Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal (M.P.)

Syllabus for Entrance Examination for Admission in Ph.D. Program

APPLIED PHYSICS

Mathematical Physics

Legendre, Bessel, Hermite, Laguerre and equations ; Physical applications, Generating function; Recurrence relation and orthogonal properties. Laplace and Fourier transforms and their applications. Solution of simultaneous linear equations, Gaussian elimination, pivoting, iterative method, matrix inversion. Numerical solution of ordinary differential equations, Euler's and Runge Kutta methods, predictor and corrector method. Elementary ideas of solutions of partial differential equations.BCC theory of Super-conductivity.

Electromagnetic Theory

Laplace and Poisson equations -- conductors and dielectrics -- boundary value problems -- Ampere's and Biot-Savart's laws -- Faraday's law -- Maxwell's equations -- scalar and vector potentials -- Coulomb and Lorentz gauges -- boundary conditions at interfaces -- electromagnetic waves -- interference, diffraction and polarization -- radiation from moving charges. Theory of Plasma state and application.

Quantum Mechanics

Application of Schodinger wave equation for particle in a box, linear harmonic oscillator and tunneling. Time independent perturbation method for non–degenerate and degenerate level and their applications , Normal Zeeman effect, first order Stark effect in Hydrogen atom, WKB method .

Solid state and semiconductor physics

Bloch theorem, Kronig-Penny model, origin of energy gap , Brillion zones, Number of possible wave functions per band, velocity of electrons according to periodic potential , Influence of electric field, effective mass, concept of hole.

Intrinsic and Extrinsic carrier concentration, Position of Fermi energy level , Carrier Drift, Variation of mobility with field strength-hot electron effect, Diffusion, carrier generation and recombination; Excess – carrier Lifetime, Continuity equation, Carrier density profile-diffusion length

Principle and working, characteristics and basic uses of following devices: FET, MOSFET, UJT, SCR, tunnel diode, Zener Diode, Solar cell, photo detector, LED and Quantum well structures. Magnetism and magnetic materials.

Nuclear and Particle Physics

Rutheford scattering -- basic properties of nuclei -- radioactive decay -- nuclear forces -- two nucleon problem -- nuclear reactions -- conservation laws -- fission and fusion -- nuclear models -- particle accelerators, detectors -- elementary particles -- photons, baryons, mesons and leptons -- Quark model.

Lasers and Fiber Optics

Laser rate equations: three- and four-level systems. Variation of laser power around threshold. Longitudinal and Transverse modes of laser cavity. Mode selection. Mode lasers. Single mode, multi mode, step index and graded index optical fibers, wave propagation through them. Pulse dispersion in optical fibers. Various losses in optical fibers. Fiber manufacturing processes: MCVD, PCVD, OVD and VAD and splicing of fibers, locking and Q switching. Ruby laser, Nd-YAG laser, Carbon di oxide laser, He-Ne laser, semiconductor Digital communication.

Electrodynamics

Maxwell's equations, boundary conditions for electric and magnetic fields, propagation of electromagnetic waves in air and ionized medium. Motion of charged particle in electromagnetic field: Uniform E and B fields, Nonuniform Fields, Diffusion across magnetic fields, time varying E and B fields.

Statistics & Research Aptitude

Mean, median, mode, basic concepts of probability, coefficient of variance, standard error, standard deviation, and correlation and regression analysis. Student t-test, F-test, analysis of variance (ANOVA), data graphics and data interpretation. Principles and various models of statistical optimization techniques, optimization softwares.

National and international scenario of scientific research, literature reviewing, reference citation, scientific and research journals, impact valuation, research article and patent drafting, various scientific websites, abstracts.