

Solid State Physics – II (4PGP4)

Unit I: Free electron Fermi gas

Energy levels and density of orbitals in 1D - Energy levels and density of orbitals in 3D – Theoretical and experimental heat capacity of electron gas – Electrical conductivity – Resistivity – Motion in magnetic fields – Hall effect – Thermal conductivity – Wiedemann Franz ratio

Unit II: Energy bands

Nearly free electron model – Origin of energy gap – Bloch function – Wave equation of an electron in a periodic potential

Unit III: Semiconductors dielectric and ferroelectrics

Direct and indirect band gap – Electron vs holes – Effective mass – Effective mass in semiconductors – Intrinsic carrier concentration – Thermo electric effect in semiconductors - Dielectric polarization – Macroscopic field – Local field of an atom – Depolarization field – Dielectric constant and polarizability – Polarization catastrophe – Dipole moment and polarization – Electronic, ionic and orientation polarization – Effects of dielectrics – Insulating materials

Unit IV: Metals and Fermi surfaces

Construction of Fermi surface – Electron orbit, hole orbit, open orbit – Pseudo potential – Quantization of orbits in a magnetic field – De hass van Alphen effect

Unit V: Magnetism

Langevin theory of diamagnetism – Paramagnetism – Quantum theory of paramagnetism – Hund's rule – Weiss theory of ferromagnetism – Temperature dependence – Curie-Weiss law – Ferromagnetic domains – Domain model

Books for reference:

1. Solid state physics, C.Kittel, Vth Edn., 1976, 9th Reprint 1989, Wiley Eastern Ltd.

Unit I: Pages 157-178

Unit II: Pages 186-190, 193-198

Unit III: Pages 207-211, 214-224, 228-231, 237-238, 401-410, 417-418

Unit IV: Pages 255-260, 268-275

Unit V: Pages 441-448, 462-467, 474-475, 487-493

2. Solid state physics, S.O. Pillai, New Age International P Ltd., 2005

Unit VI: Pages 633-637, 681-688
