

Syllabus for the post of SENIOR TECHNICAL ASSISTANT (Physics)

(A) WRITTEN TEST

(A) Electronics:

Diodes, Transistors, Differential amplifiers and Operational Amplifiers Linear Op-Amp Circuit Applications, Oscillators, Digital Principle and Digital Logic, Data Processing Circuit, JFET, transconductance, JFET amplifiers, JFET switch, biasing in Ohmic region and active region, depletion mode MOSFET, enhancement mode MOSFET, active filters, ideal responses, approximate responses, passive filters, first order stages.

(B) Condensed Matter Physics:

Crystal structure, Symmetry, Unit Cell, Miller indices, Reciprocal Lattice, Brillouin Zone, X- ray diffraction, Optical and dielectric properties of materials, Resistivity, Hall Measurement, Magnetic measurements, Electron heat capacity and conductivity, Energy bands, Direct and indirect band gap semiconductor, working principle of solar cell, photodetectors and LEDs, Types of magnetism, domains and hysteresis, magnetic susceptibility.

(C) Modern Physics:

Failure of classical physics, UV catastrophe, Radiation physics, black body radiation, basic quantum physics, Rutherford model, alpha particle scattering, Bohr atom model, Bohr's interpretation of H atom, Wave-particle duality, Schrödinger equation (time-dependent and time-independent). Eigenvalue problems, Quantum Tunneling, Wave-function, Commutators and Heisenberg uncertainty principle, Concepts of special theory of relativity, Properties of nucleus: charge, spin, magnetic moment; Radioactive decay: Alpha decay, beta decay and neutrino hypothesis, Nuclear models: Liquid drop model, Semi-empirical mass formula, Shell model; Nuclear force: deuteron problem, spin dependence of nuclear force, nuclear potential; classification of elementary particles, mesons and baryons, conservation laws, particle accelerators and detectors.

(D) Optics:

Reflection, Refraction, Fermat principle, focal plane, Image formation and magnification, F- number, Depth of the focus and depth of the field, aberrations, Snell's law, Polarization, collimation, optical components and their geometry effect on ray propagation. Basics of Interference.

(E) Classical Mechanics:

Newton's law of motion, Central force, motion under inverse square law of force, Linear and angular momentum, Two-body problem, Gravitational potential; Constraints and their classification, Principle of least action, D'alembert's principle, Lagrange's equations of motion, Generalized force, Application of Lagrangian formulation; Basic principles of special relativity, The Lorentz transformation, Length contraction, Time dilation.

(F) Electromagnetism:

Coulomb's law, Electric field, Superposition principle, electrostatic potential, Electric flux, Gauss's law, Poisson's and Laplace's equation, Electric fields in matter, dielectrics, induced dipoles, polarization, bound charges, Lorentz Force law, Biot-Savart law, Ampère's law, Magnetic fields in matter, types of magnetism, Electromagnetic induction, Maxwell's equations.

(G) Thermodynamics and Statistical Physics :

Laws of thermodynamics, thermodynamic potentials, Chemical potential, micro- and macro- states, Entropy - Change in entropy in reversible and irreversible processes, Entropy of ideal gas, Temperatureentropy diagram, entropy and second law of thermodynamics. Maxwell's Thermodynamics relations. Clausius - Clapeyron equation, Phase diagram, first order phase transition, Free energy and its connection with thermodynamic quantities, Ideal Bose and Fermi gases, Principle of detailed balance, Blackbody radiation and Planck's distribution law.

(H) Mathematical Physics:

Vector Calculus Vector differentiation, Gradient, divergence and curl, Solenoidal and irrotational vector point functions. Vector integration, Line, surface and volume integration, Gauss theorem and Stokes theorem (statements) Physical interpretation. Matrices inverse of matrices, adjoint matrices (complex conjugate transpose) orthogonal, symmetric, skew symmetric, Hermitian and skew Hermitian matrices, elementary transformations of a matrix.

(B) SKILL TEST

Hands-on based on the following experiments (Tentative) :

- 1. Traveling Microscope
- 2. Multimeter (Oscilloscope & Circuit Testing)
- 3. e/m Ratio
- 4. Hall Effect
- 5. Newton's Ring
- 6. Fresnel Biprism
- 7. Prism Spectrometer
- 8. Moment of Inertia based experiments
