

	(b) No candidate who has failed to secure the minimum cut off marks fixed by the Admissions Committee in the Entrance Examination can be sponsored /nominated for admission in the University until he/she qualifies the Entrance Examination.
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## 16. Mode of Admission

### (a) Subjects & Scheme of Examination

- (i) All candidates seeking admission to Ph.D. Programmes shall take subject matter test comprising 600 marks, which shall be administered programme wise as given in para 12 A. The question paper shall consist of objective type questions with 4 multiple choices and shall be of 3 hours duration.
- (ii) (a) For all Masters' (except Physical & Life Sciences) and MCA programmes, the question paper will consist of 50 questions of Aptitude and 150 questions of subject matter. However, Life Sciences and Physical Sciences groups will consist of 50 questions of Aptitude and 200 questions of subject matter. The question paper will be objective type with multiple choices for each question in English language only.
- (iii) There shall be one common Entrance Examination for admission to all Undergraduate Programmes. It shall be of three hours duration and shall consist of one question paper carrying 600 marks and would be of objective type with multiple choices. The bilingual question paper in English and Hindi will be supplied. There will be three groups of papers as detailed below:

**PCB paper (Code 01):** The candidate who has passed/ appeared in 10+2 examination with Physics, Chemistry and Biology stream shall have question paper consisting of questions of Mental Agility (30 questions), Physics (50 questions), Chemistry (50 questions) and Biology (70 questions). The candidate opting for this group can seek admission for degree course in Agriculture, Fisheries, Community Science, Veterinary Sciences, B.Tech. (Food Technology) and B.Tech. Biotech.

**PCM paper (Code 02):** The candidate who has passed/ appeared in 10+2 examination with Physics, Chemistry and Mathematics stream shall have question paper consisting of questions of Mental Agility (30 questions), Physics (50 questions), Chemistry (50 questions) and Mathematics (70 questions). The candidate opting for this group can seek admission for degree course in Agriculture, Community Science, B.Tech. (Food Technology) and B.Tech. Biotech..

**PCA paper (Code 03):** The candidate who has passed/ appeared in 10+2 examination with Agriculture stream shall have question paper consisting of questions of Mental Agility (30 questions), Physics (50 questions), Chemistry (50 questions) and Agriculture (70 questions). The candidate opting for this group can seek admission for degree course in Agriculture and Community Science.

The candidate having Physics, Chemistry, Mathematics and Biology subjects at his/her 10+2 level will have to indicate his/her choice of the group of paper for Entrance Examination in the Application Form. These candidates can either opt for PCB paper (Code 1) or PCM paper (Code 2). They can seek admission for degree programme as per their qualification and group of paper in the entrance examination.

**Note:(1) FOR ALL THE PROGRAMMES VIZ Ph.D., MASTERS' AND UNDERGRADUATES 3.0 MARKS WILL BE AWARDED FOR EACH CORRECT ANSWER AND 1.0 MARK WILL BE DEDUCTED FOR EACH WRONG ANSWER ATTEMPTED BY THE CANDIDATE.**

**(2) USE OF ELECTRONIC EQUIPMENT SUCH AS CALCULATOR, LOG TABLE AND MOBILE PHONE ETC. IN THE EXAMINATION HALL IS STRICTLY PROHIBITED.**

### 16. (b) Basis of Selection for Admission

- (i) The Admissions Committee will decide the cutoff marks for the academic year for qualifying the entrance examination after declaration of Rank-wise list of the candidates appeared in the Entrance Examination conducted by the University.
- (ii) For Ph.D. Programmes if the marks secured by two or more candidates are the same, the merit shall be decided on the basis of marks secured in the qualifying examination. For Masters' programmes in the event of two or more candidates securing equal marks, the merit shall be decided on the basis of marks secured in the Aptitude Test and then qualifying examination. For Undergraduate programmes in the event of two or more candidates securing equal marks, the merit shall be decided on the basis of marks secured in Mental Agility then Physics, Chemistry and thereafter marks secured in the qualifying examination. In the event of tie again, a candidate with higher in age would be rated higher in merit.

### 16. (c) Counselling

- (i) Online counselling for all programmes (UG/Masters'/MCA/M.Tech./Ph.D.) will be carried out after declaration of results. Dates of different rounds of counselling will be decided keeping in view the

## 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  $3 \times 3$  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  $\text{H}_2\text{O}$ ,  $\text{NH}_3$ ,  $\text{CH}_4$ ,  $\text{PF}_5$ ,  $\text{SF}_6$ ,  $\text{C}_2\text{H}_4$  and  $\text{C}_2\text{H}_2$ . 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 anti bonding, 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.



**SYLLABUS FOR ENTRANCE EXAMINATION OF MASTER'S PROGRAMME**

The syllabus for Postgraduate programmes will be at par with the standard course content of the subject approved by the UGC/ICAR for Indian Universities. The syllabus for Life Sciences & Physical Sciences groups are given below:

**LIFE SCIENCES****UNIT- I**

Morphology and anatomy of land plants, Cell cycle, cell division, senescence, life cycle of an angiosperm, pollination, fertilization, embryogenesis, seed formation, seed storage proteins, seed dormancy and germination. Concept of cellular totipotency, organogenesis and somatic embryogenesis, Principles of Mendelian inheritance, linkage, recombination and genetic mapping; extrachromosomal inheritance; gene mutation, chromosome aberrations (numerical and structural), transposons. Introduction to Plant Breeding. Pteridophytes and Bryophytes, Taxonomy and Plant Geography

**UNIT- II**

Diversity, distribution, systematics and phylogeny of animals, Origin of life, history of life on earth, evolutionary theories, natural selection, adaptation, speciation. Principles of inheritance, molecular basis of heredity, the genetic material, transmission of genetic material, Structure of cell, cellular organelles and their structure and function, cell cycle, cell division, Comparative physiology of different systems, Parasitic organisms and host-parasite relationship, Immune response, cellular and humoral immunity, evolution of the immune system: Embryonic development, cellular differentiation, organogenesis, metamorphosis, genetic basis of development. The ecosystem, habitats, species diversity, zoogeography and Animal behavior.

**UNIT- III**

Structure of atoms, molecules and chemical bonds, Isomerism, hydrogen bond and hydrophobic interaction in biomolecules; Chemistry of biomolecules-carbohydrates, amino acids, proteins, lipids and nucleic acids, Enzymes and their kinetics, factors affecting enzyme activity, Competitive and non-competitive inhibitions. Coenzymes and cofactors, Metabolism of carbohydrates, fatty acids and proteins. eukaryotic genome organization (chromatin structure), Genetic code, replication, transcription and translation. Regulation of gene expression, Plant pigments, Secondary metabolites, Vitamins, Hormones and metabolic regulation.

**UNIT- IV**

Spontaneous generation theory-Germ theory-Discovery of antibiotics-Types of microscopes-Principles and equipment of different kinds of sterilisation-staining Techniques-Nutritional types of bacteria-Growth curve-Factors influencing bacterial growth-Fermentation and other Metabolic pathways: Principle and Application-Classification of Bacteria-Gene transfer methods in microorganisms Antigen and antibody reaction. Role of microbes in carbon and nitrogen cycles-Influence of Rhizosphere on soil microorganism. Microbes in Industry and health

**UNIT- V**

Plant physiology and its significance in agriculture; physical properties and chemical constitution of protoplasm; plant cell water relation-imbibition, surface tension, diffusion, osmosis; absorption and translocation of water and nutrients; transpiration, guttation, mineral deficiencies and their symptoms; physiological disorders, correction, hydroponics, foliar nutrition aerobic and anaerobic respiration; Photorespiration Factors affecting respiration and Photorespiration. Photosynthesis- modern concept and the factors affecting photosynthesis, nitrogen fixation growth development and differentiation; growth hormones, growth retardants, growth inhibitors and their use in agriculture; tropism in plants photoperiodism and vernalization; seed dormancy, germination; fruit ripening process and its control.

**UNIT- VI**

Concepts and scope of biotechnology, Tissue culture and its applications, Micropropagation, Meristem culture and production of virus free plants. Anther and microspore culture. Embryo and ovary culture. Protoplast isolation, fusion, and somatic hybridization, cybrids, somaclones, synthetic seeds, In vitro germ conservation, Cryopreservation, Organellar DNA, satellite and repetitive DNA, DNA repair, Recombinant DNA technology, Cloning vector, Restriction enzymes, Gene cloning. Methods of gene transfer in plants, Achievements and recent developments of genetic engineering in agriculture.

## UNIT- VII

Ecology and its relevance to life, natural resources-their management and conservation, Climatic elements as factors of crop growth, Impact of change in environment on cropping patterns, Change in environment due to agricultural environmental pollution and associated hazards to crops and animals, Human liquid and solid waste disposal, Pollution prevention and remediation, Concepts and dynamics of ecosystem component, Food chain and energy flow, Productivity and biogeochemical cycle, Types of ecosystem, Population ecology and biological control, Community structure and organization, Sustainable development, Economic importance of microbes, plants and animals.

## UNIT- VIII

Electronic configuration of elements, periodic classification of elements, atomic number, atomic and ionic radii, ionization potential, electron affinity and electro negativity, electronic theory of valency, sigma and pi-bonds, hybridization and directional nature of covalent bonds, metallic bonds, VSEPR theory, V.B. and MO theory, ionic solids and weak interactions, Lewis and Bronsted theories of acids and bases, hard soft acid and bases (HSAB), oxidation states and oxidation number, common oxidizing and reducing agents, Ionic equations. Natural and artificial radioactivity, radioactive decay, nuclear fission and fusion. Chemistry of the common elements and their compounds. Principles of extraction isolation (and metallurgy) of important elements. Chemistry of transitional elements, lanthanides and actinides. Structures of hydrogen peroxide, diborane, aluminium chloride and the important oxyacids of nitrogen, phosphorus, chlorine and sulphur. Interhalogen compounds.

Outlines of the manufactures of: sodium carbonate, sodium hydroxide, ammonia, nitric acid, sulphuric acid, cement, glass, ceramics and artificial fertilizers.

Inert gases: Isolation and Chemistry, structure of inert gas compounds.

Werner's theory of coordination compounds, V.B. and M.O. theory of bonding in metal complexes, electronic spectrum, magnetic and spectral properties of metal complexes. Organo metallic compounds. Bioinorganic chemistry, biological role of alkaline earth metal ions, metalloporphyrins.

Analytical chemistry: Principles and methods of chemical analysis, principles involved in separation techniques, chromatography.

## UNIT- IX

Modern concepts of covalent bonding, bond lengths, energy and bond angles, electron displacements, inductive, electromeric, mesomeric and hyper conjugative effects, resonance and its applications to organic chemistry, tautomerism, effects of structure on chemical reactions, dissociation constants.

Mechanism of organic reactions: Types of reagents and organic reactions, reaction intermediates, product analysis, isotope effects, kinetic and stereo chemical studies.

Stereochemistry: Optical and geometrical isomerism, chirality, enantiomers, stereogenic centers, diastereomers, resolution and racemization, relative and absolute configuration, sequence rules, E&Z and R&S nomenclature, concept of conformation and conformational analysis of ethane, butane and cyclohexane and sugars.

Chemistry and reactions of derivative of aliphatic and aromatic compounds including: Alkanes, alkynes and alkenes. arenes and aromaticity, benzene and polynuclear hydrocarbons, alkyl and aryl halides,  $S_N1$ ,  $S_N2$  and  $S_Ni$  reactions, nuclear and side chain reactions, aromatic substitutions reactions, elimination reactions. Aliphatic and aromatic alcohols and phenols, ethers and epoxides, aliphatic and aromatic aldehydes and ketones, aliphatic and aromatic carboxylic acids and their derivatives, aliphatic and aromatic amines and amides, synthetic applications of diazonium salts. Amino-acids.

Reactions and applications of organometallic compounds, Acetoacetic and malonic esters, Organic synthesis via enolates.

Heterocyclic compounds, pyridine, quinoline, thiophene, furan and pyrrole.

Important organic name reactions and rearrangements of synthetic importance.

Carbohydrates, classification and general reactions, glucose, fructose and amino acids and proteins, terpenoids and alkaloids. Polymers, dyes and pigment.

Theory and application of spectral techniques, UV, IR and NMR in structure elucidation of simple organic molecules.

## UNIT- X

Elementary quantum mechanics

Gaseous states: Kinetic theory of gases and gas laws, Maxwell's law of distribution of velocities, Van der Waal's equation, Law of corresponding states, Liquification of gases, Ratio of  $C_p/C_v$ .

Thermodynamics: The first law of thermodynamics, Isothermal and adiabatic expansion, Enthalpy, heat capacities, Thermo chemistry –heats of reaction, formation, solution and combustion, Calculation of bond

energies, Kirchhoff equation, Criteria for spontaneous changes, second law of thermodynamics entropy. Free energy, criteria of thermodynamic equilibrium.

Solutions: osmotic pressure lowering of vapour pressure, depression of freezing point, elevation of boiling point, determination of molecular weights, association and dissociation of solutes.

Chemical equilibrium, law of mass action and its applications to homogeneous and heterogeneous equilibrium, Le Chatelier's principle, Influence of temperature on chemical equilibrium.

Electrochemistry: Faraday's laws of electrolysis, conductivity of an electrolyte: equivalent conductivity and its variation with dilution, solubility of sparingly soluble salts, electrolytic dissociation, Ostwald's dilution law, anomaly of strong electrolytes, solubility product, strength of acids and bases: hydrolysis of salts, hydrogen ion concentration buffer action, theory of indicators.

Electrochemical cells: Reversible cells, standard hydrogen and calomel electrodes and redox-potentials, concentration cells, determination of pH transport number and ionic product of water, Potentiometer titration, chemical kinetics: Molecularity and order of a reaction, First order and second order reactions, Determination of order of a reaction, temperature coefficients and energy of activation, Collision theory of reaction rates, Activated complex theory.

Phase rule: Explanation of the terms involved, Applications to one and two component system, reduced phase rule, distribution law.

Colloids: General nature of colloidal solutions and their classification, general methods of preparation and properties of colloids, coagulation, protective action, gold number, adsorption phenomenon and adsorption isotherms.

Catalysis: Homogeneous and heterogeneous catalysis, catalytic promoters and poisons.

Photochemistry: Law of photochemistry. Simple numerical problems.

## PHYSICAL SCIENCES

### UNIT- I

Gradient, Divergence and Curl of Vector fields, Gauss's, Stoke's and Green's theorems. Newton's laws, Galilean invariance, Non-relativistic motion of charged particles in electric and magnetic field, conservation of linear, angular momenta and energy, Collisions, Centre of mass frame. Inverse square law force, Kepler's laws. Harmonic oscillator. Damped harmonic oscillator, Quality factor. Coulomb's law, field due to a charge distribution, Gauss's theorem and its applications, Line integral of electrical field, electric potential, Force on a surface charge, Energy associated with electric field. Current density, charging and discharging of a condenser through a resistance. Force on a moving charge, Fields due to a Helmholtz coil, Solenoid and a current loop, magnetic flux, Faraday's law in differential form, Self and mutual inductance, RL and RC circuits. Dielectrics, Moments of a charge distribution, Torque and force on a dipole in and electric field, Induced dipole moment, Polarisability, Qualitative idea about dia, para and Ferro magnetism, Magnetic susceptibility, Langevin's theory of paramagnetism, Hysteresis phenomenon, AC circuits.

### UNIT- II

Rutherford's atomic model, Bohr's model and spectra of hydrogen atom fine structure, Sommerfield model, spatial quantization and electron spin. Normal Zeeman effect. X-ray spectra, Moseley's law, Luminescence, Principle and working of different kinds of Lasers, Raman effect.

Laws of thermodynamics, Entropy,  $C_p$  and  $C_v$  of a gas. Macroscopic and microscopic systems, Internal and external energy states of a molecule, Reversible and irreversible processes, production of low temperatures. Maxwell's thermodynamic relationships, Triple point, applications of Maxwell's thermodynamical relations. Introduction to cryogenics and refrigeration. Black body radiation and different radiation laws. Einstein's theory of specific heat and its limitations, Lattice vibrations, phonons-Debye's theory of specific heat of solids, specific heat of diatomic gases and its variation with temperature.

Black body spectrum, photoelectric effect and Compton effect. De Broglie's waves, Group and phase velocities, Uncertainty principle. Schrödinger's equation, Operators, Expectation values. Applications of Schrödinger's equation and its various applications. Michelson Morley experiment, Postulates of special relativity, Lorentz transformations, Relativistic kinematics

### UNIT- III

Fermat's Principle, Cardinal points, telescopic combinations, Interference and diffraction of light, Rayleigh criterion, resolving power of telescope and microscope, Grating, Resolving power of a grating, Polarization and different kinds of polarized light, Double refraction, optical activity Electromagnetic theory.

Kirchoffs Laws, Thevenins & Nortons Theorems, Filters, VTVM, CRO. Semiconductor Devices, diodes and transistors, FET, MOSFETS, UJT, Thermistors, Rectifiers, Power supply. Different types transistor based amplifiers and oscillators, Multivibrators, Logic gates and Boolean Algebra.

#### UNIT- IV

Crystal structure, Unit cell, Bravais lattices, Miller indices, X-ray diffraction, Bragg's law. Lattice vibrations: Free electron theory of metals, Distinction between conductors, semiconductors and insulators, Intrinsic and Extrinsic semiconductors.

Probability, Ensemble and average properties, Equilibrium and fluctuations, constraints, Equilibrium between two systems in thermal contact, the  $\beta$  parameter, Entropy and probability Boltzmann entropy relation, Statistical interpretation of second law of thermodynamics. Maxwellian Distribution of Speeds in an ideal gas.

Bose-Einstein and Fermi-Dirac Statistics, Free electrons in a metal, photons in black body chamber, Fermi level and Fermi energy.

Structure of nucleus; Liquid drop model and semi empirical mass formula, nuclear reactions, nuclear fission and fusion, elementary particles. Artificial nuclear transmutation, Particle accelerators & detectors,  $\alpha$ ,  $\beta$ ,  $\gamma$ . decay.

#### UNIT- V

Real analysis: continuity and discontinuity, Riemann Integral and its applications. Algebra of integral function, convergence and divergence. Different methods in Hydrodynamics in the equation of continuity in different systems. Equation of motion and Bernoulli's equation with different cases. Motion in 2D and its applications. Differential and Integral calculus: successive differentiation, Different form of theorems, Tangents and normal, Maxima and Minima with different cases. Various types of integral form, Beta and gamma functions.

Linear Algebra: Group, ring field, Integral domain and vector space with examples and theorems. Differential equations and Laplace transformation, vector analysis and Analytical Geometry, mechanics and complex analysis.

#### UNIT- VI

General Statistics, Probability Distributions, Test of Significance, Analysis of Variance, Sampling Theory, Design of Experiment, Time series Analysis, Index Numbers, Statistical Quality Control, Vital statistics, Statistical organizations in India.

#### UNIT- VII

Introduction to computers, fundamentals, peripherals of PCs, software and Hardware. Evolution. Operating system. Structural computer Languages: programming in C, UNIX, WINDOWS Operating Systems. Number systems and computer architecture.

Computational methods for Numerical Analysis: Algebraic and Transcendental equations, systems of simultaneous equations. Interpolation and Differentiation, solution of ordinary differential equations with initial value and boundary value problems.

#### UNIT- VIII

Electronic configuration of elements, periodic classification of elements, atomic number, atomic and ionic radii, ionization potential, electron affinity and electro negativity, electronic theory of valency, sigma and pi-bonds, hybridization and directional nature of covalent bonds, metallic bonds, VSEPR theory, V.B. and MO theory, ionic solids and weak interactions, Lewis and Bronsted theories of acids and bases, hard soft acid and bases (HSAB), oxidation states and oxidation number, common oxidizing and reducing agents, Ionic equations.

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Catalysis: Homogeneous and heterogeneous catalysis, catalytic promoters and poisons.

Photochemistry: Law of photochemistry. Simple numerical problems.

Note: Questions from similar topics can also be included.

**SYLLABUS FOR ENTRANCE EXAMINATION OF MCA PROGRAMME****MENTAL APTITUDE: (50 questions)**

The questions in this section will cover logical reasoning and quantitative aptitude. Some of the questions will be on comprehension of a logical situation and questions based on the facts given in the passage.

**MATHEMATICS: (90 questions)**

**Set Theory:** Concepts of sets Union Intersection Cardinality Elementary counting theorem permutations and combinations.

**Probability and Statistics:** Basic concepts of probability theory, Averages, Dependent and independent events, frequency distributions, measures of central tendencies and dispersions.

**Algebra:** Fundamental operations in Algebra, Expansions, Factorization, simultaneous linear & quadratic equations, indices, logarithms, arithmetic, geometric and harmonic progressions, determinants and matrices.

**Coordinate Geometry:** Rectangular Cartesian coordinates, distance formulae, equation of lines, intersections of lines, pair of straight lines, equations of a circle, parabola, ellipse and hyperbola.

**Calculus:** Limit of functions, Continuous function, Differentiation of function, tangents and normal, simple examples of maxima and minima. Integration of functions by parts, by substitution and by partial fraction; Definite integrals, Applications of Definite Integrals to areas.

**Vectors:** Position vector, addition and subtraction of vectors, scalar and vector products and their applications to simple geometrical problems and mechanics.

**Trigonometry:** Simple identities, trigonometric equations, properties of triangles, solution of triangles, heights and distances, General solutions of trigonometric equations.

**COMPUTER AWARENESS: (30 questions)**

**Computer Basics:** Organization of a Computer, Central Processing Unit (CPU), Structure of instructions in CPU, input/output devices, computer memory, back-up devices.

**Data Representation:** Representation of characters, integers and fractions, binary and hexadecimal representations, Binary Arithmetic: Addition, subtraction, multiplication, division, simple arithmetic and two's complement arithmetic, floating point representation of numbers, Boolean algebra, truth tables, Venn diagrams.

**GENERAL ENGLISH: (30 questions)**

Questions in this section will be designed to test the candidates' general understanding of the English language. There will be questions on the following topics:

Comprehension, Vocabulary, Basic English Grammar (like usage of correct forms of verbs, prepositions and articles), Word power, Synonyms and Antonyms, Meanings of words and phrases, Technical writing.

**Note:** Questions from similar topics could also be included.

**DISTRIBUTION OF QUESTIONS IN THE PAPER:**

The question paper will contain 200 multiple-choice questions distributed as follows:

1. Mental Aptitude	50 questions
2. Mathematics	90 questions
3. Computer Awareness	30 questions
4. General English	30 questions