SYLLABUS FOR ENTRANCE EXAMINATION

MATHEMATICS

a. COMPLEX NUMBERS

Algebra of complex numbers, modulus and argument (or amplitude) of a complex number, square root of a complex number. cube roots of unity, triangle inequality.

b. MATRICES AND DETERMINANTS

Determinants and matrices of order two and three- properties of determinants, evaluation of determinants, addition and multiplication of matrices, adjoint and inverse of a matrix. Solution of simultaneous linear equations using determinants.

c. QUADRATIC EQUATIONS

Quadratic equations and their solutions, relation between roots and coefficients, nature of roots, formation of quadratic equations with given roots.

d. PERMUTATIONS AND COMBINATIONS

Fundamental principle of counting; permutation as an arrangement and combination as a selection, meaning of $P(n, r)$ and $C(n, r)$, simple applications.

e. SEQUENCES AND SERIES

Arithmetic, Geometric and Harmonic progressions. Relation between A.M., G.M. and H.M.. Special series' $\sum n$, $\sum n^2$, $\sum n^3$, Arithmetico-Geometric series, exponential and logarithmic series.

f. VECTOR ALGEBRA

Vectors and scalars, addition of two vectors, components of a vector in two and three dimensional space, scalar and vector products, scalar and vector triple products. Application of vectors to plane geometry.

g. TRIGONOMETRY

Trigonometrical identities and equations. Inverse trigonometric functions and their properties. Properties of triangles including centroid, incentre, circumcentre and orthocentre. Solution of triangles. Heights and distances.

h. MEASURES OF CENTRAL TENDENCY AND DISPERSION

Calculation of mean, median and mode, standard deviation, variance and mean deviation for grouped and ungrouped data.

i. PROBABILITY

Probability of an event, addition and multiplication theorems of probability and their applications. Conditional probability; Bayes' theorem. Probability distribution of a random variate- Binomial and Poisson distributions and their properties.

j. DIFFERENTIAL CALCULUS

Polynomial, rational, trigonometric, logarithmic and exponential functions. Graphs of simple functions. Limits, continuity and differentiation of the sum, difference, product and quotient of two functions. Differentiation of trigonometric, inverse trigonometric, logarithmic, exponential, composite and implicit functions; derivatives of order up to two. Applications of derivatives-maxima and minima of functions of one variable, tangents and normals, Rolle's and Lagrange's mean value theorems.

k. INTEGRAL CALCULUS

Integral as an anti derivative, fundamental integrals involving algebraic, trigonometric, exponential and logarithmic functions. Integration by substitution, by parts and by partial fractions. Integration using trigonometric identities. Integral as a limit of sum. Properties of definite integrals. Evaluation of definite integral, determining areas of the regions bounded by simple curves.

l. DIFFERENTIAL EQUATIONS

Formation of differential equations. Solutions of first order differential equations- the method of separation of variables, homogeneous and linear differential equations.

m. TWO DIMENSIONAL GEOMETRY

Review of cartesian system of rectangular co-ordinates in a plane, distance formula, area of a triangle, condition for the collinearity of three points, slope of a line, parallel and perpendicular lines, intercepts of a line on the coordinate axes.

n. THE STRAIGHT LINE AND PAIR OF STRAIGHT LINES

Various forms of equations of a line, intersection of lines, angles between two lines, conditions for concurrence of three lines, distance of a point from a line. Equations of internal and external bisectors of angles between two lines, equation of a family of lines passing through the point of intersection of two lines, point of intersections and angles between two lines. Pair of straight lines- condition for the general second degree equation to represent a pair of lines, point of intersection and angle between pair of lines through the origin, combined equation of the bisectors of the angles between a pair of lines,

o. CIRCLES AND FAMILY OF CIRCLES

Equation of a circle- standard form, general form, parametric form, equation of a circle when the end points of a diameter are given. Radius and centre of a circle, points of intersection of a line and a circle. Condition for a line to be tangent, equation of a family of circles through the intersection of two circles, condition for two intersecting circles to be orthogonal.

p. CONIC SECTIONS

Sections of cones, equations of conic sections (parabola, ellipse and hyperbola) in standard forms, conditions for a line to be a tangent and point(s) of tangency.

PHYSICS

a. UNITS AND DIMENSIONS

Units for measurement, system of units, SI, fundamental and derived units, dimensions and their applications

b. MECHANICS

Motion in straight line, uniform and non-uniform motion, uniformly accelerated motion and its applications

Scalars and Vectors, and their properties; resolution of vectors, scalar and vector products; uniform circular motion and its applications, projectile motion

Newton's Laws of motion; conservation of linear momentum and its applications, laws of friction, Concept of work, energy and power; energy-kinetic and potential; conservation of energy; different forms of energy. Elastic collisions in one and two dimensions.

Center of mass of a many particle system; center of mass of a rigid body, rotational motion and torque. Angular momentum and its conservation. Moments of inertia, parallel and perpendicular axes theorem,   moment of inertia for a thin rod, ring, disc and sphere.

Gravitation: Acceleration due to gravity and its properties. One and two dimensional motion under gravity. Universal law of gravitation, planetary motion, Kepler's laws, artificial satellite-geostationary satellite, gravitational potential energy near the surface of earth, gravitational potential and escape velocity.

c. SOLIDS AND FLUIDS

Solids: Elastic properties, Hooke's law, Young's modulus, bulk modulus, modulus of rigidity. Liquids: Cohesion and adhesion; surface energy and surface tension; flow of fluids, Bernoulli's theorem and its applications; viscosity, Stoke's Law, terminal velocity.

(i) OSCILLATIONS AND WAVES

Periodic motion, simple harmonic motion and its equation, oscillations of a spring and simple pendulum. Wave motion, properties of waves, longitudinal and transverse waves, superposition of waves, Progressive and standing waves. Free and forced oscillations, resonance, vibration of strings and air columns, beats, Doppler effect

(ii) HEAT AND THERMODYNAMICS

Thermal expansion of solids, liquids and gases and their specific heats, relationship between

C_p and C_v for gases, first and second laws of thermodynamics ,

Carnot cycle, efficiency of heat engines. Transference of heat; thermal conductivity; black body radiations, Kirchoff's law, Wein's Law, Stefan's law of radiation and Newton's law of cooling.

(i) ELECTROSTATICS, CURRENT ELECTRICITY AND MAGNETOSTATICS

Coloumb's law, dielectric constant, electric field, lines of force, field due to dipole , electric flux, Gauss's theorem and its applications; electric potential, potential due to a point charge; conductors and insulators, distribution of charge on conductors; capacitance, parallel plate capacitor, combination of capacitors, energy stored in a capacitor

Electric current : Cells-primary and secondary, grouping of cells; resistance and specific resistivity and its temperature dependence. Ohm's law, Kirchoff's Law. Series and parallel circuits; Wheatstone's Bridge and potentiometer with their applications.

Heating effects of current, electric power, concept of thermoelectricity-Seebeck effect and thermocouple; chemical effect of current- Faraday's laws of electrolysis.

Magnetic effects: Oersted's experiment, Biot Savert's law, magnetic field due to straight wire, circular loop and solenoid, force on a moving charge in a uniform magnetic field (Lorentz force),forces and torques on a current carrying conductor in a magnetic field, force between current carrying wires, moving coil galvanometer and conversion to ammeter and voltmeter

Magnetostatics: Bar magnet, magnetic field, lines of force, torque on a bar magnet in a magnetic field, earth's magnetic field; para, dia and ferro magnetism, magnetic induction, magnetic susceptibility

d. ELECTROMAGNETIC INDUCTION AND ELECTROMAGNETIC WAVES

Induced e.m.f., Faraday's law, Lenz's law, self and mutual inductance; alternating currents, impedance and reactance, power in ac; circuits with L C and R series combination, resonant circuits, transformer and AC generator.

Electromagnetic waves and their characteristics; electromagnetic spectrum from gamma to radio waves.

e. RAY AND WAVE OPTICS

Reflection and refraction of light at plane and curved surfaces, total internal reflection; optical fiber; deviation and dispersion of light by a prism; lens formula, magnification and resolving power; microscope and telescope Wave nature of light, interference, Young's double experiment; thin films, Newton's rings. Diffraction: diffraction due to a single slit; diffraction grating, polarization and applications.

f. MODERN PHYSICS

Charge on an electron, photoelectric effect, Alpha particle scattering experiment, atomic masses, size of the nucleus; radioactivity, alpha, beta and gamma particles/rays. Radioactive decay law, half life and mean life of radio active nuclei; Nuclear binding energy, mass energy relationship, nuclear fission and nuclear fusion.
Energy bands in solids, conductors, insulators and semiconductors, pn junction, diode, diode as a rectifier, transistor action, transistor as an amplifier.

CHEMISTRY

a. BASIC CONCEPTS

Atomic and molecular masses; Chemical Equation and stoichiometry.

b. STATES OF MATTER

Gaseous State: Gas laws, Avogadro's hypothesis and gas equations; Kinetic Theory of Gases; Liquefaction, Critical Phenomena; **Liquid State and Solid state.**

c. ATOMIC STRUCTURE

Bohr's Model; de Broglie equation; Quantum Mechanical Model; Aufbau's Principle, Pauli's Exclusion Principles, Hund's Rule, Electronic Configuration; Bonding: Lewis structure, SEPR theory, hybridization, ionic, covalent and coordinate covalent bonds, bonding in solid state, MO theory, bond order and magnetic properties of H_2, O_2, N_2, F_2.

d. SOLUTIONS

Types, Units of concentration, Raoult's Law, colligative properties, abnormal molecular weights.

e. CHEMICAL ENERGETICS AND THERMODYNAMICS

Internal Energy, Enthalpy, Hess's Law, First & Second Laws of thermodynamics & applications; entropy, free energy; spontaneity of a chemical reaction.

f. CHEMICAL KINETICS & CHEMICAL EQUILIBRIUM

Rate and orders of a reaction; activation energy; catalyst; Rate law; physical & chemical equilibria; Le Chateliers's principle; acid base equilibrium; acids and bases; pH; buffers; solubility product.

g. REDOX REACTIONS, ELECTROCHEMISTRY & SURFACE CHEMISTRY

Electron Transfer Concepts of Oxidation and reduction; Electrochemical cells; emf; Nernst Equation; Molar conductivity; Kohlrausch's Law; Fuel Cells; Corrosion. Physical & Chemical adsorbtion isotherms; Colloids: Preparation & properties; Homogenous and Hetrogenous Catalysis; Enzymes.

h. PERIODIC PROPERTIES, CHEMICAL FAMILIES, CHEMISTRY OF NON METALS & METALS

Modern Periodic Law; Ionization Energy, Electron Affinity, Atomic Radii, Valency, Trends in Groups and periods. Chemistry of s and p block elements; Alkali metals, Alakaline Earth metals, Boron, Carbon, Nitrogen, Oxygen Halogen and Noble gases families; Hydrogen: Position, Ortho para, Isotopes, hybrids; Oxygen, Water, Hydrogen peroxide, Hard & Soft water; Ammonia, Nitrogen oxides, Nitric acid; Boron, Boric Acid, Borax; Carbides, Allotropy of Carbon; Sodium, Magnesium, Copper, Silver, Zinc, Transition Metals, and Lanthanides: Extraction, properties and uses.

i. CO-ORDINATION CHEMISTRY

Nomenclature, isomerism and bonding in coordination compounds; Werner's Theory.

j. NUCLEAR CHEMISTRY

Radioactivity, Nuclear reactions, Radiocarbon dating, Radioactive series, Artificial Transmutation.

k. ORGANIC CHEMISTRY FUNDAMENTALS

Purification; detection and estimation of elements; Empirical and Molecular formulae, Classification, Functional Groups, IUPAC Nomenclature, Hemolytic and Heterolytic Bond Fissions, Structural and Stereoisomerisms, Free radicals, Carbocations and carbanions; Substitution, addition, elimination and rearrangement reactions.

l. HYDROCARBONS & HALO ALKANES & HALO ALKENES

Alkanes, Alkenes and Alkynes, Halo alkanes & Halo alkenes: Preparation, properties and uses; Aromatic Hydrocarbons: Benzene, Structure, Resonance, Substitution in Benzene. Petroleum: Cracking, reforming, Octane number.

m. ORGANIC COMPOUNDS CONTAINING OXYGEN, NITROGEN

Preparation properties and uses of Aromatic and aliphatic alcohols, Polyhydric alcohols, ethers, aldehydes, ketones, carboxylilc acids and their derivatives; Cyanides, isocyanides, nitro compounds and amines.

n. SYNTHEIC AND NATURAL POLYMERS & BIOMOLECULES

Natural and Synthetic polymers; Teflon, PVC, Polystyrene, Nylon 66 Terylene, and Bakelite; carbohydrates, amino acids and peptides, Nucleic Acids, lipds etc.

o. CHEMISTRY IN ACTION & ENVIRONMENTAL CHEMISTRY

Dyes, Medicines (Antipyretics, Analgesics and Antibiotics), Rocket Propellants; Acid Rain, Ozone Hole, Green House Effect, Global Warming Industrial Pollution.