

## SYLLABUS FOR ENTRANCE EXAMINATION OF UNDERGRADUATE PROGRAMME

## MENTAL AGILITY

No Syllabus is prescribed.

## MATHEMATICS

**Sets and Functions**

**Sets** : Sets and their representations. Empty set. Finite & Infinite sets. Equal sets. Subsets. Subsets of the set of real numbers especially intervals (with notations). Power set. Universal set. Venn diagrams. Union and Intersection of sets. Difference of sets. Complement of a set and its properties.

**Relations and Functions:** Ordered pairs, Cartesian product of sets. Number of elements in the cartesian product of two finite sets. Cartesian product of the reals with itself (upto  $\mathbb{R} \times \mathbb{R} \times \mathbb{R}$ ). Definition of relation, pictorial diagrams, domain, codomain and range of a relation. Function as a special kind of relation from one set to another. Pictorial representation of a function, domain, co-domain & range of a function. Real valued function of the real variable, domain and range of these functions, constant, identity, polynomial, rational, modulus, signum and greatest integer functions with their graphs. Sum, difference, product and quotients of functions.

Types of relations: reflexive, symmetric, transitive and equivalence relations. One to one and onto functions, composite functions, inverse of a function.

**Trigonometric Functions:** Positive and negative angles. Measuring angles in radians & in degrees and conversion from one measure to another. Definition of trigonometric functions with the help of unit circle. Truth of the identity  $\sin^2 x + \cos^2 x = 1$ , for all  $x$ . Signs of trigonometric functions and sketch of their graphs. Expressing  $\sin(x+y)$  and  $\cos(x+y)$  in terms of  $\sin x$ ,  $\sin y$ ,  $\cos x$  &  $\cos y$ . Deducing the identities like the following:

$$\tan(x \pm y) = \frac{\tan x \pm \tan y}{1 \mp \tan x \tan y}, \cot(x \pm y) = \frac{\cot x \cot y \mp 1}{\cot y \pm \cot x},$$

$$\sin x + \sin y = 2 \sin \frac{x+y}{2} \cos \frac{x-y}{2}, \cos x + \cos y = 2 \cos \frac{x+y}{2} \cos \frac{x-y}{2},$$

$$\sin x - \sin y = 2 \cos \frac{x+y}{2} \sin \frac{x-y}{2}, \cos x - \cos y = -2 \sin \frac{x+y}{2} \sin \frac{x-y}{2}.$$

Identities related to  $\sin 2x$ ,  $\cos 2x$ ,  $\tan 2x$ ,  $\sin 3x$ ,  $\cos 3x$  and  $\tan 3x$ . General solution of trigonometric equations.

**Inverse Trigonometric Functions**

Definition, range, domain, principal value branch. Graphs of inverse trigonometric functions, Elementary properties of inverse trigonometric functions

**Algebra**

**Principle of Mathematical Induction:** Processes of the proof by induction, motivating the application of the method by looking at natural numbers as the least inductive subset of real numbers. The principle of mathematical induction and simple applications.

**Complex Numbers and Quadratic Equations:** Need for complex numbers, especially root - 1, to be motivated by inability to solve every quadratic equation. Brief description of algebraic properties of complex numbers. Argand plane and polar representation of complex numbers. Statement of Fundamental Theorem of Algebra, solution of quadratic equations in the complex number system.

**Linear Inequalities:** Linear inequalities. Algebraic solutions of linear inequalities in one variable and their representation on the number line. Graphical solution of linear inequalities in two variables. Solution of system of linear inequalities in two variables- graphically.

**Permutations & Combinations:** Fundamental principle of counting. Factorial  $n$ .  $(n!)$  Permutations and combinations, derivation of formulae and their connections, simple applications.

**Binomial Theorem:** History, statement and proof of the binomial theorem for positive integral indices. Pascal's triangle, General and middle term in binomial expansion, simple applications.

**Sequence and Series:** Sequence and Series, Arithmetic progression (A. P.), Arithmetic mean (A.M.), Geometric progression (G.P.), General term of a G.P., Sum of  $n$  terms of a G.P., Geometric mean (G.M.), Relation between A.M. and G.M., Sum to  $n$  terms.

## Coordinate Geometry

**Straight Lines:** Brief recall of 2D from earlier classes. Slope of a line and angle between two lines. Various forms of equations of a line: parallel to axes, point-slope form, slope-intercept form, twopoint form, intercepts form and normal form. General equation of a line. Distance of a point from a line.

**Conic Sections:** Sections of a cone: circle, ellipse, parabola, hyperbola, a point, a straight line and pair of intersecting lines as a degenerated case of a conic section. Standard equations and simple properties of parabola, ellipse and hyperbola. Standard equation of a circle.

**Three-dimensional Geometry:** Coordinate axes and coordinate planes in three dimensions. Coordinates of a point. Distance between two points and section formula.

Direction cosines and direction ratios of a line joining two points. Cartesian equation and vector equation of a line, coplanar and skew lines, shortest distance between two lines. Cartesian and vector equation of a plane. Angle between (i) two lines, (ii) two planes, (iii) a line and a plane. Distance of a point from a plane.

## Vectors

Vectors and scalars, magnitude and direction of a vector. Direction cosines and direction ratios of a vector. Types of vectors (equal, unit, zero, parallel and collinear vectors), position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, position vector of a point dividing a line segment in a given ratio. Definition, Geometrical Interpretation, properties and application of scalar (dot) product of vectors, vector (cross) product of vectors, scalar triple product of vectors.

## Calculus

**Limits and Derivatives:** Derivative introduced as rate of change both as that of distance function and geometrically, intuitive idea of limit. Definition of derivative, relate it to slope of tangent of the curve, derivative of sum, difference, product and quotient of functions. Derivatives of polynomial and trigonometric functions.

## Continuity and Differentiability

Continuity and differentiability, derivative of composite functions, chain rule, derivative of inverse trigonometric functions, derivative of implicit functions. Concept of exponential and logarithmic functions. Derivatives of logarithmic and exponential functions. Logarithmic differentiation, derivative of functions expressed in parametric forms. Second order derivatives. Rolle's and Lagrange's Mean Value Theorems (without proof) and their geometric interpretation.

## Applications of Derivatives

Applications of derivatives: rate of change of bodies, increasing/decreasing functions, tangents and normals, use of derivatives in approximation, maxima and minima (first derivative test motivated geometrically and second derivative test given as a provable tool). Simple problems (that illustrate basic principles and understanding of the subject as well as real-life situations).

## Integrals

Integration as inverse process of differentiation. Integration of a variety of functions by substitution, by partial fractions and by parts, Evaluation of simple integrals of the following types and problems based on them.

$$\int \frac{dx}{x^2 \pm a^2}, \int \frac{dx}{\sqrt{x^2 \pm a^2}}, \int \frac{dx}{\sqrt{a^2 - x^2}}, \int \frac{dx}{ax^2 + bx + c}, \int \frac{dx}{\sqrt{ax^2 + bx + c}}$$
$$\int \frac{px + q}{ax^2 + bx + c} dx, \int \frac{px + q}{\sqrt{ax^2 + bx + c}} dx, \int \sqrt{a^2 \pm x^2} dx, \int \sqrt{x^2 - a^2} dx$$
$$\int \sqrt{ax^2 + bx + c} dx, \int (px + q)\sqrt{ax^2 + bx + c} dx$$

Definite integrals as a limit of a sum, Fundamental Theorem of Calculus (without proof). Basic properties of definite integrals and evaluation of definite integrals.

## Applications of the Integrals

Applications in finding the area under simple curves, especially lines, circles/ parabolas/ellipses (in standard form only), Area between any of the two above said curves (the region should be clearly identifiable).

## Differential Equations

Definition, order and degree, general and particular solutions of a differential equation. formation of differential equation whose general solution is given. Solution of differential equations by method of separation of variables, solutions of homogeneous differential equations of first order and first degree. Solutions of linear differential equation of the type:  $(dy/dx) + py = q$ , where p and q are functions of x or constants.

## **Mathematical Reasoning**

**Mathematical Reasoning:** Mathematically acceptable statements. Connecting words/ phrases – consolidating the understanding of “if and only if (necessary and sufficient) condition”, “implies”, “and/or”, “implied by”, “and”, “or”, “there exists” and their use through variety of examples related to real life and Mathematics. Validating the statements involving the connecting words difference between contradiction, converse and contra positive.

## **Statistics and Probability**

**Statistics:** Measure of dispersion; mean deviation, variance and standard deviation of ungrouped/grouped data. Analysis of frequency distributions with equal means but different variances.

**Probability:** Random experiments: outcomes, sample spaces (set representation). Events: occurrence of events, ‘not’, ‘and’ and ‘or’ events, exhaustive events, mutually exclusive events Axiomatic (set theoretic) probability, connections with the theories of earlier classes. Probability of an event, probability of ‘not’, ‘and’ & ‘or’ events.

Conditional probability, multiplication theorem on probability, independent events, total probability, Bayes’ theorem, Random variable and its probability distribution, mean and variance of random variable.

## **Matrices**

Concept, notation, order, equality, types of matrices, zero and identity matrix, transpose of a matrix, symmetric and skew symmetric matrices. Operation on matrices: Addition and multiplication and multiplication with a scalar. Simple properties of addition, multiplication and scalar multiplication.

Non- commutativity of multiplication of matrices and existence of non-zero matrices whose product is the zero matrix (restrict to square matrices of order 2). Concept of elementary row and column operations. Invertible matrices and proof of the uniqueness of inverse, if it exists; (Here all matrices will have real entries).

## **Determinants**

Determinant of a square matrix (up to 3 x 3 matrices), properties of determinants, minors, co- factors and applications of determinants in finding the area of a triangle. Adjoint and inverse of a square matrix. Consistency, inconsistency and number of solutions of system of linear equations by examples, solving system of linear equations in two or three variables (having unique solution) using inverse of a matrix.

## **Linear Programming**

Introduction, related terminology such as constraints, objective function, optimization, different types of linear programming (L.P.) problems, mathematical formulation of L.P. problems, graphical method of solution for problems in two variables, feasible and infeasible regions (bounded or unbounded), feasible and infeasible solutions, optimal feasible solutions (up to three non-trivial constraints).

# **PHYSICS**

Physical measurements, System of units, Dimensions, Errors in measurement, Motion in one, two and three dimensions, Laws of motion, Work, Energy and power, Center of mass, Rigid bodies, Rotational motion, Gravitation, Acceleration due to gravity, Gravitational potential energy, Geostationary satellites.

Brownian motion, Avogadro’s hypothesis and Avogadro’s number, Inter-atomic and intermolecular forces, States of matter, Crystalline and glassy solids, Elasticity, Pressure, Archimede’s principle, Viscosity, Fluid flow, Surface tension.

Kinetic theory of gases, Temperature, Thermal expansion, Heat, Specific heat, Heat capacity, First and second laws of thermodynamics, Heat engines, Transfer of heat.

Periodic motion, Time period and frequency, Simple harmonic motion, Springs, Kinetic and potential energy in SHM, Simple pendulum, Forced oscillations, Resonance, Free and damped oscillations, Superposition principle of waves, Harmonic waves, Reflection of waves, Standing and traveling waves, Beats, Doppler effect.

Properties of electric charge, Coulomb’s law, Lines of force, Electric dipole, Electric flux, Electric field, Gauss’s theorem, Electrostatic potential, Potential energy, Capacitors and capacitance, Current, Voltage, Resistance, Ohm’s law, Kirchhoff’s laws, Ammeter, Voltmeter, Chemical and thermal effects of currents, Thermoelectricity.

Magnetic field due to a current, Biot-Savart law, Lorentz force, Amperes law, Magnetic dipole moment, Torque, Galvanometer, Moving charges in magnetic and electric fields, Field of a bar magnet, Magnetic field lines, Magnetic flux, Magnetic field of earth, Tangent galvanometer.

Faraday’s law of induction, Lorenz’s law, Lorentz force, Inductance, RC, LR and LCR circuits, Power flow in AC circuits, Resonance and oscillations, Electromagnetic waves, em-wave equations, Spectrum of e.m. waves and light.

Light rays, Wavefronts, Coherent and incoherent sources, Interference, Diffraction and Polarization of light, Luminosity, Velocity of light, Reflection from spherical surfaces, Refraction at spherical surfaces, Lenses,

Dispersion and spectroscopes, Optical defects in mirrors and lenses, Optical instruments, Microscope, Telescope, Cathode rays,  $e/m$  of electrons, Photoelectric effect, Photocell, Wave nature of matter. Atomic masses, Binding energy, Size of the nucleus, Radioactivity, Nuclear energy, Fission and fusion reactions.

Molecules, Molecular energies, Rotational and vibrational spectra, Solids and their structures, Semiconductors, Semiconductor diodes, Transistors.

## BIOLOGY

### BOTANY

1. Morphology of root, stem and leaf and their modifications.
2. Flower, inflorescence, seed and fruits.
3. Development of male and female gametophytes, pollination, fertilization and development of embryo.
4. Germination, growth and development.
5. Cell and cellular functions, tissues, anatomy of root, stem and leaf of both monocot and dicots, secondary growth.
6. Elementary study of Plant Physiology.
  - (a) Structure of root hair, uptake of water and minerals root pressure and transpiration.
  - (b) Structure of stomata, function, factors, and carbon assimilation.
  - (c) Translocation and storage of food materials.
  - (d) Respiration
  - (e) Mineral nutrition and metabolism
  - (f) Plant hormones and vitamins.
7. Plant taxonomy and elementary study of the following families:
  - (a) Brassicaceae (b) Leguminosae (c) Malvaceae (d) Solanaceae (e) Cucurbitaceae (f) Asteraceae (g) Poaceae (Gramineae)
8. Classification of plant kingdom. A brief study of the following groups/plants:
  - (a) Viruses (b) Bacteria (c) Spirogyra (d) Mucor/Rhizopus (e) Moss (f) Fern (g) Cycas
9. Natural resources and their conservation; environment and pollution-air, water and soil community, ecosystem, pyramids, energy flow, mineral cycles, and succession.
10. Plant tissue culture, biotechnology and its applications.

### ZOOLOGY

1. A brief account of classification of animal kingdom with reference to animal biodiversity including both invertebrates and vertebrates.
2. Physiology of animals with emphasis on Human. Homeostasis, nutrition and digestion, circulation, respiration, reproduction, excretion, co-ordination and endocrine.
3. Embryology of human
4. A brief account of animal biotechnology. Immune system and human health, DNA, Gene and genetic engineering.
5. Cell and cell division.
6. Mendelism, sex determination, sex linked inheritance, genetic disorders and polyploidy.
7. Biological molecules including carbohydrates, lipids, proteins and nucleic acids.

## CHEMISTRY

### ATOMS AND ATOMIC STRUCTURE

Measurements in Chemistry (Significant figures, S.I. Units), Mole concept, Nature of light and electromagnetic waves, atomic spectra, Bohr model, line spectra (a brief idea). Inadequacy of Bohr's Model, concept of an atomic orbital, quantum numbers and its application to electronic structures of atoms). Pauli's exclusion principle. Aufbau principle, Stability of filled & half-filled orbital Configuration of transition elements in 3d series. Dual nature of particle and radiation (photoelectric effect etc.) de-Broglie equation, uncertainty principle (simple numerical problems), Hund's rule.

### PERIODIC PROPERTIES OF ELEMENTS

Periodic law, long form of periodic table, Periodicity in properties like atomic radii and volume, ionic radii, ionization energy, electron affinity. Division of elements into s, p, d and f blocks.

### CHEMICAL BONDING AND MOLECULAR STRUCTURE

Concept of orbital overlap in bond formation, sigma and pi bonds shapes of molecules (VSEPR) Theory, hybridization ( $sp$ ,  $sp^2$ ,  $sp^3$ ,  $dsp^2$ ,  $sp^3d$ ,  $sp^3d^2$ ), properties of covalent compounds, shapes of simple

molecules like H<sub>2</sub>O, NH<sub>3</sub>, CH<sub>4</sub>, PF<sub>5</sub>, SF<sub>6</sub>, C<sub>2</sub>H<sub>4</sub> and C<sub>2</sub>H<sub>2</sub>. Coordinate bond formation with a few examples, ionic bonds; definition, factors influencing the formation of ionic compounds. An elementary treatment of metallic and hydrogen bonds. Idea of molecular orbital, bonding and antibonding, molecular orbital picture in hydrogen and oxygen molecules only.

### **CHEMISTRY OF REPRESENTATIVE ELEMENTS**

The chemistry of s and p block elements with reference to general trends in physical and chemical properties, anomalous behavior of first member of each group, diagonal relationship.

Group 1 Elements: Alkali metals; Group 2 Elements: Alkali earth metals; Group 13 Elements: Boron family; Group 14 Elements: Carbon and silicon family; Group 15 Elements: Nitrogen family;

Group 16 Elements: Oxygen family; Group 17 Elements: Halogen family; hydrogen; Group 18 Elements: Noble gases;

Preparation and properties of a few important compounds of representative elements (like halides, oxides and oxy acids etc.)

### **COORDINATION CHEMISTRY AND ORGANOMETALLICS**

Coordination Compounds nomenclature; Isomerism in Coordination compounds; Bonding in Coordination compounds; Valence Bond Theory Application of Coordination Compounds; Compounds containing metal carbon bonds; Application of organometallics.

### **CHEMICAL THERMODYNAMICS**

Energy changes during a chemical reaction. First law of thermodynamics. Concepts of internal energy and enthalpy. Application of first law of thermodynamics. Hess's law of constant heat summation, Heat of reaction, Heat of neutralization, heat of combustion, heat of fusion and vaporization. Numericals based on the above concepts.

Second law of Thermodynamics: Entropy, free energy, spontaneity of a chemical reaction, free energy and chemical equilibrium, free energy available for useful work. Third law of Thermodynamics (concept of zero entropy only).

### **CHEMICAL EQUILIBRIUM & PHASE EQUILIBRIUM**

Law of mass action and its application to chemical equilibrium.

Effect of changing the conditions of system at equilibrium-Le-Chatelier's principle.

### **IONIC EQUILIBRIUM IN SOLUTION**

Equilibrium involving ions, various concepts of acids and bases-Arrhenius, Bronsted, Lowery and Lewis, dissociation of acids and bases, acid-base equilibria, ionization of water, pH scale, hydrolysis of salts, pH calculation of solutions, acid base titration using indicators. Solubility equilibria-solubility of sparingly soluble salts, solubility equilibria and solubility products, common ions effect, buffer solution and buffer action.

### **REDOX REACTIONS**

Oxidation and reduction-electron transfer concept, redox reactions in aqueous solution, oxidation number, balancing of chemical equations in redox reactions by oxidation number method and ion-electron method or half equation method.

### **CHEMICAL KINETICS**

Rate of reaction-symbolic expression, rate expression. Units of rates and specific rate constants. Order of reaction, molecularity. Determination of order of reaction and concentration (first order reactions only). Temperature dependence of rate constant. Activation energy, Photochemical reactions.

### **STATES OF MATTER**

Gaseous state: Properties of a gas, gas laws, kinetic molecular theory of gases, Solid state. Classification of solids, X-ray studies of crystal lattices & unit cell. Liquid state, Properties of Liquids like vapour pressure, surface tension, viscosity.

### **NUCLEAR & RADIOCHEMISTRY**

Nature of radiation from radioactive substances; nuclear structure and nuclear properties, Nuclear reaction, radioactive disintegration series, artificial transmutation of elements. Isotopes and their uses. Radio carbon dating. Synthetic elements.

### **SOLUTIONS**

Types of solutions, Vapour pressure of solutions and Raoult's law. Colligative properties of solutions. Calculation of molecular masses. Electrolyte solutions, distribution law.

## **COLLOIDS AND MACROMOLECULES**

Colloidal solutions, electrokinetic and optical of colloidal Solutions, properties, applications, concept of gold number, protective colloids, Macromolecules, molecular weight of macromolecules, methods of determining molecular weight of macromolecules.

## **SURFACE AND CATALYSIS**

Absorption and adsorption, emulsions, micelles, modern developments, Interfaces, Homogeneous and heterogeneous catalysis, structure of a catalyst.

## **CARBON AND ITS COMPOUNDS INTRODUCTION TO CARBON COMPOUNDS**

Elemental Carbon. Inorganic compounds of carbon (oxides and carbides)

## **HYDROCARBONS**

Alkanes:  $sp^3$ -hybridization, sigma bond, chain isomerism; Alkenes  $sp^2$  hybridization, carbon-carbon double bond, sigma and pi-bonds. Planar molecular of ethylene cis-trans isomerism; Alkynes:  $sp$ -hybridization C (C, linear molecule of acetylene); Arenes: Delocalisation of electronics in benzene, Resonance structure of benzene: o.m.p. –isomers ; Systematic nomenclature of organic compounds.

## **PREPARATION AND PROPERTIES OF HYDROCARBONS**

Source of hydrocarbons (composition of coal and petroleum, hydrocarbons from coal and petroleum, cracking and reforming, quality of gasoline-octane number, gasoline additives).

Laboratory preparation of alkanes (preparation from unsaturated hydrocarbons, alkyl halides and carboxylic acids) ; Laboratory preparation of alkenes (Preparation from alcohol and alkyl halides); Laboratory preparation of alkynes (Preparation from calcium carbide and acetylene) ; Physical properties of alkanes (boiling and melting points, solubility and density)

Reactions of hydrocarbons, (oxidation, additions, substitutions and miscellaneous reactions).

## **PURIFICATION AND CHARACTERIZATION OF ORGANIC COMPOUNDS**

Purification (crystallization, sublimation, distillation, differential extraction and chromatography), Qualitative analysis of elements. Quantitative analysis (estimation of carbon, hydrogen, nitrogen, halogen). Determination of molecular mass (Victor Meyer's Method). Calculation of empirical and molecular formulae from weight percentage data of elements and molecular weight.

## **ORGANIC CHEMISTRY BASED ON FUNCTIONAL GROUPS**

### **HALIDES AND HYDROXY COMPOUNDS**

Nomenclature of compounds containing halogen atoms and hydroxyl group; haloarenes, alcohols and phenols, correlation of physical properties and uses. A few important polyhalogen compounds-chloroforms, carbon tetrachloride, DDT, benzene hexachloride. Polyhydric compounds, ethane 1,2-diol. Propane 1,2,3, triol.

### **ORGANIC CHEMISTRY BASED ON FUNCTIONAL GROUPS-I**

Ethers, aldehydes ketones, carboxylic acids and their derivatives. Nomenclature of ethers, aldehydes ketones, carboxylic acids and their derivative. Acylhalides, acid anhydride, amides and esters, methods of preparation, correlation of physical properties with their structures, chemical properties & uses.

### **ORGANIC CHEMISTRY BASED ON FUNCTION GROUPS-II**

Nitrogen compounds. A brief description of the chemistry of the carbon compounds containing nitrogen (cyanides, isocyanides, nitro-compounds and amines) and their methods of preparation; correlation of physical properties with structure, chemical reaction, uses.

## **SYNTHETIC AND NATURAL POLYMERS**

Classification of polymers, some important natural and synthetic polymers (with stress on their general methods of preparation); some common examples and their important uses.

**BIO CHEMISTRY:** (Structures of complicated molecules excluded)

**CARBOHYDRATES:** Monosaccharides, Disaccharides, Polysaccharides.

**AMINO ACIDS AND PEPTIDES:** Structure and classification, properties of amino acids and peptides, biologically important peptides.

**PROTEINS AND ENZYMES:** Structure of proteins, some important proteins, enzymes.

**NUCLEIC ACIDS:** Chemical properties of nucleic acids, Biological functions of nucleic acids, protein synthesis.

**LIPIDS:** Classification, structure and function.

## **AGRICULTURE**

### **AGRONOMY**

Cultivation of common crops-wheat, paddy, cotton, jowar, bajra, maize, soybean, arhar, mustard, sunflower, pea, groundnut, gram, tobacco, barseem, potato and sugarcane under the following heads:

Recommended varieties and their main characteristics, suitable areas, seed rate, time and method of sowing, irrigation, fertilizer use, control of weeds, insect-pests and diseases, harvesting, processing and yield.

Soils-origin and classification loam, silt, clay, sandy loam, etc.; physical and chemical properties; soil conservation. Use of fertilizers, essential nutrients- nitrogen, phosphorus and potassium uptake by different crops, organic and inorganic fertilizers and their effects on crops and soil, methods of using fertilizers, farmyard manure, composting, green manuring, study of organic and inorganic fertilizers/ manures. Pollution of soil, water and air in modern agriculture and remedial measures.

Irrigation and Drainage – water requirement of crops, measurement of water discharge, prevention of loss of water; quality of water; different methods of irrigation – flooding, basin method, border /strip method, sprinkler and drip irrigation – their advantages and limitations. Necessity for drainage, damage to soil and crops due to excess moisture, prevention of formation of acidic and alkaline soils and their management; natural calamities- floods and drought and their management.

### **HORTICULTURE**

Study of following horticultural crops including recommended varieties and their main features, suitability for different regions, time and method of sowing, fertilizer use, irrigation, diseases and pests and their control.

Crops- cabbage, cauliflower, onion, garlic, cucurbits, bittergourd, bottlegourd, muskmelon, squash, ridgegourd; root crops-carrot, radish sweet potato, turnip; peas, tomato, bringal, lady's finger, spices; fruit crops such as banana, apple, mango, litchi, citrus, guava, papaya, peach etc.

### **AGRICULTURAL ENGINEERING**

Type of iron and steel, wood, plastic and tin used in agricultural implements and their forms & properties. Study of different types of ploughs-their merits and demerits; mechanical devices such as cultivator, harrow, sprayer, seed drill, threshers etc. their management & cost, selection of prime movers, water lifting devices; discharge, command area, cost of different system; soil preparation, methods of ploughing, need for tillage, kinds of tillage, interculture, equipment for interculture.

Power transmission through belts, pulleys and gears, questions relating to number of teeth in gears according to speed and size of pulleys, hand operated chaff cutters, cane crusher etc., draught and its measurement.

### **AGRICULTURAL ECONOMICS**

Introductory agricultural economics-meaning and scope, significance of agricultural economics in national planning. Production – meaning, factors of production such as land, labour, capital and management, properties of factor of production; law of returns; intensive and extensive agriculture; Exchange - meaning, types, advantages; types of markets, general price determination; money and credit; banks and their functions; principle of international trade, Distribution-meaning, rent, wages, interest and profit; Consumption -meaning, wants and their properties, law of diminishing marginal utility, law of demand, relative prices and standard of living; Cooperation - meaning, principles of cooperation, types of cooperative societies in agriculture, single purpose and multi-purpose cooperative societies, land development banks: Agriculture-place in Five Year Plans; statistics of agricultural production in the State; Major programmes of agricultural development.

### **ANIMAL HUSBANDRY AND VETERINARY SCIENCE**

Study of major breeds of cows, buffaloes, goat, sheep and poultry; elementary physiology and anatomy of cows and bullocks; estimate of their age; characteristics of good milch cows and buffaloes, bulls and bullocks.

Care and management of pregnant cow, during calving, newborn calves, young calves, mulch cows; poultry management.