WBPSC WBCS Physics Syllabus

PHYSICS :	
Paper – I :	**1. Mechanics:** a) Particle dynamics: Laws of motion, conservation principles. Inertia and inertial frame, Centripetal and Coriolis acceleration. Motion under a central force, Kepler's laws. Gravitational Field and potential - simple examples. System of particles, centre of mass and laboratory reference frame. Elastic and inelastic collision. Generalised coordinate, degrees of freedom. Lagrange's and Hamilton's equations- simple applications. Hamilton's principle. b) Rigid body dynamics: Degrees of freedom of a rigid body. Euler angle. Moment of Inertia, parallel and perpendicular axes theorem. c) Properties of matter & fluid dynamics: Elasticity. Surface Tension. Viscosity. Equation of continuity. Bernoulli's equation. **2. Special Relativity:** Michelson-Morley experiment. Lorentz transformation, length contraction, time dilation, addition of velocities. Doppler effect, relativistic kinematics, mass energy relation. Four vector and covariance. **3. Waves and Oscillations:** a) Oscillation: Simple harmonic motion, damped oscillation, forced oscillation and resonance. Fourier series and its simple applications. Superposition, beats. b) Waves: Equation of progressive wave, wave packets, phase and group velocities. Stationary waves, reflection and refraction from Huygen's principle. c) Geometrical Optics: Fermat's principle and laws of reflection and refraction. Matrix method in paraxial optics, thin lens formula, nodal points, two thin lenses separated by a distance. Chromatic and spherical aberration (qualitative). d) Physical Optics: Spatial and temporal coherence. Interference of light, Young's experiment. Stoke's law, thin films. Newton's ring. Michelson interferometer. Fraunhofer diffraction – single slit, double slit, diffraction grating. Fresnel diffraction, Zone plate. e) Polarization: Linear and circularly polarized light, double refraction, quarter wave plate. Optical activity. Polarimeter. f) Laser: Einstein A and B coefficients. Ruby and He-Ne lasers. **4. Electricity and Magnetism:** a) Electrostatics & Magnetostatics: Gauss and Stoke's theorem. Laplace and Poisson equations and boundary value problems. System of charges, multipole expansion of scalar potential. Method of images and its applications. Dipole field and potential. Dipole in an external field. Dielectrics, polarization. Boundary value problems for conducting & dielectric spheres in a uniform field. Magnetic shell, uniformly magnetized sphere. Ferro-, para- and diamagnetic substances. Hysteresis in ferromagnetic materials. b) Current electricity: Kirchhoff's laws and their applications, Biot-Savart law, Ampere's law, Faraday's law, Lenz's law. Self and mutual inductances. Mean and rms values in AC circuits. DC & AC circuits with R, L and C components. Series and parallel resonances. Q-factor. Basic principle of transformer. c) Electromagnetic theory: Displacement current and Maxwell's equations. Wave equations in vacuum, Poynting theorem. Vector and Scaler potentials. Normal and anomalous dispersion. **5. Thermodynamics:** Laws of thermodynamics, change of entropy in different processes. Maxwell's relations and its applications. Clausius – Claperyon equation. Gibbs' phase rule and chemical potential. Joule-Thomson effect and liquification of gasses.

Paper – II :	**1. Quantum Mechanics:** Wave-particle duality, Schrödinger equation and expectation value, uncertainty principle, Solutions of the one-dimensional Schrödinger equation for a free particle (Gussian wave-packet) particle in a box, particle in a finite well, linear harmonic oscillator, Reflection and transmission by a step potential and by a rectangular barrier. Particle in a three dimensional box. Angular momentum. Hydrogen atom. Spin. Spin half particle, properties of Pauli spin matrices. Stern - Gerlach experiment, electron spin, fine structure of hydrogen atom, L-S coupling, J-J coupling, Spectroscopic notation of atomic states, Zeeman effect, Raman Effect and molecular structure, Laser Raman spectroscopy. **2. Statistical Physics:** Macro and micro states. Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac distributions. Partition function. Distribution of molecular velocities in ideal gasses, equipartition theorem. Specific heat of solids, Einstein and Debye theory. Blackbody radiation, Planck's law, Stefan Boltzmann law. Rayleigh-Jeans formula and Wein's displacement law. Specific heat of electrons at low temperature. **3. Nuclear and Particle Physics:** Basic nuclear properties - size, binding energy, angular momentum, parity, magnetic moment; Semi-empirical mass formula and applications, mass parabolas; Shell model of the nucleus-successes and limitations; Violation of parity in beta decay; Q-value of nuclear reactions; Nuclear fission and fusion, energy production in stars; Classification of elementary particles and their interactions; Conservation laws; **4. Solid State Physics:** Crystalline and amorphous structure of matter; Different crystal systems. Methods of determination of crystal structure; X-ray diffraction; Band theory of solids-conductors, insulators and semiconductors; Magnetism; dia, para and ferromagnetism; Elements of superconductivity, **5. Electronics:** Intrinsic and extrinsic semiconductors, p-n-p and n-p-n transistors, Amplifiers, Oscillators-Hartley, Weinbridge and crystal oscillators, Op-amps, FET, JFET and MOSFET. Digital electronics-Boolean identities. De Morgan's laws. Logic gates and truth tables. Simple logic circuits.