

# Syllabus

## Paper-I Mathematics (Maximum Marks - 300)

1. Algebra : Concept of a set, operations on sets, Venn diagrams. De Morgan laws. Cartesian product, relation, equivalence relation. Representation of real numbers on a line. Complex numbers - basic properties, modulus, argument, cube roots of unity. Binary system of numbers. Conversion of a number in decimal system to binary system and vice-versa. Arithmetic, Geometric and Harmonic progressions. Quadratic equations with real coefficients. Solution of linear inequations of two variables by graphs. Permutation and Combination. Binomial theorem and its application. Logarithms and their applications.

2. Matrices and Determinants: Types of matrices, operations on matrices Determinant of a matrix, basic properties of determinant. Adjoint and inverse of a square matrix, Applications - Solution of a system of linear equations in two or three unknowns by Cramer's rule and by Matrix Method.

3. Trigonometry: Angles and their measures in degrees and in radians. Trigonometrical ratios. Trigonometric identities Sum and difference formulae. Multiple and Sub-multiple angles. Inverse trigonometric functions. Applications - Height and distance, properties of triangles.

4. Analytical Geometry of two and three dimensions: Rectangular Cartesian Coordinate system. Distance formula. Equation of a line in various forms. Angle between two lines. Distance of a point from a line. Equation of a circle in standard and in general form. Standard forms of parabola, ellipse and hyperbola. Eccentricity and axis of a conic. Point in a three dimensional space, distance between two points. Direction Cosines and direction ratios. Equation of a plane and a line in various forms. Angle between two lines and angle between two planes. Equation of a sphere.

5. Differential Calculus: Concept of a real valued function - domain, range and graph of a function. Composite functions, one to one, onto and inverse functions. Notion of limit, Standard limits - examples. Continuity of functions - examples, algebraic operations on continuous functions. Derivative of a function at a point, geometrical and physical interpretation of a derivative - applications. Derivatives of sum, product and quotient of functions, derivative of a function with respect of another function, derivative of a composite function. Second order derivatives. Increasing and decreasing functions. Application of derivatives in problems of maxima and minima.

6. Integral Calculus and Differential equations: Integration as inverse of differentiation, integration by substitution and by parts, standard integrals involving algebraic expressions, trigonometric, exponential and hyperbolic functions. Evaluation of definite integrals - determination of areas of plane regions bounded by curves - applications. Definition of order and degree of a differential equation, formation of a differential equation by examples. General and particular solution of a differential equation, solution of first order and first degree differential equations of various types - examples. Application in problems of growth and decay.

7. Vector Algebra : Vectors in two and three dimensions, magnitude and direction of a vector. Unit and null vectors, addition of vectors, scalar multiplication of vector, scalar product or dot product of two-vectors. Vector product and cross product of two vectors. Applications-work done by a force and moment of a force, and in geometrical problems.

8. Statistics and Probability :

Statistics: Classification of data, Frequency distribution, cumulative frequency distribution - examples Graphical representation - Histogram, Pie Chart, Frequency Polygon - examples. Measures of Central tendency - mean, median and mode. Variance and standard deviation - determination and comparison. Correlation and regression.

Probability : Random experiment, outcomes and associated sample space, events, mutually exclusive and exhaustive events, impossible and certain events. Union and Intersection of events. Complementary, elementary and composite events. Definition of probability - classical and statistical - examples. Elementary theorems on probability - simple problems. Conditional probability, Bayes' theorem - simple problems. Random variable as function on a sample space. Binomial distribution, examples of random experiments giving rise to Binominal distribution.

### **GENERAL ABILITY TEST – PAPER-II (Maximum Marks-600)**

#### **Part 'A' – ENGLISH (Maximum Marks 200)**

The question paper in English will be designed to test the candidate's understanding of English and workman like use of words. The syllabus covers various aspects like: Grammar and usage, vocabulary, comprehension and cohesion in extended text to test the candidate's proficiency in English.

#### **Part 'B' – GENERAL KNOWLEDGE (Maximum Marks-400)**

The question paper on General Knowledge will broadly cover the subjects: Physics, Chemistry, General Science, Social Studies, Geography and Current Events. The syllabus given below is designed to indicate the scope of these subjects included in this paper. The topics mentioned are not to be regarded as exhaustive and questions on topics of similar nature not specifically mentioned in the syllabus may also be asked. Candidate's answers are expected to show their knowledge and intelligent understanding of the subject.

Section 'A' (Physics): Physical Properties and States of Matter, Mass, Weight, Volume, Density and Specific Gravity, Principle of Archimedes, Pressure Barometer. Motion of objects, Velocity and Acceleration, Newton's Laws of Motion, Force and Momentum, Parallelogram of Forces, Stability and Equilibrium of bodies, Gravitation, elementary ideas of work, Power and Energy. Effects of Heat, Measurement of temperature and heat, change of State and Latent Heat, Modes of transference of Heat. Sound waves and their properties, Simple musical instruments. Rectilinear propagation of Light, Reflection and refraction. Spherical mirrors and Lenses. Human Eye. Natural and Artificial Magnets, Properties of a Magnet, Earth as a Magnet. Static and Current Electricity, conductors and Non-conductors, Ohm's Law, Simple Electrical Circuits, Heating, Lighting and Magnetic effects of Current, Measurement of Electrical Power, Primary and Secondary Cells, Use of X-Rays. General Principles in the working of the following : Simple Pendulum, Simple Pulleys, Siphon, Levers, Balloon, Pumps, Hydrometer, Pressure Cooker, Thermos Flask, Gramophone, Telegraphs, Telephone, Periscope, Telescope, Microscope, Mariner's Compass; Lightning Conductors, Safety Fuses.

Section 'B' (Chemistry): Physical and Chemical changes. Elements, Mixtures and Compounds, Symbols, Formulae and simple Chemical Equations, Law of Chemical Combination (excluding problems). Properties of Air and Water. Preparation and Properties of Hydrogen, Oxygen, Nitrogen and Carbon dioxide, Oxidation and Reduction. Acids, bases and salts. Carbon – different forms. Fertilizers – Natural and Artificial Material used in the preparation of substances like soap, Glass, Ink, Paper, Cement, Paints, Safety Matches, and Gun-Powder. Elementary ideas about the Structure of Atom, Atomic, Equivalent and Molecular Weights, Valency.

Section 'C' (General Science): Difference between the living and non- living. Basis of Life – Cells, Protoplasm's and Tissues. Growth and Reproduction in Plants and Animals. Elementary knowledge of Human Body and its important organs. Common Epidemics, their causes and prevention. Food – Source of Energy for man. Constituents of food, Balanced Diet. The Solar System – Meteors and Comets, Eclipses. Achievements of Eminent Scientists.

Section 'D': (History, Freedom Movement etc.) A broad survey of Indian History, with emphasis on Culture and Civilizations. Freedom Movement in India. Elementary study of Indian Constitution and Administration. Elementary knowledge of Five Year Plans of India. Panchayati Raj, Co-operatives and Community Development. Bhoodan, Sarvodaya, National Integration and Welfare State, Basic Teachings of Mahatma Gandhi. Forces shaping the modern world; Renaissance, Exploration and Discovery; War of American Independence. French Revolution, Industrial Revolution and Russian Revolution. Impact of Science and Technology on Society. Concept of one World, United Nations, Panchsheel, Democracy. Socialism and Communism. Role of India in the present world.

Section 'E' (Geography): The Earth, its shape and size. Latitudes and Longitudes, Concept of time. International Date Line. Movements of Earth and their effects. Origin of Earth. Rocks and their classification; Weathering – Mechanical and Chemical, Earthquakes and volcanoes. Ocean Currents and Tides Atmosphere and its composition; Temperature and Atmospheric Pressure, Planetary Winds, cyclones and Anti-cyclones; Humidity; Condensation and Precipitation; Types of Climate. Major Natural regions of the World. Regional Geography of India – Climate, Natural vegetation. Mineral and Power resources; location and distribution of agricultural and industrial activities. Important Sea ports and main sea, land and air routes of India. Main items of Imports and Exports of India.

Section 'F' (Current Events): Knowledge of Important events that have happened in India in the recent years. Current important world events. Prominent personalities – both Indian and International including those connected with cultural activities and sports.