

Syllabus for the Post of Junior Laboratory Assistant (Technical)

School of Physical Sciences

(Post Code: 004)

Advertisement No. IIT Mandi/Recruit./NTS/2025/05 dated 17.12.2025

There will be two-stage examination.

Stage I: Written Examination (Objective type MCQs)

Stage II: Skill/Trade Test

Syllabus of Stage-I (Written Examination):

Mathematical Methods of Physics: Dimensional analysis. Vector algebra and vector calculus. Linear algebra, matrices, Eigenvalues and eigenvectors. Linear ordinary differential equations of first & second order. Fourier series, Fourier and Laplace transforms. Elements of complex analysis, analytic functions; Elementary probability theory, random variables, binomial, Poisson and normal distributions.

Classical Mechanics: Dynamical systems. Central force motions. Two body Collisions. Centre of mass frames. Rigid body dynamics. Non-inertial frames and pseudoforces. Generalized coordinates. Lagrangian and Hamiltonian formalism and equations of motion. Conservation laws and cyclic coordinates. Periodic motion: small oscillations, normal modes. Special theory of relativity.

Electromagnetic Theory: Gauss's law and its applications, Laplace and Poisson equations, boundary value problems. Biot-Savart law, Ampere's theorem. Electromagnetic induction. Maxwell's equations. Scalar and vector potentials, gauge invariance. Dielectrics and conductors. Reflection and refraction, polarization, Fresnel's law, interference, coherence, and diffraction.

Quantum Mechanics: Wave-particle duality. Schrödinger equation. Tunneling through a barrier. Heisenberg uncertainty principle. Orbital angular momentum, angular momentum algebra, spin, addition of angular momenta; Hydrogen atom. Stern-Gerlach experiment. Perturbation theory, Fermi's golden rule, selection rules. Identical particles, Pauli exclusion principle, spin-statistics connection.

Thermodynamic and Statistical Physics: Laws of thermodynamics. Thermodynamic potentials, Maxwell relations, chemical potential, phase equilibria. Phase space, micro- and macro-states. Micro-canonical, canonical and grand-canonical ensembles and partition functions. Free energy. Classical and quantum statistics. Ideal Bose and Fermi gases. Blackbody radiation and Planck's distribution law.

Electronics and Experimental Methods: Semiconductor devices, Opto-electronic devices. Operational amplifiers and their applications. Digital techniques and applications. A/D and D/A converters. Data interpretation and analysis. Precision and accuracy. Error analysis. Transducers. Measurement and control. Signal conditioning and recovery. Impedance matching, amplification, filtering, and noise reduction, shielding and grounding. Fourier transforms. Fundamentals of Measurement, Oscilloscope, Bridge Circuits, AC bridges, Digital Instruments, Virtual Instrumentation

Atomic & Molecular Physics: Electron spin. LS & JJ couplings. Zeeman, Paschen-Bach & Stark effects. Electron spin resonance. Nuclear magnetic resonance, chemical shift. Born-Oppenheimer approximation. Raman spectra. Lasers.

Condensed Matter Physics: Bravais lattices. Reciprocal lattice. Diffraction and the structure factor. phonons, lattice specific heat. Free electron theory and electronic specific heat. Drude model of electrical and thermal conductivity. Hall effect and thermoelectric power. Electron motion in a periodic potential, band theory of solids: metals, insulators and semiconductors. Superconductivity. Magnetism

Nuclear and Particle Physics: Basic nuclear properties: size, shape and charge distribution, spin and parity. Binding energy, semiempirical mass formula, liquid drop model. Nature of the nuclear force. Shell structure. Alpha, beta and gamma decays. Fission and fusion. Nuclear reactions, reaction mechanism, compound nuclei and direct reactions. Classification of fundamental forces. Elementary particles and their quantum numbers. Quark model, baryons and mesons. C, P, and T invariance.

Important Instructions for candidates:

General information about the Exam:

- The MCQs have negative marking for wrong answers. The unanswered questions will not be considered for evaluation. (*i.e.*, no marks will be awarded for any question not attempted).
- Only one best-suited answer has to be given for any MCQ. More than one answer will be treated as wrong answer.
- Use of only blue or black ballpoint pen is permitted to answer the questions and fill the form in the exam hall. Use of ink pen/gel pen/pencil/whitener is not permitted.
- Use of calculator, cell phones, log book, periodic table, and any type of electronic device etc., are strictly prohibited.
- The medium of instruction/answers will be English only.
- Involvement in any malpractices will lead to disqualification
- Any additional instructions given during the selection process must be adhered/complied.

Final Selection:

- Examinations for Stage-I and Stage-II will be conducted for all the candidates or as decided by the selection committee.
- Final selection will be made on the scores obtained in the Stage-I, as the Stage –II is of qualifying nature. But if a candidate fails to qualify in Stage-II, her/his candidature will not be considered further.
- Please note that for consideration in the merit list, a candidate has to secure minimum marks fixed by the selection committee in both exams at Stage-I and Stage-II – failing which institute will not make an offer of appointment even if vacancies go unfilled.