JNU M.Sc Physics

PATTERN

The Examination is carried out as **ONLINE** Computer Based Test (CBT) where the candidates will be shown the questions in a random sequence on a computer screen. The duration of the examination will be 3 hours. The medium for all the test papers will be English only.

SYLLABUS

Mathematical Methods

Calculus of single and multiple real variables. Fourier and Laplace transforms. Vector Calculus, Divergence theorem, Green's theorem, Stokes' theorem. First order and linear second order differential equations with constant coefficients. Matrices and determinants. Complex numbers.

Mechanics and General Properties of Matter

Newton's laws of motion and applications. Motion under a central force, and Kepler's laws. Elastic and inelastic collisions. Rigid body motion. Principal moments and axes. Kinematics of fluids. ernoulli's theorem.

Oscillations, Waves and Optics

Simple harmonic motion. Damped and forced oscillators. Resonance. Wave equation. Group and phase velocities. Sound waves in media. Doppler Effect. Interference and diffraction. Diffraction gratings. Polarization: linear, circular and elliptic polarization. Double refraction and optical rotation.

Electromagnetism

Coulomb's law. Gauss's law. Electric field and potential. Solution of Laplace's equation for simple cases. Conductors, capacitors, dielectrics. Electrostatic energy. Biot-Savart law, Ampere's law, Faraday's law of electromagnetic induction. LCR circuits. Maxwell's equations and plane electromagnetic waves, Poynting's theorem. Transmission and reflection coefficients (normal incidence only). Lorentz Force and motion of charged particles in electric and magnetic fields.

Thermal and Statistical Physics

Maxwell-Boltzmann distribution. Equipartition of energy. Ideal gas law. Specific heat. van-der-Waals gas and equation of state. Laws of thermodynamics. First law and its consequences. Isothermal and adiabatic processes. Second law and entropy. Maxwell's thermodynamic relations. Thermodynamic potentials. Fermi-Dirac and Bose-Einstein distributions.

Modern Physics

Basics of special relativity. Length contraction. Time dilation. Relativistic velocity addition theorem. Mass-energy equivalence. Blackbody radiation. Photoelectric effect. Compton effect. Bohr's atomic model. Pauli exclusion principle. Wave-particle duality. Uncertainty principle. Superposition principle. Schrodinger equation. Particle in a box problem in one, two and three dimensions. Solution of the Schrodinger equation for one dimensional harmonic oscillator. Structure of atomic nucleus, mass and binding energy. Radioactivity.

Solid State Physics, Devices and Electronics

Crystal structure, Bravais lattices and basis. Miller indices. X-ray diffraction and Bragg's law. Intrinsic and extrinsic semiconductors, variation of resistivity with temperature. Fermi level. p-n junction diode, I-V characteristics, Zener diode and its applications. Transistor characteristics. R-C coupled amplifiers. Operational Amplifiers: Inverting and non-inverting amplifier. Boolean algebra: Binary number systems; binary addition and subtraction. Conversion from one number system to another. Logic Gates AND, OR, NOT, NAND, NOR, X-OR. Truth tables. Combination of gates.