Applications of Matrices and Determinants
Adjoint, inverse – properties, computation of inverses, solution of system of linear equations by matrix inversion method. Rank of a matrix – elementary transformation on a matrix, Cramer’s rule, non-homogeneous equations, homogeneous linear system and rank method.

Complex Numbers

Analytical Geometry of two dimensions
Definition of a conic – general equation of a conic, classification with respect to the general equation of a conic, classification of conics with respect to eccentricity. Equations of conic sections (parabola, ellipse and hyperbola) in standard forms and general forms- Directrix, Focus and Latus rectum - parametric form of conics and chords. – Tangents and normals – cartesian form and parametric form- equation of chord of contact of tangents from a point (x\(_1\),y\(_1\)) to all the above said curves. Asymptotes, Rectangular hyperbola – Standard equation of a rectangular hyperbola.

Vector Algebra

Differential Calculus
Derivative as a rate measurer - rate of change, velocity, acceleration, related rates, derivative as a measure of slope, tangent, normal and angle between curves, maxima and minima. Mean value theorem - Rolle’s Theorem, Lagrange Mean Value Theorem, Taylor’s and Maclaurin’s series, L’Hospital’s Rule, stationary points, increasing, decreasing, maxima, minima, concavity, convexity and points of inflexion.

Integral Calculus and its Applications
Simple definite integrals – fundamental theorems of calculus, properties of definite integrals. Reduction formulae – reduction formulae for }\int \sin x\, dx and }\int \cos x\, dx , Bernoulli’s formula. Area of bounded regions, length of the curve.
**Differential Equations**
Differential equations - formation of differential equations, order and degree, solving differential equations (1st order), variables separable, homogeneous and linear equations. Second order linear differential equations - second order linear differential equations with constant co-efficients, finding the particular integral if \( f(x) = e^{mx}, \sin(mx), \cos(mx), x, x^2 \).

**Probability Distributions**
Probability – Axioms – Addition law - Conditional probability – Multiplicative law - Baye’s Theorem - Random variable - probability density function, distribution function, mathematical expectation, variance Theoretical distributions - discrete distributions, Binomial, Poisson distributions- Continuous distributions, Normal distribution.

**Discrete Mathematics**
Mathematical logic – logical statements, connectives, truth tables, logical equivalence, tautology.

**Groups**
Binary operations, semigroups, monoids, groups, order of a group, order of an element, properties of groups.
Electrostatics
Frictional electricity – Charges and their conservation – Coulomb’s law – Forces between two point electric charges – Superposition principle
Electric field – Electric field due to a point charge – Electric field lines – Electric dipole – Electric field intensity due to a dipole (on its axial line and on the equatorial line) – Behaviour of dipole in a uniform electric field – Application of electric dipole in microwave oven
Electric potential – Potential difference – Electric Potential due to a point charge and due to a dipole – Equipotential surfaces – Electrical potential energy of a system of two point charges
Electric flux – Gauss’s theorem – Field due to infinitely long straight wire – Field due to uniformly charged infinitely plane sheet – Field due to two parallel sheets – Field due to uniformly charged thin spherical shell (inside and outside)
Electrostatic induction – Capacitor and capacitance – Dielectric and electric polarization – Parallel plate capacitor with and without dielectric medium – Applications of a capacitor – Energy stored in a capacitor – Capacitors in series and in parallel – Action of points – Lightning arrester – Van de Graaff generator

Current Electricity
Electric current – Flow of charges in a metallic conductor – Drift velocity and mobility – Their relation with electric current
Kirchoff’s law – Illustration by simple circuits – Wheatstone’s bridge and its applications for temperature coefficient of resistance measurement – Meterbridge – Special case of Wheatstone bridge – Potentiometer – Principle – Comparing the emf of two cells
Electric power – Chemical effect of current – Electro chemical cells – Primary (Voltaic, Lechlanche, and Daniel cells) – Secondary – Rechargeable cell – Lead acid accumulator

Effects of Electric Current
Magnetic effect of electric current – Concept of magnetic field – Oersted’s experiment – Biot-Savart law – Magnetic field due to an infinitely long current carrying straight wire and circular coil – Tangent galvanometer – Construction and working – Bar magnet as an equivalent solenoid – Magnetic field lines
Ampere’s circuital law and its application to solenoid
Force on a moving charge in uniform magnetic field and electric field – Cyclotron – Force on current carrying conductor in a uniform magnetic field – Forces between two parallel current carrying conductors – Definition of ampere
Torque experienced by a current loop in a uniform magnetic field – Moving coil galvanometer – Conversion to ammeter and voltmeter – Current loop as a magnetic dipole and its magnetic dipole moment – Magnetic dipole moment of a revolving electron

**Electromagnetic Induction and Alternating Current**
Electromagnetic induction – Faraday’s law – Induced emf and current – Lenz’s law
Self induction – Mutual induction – Self inductance of a long solenoid – Mutual inductance of two long solenoids
Methods of inducing emf – (1) By changing magnetic induction (2) By changing area enclosed by the coil and (3) By changing the orientation of the coil (quantitative treatment)
AC generator – Commercial generator (Single phase, three phase)
Eddy current – Applications – Transformer – Long distance transmission

**Electromagnetic Waves and Wave Optics**
Electromagnetic waves and their characteristics – Electromagnetic spectrum, Radio, microwaves, Infra red, visible, ultra violet – X rays, gamma rays – Propagation of electromagnetic waves
Emission and Absorption spectrum – Line, Band and continuous spectra – Fluorescence and phosphorescence
Theories of light – Corpuscular – Wave – Electromagnetic and Quantum theories
Scattering of light – Rayleigh’s scattering – Tyndal scattering – Raman Effect – Raman spectrum – Blue colour of the sky and reddish appearance of the sun at sunrise and sunset
Wave front and Huygens’s principle – Reflection, Total internal reflection and refraction of plane wave at a plane surface using wave fronts.
Interference – Young’s double slit experiment and expression for fringe width – Coherent source - Interference of light – Formation of colours in thin films – Analytical treatment – Newton’s rings
Diffraction – Differences between interference and diffraction of light – Diffraction grating

**Atomic Physics**
Atomic structure – Discovery of the electron – Specific charge (Thomson’s method) and charge of the electron (Millikan’s oil drop method) – alpha scattering – Rutherford’s atom model
Bohr’s model – Energy quantization – Energy and wave number expression – Hydrogen spectrum – energy level diagrams – Sodium and mercury spectra - Excitation and ionization potentials
Sommerfeld’s atom model – X rays – Production, properties, detection, absorption, diffraction of X-rays – Laue’s experiment – Bragg’s law – Bragg s X-ray spectrometer – X-ray spectra – Continuous and characteristic X–ray spectrum – Mosley’s law and atomic number

**Dual Nature of Radiation and Matter – Relativity**

Photoelectric effect – Light waves and photons – Einstein’s photoelectric equation – Laws of photoelectric emission – Particle nature of energy – Photoelectric equation – Work function – Photo cells and their application


Concept of space, mass, time – Frame of references – Special theory of relativity – Relativity of length, time and mass with velocity – \( (E = mc^2) \)

**NUCLEAR PHYSICS**

Nuclear properties – Nuclear Radii, masses, binding energy, density, charge – Isotopes, isobars and isotones – Nuclear mass defect – Binding energy – Stability of nuclei-Bain bridge mass spectrometer

Nature of nuclear forces – Neutron – Discovery – Properties – Artificial transmutation – Particle accelerator

Radioactivity – Alpha, beta and gamma radiations and their properties, \( \alpha \)-decay, \( \beta \)-decay and \( \gamma \)-decay – Radioactive decay law – Half life – Mean life – Artificial radioactivity – Radio isotopes – Effects and uses Geiger-Muller counter

Radio carbon dating – Biological radiation hazards

Nuclear fission – Chain reaction – Atom bomb – Nuclear reactor – Nuclear fusion – Hydrogen bomb – Cosmic rays – Elementary particles

**Semiconductor Devices and their Applications**

Semiconductor theory – Energy band in solids – Difference between metals, insulators and semiconductors based on band theory – Semiconductor doping – Intrinsic and Extrinsic semiconductors

Formation of P-N Junction – Barrier potential and depletion layer – P-N Junction diode – Forward and reverse bias characteristics – Diode as a rectifier – Zener diode – Zener diode as a voltage regulator – LED


Logic gates – NOT, OR, AND, EXOR using discrete components – NAND and NOR gates as universal gates – Integrated Circuits

Laws and theorems of Boolean’s algebra – Operational amplifier – Parameters – Pin-out configuration – Basic applications – Inverting amplifier – Non-inverting amplifier – Summing and difference amplifiers


**Communication Systems**

Modes of propagation, ground wave – Sky wave propagation
Amplitude modulation, merits and demerits – Applications – Frequency modulation – Advantages and applications – Phase modulation
Antennas and directivity
Radio transmission and reception – AM and FM – Super heterodyne receiver
T.V. transmission and reception – Scanning and synchronizing
Vidicon (camera tube) and picture tube – Block diagram of a monochrome TV transmitter and receiver circuits
Radar – Principle – Applications
Digital communication – Data transmission and reception – Principles of fax, modem, satellite communication – Wire, cable and Fibre-optical communication
Atomic Structure
Bohr’s atomic model – limitations – Sommerfeld’s theory of atomic structure; Electronic configuration and Quantum numbers; Shapes of s, p, d, f orbitals – Pauli’s exclusion principle - Hund’s Rule of maximum multiplicity – Aufbau principle of filling up of electrons in orbitals. Hydrogen spectrum – Lyman, Balmer, Paschen, Brakett and Pfund series; deBroglie’s theory; Heisenberg’s uncertainty principle – wave nature of electron – Schrodinger wave equation and its significance – Eigen values and Eigen functions. Hybridization of atomic orbitals to form molecular orbitals.

p, d and f – Block Elements

Coordination Chemistry and Solid State Chemistry

Thermodynamics, Chemical Equilibrium and Chemical Kinetics
First and second law of thermodynamics – spontaneous and non spontaneous processes, entropy, Gibb’s free energy – Free energy change and chemical equilibrium – significance of entropy. Law of mass action – Le Chatlier’s principle, applications of chemical equilibrium. Rate expression, order and molecularity of reactions, zero order, first order and pseudo first order reaction – half life period. Determination of rate constant and order of reaction. Temperature dependence of rate constant – Arrhenius equation, activation energy

Electrochemistry
**Isomerism in Organic Compounds**

**Alcohols and Ethers**

**Carbonyl Compounds**

**Carboxylic Acids and their derivatives**

**Organic Nitrogen Compounds**

**Biomolecules**
**Carbohydrates** – distinction between sugars and non sugars, structural formulae of glucose, fructose and sucrose, with their linkages, invert sugar – definition, examples of oligo and polysaccharides,
**Amino acids** – classification with examples, Peptides – properties of peptide bond.
Botany

Biodiversity and Taxonomy

Plant morphology, anatomy and Physiology

Cell Biology

Genetics

Biotechnology and Biology in Human welfare
Zoology

Human Anatomy and Physiology

Cell Biology and Genetics

Microbiology and Immunology


Applied biology

Environmental Science:
Human population and explosion -Issue - Global warming Crisis Green House Effect-Ozone layer depletion - Waste management - Biodiversity conservation (Biosphere reserves) Government and Non Governmental organisations involved - Energy crisis and Environmental impact-Poverty and environment-Fresh water crisis and management.