RKDF UNIVERSITY Ph. D ENTRANCE TEST
Syllabus of Physics
Nuclear Physics

Nuclear Structure & Nuclear properties, Quantitative treatment of nuclear models: liquid drop and shell models, Linear Particle accelerator, Cyclotron, Synchrotron, Synchrocyclotron, and Betatron, Nuclear cross section, chain reaction, critical size. Application of $E = mc2$, Q-Value, Nuclear fusion & fission, Nuclear reactors, Geiger-Muller Counter, Bainbridge and Auston mass Spectrograph.

Semiconductors & Nano-Physics

Free Electron model of solids, Qualitative Analysis of Kronig Penny model ,Effective mass, Fermi level for Intrinsic and Extrinsic Semiconductors: p-n junctions, Zener break down, photodiode, solar-cells, Hall effect. Elementary idea about Nano structures and Nano materials

Laser and Fiber Optics

Laser: Stimulated and spontaneous emission, Einstein's A & B Coefficients, transition probabilities, active medium, population inversion, pumping, Optical resonators, characteristics of laser beam. Coherence, directionality and divergence. Principles and working of Ruby, Nd: YAG, He-Ne & Carbon dioxide Lasers with energy level diagram.. Fundamental idea about optical fiber, types of fibers, acceptance angle & cone, numerical aperture, V-number, propagation of light through step index fiber (Ray theory) pulse dispersion, attenuation, losses & various uses. Engineering uses & applications of laser and Optical Fiber

Quantum Physics

Origin of Quantum hypothesis, DeBroglie's hypothesis of matter wave & its experimental verification. Group and particle velocities & their relations. Uncertainty principle with elementary proof & its application to Electron microscope, Compton effect. Wave function and its physical significance, general idea and application of time dependent and time independent Schrodinger wave equation.

Wave Optics

Interference: Fresnel's biprism, Interference in thin films, Newton's rings and Michelson's interferometer experiments. Diffraction at single slit, double slit and n-slit. Diffraction grating. Rayleigh criterion, resolving power of a telescope, grating and prism. Concept of polarized light, Brewster's laws, Double refraction, Nicol prism, quarter & half wave plate. Idea about circularly & elliptically polarized light.

Maneto statics

Force on a moving charge, Lorentz force equation and definition of B, Force on a straight conductor carrying current in a uniform magnetic field, Torque on a current loop, Magnetic dipole moment, angular momentum and gyro magnetic ratio, Biot and Savart's law, calculation of H for simple Geometrical situation such as Solenoid, Anchor ring. Ampere's Law, $V*B=\mu JVB=0$. Field due to a magnetic dipole, free and bound current, magnetization vector (m, relationship between B,H and M, Derivation of the relation $V*M=J$ for non uniform Magnetization.

Current Electricity and Bio-electricity :

Current Electricity: Steady current, current density **J**, Non steady current and continuity equation , Kirchhoff's laws and analysis of multi loop circuits, growth and decay of current in LR and CR circuits, decay constants, LCR circuits, Complex number and their application in solving AC circuit problem, complex impedance and reactance, series and parallel resonance. Q- Factor, power consumed by an A.C. Circuit, Power facto, Y and net works and transmission of electric power. Origin of Bio-electricity, Sodium and potassium transport , Resting potential and action potential, Nernst's equation, conductor velocity and function , An axon as cable membrane resistance and capacitance