

**Scheme and Syllabus for Recruitment to the post of Executive Officers,  
Grade-III in A.P. Endowments Sub-Service  
(BACHELOR'S DEGREE STANDARD)**

**a: Written (OBJECTIVE TYPE) Examination**

Sl. No.	Subject	No. of Questions	Duration (Minutes)	Maximum Marks	Minimum qualifying Marks		
					SCs, STs & PH	B.Cs	Others
1	Paper-I: General Studies	150	150	150	90	105	120
2	Paper-II: Optional Subject (One paper)	150	150	150			
<b><u>b: Oral Test (Interview)</u></b>				30			
<b>Total Marks:</b>				330			

**NOTE:** The candidates have to choose ONE subject from the following for Paper-II Optional Subject:

Code No.	Subject Name	Code No.	Subject Name
01	English Literature	15	Sociology
02	Hindi Literature	16	Agriculture
03	Telugu Literature	17	Animal Husbandry & Veterinary Science
04	Urdu Literature	18	Botany
05	Anthropology	19	Chemistry
06	Commerce	20	Geology
07	Economics	21	Mathematics
08	Geography	22	Physics
09	History	23	Statistics
10	Law	24	Zoology
11	Philosophy	25	Civil Engineering
12	Political Science	26	Electrical Engineering
13	Psychology	27	Electronics & Communication Engineering
14	Public Administration	28	Mechanical Engineering

- N.B: 1. The selection to the post will be based on the total marks obtained at the Written examination and Oral test taken together subject to Special Rules and local cadre rules.
2. The candidates will be called based on the merit in the written examination for an interview at the ratio of 1:2 with reference to the no. of vacancies in terms of General Rule 22 and 22-A including local reservation and with due regard to the qualifications prescribed for the post.
3. The candidates belonging to SC/ST/BC/PH may be called for interview by relaxing the minimum qualifying marks at the discretion of the Commission. If the Commission is of the opinion that sufficient no. of candidates from these communities are not likely to come up for interview.
4. Appearance for all the written papers at the written exam and Oral test, if qualified is compulsory and there will be no waiting list as per Rules.

## **SYLLABUS**

### **GENERAL STUDIES**

General Science

Current events of National and International importance.

History of India and Indian National movement. India and World Geography.

Indian Polity and Economy.

General mental Ability.

Questions on General Science will cover General appreciation and understanding of science including matters of everyday observation and experience, as may be expected of a well educated person who has not made a special study of any particular scientific discipline. In current events, knowledge of significant national and international events will be tested. In History of India, emphasis will be on broad general understanding of the subject in its social, economic and political aspects. Questions on the Indian National Movement will relate to the nature and character of the nineteenth century resurgence, growth of nationalism and attainment of Independence. In Geography, emphasis will be on Geography of India. Questions on the Geography of India will relate to physical, social and economic geography of the country, including the main features of Indian agricultural and natural resources. Questions on Indian Polity and Economy will test knowledge of the country's political system and Constitution of India, Panchayati Raj, Social Systems and economic developments in India. On general mental ability, the candidates will be tested on reasoning and analytical abilities.

## **OPTIONAL SUBJECTS**

### **03. TELUGU LITERATURE**

**Unit I:** Age of Ithihasas and Puranas - Major poets and their works - Aesthetic approach of different poets and historical background.

Nannaya, Tikkana, Errana, Nannechoda, Palkuriki Somanna, Marana, Kethana, Manchana, Nachana Somana, Ramayana Poets.

**Unit II:** Age of Kavyas and Katha Kavyas: Major poets during the period and their works Poetic qualities of the poets:

Srinatha, Pothanna, Vallabhamatya, Pillalamarri Pina Veerabhadrana, Nandimallaya and Ghanta Singana, Koravi Goparaju, Anantamatya, Annamayya etc.

**Unit III:** Age of Prabandhas: Evolution of Prabandhas - Works and poetic talents of the poets during the period.

Srikrishnadevaraya, Ashtadiggaja poets and other major poets.

**Unit IV:** Telugu literature of Southern School: Literary genres like Prabandha, Dvipada, Yakshagana, Geya, Kirthana, Prose works and major poets and writers of these works.

**Unit V:** Telugu language and literature during nineteenth century, Evolution of Telugu prose contribution of Telugu and Western scholars to Telugu language and literature.

**Unit VI:** Modern period: Major literary movements and trends in Telugu literature – Reformation, Rationalism, Romanticism – Progressive, Revolutionary, Feminist and Dalit movements – Major writers.

**Unit VII:** Evolution of literary genres in modern period: Poetry, Novel, Short story, Biography, Auto-biography, Essay etc. – Major writers.

**Unit VIII:** Poetics and literary criticism: Rasa, Dwani, Alankara, Rithi, Vakrokti, Auchitya – Major trends in Literary criticism and major writers.

**Unit IX:** Grammar and Alankaras – Major Sanskrit and Telugu Sandhis applicable to Classical and Modern Telugu.

The Alankaras (Artha and Sabda): Upama, Rupaka, Utpreksha, Ananvaya, Dipaka, Parinama, Upameyopama, Sandeha, Bhrantimat, Smruti, Arthantaranyasa, Drustanta – Anuprasa, Yamaka.

**Unit X:** Structure of Modern Telugu: Classification of the vocabulary – Plural formation, cases, verbs, major divisions of Telugu sentences – simple, complex, compound sentences.

## 01. ENGLISH LITERATURE

### PART – ‘A’

#### UNIT 1.1: SHAKESPEARE:

A Midsummer Night's Dream  
Measure for Measure  
Hamlet  
The Tempest

#### UNIT 1.2: SHAKESPEARE'S CONTEMPORARIES:

The Play of Everyman  
Christopher Marlow: Doctor Faustus  
Ben Jonson: The Alchemist  
John Webster: The Duchess of Malfi  
Edmund Spenser: The Faerie Queene, Book 1

#### UNIT II.1: SEVENTEENTH-CENTURY LITERATURE:

John Milton: Paradise Lost, Books 1,4 and 9  
Milton's English Sonnets  
John Donne: The Sonnets  
"The Flea"; "Canonization"; "Valediction  
Forbidding Mourning"  
John Dryden: All for Love

#### UNIT II.2: RESTORATION LITERATURE:

William Congreve: The Way of the World  
John Bunyan: The Pilgrim's Progress

#### UNIT III.1: THE EIGHTEENTH-CENTURY NOVEL:

Daniel Defoe: Moll Flanders; Robinson Crusoe  
Jonathan Swift: Gulliver's Travels  
Henry Fielding: Joseph Andrews  
Oliver Goldsmith: The Vicar of Wakefield  
Horace Walpole: The Castle of Otranto

#### UNIT III.2 EIGHTEENTH-CENTURY POETRY:

Alexander Pope: The Rape of the Lock  
Samuel Johnson: "London"  
Oliver Goldsmith: The Deserted Village  
William Blake: From Songs of Innocence, "Introduction", "Lamb",  
"Nurse's Song", "Holy Thursday" and from Songs of  
Experience: "Tyger", "Nurse's Song", "Holy Thursday",  
"Poison Tree".

#### UNIT III.3 EIGHTEENTH-CENTURY DRAMA:

Henry Fielding: Tom Thumb  
John Gay: The Beggar's Opera  
R.B.Sheridan: The Rivals

#### UNIT IV.1 ROMANTIC POETRY:

William Wordsworth: "Michael", "Tintern Abbey",  
The Immortality Ode  
S.T. Coleridge: Rime of the Ancient Mariner,  
"Christabel", "Dejection, an Ode"  
P.B.Shelly: "Ode to the West Wind"  
John Keats: "The Grecian Urn" and "The Nightingale"

#### UNIT IV.2: THE ROMANTIC NOVEL:

Sir Walter Scott: Ivanhoe  
Jane Austen: Pride and Prejudice; Persuasion  
James Hogg: Confessions

**UNIT IV.3: ROMANTIC PROSE:**

The Major Essays of Charles Lamb and William Hazlitt;  
De Quincey's "On knocking at the Gate in Macbeth",  
The Preface to The Lyrical Ballads (1800)

**PART-B**

**UNIT V.1: THE VICTORIAN NOVEL:**

Charlotte Bronte:	Jane Eyre
Emily Bronte:	Wuthering Heights
Charles Dickens:	Oliver Twist
Thomas Hardy:	Jude the Obscure
Joseph Conrad:	Heart of Darkness
R.L. Stevenson:	Treasure Island

**UNIT V.2: VICTORIAN POETRY:**

Tennyson:	"Mariana", "The Lady of Shalott", "Ulysess", "Crossing the Bar",
Robert Browning:	"My last Duchess", "Soliloquy of a Spanish Cloister", "Love among the Ruins"
Matthew Arnold:	"Forsaken Merman", "Dover Beach", "The Buried Life"
Thomas Hardy:	"She Hears the Storm", "The Ruined Maid", "Convergence of the Twain"
G.M. Hopkins:	"The Windhover", "Pied Beauty", "God's Grandeur"

**UNIT VI.1 THE MODERN NOVEL:**

James Joyce:	Portrait of an Artist as a Young Man
Virginia Wolf:	To the Lighthouse
Graham Greene:	The Power and the Glory
William Golding:	Lord of the Flies

**UNIT V1.2 MODERN POETRY:**

W.B. Yeats:	"Easter 1916", "Byzantium", "Lake Isle of Innisfree"
T.S. Eliot	The Waste Land
W.H. Auden	"W.B. Yeats", "The Unknown Citizen"
Ted Hughes:	Poems from Crow

**UNIT VI.3 MODERN DRAMA:**

G.B. Shaw:	St. Joan
John Osborne:	Look Back in Anger
Samuel Beckett:	Waiting for Godot
Harold Pinter:	Birthday Party

**UNIT VII CRITICAL TEXTS:**

Sir Philip Sidney's *Apology*; John Dryden's *Defence*;  
Alexander Pope's *Essay on Man* and *Essay on Criticism*;  
Jonathan Swift's "A Modest Proposal"; Samuel Johnson's  
Preface to Shakespeare, and the Lives of Milton and Gray;  
Mathew Arnold's *Culture and Anarchy*, The 1853 Preface,  
"Wordsworth"; T.S.Eliot's "Tradition and the Individual  
Talent"

**UNIT VIII FORMS OF LITERATURE:**

Epic- Paradise Lost  
Sonnet- Shakespeare's, John Donne's, Keats's Sonnets;  
Elegy- Milton's "Lycidas", Gray "Elegy in a Country  
Churchyard", W.H. Auden's "In Memory of W.B. Yeats";  
Ode- Odes of Pope, Wordsworth and Keats;  
Dramatic Monologue-Tennyson's "Ulysses",  
Robert Browning's "My Last Duchess";  
Novel-all the novels in Units I to VII above;  
The Short Story;  
The Essay.

## **02. HINDI LITERATURE**

**Unit I: General Study of life, works, the personality of the following writers of Hindi Literature:**

- (a) Kabirdas, Tulsidas, Surdas, Biharilal, Meerabai
- (b) Premchand, Phaneeswarnath Renu
- (c) Jaishankar Prasad, Sumitranandan Pant, Suryakant Tripathi Nirala, Dhumi, Muktibodh

**Unit II: Trends and tendencies in the History of Hindi literature**

- (a) Veeragathakal, Siddha sahitya, Nath sahitya
- (b) Bhaktikal : Nirguna & Saguna Bhakti Sahitya
- (c) Ritikal
- (d) Adhunik kal: Bharatendu yug, Dwivedhi yug, Chayavadi yug, Nayee Dharaayen

**Unit III: Development of modern Genre**

- (a) Natak
- (b) Upanyas
- (c) Kahanii
- (d) Nibhandh

**Unit IV : History of Hindi Language**

- (a) Dialects of Hindi : Khadiboli, Brajbhasha and Avadhi
- (b) Development of Khadiboli
- (c) Hindi-Urdu-Hindusthaani
- (d) National Independence movement and Hindi
- (e) Constitution, National Language and directions in the constitution for development

**Unit V : Modern Hindi grammar:**

- (a) Hindi sounds
- (b) Hindi Lipi
- (c) Hindi vocabulary (Nouns and Gender)
- (d) General grammar rules
- (e) Sandhi in Hindi
- (f) Samaasa in Hindi

**Unit VI : Alankara, Chanda and Rasa:**

- (a) **Alankaras:** Upama, Utprekshaa, Yamak, Shlesh, Anuprasa, Ruupak, Sandeha, Vakrokti, Arthaantaranyasa, Lokokti (definitions & identification)
- (b) **Rasa:** Srigara, Veera, Shanta and their Staayee
- (c) **Chand :** Doha, Sorataa, Kavita, Rola, Chowpayee (rules & identification)

**Unit VII: Criticism (Alochanaa):**

The trends and contributions of the following critics of Hindi

- (a) Ramachendra Shukla
- (b) Nagendra
- (c) Ravilas Shama
- (d) Namvar Singh

**Unit VIII: Indian Poetics**

General study of the following Sanskrit Sampradayas

- (a) Rasa Sampradaya
- (b) Alankar Sampradaya
- (c) Dwani Sampradaya only

**Unit IX : Identifications Forms of Hindi**

Under this Unit the works of the important writers are mentioned and the candidates are required to identify the form of the work as Natak, Upanyas, Ekanki, Kavya etc.

**Unit X Functional aspects of Hindi**

General knowledge of the **vocabulary and terms** used in **Hindi** in offices. Under this Unit generally used **English Words** in offices and office correspondence are given and the Hindi equivalents are to be identified.

## **04. URDU LITERATURE**

### **I. History of Urdu Language:**

- a. Hind Aariya, Zabano Ke Advar
- b. Magribi Hindi Aur Uskey Boliyan
- c. Khdi Boli – Urdu Aur Hindi Ka Rishta

### **II. Important Writers of Deccani Literature:**

1. Mohd. Quli Qutub Shah
2. Gawasi
3. Mula Asadullah Wajhi
4. Nusrati
5. Walli

### **III. General study of life works, the personalities of the following writers of Urdu Literature:**

- a. Sir Syed Ahmad Khan, Moulana Altaf Hussain Halli, Munshi Premchand, Dr. Syed Mohiuddin Qadri, Zor.
- b. Mir Taqi Mir, Ghalib, Iqbal, Josh

### **IV. Important School of thought of Urdu Literature:**

- a. DABISTAN-E- DELHI
- b. DABISTAN-E-LUCKNOW

### **V. Literary Trends of Urdu Literature**

1. Aligarh Tahreek
2. Progressive movement

### **VI. Important Urdu Genres and Writers:**

- a. Ghazal – Qhasida, Mathanavi, Marsia
- b. Mirtaqi Mir, Ghalib
- c. Sauda, Zaoq
- d. Mir Anees, Mirza Dabeer
- e. Mir Hasan, Daya Shankar, Naseem

### **VII Development of Modern Urdu Genre:**

- a. Novel
- b. Short Story
- c. Drama
- d. Auto Bio-graphy
- e. Essay etc. Major Writer

### **VIII Criticism:**

The trends and contributions of following critic of Urdu

- a. Altaf Hussain HALLI
- B. Abdul Rahman Bijnori
- c. Ahtesham Hussain
- d. Aal-e-Ahmad Suroor

IX Literary contribution of Fort William College.

X. National Independence Movement and URDU.

## 21. MATHEMATICS

1. **Algebra:** Elements of Set Theory; Algebra of Real and Complex numbers including Demovire's between Coefficients and Roots, symmetric functions of roots; Elements of Group Theory; Sub-Group, Cyclic groups, Permutation, Groups and their elementary properties. Rings, Integral Domains and Fields and their elementary properties.
2. **Vector Spaces and Matrices:** Vector Space, Linear Dependence and Independence. Subspaces. Basis and Dimensions, Finite Dimensional Vector Spaces. Linear Transformation of a Finite dimensional vector Space, Matrix Representation. Singular and Nonsingular Transformations. Rank and nullity. **Matrices:** Addition, Multiplication, Determinants of a Matrix, Properties of Determinants of order  $n$ , Inverse of a Matrix, Cramer's rule.
3. **Geometry and Vectors:** Analytic Geometry of straight lines and conics in Cartesian and Polar coordinates; Three Dimensional geometry for planes, straight lines, sphere, cone and cylinder. Addition, Subtraction and Products of Vectors and Simple applications to Geometry.
4. **Calculus:** Functions, Sequences, Series, Limits, Continuity, Derivatives. Application of Derivatives: Rates of change, Tangents, Normals, Maxima, Minima, Rolle's Theorem, Mean value Theorems of Lagrange and Cauchy, Asymptotes, Curvature. Methods of finding indefinite integrals, Definite Integrals, Fundamental Theorem of integrals Calculus. Application of definite integrals to area, Length of a plane curve, Volume and Surfaces of revolution.
5. **Ordinary Differential Equations:** Order and Degree of a Differential Equation, First order differential Equations, Singular solution, Geometrical interpretation, Second order equations with constant coefficients.
6. **Mechanics:** Concepts of particles-Lamina; Rigid body; Displacement; force, Mass; Weight; Motion, Velocity; Speed; Acceleration; Parallelogram of forces; Parallelogram of velocity, acceleration; resultant; equilibrium of coplanar forces; Moments; Couples; Friction; Centre of mass, Gravity; Laws of motion; Motion of a particle in a straight line; simple Harmonic motion; Motion under conservative forces; Motion under gravity; Projectile; Escape velocity; Motion of artificial satellites.
7. **Elements of Computer Programming:** Binary system, Octal and Hexadecimal systems. Conversion to and from Decimal systems. Codes, Bits, Bytes and Words. Memory of a computer, Arithmetic and Logical operations on numbers. Precision. AND, OR, XOR, NOT and Shift/Rotate operators, Algorithms and Flow charts.

## **23. STATISTICS**

**Probability:** Random experiment, sample space, event, algebra of events, probability on a discrete sample space, basic theorems of probability and simple examples based theorem, conditional, probability of an event, independent events, Bayer's theorem and its application, discrete and continuous random variables and their distributions, expectation, moments, moment generating function, joint distribution of two or more random variables, marginal and conditional distributions, independence of random variables, covariance, correlation, coefficient, distribution of a function of random variables. Bernouli, binomial, geometric, negative binomial, hypergeometric, poisson, multinomial, uniform, beta, exponential, gamma, cauchy, normal, longnormal and bivariate normal distributions, real-life situations where these distributions provide appropriate models, Chebyshev's inequality, weak law or large numbers and central limit theorem for independent and identically distributed random variables with finite variance and their simple applications.

**Statistical Methods:** Concept of a statistical population and a sample, types of data, presentation and summarization of data, measures of central tendency, dispersion, skewness and kurtosis, measures of association and contingency, correlation, rank correlation, intraclass correlation, correlation ratio, simple and multiple linear regression, multiple and partial correlations (involving three variables only), curve-fitting and principle of least squares, concepts of random sample, parameter and statistic, Z, X<sup>2</sup>, t and F statistics and their properties and applications, distributions of sample range and median (for continuous distributions only), censored sampling (concept and illustrations).

**Statistical Inference:** Unbiasedness, consistency, efficiency, sufficiency, completeness, minimum variance unbiased estimation, Rao-Blackwell theorem, Lehmann-Scheffe theorem, Cramer-Rao inequality and minimum variance bound estimator, moments maximum likelihood, least squares and minimum chisquare methods of estimation, properties of maximum likelihood and other estimators, idea of a random interval, confidence intervals for the parameters of standard distributions, shortest confidence intervals, large-sample cofidence intervals. Simple and composite hypotheses, two kinds of errors, level of significance, size and power of a test, desirable properties of a good test, most powerful test, Neyman-Pearson lemma and its use in simple example, uniformly most powerful test, likelihood ratio test and its properties and applications.

Chi-square test, sign test, Wald-Wolfowitz runs test, run test for randomness, median test, Wilcoxon test and Wilcoxon-Mann-Whitney test.

Wal's sequential probability ratio test, OC and ASN functions, application to binomial and normal distributions.

Loss function, risk function, mini-max and Bayes rules.

**Sampling Theory and Design of Experiments:** Complete enumeration vs. sampling, need for sampling, basic concepts in sampling, designing large-scale sample surveys, sampling and non-sampling errors, simple random sampling, properties of a good estimator, estimation of sample size, stratified random sampling, systematic sampling cluster sampling, ratio and regression methods of estimation under simple and stratified random sampling, double sampling for ratio and regression methods of estimation, two-stage sampling with equal-size first-stage units.

Analysis of variance with equal number of observations per cell in one, two and three-way classifications, analysis of covariance in one and two-way classifications, completely randomized design, randomized block design, latin square design, missing plot technique, 2<sup>n</sup> factorial design, total and partial confounding, 3<sup>2</sup> factorial experiments, split-plot design and balanced incomplete block design.



## **24. ZOOLOGY**

### **1. Cell structure and function:**

- a) Prokaryote and eukaryote
- b) Structure of animal cell, structure and functions of cell organelles.
- c) Cell cycle-mitosis, meiosis.
- d) Structure and contents of nucleus including nuclear membrane, structure of chromosome and gene, chemistry of genetic components.
- e) Mendel's laws of inheritance, linkage and genetic recombination; cytoplasmic inheritance.
- f) Function of gene: replication, transcription and translation; mutations (spontaneous and artificial); Recombinant DNA; principle and application
- g) Sex determination in *Drosophila* and man; sex linkage in man

### **2 Systematics:**

- a) Classification of non-chordates (upto sub-classes) and chordates (up to orders) giving general features and evolutionary relationship of the following phyla: Protozoa, Porifera, Coelenterata, Platyhelminthes, Nematelminthes, Annelida, Arthropoda, Mollusca, Echinodermata, Minor Phyla (Bryozoa, Phoronida and Chaetognatha) and Hemichordata.
- b) Structure reproduction and life history of the following types: Amoeba, Monocystis, Plasmodium, Paramecium, Sycon, Hydra, Obelia, Fasciola, Taenia, Ascaris, Nereis, Pheretima, Hirudina, Palaemon, Buthus, Periplaneta, Lamellidens, Pila, Asterias and Balanoglossus.
- c) Classification of chordates (up to orders), giving general features and evolutionary relationship of the following: Protochordata; Agnatha; Gnathostomata-Pisces, Amphibia, Reptilia, Aves and Mammalia.
- d) Comparative functional anatomy of the following based on type animals (Scoliodon, Rana, Calotes, Columba and Oryctolagus): integument and its derivatives, endoskeleton, digestive system, respiratory system, circulator system including heart and aortic arches, urinogenital system; brain and sense organs (eye and ear); endocrine glands and other hormone producing structures, (Pituitary, thyroid, parathyroid, adrenal, pancreas, gonads) their function.

### **3. Vertebrate Physiology and Biochemistry:**

- a) Chemical composition of protoplasm; nature and function of enzymes; vitamins, their sources and role; colloids and hydrogen ion concentration; biological oxidation, electron transport and role of ATP, energetics, glycolysis, citric acid cycle; vertebrate hormones; their type, sources and function; pheromones and their role.
- b) Neuron and nerve impulse-conduction and transmission across synapses; neurotransmitters and their role, including acetyl cholinesterase activity.
- c) Homeostasis; osmoregulation; active transport and ion pump.
- d) Composition of carbohydrates, fats, lipids and proteins; steroids.

### **4. Embryology:**

- a) Gametogenesis, fertilization, cleavage; gastrulation in frog and chick
- b) Metamorphosis in frog and retrogressive metamorphosis in ascidian; extra-embryonic membranes in chick and mammal; placentation in mammals; Bio-genetic law.

### **5. Evolution:**

- a) Origin of life; principles, theories and evidences of evolution; species concept.
- b) Zoogeographical realms, insular fauna; geological eras.
- c) Evolution of man; evolutionary status of man.

### **6. Ecology, Wildlife and Ethology:**

- a) Abiotic and biotic factors; concept of ecosystem, food chain and energy flow; adaptation of aquatic, terrestrial and aerial fauna; intra-and inter-specific animal relationships; environmental pollution; Types, sources, causes, control and prevention.
- b) Wildlife of India; endangered species of India; sanctuaries and national parks of India.
- c) Biological rhythms.

### **7. Economic Zoology:**

- a) Beneficial and harmful insects including insect vectors of human diseases.
- b) Industrial fish, prawn and molluscs of India.
- c) Non-poisonous and poisonous snakes of India
- d) Venomous animals-centipede, wasp, honey bee
- e) Diseases caused by aberrant chromosomes/genes in man; genetic counselling; DNA as a tool for forensic investigation.

## **10. LAW**

### **I. Jurisprudence**

1. Nature and concept of law.
2. School of Jurisprudence: Analytical, Historical; Philosophical, Sociological & Natural.
3. Administration of Justice: Theories of punishment.
4. Sources of Law: Custom, Precedent and Legislation.
5. A few basic Legal concepts:
  - (i) Rights and Duties
  - (ii) Legal Personality
  - (iii) Ownership and Possession

### **II. Constitutional Law of India**

1. Salient features of the Indian Constitution.
2. Preamble.
3. Fundamental Rights. Directive Principles and Fundamental Duties
4. Constitutional position and powers of President and Governors
5. Supreme Court and High Courts: Jurisdiction, powers, appointment and transfer of Judges
6. Union Public Service Commission and State Public Service Commissions: Powers and functions
7. Distribution of Legislative and Administrative Powers between the Union and the States
8. Emergency Provisions
9. Amendment of the Constitution

### **III. International Law:**

1. Nature and definition of International Law
2. Sources: treaty, Custom, General Principles of Law recognized by civilized nations and subsidiary means of determination of law
3. State Recognition and State succession
4. The United Nations, its objective, purpose and principal organs; Constitution, role and jurisdiction of International Court of Justice
5. Protection of Human Rights:
  - (i) Provisions in the UN Charter
  - (ii) Universal declaration of Human Rights, 1948
  - (iii) International Covenant of civil and Political Rights, 1966
  - (iv) International covenant on Economic, Social and Cultural Rights, 1966

### **IV. Torts:**

1. Nature and Definition of Tort.
2. Liability based on fault and strict liability
3. Vicarious Liability including State Liability
4. Joint Tort feasons
5. Negligence
6. Defamation
7. Conspiracy
8. Nuisance
9. False imprisonment
10. Malicious Prosecution

### **V. Criminal Law:**

1. General Principles of criminal liability: Mens rea and actus reus
2. Preparation and criminal attempts
3. General Exceptions
4. Joint and constructive liability
5. Abetment
6. Criminal Conspiracy
7. Sedition
8. Murder and culpable homicide
9. Theft, extortion, robbery and decoity
10. Misappropriation and Criminal Breach of Trust

### **VI. Law of Contract:**

1. Definition of contract
2. Basic elements of contract: Offer acceptance, consideration, contractual capacity
3. Factors vitiating consent
4. Void, Voidable, illegal and unenforceable agreements
5. Wagering agreements
6. Contingent contracts
7. Performance of contracts
8. Dissolution of contractual obligations: frustration of contracts
9. Quasi-contracts
10. Remedies for breach of contract

## **07. ECONOMICS**

### **PART-I**

#### **General Economics:**

1. **Micro- Economics:** (a) Production, Agents of Production; Costs and Supply; Isoquants, (b) Consumption and Demand; Elasticity concept, (c) Market Structure and concepts of equilibrium; (d) Determination of prices; (e) Components and Theories of Distribution, (f) Elementary concepts of Welfare economics: Pareto-optimality-Private and social products consumers surplus.

2. **Macro- Economics:** (a) National Income concepts; (b) Determinants of National income employment (c) Determinants of consumption, savings and investment, (d) Rate of Interest and its determination, (e) Interest and Profit.

3. **Money, Banking and Public Finance:** (a) Concepts of Money and measures of money supply; velocity of money, (b) Banks and credit creation; Banks and portfolio management, (c) Central Bank and control over money supply, (d) Determination of the price level, (e) Inflation, its causes and remedies, (f) Public, Finance-Budgets-Taxes and non-tax revenues-Types of Budget deficits.

#### **4. International Economics:**

(1) Theories of International Trade-comparative costs – Hecksher-Ohlin-Gains from Trade-Terms of Trade.

(2) Free Trade and Protection

(3) Balance of payments accounts and adjustment

(4) Exchange rate under the exchange markets

(5) Evolution of the International Monetary System and World Trading order-Gold Standard-the Brettonwoods system.

IMF and the World Bank and their associates.

#### **Floating rates-GATT and WTO:**

5. **Growth and Development:** (1) Meaning and measurement of growth; Growth, distribution and Welfare; (2) Characteristics of under-development; (3) Stages of Development; (4) Sources of growth-capital, Human capital, population, productivity, Trade and aid, non-economic factors; growth Strategies, (5) Planning in a mixed economy-Indicative planning-Planning and growth.

6. **Economic Statistics:** Types of averages-measures of dispersion-correlation-Index numbers; types, uses and limitations.

### **PART-II**

#### **Indian Economics:**

1. Main features; Geographic size-Endowment of natural resources, Population; size composition quality and growth trend-Occupational distribution-Effects of British Rule with reference to Drain theory and Laissez Faire policy.

2. Major problems, their dimensions, nature and broad causes; Mass poverty-Unemployment and its types-Economics effects of population pressure-Inequality and types thereof-Low productivity and low per capita income, Rural-urban disparities-Foreign Trade and payments imbalances. Balance of Payments and External Debt-Inflation and parallel economy and its effects-Fiscal deficit.

3. Growth in income and employment since Independence-Rate, Pattern, Sectoral trends-Distributional Changes-Regional disparities.

4. Economic Planning in India: Major controversies on planning in India-Alternative strategies-goals and achievements, shortfalls of different plans-planning and the Market

5. Broad Fiscal, monetary, industrial trade and agricultural policies-objectives, rationale, constraints and effects.

## **25. CIVIL ENGINEERING**

### **PART-A**

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

First and Second Moments of area, Mass moment of Inertia.

Static Friction Inclined plane and bearings.

Kinematics and Kinetics: Kinematics in Cartesian and polar co-ordinates, motion under uniform and non-uniform acceleration, motion under gravity. Kinetics of particle: Momentum and Energy principles, D'Alembert's Principle, Collision of elastic bodies, rotation of rigid bodies, simple harmonic motion.

**2. Strength of Materials:** Simple Stress and Strain, Elastic constants, axially loaded compression members, Shear force and bending moment, theory of simple bending moment, Shear Stress distribution across cross sections, Beams of uniform strength, Leaf spring, Strain Energy in direct stress, bending and shear.

**Deflection of beams:** Macaulay's method, Mohr's moment area method, Conjugate beam method, unit load method. Torsion of Shafts, Transmission of power, close coiled helical springs, Elastic stability of columns: Euler's, Rankine's and Secant formulae. Principal Stresses and Strains in two dimension, Mohr's Circle. Theories of Elastic failure, Thin and Thick cylinders: Stresses due to internal and external pressures-Lame's equation.

**3. Structural Analysis:** Analysis of pin jointed plane trusses, deflection in trusses. Three hinged and two hinged arches, rib shortening, temperature effects, influence lines in arches. Analysis of propped cantilevers, fixed beams, continuous beams and rigid frames. Slope deflection, moment distribution, Kani's method and Matrix method: Force and Displacement methods. Rolling loads and influence lines for determinate beams and pin jointed trusses.

### **PART-B**

**Geotechnical Engineering:** Types of soil, field identification and classification, phase relationships, consistency limits, particle size distribution, classification of soil, structure and clay mineralogy.

Capillary water and structural water, effective stress and pore water pressure, Darcy's Law, factors affecting permeability, determination of permeability, permeability of stratified soil deposits.

Seepage pressure, quick sand condition, compressibility and consolidation, Terzaghi's theory of one dimensional consolidation, consolidation test. Compaction of soil, optimum moisture content, Proctor Density.

Subsurface exploration, methods of boring, sampling, types of sampler, field tests.

Shear strength of soils, Mohr-Coulomb failure theory, shear tests Earth pressure at rest, active and passive pressures, Rankine's theory, Coulomb's wedge theory, earth pressure on retaining wall.

Bearing capacity, Terzaghi and other important theories, net and gross bearing pressure, immediate and consolidation settlement.

Load carrying capacity of pile groups.

Stability of slope-conventional method of slices, stability numbers.

**Transportation Engineering:** Highway alignment, choice of layout and capacity of highways, location survey, geometric design of highways-various elements, curves, grade separation and segregation of traffic, inter-section design, highway materials and testing subgrade and pavement components, type of pavements, road drainage, elements of airport engineering.

Railway engineering-elements of permanent track-rails, sleepers, ballast and rail fastenings, tractive resistance, elements of geometric design-gradients and grade compensation on curves, cant transition curves and vertical curves, stresses in railway tracks, points and crossing, signaling and inter-locking, maintenance of railway track. Culverts and small bridges.

### **PART-C**

**Fluid Mechanics:** fluid properties, fluid statics, forces on plane and curved surfaces, stability of floating and submerged bodies.

**Kinematics:** Velocity, streamlines, continuity equation, accelerations irrotational and rotational flow, velocity potential and stream functions, flownet, separation.

**Dynamics:** Euler's equation along streamline, control volume equation, continuity, momentum, energy and moment of momentum equation from control volume equation, applications to pipe flow, moving vanes, moment of momentum, Dimensional analysis.

Boundary layer on a flat plate, drag and lift on bodies. Laminar and Turbulent Flows. Laminar and turbulent flow through pipes, friction factor variation, pipe networks, water hammer and surge tanks.

**Open Channel Flow:** Energy and momentum correction factors, uniform and non-uniform flows, specific energy and specific force, critical depth, Friction factors and roughness co-efficients, flow in transitions, free overfall, weirs, hydraulic jump, surges, gradually varied flow equations, surface profiles, moving hydraulic jump.

## **PART-D**

### **Environmental Engineering:**

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

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

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

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

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

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

**Construction Management:** Elements and principles of Activity on Arrow (AOA) and Activity on Node (AON) networks and work breakdown structure. Interfaces. Ladder networks. Activity time. Time computations and works. ATC and PTC trade-off. Work study and sampling. Scheduling principles-material schedules. ABC and EOQ analysis of inventory. Budgeting with bar-charts. Working capital. PERT, probability of completion.

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

## **28. MECHANICAL ENGINEERING**

**STATICS:** Simple applications of equilibrium equations.

**DYNAMICS:** Simple applications of equations of motion, work, energy and power.

**THEORY OF MACHINES:** Simple examples of kinematic chains and their inversions.

Different types of gears, bearings, governors, flywheels and their functions.

Static and dynamic balancing of rigid rotors.

Simple vibration analysis of bars and shafts.

Linear automatic control systems.

**MECHANICS OF SOLIDS:** Stress, strain and Hooke's Law. Shear and bending moments in beams.

Simple bending and torsion of beams, springs and thin walled cylinders. Elementary concepts of elastic stability, mechanical properties and material testing.

**MANUFACTURING SCIENCE:** Mechanics of metal cutting, tool life, economics of machining, cutting tool materials. Basic types of machine tool and their processes. Automatic machine tools, transfer lines. Metal forming processes and machines-shearing, drawing, spinning, rolling, forging, extrusion. Types of casting and welding methods. Power metallurgy and processing of plastics.

**MANUFACTURING MANAGEMENT:** Methods and time study, motion economy and work space design, operation and flow process charts. Cost estimation, break-even analysis. Location and layout of plants, material handling. Capital budgeting, job shop and mass production, scheduling, dispatching, Routing, Inventory.

**THERMODYNAMICS:** Basic concepts, definitions and laws heat, work and temperature, Zeroth law, temperature scales, behaviour of pure substances, equations of state, first law and its corollaries, second law and its corollaries. Analysis of air standard power cycles, Carnot, Otto, Diesel, Brayton cycles. Vapour power cycles, Rankine reheat and regenerative cycles, Refrigeration cycles-Bell Coleman, Vapour absorption and Vapour compression cycle analysis, open and closed cycle gas turbine with inter-cooling, reheating.

**ENERGY CONVERSION:** Flow of steam through nozzles, critical pressure ratio, shock formation and its effect. Steam generators, mountings and accessories. Impulse and reaction turbines elements and layout of thermal power plants.

Hydraulic turbines and pumps, specific speed, layout of hydraulic power plants.

Introduction to nuclear reactors and power plants, handling of nuclear waste.

**REFRIGERATION AND AIR CONDITIONING:** Refrigeration equipment and operation and maintenance, refrigerants, principles of air conditioning, psychrometric chart, comfort zones, humidification and dehumidification.

**FLUID MECHANICS:** Hydrostatics, continuity equation, Bernoulli's theorem, flow through pipes, discharge measurement, laminar and turbulent flow, boundary layer concept.

## **26. ELECTRICAL ENGINEERING**

**Electrical Circuits – Theory and Applications:** Circuit components, network graphs, KCL, KVL; circuit analysis methods; nodal analysis, mesh analysis; basic network theorems and applications; transient analysis; RL, RC and RLC circuits; sinusoidal steady state analysis; resonant circuits and applications; coupled circuits and applications; balanced 3-phase circuits. Two port networks, driving point and transfer functions; poles and zeros of network functions.

**Signals & Systems:** Representation of continuous-time and discrete-time signals & system's; LTI systems; convolution; impulse response; time-domain analysis of LTI systems based on convolution and differential/difference equations. Fourier transform, Laplace transform, Z-transform, Transfer function. Sampling and recovery of signals.

**Control Systems:** Elements of control systems; block-diagram representations; open-loop & closed-loop systems; principles and applications of feed-back. LTI systems: time domain and transform domain analysis. Stability: Routh Hurwitz criterion, root-loci, Nyquist's criterion. Bode-plots, Design of lead-lag compensators; Proportional, PI, PID controllers.

**E.M. Theory:** Electro-static and magneto-static fields; Maxwell's equations; e.m. waves and wave equations; wave propagation and antennas; transmission lines; micro-wave resonators, cavities and wave guides.

**Electrical Engineering Materials:** Electrical/electronic behaviour of materials: conductivity; free-electrons and band-theory; intrinsic and extrinsic semi-conductor, p-n junction; solar cells, super-conductivity. Dielectric behaviour of materials: polarization phenomena; piezo-electric phenomena. Magnetic materials: behaviour and application.

**Analog Electronics:** Diode circuits: rectifiers filters, clipping and clamping, zener diode and voltage regulation, Bipolar and field effect transistors (BJT, JFET and MOSFET): Characteristics, biasing and small signal equivalent circuits. Basic amplifier circuits; differential amplifier circuits. Amplifiers: analysis, frequency response. Principles of feedback; OPAMP circuits; filters; oscillators.

**Digital Electronics:** Boolean algebra; minimisation of Boolean function; logic gates, digital IC families (DTL, TTL, ECL, MOS, CMOS). Combination circuits: arithmetic circuits, code converters, multiplexers and decoder's. Sequential circuits: latches and flip-flops, counters and shift-registers. Comparators, timers, multi-vibrators. Sample and hold circuits; ADCs and DACs. Semiconductor memories.

**Communication Systems:** Fourier analysis of signals: amplitude, phase and power spectrum, auto-correlation and cross-correlation and their Fourier transforms. Analog modulation systems: amplitude and angle modulation and demodulation systems, spectral analysis; super heterodyne receivers. Pulse code modulation (PCM), differential PCM, delta modulation. Digital modulation schemes : amplitude, phase and frequency shift keying schemes (ASK,PSK,FSK). Multiplexing: time-division, frequency-division. Additive Gaussian noise; characterization using correlation, probability density function, power spectral density, Signal-to-noise ratio calculations for AM and FM. Elements of digital communication systems; source coding, channel coding; digital modulation & demodulation. Elements of information theory, channel capacity. Elements of satellite and mobile communication; principles of television engineering; radar engineering and radio aids to navigation.

**Computers and Microprocessors:** Computer organization; number representation and arithmetic, functional organization machine instructions, addressing modes, ALU hardware and micro programmed control, memory organization. Elements of microprocessors; 8-bit microprocessors-architecture, instruction set, assembly level programming, memory, I/O interfacing, micro controllers and applications.

**Measurement and Instrumentation:** Error analysis; measurement of current voltage, power, energy, power-factor, resistance, inductance, capacitance and frequency; bridge measurements. Electronic measuring instruments; multimeter, CRO, digital volt meter, frequency counter, Q-meter, spectrum analyser, distortion-meter. Transducers; thermocouple, thermistor, LVDT, strain-gauges, piezo-electric crystal. Use of transducers in measurement of non-electrical quantities. Data-acquisition systems.

**Energy Conversion:** Single-phase transformer; equivalent circuit, phasor-diagram, tests, regulation and efficiency; three-phase transformer; auto transformer. Principles of energy conversion-d.c. generators and motors: Performers characteristics, starting and speed control armature reaction and commutation; three-phase induction motor; performance characteristics, starting and speed control. Single-phase induction motor. Synchronous generators; performance characteristics, regulation, parallel operation. Synchronous motors; starting characteristics, applications; synchronous condenser, FHP motors, permanent magnet and stepper motors, brushless d.c. motors, single-phase motors.

**Power Systems:** Electric power generation; thermal, hydro, nuclear. Transmission line parameters; steady-state performance of overhead transmission lines and cables. Distribution systems; insulators, bundle conductors, corona and radio interference effects; per-unit quantities; bus admittance and impedance matrices; load flow; voltage control and power factor correction. Economic operation. Principles of over current, differential and distance protection; solid state relays, circuit breakers, concept of system stability, HVDC transmission.

**Power Electronics and Electric Drives:** Semiconductor power devices; diode, transistor, thyristor, triac, GTO and MOSFET, static characteristics, principles of operation; triggering circuits; phase controlled rectifiers; bridge converters-fully controlled and half controlled; principles of thyristor chopper and inverter. Basic concept of speed control of DC and AC motor drives.

**Elements of IC Fabrication Technology:** Overview of IC Technology. Unit steps used in IC fabrication; wafer cleaning, photo-lithography, wet and dry etching, oxidation, diffusion, ion-implantation, CVD and LPCVD techniques for deposition of poly-silicon, silicon, silicon-nitride and silicon dioxide; metallisation and passivation.



## **27. ELECTRONICS AND COMMUNICATION ENGINEERING**

**Solid State Physics:** Quantum theory of free electrons, classical wave equation, Schrodinger's wave equation, Fermi distribution function, Band theory of solids, Electron in a periodic field of a crystal (Kronig-Penny model), Diffusion, Drift Mechanism, Continuity equation, Hall effect. Basic Principles of Super Conductivity.

**Electronic Devices and Circuits** PN junction diode, Zener diode, Tunnel diode, Gunn diode, P-I-N diode, BJT, FET, PNP Devices, Operational Amplifier. Biasing and bias stability, small signal and HF equivalent circuits. Rectifier circuits. Amplifiers: Single- and multistage, differential, Operational, feedback and power amplifiers. Analysis of amplifiers, frequency response of amplifiers, simple operational amplifier circuits, sinusoidal oscillators.

**Networks:** Network definitions, Network topology, Mesh and Node circuit analysis, Steady state sinusoidal analysis, Network theorems, Response of RL, RC and RLC networks to various types of excitation, series and parallel resonance, Two port networks, Laplace transforms.

**Communication systems:** Fourier analysis of signals – amplitude, phase and power spectrum, Fourier Transforms. Autocorrelation and cross-correlation functions, signal transmission through linear time invariant systems. Analog and Digital Modulation Schemes: AM, DSB, SSB, VSB, FM, PM, PAM, PWM, PPM, PCM, DM, ASK, FSK, PSK – Signal generation and demodulation – spectral analysis. (S/N) calculations at the destination. Transmitters and receivers: Radio, TV, Radar and Satellite. Satellite Orbits, Subsystems of a Satellite, G/T of an earth station, Multiple Access Techniques, Basics of optical fiber communication system.

**Electromagnetics:** Gradient, divergence, curl. Gauss and Stokes theorems. Electrostatics, Magnetostatics, Boundary conditions. Maxwell's equations, Wave equation and its solutions, Poynting Vector, Propagation of Electromagnetic waves through various media, reflection, refraction. Phase and group velocity. Transmission lines: Transmission line parameters, transmission line theory, Line at Radio frequencies, Impedance matching. Wave Guides: Modes in Rectangular and Circular Wave guides, attenuation, Wave impedance. Antennas: Retarded Vector potential. LF, MF, HF, VHF, UHF, SHF antennas. Propagation: Ground, Sky and space wave propagation.

**Digital Electronics:** Clipping, Clamping circuits. Boolean algebra, Minimisation of Boolean functions, logic gates, digital IC families, arithmetic circuits, code converters, multiplexers and decoders. Latches and flip-flops, counters and shift registers, comparators, timers, ADC and DACs. Microprocessor (8085) architecture, programming, memory and I/O interfacing.

**Control Systems:** Open loop and closed loop (feedback) systems, LTI systems-transfer function, impulse response, poles, zeros – their significance, stability analysis, Root loci, Routh-Hurwitz criterion, Bode and Nyquist plots.

**Electronic Instrumentation:** Types of errors, Power supplies, CRO, Special purpose CROs, DVM, DMM, digital frequency meters, function generators, standard AM/FM signal generators, pattern generators, Transducers.

## 19. CHEMISTRY

### SECTION-A: (INORGANIC CHEMISTRY):

**1.1 Atomic structure:** Schrodinger wave equation, significance of  $n$  and  $l$  quantum numbers and their significance, radial and angular probability, shapes of orbitals, relative energies of atomic orbitals as a function of atomic number. Electronic configurations of elements; Aufbau principle, Hund's multiplicity rule, Pauli exclusion principle.

**1.2 Chemical periodicity:** Periodic classification of elements, salient characteristics of s,p,d and f block elements. Periodic trends of atomic radii, ionic radii, ionization potential, electron affinity and electro-negativity in the periodic table.

**1.3 Chemical bonding:** Types of bonding, overlap of atomic orbitals, sigma and pi-bonds, hydrogen and metallic bonds. Shapes of molecules bond order, bond length, V.S.E.P.R. theory and bond angles. The concept of hybridization and shapes of molecules and ions.

**1.4 Oxidation states and oxidation number:** Oxidation and reduction, oxidation numbers, common redox reactions, ionic equations. Balancing of equations for oxidation and reduction reactions.

**1.5 Acids and bases:** Bronsted and Lewis theories of acids and bases. Hard and soft acids and bases. HSAB principle, relative strengths of acids and bases and the effect of substituents and solvents on their strength.

#### **1.6 Chemistry of elements:**

- i) **Hydrogen:** Its unique position in the periodic table, isotopes, ortho and para hydrogen, industrial production, heavy water.
- ii) **Chemistry of 's' and 'p' block elements:** Electronic configuration, general characteristics properties, inert pair effect, allotropy and catenation. Special emphasis on solutions of alkali and alkaline earth metals in liquid ammonia. Preparation, properties and structures of boric acid, borates, boron nitrides, borohydride (diborane), carboranes, oxides and oxyacids of nitrogen, phosphorous, sulphur and chlorine; interhalogen compounds, polyhalide ions, pseudohalogens, fluorocarbons and basic properties of halogens. Chemical reactivity of noble gases, preparation, structure and bonding of noble gas compounds.
- iii) **Chemistry of 'd' block elements:** Transition metals including lanthanides, general characteristic properties, oxidation states, magnetic behaviour, colour. First row transition metals and general properties of their compounds (oxides, halides and sulphides); lanthanide contraction.

**1.7 Extraction of metals:** Principles of extraction of metals as illustrated by sodium, magnesium, aluminum, iron, nickel, copper, silver and gold.

**1.8 Nuclear Chemistry:** Nuclear reactions; mass defect and binding energy, nuclear fission and fusion. Nuclear reactors; radioisotopes and their applications.

**1.9 Coordination compounds:** Nomenclature, isomerism and theories of coordination compounds and their role in nature and medicine.

**1.10 Pollution and its control:** Air pollution, types of air pollution, control of air and water pollution, radioactive pollution.

### SECTION-B: (ORGANIC CHEMISTRY):

**2.1 Bonding and shapes of organic molecules:** Electronegativity, electron displacements-inductive, mesomeric and hyperconjugative effects; bond polarity and bond polarizability, dipole moments of organic molecules; hydrogen bond; effects of solvent and structure on dissociation constants of acids and bases; bond formation, fission of covalent bonds; homolysis and heterolysis; reaction intermediates-carbocations, carbanions, free radicals and carbenes; generation geometry and stability; nucleophiles and electrophiles.

**2.2 Chemistry of aliphatic compounds:** Nomenclature alkanes-synthesis, reactions (free radical halogenation) – reactivity and selectivity, sulphonation-detergents; cycloalkanes-Baeyers' strain theory; alkanes and alkynes-synthesis, electrohilic addition; reactions, Markownikov's rule, peroxide effects, 1-3-dipolar addition; nucleophilic addition to electron-deficient alkenes; polymerization; relative acidity; synthesis and reactions of alkyl halides, alkanols, alkanals, alkanones, alkanolic acids, esters, amides, nitriles, amines, acid anhydrides,  $\alpha$ -unsaturated ketones, ethers and nitro compounds.

**2.3 Stereochemistry of carbon compounds:** Elements of symmetry, chiral and achiral compounds. Fischer projection formulae; optical isomerism of lactic and tartaric acids, enantiomerism and diastereo-isomerism; configuration (relative and absolute); conformations of alkanes upto four carbons, cyclohexane and dimethylcyclo-hexanes their potential energy **D,L** and **R,S** notations of compounds containing chiral centers; projection formulae-Fischer, Newman and sawhorse of compounds containing two adjacent chiral centers; meso and dl-isomers, erythro and threo isomers; racemization and resolution; examples of homotopic, enantiotopic and diastereotopic atoms and groups in organic compounds, geometrical isomers; **E** and **Z** notations. Stereo-chemistry of SN1, SN2, E1 and E2 reactions.

**2.4 Organometallic compounds:** Preparation and synthetic uses of Grignard reagents, alkyl lithium compounds.

**2.5 Active methylene compounds:** Diethyl malonate, ethyl acetoacetate. ethyl cyanoacetate-applications in organic synthesis; tautomerism (keto-enol).

**2.6 Chemistry of aromatic compounds:** Aromaticity; Huckel's rule; electrophilic aromatic substitution-nitration, sulphonation, halogenation (nuclear and side chain), Friedel-Crafts alkylation and acylation, substituents effect; chemistry and reactivity of aromatic halides, phenols, nitro, diazo, dia-zonium and sulphonic acid derivatives, benzyne reactions.

**2.7 Chemistry of biomolecules:** (i) **Carbohydrates:** Classification, reactions, structure of glucose, D,L-configuration, osazone formation; fructose and sucrose; step-up step-down of aldoses and ketoses; and their interconversion, (ii) **Amino acids:** Essential amino acids; zwitterions, isoelectric point, polypeptides; proteins; methods of synthesis of  $\alpha$ -amino acids. (iii) Elementary idea of oils, fats, soaps and detergents.

**2.8 Basic principles and applications of UV, visible, IR and NMR spectroscopy of simple organic molecules.**

### **SECTION-C: (PHYSICAL CHEMISTRY):**

**3.1 Gaseous state:** Deviation of real gases from the equation of state for an ideal gas, Vander Waals and Virial equation of state, critical phenomena, principle of corresponding states, equation for reduced state. Liquification of gases, distribution of molecular speed, collisions between molecules in a gas; mean free path, specific heat of gases.

#### **3.2 Thermodynamics:**

- (i) **First Law and its applications:** Thermodynamic systems, states and processes work, heat and internal energy, zeroth law of thermodynamics, various types of work done on a system in reversible and irreversible processes. Calorimetry and thermo-chemistry, enthalpy and enthalpy changes in various physical and chemical processes, Joule-Thomson effect, inversion temperature. Heat capacities and temperature dependence of enthalpy and energy changes.
- (ii) **Second Law and its applications:** Spontaneity of a process, entropy and entropy changes in various processes, free energy functions, criteria for equilibrium, relation between equilibrium constant and thermodynamic quantities.

**3.3 Phase rule and its applications:** Equilibrium between liquid, solid and vapours of a pure substance, Clausius-Clapeyron equation and its applications. Number of components, phases and degrees of freedom; phase rule and its applications; simple systems with one (water and sulphur) and two components (lead-silver, salt hydrates). Distribution law, its modifications, limitations and applications.

**3.4 Solutions:** Solubility and its temperature dependence, partially miscible liquids, upper and lower critical solution temperatures, vapour pressures of liquids over their mixtures, Raoult's and Henry's law, fractional and steam distillations.

**3.5 Colligative Properties:** Dilute solutions and colligative properties, determination of molecular weights, using colligative properties.

**3.6 Electro-chemistry:** Ions in solutions, ionic equilibria, dissociation constants of acids and bases, hydrolysis, pH and buffers, theory of indicators and acid-base titrations. Conductivity of ionic solutions, its variation with concentration, Ostwald's dilution law, Kohrausch law and its application. Transport number and its determination. Faraday's laws of electrolysis, galvanic cells and measurements of their e.m.f., cell reactions, standard cell, standard reduction potential Nernst equation, relation between thermodynamic quantities and cell e.m.f., fuel cells, potentiometric titrations.

**3.7 Chemical kinetics:** Rate of chemical reaction and its dependence on concentrations of the reactants, rate constant and order of reaction and their experimental determination; differential and integral rate equations for first and second order reaction, half-life periods; temperature dependence of rate constant and Arrhenius parameters; elementary ideas regarding collision and transition state theory.

**3.8 Photochemistry:** Absorption of light, laws of photochemistry, quantum yield, the excited state and its decay by radiative, non-radiative and chemical pathways; simple photochemical reactions.

**3.9 Catalysis:** Homogeneous and heterogeneous catalysis and their characteristics, mechanism of heterogeneous catalysis; enzyme catalysed reactions (Michaelis-Menten mechanism)

**3.10 Colloids:** The colloidal state, preparation and purification of colloids and their characteristics properties; lyophilic and lyophobic colloids and coagulation; protection of colloids; gels, emulsions, surfactants and micelles.

## 20. GEOLOGY

### Part - I

- a) **General Geology:** Solar System. The Earth: its origin, age and internal constitution. Volcanoes-types, distribution geological effects and products. Earth-quakes-intensity, magnitude, distribution, causes and effects. Elementary ideas about isostasy, geosynclines, mountain building, continental drift, sea floor spreading and plate tectonics.
- b) **Geomorphology:** Basic concepts. External and internal processes. Rock weathering. Cycle of erosion. Fluvial landforms and drainage patterns. Landforms of Aeolian, marine, glacial and 'Karst' landscapes. Elements of Remote Sensing.
- c) **Structural and field Geology:** Primary and secondary structures. Dip and strike of beds. Unconformities. Study of folds, joints, faults, foliation and lineations. Overthrusts and nappe structures. Stages of rock deformation. Construction of block diagrams, Stereographic and equal-area nets. Solutions of simple problems by stereographic net. Topographic maps and their interpretation. Use of clinometer compass in the field Measurements of bed, foliation, folds joints, faults and lineations in the field. Principles of geological mapping. Effects of topography on outcrops. Drawing of sections.

### Part – II

- a) **Crystallography:** Elements of crystal structure. Laws of crystallography, Symmetry elements of normal classes of seven crystal systems. Properties and interaction of light and crystalline matter. Petrological microscope and accessories. Construction and use of Nicole prism. Pleochroism, double refraction, extinction angle, birefringence and twinning in crystals, Isotropic, uniaxial and biaxial minerals.
- b) **Mineralogy:** Physical, chemical and optical properties of the following common rock forming minerals: quartz, feldspar, mica, pyroxene, amphibole, olivine, garnet, chlorite, carbonates, aluminosilicates. Structure of silicates and crystal chemistry of minerals. Gemstones.
- c) **Economic Geology:** Ore, ore mineral and gangue. Classification of ore deposits. Important processes of their formation. Occurrence, origin and distribution in India of the ores of aluminium, chromium, copper, gold, lead, zinc, iron, manganese and radioactive elements. Deposits of minerals use as abrasives, refractories and in ceramics, deposits of coal and petroleum. Elements of prospective of mineral deposits.

### Part – III

- a) **Igneous Petrology:** Origin of magma and formation of igneous rocks. Bowen's reaction principle. Crystallisation of binary systems. Classification of igneous rocks. Textures and structures of igneous rocks. Composition, origin and mode of occurrence of granite, syenite diorite, mafic and ultramafic groups, anorthosites and alkaline rocks.
- b) **Sedimentary Petrology:** Sedimentary process and products. Classification of sedimentary rocks. Sedimentary structures. Residual deposits – their mode of formation, characteristics and types, Clastic deposits – their classification, mineral composition and texture. Elementary ideas about the origin and characteristics of quartz arenites, arkoses and greywackes. Siliceous and calcareous deposits of chemical and organic origin.
- c) **Metamorphic Petrology:** Types and factors of metamorphism. Zones, grades and facies of metamorphism. Regional and contact metamorphism. Textures and structures of metamorphic rocks. Metamorphism of argillaceous, arenaceous, calcareous and basic rocks. Metasomatism.

### Part – IV

- a) **Paleontology:** Habits and habitats of animals. Fossils and fossilization. Modes of preservation. Application of fossils, Study of morphology and geological history of Foraminiferida, Brachipoda, Bivalvia, Gastropoda, Cephalopoda, Trilobita, Echinoidea and Anthozoa. Mammals of Siwalik Group. A brief study of Gondwana flora.
- b) **Stratigraphy and Geology of India:** Fundamental laws of stratigraphy. Stratigraphic classification lithostratigraphic, biostratigraphic and chronostratigraphic. Geological time scale. Physiographic divisions and outline of stratigraphy of India. Brief study of Dharwar, Vindhyan and Gondwana Supergroups and Siwalik Group with reference to their major subdivisions, lithology, fossils, aerial distribution and economic importance.

## **11. PHILOSOPHY**

### **SECTION-A:**

#### **PROBLEMS OF PHILOSOPHY:**

1. Substance and Attributes: Aristotle, Descartes, Locke, Berkeley's criticism, Nyaya-Vaisesika, Buddhist criticism of Pudgala.
2. God, Soul and the World: Thomas Aquinas, St. Augustine, Spinoza, Descartes, Nyaya-Vaisesika, Sankara, Ramanuja.
3. Universals: Realism and Nominalism (Plato, Aristotle, Berkeley's criticism of abstract ideas, Nyaya-Vaisesika, Buddhism).
4. Bases of knowledge: Pramanavada in Carvaka, Nyaya-Vaisesika, Buddhism, Advaita Vedanta.
5. Truth and Error: Correspondence theory, Coherence theory, Pragmatic theory; Khyativada (Anyathakhyati, Akhyati, Anivacaniyakhyati)
6. Matter and Mind: Descartes, Spinoza, Leibnitz, Berkeley.

### **SECTION-B:**

#### **Logic:**

1. Truth and Validity
2. Classification of sentences: Traditional and Modern
3. Syllogism: Figures and Moods; Rules of Syllogism (General and special) validation by Venn Diagrammes; Formal Fallacies
4. Sentential Calculus: Symbolisation; Truth-Functions and their interdefinability, Truth tables; Formal proof.

### **SECTION-C:**

#### **Ethics:**

1. Statement of fact and statement of value
2. Right and Good; Teleology and Deontology
3. Psychological Hedonism
4. Utilitarianism (Bentham; J.S. Mill)
5. Kantian Ethics
6. Problem of the freedom of will
7. Moral judgements: Descriptivism, Prescriptivism, Emotivism
8. Niskamakarma: Sthitaprajna
9. Jaina Ethics
10. Four Noble Truths and Eight fold path in Buddhism
11. Gandhian Ethics: Satya, Ahimsa, Ends and Means.

## 09. HISTORY

### Section – A

1. Prehistoric cultures in India.
2. Indus Civilization. Origins. The Mature Phase: extent, society, economy and culture. Contacts with other cultures. Problems of decline.
3. Geographical distribution and characteristics of pastoral and farming communities outside the Indus region, from the Neolithic to early iron phases.
4. Vedic society. The Vedic texts; change from Rigvedic to later Vedic phases. Religion; Upanishadic thought. Political and social organization; evolution of monarchy and varna system.
5. State formation and urbanization, from the mahajanapadas to the Nandas. Jainism and Buddhism. Factors for the spread of Buddhism.
6. The Mauryan Empire. Chandragupta; Megasthenes. Ashoka and his inscriptions; his dhamma, administration, culture and art. The Arthashastra.
7. Post-Mauryan India, BC 200 – AD 300. Society: Evolution of jatis. The Satavahanas and state formation in Peninsula. Sangam texts and society. Indo-Greeks, Sakas Parthians, Kushanas; Kanishka. Contacts with the outside world. Religion: Saivism, Bhagavatism, Hinayana and Mahayana Buddhism; Jainism; Culture and art.
8. The Guptas and their successors (to c. 750 AD). Changes in political organization of empire. Economy and society. Literature and science. Arts.

### Section - B

9. Early Medieval India. Major dynasties; the Chola Empire. Agrarian and political structures. The Rajaputras. Extent of social mobility. Position of women. The arabs in Sind and the Ghaznavides.
10. Cultural trends, 750-1200, Religious conditions: importance of temples and monastic institutions; Sankaracharya; Islam; Sufism. Literature and Science. Alberuni's "India". Art and architecture.
- 11-12. Thirteenth and fourteenth Centuries: Ghorian invasions causes and consequences. Delhi Sultanate under the "Slave" Rulers. Alauddin Khilji: Conquests; administrative, agrarian and economic measures. Muhammad Tughluq's innovations. Firoz Tughluq and the decline of the Delhi Sultanate. Growth of commerce and urbanization. Mystic movements in Hinduism and Islam. Literature. Architecture, Technological changes.
13. The fifteenth and early 16<sup>th</sup> Century: major Provincial dynasties; Vijayanagara Empire. The Lodis, First phase of the Mughal Empire: Babur, Humayun. The Sur empire and administration. The Portuguese. Monotheistic movements: Kabir; Guru Nanak and Sikhism; Bhakti, Growth of regional literatures. Art and Culture.
- 14-15. The Mughal Empire: 1556-1707. Akbar: conquests, administrative measures, **jagir** and **mansab** systems; policy of **sulh-i-kul**. Jahangir, Shahjahan and Aurangzeb: expansion in the Deccan; religious policies. Shivaji, Culture: Persian and regional literatures. Religious thought: Abul Fazi; Maharashtra dharma. Painting. Architecture. Economy: conditions of peasants and artisans, growth in trade; commerce with Europe. Social stratification and status of women.
16. Decline of Mughal Empire, 1707-61. Causes behind decline. Maratha power under the Peshwas. Regional states. The Afghans. Major elements of composite culture. Sawai Jai Singh, astronomer. Rise of Urdu language.

### Section – C

17. British expansion: The Carnatic Wars, Conquest of Bengal. Mysore and its resistance to British expansion: The three Anglo-Maratha Wars. Early structure of British raj: Regulating and Pitt's India Acts.
18. Economic impact of the British Raj: Drain of Wealth (Tribute); land revenue settlements (zamindari, ryotwari, mahalwari); De-industrialisation; Railways and commercialization of agriculture; Growth of landless labour.
19. Cultural encounter and social changes: Introduction of western education and modern ideas. Indian Renaissance, social and religious reform movements; growth of Indian middle class; The press and its impact: rise of modern literature in Indian languages. Social reforms measures before 1857.
20. Resistance to British rule: early uprisings; The 1857 Revolt-causes, nature, course and consequences.
21. Indian Freedom struggle-the first phase: Growth of national consciousness; Formation of Associations; Establishment of the Indian national Congress and its Moderate phase;-Economic Nationalism; Swadeshi Movement; The growth of "Extremism" and the 1907 split in Congress; The Act of 1909-the policy of Divide and Rule; Congress-League Pact of 1916.
22. Gandhi and his thought; Gandhian techniques of mass mobilization-Khilafat and Non-Cooperation Movement, Civil Disobedience and Quit India Movement; Other strands in the National Movement-Revolutionaries, the Left, Subhas Chandra Bose and the Indian National Army.
23. Separatist Trends in Indian Nationalist Politics-the Muslim League and the Hindu Mahasabha; The post-1945 developments; Partition and Independence.
24. India independent to 1964. A parliamentary, secular, democratic republic the 1950 Constitution. Jawaharlal Nehru's vision of a developed, socialist society. Planning and state-controlled industrialization. Agrarian reforms. Foreign policy of Non-alignment. Border conflict with China, and Chinese aggression.

## **18. BOTANY**

1. **Cell Biology:** Structure and function of cell wall(extracellular matrix or ECM), cell membrane and cell organelles, Nucleus, nucleolus, nuclear pore complex (NPC), chromosome and nucleosome, Mitosis, meiosis, molecular control involving check-points in cell division cycle. Differentiation, cellular senescence.

2. **Genetics, Molecular Biology and Biotechnology:** Laws of inheritance. Concept of gene and allelomorph. Linkage crossing over and gene mapping. Structural and numerical changes in chromosomes and gene mutations. Sex determination and differentiation. Structure and synthesis of nucleic acids and proteins. Genetic code. Regulation of gene expression. Genetic engineering and crop improvement. Protoplast, cell, tissue and organ cultures. Somatic hybridization. Biofertilizers and biopesticides. Biotechnology in agri-horticulture, medicine and industry.

3. **Tissue Systems:** Origin, development, structure and function of primary and secondary tissue.

4. **Plant Diversity and Systematics:** Structure and function of plant forms from evolutionary aspects (viruses to Angiosperms including fossils). Principles of nomenclature, classification and identification of plants. Modern approaches in plant Taxonomy. Recent classification of living organism into three groups (bacteria, archaea and eukarya).

5. **Plant Physiology:** Water relations. Mineral nutrition. Photosynthesis. Respiration. Nitrogen metabolism. Enzymes and coenzymes. Dynamics of growth, growth movements, growth substances, photomorphogenesis. Secondary metabolites. Isotopes in biological studies. Physiology of flowering.

6. **Methods of Reproduction and Seed Biology:** Vegetative, asexual and sexual methods of reproduction. Pollination and fertilization. Sexual incompatibility. Development, structure, dormancy and germination of seed.

7. **Plant Pathology:** Diseases of rice, wheat, sugarcane, potato, mustard, groundnut and cotton crops. Factors affecting infection (host factors, pathogen factors, biotic factors like rhizosphere and phyllosphere organisms). Chemical, biological and genetic methods of disease control (including transgenic plants).

8. **Plant and Environment:** Biotic and abiotic components. Ecological adaptation. Types of vegetational zones and forests of India. Deforestation, afforestation, social forestry and plant introduction. Soil erosion, wasteland, reclamation. Environmental pollution and its control (including phytoremediation). Bio-indicators. Global warming.

9. **Biodiversity, plant Genetic Resources:** Methods of conservation of plant genetic resources and its importance. Convention of Biological Diversity (CBD). Endangered, threatened and endemic taxa. Role of cell/tissue culture in propagation and enrichment of genetic diversity. Plants as sources of food, fodder, forage, fibres, oils, drugs, wood and timber, paper, rubber, beverages, spices, essential oils and resins, gums, dyes, insecticides, pesticides and ornamentation. Biomass as a source of energy.

10. **Origin of Life and Evolution:** Basic concept of origin of earth and origin of life. Theories of organic evolution, molecular basis of evolution.



## **05. ANTHROPOLOGY**

1 Meaning and scope of Anthropology, Branches of Anthropology – Social – Cultural Anthropology, Physical Biological anthropology, Linguistic anthropology, Archaeological anthropology, Contribution of these branches to the 'holistic' study of Man. Anthropology's relation with other social sciences, humanities and natural sciences.

2 Physical anthropology: Meaning and scope. Relationship of Physical anthropology with other branches of anthropology and also Biological sciences, Anatomy, Physiology, Human Biology and Genetics.

3 Theories of organic evolution – Lamarckism, Darwinism, Synthetic theory of Evolution.

4 Human Genetics. Mendel's Laws of inheritance and their application to Man Branches and scope of Human Genetics.

5 Man's place in the Animal Kingdom. Order primates – General characteristics, the Great Apes – Gibbon. Orangutan. Gorilla and Chimpanzee and Man.

6 Fossil evidence of human evolution. Australopithecus africanus, Homo erectus – Pithecanthropuserectus, Sinanthropus Pekinensis. Neanderthal Man, Rhodesian Man. Homo Sapiens, Cro-magnon, Chancelade, Grimaldi, Characteristics of Homo Sapiens.

7 Concept of race: Criteria for racial classification. Major races of the world. Racial classification of Indian population – Risley's classification, Guha's classification.

8 Archaeological anthropology: Origin, aims and scope. Its relations with other branches of anthropology.

9 Pleistocene environment. Glacial and inter glacial, Pluvial and inter pluvial. Archaeological data and cultural reconstructions; Methods of dating. Relative and absolute dating their relevance.

10 Paleolithic cultures. Lower, Middle and Upper Paleolithic cultures – their tool technology, typology and cultural traits and associated human fossils.

Mesolithic Cultures: Salient features.

11 Neolithic Cultures – emergence and characteristic features in India. Megaliths, definition; Megalithic cultures and their salient features.

12 Sites of Paleolithic, Mesolithic and Neolithic cultures in India and their features. Megalithic cultures and their salient features in India.

13 Concept of culture in anthropology – definition and characteristics. Concepts of society, Association, Community, institution, comparison of society – culture civilization.

14 Family Definition and its universality; Family of Orientation and Procreation, Family typology – Nuclear, Extended and Joint; Features and significance of Hindu Joint Family, Changing family system in India.

15 Marriage. Definition. Marriage and Family; Marriage rules – Endogamy, Exogamy. Incest; Preferential Marriages, Marriage payments: Ways of acquiring a mate in tribal societies. Forms of marriage - :Monogamy, Polygamy, Polygyny and Polyandry. Levirate and Sororate; Rules of Post marital residence – patrilocal, matrilocal, neolocal.

16 Kinship. Definition and significance of kinship in simple societies; primary, secondary and tertiary relatives; kinship terms – terms of reference and terms of address classificatory and descriptive kinship terms; Analysis of kinship terminology kinship usages.

Rules of Descent – Patrilineal, matrilineal and double; Rules of inheritance and succession. Structure and functions of descent groups in tribal societies – Clan, Phratry, Moiety, Dual organisation.

17 Tribe – Definition. Tribes in India and their geographical distribution; characteristic features of tribal societies in India. Features of food gathering, pastoral and food producing societies, shifting cultivation. Concept of property and types of property in tribal societies – Primitive communism, Exchange – Balter, ceremonial exchange, reciprocity and redistribution. Market, Money and trade. Impact of urbanization and industrialization on tribal societies.

18 Nature of political organisation in tribal societies, Social control, Law and justice. Role of oaths and ordeals in tribal societies. Panchayati Raj in tribal societies.

19 Indian society – Characteristic features – Racial, ethnic, religious and linguistic elements in Indian population – Unity and diversity in Indian society. Indian village, its features and Jaimini system; concept of caste and dominant caste. Concepts of Sanskritisation. Westernisation, great and Little Traditions.

20 Constitutional provisions and safeguards for Scheduled Tribes in India. Tribal development programmes. Role of NGOs in tribal development.

21 Emergence and development of anthropology in India. Applied Anthropology – Meaning, Scope, Development anthropology; Role of anthropology in tribal welfare administration; Role and relevance of anthropology in agricultural development; Health and Family Welfare in India and education.

## **15. SOCIOLOGY**

### **Unit-I: Basic Concepts:**

Society, community, association, institution. Culture-culture change, diffusion, Cultural-tag, Cultural relativism, ethnocentrism, acculturation

Social Groups-primary, secondary and reference groups.

Social structure, social system, social action.

Status and role, role conflict, role set.

Norms and values-conformity and deviance

Law and customs.

Socio-cultural processes: socialisation, assimilation, integration, cooperation, competition, conflict, accommodation, social distance, relative deprivation.

### **Unit-II: Marriage, Family and Kinship.**

Marriage: types and norms, marriage as contract and as a sacrament.

Family: types, functions and changes.

Kinships: terms and usages, rules of residence, descent, inheritance.

### **Unit-III: Social Stratification:**

Forms and functions; Caste and Class. Jajmani system, purity and pollution, dominant caste, sanaskritisation.

### **Unit-IV: Types of Society:**

Tribal, agrarian, industrial and post-industrial.

### **Unit-V: Economy and Society:**

Man, nature and social production, economic systems of simple and complex societies, non-economic determinants of economic behaviour, market (free) economy and controlled (planned) economy.

### **Unit-VI: Industrial and Urban Society:**

Rural-Urban Continuum, urban growth and urbanisation-town, city and metropolis; basic features of industrial society; impact of automation on society; industrialisation and environment.

### **Unit-VII: Social Demography:**

Population size, growth, composition and distribution in India; components of population growth-births, deaths and migration; causes and consequences of population growth; population and social development; population policy.

### **Unit-VIII: Political Processes:**

Power, authority and legitimacy; political socialisation; political modernisation, pressure groups; caste and politics.

### **Unit-IX: Weaker Section and Minorities:**

Social justice-equal opportunity and special opportunity; protective discrimination; constitutional safeguards.

### **Unit-X: Social change:**

Theories of change; factors of change; science, technology and change. Social movements- Peasant Movement, Women's Movement, Back-ward Caste Movement, Dalit Movement.

## **14. PUBLIC ADMINISTRATION**

1. **Introduction:** Meaning, scope and significance. Evolution and status of the discipline. Comparative Public Administration and Development Administration. Public and Private Administration. State versus market debate. New public Administration. New Public Management perspective.
2. **Basic concepts and principles:** Organisation, hierarchy, Unity of command, Span of control, Authority and Responsibility, Co-ordination, Centralization and Decentralization, Delegation, Supervision, Line and Staff.
3. **Theories of Administration:** Scientific Management (Tylor and the Scientific Management Movement), Classical Theory (Fayol, Urwick, Gulick and others) Bureaucratic theory (Weber and his critics). Ideas of Mary Parker Follett and CI B arnard; Human Relations School (Elton Mayo and others). Behavioral approach, Systems approach.
4. **Administrative Behaviour:** Decision making with special reference to H Simon, communication and control, leadership theories. Theories of motivation (Maslow and Herzberg)
5. **Accountability and Control:** The concepts of Accountability and control; Legislative, executive and judicial control. Citizen and Administration; Role of civil society, people's participation and right to information.
6. **Administrative Systems:** Comparative Administrative features of USA, Great Britain, and Japan.
7. **Personnel Administration:** Role of Civil Service in developing societies; position classification, Recruitment, Training, Promotion, Pay and Service conditions. Relations with the Political Executive; Administrative Ethics.
8. **Financial Administration:** Budget; Concepts and forms. Formulation and execution of budget, deficit financing public debt, Accounts and Audit.
9. **Union Government and Administration in India. British legacy:** Constitutional context of Indian Administration; The President, Prime Minister and the Council of Ministers; Central Secretariat; Cabinet Secretariat, Prime Minister's Office, Planning Commission; Finance Commission; Election Commission; Comptroller and Auditor-General of India. Public enterprises; Patterns, role performance and impact of liberalization.
10. **Civil Services in India:** Recruitment to All India and Central Services. Union Public Service Commission; Training of Civil Servants. Generalists and Specialists. Minister-Civil Servant relationship.
11. **State and District Administration:** Governor, Chief Minister, Secretariat, Chief Secretary, Directorates, District Collector; changing role.
12. **Local Government:** Panchayati Raj and Urban local Government; Main features, structures, finances and problem areas. 73<sup>rd</sup> and 74<sup>th</sup> Constitutional Amendments.

## 12. POLITICAL SCIENCE

### SECTION – A

1. **Political Science** : Nature & scope of the discipline, relationship with allied disciplines like History, Economics, Philosophy, Sociology, Psychology.
2. **Meaning of Politics** : Approaches to the study of Politics.
3. **Key Concepts** : State, Society, Sovereignty, Power, Citizenship, Nation, Global order and Imperialism.
4. **Political Ideas** : Rights, Liberty, Equality, Justice, Rule of Law. Civil Society Swaraj, Revolution, Democratic Participation.
5. **Democracy** : Meaning and Theories of Democracy, Electoral system, Forms of Representation & Participation, Political accountability.
6. **Political Ideologies** : Liberalism, Neoliberalism, Marxism, Socialism, Fascism, Gandhism.
7. **Party System and Political Process** : Theories of Party System, National and regional parties, Political Parties in the Third World. Patterns of coalition politics, interest and pressure groups.
8. **Forms of Government** : Parliamentary and Presidential. Federal & Unitary Models of decentralisation.
9. **Bureaucracy Concept** : Theories, Weber and critiques of Bureaucracy.
10. **Theories of Development** : Meaning and various approaches. Concept and Theories of underdevelopment Debates in the Third World.
11. **Social Movements** : Meaning, Theories & Forms, Role of Environmental Feminist Peasant & workers movements, Role of Non-Government Organisation.
12. Nationalism and Internationalism :
13. **Major theories of International relations** : Realist Marxist, Systems & Decision making & Game theory.  
State & the Global Order : Neo-Liberalism, globalisation, structural adjustment, regional economic integration, Nature and Impact of globalisation.

### SECTION – B

#### INDIAN GOVERNMENT AND POLITICS

1. **Approaches to the study of Governments** : Comparative historical, legal institutional, political economy and political sociology, approaches.
2. **Classification of Political Systems** : Democratic and Authoritarian, characteristics of Political systems in the third world.
3. **Typologies of Constitutions; Basic features of these constitutions & governments** : Including U.K., USA., France, Germany, China and South Africa.
4. **Constitutional development** : In India during British Rule-A historical perspective.
5. **Constituent Assembly** : Philosophical and socio-economic dimensions. Salient features of the Indian Constitution.
6. **Nature of Indian Federalism** : Centre-state relations, legislative, administrative, financial and political; politics of regional move and National Integration.
7. **Fundamental Rights** : Constitutional provisions and political dynamics. Judicial interpretations and socio political realities; Fundamental Duties.
8. **The Union Executive** : President, Prime Minister and the Council of Ministers, Constitutional provisions & frame-work and political trends.
9. **Parliament** : Powers and functions of the Lok Sabha & Rajya Sabha; Parliamentary Committees; Functioning of the Parliamentary system in India.
10. **The Judiciary** : The Supreme Court, Judicial Review Judicial Activism, Public Interest Litigation; Judicial Reforms.
11. **The State Executive** : Governor, Chief Minister and the Council of Ministers; Constitutional Provisions and Political trends.
12. **Indian Party System** : Evolution and Contemporary trends; Coalition government at the Centre and States, pressure groups in Indian Politics.
13. **The interaction of Government & Scientific & Technology business** : Previous and now their inter relationship and changing roles in Society, Elites, Role of Pressure groups class and voluntary associations in society.
14. **Local Government & Politics** : Panchayati Raj and Municipal Government, structure power & functions. Political realities, significance of 73rd and 74th Amendments, role of women in Panchayats.
15. **Bureaucracy and Development** : Post-colonial India; its changing role in the context of liberalization bureaucratic Accountability.
16. **Challenges to Indian Democracy** :
  - a) munalism Regionalism violence, 'criminalisation' and corruption.
  - b) ional disparities, environmental degradation, illiteracy, Mass Poverty, Population, growth, caste oppressions and socio economic in equalities amongbackward classes.

## **06. COMMERCE**

### **PART-I:**

**Accounting and Auditing:** Nature, Scope and Objectives of Accounting-Accounting as an Information System Users of Accounting Information.

Generally Accepted Principles of Accounting-The Accounting Equation-Accrual Concept-other concepts and conventions, Distinction between capital and revenue expenditure. Accounting Standards and their application-Accounting standards relating to fixed assets, depreciation, inventory, recognition of revenue

Final Accounts of Sole Proprietors, Partnership Firms and Limited Companies-Statutory Provisions-Reserves, Provisions and Funds. Final Accounts of not-for profit organisation. Accounting problems related to admission and retirement of a partner and dissolution of a firm.

Accounting for Shares and Debentures Accounting Treatment of Convertible debentures.

Analysis and Interpretation of Financial Statements Ratio analysis and interpretation. Ratios relation to short term liquidity, long term solvency and profitability-Importance of the rate of return on investment (ROI) in evaluating the overall performance of a business entity-Cash-flow Statement and Statement of Source and Application of Funds-Societal obligations of Accounting.

**Auditing:** Nature, objectives and basic principles of auditing.- Techniques of auditing-physical verification, examination of documents and vouching, direct confirmation, analytical review.

Planning an audit, audit programmes, working papers, audit process.

Evaluation of internal controls.

Test checking and sampling.

Broad outlines of company audit.

Audit of non-corporate enterprises.

Internal and management audit.

### **PART-II:**

**Business Organisation:** Distinctive features of different forms of business organisation.

#### **SOLE PROPRIETOR**

Partnerships-characteristics, Registration, Partnership deed, Rights and duties, Retirement, Dissolution.

Joint Stock Company-Concept, characteristics, types.

Cooperative and State ownership forms of organizations.

Types of securities and methods of their issue.

Economic functions of the capital market, stock exchanges, Mutual Funds. Control and regulation of capital market.

Business combination; control of Monopolies. Problems of modernisation of industrial enterprises.

Social responsibility of business. Foreign Trade-Procedure and financing of import and export trade.

Incentives for export promotion. Financing of foreign trade.

Insurance-Principles and practice of Life, Fire, Marine and General Insurance.

#### **MANAGEMENT**

Management functions-Planning-strategies, Organising-levels of authority Staffing, Line function and staff function, Leadership, Communication, Motivation, Directing-Principles, Strategies.

Coordination-Concept, types, methods.

Control-principles, performance standards, corrective action. Salary and wage administration-job evaluation.

Organisation Structure-Centralization and decentralization-Delegation of authority-span of control-Management by Objectives and management by Exception.

Management of change; Crisis Management. Office Management-scope and principles, systems and routines; handling of records-modern aids of Office management; office equipment and machines; Automation and Personal computers.

Impact of Organisation and Methods (O&M)

**Company Law:** Joint stock companies-incorporation; documents and formalities-Doctrine of indoor management and constructive notice.

Duties and powers of the board of directors of a company.

**Accounts and audit of companies:** Company Secretary-role and functions-qualifications for appointment.

## 22. PHYSICS

- 1. Mechanics and Waves:** Dimensional analysis. Newton's laws of motion and applications, variable mass systems, projectiles. Rotational dynamics-kinetic energy, angular momentum, theorems of moment of inertia and calculations in simple cases. Conservative forces, frictional forces. Gravitational potential and intensity due to spherical objects. Central forces, Kepler's problem, escape velocity and artificial satellites (including GPS). Streamline motion, viscosity, Poiseuille's equation. Applications of Bernoulli's equation and Stokes' law. Special relativity and Lorentz transformation-length contraction, time dilation, mass-energy relation. Simple harmonic motion, Lissajous figures. Damped oscillation, forced oscillation and resonance. Beats, Phase and group velocities. Stationary waves, vibration of strings and air columns, longitudinal waves in solids. Doppler effect. Ultrasonics and applications.
- 2. Geometrical and Physical Optics:** Laws of reflection and refraction from Fermat's principle. Matrix method in paraxial optics- thin lens formula, nodal planes, system of two thin lenses. Chromatic and spherical aberrations. Simple optical instruments- magnifier, eyepieces, telescopes and microscopes. Huygen's principle-reflection and refraction of waves. Interference of light – Young's experiment, Newton's rings, interference by thin films, Michelson interferometer. Fraunhofer diffraction-single slit, double slit, diffraction grating, resolving power. Fresnel diffraction- half-period zones and zone plate. Production and detection of linearly, circularly and elliptically polarized light. Double refraction, quarter-waves plates and half-wave plates. Polarizing sheets. Optical activity and applications. Raman & Rayleigh scattering and applications. Elements of fibre optics-attenuation; pulse dispersion in step index and parabolic index fibres; material dispersion. Lasers, characteristics of laser light-spatial and temporal coherence. Focusing of laser beams and applications.
- 3. Heat and Thermodynamics:** Thermal equilibrium and temperature. The zeroth law of thermodynamics. Heat and the first law of thermodynamics. Efficiency of Carnot engines. Entropy and the second law of thermodynamics. Kinetic theory and the equation of state of an ideal gas. Mean free path, distribution of molecular speeds and energies. Transport phenomena. Andrew's experiments-van der Waals equation and applications. Joule-Kelvin effect and applications. Brownian motion. Thermodynamic potentials-Maxwell relations. Phase transitions. Kirchhoff's laws. Black-body radiation – Stefan-Boltzmann law, spectral radiance, Wien displacement law, application to the cosmic microwave background radiation, Planck radiation law.
- 4. Electricity and Magnetism:** Electric charge, Coulomb's law, electric field, Gauss' law. Electric potential, van de Graaff accelerator. Capacitors, dielectrics and polarization. Ohm's law, Kirchhoff's first and second rules, resistors in series and parallel, applications to two-loop circuits. Magnetic field-Gauss' law for magnetism, atomic and nuclear magnetism, magnetic susceptibility, classification of magnetic materials. Circulating charges, cyclotron, synchrotron. Hall effect. Biot-Savart law, Ampere's law, Faraday's law of induction – Lenz's law. Inductance. Alternating current circuits – RC, LR, single-loop LRC circuits, impedance, resonance, power in AC circuits. Displacement current, Maxwell's equations (MKS Units), electromagnetic waves, energy transport and Poynting vector.
- 5. Atomic and Nuclear Physics:** Photoelectric effect, Einstein's photon theory. Bohr's theory of hydrogen atom. Stern Gerlach experiment, quantisation of angular momentum, electron spin. Pauli exclusion principle and applications. Zeeman effect. X-ray spectrum, Bragg's law, Bohr's theory of the Mosley plot. Compton effect, Compton wavelength. Wave nature of matter, de Broglie wavelength, wave-particle duality. Heisenberg's uncertainty relationships. Schrodinger's equation-eigenvalues and eigenfunctions of (i) particle in a box, (ii) simple harmonic oscillator and (iii) hydrogen atom. Potential step and barrier penetration. Natural and artificial radioactivity. Binding energy of nuclei, nuclear fission and fusion. Classification of elementary particles and their interactions.
- 6. Electronics.:** Diodes in half-waves and full-wave rectification, qualitative ideas of semiconductors p type and n type semiconductors, junction diode, Zener diode, transistors, binary numbers, Logic gates and truth tables, Elements of microprocessors and computers.

## **08. GEOGRAPHY**

### **Section – A PHYSICAL GEOGRAPHY**

- i) **Geomorphology:** Origin of the earth; Geological Time Scale; Interior of the earth; Types and characteristics of rocks; Folding and Faulting; Volcanoes; Earth quakes; Weathering; Landforms caused by fluvial, Aeolian and glacial actions.
- ii) **Climatology:** Structure and composition of atmosphere; Temperature; Pressure belts and Wind systems; Clouds and rainfall types; Cyclones and anti-cyclones; Major climatic types.
- iii) **Oceanography:** Ocean relief; Temperature; Salinity; Ocean deposits; Ocean currents, El Nino and La Nino; Waves and tides.
- iv) **Biogeography:** Origin and types of soils; Major biomes of the world; Ecosystem and food chain; Environmental degradation and conservation.

### **Section – B HUMAN GEOGRAPHY**

- i) **Man and Environment Relationship:** Growth and development of Human Geography; Concepts of Determinism and Possibilism.
- ii) **Population:** Races of mankind and tribes; growth and distribution of world population; migration; population problems of developed and developing countries.
- iii) **Economic Activities:** Food gathering and hunting; Pastoral herding; fishing and forestry; Types of agriculture-shifting, subsistence, commercial and plantation; Mining, power; Manufacturing – locational factors of textile, iron and steel, sugar and fertilizer industries; Tertiary activities-trade, transport, communication and services.
- iv) **Settlements:** Origin, types and patterns of rural settlements; Processes of urbanisation; morphology and functional classification of towns; million-cities and mega-cities.

### **Section – C GEOGRAPHY OF THE WORLD**

- i) Major Natural Regions: Characteristics, economic base and human adaptation.
- ii) Regional Geography of Developed Countries: Canada, U.S.A., Western Europe, Russia, Japan, Australia and New Zealand.
- iii) Regional Geography of Developing Countries: S.E. Asia, S.W. Asia, China, Southern Africa and Brazil.
- iv) Regional Geography of South Asia.

### **Section – D GEOGRAPHY OF INDIA**

- i) **Physical Setting:** Landforms, drainage, climate, soils and natural vegetation.
- ii) **Economic Base:** Minerals & energy resources, aquatic resources, forest resources; irrigation, agriculture and industries; trade and commerce.
- iii) **Population:** Growth, distribution and density; demographic characteristics.
- iv) Environmental problems, developmental issues and regional planning.

### **Section – E GEOGRAPHICAL THOUGHT**

- i) **Ancient Period:** Contributions of Indians, Greeks, Romans and Arabs.
- ii) **Pre-Modern Period:** Contribution of Verenius, Kant, Humboldt and Ritter.
- iii) **Modern Period:** Dichotomy of determinism and possibilism; contributions of Ratzel, Semple, Huntington and La Blache.
- iv) **Recent Period:** Quantitative Revolution; Radicalism, Behaviouralism and Humanism.

### **Section – F TECHNIQUES OF GEOGRAPHICAL ANALYSIS**

- i) **Maps:** Scale and types, uses.
- ii) **Diagrams:** Types and uses.
- iii) **Projections:** Types, characteristics and uses.
- iv) **Remote sensing and geographical information system (GIS):** Aerial photographs and imagery, GIS.



### 13. PSYCHOLOGY

1. **Introduction to Psychology** : Concept and definition of psychology – Nature and Scope – Branches of psychology – Application of psychology to society and social problems.
2. **Methods in Psychology** : Characteristics of psychological studies, Observation, Survey method, Clinical and case study method. Experimental method. Application of the method.
3. **Quantitative Analysis** : Measures of central tendency and dispersion. Correlation. Levels of measurement. Reliability and validity. Application in test construction.
4. **Physiological Psychology** : Structure of neuron, nerve impulses, synapse and neurotransmitters. Central and peripheral nervous system-structure and neural control of behaviour. Hemispheric specialization. Endocrine system and hormonal control of behaviour. Application of hemispheric knowledge to diagnostic purposes.
5. **Development of human behaviour**: Individual Differences; Heredity and environment;. Life span development. Role of early experience and mastering developmental tasks. Sensitive or critical periods of development in human life cycle and its application.
6. **Perception**: Preceptual process. Perceptual organisation. Perceptual of form, colour, depth and time. Perceptual readiness and constancy. Role of motivation, social and cultural factors in Perception. Application of knowledge of Perception to skill development (e.g. for certain jobs like that of driving, airline pilots etc.)
7. **Learning**: Classical conditioning and operant conditioning. Modeling and observational learning. Transfer of training. Learning and motivation. Application of the above to the improvement of academic performance in education.
8. **Memory**: Physiological basis of memory. Memory and forgetting. Measurement of memory (Recall, Recognition, Relearning). Short term and long term memory. Theories of forgetting (Decay and interference theories and Repressive forgetting) Application of Mnemonic devices etc., to improving memory.
9. **Cognition and Language**: Concept of formation. Nature and development of thinking. Language and thought and acquisition of language. Problem solving. Creative thinking and its applications.
10. **Intelligence and Aptitude**: Definition and concept. Theories and models of Intelligence. Measurement of intelligence and aptitude. Exceptional intelligence. Mental retardation. Concepts of multiple, emotional and artificial intelligence and their applications.
11. **Motivation and Emotion**: Definition and concept. of instinct, needs, drives and motives. Theories of motivation and their application (drive reduction theory, Maslow's motivational hierarchy). Social motivation; Achievement, power, affiliation motives and influence of early experiences. Physiological basis of emotion. Theories of emotion )James-Lange and Cannon-Brad theories, cognitive physiological theory).
12. **Personality**: Concepts and Definition of personality. Study of personality (Trait, type and eclectic approaches) Development of personality (Freud, Erikson, Biological and socio-cultural determinants). Measurement of Personality (Projective tests, pencil-paper tests). Application of personality profiles in fitting a person to a job.
13. **Adjustment and Stress**: Concept and definition. Factors affecting adjustment (frustration and conflict). Sources of stress and reactions to stress. Coping with stress. Application of stress management techniques.
14. **Social Behaviour**: Socio-cultural factors and behaviour. Development of attitudes, stereo-types and prejudice, Measurement of Attitudes (Thurstone, Likert attitude scale and Bogardus Social Distance scale). Strategies for reducing prejudice and changing attitude. Person perception, implicit personality theory and integrating impressions. Application of person perception to impression management.
15. **Application of Psychology**: Health and mental health (yoga, meditation and relaxation therapies). Education (programmed learning; self instructional learning and learning styles). Community (self help through group cohesiveness and leadership). Industry (Assessment centre approach in selection, recruitment and training). Environment (man-nature interaction, personal space concept, pollution reduction information technology (Application to commercial, educational and health areas).

## **16. AGRICULTURE**

Agriculture, its importance in National economy. Factors determining agro-ecological zones and geographic distribution of crop plants. Importance of crop plants, cultural practices for cereal, pulses, oilseed, fibre, sugar, tuber and fodder crops and scientific basis for these crop-rotations, multiple and relay cropping, intercropping and mixed cropping.

Soil as medium of plant growth and its composition, mineral and organic constituents of the soil and their role in crop production; chemical, physical and microbiological properties of soils. Essential plant nutrients (macro and micro) their functions, occurrence, cycling in soils. Principles of soil fertility and its evaluation for judicious fertilizer use. Organic manures and bio-fertilizers, inorganic fertilizers, integrated nutrient management.

Principles of plant physiology with reference to plant nutrition, absorption, translocation and metabolism of nutrients.

Diagnosis of nutrient deficiencies and their amelioration photosynthesis and respiration, growth and development, auxins and hormones in plant growth.

Cell and cell organelles. Cell division. Reproductive cycle, Principles of genetics, gene-interaction, sex determination, linkage and re-combination, mutation, extra chromosomal inheritance, polyploidy. Origin and domestication of crop plants. Genetic resources-conservation and utilization. Floralbiology in relation to selfing and crossing.

Genetic basis of plant breeding pureline selection, mass selection, male sterility and incompatibility and their use in plant breeding. Pedigree selection, back-cross method of selection. Heterosis and its exploitation. Development of hybrids, composites and synthetic, important varieties, hybrids, composites and synthetic of major crops. Seeds and seed production techniques.

Important fruit and vegetable crops of India, method of propagation-Sexual and asexual. Package and practices and their scientific basis. Crop rotation, intercropping, companion crops, role of fruits and vegetables in human nutrition, post-harvest handling and processing of fruits and vegetables. Landscaping and ornamental horticulture, commercial floriculture. Medicinal and aromatic plants. Serious pests and diseases affecting major crops. Principles of control of crop pests and diseases, integrated management. Proper use and maintenance of plant protection equipment.

Principles of economics as applied to agriculture. Farm planning and optimum resource-use efficiency and maximizing income and employment. Farm systems and their spatial distribution, their significant roles in regional economic development.

## **17. ANIMAL HUSBANDRY AND VETERINARY SCIENCE**

### **ANIMAL HUSBANDRY**

1. **General:** Role of Livestock in Indian Economy and human health. Mixed farming. Agroclimatic zones and livestock distribution. Socioeconomic aspects of livestock enterprise with special reference to women.

2. **Genetics and Breeding:** Principle of genetics, chemical nature of DNA and RNA and their models and functions. Recombinant DNA technology, transgenic animals, multiple ovulation and embryo-transfer. Cytogenetics, immunogenetics and biochemical polymorphic and their application in animal improvement. Gene actions. Systems and strategies for improvement. Geneaction. Systems and strategies for improvement of livestock for milk, meat, wool production and drought and poultry for eggs and meat. Breeding of animals for disease resistance. Breeds of livestock, poultry and rabbits.

3. **Nutrition:** Role of nutrition in animal health and production. Classification of feeds, Proximate composition of feeds, feeding standards, computation of rations. Ruminant nutrition. Concepts of total digestible nutrients and starch equivalent systems. Significance of energy determinations. Conservation of feeds and fodder and utilization of agro by-products. Feed supplements and additives. Nutrition deficiencies and their management.

4. **Management:** Systems of housing and management of livestock poultry and rabbits. Farm record. Economics of livestock, poultry and rabbit farming. Clean milk production. Veterinary hygiene with reference to water, air and habitation. Sources of water and standards of potable water. Purification of water. Air changes and thermal comfort. Drainage systems and effluent disposal Biogas.

5. **Animal Production:** (a) Artificial insemination, fertility and sterility. Reproductive physiology, semen characteristics and preservation. Sterility its causes and remedies. (b) Meat eggs and wool production. Methods of slaughter of meat animals, meat inspection, judgment, carcass characteristics, adulteration and its detection processing and preservation; Meat products, quality control and nutritive value, By-products. Physiology of egg production, nutritive value, grading of eggs preservation and marketing. Types of wool, grading and marketing.

6. **Veterinary Science:** (i) Major contagious diseases affecting cattle, buffaloes, horses, sheep and goats, pigs, poultry, rabbits and pet animals-Etiology, symptoms, pathogenicity, diagnosis, treatment and control of major bacterial, viral, rickettsial and parasitic infections. (ii) Description, symptoms, diagnosis and treatment of the following:

- a) Production diseases of milk animals, pig and poultry.
- b) Deficiency diseases of domestic livestock and birds
- c) Poisonings due to infected/contaminated foods and feeds, chemicals and drugs.

7. **Principles of immunization and vaccination:** Different types of immunity, antigens and antibodies. Methods of immunization. Break-down of immunity, Vaccines and their use in animals. Zoonoses, Foodborne infections and intoxications, occupation hazards.

8. (a) Poisons used for killing animals euthanasia.
- (b) Drugs used for increasing production/performance efficiency and their adverse effects.
- (c) Drugs used to tranquilize wild animals as well as animals in captivity.
- (d) Quarantine measures in India and abroad. Act, Rules and Regulations.

9. **Dairy Science:** Physicochemical and nutritional properties of milk.

Quality assessment of milk and milk products, Common tests and legal standards. Cleaning and sanitation of dairy equipment. Milk collections, chilling, transportation processing, packaging, storage and distribution. Manufacture of market milk, cream butter, cheese, ice-cream, condensed and dried milk, by products and Indian Milk products.

Unit operations in dairy plant.

Role of micro organism in quality of milk and products physiology of milk secretion.