

SS P-S 322
2007 2008

ANDHRA UNIVERSITY
DEPARTMENT OF PHYSICS
M.Sc. PHYSICS, MATERIALS SCIENCE
III SEMESTER - Effective from 2007-2008 admitted batch.

P. 303, MS 303 ELECTRICAL AND MAGNETIC MATERIALS

I: SEMICONDUCTORS AND SEMICONDUCTOR DEVICES:

Band gap, Intrinsic carrier concentration-Mobility in the intrinsic region, Impurity conductivity- N type and P type semi-conductors, mobility in the presence of impurities.

The contact potential-Equilibrium Fermi levels-Space charge at a junction-Forward and reverse bias junctions-Steady state conditions-Carrier injections-Minority and Majority Carrier injection-Transient and AC conditions-Time variation of stored charge- Capacitance of p-n junction, Degenerate semiconductors- Tunnel diode operation-Current and Voltage in an illuminated junction-Solar Cells-Light emitting diodes-LED materials.

II: DIELECTRICS AND FERROELECTRICS:

Macroscopic electric field-depolarization field; Local electric field at an atom-field of dipoles inside a cavity; Dielectric constant and polarizability-derivation of Clausius-Mossotti relation; Ferroelectric Crystals-classification; Polarization Catastrophe-Landau theory of phase transitions, second order transitions, first order transitions; Soft optical phonons-anti ferro electricity-Ferroelectric domains-Piezoelectricity-Ferroelasticity.

III: MAGNETIC MATERIALS: DIAMAGNETISM AND PARAMAGNETISM:

Langevin diamagnetism equation, Theory of paramagnetism, Rare earth ions, Hund rules, Iron group ions, Crystal field splitting, Quenching of the orbital angular momentum, Cooling by adiabatic demagnetization, Nuclear demagnetization, Paramagnetic susceptibility of conduction electrons.

IV: FERROMAGNETISM AND ANTIFERROMAGNETISM:

Curie point and the Exchange Integral, temperature dependence of Saturation magnetization. Saturation magnetization at absolute zero, Magnons, Thermal excitation of magnons, Ferrimagnetic order, Curie temperature and susceptibility of ferrimagnets, Antiferromagnetic order-Susceptibility below Neel's temperature, Ferromagnetic domains-Anisotropy energy, Transition region between domains.

SUPER CONDUCTIVITY:

Experimental survey-Occurrence, Meissner effect, Heat capacity, Energy gap, Microwave and infrared properties, isotope effect.

Thermodynamics of the superconducting transition, London equation, Coherence length, BCS theory of Superconductivity, Type II superconductors-Vortex state, Estimation of H_{c1} and H_{c2} .

TEXT BOOK: SOLID STATE PHYSICS 5TH EDITION, C.KITTEL.