DAT SYLLABUS

Subject – Science

A. Chemistry

1. **Particle nature and their basic units:** Atoms and molecules, Law of constant proportions, Atomic and molecular masses. Mole concept: Relationship of mole to mass of the particles and numbers.

2. **Structure of atoms:** Electrons, protons and neutrons, valency, chemical formula of common compounds. Isotopes and Isobars.

3. **Chemical reactions:** Chemical equation, Balanced chemical equation, implications of a balanced chemical equation, types of chemical reactions: combination, decomposition, displacement, double displacement, precipitation, neutralization, oxidation and reduction.

4. **Acids, bases and salts:** Their definitions in terms of furnishing of H^+ and OH^- ions, General properties, examples and uses, concept of pH scale (Definition relating to logarithm not required), importance of pH in everyday life; preparation and uses of Sodium Hydroxide, Bleaching powder, Baking soda, Washing soda and Plaster of Paris.

5. **Metals and nonmetals:** Properties of metals and non-metals; Reactivity series; Formation and properties of ionic compounds.

6. **Carbon compounds:** Covalent bonding in carbon compounds. Versatile nature of carbon. Homologous series.

7. **Periodic classification of elements:** Need for classification, early attempts at classification of elements (Dobereiner's Triads, Newland's Law of Octaves, Mendeleev's Periodic Table), Modern periodic table, gradation in properties, valency, atomic number, metallic and non-metallic properties.

B. Biology

1. **Cell - Basic Unit of life:** Cell as a basic unit of life; prokaryotic and eukaryotic cells, multicellular organisms; cell membrane and cell wall, cell organelles and cell inclusions; chloroplast, mitochondria, vacuoles, endoplasmic reticulum, Golgi apparatus; nucleus, chromosomes - basic structure, number.

2. **Tissues, Organs, Organ System, Organism:** Structure and functions of animal and plant tissues (only four types of tissues in animals; Meristematic and Permanent tissues in plants).

3. **Health and Diseases:** Health and its failure. Infectious and Non-infectious diseases, their causes and manifestation. Diseases caused by microbes (Virus, Bacteria and Protozoans) and their prevention; Principles of treatment and prevention. Pulse Polio programmes.

4. **Life processes:** 'Living Being'. Basic concept of nutrition, respiration, transport and excretion in plants and animals.

5. **Reproduction:** Reproduction in animals and plants (asexual and sexual) reproductive health- need and methods of family planning. Safe sex vs HIV/AIDS. Child bearing and women's health.

6. **Heredity:** Heredity; Mendel's contribution- Laws for inheritance of traits: Sex determination: brief introduction

7. **Our environment:** Eco-system, Environmental problems, Ozone depletion, waste production and their solutions. Biodegradable and non-biodegradable substances.

C. Physics

1. **Motion:** Distance and displacement, velocity; uniform and non-uniform motion along a straight line; acceleration, distance-time and velocity-time graphs for uniform motion and uniformly accelerated motion, derivation of equations of motion by graphical method; elementary idea of uniform circular motion.

2. **Force and Newton's laws:** Force and Motion, Newton's Laws of Motion, Action and Reaction forces, Inertia of a body, Inertia and mass, Momentum, Force and Acceleration. Elementary idea of conservation of Momentum.

3. **Gravitation:** Gravitation; Universal Law of Gravitation, Force of Gravitation of the earth (gravity), Acceleration due to Gravity; Mass and Weight; Free fall.

4. **Work, energy and power:** Work done by a Force, Energy, power; Kinetic and Potential energy; Law of conservation of energy.

5. **Natural Phenomena**-Reflection of light by curved surfaces; Images formed by spherical mirrors, centre of curvature, principal axis, principal focus, focal length, mirror formula (Derivation not required), magnification. Refraction; Laws of refraction, refractive index.

   Refraction of light by spherical lens; Image formed by spherical lenses; Lens formula (Derivation not required); Magnification. Power of a lens.

   Refraction of light through a prism, dispersion of light, scattering of light, applications in daily life.

6. **Effect of Current**-Electric current, potential difference and electric current. Ohm's law; Resistance, Resistivity, Factors on which the resistance of a conductor depends. Series combination of resistors, parallel combination of resistors and its applications in daily life. Heating effect of electric current and its applications in daily life. Electric power, Interrelation between P, V, I and R.

7. **Magnetic effects of current:** Magnetic field, field lines, field due to a current carrying conductor, field due to current carrying coil or solenoid; Force on current carrying conductor, Fleming's Left Hand Rule, Electric Motor, Electromagnetic induction. Induced potential difference, Induced current. Fleming's Right Hand Rule.

DAT SYLLABUS
Subject – Mathematics

1. **REAL NUMBERS**

    A. Review of representation of natural numbers, integers, rational numbers on the number line.

    B. Rational numbers as recurring/ terminating decimals. Operations on real numbers.

    C. Examples of non-recurring/non-terminating decimals. Existence of non-rational numbers (irrational numbers) such as $\sqrt{2}, \sqrt{3}$ and their representation on the number line.

    D. Rationalization (with precise meaning) of real numbers of the type $\frac{1}{a+b\sqrt{a}}$ and $\frac{1}{\sqrt{x}+\sqrt{y}}$

    (and their combinations) where x and y are natural number and a and b are integers.

    E. Recall of laws of exponents with integral powers. Rational exponents with positive real bases (to be done by particular cases, allowing learner to arrive at the general laws.)

    F. Fundamental Theorem of Arithmetic - statements after reviewing work done earlier and after illustrating and motivating through examples, Proofs of irrationality of $\sqrt{2}, \sqrt{3} \sqrt{5}$ Decimal representation of rational numbers in terms of terminating/non-terminating recurring decimals.

2. **POLYNOMIALS**

    Definition of a polynomial in one variable, with examples and counter examples. Coefficients of a polynomial, terms of a polynomial and zero polynomial. Degree of a polynomial. Constant, linear, quadratic and cubic polynomials. Monomials, binomials, trinomials. Factors and multiples. Zeros of a polynomial. Factorization of $ax^2 + bx + c, a \neq 0$ where a, b and c are real numbers, and of cubic polynomials using the Factor Theorem.

    Recall of algebraic expressions and identities. Verification of identities:

$$(x + y + z)^2 = x^2 \ y^2 + z^2 + 2xy + 2yz + 2zx$$
$$(x \pm y)^3 = x^3 \pm y^3 \pm 3xy \, (x \pm y)$$
$$x^3 \pm y^3 = (x \pm y) \, (x^2 \mp xy + y^2)$$

    and their use in factorization of polynomials.

    Zeros of a polynomial. Relationship between zeros and coefficients of quadratic polynomials

3. **LINEAR EQUATIONS IN TWO VARIABLES**

    Recall of linear equations in one variable. Introduction to the equation in two variables. Focus on linear equations of the type ax+by+c=0. Explain that a linear equation in two variables has infinitely many solutions and justify their being written as ordered pairs of real numbers, plotting them and showing that they lie on a line. Graph of linear equations in two variables. Examples, problems from real life with algebraic and graphical solutions being done simultaneously.

    Pair of linear equations in two variables and graphical method of their solution, consistency/inconsistency.

Algebraic conditions for number of solutions. Solution of a pair of linear equations in two variables algebraically - by substitution, by elimination. Simple situational problems. Simple problems on equations reducible to linear equations.

4. **LINES AND ANGLES**

   A. (Motivate) If a ray stands on a line, then the sum of the two adjacent angles so formed is 180° and the converse.

   B. (Prove) If two lines intersect, vertically opposite angles are equal.

   C. (Motivate) Results on corresponding angles, alternate angles, interior angles when a transversal intersects two parallel lines.

   D. (Motivate) Lines which are parallel to a given line are parallel.

   E. (Prove) The sum of the angles of a triangle is 180°.

   F. (Motivate) If a side of a triangle is produced, the exterior angle so formed is equal to the sum of the two interior opposite angles.

   G. **Review:** Concepts of coordinate geometry, graphs of linear equations. Distance formula. Section formula (internal division).

5. **TRIANGLES**

   A. (Motivate) Two triangles are congruent if any two sides and the included angle of one triangle is equal to any two sides and the included angle of the other triangle (SAS Congruence).

   B. (Motivate) Two triangles are congruent if the three sides of one triangle are equal to three sides of the other triangle (SSS Congruence).

   C. (Motivate) Two right triangles are congruent if the hypotenuse and a side of one triangle are equal (respectively) to the hypotenuse and a side of the other triangle. (RHS Congruence)

   D. (Prove) The angles opposite to equal sides of a triangle are equal.

   E. (Motivate) The sides opposite to equal angles of a triangle are equal.

   F. (Prove) If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.

   G. (Motivate) If a line divides two sides of a triangle in the same ratio, the line is parallel to the third side.

   H. (Motivate) If in two triangles, the corresponding angles are equal, their corresponding sides are proportional and the triangles are similar.

   I. (Motivate) If the corresponding sides of two triangles are proportional, their corresponding angles are equal and the two triangles are similar.

   J. (Motivate) If one angle of a triangle is equal to one angle of another triangle and the sides including these angles are proportional, the two triangles are similar.

   K. (Motivate) If a perpendicular is drawn from the vertex of the right angle of a right triangle to the hypotenuse, the triangles on each side of the perpendicular are similar to the whole triangle and to each other.

   L. (Prove) In a right triangle, the square on the hypotenuse is equal to the sum of the squares on the other two sides.

6. **QUADRILATERALS**

   A. (Prove) The diagonal divides a parallelogram into two congruent triangles.

   B. (Motivate) In a parallelogram opposite sides are equal, and conversely.

   C. (Motivate) In a parallelogram opposite angles are equal, and conversely.

   D. (Motivate) A quadrilateral is a parallelogram if a pair of its opposite sides is parallel and equal.

   E. (Motivate) In a parallelogram, the diagonals bisect each other and conversely.

   F. (Motivate) In a triangle, the line segment joining the mid points of any two sides is parallel to the third side and in half of it and (motivate) its converse.

7. **CIRCLES**

   A. Through examples, arrive at definition of circle and related concepts-radius, circumference, diameter, chord, arc, secant, sector, segment, subtended angle.

   B. (Prove) Equal chords of a circle subtend equal angles at the center and (motivate) its converse.

   C. (Motivate) The perpendicular from the center of a circle to a chord bisects the chord and conversely, the line drawn through the center of a circle to bisect a chord is perpendicular to the chord.

   D. (Motivate) Equal chords of a circle (or of congruent circles) are equidistant from the center (or their respective centers) and conversely.

   E. (Prove) The angle subtended by an arc at the center is double the angle subtended by it at any point on the remaining part of the circle.

   F. Motivate) Angles in the same segment of a circle are equal.

   G. (Motivate) The sum of either of the pair of the opposite angles of a cyclic quadrilateral is 180° and its converse.

      Tangent to a circle at, point of contact

   H. (Prove) The tangent at any point of a circle is perpendicular to the radius through the point of contact.

   I. (Prove) The lengths of tangents drawn from an external point to a circle are equal.

8. **INTRODUCTION TO TRIGONOMETRY**   **(8) Periods**

   Trigonometric ratios of an acute angle of a right-angled triangle. Proof of their existence (well defined). Values of the trigonometric ratios of 30^0, 45^0 and 60^0. Relationships between the ratios.

9. **TRIGONOMETRIC IDENTITIES**   **(10) Periods**

   Proof and applications of the identity $sin^2A + cos^2A = 1$. Only simple identities to be given.

10. **HEIGHTS AND DISTANCES: Angle of elevation, Angle of Depression.**   **(8) Periods**

   Simple problems on heights and distances. Problems should not involve more than two right triangles. Angles of elevation / depression should be only 30°, 45°, 60°.

11. Area

Area of a triangle using Heron's formula (without proof)

Motivate the area of a circle; area of sectors and segments of a circle. Problems based on areas and perimeter / circumference of the above said plane figures. (In calculating area of segment of a circle, problems should be restricted to central angle of 60°and 90° only. Plane figures involving triangles, simple quadrilaterals and circle should be taken.)

12. SURFACE AREAS AND VOLUMES

Surface areas and volumes of cubes, cuboids, spheres (including hemispheres) and right circular cylinders/cones.

A. Surface areas and volumes of combinations of any two of the following: cubes, cuboids, spheres, hemispheres and right circular cylinders/cones.

B. Problems involving converting one type of metallic solid into another and other mixed problems. (Problems with combination of not more than two different solids be taken).

13. STATISTICS

Introduction to Statistics: Collection of data, presentation of data — tabular form, ungrouped / grouped, bar graphs

Mean, median and mode of grouped data (bimodal situation and step deviation method for finding the mean to be avoided).

14. PROBABILITY

History, Repeated experiments and observed frequency approach to probability.

Focus is on empirical probability. (A large amount of time to be devoted to group and to individual activities to motivate the concept; the experiments to be drawn from real - life situations, and from examples used in the chapter on statistics).

Classical definition of probability. Simple problems on finding the probability of an event.

15. QUADRATIC EQUATIONS

Standard form of a quadratic equation $ax^2 + bx + c = 0$, ($a \neq 0$). Solutions of quadratic equations (only real roots) by factorization, and by using quadratic formula. Relationship between discriminant and nature of roots.

16. ARITHMETIC PROGRESSIONS

Motivation for studying Arithmetic Progression Derivation of the nth term and sum of the first n terms of AP