

"Education for Knowledge, Science and Culture"

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Department of Physics

M.Sc. Entrance Examination Syllabus 2025-26

Sr. No.	Content
1	Laws of motion: Introduction of coordinate systems (Cartesian, Polar, Cylindrical, and Spherical), Definition of translational and rotational motion, force and torque, Frames of reference - Inertial and Non-inertial frame with examples, Newton's laws of motion (first, second and third) and their proofs. Momentum and Energy: Introduction to mechanics, Mechanics of a particle - Conservation theorem of linear momentum, angular momentum, energy, Concept of Centre of Mass, Mechanics of system of particles - Conservation theorem of linear momentum, angular momentum, energy.
2	Gravitation: Newton's Law of Gravitation, Motion of a particle in a central force field (motion in a plane, angular momentum is conserved, areal velocity is constant), Kepler's Laws (statement only), Satellite in circular orbit and applications, Geosynchronous orbits, Weightlessness, Basic idea of global positioning system (GPS). Elasticity: Bending of beam, Bending moment, Cantilever (without considering weight of cantilever), Beam supported at both the ends (without considering weight of beam). Torsional oscillation, Work done in twisting a wire, Twisting couple on a cylinder, Torsional pendulum - Determination of Rigidity modulus and moment of inertia, Determination of Y, η and σ by Searles method.
3	Laws of Thermodynamics: Thermodynamic system, thermodynamic variables, thermodynamic state, equation of state, thermodynamic equilibrium, Zeroth Law of thermodynamics, Internal energy, First law of thermodynamics, conversion of heat into work, specific heats CP & CV, Applications of First Law (Isothermal process, Adiabatic process, Isochoric, Isobaric), relation between CP & CV, work done during isothermal and adiabatic processes, reversible & irreversible processes,

	Second law of thermodynamics, Carnot's ideal heat engine, Carnot's cycle (Working, efficiency), Carnot's theorem, Entropy (concept & significance), change in entropy, Entropy changes in reversible & irreversible processes, Third law of thermodynamics, Entropy change in conduction of heat, diffusion of gases, physical significance of entropy, Un-attainability of absolute zero. Zero point energy.
4	Interference: Principle of Superposition, Coherence and condition for interference, Division of amplitude and division of wave front, Division of wave front – Lloyds single mirror(determination of wavelength of light of monochromatic source), Division of amplitude- Interference in thin parallel films (reflected light only), Wedge shaped films, Newton's rings and its application for determination of wavelength and refractive index of light. Diffraction: Revision of wave fronts and diffraction, Fraunhofer diffraction - Elementary theory of plane diffraction grating, Determination of wavelength of light using diffraction grating, Theory of Fresnel's half period zones, Zone plate (construction, working and its properties), Fresnel's diffraction at a straight edge.
5	Orthogonal curvilinear co-ordinates: Introduction to Cartesian, spherical, polar and cylindrical co-ordinates system, concept of orthogonal curvilinear co-ordinates, unit tangent vectors, arc length, area and volume elements in orthogonal curvilinear co-ordinates system, Expression for gradient, divergence, Laplacian and curl in Cartesian, spherical, polar and cylindrical co-ordinate system. Partial differential equation: Partial differential equation, degree, order, linearity and homogeneity of differential equations, methods of separation of variables, Frobenius method of power series, solution of Legendre, Hermite and Bessel differential equation
6	Nucleus (Nuclear Structure & General Properties of nuclei): Introduction, Constituents of nuclei, Nuclear size, Nuclear magnetic moment, Electric quadrupole moment, Nuclear spin, Unit of atomic mass (amu), Mass defect, Packing fraction, Packing fraction curve, Binding energy, B.E. curve, Nuclear forces, Liquid drop model, Semiempirical B.E. formula, Magic numbers, Introduction of elementary particles. Particles Accelerators: Need of accelerators, Types of accelerators (Qualitative) orbital accelerators, Cyclotron, (Principle, construction, working, theory, merits, demerits). Limitation of cyclotron,

	Synchrocyclotron, (construction, working, theory). Betatron, (principle, construction, working, mathematical theory, merits) Accelerators in India.
7	Introduction to Quantum Mechanics: Origin of quantum mechanics, Review of black body radiation, Photoelectric effect, matter waves, De-Broigle hypothesis , experimental evidence of de Broglie theory (Davisson and Germer experiment), wave particle duality, Heisenberg's uncertainty principle and different forms uncertainty principle The Schrodinger's Equation: Physical interpretation of wave function, Schrodinger's time dependent and independent equation (one and three dimensional) Requirements of wave function, Eigen value, Eigen function, Normalized orthogonal and orthonormal wave functions, Probability current density (Continuity equation). Examples on Normalization of wave function
8	Crystal Structure: Types of the solids, Amorphous, crystalline, lattice, lattice translation vectors, lattice with basis (Central , non central elements) Unit cell , Examples of crystal structure NaCl, KCl, ZnS, Diamond, Miller Indices, Calculations of coordination number, lattice constant, reciprocal lattices, types of lattices, Brillouin Zones, Diffraction of X-rays, Bragg's law, atomic, geometrical factor, Bragg's X-ray spectrometer, Superconductivity: Idea of superconductivity, Critical temperature, Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth, Isotope effect
9	Digital Electronics: Introduction to logic gates, De-Morgan's theorem, NAND and NOR gates as universal gates, R-S and J-K flip flops, half and full adder, parallel binary adder. Operational Amplifiers (Black Box approach): Introduction of differential amplifier and its types, symbol of Op-Amp, different parameters of Op-Amp, Characteristics of Op-Amp (IC 741), Open-loop & Closed-loop Gain. CMRR, concept of Virtual ground. Applications of Op-Amps: (1) Inverting and Non-inverting Amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator, (5) Integrator
10	Lagrangian Dynamics: Introduction Basic Concepts: (1) Co-ordinate system (2) Degrees of freedom; Constraints: Holonomic constraints, Nonholonomic constraints, Forces of constraints, Configuration space, Generalized Co-ordinates, Principle of virtual work, D'Alembert's principal. Lagrange's

	equation from D'Alembert's principle. Application of Lagrange's equation to a particle in a space, Atwood's machine and bead sliding on uniformly rotating wire under force free condition, simple pendulum
11	Atomic Physics: Quantum numbers , spatial quantization, vector atom model, Alkali Spectra, Optical spectral series, Spectral term spectral notation, energy level diagram of sodium, spin orbit interaction Zeeman effect, Explanation of Anomalous Zeeman effect on vector atom model, Anomalous Splitting of D1 and D2 Line Molecular Physics: Molecular system, type of bonds, diatomic molecule as a rigid rotator rotational states of diatomic molecule, Raman effect, Experimental study of Raman effect, classical theory of Raman effect, Applications of Raman effect.
12	X-Ray Diffraction: Reciprocal lattice and its properties, concept of Brillouin zone , diffraction of X-rays by crystals, Ewald construction, Bragg's law in reciprocal lattice, X-ray diffraction methods: 1) Laue method. 2) Rotating crystal 3) Powder method - Principle, Construction, Working , analysis of cubic crystal by powder crystal method