. Mechanics and Relativeity:

Newtons laws of motion, force and potential energy, conservative force. Conservation laws – collisions – impact parameter, scattering cross-section Laboratory and Centre of mass reference frames. Transformations between them. Rutherford scatterering. Motion of a rocket. Rigid body dynamics – Moment of inertia of simple regular bodies, rotating frames of reference – coriolis force. Angular momentum, torque, precession of a top, gyroscope. Central forces – motion under inverse square law – gravitational force, Kepler's laws. Motion of satellites. Motion of fluids – streamline and turbulent flow. Bernoulli's equation with simple applications – Reynolds number.

Galelean relativity, special theory of relativity – Time duration and length contraction Michelson – Morley experiment, Lorentz transformations, addition of velocities, variation of mass with velocity – mass energy equivalence.

2. Waves and Oscillations:

Oscillations, Simple harmonic motion, progressive and stationary waves. Damped harmonic Oscillator, Forced oscillations and resonance. Wave equation, harmonic solutions. Plane and spherical waves, superposition of waves and beats, phase velocity, group velocity, Doppler effect.

3. Thermal Physics:

Laws of thermodynamics, carnot's cycle. Isothermal and adiabatic processes. Thermodynamic potentials, Maxwells relations. Claussius – clapeyrons equation joule – Thomson effect. Kinetic theory of gases. Maxwell's velocity distribution, equipartion theorem, specific heat of gases. Mean free path. Brownian motion, specific heat of solids – Einstein and Debye's theories. Black body radiation Wien's, Rayleigh-jeans and plancks laws. Solar constant, Sahas theory of thermal ionization – stellar spectra, production of low temperature – adiabatic demagnetization – negative temperature. Vander waals equation, critical constants.

4. Optics:

Huygens principle interference, young's experiment interference in thin films, Newton's rings. Michelson's interferometer. Diffraction – Fresnel and Fraunhoffer diffraction. Diffraction by straight edge, circular and rectangular apperture, single and double slits, plane grating, Dispersive power

Resolving power, Rayleigh's criterion. X-ray diffraction and Bragg's law. Polarisation – Plane, Polarisation by reflection, circular, elliptic polarisation, double refraction, Nicol prism, quarter and half wave plates. Laser principle – spontaneous and stimulated emission of Radiation. He-Ne, Ruby and semiconductor diode lasers. Coherence. Diffraction as Fourier transformation. Holography and applications.

(Electricity & Magnetism, Modern Physics and Electronics)

1. Electricity and Magnetism:

Coulomb's Law, Electric field, Gauss's Law, electric potential. Poisson's and Laplace equations and solutions for homogeneous dielectric, uncharged conducting sphere in a uniform field, point charge and infinite conducting plane. Magnetic shell, magnetic induction and field strength Biot Savart's law and applications. Electromagnetic induction, Faraday's and Lenz's laws. Self and mutual inductance, induction coil and transformer.

Alternating currents L-R, C-R, L-C-R circuits. Series and parallel resonance, Q-factor. Electromagnetic waves – Maxwell's equations. Transverse nature of e-m waves, Poynting vector.

Magnetic materials – Dia, para, ferro, antiferro and ferri magnetism (Qualitative features only). Langevin's theory of paramagnetism, Weiss theory of ferromagnetism. Ferro magnetic Domains Hysteresis, Nuclear magnetism. Dielectric materials – Capacitive with dielectric material as medium; electric polarisation; electronic, ionic, electric polarisabilities and their variations with temperature.

2. Modern Physics:

Bohr's model, Sommerfeld extension. Explanation of atomic spectra. Stern-Gerlach experiment, space quantization, electron spin, vector atom model, spectral terms, fine structure of spectral lines. J-J and L-S coupling schemes. Pauli's exclusion principle, spectral terms of two equivalent and non-equivalent electrons, Zeeman, Paschenback effects, Stark effect. Characteristic X-rays, Moseley's Law. Gross and fine structure of Band spectra, Raman effect.

Black body radiation, Wien, Rayleigh Jeans and Planck's Laws of radiation. Photo electric effect and Einstein's Explanation, Compton effect, de Broglie hypothesis. Wave-particle duality, uncertainty principle, Schrodinger equation, eigen functions and eigen values. Physical meaning of eigen function, Solution of Schrodinger equation for 1) particle in a box 2) potential step 3) harmonic oscillator 4) hydrogen atom.

Radioactivity – alpha, beta and gamma rays, Gamow's theory of alpha decay. Laws of radioactivity. Radioactive equilibrium. Artificial radioactivity – Rutherford's experiment, discovery of Neutron. Mass spectrometers. Nuclear binding energy, semi-empirical mass formula. Nuclear fission, nuclear reactors. Nuclear fusion, fusion cycles. Elementary particles and their classification. Strong, Weak and electromagnetic interactions. Particle accelerators – Cyclotron and linear accelerators. Basic experimental ideas of superconductivity.

3. Electronics:

Band theory of solids – Conductors, insulators and semi conductors. Intrinsic and extrinsic semi conductors; p-n junction diode, forward and reverse bias. Diode as a rectifier. Transistor – different configurations of transistor, Transistor parameter amplifier. Transistor oscillator. Modulation and detection. Transistor receiver. Basic principle of television. Digital principles – Logic gates – AND, OR NOT, XOR gates – truth tables.

9. STATISTICS

Attempt any 5 questions choosing at most 2 from each Section. Four questions of equal weightage will be set in each section.

Section-A: Probability and Distributions

Sample space and events, Probability space, Statistical independence, Random variable, Discrete and continuous random variables. Probability density and distribution functions, marginal and conditional distribution, functions of random variables, expectation and moments, conditional expectation, correlation coefficient, convergence in probability, almost sure, Markov, Chebychev and Kolmogorov inequalities, Borel Cantelli lemma, weak and strong Laws of large numbers, probability generating and characteristic functions; Uniqueness and continuity theorems. Lindeberg Levy Central limit theorem. Standard discrete and continuous probability distributions, their interrelations including limiting cases. Exact Sampling distributions – t, F and Chi-square, Distributions of order statistics.

Section-B: Statistical Inference

Properties of estimates, consistency, unbiasedness, efficiency, sufficiency and completeness, Cramer-Rao bound, Minimum variance unbiased estimation, Rao-Black well and Lehmann-Sehffe's theorems methods of estimation by moments, maximum likelihood and minimum Chi-square. Properties of maximum likelihood estimators, confidence interval for of standards distributions.

Simple and composite hypotheses, statistical tests, critical region, two kinds of error, power function unbiased tests, most powerful and uniformly most powerful tests, Neyman-pearson, Lemma, Optimal tests for simple hypotheses concerning one parameter, monotone likelihood ratio property and its use in constructing UMP test, likelihood ratio criterion and its asymptotic distribution, chi-square and Kolmogorv tests for goodness of fit. Run test for randomness, Sign test for Location, Wilcoxon-Mann-Whitney test and Kol mogor – Simirnov test for the two sample problem and tests of independence based on sparmants next correction Distribution-free confidence intervals for quantiles and confidence bands for ditribution functions.

Notions of a sequential test, Walds SPRT, its CC and ASN functions, with applications to standard distributions.

Section-C: Multivariate Analysis

Theory of least squares, Gauss-Markoff theory, normal equations, least square estimates and their precision, Tests of significance and intervals – estimates based on least square theory. Regression Analysis, linear regression, estimates and tests about correlation and regression coefficient, curvi-linear regression, and orthogonal polynomials, test for linearity of regression-Multivariate normal distribution, multiple regression, multiple and partial correlations and tests for them. Mahalanobis D^2 and Hotelling T^2 statistics and their applications (derivations of distribution of D^2 and T^2 excluded). Fisher's discriminant analyses.

Attempt any 5 questions choosing atleast one question from each section. Three questions of equal weight will be set in each section.

Section-A – Sampling Theory

Nature and scope of sampling, simple random sampling, sampling from finite population with a without replacement, estimation of the standard errors, sampling with equal probabilities, PPS sampling, Stratified random sampling, systematic sampling, two-stage and multistage sampling, multiphase and cluster sampling schemes.

Estimation of population total and mean, use of biased and unbiased estimates, Standard errors of estimates, cost and variance functions, ratio and regression estimates and their relative efficiency, planning and organization of sample survey with special reference to recent large scale surveys conducted in India.

Section-B – Design of Experiments

Analysis of variance of one way, two-way and three-way classified data with and without interactions. Principles of experimental designs, CRD, RBD, LSD, Missing-plot technique, Factorial experiments, 2^n and 3^n designs. General theory of total and partial confounding and fractional replication. Analysis of split-plot, BIBD and PBIBD.

Section-C – Industrial Statistics

Concept and importance of quality control, different types of control charts, X,R,P & C charts; cumulative-sum control charts.

Sampling inspection Vs 100 per cent inspection. Concepts of producer's risk and consumer's risk. Single, double, multiple and sequential sampling plans for attributes; OC, ASN curves, Rectifying sampling plans, AOQ and ATI curves; sampling plans for variables.

Definition of Reliability, Life distribution, failure rate and bath-tub failure curve; exponential and Weibull models. Reliability of series, Parallel and K out of n systems.

Section-D – Operations Research

Homogenous discrete-time Markov chains, transition probability matrix, classification of states; stationary distribution, Birth and death process. Elements of queuing theory, M/M/1 and M/M/K queues; G/M/1 and M/G/1 - queues.

The structure and formulation of linear programming problem. The simplex method, two phase simplex method and charne's method with Artificial variables. Transportation and Assignment problems.

Introduction to computers and elements of Fortran IV Programming, Formats for input and output statements, specification and logical statements and sub-routines. Application to some simple statistical problems.

10. ZOOLOGY

(Non-Chordata, Chordata, ethology & Biostatistics)

Protozoa:

General Organisation and Classification; Locomotory organelles; Pathogenic protozoa of human importance (i.e.)

Trypanosoma, Leishmania, Entamoeba, Histolytica, Giardia, Malarial Parasites.

Porifera:

Various types of canal system, Histological structure and their functions; Reproduction and development of sponges, systematic position and affinities of sponges; development of spicules.

Coelenterata:

General Organisation and Classification; Aurilia; Coral reef formation in Actinozoa, general organisation and phylogenetic relationship of ctenophore, polymorphism in Hydrozoa.

Platyhelminthes:

General Organisation and Classification; Planaria; Fasciola; Taenia, general outline of the life cycle of parasites of human importance, Host-parasitic interactions.

Nemathelminthis:

Parasitic Nematodes of human importance i.e., Ascaris, Oxyuris, Anncylostoma, Strongyloides plant parasitic nematodes with specific examples.

Annelia:

General Organisation and Classification; Neriais; Leech; types of Nephridia, Coelome and Coelomoducts; Regeneration in Polychaetes, affinities, Trochophore larva.

Arthropoda:

Outline classification (up to orders) palaemon; scorpion; Insect mouth parts, respiration, metamorphosis, social use in insects, harmful and useful insects and economic importance, vectors- flies, lice, bugs, ticks and mosquitoes; Structure and systematic position of onychophora.

Mollusca:

Classification, Unio; pilla; torsion and detorsion, Distinctive features of Cephalopoda; pearl formation in Mollusea.

Chinoderamata:

Classification; star fish; water vascular system, larval forms and their revolutionary significance.

Hermichodata:

General organisation; systematic position and affinities of Balanoglossus.

Chordata:

Origin of Chordates, general organisation, Ascidian and classification of Urochordata, Sessile and Pelagic tunicates, Mucous and mode of feeding, affinities, Retrogressive metamorphosis.

General organisation of Cephalochordata; Branchiostoma.

Introduction to Agnatha. General Organisation and classification of Cyclostomata; affinities. General introduction of Craniata, Dog fish; any Bony fish.

Systematic position and significance of coelocanthini, Dipnoi, the conquest of land, origin and evolution of Amphibia and classification; Anatomical peculiarities and affinities of Urodele and parental care in Amphibia.

Reptiles:

Origin of reptiles general organisation of Chelonia, squamata, Rhynchocephalia and Crocodilia. Fossil Reptiles, poisonous and non-poisonous snakes of India.

Birds:

Origin and evolution of birds, migration of birds, adaption for flight, economic importance of birds.

Mammals:

Prototheria, Metatheria and Eutheria, phylogenetic relations of prototheria & Methatheria, adaptive radiations in marsupials, Aquatic and aerial adaptations in mammals, Oestrous cycle and Placentation in mammals, distinctive features of Primates.

Comparative account of various systems of vertebrates.

Ethology:

Introduction and History of ethology, Ethology Vs behaviourism; Instinct Vs learning, Communication by means of Pheromon Domec language of honey bees Forging and predation; Defensive secretions in insects. Social behaviour in insects.

Biostatistics:

Methods of sampling, frequency distribution and Measures of central tendency; Standard deviation, Standard error; correlation and regression and T-test, F-test, X 2 test.

(Cell Biology, Physiology, Genetics, Embryology, Histology, Evolution, Ecology and Zoogeography)**Cell Biology:**

Prokaryotic and Eukaryotic cells, cell membrane, Endoplasmic reticulum, Golgi Complex, Lysosomes, Mitochondrion, Microsome, Peroxisomes, Nucleus, Nucleolus, Centrioles, Cilia, Flagella, Microtubules, Chemical components and molecular models of cell membrane. Passive active and ionic transport. Transport protiens, carrier and fixed pore mechanism cell coat and cell recognition. Cell surface receptors and mechanism of signal transduction (Steroid, Cyclic AMP and Ca^{+2}). Ultra structure of a muscle and nerve fibre, ultra structure and chemical composition of a chromosome, hetero and euchromatin, polytene and lambrush chromosomes, chromosomal aberration and variation cell cycle and chemical events of cell cycle, cell division mitosis & meosis, cancerous cells and lymphocytes.

Physiology:

Nutritional types, Essential nutrients, types of food, vitamins, minerals, balanced diet. Digestion and absorption. Endocrine regulation of gastro intestinal movements and secretions. Breathing movements, Respiratory pigments and transport of respiratory gases, Muscle contraction – Muscle proteins and theories of muscle contraction. Nerve impulse – Propagation and mechanism of

synaptic transmission. Electrical and chemical theories and neurotransmitters. Physiology of vision, auditing, olfaction and taste. Excretion – Formation of nitrogenous excretory products. Osmoregulation in fresh water, marine water and terrestrial animals. Cellular metabolism – Carbohydrate and protein metabolism. Enumeration of endocrine glands and their hormones, chemical nature and mechanism of action of hormones.

Genetics:

Principles of mendelian inheritance (mono, di and tri hybrid ratios) phenomenon of linkage and chromosome mapping, sex linkage, crossing over, sex determination and genic balance, extra chromosomal inheritance, concept of multiple alleles, blood groups and RH factors; Inborn errors metabolism, one gene one polypeptide hypothesis, structure and chemistry of DNA and RNA, point mutation, genetic code and protein synthesis. Eugenics; Gene cloning, genetic engineering, gene transfer and immunogenetics.

Embryology:

Gametogenesis; Fertilization, Cleavage, Gastrulation, extra embryonic membranes placenta, organogenesis of central nervous system, heart, kidney, Regeneration, Carcinogenic development.

Histology:

Histology of Blood, lymphoid tissues, cartilage, bone, skin, stomach, intestine, liver, pancreas, lung, kidney, testis and ovary of chordates.

Evolution:

Prebiotic and early evolutions in primordial atmosphere origin of life concept of organic evolution. Lamarckism, Darwinism and Deveries theory, modern concept of recapitulation hypothesis, Homology and Analogy, paleontological evidence and evolution, Dating of fossils, Ancestry of man, Neo-Lamarckism and Neo-Darwinism, Isolating mechanism. Reproductive isolation, speciation, Mutation, Genetic drift, Gene frequencies and basic concept of Hard Weinberg law.

Ecology:

Introduction of ecology, the scope of ecology, factors of the environment in relation to the organism, heat, light, mechanical factors oxygen and carbon dioxide, inorganic salts and biotic factors, the concept of an ecosystem fresh water, marine and terrestrial ecosystem, energy flow in eco-system, energy fixation by autotrophs, Food chains and Food Web, Biogeochemical cycles, Water cycle, carbon cycle, general features of community, Nitrogen cycle, population attributes, definition and size communities, ecological succession, pollution, ecology in relation to man.

Zoogeography:

General principles of animal distribution, Barriers, continuous and discontinuous, continental drift, zoogeographic realms, Insular, fauna, wildlife protection, mimicry and colouration.

SCHEME

Part-A: Written (Objective type) Examination				
Paper-1	General Studies	150 Marks	150 Questions	150 Minutes
Paper-2	Subject (Economics OR Maths OR Statistics)	300 Marks	150 Questions	150 Minutes
Part-B: Oral Test (Interview)		50 Marks		

SYLLABUS

PAPER-1 GENERAL STUDIES

1. SCIENCE AND TECHNOLOGY:
 - e) General Science and Technology
 - f) Role and impact of science and Technology on India's development.
(Questions will cover general appreciation and understanding of matters of everyday observation and experience as may be expected of a well-educated person who has not made a special study of science and technology disciplines).
2. INDIAN HISTORY AND CULTURE:
 - i) Modern Indian History from 19th century to the present
 - j) Nationalist Movement and Constitutional development
 - k) Indian culture and Heritage including architecture, Fine Arts, dance forms, music, paintings, Folk arts and performing arts.
 - l) History of Andhradesa Society, Culture, Geography and Economic development.
3. INDIAN POLITY:
General and broad understanding of the structural (institutions) and functional (processes) aspects of Indian Political system.
4. INDIAN ECONOMY AND GEOGRAPHY OF INDIA:
 - (a) Structure of National economy
 - (b) Economic development (including planning) since independence
 - (c) Economic Reforms
 - (d) Physical, economic and social Geography of India.
5. CURRENT EVENTS:
Current Events of Regional, National and International importance.
6. GENERAL MENTAL ABILITY: (Reasoning and analytical abilities)

PAPER-2 SUBJECT

1. ECONOMICS

1. Methodology in Economics. The framework of an economy. National Income Accounting – Estimation of National Income.
2. Economic Choice: Consumer behaviour, producer behaviour, market forms and distribution
3. Determination of income and employment: Investment decisions. Macro economic models of income, distribution and growth.
4. Banking: Supply of money and near money; Central Banking – Objectives, instruments of credit policy in a developing economy.
5. Public Finance: Principles of taxation and Public expenditure – Functional Finance – Budgetary and Fiscal policy in a developing economy – Public debt and its effects on economy.
6. International trade: Tariffs, exchange rates – convertibility – Balance of Payments – Monetary and Banking Institutions.

1. The Indian economy: Guiding principles of Indian economic policy – Planned growth and distributive justice. Eradication of poverty. Institutional framework of the Indian economy – Federal structure of the Government – Agricultural and Industrial Sector. National Income of India, its Sectorial and regional distribution.
Magnitude and incidence of poverty (rural & urban)
2. Agriculture: Agricultural policy; Land Reforms – Technological change – Relationship with the industrial sector.
3. Industry: Industrial policy – Public and Private sector – Regional distribution of Industry – Industrial Infrastructure – Aspects of economic liberalisation.
4. Pricing policies of Agricultural and Industrial outputs – Administered prices – Procurement and Public Distribution.
5. Budgetary trends and Fiscal policy.
6. Monetary and credit trends and policies – Banking and non-banking financial institutions.
7. Foreign trade and Balance of payments (Before and after economic reforms)
8. Indian Planning: Objectives, strategy, experience and problems.
9. Andhra Pradesh Economy: Structure of the A.P. economy – State Income - its sectorial and regional distribution and extent of poverty – Regional imbalances State of agriculture – Agricultural inputs and technology – Subsidies – State of industry – Infrastructure – Industrial sickness – State finances and budgetary policy – World Bank Aid and state economy.

2. MATHEMATICS

The candidate has to answer 10 questions choosing atleast 2 questions from each Sections I – IV. Five questions will be from each section. Each question carries 15 marks.

Section-I – Algebra:

Groups – subgroups – normal subgroups – quotient groups – homomorphism and isomorphism theorems – cyclic groups – permutation groups – Cayleay's theorem.

Rings – subrings – integral domain – fields – ideals quotient ring – maximal and prime ideals – Euclidean rings – polynomial rings – Unique factorization domains – principal ideal domains.

Section-II – Linear Algebra:

Vector spaces – subspaces – linear independence and dependence – Bases and dimension – Finite – dimensional vector spaces and their properties.

Linear transformations – Rank and nullity of a linear transformation – Cayley – Hamilton theorem – Matrix of a linear transformation – eigen values and eigen vectors – Canonical forms.

Inner product spaces – Orthonormal basis – Quadratic forms.

Section-III – Differential equations:

Order and degree of a differential equation – Formation of a differential equation – Differential equations of first order and first degree – Linear differential equations with constant and variable coefficients – Total differential equations.

Formation of partial differential equations – Equations of first order – Charpit's methods.

Section-IV – Geometry:

General equation of second degree in two variables – Tracing of conics.

Plane, straight lines in space – sphere – Cone.

Curves in space – curvature – Torsion – Serret – Frenet formulae.

The candidate has to answer 10 questions choosing atleast TWO questions from each of the Sections 1 to IV. FOUR questions will be given from each of the Sections I,II and III and EIGHT questions will be given from Section IV with two questions from the four topics given in that section.

Section-I – Real Analysis:

Real number system \mathbb{R} – Open and closed sets in \mathbb{R} - Compact sets – sequences in \mathbb{R} and their convergence – Series of real numbers – Tests of convergence – absolute and conditional convergence – rearrangements of series.

Limits and continuity of a real valued function properties of continuous functions – Differentiation – Mean value theorems – Applications.

Riemann integration – conditions for Riemann integrability – improper integrals.

Section-II – Complex Analysis:

Complex numbers and their geometric representation – limits and continuity of functions of a Complex variable – Analytic functions – Cauchy Riemann equations – Complex integration – Cauchy's theorem – Cauchy's integral formula – Power series – Taylor's and Laurent's series – Types of singularities – Calculus of residues and application to evaluation of definite integrals.

Section-III – Vector calculus:

Differentiation of a vector valued function – Gradient of a scalar function – Divergence and curl of a vector function in Cartesian and polar coordinates.

Green's theorem – Gauss and Stoke's theorems and their applications to evaluation of double and triple integrals.

Section-IV:

- i) Transform Calculus: Laplace Transforms – Inverse Laplace transforms – solving differential equations using Laplace transforms. Fourier and Hankel transforms.
- j) Numerical Analysis: transcendental and Polynomial equations – Regula Falsi method – Newton Raphson method Interpolation – numerical differentiation – numerical integration – Runga Kutta method.
- k) Number Theory: Fundamental theorem of arithmetic – congruences and their applications – Fermat's and Wilson's theorems – solution of linear congruences – Chinese remainder theorem.
- l) Linear Programming: Formation of linear programming problem – Graphical solution – Dual problem – simplex method – Transportation problem.

3. STATISTICS

Attempt any 5 questions choosing at most 2 from each Section. Four questions of equal weightage will be set in each section.

Section-A: Probability and Distributions

Sample space and events, Probability space, Statistical independence, Random variable, Discrete and continuous random variables. Probability density and distribution functions, marginal and conditional distribution, functions of random variables, expectation and moments, conditional expectation, correlation co-efficient, convergence in probability, almost sure, Markov, Chebychev and Kolmoorov inequalities, Borel Centelli lemma, weak and strong Laws of large numbers, probability generating and characteristic functions; Uniqueness and continuity theorems. Lindeberg Levy Central limit theorem. Standard discrete and continuous probability distributions, their interrelations including limiting cases. Exact Sampling distributions – t, F and Chi-square, Distributions of order statistics.

Section-B: Statistical Inference

Properties of estimates, consistency, unbiasedness, efficiency, sufficiency and completeness, Cramer-Rao bound, Minimum variance unbiased estimation, Rao-Black well and Lehmann-Sehffe's theorems methods of estimation by moments, maximum likelihood and minimum Chi-square. Properties of maximum likelihood estimators, confidence interval for of standards distributions.

Simple and composite hypotheses, statistical tests, critical region, two kinds of error, power function unbiased tests, most powerful and uniformly most powerful tests, Neyman-pearson, Lemma, Optimal tests for simple hypotheses concerning one parameter, monotone likelihood ratio property and its use in constructing UMP test, likelihood ratio criterion and its asymptotic distribution, chi-

square and Kolmogorov tests for goodness of fit. Run test for randomness, Sign test for Location, Wilcoxon-Mann-Whitney test and Kolmogorov – Smirnov test for the two sample problem and tests of independence based on Spearman's next correction Distribution-free confidence intervals for quantiles and confidence bands for distribution functions.

Notions of a sequential test, Wald's SPRT, its CC and ASN functions, with applications to standard distributions.

Section-C: Multivariate Analysis

Theory of least squares, Gauss-Markoff theory, normal equations, least square estimates and their precision, Tests of significance and intervals – estimates based on least square theory. Regression Analysis, linear regression, estimates and tests about correlation and regression coefficient, curvi-linear regression, and orthogonal polynomials, test for linearity of regression-Multivariate normal distribution, multiple regression, multiple and partial correlations and tests for them. Mahalanobis D^2 and Hotelling T^2 statistics and their applications (derivations of distribution of D^2 and T^2 excluded). Fisher's discriminant analyses.

Attempt any 5 questions choosing atleast one question from each section. Three questions of equal weight will be set in each section.

Section-A – Sampling Theory

Nature and scope of sampling, simple random sampling, sampling from finite population with and without replacement, estimation of the standard errors, sampling with equal probabilities, PPS sampling, Stratified random sampling, systematic sampling, two-stage and multistage sampling, multiphase and cluster sampling schemes.

Estimation of population total and mean, use of biased and unbiased estimates, Standard errors of estimates, cost and variance functions, ratio and regression estimates and their relative efficiency, planning and organization of sample survey with special reference to recent large scale surveys conducted in India.

Section-B – Design of Experiments

Analysis of variance of one way, two-way and three-way classified data with and without interactions. Principles of experimental designs, CRD, RBD, LSD, Missing-plot technique, Factorial experiments, 2^n and 3^n designs. General theory of total and partial confounding and fractional replication. Analysis of split-plot, BIBD and PBIBD.

Section-C – Industrial Statistics

Concept and importance of quality control, different types of control charts, \bar{X} , R, P & C charts; cumulative-sum control charts.

Sampling inspection Vs 100 per cent inspection. Concepts of producer's risk and consumer's risk. Single, double, multiple and sequential sampling plans for attributes; OC, ASN curves, Rectifying sampling plans, AOQ and ATI curves; sampling plans for variables.

Definition of Reliability, Life distribution, failure rate and bath-tub failure curve; exponential and Weibull models. Reliability of series, Parallel and K out of n systems.

Section-D – Operations Research

Homogenous discrete-time Markov chains, transition probability matrix, classification of states; stationary distribution, Birth and death process. Elements of queueing theory, M/M/1 and M/M/K queues; G/M/1 and M/G/1 - queues.

The structure and formulation of linear programming problem. The simplex method, two phase simplex method and Charnes's method with Artificial variables. Transportation and Assignment problems.

Introduction to computers and elements of Fortran IV Programming, Formats for input and output statements, specification and logical statements and sub-routines. Application to some simple statistical problems.

SCHEME

Part-A: Written (Objective type) Examination				
Paper-1	General Studies	150 Marks	150 Questions	150 Minutes
Paper-2	Subject (Town Planning)	300 Marks	150 Questions	150 Minutes
Part-B: Oral Test (Interview)		50 Marks		

SYLLABUS

PAPER-1 GENERAL STUDIES

1. SCIENCE AND TECHNOLOGY:
 - g) General Science and Technology
 - h) Role and impact of science and Technology on India's development.(Questions will cover general appreciation and understanding of matters of everyday observation and experience as may be expected of a well-educated person who has not made a special study of science and technology disciplines).
2. INDIAN HISTORY AND CULTURE:
 - m) Modern Indian History from 19th century to the present
 - n) Nationalist Movement and Constitutional development
 - o) Indian culture and Heritage including architecture, Fine Arts, dance forms, music, paintings, Folk arts and performing arts.
 - p) History of Andhradesa Society, Culture, Geography and Economic development.
3. INDIAN POLITY:

General and broad understanding of the structural (institutions) and functional (processes) aspects of Indian Political system.
4. INDIAN ECONOMY AND GEOGRAPHY OF INDIA:
 - (a) Structure of National economy
 - (b) Economic development (including planning) since independence
 - (c) Economic Reforms
 - (d) Physical, economic and social Geography of India.
5. CURRENT EVENTS:

Current Events of Regional, National and International importance.
6. GENERAL MENTAL ABILITY: (Reasoning and analytical abilities)

PAPER-2 SUBJECT

1. TOWN PLANNING

1. History of Town Planning: Principles of town planning, Town planning in ancient India, Indus Valley civilisation, objects and necessity of town planning, growth of towns, forms of cities, site for an ideal town, planning of modern town, Medieval town, industrialisation and its effects on town planning.
2. Planning techniques and its implementation: Basic methods of various types of surveys, collection of data, Methods adopted to collect data, standards for development and re-development of residential commercial industrial and re-recreational areas, land use planning, socio economic data for urban planning.
3. Master plan and Zoning: Master plan objects and necessity, stages in preparation of master plan, principles of zoning, objects and importance of zoning, Aspects, uses and economy of zoning, site for buildings, requirements of residential buildings classification of residential buildings, design of residential areas.
4. Slum and re-development of existing towns:

Slum: Causes, growth, characteristics, effects, slum clearance and re-housing, prevention of slum formation, financial assistance for slum clearance, objects of re-planning, defects of existing terms, urban renewal projects.

5. Housing: Housing policy, different types of housing Agencies involved in housing, affordability of housing, infrastructure available in housing, different categories of houses as per HUDCO norms.
6. Parks and playgrounds: Selection of site for parks – Forms of recreation amenities, park design – standards for open spaces, land scape architecture, standards for school buildings and hospitals.
7. Industrial Planning: Classification of industries – selection of site for industries, planning of industrial estate, industrial wastes, treatment of industrial effluents.
8. Traffic planning and regulation: Principles of traffic planning, classification of roads, principles of segregation of traffic, types of streets, road system, road junctions, parking facilities, traffic signals street lightings, traffic management.
9. Town planning legislations: Different Acts – A.P. Town planning Act, 1920, A.P. Urban Area Act, 1975, A.P. Municipalities Act, 1965, Hyderabad Municipal Corporation Act 1955.
10. Regional Planning: Concept of Regional planning, principle involved, delimitation of region, Factors influencing, Regional planning, principle involved, delimitation of region, Factors influencing, Regional planning, Methods of regional planning.

SCHEME

Part-A: Written (Objective type) Examination				
Paper-1	General Studies	150 Marks	150 Questions	150 Minutes
Paper-2	Subject (Botany OR Zoology OR Chemistry OR Physics OR Geology OR Mathematics OR Civil Engg OR Mechanical Engg. OR Electrical Engg. OR Electronics & Telecommunications Engg.	300 Marks	150 Questions	150 Minutes
Part-B: Oral Test (Interview)		50 Marks		

SYLLABUS

PAPER-1 GENERAL STUDIES

1. SCIENCE AND TECHNOLOGY:
 - i) General Science and Technology
 - j) Role and impact of science and Technology on India's development.(Questions will cover general appreciation and understanding of matters of everyday observation and experience as may be expected of a well-educated person who has not made a special study of science and technology disciplines).
2. INDIAN HISTORY AND CULTURE:
 - q) Modern Indian History from 19th century to the present
 - r) Nationalist Movement and Constitutional development
 - s) Indian culture and Heritage including architecture, Fine Arts, dance forms, music, paintings, Folk arts and performing arts.
 - t) History of Andhradesa Society, Culture, Geography and Economic development.
3. INDIAN POLITY:

General and broad understanding of the structural (institutions) and functional (processes) aspects of Indian Political system.
4. INDIAN ECONOMY AND GEOGRAPHY OF INDIA:
 - (a) Structure of National economy
 - (b) Economic development (including planning) since independence
 - (c) Economic Reforms
 - (d) Physical, economic and social Geography of India.
5. CURRENT EVENTS:

Current Events of Regional, National and International importance.
6. GENERAL MENTAL ABILITY: (Reasoning and analytical abilities)

PAPER-2 SUBJECT

1. BOTANY

Microbiology, Pathology, Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms, Taxonomy of Angiosperones, Anatomy, Morphogenesis, Embryology & Palynology.

MICROBIOLOGY:

Viruses, Bacteria, Plasmids, General account of infection and immunology, structure, classification, reproduction and physiology. Importance of microbes in agriculture, industry and medicine. Biological control of pollution using micro-organisms.

PATHOLOGY:

Plant diseases caused by viruses, bacteria, mycoplasma, actinomycetes, fungi and nematodes. Modes of infection, dissemination, Physiology of parasitism and methods of control. Different fungal toxins. Mechanism of action of Biocides.

ALGAE:

Principles of algal classification; thallus organisation in algae. Types of life cycles in algae. Phylogeny and interrelationships of various groups of algae. Economic importance of algae.

FUNGI:

General characters of fungi and their classification. Structure, reproduction, life cycles, phylogeny and inter-relationships and affinities of the main groups of fungi viz., Myxomycetes, Oomycetes, Zygomycetes, Ascomycetes, Basidiomycetes, Deuteromycetes, Economic importance of fungi, Symbiotic fungi, the lichens, Mycorrhizae.

BRYOPHYTES:

General account and classification of bryophytes. Comparative study of structure and development of sporophytes in bryophytes. Ecology and economic importance of bryophytes.

PTERIDOPHYTES:

General account and classification of pteridophytes – Evolution of stele systems in pteridophytes. Telome-theory, heterospory and seed habit. Ecology and economic importance of pteridophytes.

GYMNOSPERMS:

Classification and distribution of living gymnosperms, origin and evolutionary tendencies in gymnosperms vis-à-vis pteridophytes and angiosperms – General account of fossil gymnosperms; pteridospermales (Cycadofilicales), Corditales, Bennettitales and their affinities and inter relationship. Taxonomic and economic importance of gymnosperms.

TAXONOMY OF ANGIOSPERMS:

A comparative study of the systems of classification; Bentham and Hooker, Engler and Prantl and Hutchinson. Modern trends in biosystematics with reference to phytochemical, cytological, palynological, embryological and anatomical criteria. Taxonomic and economic importance of Magnoliaceae, Ranunculaceae, Cruciferae, Malvaceae, Rosaceae, Leguminosae, Umbelliferae, Asclepiadaceae, Verbenaceae, Euphorbiaceae, Liliaceae, Orchidaceae, Palmae and Poaceae.

ANATOMY:

Plant meristems, Normal and Anomalous secondary growth in stem and root. Anatomy of wood. Anatomy of C₃ and C₄ plants. Stomatal types.

MORPHOGENESIS:

Polarity, symmetry and totipotency – Differentiation and dedifferentiation of cells and organs. Factors of morphogenesis. Methodology and applications of cell, tissue, organ and protoplast cultures from vegetative and reproductive parts; Somatic hybrids.

EMBRYOLOGY AND PALYNOLOGY:

Development of male and female gametophyte, double fertilization, endosperm formation, embryo and its main types. Apomixis and polyembryony. Seed structure. Palynology with reference to overall Pollen morphology of angiosperms. Aspects and applications of aerology and Mellitopalynology.

Cell biology, Genetics & evolution, Physiology, Ecology, Economic botany, Ethnobotany.

CELL BIOLOGY:

Modern tools and techniques in the study of cytology. Prokaryotic and eukaryotic cells. Structural and ultra-structural functions of a) Plasma membrane b) Endoplasmic reticulum c) Golgi apparatus d) Mitochondria e) Ribosomes f) Plastids g) Microbodies h) Nucleus.

Chemical nature of Chromosomes, Polytene and lamp brush chromosomes. Numerical and structural variations in chromosomes and their significance. Detailed study of cell cycle – mitosis and meiosis.

GENETICS & EVOLUTION:

Pre and post Mendelian concept of genetics, development of gene concept Nucleic acids their structure and role in reproduction and protein synthesis, genetic code and gene regulation. Mechanism of microbial recombination, Mutation, its roles in evolution; Multiple factor inheritance, linkage and crossing-over, methods of gene mapping, Sex chromosomes and sex linked inheritance, cytoplasmic inheritance, Genetic engineering, Organic evolution, evidence, mechanism and theories.

PHYSIOLOGY:

Detailed study of Water Relations. Study of macro and micro nutrients, criteria for essentiality, availability, uptake and role. Photosynthesis – mechanism and importance, photosystem I & II Calvin cycle, C₄ pathway, CAM Pathway, Photorespiration, Respiration and fermentation. Nitrogen fixation and nitrogen metabolism, Protein synthesis. Enzymes, classification and mode of action. Growth indices, growth movements, Senescence. Growth substances their chemical nature role and application in agrichorticulture, Parthenocampy and fruit ripening. Seed-dormancy, storage and germination.

ECOLOGY:

Structure function and dynamics of ecosystems. Plant communities and succession. Conservation of ecosystems; pollution and its control. Forest types of India. Aforestation deforestation and social forestry. Forest management – use of resources. Endangered plants.

ECONOMIC BOTANY:

Origin of cultivated plants. Study of plants as sources of food, fodder and forage, wood and timber, fibre, paper, rubber, beverages, drugs, narcotics, resins and gums essential oils, dyes, medicines, insecticides and pesticides. Energy plantation.

ETHNOBOTANY:

Its scope. Medicoethnobotany and ethnoagriculture. Conservation and propagation of medicinal plants used by various tribal communities of A.P.

2. CHEMISTRY

1. Atomic structure and chemical bonding:

Quantum theory, Heisenberg's uncertainty principle, Schrodinger's wave equation (time independent), particle in a one dimensional box, quantum numbers, hydrogen atoms wave functions, shapes of orbitals. Valence bond and molecular orbital theories. Resonance and resonance energy Sigma and Pi bonds (non-mathematical approach).

2. Thermodynamics:

Laws of thermodynamics and their application to Physico-chemical processes. Laws of thermochemistry. Kirchoff's equation. Spontaneous and non-spontaneous changes. Second law of thermodynamics. Entropy changes in gases for reversible and irreversible processes. Third law of thermodynamics. Gibbs-Helmholtz equation. Vanthoff's reaction isochore. Thermodynamic criteria for equilibrium. Free energy changes in chemical reaction and equilibrium constant.

3. Solid State:

Forms of solids. Crystal systems and crystal classification. Designation of crystal faces. Lattice structure and unit cell. Bragg's law. X-Ray diffraction by crystals. Defects in crystals. Elementary idea of liquid crystals.

4. Chemical Kinetics:

Order and molecularity of reactions. Rate equations of Zero, first and second order reactions. Effect of temperature, concentration and catalyst on the rate of a reaction. Collision theory and absolute reaction rates of bimolecular reactions. Kinetics of polymerization. Homogeneous and heterogeneous reactions.

5. Photochemistry:

Lambert-Beer's law. Grothus-Draper law. Einsteins law of photochemical equivalence. Quantum yield and its application. Photo physical and photo chemical processes – Joblensky diagram.

6. Ionic equilibria:

Ostwald's dilution law and its verification. Theory of strong electrolytes. Debye-Huckel's theory. Ionic activities and activity coefficients. Common ion effect. Solubility product and its applications. Electrolysis conductance and its theory and applications. Laws of electrolysis.

7. Electromotive force:

Reversible and irreversible cells. e.m.f. and its measurement. Types of cells. Single electrode potentials and their applications. Theory and applications of over voltages. Dropping Mercury Electrode (DME).

8. Reactions in non-aqueous media:

Liquid ammonia and liquid sulphur dioxide. Pearson's theory of hard and soft acids and bases.

9. d-Block elements:

Electronic configuration – variable oxidation states. Magnetic properties. Ability to form complexes. Absorption spectra (including charge transfer spectra). Metal-metal bonds and metal atom clusters. A comparative study of physical and chemical properties of the first, second and third transition series.

Lanthanides and actinides:

Methods of separation of lanthanides. Oxidation states and magnetic properties. Synthesis of actinides and actinide contraction.

10. Co-ordination chemistry:

Theories of bonding – valence bond theory. Crystal field theory and its limitation. Molecular orbital theory. Stability of coordination compounds. Factors effecting the stability constants. Determination of stability constants by potentiometric and spectro photometric methods.

11. Organometallic compounds:

Nature of the metal-carbon bond. Organometallic compounds of aluminium, Zinc and mercury. Olefinic complexes of palladium (II) and platinum (II). Their preparation, properties and bonding.

12. Molecular spectroscopy:

Type of spectra and their origin. Measurement of spectra.

a) Vibrational spectroscopy:

i) Infra Red Spectra: Calculation of force constants. Modes of vibrations in linear and non linear molecules. Vibrational frequencies of some important groups. Applications of IR spectroscopy in structure elucidation.

ii) Raman spectra: Origin and measurement. Differences between IR and Raman spectra.

b) Electronic spectroscopy:

UV and visible spectra. Types of electronic transitions in molecules. Absorptions due to multiple bonds and the effect of conjugation on them. Applications of UV-visible spectroscopy in the study of organic molecules. Charge transfer spectra.

PAPER-II**1. Structure, reactivity and nomenclature of organic molecules:**

Covalent character of organic compounds. Single and multiple bonds. Types of organic reactions and reagents with examples. Homolytic and heterolytic cleavage of bonds.

Inductive, electromeric, conjugative and hyperconjugative effects on the physical and chemical properties of organic compounds with suitable examples Dipole moments.

IUPAC and Chemical Abstract systems of nomenclature of organic compounds.

2. Stereo Chemistry:

Concept of isomerism and isomers. Elements of symmetry. Criteria for optical activity. Symmetry operations (C_n and S_n symmetry elements). Symmetric, dissymmetric and asymmetric molecules with examples.

DL and RS nomenclature of chiral molecules. Asymmetric induction. Cram's rule. Stereo selective and stereo specific synthesis. E, Z-nomenclature of unsaturated systems. Physical and chemical properties, relative reactivity, stability and interconversion of E,Z-isomers.

Stereo chemistry of oximes.

3. Reaction mechanisms:

General methods of study of organic reaction mechanism. Formation and stability of reactive intermediates. Viz. carbocations, carbanions, freeradicals, carbenes, nitrenes and benzyne.

S_N1 and S_N2 mechanisms. E_1 , E_2 and E_1cB mechanism of elimination reactions. Electrophilic addition to carbon – carbon double bonds. Addition to carbon-oxygen double bonds. Michael addition. Aromatic electrophilic and nucleophilic substitution.

4. Pericyclic reaction:

Classification and examples. An elementary study of Woodward-Hofmann Rules.

5. Carbohydrates:

Classification. Structure elucidation of open chain and cyclic structures of D-glucose and D-fructose. Inter-conversion of monosaccharides. Determination of the configuration of D-glucose.

6. Amino acids, polypeptides and proteins:

Classification of amino acids. Synthesis of natural amino acids (general methods) properties of amino acids. Structural studies of polypeptides. Synthesis of poly peptides primary and secondary structures of proteins.

7. Aromatic and heterocyclic compounds:

Theory of aromaticity. Frost-Musulin diagrams of cyclobutadiene and benzene. Synthesis and reactions of furan, pyrrole, thiophene and pyridine. A comparative study of their aromatic character.

8. Chemistry of the following name reactions:

Aldol condensation, dieckmann reaction, Claisen condensation, perkin reaction, Beckman rearrangement and Cannizzaro reaction, reimer – Tiemann reaction.

9. Reagents in organic synthesis:

Use of the following reagents in organic synthesis:
Ozone, periodic acid, NBS, diborane, Sodium in liquid ammonia, NaBH_4 and LiAlH_4 .

10. Chemistry of Natural products:

Isolation and structural features of the following natural products:
Citral, nicotine, papaverine and Vitamin-C.

11. NMR Spectroscopy:

Introduction to proton magnetic Resonance spectroscopy – Principles. Chemical shifts, shielding and deshielding effects, Splitting of signals, Coupling constants.

Application of PMR to the study of simple organic molecules.

12. Polymer chemistry:

Physical chemistry of polymers. End group analysis, sedimentation, light scattering and viscosity of polymers. Ziegler-Natta catalysis. Study of addition and condensation polymerization. Stereochemistry of polymers. Inorganic polymers.

3. GEOLOGY

(General Geology, Geo-morphology, Structural Geology, Stratigraphy and Palaeontology)

i) General Geology:

Origin and interior of the earth. Dating of the rocks by various methods and age of the Earth. Volcanoes, Earthquakes, Geo-synclines, Isostasy, Continental drift and Mountain building activity. Sea floor spreading and plate tectonics.

ii) Geomorphology:

Land forms, their types and development. Weathering, Transport and Erosion. Geomorphic processes, such as Fluvial, Fluvio-marine, Marine, Glacials and Eolian. Topography and its relation to structures and lithology.

iii) Structural Geology:

Concepts of stress and strain. Description, terminology and nomenclature of folds. Mechanics of folding, classification, genesis and dynamic significance of joints. Classification of unconformities. Description, classification and genesis of faults. Mechanism and recognition of faults in the fields. Foliation and lineation. Tectonic framework of India.

iv) Stratigraphy:

Principles of stratigraphy. Stratigraphic classification and nomenclature. Standard stratigraphic scale. Detailed study of various geological systems of Indian sub-continent. Boundary problems in stratigraphy. Paleogeography and evolution of Indian sub-continent through phanerozoic time.

v) Palaeontology:

Origin and evolution of life. Fossils, their modes of formation and utility. Morphology, classification and evolutionary trends of Branchiopods, Lemellibranches, gastropods, Ammonoids, Trilobites, Echinoids and Corals. Microfossils and their application. Evolutionary history of Man, Horse & Elephant. A brief study of Gondwana flora.

PAPER-II

(Crystallography, Mineralogy, Petrology and Economic Geology)

i) Crystallography:

Crystalline and non-crystalline substances. Concept of symmetry, point group, lattice and space groups. 32 classes of crystal symmetry. Stereographic projections and their use. Twinning, crystal growth and irregularities.

ii) Mineralogy:

Types of bondings, ionic radii, coordination number. Isomorphism, polymorphism and pseudomorphism. Structure and classification of silicates. Detailed study of rock forming minerals. General principles of Optics. Nicol prism. Isotropism and Anisotropism. Dispersion, pleochroism, Birefringence optical indicatrix. Optic sign – Acute and obtuse bisectrix – 2V angle.

iii) Petrology:

Simple phase diagrams of single, binary, ternary and quaternary silicate systems, with reference to petrogenesis. Magmas, their generation in the crust and mantle their emplacement and their relation to paleo-tectonics. Magmatic crystallization, differentiation and assimilation. Bowen's Reaction principle classification of Igneous rocks.

Process and formation of sedimentary rocks. Diagenesis and lithification. Textures and structures. Heavy minerals and their significance. Classification of Sedimentary rocks.

Role of T P and fluids in metamorphism. Metamorphic facies. Relationship among metamorphism, anatexis and granitization. Types of metamorphism.

Petrogenic aspects of important rocks of India, such as Deccan Traps, the layered intrusions, charnockites khondalites and gneisses.

iv) Economic Geology:

Concepts of ore. Ore mineral and gangue. Tenor of ores. Process of formation of mineral deposits. Physico-chemical controls of deposition. Geological setting, characteristic features and genesis of metallic and non-metallic mineral deposits in India. Occurrence and distribution of fuels – coal, petroleum and Atomic minerals. Exploration techniques for surface and subsurface mineral deposits. Sampling, Assaying and evaluation of ore bodies.

Geological investigation for the construction of dams, Bridges, Highways and Tunnels.
Ground water exploration and management, water pollution.
Geological interpretation of air photos and imagery.

4. MATHEMATICS

The candidate has to answer 10 questions choosing atleast 2 questions from each Sections I – IV. Five questions will be from each section. Each question carries 15 marks.

Section-I – Algebra:

Groups – subgroups – normal subgroups – quotient groups – homomorphism and isomorphism theorems – cyclic groups – permutation groups – Cayley's theorem.

Rings – subrings – integral domain – fields – ideals quotient ring – maximal and prime ideals – Euclidean rings – polynomial rings – Unique factorization domains – principal ideal domains.

Section-II – Linear Algebra:

Vector spaces – subspaces – linear independence and dependence – Bases and dimension – Finite – dimensional vector spaces and their properties.

Linear transformations – Rank and nullity of a linear transformation – Cayley – Hamilton theorem – Matrix of a linear transformation – eigen values and eigen vectors – Canonical forms.

Inner product spaces – Orthonormal basis – Quadratic forms.

Section-III – Differential equations:

Order and degree of a differential equation – Formation of a differential equation – Differential equations of first order and first degree – Linear differential equations with constant and variable coefficients – Total differential equations.

Formation of partial differential equations – Equations of first order – Charpit's methods.

Section-IV – Geometry:

General equation of second degree in two variables – Tracing of conics.

Plane, straight lines in space – sphere – Cone.

Curves in space – curvature – Torsion – Serret – Frenet formulae.

The candidate has to answer 10 questions choosing atleast TWO questions from each of the Sections 1 to IV. FOUR questions will be given from each of the Sections I,II and III and EIGHT questions will be given from Section IV with two questions from the four topics given in that section.

Section-I – Real Analysis:

Real number system \mathbb{R} – Open and closed sets in \mathbb{R} - Compact sets – sequences in \mathbb{R} and their convergence – Series of real numbers – Tests of convergence – absolute and conditional convergence – rearrangements of series.

Limits and continuity of a real valued function properties of continuous functions – Differentiation – Mean value theorems – Applications.

Riemann integration – conditions for Riemann integrability – improper integrals.

Section-II – Complex Analysis:

Complex numbers and their geometric representation – limits and continuity of functions of a Complex variable – Analytic functions – Cauchy Riemann equations – Complex integration – Cauchy's theorem – Cauchy's integral formula – Power series – Taylor's and Laurent's series – Types of singularities – Calculus of residues and application to evaluation of definite integrals.

Section-III – Vector calculus:

Differentiation of a vector valued function – Gradient of a scalar function – Divergence and curl of a vector function in Cartesian and polar coordinates.

Green's theorem – Gauss and Stoke's theorems and their applications to evaluation of double and triple integrals.

Section-IV:

- m) Transform Calculus: Laplace Transforms – Inverse Laplace transforms – solving differential equations using Laplace transforms. Fourier and Hankel transforms.
- n) Numerical Analysis: transcendental and Polynomial equations – Regula Falsi method – Newton Raphson method Interpolation – numerical differentiation – numerical intergration – Runga Kutta method.
- o) Number Theory: Fundamental theorem of arithmetic – congruences and their applications – Fermat's and Wilson's theorems – solution of linear congruences – Chinese remainder theorem.
- p) Linear Programming: Formation of linear programming problem – Graphical solution – Dual problem – simplex method – Transportation problem.

5. PHYSICS

(Mechanics and relativity, Waves and Oscillations, Thermal Physics, Optics)

1. Mechanics and Relativity:

Newtons laws of motion, force and potential energy, conservative force. Conservation laws – collisions – impact parameter, scattering cross-section Laboratory and Centre of mass reference frames. Transformations between them. Rutherford scatterering. Motion of a rocket. Rigid body dynamics – Moment of inertia of simple regular bodies, rotating frames of reference – coriolis force. Angular momentum, torque, precession of a top, gyroscope. Central forces – motion under inverse square law – gravitational force, Kepler's laws. Motion of satellites. Motion of fluids – streamline and turbulent flow. Bernoulli's equation with simple applications – Reynolds number.

Galelean relativity, special theory of relativity – Time duration and length contraction Michelson – Morley experiment, Lorentz transformations, addition of velocities, variation of mass with velocity – mass energy equivalence.

2. Waves and Oscillations:

Oscillations, Simple harmonic motion, progressive and stationary waves. Damped harmonic Oscillator, Forced oscillations and resonance. Wave equation, harmonic solutions. Plane and spherical waves, superposition of waves and beats, phase velocity, group velocity, Doppler effect.

3. Thermal Physics:

Laws of thermodynamics, carnot's cycle. Isothermal and adiabatic processes. Thermodynamic potentials, Maxwells relations. Claussius – clapeyrons equation joule – Thomson effect. Kinetic theory of gases. Maxwell's velocity distribution, equipartion theorem, specific heat of gases. Mean free path. Brownian motion, specific heat of solids – Einstein and Debye's theories. Black body radiation Wien's, Rayleigh-jeans and plancks laws. Solar constant, Sahas theory of thermal ionization – stellar spectra, production of low temperature – adiabatic demagnetization – negative temperature. Vander waals equation, critical constants.

4. Optics:

Huygens principle interference, young's experiment interference in thin films, Newton's rings. Michelson's interferometer. Diffraction – Fresnel and Fraunhofer diffraction. Diffraction by straight edge, circular and rectangular apperture, single and double slits, plane grating, Dispersive power Resolving power, Rayleighs criterion. X-ray diffraction and Bragg's law. Polarisation – Plane, Polarisation by reflection, circular, elleptic polarisation, double refraction, Nicol prism, quarter and half wave plates. Laser principle – spontaneous and stimulated emission of Radiation. He-Ne, Ruby and semiconductor diode lasers. Coherence. Diffraction as Fourier transformation. Holography and applications.

(Electricity & Magnetism, Modern Physics and Electornics)

1. Electricity and Magnetism:

Coulomb's Law, Electric field, Gauss's Law, electric potential. Poissons and Laplace equations and solutions for homogeneous dielectric, uncharged conducting sphere in a uniform field, point charge and infinite conducting plane. Magnetic shell, magnetic induction and field strength Biot savarts law and applications. Electromagnetic induction, Faradays and Lenz's laws. Self and mutual inductance, induction coil and transformer.

Alternating currents L-R, C-R, L-C-R circuits. Series and parallel resonance, Q-factor. Electromagnetic waves – Maxwells equations. Transverse nature of e-m waves, pointing vector.

Magnetic materials – Dia, para, ferro, antiferro and ferri magnetism (Qualitative features only). Langevin's theory of paramagnetism, Weiss theory of ferromagnetism. Ferro magnetic Domains Hysterisis, Nuclear magnetism. Dielectric materials – Capacitative with dielectric material as medium; electric polarisation; electronic, ionic, electric polarisabilities and their variations with temperature.

2. Modern Physics:

Bohr's model, sommerfeld extension. Explanation of atomic spectra. Stern-Gerlach experiment, space quantization, electron spin, vector atom model, spectral terms, fine structure of spectral lines. J-J and L-S coupling schemes. Pauli's exclusion principle, spectral terms of two equivalent and non-equivalent electrons, Zeeman, Paschenback effects, Stark effect. Characteristic X-rays, Moseley's Law. Gross and fine structure of Band spectra, Raman effect.

Black body radiation, Wien, Rayleigh Jeans and Planck's Laws of radiation. Photo electric effect and Einstein's Explanation, Compton effect, de Broglie hypothesis. Wave-particle duality, uncertainty principle, Schrodinger equation, eigen functions and eigen values. Physical meaning of eigen function, Solution of Schrodinger equation for 1) particle in a box 2) potential step 3) harmonic oscillator 4) hydrogen atom.

Radioactivity – alpha, beta and gamma rays, Gammow's theory of alpha decay. Laws of radioactivity. Radioactive equilibrium. Artificial radioactivity – Rutherford's experiment, discovery of Neutron. Mass spectrometers. Nuclear binding energy, semi-empirical mass formula. Nuclear fission, nuclear reactors. Nuclear fusion, fusion cycles. Elementary particles and their classification. Strong, Weak and electromagnetic interactions. Particle accelerators – Cyclotron and linear accelerators. Basic experimental ideas of superconductivity.

3. Electronics:

Band theory of solids – Conductors, insulators and semi conductors. Intrinsic and extrinsic semi conductors; p-n junction diode, forward and reverse bias. Diode as a rectifier. Transistor – different configurations of transistor, Transistor parameter amplifier. Transistor oscillator. Modulation and detection. Transistor receiver. Basic principle of television. Digital principles – Logic gates – AND, OR NOT, XOR gates – truth tables.

6. ZOOLOGY

(Non-Chordata, Chordata, ethology & Biostatistics)

Protozoa:

General Organisation and Classification; Locomotory organelles; Pathogenic protozoa of human importance (i.e.)

Trypanosoma, Leishmania, Entamoeba, Histolytica, Giardia, Malarial Parasites.

Porifera:

Various types of canal system, Histological structure and their functions; Reproduction and development of sponges, systematic position and affinities of sponges; development of spicules.

Coelenterata:

General Organisation and Classification; Auriclia; Coral reef formation in Actinozoa, general organisation and phylogenetic relationship of ctenophore, polymorphism in Hydrozoa.

Platyhelminthes:

General Organisation and Classification; Planaria; Fasciola; Taenia, general outline of the life cycle of parasites of human importance, Host-parasitic interactions.

Nemathelminthis:

Parasitic Nematodes of human importance i.e., Ascaris, Oxyuris, Anncylostoma, Strongyloides plant parasitic nematodes with specific examples.

Annelia:

General Organisation and Classification; Neriais; Leech; types of Nephridia, Coelome and Coelomoducts; Regeneration in Polychaetes, affinities, Trochophore larva.

Arthropoda:

Outline classification (up to orders) palaemon; scorpion; Insect mouth parts, respiration, metamorphosis, social use in insects, harmful and useful insects and economic importance, vectors- flies, lice, bugs, ticks and mosquitoes; Structure and systematic position of onychophora.

Mollusca:

Classification, Unio; pilla; torsion and detorsion, Distinctive features of Cephalopoda; pearl formation in Mollusea.

Chinoderamata:

Classification; star fish; water vascular system, larval forms and their revolutionary significance.

Hermichodata:

General organisation; systematic position and affinities of Balanoglossus.

Chordata:

Origin of Chordates, general organisation, Ascdian and classification of Urochordata, Sessile and Pelagic turnicates, Mucous and mode of feeding, affinities, Retrogressive metamorphosis.

General organisation of Cephalochordata; Branchiostoma.

Introduction to Agnatha. General Organisation and classification of Cyclostomata; affinities. General introduction of Craniata, Dog fish; any Bony fish.

Systematic position and significance of coelocanthini, Dipnoi, the conquest of land, origin and evolution of Amphibia and classification; Anatomical peculiarities and affinities of Urodele and parental care in Amphibia.

Reptiles:

Origin of reptiles general organisation of Chelonia, squamata, Rhynchocephalia and Crocodilia. Fossil Reptiles, poisonous and non-poisonous snakes of India.

Birds:

Origin and evolution of birds, migration of birds, adaption for flight, economic importance of birds.

Mammals:

Prototheria, Metatheria and Eutheria, phylogenetic relations of prototheria & Methatheria, adaptive radiations in marsupials, Aquatic and aerial adaptations in mammals, Oestrous cycle and Placentation in mammals, distinctive features of Primates.

Comparative account of various systems of vertebrates.

Ethology:

Introduction and History of ethology, Ethology Vs behaviourism; Instinct Vs learning, Communication by means of Pheromon Domec language of honey bees Forging and predation; Defensive secretions in insects. Social behaviour in insects.

Biostatistics:

Methods of sampling, frequency distribution and Measures of central tendency; Standard deviation, Standard error; correlation and regression and T-test, F-test, X 2 test.

(Cell Biology, Physiology, Genetics, Embryology, Histology, Evolution, Ecology and Zoogeography)

Cell Biology:

Prokaryotic and Eukaryotic cells, cell membrane, Endoplasmic reticulum, Golgi Complex, Lysosomes, Mitochondrion, Microsome, Peroxisomes, Nucleus, Nucleolus, Centrioles, Cilia, Flagella, Microtubules, Chemical components and molecular models of cell membrane. Passive active and ionic transport. Transport proteins, carrier and fixed pore mechanism cell coat and cell recognition. Cell surface receptors and mechanism of signal transduction (Steroid, Cyclic AMP and Ca^{+2}). Ultra structure of a muscle and nerve fibre, ultra structure and chemical composition of a chromosome, hetero and euchromatin, polytene and lambrush chromosomes, chromosomal aberration and variation cell cycle and chemical events of cell cycle, cell division mitosis & meiosis, cancerous cells and lymphocytes.

Physiology:

Nutritional types, Essential nutrients, types of food, vitamins, minerals, balanced diet. Digestion and absorption. Endocrine regulation of gastro intestinal movements and secretions. Breathing movements, Respiratory pigments and transport of respiratory gases, Muscle contraction – Muscle proteins and theories of muscle contraction. Nerve impulse – Propagation and mechanism of synaptic transmission. Electrical and chemical theories and neurotransmitters. Physiology of vision, auditing, olfaction and taste. Excretion – Formation of nitrogenous excretory products. Osmoregulation in fresh water, marine water and terrestrial animals. Cellular metabolism – Carbohydrate and protein metabolism. Enumeration of endocrine glands and their hormones, chemical nature and mechanism of action of hormones.

Genetics:

Principles of mendelian inheritance (mono, di and tri hybrid ratios) phenomenon of linkage and chromosome mapping, sex linkage, crossing over, sex determination and genic balance, extra chromosomal inheritance, concept of multiple alleles, blood groups and RH factors; Inborn errors metabolism, one gene one polypeptide hypothesis, structure and chemistry of DNA and RNA, point mutation, genetic code and protein synthesis. Eugenics; Gene cloning, genetic engineering, gene transfer and immunogenetics.

Embryology:

Gametogenesis; Fertilization, Cleavage, Gastrulation, extra embryonic membranes placenta, organogenesis of central nervous system, heart, kidney, Regeneration, Carcinogenic development.

Histology:

Histology of Blood, lymphoid tissues, cartilage, bone, skin, stomach, intestine, liver, pancreas, lung, kidney, testis and ovary of chordates.

Evolution:

Prebiotic and early evolutions in primordial atmosphere origin of life concept of organic evolution. Lamarckism, Darwinism and Deveries theory, modern concept of recapitulation hypothesis, Homology and Analogy, paleontological evidence and evolution, Dating of fossils, Ancestry of man, Neo-Lamarckism and Neo-Darwinism, Isolating mechanism. Reproductive isolation, speciation, Mutation, Genetic drift, Gene frequencies and basic concept of Hard Weinberg law.

Ecology:

Introduction of ecology, the scope of ecology, factors of the environment in relation to the organism, heat, light, mechanical factors oxygen and carbon dioxide, inorganic salts and biotic factors, the concept of an ecosystem fresh water, marine and terrestrial ecosystem, energy flow in eco-system, energy fixation by autotrophs, Food chains and Food Web, Biogeochemical cycles, Water cycle, carbon cycle, general features of community, Nitrogen cycle, population attributes, definition and size communities, ecological succession, pollution, ecology in relation to man.

Zoogeography:

General principles of animal distribution, Barriers, continuous and discontinuous, continental drift, zoogeographic realms, Insular, fauna, wildlife protection, mimicry and colouration.

7. CIVIL ENGINEERING

Note: Candidates shall have the option to answer questions from any two parts.

Section (A): Strength of Materials, Theory of Structures and Designs.

- f) Strength of materials: Simple stresses and strains, principal stresses and strains, shear force and bending moment of beams, Derivation of $M/I = f_b / y = E/R$, Deflection of beams, Direct and bending stresses, torsion of circular shafts, columns and struts.
- g) Theory of structures: Castigliano's I and II theorems, slope deflection, moment distribution and Kani's methods of analysis applied for indeterminate beams and rigid frames.
Rolling loads: Propositions for the maximum bending moment at any given section and under any given load, Equivalent uniformly distributed load, influence line for uniformly distributed load shorter than span for maximum bending moment and shear force, Maximum bending moment for series of point loads travelling the girder, Influence lines for tresses.
Arches: Three hinged and two hinged parabolic arches influence lines for three hinged arches.
- h) Steel structures: Design of simple, compound beams and laced and batened columns. Design of column bases and footings, Design of highway and railway bridges through and deck type plate girders, warren girders and pratt truss.
- i) Limit state method: Design of singly, doubly reinforced and T-beams, Design of lintel one way and two way slab, Design of long and short columns, design of rectangular and combined footings.
- j) Pre-stressing concrete: Methods of pre-stressing, pre-tensioned and post-tensioned numbers, analysis and design of sections for flexures, losses in pre-stressing.

Section (B) Soil Mechanics and Foundation Engineering

- f) Soil Mechanics: Definitions and relationships, particle size distribution, Atterburg limits, Permeability and permeability tests, Seepage pressure, quick sand condition, Laplace equation, Flow net, construction, properties, uses and applications.
- g) One dimensional consolidation, co-efficient of compressibility consolidation settlement, pre-consolidation pressure, one dimensional consolidation equation, consolidation test, compaction, Field compaction method, proctor's and modified compaction test, field compaction control, factors affecting compaction.
- h) Shear strength, Moher's Coulomb failure theory, effective stress, Direct shear test, Triaxial compression test and vane shear test, Rankine's theory of active and passive earth, pressures, Retaining walls, Horizontal and sloping back fill, Coulomb's Wedge theory and Rohban's construction.
- i) Infinite and finite slopes, Swedish circle method, Friction circle method, Taylor's Stability number, Bearing capacity, definations, Terzaghi's analysis for shallow footing, general and local shear failure, Terzaghi's semi empirical equations for square and circular footings, effect of water table on bearing capacity.
- j) Types of selection of footing, Raft, pile and floating foundations, settlement, computation for immediate and consolidation settlement, Boussarlugy equation for stress under point load and uniformly distributed load, pressure bulb, vertical pressure under uniformly distributed load on circular area, New mark influence chart.

Section (C) Fluid Mechanics:

Fluid properties, Fluid Statics – Forces on flat plate and curved surfaces.

Kinematics and Dynamics of Fluid flow, stream lines, equation of continuity, stream function and velocity potential function, flow nets, types of flows.

Euler's equation of motion, Energy and Momentum equations and their applications to pipe flow, free and forced vertices, venturimeters, and Notches & Weirs.

Laminar flow through circular tubes, Reynold's experiments, Flow through pipes, hydraulic gradient and total energy lines, pipes in series and parallel, syphom, Minor losses in pipes.

Open channel Flow, uniform and non-uniform flows, best hydraulic sections, specific energy and critical depth, Rapidly varied flow – hydraulic jump and its applications, Gradually varied flow – differential equations, classification of surface profiles.

Boundary layers – development of b.L. flow, laminar and turbulent boundary layers, laminar sub-layer, smooth and rough boundaries, drag and lift.

Dimensional analysis and similitude: Types of similarities, model studies, undistorted and distorted models, Buckingham II-theorem – applications.

Section (D): Computer Programming:

Type of computers – components of computer, historical development of computing systems. Different languages, Flow charts.

Fortran/Basic programming, constants & Variables, expressions, arithmetic statements, library functions.

Control statements, GO TO statements – Un conditional and computed, IF statements, DO statements.

Subroutines and Function sub-programmes – Arguments, CALL statement RETURN statement, Declaration statements.

Input and output statements, and Quoted Formats, FORMAT statements, Field specification, Stop and END statements.

Subscripted Variables, Arrays, DIMENSION statement, Simple applications of computer programming in civil engineering.

Note: A candidate shall answer questions from any two parts.

PART–A: Building Materials, Construction and Surveying:

Building materials: Timber, stones, bricks, sand, limes, cement, paints, varnishes and damp proofing material.

Brick work for walls, types of brick bonds, design of brick masonry walls as per IS code, detailing of walls, floors, roofs, ceilings, stair cases, doors and windows, finishing of buildings – plastering, pointing and painting – IS codes.

Use of Ferro cement, fiber – reinforced and polymer concrete in construction, building estimates and specifications.

Construction Scheduling, PERT and CPM methods.

General surveying – chain and compass survey, plane table survey – in combination with one another.

Levelling and contouring:- Fly levelling, reciprocal levelling, net levels, Reduction of levels, curvature and refraction corrections, characteristics of contours – estimation of earth work.

Theodolite survey: Temporary and Permanent adjustments, Traverse survey, computation of areas by co-ordinate system, theory of simple circular curve by linear and instrumental methods.

Tachometry: Stadia wires, Fixed and mobile wires, Tachometric tables, tachometric alidade, Reduction by calculations.

PART–B: Water resources and Irrigation Engineering:

Hydrology: Hydrologic cycle, precipitation, evaporation, transpiration, infiltration. Run-off hydrograph, unit hydrograph, flood estimation frequency analysis.

Ground Water: Ground water resources, specific yield, storage coefficient of permeability, confined and unconfined aquifers, radial flow into a well under confined and unconfined conditions, recuperation tests.

Water Resources Planning: Single and multipurpose projects, storage capacity, zones of storage, reservoir losses, reservoir sedimentation, flood routing through reservoirs, economics of water resources projects.

Water Requirement of Crops: Consumptive use of water, Duty and Delta, frequency of irrigation, efficiency of irrigation, Irrigation methods.

Storage Works: Types of Dams and their characteristics, Gravity dams principles of design, criteria for stability, control of seepage, Earth dams – Design principles, spillways – types and their suitability, energy dissipation, crest gates.

Canals: Alignment of canals types of canals, design of unlined canals Lacey's regime theory, cross masonry works – canal falls, Cross Drainage works – Aqueducts and super passages.

Diversion Works: Components of Diversion scheme, Weirs on permeable foundations – Bligh's and Khosla's theories – Design principles.

PART–C: Environmental Engineering:

f) Water Supply: Protected Water Supply Scheme, Rate of demand, Population forecast, Analysis of water, Hydrogen-ion concentration, Sedimentation, Coagulation Chlorination, Methods of disinfection, Break point chlorination, Slow sand, Rapid sand and Pressure filters.

g) Hardness of Water: Removal of temporary and permanent hardness, Distribution systems of water, pipe appurtenances, Analysis of distribution system using Hardy cross method, general principle of optimal design based on cost and head loss ratio criterion, Maintenances of distribution systems, pumping station and their operation.

- h) Sanitary Engineering: Methods of carrying refuses, systems of swarage, Sewers of different materials and shapes, self cleansing velocity, purification of natural streams, empirical formulae used in the design of sewers, deep man holes and their location, Automatic flushing tank, Different types of traps and classification.
- i) Quality of Sewage: Primary treatment to sewage, carbon cycle, B.O.D., C.O.D., and dissolved oxygen, Grit chamber, Detritus tank, skimming tank, sludge digestion process, contact beds, septic tank, imhoff tank, Activated sludge process, sludge volume index.
- j) Sources, effects and remedial measures of water, Air and Noise pollutions, particulate and Dust collection devices like internal separators, wet collection devices and electrostatic precipitators.

PART–D: Transportation Engineering:

- f) Road development in India, Road planning, High way alignments, width of pavement, camber, types of gradient, Resistance to traction, sight distances, Super elevation and centrifugal ratio, circular, compound, vertical, reverse and transition curves.
- g) Types of Road: Water Bound Macadam Road, Bituminous and cement concrete Roads, Flexible and rigid pavements, types of study for traffic, Road parking, Road accidents and traffic regulation, inter sections and rotary.
- h) Permanent Ways: Rails, creep of rails, blast, sleepers, Fastings and Fixtures, Gauges, Trunouts, Crossings, Types of crossings, Railway track, drainage, Maintenance of track components, Traffic signals.
- i) Station yards and Machinery, station buildings, Platform sidings, turn tables, signal and inter locking, level crossing and necessary precautions.
- j) Development of Air Port: Take off and landing distances, characteristics of jet air craft, selection of site for air port, Survey for selection of site, Wind rose diagram, Run way width, length and design criteria, standard for general aviation.

8. ELECTRICAL ENGINEERING

I. Electrical Circuits:

Basic electrical laws, Analysis of DC networks, transient response of RLC networks excited by impulse, step, ramp and sinusoidal excitations. Transform methods, transfer functions, poles and zeros steady state AC networks, frequency domain analysis, resonance, coupled circuits, two port networks, three phase networks, power in a.c. networks, power measurement in 3-phase networks.

II. E.M. Theory :

Electro static and electro magnetic fields, vector methods, Fields in dielectric, conducting and magnetic materials, Laplace and Poisson's equation. Time varying fields, Maxwell's equation, Poynting Theory, properties of transmission lines.

III. Electrical measurement and Instruments:

Electrical standards, Error analysis, Measurement of current, voltage, power, energy, power factor, resistance, inductance capacitance frequency and loss angle. Indicating instruments, extension of range of instruments, DC and AC bridges. Electronic measuring instruments. Electronic multimeter, CRO, frequency counter, digital voltmeter, transducers, Thermocouples, Thermistor, LVDT, strain gauges, Piezo electric crystal, Measurement of non-electrical quantities like, pressure, velocity, temperature, flow rate, displacement acceleration and strain.

IV. Control Systems

Open and closed loop control systems, Mathematical modeling, block diagram, signal flow graphs, time response and frequency response of linear systems, error constants and series Rootlocus technique, Bodeplot, polar plot, M-circles, N-circles, Nichol's charts, stability, Routh Hurwitz criteria. Nyquist stability criteria, compensators, design in frequency domain. Control system components. Servo motors, synchros, tacho generator, error detector. State variable approach, modeling, state transition matrix, transfer function, response.

V. Electronics:

Solid state devices and circuits. Small and large signal-amplifiers with and without feedback at audio and radio frequency, multistage amplifiers. Operational amplifiers and applications. Integrated circuits oscillators, RC, LC and crystal oscillators wave form generators, multi-vibrators – Digital circuits, Logic gates, Boolean algebra combinational and sequential circuits. A to D and D to A converters Micro processors (8085) instruction set, memories, interfacing programmable peripheral

devices – Number system flow charts – expressions and statements in C – language – simple programs for engineering application.

I. D.C. ELECTRICAL MACHINES :

Fundamentals of electro mechanical energy conversion, constructional features of D.C. Machines, emf equation types and characteristics of generators application, Torque in DC motor, types of DC motors, applications. Testing of D.C. motors, efficiency, and starting and speed control.

II. TRANSFORMERS:

Construction – Principle of operation of 1-phase transformers – Vector diagram on No Load and – Load – Parallel operation – Regulation – efficiency – Equivalent circuit 3 phase transformer connections – Scott connection.

III. INDUCTION MOTORS:

Production of rotating magnetic field, production of torque types of motors equivalent circuits, Circle diagram, torque slip characteristics, starting and maximum torque, speed control, principle of single phase induction motors, Applications.

IV. SYNCHRONOUS MACHINES :

Generation of emf in 3 phase AC Generator, Armature reaction, regulation by Synchronous impedance and Ampere turn methods, parallel operation, transient and sub-transient reactances, theory of salient pole machines.

Synchronous Motor: Torque production, performance characteristics, methods of starting, V-Curves, synchronous condenser.

Special Machines: Stepper motor, Methods of operation, Amplidyne and metadyne-applications.

V. ELECTRICAL POWER GENERATION:

General layout – Types of power stations, economics of different types, base load and peak load stations, load factor and its effects, pumped storage schemes.

VI. POWER TRANSMISSION :

Calculation of line parameters, concepts of short, medium and long transmission lines, ABCD parameters, insulators, Corona, P.U. quantities, fault calculations, symmetrical components load flow analysis using Gauss Seidal, New-ton Raphson, methods, economic operation, stability, steady state and transient stability, equal area criterion, ALFC and AVR control for real time operation of interconnected systems.

VII. POWER SYSTEM PROTECTION :

Principles of arc quenching, circuit breaker classification, Recovery and restriking voltages, relaying principles over current, directional over current relays-generator and transformer protection using differential relays-line protection using distance relays Surge phenomena in transmission lines – Travelling wave theory, protection against surges.

VIII. UTILISATION :

Industrial Drives – Motors for various drives – Braking methods – Speed control of motors – Economics of rail traction – Mechanics of train movement – Estimation of power and energy requirements – Illumination – Laws Factory lighting – Street lighting – Induction and dielectric heating.

9. ELECTRONICS & TELECOMMUNICATIONS

A) Computer Programming: Number systems, Binary, Octal, Hexadecimal, Decimal and their conversions, fixed and floating point representation of numbers; concept of flow charts and Algorithms, Control and Decision Statements, Loops, Subroutines.

E) Network Theory: Kircheff's Laws, Node and Loop analysis, Ideal sources, Network Theorems, Thevinin's, Norton's Reciprocity, Superposition and Max. Power Transfer Theorems, Applications to simple R.L.C. Networks.

Linear time invariant circuits, Integro differential equations equations in RLC networks, Initial conditions for inductors and capacitors, Response of networks to step, impulse, sinusoidal and

exponential excitations, steady state analysis, Vector representation, series and parallel resonance, Quality factor and bandwidth.

Problems with initial conditions and switches, zero input and zero state response, Time constants for RC and RL networks.

F) Network solutions using Laplace Transform Techniques, complex frequency, properties of Laplace Transforms, initial and final value theorems, Laplace Transforms of periodic signals, Inverse Laplace Transform.

Fourier series, Exponential and Trigonometric Fourier series, Fourier Transforms, Properties, Parseval's Theorem.

Convolution integral, Response to arbitrary excitation, Graphical representation of convolution integral.

Two port network parameters, Z, Y, Z ABCD parameters, applications to Network Analysis, Interconnection of two port networks, series parallel and cascade connections.

Network Functions, Driving point and Transfer functions, properties, Time domain response from pole zero plot. Complex frequency(s) plane.

Characteristic impedance, image impedance, image transfer constant, insertion loss.

G) Semi Conductor Devices:

PN Junction, NPN and PNP transistors, small signal model determination of h-parameters, Analysis using h-parameters, CE, CB and CC configurations, Transistor biasing circuits, Transistor as a switch.

Field effect Transistor, JFET, MOSFET, Cathode Ray Oscilloscope and applications.

Transistor as amplifier, Gain Bandwidth, Three amplifier configurations, Multi stage amplifiers.

Operational amplifiers, principles, characteristics, Comparator, Integrator, Differentiator, Summing, Adder, Subtractor, log amplifier.

G) **Electromagnetic theory :**

Coulomb's Law, Gauss's Law, Electric field due to charge, Electric flux density, Poisson's and Laplace's equations, Energy and potential, conductors, Dielectric, Boundary conditions.

Biot Savart's Law, Amper's Law, Stokes Theorem, Faraday's Law.

Maxwell's equations, interrelation, uniform plane wave, wave motion in free space, pointing vector.

H) **Pulse and Digital Circuits :**

Wave shaping, RC RL circuits, Non-linear diode wave shaping circuits, diode clamping.

Multivibrator circuits, Astable, Monostable Schmitt Trigger Circuits, Blocking Oscillator.

Sweep Generator, Bootstrap and Miller Voltage Sweep Circuits, Linear current sweeps.

Logic Circuits : AND, OR, NOT, NAND and NOR gate circuits, DTL, TTL, MOS, CMOS, NAND, NOR circuits, realization of various flip flops.

Square wave generator, pulse generator.

I) **Communication Systems:**

Modulation techniques, Amplitude Modulation, generation and demodulation, DSB Waves.

Phase and Frequency modulation, narrow band and wide band FM, transmission bandwidth, generation and demodulation of FM Waves.

Pulse Modulation, Sampling, TDM, PPM, PCM, Characteristics of ASK, FSK, PSK, Signals.

AM and FM Transmitters and Receiver circuits, communication receivers, SSB transmitters and receivers, super heterodyne receivers, IF, AGC, tracking and alignment, receiver measurements.

J) **Control Systems:**

Open loop and closed loop systems, signal flow graphs, Transfer functions and impulse response.

Routh Hurwitz criterion for stability, Root locus, techniques, effect of location of roots in system response.

Frequency Response Plots, Bode Plots, Nyquist criterion for stability. Gain and phase margin, Compensation, using Bode Plots, Lag and Lead compensation.

Effect of feed back, sensitivity. Control system components; potentiometers, servomotors, synchros, error-sensing devices.

K) Transmission Lines & Antennas:

Reflection of E.M. Waves, standing waves, transmission line equations, Input impedance, reflection coefficient, VSWR, properties of $\lambda/4$, $\lambda/2$ lines, short-circuited stubs, impedance matching.

Principle of radiation, Vector potential, Linear Arrays, Broad Side and End fire Array, multiplication of Antenna patterns.

Antenna characteristics – Gain, radiation pattern, side lobe level directivity.

L) Microwaves:

Propagation of E.W. Waves through parallel plate and rectangular, circular wave guides, T.E., T.M., modes cavity, Resonators, Resonant frequency and quality factors.

Microwave Tubes, Klystron Amplifier, Reflex, Klystron, Magnetron, Travelling wave Tube.

Microwave components – Directional couplers, circulators, isolators, Ferrite Components.

Microwave Measurements – VSWR, Impedance and Reflection measurements, slotted line techniques.

10. MECHANICAL ENGINEERING

Theory of Machines

Constrained motion, plane mechanisms, velocity and acceleration analyses, instantaneous centre, flywheels and their applications, balancing of reciprocating and rotating masses, planar cams and followers, tooth profiles, types of gears, fixed axis and planetary gear, drives principles of gyroscope vibration of free and forced one degree of freedom systems with and without damping, transmissibility and vibration isolation, critical speed of shaft.

Mechanics of solids

Stress and strain in two dimensions, Mohr's circle, theories of failure. Bending moment and shear force diagrams. Deflection of simple beams, Buckling of columns, torsion in shafts, thin and thick cylinders, shrink fit and thermal stresses.

Machine design

Material and manufacturing considerations in design, design for static and dynamic loading, fatigue strength, stress concentration, factor of safety, design of bolted riveted and welded joints, power screws, helical springs, hydrodynamic lubrication and journal bearing, rolling element bearings, design of spur gears, design of shifts, keys and couplings, clutches and brakes, belt and rope drives.

Manufacturing process

Classification of manufacturing process. Casting casting defects, investment casting, die casting, centrifugal and continuous casting. Metal forming: hot and cold working. Unconventional machining and forming methods. Powder metallurgy. Welding. Jigs and fixtures, gauges and comparators. Metal cutting: Mechanics of orthogonal cutting, machinability, economics of machining, chip formation, forces, power and surface finish in turning, milling and shaping operations. Grinding, wheel wear mechanism in grinding.

Metallurgy and Material Science

Phase diagram of Binary alloys, Iron-Iron Carbide diagram. Construction and Interpretation of T.T.T. curve for steels. Case hardening, Age hardening. Alloy steels. Mechanism of fatigue and creep. Types of failures Diffusion.

Production management

Production planning and control, Forecasting assembly line balancing Product, development. Production control charts. Break-even-analysis, PERT and CPM. Control operations: Inventory control – ABC analysis, EOQ model. MRP-II, JIT work study, value engineering. Linear programming, graphical and simplex methods and queuing (Single server, Poisson Queue) theory. Maintenance engineering Quality assurance control charts for variables and attributes.

Thermodynamics

Reversible and irreversible processes. Thermodynamic systems. Applications of First and Second law of thermodynamics. Concept of entropy. Availability and unavailable energies.

Tds relations, Properties of pure substances.

I.C. Engines. Fuels and Combustion

Thermodynamic analysis of cycles. SI and CI engines. 4 stroke and 2 stroke engines. Performance testing and heat balance of IC engines. Detonation and knocking phenomena in I.C. engines. Carburetion and fuel injection systems. Engine emissions and control.

Heat Transfer, Refrigeration and Air Conditioning.

Modes of heat transfer, One dimensional steady and unsteady conduction, Heat transfer with fins, Convective heat transfer, Forced Convection over flat plate and through tubes, Free Convection over vertical flat plate and cylinders, Radiative heat transfer – Black and Gray surfaces, Shape factors. Heat Exchanger performance – LMTD and NTU method.

Refrigeration cycles and systems. Vapour compression, Vapourabsorption and Air Refrigeration systems. COP of a Refrigerator. Condensers, Evaporators and Expansion devices and Controls.

Psychrometry and Psychrometric processes. Comfort conditions. Estimation of cooling and heating load.

Fluid mechanics and turbomachinery

Continuity, Momentum and Energy equations. Adiabatic and isentropic flow. Flow through turbo machinery passages. Classification of turbo machines. Fans, Blowers and Compressors. Axial and Centrifugal machines. Steam and Gas Turbines. Pumps and Hydraulic Turbines. Model tests. Work done and Efficiencies. Specific speed.

Energy Systems

Types of Power plants. Thermal, Hydro, Nuclear and gas Turbine Power plants. Layout and Selection of a Power plant. Power plant Economics. Cost of electrical energy. Importance of Renewable Energy sources. Solar, Wind, Bio-mass and Ocean Energy Technologies, Solar thermal and Solar photovoltaic power generation.

SCHEME

Part-A: Written (Objective type) Examination				
Paper-1	General Studies	150 Marks	150 Questions	150 Minutes
Paper-2	Subject (Chemical OR Industrial OR Mechanical Engg. OR Electrical Engg.)	300 Marks	150 Questions	150 Minutes
Part-B: Oral Test (Interview)		50 Marks		

SYLLABUS

PAPER-1 GENERAL STUDIES

1. SCIENCE AND TECHNOLOGY:
k) General Science and Technology
l) Role and impact of science and Technology on India's development.
(Questions will cover general appreciation and understanding of matters of everyday observation and experience as may be expected of a well-educated person who has not made a special study of science and technology disciplines).
2. INDIAN HISTORY AND CULTURE:
u) Modern Indian History from 19th century to the present
v) Nationalist Movement and Constitutional development
w) Indian culture and Heritage including architecture, Fine Arts, dance forms, music, paintings, Folk arts and performing arts.
x) History of Andhradesa Society, Culture, Geography and Economic development.
3. INDIAN POLITY:
General and broad understanding of the structural (institutions) and functional (processes) aspects of Indian Political system.
4. INDIAN ECONOMY AND GEOGRAPHY OF INDIA:
(a) Structure of National economy
(b) Economic development (including planning) since independence
(c) Economic Reforms
(d) Physical, economic and social Geography of India.
5. CURRENT EVENTS:
Current Events of Regional, National and International importance.
6. GENERAL MENTAL ABILITY: (Reasoning and analytical abilities)

PAPER-2 SUBJECT

1. ELECTRICAL ENGINEERING

I. Electrical Circuits:

Basic electrical laws, Analysis of DC networks, transient response of RLC networks excited by impulse, step, ramp and sinusoidal excitations. Transform methods, transfer functions, poles and zeros steady state AC networks, frequency domain analysis, resonance, coupled circuits, two port networks, three phase networks, power in a.c. networks, power measurement in 3-phase networks.

II. E.M. Theory :

Electro static and electro magnetic fields, vector methods, Fields in dielectric, conducting and magnetic materials, Laplace and Poisson's equation. Time varying fields, Maxwell's equation, Poynting Theory, properties of transmission lines.

III. Electrical measurement and Instruments:

Electrical standards, Error analysis, Measurement of current, voltage, power, energy, power factor, resistance, inductance capacitance frequency and loss angle. Indicating instruments, extension of range of instruments, DC and AC bridges. Electronic measuring instruments. Electronic multimeter, CRO, frequency counter, digital voltmeter, transducers, Thermocouples, Thermistor, LVDT, strain gauges, Piezo electric crystal, Measurement of non-electrical quantities like, pressure, velocity, temperature, flow rate, displacement acceleration and strain.

IV. Control Systems

Open and closed loop control systems, Mathematical modeling, block diagram, signal flow graphs, time response and frequency response of linear systems, error constants and series Rootlocus technique, Bodeplot, polar plot, M-circles, N-circles, Nichol's charts, stability, Routh Hurwitz criteria. Nyquist stability criteria, compensators, design in frequency domain. Control system components. Servo motors, synchros, tachogenerator, error detector. State variable approach, modeling, state transition matrix, transfer function, response.

V. Electronics:

Solid state devices and circuits. Small and large signal amplifiers with and without feedback at audio and radio frequency, multistage amplifiers. Operational amplifiers and applications. Integrated circuits oscillators, RC, LC and crystal oscillators wave form generators, multi-vibrators – Digital circuits, Logic gates, Boolean algebra combinational and sequential circuits. A to D and D to A converters Micro processors (8085) instruction set, memories, interfacing programmable peripheral devices – Number system flow charts – expressions and statements in C – language – simple programs for engineering application.

I. D.C. ELECTRICAL MACHINES :

Fundamentals of electro mechanical energy conversion, constructional features of D.C. Machines, emf equation types and characteristics of generators application, Torque in DC motor, types of DC motors, applications. Testing of D.C. motors, efficiency, and starting and speed control.

II. TRANSFORMERS:

Construction – Principle of operation of 1-phase transformers – Vector diagram on No Load and – Load – Parallel operation – Regulation – efficiency – Equivalent circuit 3 phase transformer connections – Scott connection.

III. INDUCTION MOTORS:

Production of rotating magnetic field, production of torque types of motors equivalent circuits, Circle diagram, torque slip characteristics, starting and maximum torque, speed control, principle of single phase induction motors, Applications.

IV. SYNCHRONOUS MACHINES :

Generation of emf in 3 phase AC Generator, Armature reaction, regulation by Synchronous impedance and Ampere turn methods, parallel operation, transient and sub-transient reactances, theory of salient pole machines.

Synchronous Motor: Torque production, performance characteristics, methods of starting, V-Curves, synchronous condenser.

Special Machines: Stepper motor, Methods of operation, Amplidyne and metadyne-applications.

V. ELECTRICAL POWER GENERATION:

General layout – Types of power stations, economics of different types, base load and peak load stations, load factor and its effects, pumped storage schemes.

VI. POWER TRANSMISSION :

Calculation of line parameters, concepts of short, medium and long transmission lines, ABCD parameters, insulators, Corona, P.U. quantities, fault calculations, symmetrical components load flow analysis using Gauss Seidal, Newton Raphson, methods, economic operation, stability, steady state and transient stability, equal area criterion, ALFC and AVR control for real time operation of interconnected systems.

VII. POWER SYSTEM PROTECTION :

Principles of arc quenching, circuit breaker classification, Recovery and restriking voltages, relaying principles over current, directional over current relays-generator and transformer protection using differential relays-line protection using distance relays Surge phenomena in transmission lines – Travelling wave theory, protection against surges.

VIII. UTILISATION :

Industrial Drives – Motors for various drives – Braking methods – Speed control of motors – Economics of rail traction – Mechanics of train movement – Estimation of power and energy requirements – Illumination – Lamps Factory lighting – Street lighting – Induction and dielectric heating.

2. ELECTRONICS & TELECOMMUNICATIONS

- B) Computer Programming: Number systems, Binary, Octal, Hexadecimal, Decimal and their conversions, fixed and floating point representation of numbers; concept of flow charts and Algorithms, Control and Decision Statements, Loops, Subroutines.
- H) Network Theory: Kirchoff's Laws, Node and Loop analysis, Ideal sources, Network Theorems, Thevenin's, Norton's Reciprocity, Superposition and Max. Power Transfer Theorems, Applications to simple R.L.C. Networks.
Linear time invariant circuits, Integro differential equations equations in RLC networks, Initial conditions for inductors and capacitors, Response of networks to step, impulse, sinusoidal and exponential excitations, steady state analysis, Vector representation, series and parallel resonance, Quality factor and bandwidth.
Problems with initial conditions and switches, zero input and zero state response, Time constants for RC and RL networks.
- I) Network solutions using Laplace Transform Techniques, complex frequency, properties of Laplace Transforms, initial and final value theorems, Laplace Transforms of periodic signals, Inverse Laplace Transform.
Fourier series, Exponential and Trigonometric Fourier series, Fourier Transforms, Properties, Parseval's Theorem.
Convolution integral, Response to arbitrary excitation, Graphical representation of convolution integral.
Two port network parameters, Z, Y, Z ABCD parameters, applications to Network Analysis, Interconnection of two port networks, series parallel and cascade connections.
Network Functions, Driving point and Transfer functions, properties, Time domain response from pole zero plot. Complex frequency(s) plane.
Characteristic impedance, image impedance, image transfer constant, insertion loss.
- J) Semi Conductor Devices:
PN Junction, NPN and PNP transistors, small signal model determination of h-parameters, Analysis using h-parameters, CE, CB and CC configurations, Transistor biasing circuits, Transistor as a switch.
Field effect Transistor, JFET, MOSFET, Cathode Ray Oscilloscope and applications.
Transistor as amplifier, Gain Bandwidth, Three amplifier configurations, Multi stage amplifiers.
Operational amplifiers, principles, characteristics, Comparator, Integrator, Differentiator, Summing, Adder, Subtractor, log amplifier.
- M) Electromagnetic theory :**
Coulomb's Law, Gauss's Law, Electric field due to charge, Electric flux density, Poisson's and Laplace's equations, Energy and potential, conductors, Dielectric, Boundary conditions.
Biot Savart's Law, Ampere's Law, Stokes Theorem, Faraday's Law.
Maxwell's equations, interrelation, uniform plane wave, wave motion in free space, pointing vector.
- N) Pulse and Digital Circuits :**
Wave shaping, RC RL circuits, Non-linear diode wave shaping circuits, diode clamping.
Multivibrator circuits, Astable, Monostable Schmitt Trigger Circuits, Blocking Oscillator.
Sweep Generator, Bootstrap and Miller Voltage Sweep Circuits, Linear current sweeps.
Logic Circuits : AND, OR, NOT, NAND and NOR gate circuits, DTL, TTL, MOS, CMOS, NAND, NOR circuits, realization of various flip flops.
Square wave generator, pulse generator.
- O) Communication Systems:**
Modulation techniques, Amplitude Modulation, generation and demodulation, DSB Waves.
Phase and Frequency modulation, narrow band and wide band FM, transmission bandwidth, generation and demodulation of FM Waves.
Pulse Modulation, Sampling, TDM, PPM, PCM, Characteristics of ASK, FSK, PSK, Signals.

AM and FM Transmitters and Receiver circuits, communication receivers, SSB transmitters and receivers, super heterodyne receivers, IF, AGC, tracking and alignment, receiver measurements.

P) Control Systems:

Open loop and closed loop systems, signal flow graphs, Transfer functions and impulse response.

Routh Hurwitz criterion for stability, Root locus, techniques, effect of location of roots in system response.

Frequency Response Plots, Bode Plots, Nyquist criterion for stability. Gain and phase margin, Compensation, using Bode Plots, Lag and Lead compensation.

Effect of feed back, sensitivity. Control system components; potentiometers, servomotors, synchros, error-sensing devices.

Q) Transmission Lines & Antennas:

Reflection of E.M. Waves, standing waves, transmission line equations, Input impedance, reflection coefficient, VSWR, properties of $\lambda/4$, $\lambda/2$ lines, short-circuited stubs, impedance matching.

Principle of radiation, Vector potential, Linear Arrays, Broad Side and End fire Array, multiplication of Antenna patterns.

Antenna characteristics – Gain, radiation pattern, side lobe level directivity.

R) Microwaves:

Propagation of E.M. Waves through parallel plate and rectangular, circular wave guides, T.E., T.M., modes cavity, Resonators, Resonant frequency and quality factors.

Microwave Tubes, Klystron Amplifier, Reflex, Klystron, Magnetron, Travelling wave Tube.

Microwave components – Directional couplers, circulators, isolators, Ferrite Components.

Microwave Measurements – VSWR, Impedance and Reflection measurements, slotted line techniques.

3. MECHANICAL ENGINEERING

Theory of Machines

Constrained motion, plane mechanisms, velocity and acceleration analyses, instantaneous centre, flywheels and their applications, balancing of reciprocating and rotating masses, planar cams and followers, tooth profiles, types of gears, fixed axis and planetary gear, drives principles of gyroscope vibration of free and forced one degree of freedom systems with and without damping, transmissibility and vibration isolation, critical speed of shaft.

Mechanics of solids

Stress and strain in two dimensions, Mohr's circle, theories of failure. Bending moment and shear force diagrams. Deflection of simple beams, Buckling of columns, torsion in shafts, thin and thick cylinders, shrink fit and thermal stresses.

Machine design

Material and manufacturing considerations in design, design for static and dynamic loading, fatigue strength, stress concentration, factor of safety, design of bolted riveted and welded joints, power screws, helical springs, hydrodynamic lubrication and journal bearing, rolling element bearings, design of spur gears, design of shafts, keys and couplings, clutches and brakes, belt and rope drives.

Manufacturing process

Classification of manufacturing process. Casting casting defects, investment casting, die casting, centrifugal and continuous casting. Metal forming: hot and cold working. Unconventional machining and forming methods. Powder metallurgy. Welding. Jigs and fixtures, gauges and comparators. Metal cutting: Mechanics of orthogonal cutting, machinability, economics of machining, chip formation, forces, power and surface finish in turning, milling and shaping operations. Grinding, wheel wear mechanism in grinding.

Metallurgy and Material Science

Phase diagram of Binary alloys, Iron-Iron Carbide diagram. Construction and Interpretation of T.T.T. curve for steels. Case hardening, Age hardening. Alloy steels. Mechanism of fatigue and creep. Types of failures Diffusion.

Production management

Production planning and control, Forecasting assembly line balancing Product, development. Production control charts. Break-even-analysis, PERT and CPM. Control operations: Inventory control – ABC analysis, EOQ model. MRP-II, JIT work study, value engineering. Linear programming, graphical and simplex methods and queuing (Single server, Poisson Queue) theory. Maintenance engineering Quality assurance control charts for variables and attributes.

Thermodynamics

Reversible and irreversible processes. Thermodynamic systems. Applications of First and Second law of thermodynamics. Concept of entropy. Availability and unavailable energies.

Tds relations, Properties of pure substances.

I.C. Engines. Fuels and Combustion

Thermodynamic analysis of cycles. SI and CI engines. 4 stroke and 2 stroke engines. Performance testing and heat balance of IC engines. Detonation and knocking phenomena in I.C. engines. Carburetion and fuel injection systems. Engine emissions and control.

Heat Transfer, Refrigeration and Air Conditioning.

Modes of heat transfer, One dimensional steady and unsteady conduction, Heat transfer with fins, Convective heat transfer, Forced Convection over flat plate and through tubes, Free Convection over vertical flat plate and cylinders, Radiative heat transfer – Black and Gray surfaces, Shape factors. Heat Exchanger performance – LMTD and NTU method.

Refrigeration cycles and systems. Vapour compression, Vapour absorption and Air Refrigeration systems. COP of a Refrigerator. Condensers, Evaporators and Expansion devices and Controls.

Psychrometry and Psychrometric processes. Comfort conditions. Estimation of cooling and heating load.

Fluid mechanics and turbomachinery

Continuity, Momentum and Energy equations. Adiabatic and isentropic flow. Flow through turbo machinery passages. Classification of turbo machines. Fans, Blowers and Compressors. Axial and Centrifugal machines. Steam and Gas Turbines. Pumps and Hydraulic Turbines. Model tests. Work done and Efficiencies. Specific speed.

Energy Systems

Types of Power plants. Thermal, Hydro, Nuclear and gas Turbine Power plants. Layout and Selection of a Power plant. Power plant Economics. Cost of electrical energy. Importance of Renewable Energy sources. Solar, Wind, Bio-mass and Ocean Energy Technologies, Solar thermal and Solar photovoltaic power generation.

4. CHEMICAL ENGINEERING

Section – A

(a) Fluid and Particle Dynamics: Viscosity of fluids. Laminar and turbulent flows. Equation of continuity and Navier-Stokes equation Bernoulli's theorem. Flow meters. Fluid drag and pressure drop due to friction. Reynolds's Number and friction factor effect of pipe roughness. Economic pipe diameter, pumps, water, air/steam 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 fluidization velocity, concepts of compressible and incompressible flow. Transport of solids.

(b) Mass Transfer: Molecular diffusion coefficients, First and second law and diffusion, mass transfer coefficients, film and penetration theories of mass transfer. Distillation, simple distillation, relative volatility, fractional distillation, plate and packed columns for distillation. Calculation of theoretical number of plates: Liquid-liquid equilibria. Extraction theory and practice; Design of gas-absorption columns. Drying, Humidification, dehumidification. 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 Process: Equilibrium separation processes – ion-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, underground tanks for atmospheric and higher pressure, Design of closures flat and elliptical head. Design of supports. Materials of construction-characteristics and selection.

(f) Process Dynamics and Control: Measuring instruments for process variables 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.

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 relationships for pure components and mixtures. Energy functions and inter-relationships – Maxwell's relations. Fugacity, activity and chemical potential. Vapour-liquid 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 – catalytic and non-catalytic and gas-solid and gas-liquid reactions. Intrinsic kinetics and global rate concept. Importance of interphase and intraparticle mass transfer on performance. Effectiveness factor. 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 legislation's – 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. Breakeven point analysis. Project scheduling – PERT and CPM. Profit and loss account, balance sheet and financial statement. Plant location and plant layout including piping.

5. INDUSTRIAL ENGINEERING

1. Theory of Machines:

Kinematic and dynamic analysis of planar mechanisms, Gears, 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, uniaxial loading, thermal stresses. Beams: bending 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 and theories of failure. Rotating discs, Shrink fits,

3. Engineering Materials

Basic concepts on structure of solids, Crystalline materials, Defects in crystalline materials, Alloys and 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, machine ability and machining economics, Rigid small and flexible automation, NC, CNC, Recent machining methods – EDM, ECM and ultra sonics. 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. METROLOGY AND INSTRUMENTATION

Limits and fits, ISO System: Types of interchangeability. Slip gauges and end bars. Different types of micrometers. Height gauges. Tomlinson gauges. Precision polygon. Sine bar, Auto collimator. Dial indicator, Sigma and mechanical comparator, Free Flow and back pressure type pneumatic comparator. Application of single, double and triple set jet gauge heads.

Optical projector, Chart gauges, Micro gauges, Micro gauge bridge lines. Tool maker's microscope. Floating carriage diameter measuring machine and coordinate measuring machine. Measurement of straightness and flatness. Roundness measurement with bench centers and Talysurf.

Taylor's principle for plain limit gauges. Use of plug, Ring and Snap gauges. Indicating type limit gauges. Gauge material and step in gauge manufacture. General geometric tests for testing machine tools.

Elements of instrumentation system. Static and dynamic characteristics. Dynamic response of first order and second order instruments. Types of error. Displacement transducers LVDT.

1. Production Management:

Production planning and control, Forecasting Moving average, exponential smoothing, Operations scheduling; assembly line balancing. Product development Breakeven analysis, Capacity planning PERT and CPM.

2. **Operations Research:**

Linear programming – graphical method, Simplex, Revised Simplex and Dual Simplex methods. Duality and economic interpretation of dual variables.

Post optimal sensitivity analysis. Integer programming. Transportation, Transshipment, Assignment and Travelling salesman problems.

Dynamic programming – capital budgeting problem. Game theory. Waiting lines – single server and multiple server models based on Poisson's arrivals.

3. **Material Management:** Role of material planning. EOQ inventory, control (deterministic and probabilistic models) MRP – 1 (Inputs & Outputs) MRP-2 Material handling equipment (Selection, Classification, types) ABC analysis. Industrial Robots.

4. **Work Study:** Procedure of method study, various charts used in method study principals of motion of economy. Work place design, ergonomics.

Time Study: Calculation of standard time. Performance rating types of ratings, work sampling, types of incentive financial and non-financial. Different wage payment plans.

5. **Inspection and Quality Control:** Types and objectives of inspection, SQC and its principals. Acceptance sampling, inspection, OC curves, process control charts, Zero defect concept, Quality development function, TQM (principals) Taguchi method of total quality, ISO – 9000 series. Reliability – failure concepts. Bath tub curves explanation, use of Weibul distribution.

Costing: Elements of costs. Types over heads and overhead distribution. Break even analysis and its calculation. Description and its methods.

6. **Plant maintenance (objective importance).** Types of maintenance (break down, preventive, scheduled, predictive) plant maintenance schedule. Recent development in plant maintenance techniques, conditioning monitoring.

Replacement analysis (Reasons and factors considered for equipment replacement) methods like MAPI.

7. **Computers in Industrial Engineering:** Flow charts, dBase-IV, Lotus 1-2-3 & Elementary Programming.

SCHEME

Part-A: Written (Objective type) Examination				
Paper-1	General Studies	150 Marks	150 Questions	150 Minutes
Paper-2	Subject (Electrical Engineering)	300 Marks	150 Questions	150 Minutes
Part-B: Oral Test (Interview)		50 Marks		

SYLLABUS

PAPER-1 GENERAL STUDIES

1. SCIENCE AND TECHNOLOGY:
m) General Science and Technology
n) Role and impact of science and Technology on India's development.
(Questions will cover general appreciation and understanding of matters of everyday observation and experience as may be expected of a well-educated person who has not made a special study of science and technology disciplines).
2. INDIAN HISTORY AND CULTURE:
y) Modern Indian History from 19th century to the present
z) Nationalist Movement and Constitutional development
aa) Indian culture and Heritage including architecture, Fine Arts, dance forms, music, paintings, Folk arts and performing arts.
bb) History of Andhradesa Society, Culture, Geography and Economic development.
3. INDIAN POLITY:
General and broad understanding of the structural (institutions) and functional (processes) aspects of Indian Political system.
4. INDIAN ECONOMY AND GEOGRAPHY OF INDIA:
(a) Structure of National economy
(b) Economic development (including planning) since independence
(c) Economic Reforms
(d) Physical, economic and social Geography of India.
5. CURRENT EVENTS:
Current Events of Regional, National and International importance.
6. GENERAL MENTAL ABILITY: (Reasoning and analytical abilities)

PAPER-2 SUBJECT

ELECTRICAL ENGINEERING

I. Electrical Circuits:

Basic electrical laws, Analysis of DC networks, transient response of RLC networks excited by impulse, step, ramp and sinusoidal excitations. Transform methods, transfer functions, poles and zeros steady state AC networks, frequency domain analysis, resonance, coupled circuits, two port networks, three phase networks, power in a.c. networks, power measurement in 3-phase networks.

II. E.M. Theory :

Electro static and electro magnetic fields, vector methods, Fields in dielectric, conducting and magnetic materials, Laplace and Poisson's equation. Time varying fields, Maxwell's equation, Poynting Theory, properties of transmission lines.

III. Electrical measurement and Instruments:

Electrical standards, Error analysis, Measurement of current, voltage, power, energy, power factor, resistance, inductance capacitance frequency and loss angle. Indicating instruments, extension of range of instruments, DC and AC bridges. Electronic measuring instruments. Electronic multimeter, CRO, frequency counter, digital voltmeter, transducers, Thermocouples, Thermistor, LVDT, strain gauges, Piezo electric crystal, Measurement of non-electrical quantities like, pressure, velocity, temperature, flow rate, displacement acceleration and strain.

IV. Control Systems

Open and closed loop control systems, Mathematical modeling, block diagram, signal flow graphs, time response and frequency response of linear systems, error constants and series Rootlocus technique, Bodeplot, polar plot, M-circles, N-circles, Nichol's charts, stability, Routh Hurwitz criteria. Nyquist stability criteria, compensators, design in frequency domain. Control system components. Servo motors, synchros, tachogenerator, error detector. State variable approach, modeling, state transition matrix, transfer function, response.

V. Electronics:

Solid state devices and circuits. Small and large signal amplifiers with and without feedback at audio and radio frequency, multistage amplifiers. Operational amplifiers and applications. Integrated circuits oscillators, RC, LC and crystal oscillators wave form generators, multi-vibrators – Digital circuits, Logic gates, Boolean algebra combinational and sequential circuits. A to D and D to A converters Micro processors (8085) instruction set, memories, interfacing programmable peripheral devices – Number system flow charts – expressions and statements in C – language – simple programs for engineering application.

I. D.C. ELECTRICAL MACHINES :

Fundamentals of electro mechanical energy conversion, constructional features of D.C. Machines, emf equation types and characteristics of generators application, Torque in DC motor, types of DC motors, applications. Testing of D.C. motors, efficiency, and starting and speed control.

II. TRANSFORMERS:

Construction – Principle of operation of 1-phase transformers – Vector diagram on No Load and – Load – Parallel operation – Regulation – efficiency – Equivalent circuit 3 phase transformer connections – Scott connection.

III. INDUCTION MOTORS:

Production of rotating magnetic field, production of torque types of motors equivalent circuits, Circle diagram, torque slip characteristics, starting and maximum torque, speed control, principle of single phase induction motors, Applications.

IV. SYNCHRONOUS MACHINES :

Generation of emf in 3 phase AC Generator, Armature reaction, regulation by Synchronous impedance and Ampere turn methods, parallel operation, transient and sub-transient reactances, theory of salient pole machines.

Synchronous Motor: Torque production, performance characteristics, methods of starting, V-Curves, synchronous condenser.

Special Machines: Stepper motor, Methods of operation, Amplidyne and metadyne-applications.

V. ELECTRICAL POWER GENERATION:

General layout – Types of power stations, economics of different types, base load and peak load stations, load factor and its effects, pumped storage schemes.

VI. POWER TRANSMISSION :

Calculation of line parameters, concepts of short, medium and long transmission lines, ABCD parameters, insulators, Corona, P.U. quantities, fault calculations, symmetrical components load flow analysis using Gauss Seidal, Newton Raphson, methods, economic operation, stability, steady state and transient stability, equal area criterion, ALFC and AVR control for real time operation of interconnected systems.

VII. POWER SYSTEM PROTECTION :

Principles of arc quenching, circuit breaker classification, Recovery and restriking voltages, relaying principles over current, directional over current relays-generator and transformer protection using differential relays-line protection using distance relays Surge phenomena in transmission lines – Travelling wave theory, protection against surges.

VIII. UTILISATION :

Industrial Drives – Motors for various drives – Braking methods – Speed control of motors – Economics of rail traction – Mechanics of train movement – Estimation of power and energy requirements – Illumination – Lamps Factory lighting – Street lighting – Induction and dielectric heating.

SCHEME

Part-A: Written (Objective type) Examination				
Paper-1	General Studies	150 Marks	150 Questions	150 Minutes
Paper-2	Subject (Horticulture)	300 Marks	150 Questions	150 Minutes
Part-B: Oral Test (Interview)		50 Marks		

SYLLABUS

PAPER-1 GENERAL STUDIES

1. SCIENCE AND TECHNOLOGY:
o) General Science and Technology
p) Role and impact of science and Technology on India's development.
(Questions will cover general appreciation and understanding of matters of everyday observation and experience as may be expected of a well-educated person who has not made a special study of science and technology disciplines).
2. INDIAN HISTORY AND CULTURE:
cc) Modern Indian History from 19th century to the present
dd) Nationalist Movement and Constitutional development
ee) Indian culture and Heritage including architecture, Fine Arts, dance forms, music, paintings, Folk arts and performing arts.
ff) History of Andhradesa Society, Culture, Geography and Economic development.
3. INDIAN POLITY:
General and broad understanding of the structural (institutions) and functional (processes) aspects of Indian Political system.
4. INDIAN ECONOMY AND GEOGRAPHY OF INDIA:
(a) Structure of National economy
(b) Economic development (including planning) since independence
(c) Economic Reforms
(d) Physical, economic and social Geography of India.
5. CURRENT EVENTS:
Current Events of Regional, National and International importance.
6. GENERAL MENTAL ABILITY: (Reasoning and analytical abilities)

PAPER-2 SUBJECT

HORTICULTURE

PART – A

1. FUNDAMENTALS OF HORTICULTURE

Definition, importance of horticulture in terms of economy, production, and employment generation. Nutritional value of horticultural crops. Divisions of horticulture and their importance. Horticultural stations in Andhra Pradesh. Horticultural zones of India and Andhra Pradesh.

Temperature, light, humidity, rainfall and soil requirements for horticultural crops. Selection of site for establishing an orchard, orchard plan, systems of planting and establishment of an orchard. Importance, scope and practicing of organic farming in horticultural crop production.

Nutrition of horticultural crops – assessment of nutritional requirements based on soil, tissue analysis, and field experiments. Identification of deficiency symptoms of various nutrients and methods of nutrient application. Assessment of irrigation requirements for different horticultural crops and different methods of irrigation. Pruning and training, their objectives and methods. Pollination and fruit set, problems and requirements, flower and fruit drop, stages, causes and remedial measures. Fruit thinning, objectives, advantages and disadvantages. Unfruitfulness, reasons and remedial measures.

2. PLANT PROPAGATION AND NURSERY MANAGEMENT

Introduction, principles and classification of plant propagation methods. Selection of site for commercial nursery. Ecological and economic factors. Plant propagation structures, containers and media.

Sexual propagation and its importance. Seed germination, process of seed germination. Factors affecting seed germination and pre-germination treatments and viability tests.

Asexual propagation and its importance. Propagation of plants by cuttage, types of cuttings and factors affecting regeneration of plants from cuttings. Propagation by layerage. Methods of layerage. Factors affecting regeneration of plants by layerage.

Propagation by grafting and importance of graftage. Methods of grafting. Factors for successful graft formation and steps in graft union. Methods of budding and bud wood selection. Role of rootstocks in fruit production. Selection of rootstocks for commercial fruit plants. Production of nursery stock. Propagation of various fruit and ornamental plants. Role of growth regulators in propagation.

Importance of micro propagation of plants. Types of aseptic cultures. Types of media, preparation of media and inoculation of explants, establishment, sub culture and rooting of explants.

Establishing of *in vitro* rooted cuttings in growing media and hardening.

3. FRUIT CROPS

Area, production, importance, uses, origin, distribution, botany, classification of varieties, use of rootstocks, high density planting, climate, soils, planting methods, training and pruning, nutrition, irrigation scheduling, intercrops, weed control, problems in orchard management, flowering, fruit set, problems in fruit set, harvesting indices, harvesting, preharvest treatments, use of growth regulators, yield, grading, packing for internal and export markets, ripening methods and storage in respect of mango, banana, citrus, grape, pineapple, guava, papaya and sapota.

PART – B

4. VEGETABLE CROPS

Importance of vegetables in human diet and national economy. Detailed study regarding origin and distribution, area and production, importance, nutritive value, botany, varieties, soil and climatic requirements, seed treatment, seed sowing/nursery raising, transplanting, nutrition, irrigation, intercultural operations, physiological disorders, harvest indices, harvesting, post harvest handling, curing, storage and usage of plant growth regulators in vegetable crops like tomato, brinjal, chillies, sweet pepper, potato, okra, cucurbitaceous crops like cucumber, pumpkin, ridge gourd, snake gourd, bitter melon, bottle gourd, melons like water melon and muskmelon, leguminous vegetables like cluster bean, French bean, dolichos bean, pea and broad bean, cole crops like cabbage, cauliflower and knolkhol, root crops like radish, carrot, beetroot and turnip, bulb crops like onion and garlic, tuber crops like sweet potato, tapioca, amorphophallus, colocasia, dioscorea and yam, leafy vegetables like amaranthus, palak, Roselle, perennial vegetables like drumstick, coccinia and murraya.

5. PRESERVATION OF FRUITS AND VEGETABLES

Importance and scope of fruit and vegetable preservation in India. Principles of preservation by heat, low temperature, chemicals and various methods of preservation. Selection of site for processing, processing unit layout and precautions for hygienic conditions of the unit. Preservation of fruits and vegetables through canning, bottling, freezing, dehydration, drying, ultraviolet and ionizing radiations.

Micro-organisms associated with spoilage of fruit and vegetable products. Spoilage of canned products-hydrogen swell, filippin, dent, leaker etc., Biochemical changes associated with spoilage of fruit and vegetable products. Preservatives and colours permitted and prohibited in India.

Different kinds of equipments used in processing. Preparation of jams, jellies, marmalades, candies, crystallized and glazed fruits, preserves, chutneys, pickles, ketchup, sauce, puree, syrups, juices, squashes and cordials.

6. PLANT PHYSIOLOGY (INCLUDING C3 & C4 PLANT) PHOTOSYNTHESIS RESPIRATION ETC. GROWTH REGULATION & HORMONES

Nomenclature of plant growth substances. Plant growth substances and their classification. History, occurrence, distribution, mode of action, movement, mechanism of action and function of auxins, gibberellins, cytokinins, ethylene, inhibitors, retardants, phenolic substances and morphactins.

Role of plant growth regulators in seed and bud dormancy, juvenility, maturity and senescence, flowering, pollination, fruitset including parthenocarpy, fruit growth, fruit drop and fruit ripening (climacteric and non-climacteric) and fruit colour development, tuber and bulb formation and

sex expression and extension of shelf life in fruits, vegetables and flowers. Role of growth regulators in plant propagation.

6(a) ENTOMOLOGY

Commonly occurring pests, life cycle of pests, control measures.

6(b) PATHOLOGY

Commonly occurring diseases, life cycle of bacteria, fungal parasites, control measures.

PART – A

1. COMMERCIAL FLORICULTURE

Area, production, importance, uses, origin, distribution, classification of varieties, propagation, environmental factors affecting growth and flowering, soils, nutrition, irrigation, weeding, special techniques of production such as controlling growth and production of flowers, use of growth regulators, harvesting, postharvest handling, extension of shelf life of flowers of commercial flower crops such as rose, chrysanthemum, jasmine, carnations, gladiolus, anthurium, tuberose, china aster, marigold, crossandra and gerbera.

2. GREENHOUSE MANAGEMENT OF HORTICULTURAL CROPS

Importance, uses, scope and production of horticultural crops in greenhouse. Status and development of greenhouse production of horticultural crops in the world and India. Development, constraints, research needs and future of protected culture of horticultural crops in India and A.P. Points to be considered before establishing a greenhouse. Types of greenhouses, classification of greenhouses based on the shapes, material used, utility and cladding material used. Size and arrangement of greenhouses and characteristics of various greenhouse cladding materials, greenhouse benches etc.,

Management of light, temperature (greenhouse heating and cooling), CO₂ and relative humidity inside the greenhouse.

Various types of growing media used and their suitability for different horticultural crops. Preparation of growing media and its pasteurization. Management of nutrients through fertigation.

Detailed production technology in respect of tomato, cucumber, rose, carnation, gerbera, chrysanthemum and anthurium under greenhouse/polyhouse.

3. MEDICAL, AROMATIC, SPICE, CONDIMENT AND PLANTATION CROPS

Origin, importance, export potential, varieties, climate, soil requirements, propagation and planting and after care, maring, irrigation, training, pruning, harvesting, yield and post harvest handling, curing and processing practices, storage methods, and distillation of essential oils of the following crops.

Medicinal Plants

Aloe, amla(aonla), stevia, ashwagandha, dioscorea, opium poppy, sarpangandha, steroids bearing *solanum*, *Phyllanthus amarus*, *chakramani*, *madhunasaini*, *sweet flag*, *Catharanthus roseus*, *isabgol*, *fox glove*, *belladonna*, *senna*, *tinospora*, *annatto*, *coleus*, *safed musli* and *asparagus*.

Aromatic Crops

Citronella, lemon grass, palmarosa, vetiver, geranium, davana, mint lavender and vanilla.

Spices and condiments

Turmeric, ginger, coriander, fenugreek, cardamom, pepper, cinnamon, clove, nutmeg and cumin.

Plantation Crops

Coconut, cashewnut, oil palm, betelvine, coffee, tea, cacao, arecanut and rubber.

PART – B

4. ORNAMENTAL GARDENING AND LANDSCAPE ARCHITECTURE

Need for bioaesthetic planning, places suitable for bioaesthetic planning-towns, cities, villages, schools, temples, road side, parks, ghats of rivers and canals, platforms, railway lines, public and private buildings, institutes and places of worship. Study of ornamental trees, shrubs and climbers used in bioaesthetic or landscape gardening. Study of cacti, succulents and bonsai. Principles of garden designs, types of gardens-japanese, English and Moghul gardens. Various features of gardens such as paths, garden walls, fencing, steps, edges, hedges, arches, pergolas, shrubbery, topiary, rockery, flower beds, lawns, fountains, statues, water garden, conservatory and glass or greenhouse. Indoor plants, and their management.

Flower arrangement – principles, styles, containers and holding solutions.

5. DRY LAND HORTICULTURE AND WATERSHED MANAGEMENT

Dry land horticulture farming, introduction, definition, dry climate and their classifications with reference to India in general and Andhra Pradesh in particular. Importance of horticultural crops in dry land, yield potential of agriculture and horticulture crops in dry lands. Fruits and vegetables crops suitable for dry land farming. Adaptive features of dry land fruit crops for drought and salinity.

Watershed management, objectives, approaches, steps in watershed development planning, land use capability, classification, soil and rain water conservation, water harvesting measures in watershed area. Problems and prospects under water shed. Alternate water use system.

Cultural practices like planting, training, pruning, nutrition and water management and harvesting of important dry land fruits viz., ber, pomegranate, custard apple, phalsa, fig, aonla, jamun and tamarind.

6. SOCIAL AND FARM FORESTRY

Introduction – forests in India, forest policy and law, gap between demand and supply of forest products. Principles of general silviculture.

Social forestry – need, objectives and scope, choice of species for fuelwood, fodder, smaller timber and timber, their culture, propagation, application of agro-techniques and economic benefits, management of social forestry plantations nurseries and their practices.

Afforestation on different problematic sites. Voluntary organizations and their role in promoting afforestation programmes. Maintenance and conservation of village woodlots. Energy plantations. Social forestry for watershed management.

Farm forestry – objectives and role, need for shelter belts and wind breaks, types of farm forestry.

Agro forestry – need, objectives, scope, principles and practices of agro forestry systems, choice of the tree species, and management implications.

Forest products, their processing and use.