उ0प्र0 शिक्षा सेवा चयन आयोग, प्रयागराज।

Syllabus

Lecturer (PGT) - PHYSICS
(Subject Code- 01)

1. Mechanics

Vector algebra, product of vectors and scalars, vector identities, background of vector calculus, concept of line, surface and volume integrals, physical significance of gradient, divergence and curl, Gauss and Stokes theorems.

Centre of mass, rotating frame of reference, Coriolis force, motion of rigid body, moment of inertia, theorems of parallel and perpendicular axes, moment of inertia of sphere, ring, cylinder and disc, angular momentum, torque, central force, Kepler's laws, motion of satellite (including geostationary satellite), Galilean transformation equations, variation of mass and length with velocity, time- dilation, addition of velocities and mass-energy equivalence relation.

Streamlined and turbulent flow, Reynolds number, Stokes law, Poiseuille's formula, flow of liquid in capillary tube, Bernoulli's theorem and applications, surface tension.

Relation between stress and strain, Hooke's law, elastic moduli, Poisson's ratio, elastic energy. Physical world and measurement, kinematics, laws of motion, work, energy and power, gravitation.

2. Thermal Physics

Concept of heat and zeroth law, first law of thermodynamics and internal energy, isothermal and adiabatic processes. Second law of thermodynamics, entropy, Carnot cycle and Carnot engine, Maxwell's thermodynamic relations, Clausius-Clapeyron equation, porous plug experiment and Joule-Thomson effect.

Behavior of ideal gas and kinetic theory of gases, Maxwell's law of kinetic distribution. Calculation of average velocity, root mean square velocity and most probable velocity. Degrees of freedom, law of equipartition of energy, specific heat of gases, mean free path, transport phenomena.

Black body radiation, Stefan's law and Newton's law of cooling, Wien's law, Rayleigh-Jeans law, Planck's law, solar constant, production of low temperature by adiabatic demagnetization.

3. Waves and Oscillations

Oscillations, simple harmonic motion, progressive and stationary waves, damped harmonic motion, forced oscillations and resonance, sharpness of resonance, wave motion, plane and spherical waves, superposition of waves, Fourier analysis of periodic waves - square and triangular waves, phase velocity and group velocity, beats.

4. Optics

Cardinal points of coaxial system, simple questions based on combination of thin lenses, eyepieces - Ramsden and Huygens.

Huygens' principle, conditions for sustained interference, Young's double slit experiment.

Division of amplitude and wavefront, Fresnel's biprism, Newton's rings, Michelson's interferometer.

Diffraction by straight edge, single, double, multiple slits, Rayleigh criterion, resolving power of grating and optical instruments.

Polarization, production and detection of polarized light (linear, circular and elliptical), Brewster's law, Huygens' law of double refraction, optical rotation, polarimeter.

Lasers - temporal and spatial coherence, spontaneous and stimulated emission, general concept of laser emission, Ruby and Helium-Neon lasers.

5. Electricity and Magnetism

Gauss's law and applications, electric potential, capacitors and capacitance, Kirchhoff's laws and applications, Wheatstone bridge, Biot-Savart law and its applications, Ampere's circuital law and applications, magnetic induction and field intensity, magnetic field on the axis of a circular coil, electromagnetic induction, Faraday's and Lenz's laws, self and mutual inductance, alternating current, L-C-R circuit, series and parallel resonance circuits, Quality factor (Q-factor), AC bridges, Maxwell's equations and electromagnetic waves, transverse nature of electromagnetic waves, Poynting vector, dia-, para-, ferro-, antiferro- and ferrimagnetism (qualitative), hysteresis.

6. Modern Physics

Bohr's theory of hydrogen atom, electron spin, Pauli's exclusion principle, optical and X-ray spectra, X-ray diffraction, Bragg's law, spatial quantization, Stern-Gerlach experiment, vector atom model, spectral terms, fine structure of spectral lines, j-j and L-S coupling, Zeeman, Raman, photoelectric and Compton effects, de Broglie waves, wave-particle duality, uncertainty principle, concepts of quantum mechanics, Schrödinger wave equation and its applications to (1) particle in a box, (2) motion in a step potential and (3) one-dimensional linear harmonic oscillator, eigenvalues, lattice, specific heat, energy bands, Kronig-Penney model (one dimensional), energy gap, difference between metals, semiconductors and insulators, variation of Fermi level with temperature, effective mass.

Radioactivity, alpha, beta and gamma radiation, elementary theory of alpha decay, nuclear binding energy, semi-empirical mass formula, nuclear fission and fusion, elementary reactor physics, elementary particles, particle accelerators, cyclotron, linear accelerator, elementary concept of superconductivity.

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