PH3303 CONDENSED MATTER PHYSICS

Crystal structure: symmetry operations, Bravais lattices, point groups, examples of simple crystal structures, Miller indices and reciprocal lattice, Bragg and von Laue diffraction, structure factor; Lattice vibration and thermal properties: harmonic approximation, monatomic and diatomic lattices, Brillouin zone, phase and group velocities, density of states, acoustic and optical modes, quantization of linear chain, phonons, crystal momentum, determination of dispersion relations,

Debye model of specific heat; Free electron theory: Fermi gas, specific heat, Ohm's law, magneto-resistance, thermal conductivity Wiedemann-Franz law; Band theory: Bloch theorem, nearly free electron model, classification of metal, insulator and semiconductor, motion of electron in energy bands, effective mass, tight binding model, Fermi surfaces of metals; Semiconductor: Intrinsic and extrinsic semiconductors, mobility and electrical conductivity, Fermi level, Hall effect; Magnetism: Diamagnetism, Hund's rules, Lande g-factor, quantum theory of paramagnetism, Pauli paramagnetism, exchange interaction, ferromagnetism, Ising model, Superconductivity: Meissner effect, London equations, type-I and type-II superconductors, BCS theory, Flux quantization.

References:

(1) C. Kittel, Introduction to Solid State Physics, John Wiley & Sons, 8_{th} Edition (2005).
(2) N. W. Ashcroft and N. D. Mermin, Solid State Physics, Hacourt Asia Pvt. Ltd. (2001).