

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

MATERIALS RESEARCH CENTRE

Syllabus for M.Tech. admission test (Self-financed category) July 2026 for the program
“Semiconductor Materials and Devices”

S. No.	Syllabus
1.	Basics of Solid State Introduction to Solids: Classification as amorphous and crystalline solids. Crystal Structure: Crystalline solids, long-range order, and uniform interactions. Unit Cells & Lattices: Crystal lattices, unit cells (primitive, body-centered, face-centered), and 7 crystal systems. Packing Structure: Closed packed structures, packing efficiency (hcp, ccp, bcc, simple cubic), coordination numbers, and voids (tetrahedral, octahedral). Imperfections/Defects in Solids: Fundamentals of crystallography, crystal-systems, point defects (stoichiometric, Frenkel, Schottky), vacancy defects, and interstitial defects, surfaces and interfaces. Properties of Solids: Band theory, magnetic properties (diamagnetic, paramagnetic, ferromagnetic), and electrical properties
2.	Properties of Materials Introduction: Conductors, insulators, semiconductors: types of semiconductors, diode, electric current, flow of electric charges in a metallic conductor, drift velocity and mobility, and their relation with electric current; Ohm’s law, electrical resistance, $V-I$, $C-V$ characteristics, Electrical Properties: Electrical conductivity, resistivity, dielectric strength, dielectric constant, temperature coefficient of resistance, Hall Effect, dielectric behaviour, piezo- and ferro-electric behavior. Mechanical Properties: Elastic behaviour, stress-strain relationship, Hooke’s law, Young’s modulus, bulk modulus, shear, modulus of rigidity, Pascal’s law.
3.	Thermodynamics Thermal equilibrium and definition of temperature (zeroth law of Thermodynamics). Heat, work and internal energy. First law of thermodynamics. Isothermal and adiabatic processes, second law of thermodynamics, reversible and irreversible processes. Heat engines and refrigerators, heat, temperature, thermal expansion; thermal expansion of solids, liquids, and gases.
4.	Material Characterization Techniques Basic principles and applications of X-ray diffraction, optical and electron microscopy, spectroscopy-UV-visible, FTIR and Raman spectroscopy.