EC/EE/CS/IT-108	ELECTRONIC AND ELECTRICAL ENGINEERING MATERIALS	L	T	P	C
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COURSE OBJECTIVES:

1. To understand the concept of electron motion in a periodic potential and classification of solids through bands and intrinsic and extrinsic semiconductors and their carrier densities.
2. To understanding Energy level diagrams in in PN junction, its characteristic equation and the related optoelectronic devices.
3. To understand Basics of Dielectrics and magnetism, Classification of materials on Polarization and Magnetization and applications.
4. To understand Properties and applications of super conductors
5. To understand Nano materials and characterization with X-rays and electron probe techniques.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. classify the solids based on electronic theory of solids.
2. analyze P-N junction diodes and the devices based on it.
3. classify the materials based on Polarization and Magnetization.
4. Discuss the Properties and applications of super conductors.
5. Recognize Nano materials and characterization with X-rays and electron probe techniques.

UNIT I **(12)**

Electron theory of solids: Failures of Classical free electron theory and quantum free electron theory (qualitative), Bloch theorem (Qualitative), Kronig-Penney model (Qualitative treatment), effective mass of electron, energy band formation in solids, Classification of solids into metals, semiconductors and insulators.

Semiconductor Physics: Intrinsic & extrinsic semiconductors, density of states, derivation for intrinsic carrier concentration, Hall effect and its uses, direct & indirect band gap semiconductors, donor and acceptor energy levels, charge neutrality, law of mass action.

UNIT II **(12)**

Physics of Semiconductor materials: Drift and Diffusion current , Continuity equation Formation of P-N junction, energy level diagram and built in potential, Diode equation, I-V Characteristics of P-N junction diode, Photodiode, LED, LCD, solar cell (qualitative).

UNIT III **(12)**

Magnetic Materials: Introduction, origin of magnetic moment, Bohr Magneton, Langevin's theory of paramagnetism, hysteresis curve, soft and hard magnetic materials, Ferrites and their applications.

Dielectric Materials: Fundamental definitions: Electric dipole moment, polarization vector, polarizability, electric displacement, dielectric constant and electric susceptibility. Types of polarizations - Electric and ionic polarisations, internal fields in solids (Lorentz method), Clausius-Mossotti equation, Frequency dependence of polarization, loss tangent, and dielectric loss, Ferroelectrics and their applications.

UNIT IV **(12)**

Superconducting materials: Introduction, critical parameters (Tc, Hc, Ic), Meissner effect, types of superconductors, entropy, specific heat, energy gap, BCS Theory(in brief), Josephson effect, London equation and penetration depth, high temperature superconductors, applications of superconductors.

UNIT V **(12)**

Nanomaterials: Introduction to nano materials, surface to volume ratio, General properties of nano materials in brief, fabrication of nano materials (sol-gel and chemical vapour deposition methods), applications of nano materials.

Characterization techniques:SEM,AFM

LEARNING RESOURCES:

TEXT BOOK(s):

1. V. Rajendran - Engineering Physics
2. P.K.Palanisamy - Engineering Physics, Scitech Publications.

REFERENCE BOOK(s):

1. M. Vijaya and G. Rangarajan - Materials science, McGraw Hill Education, 2014.
2. S.O. Pillai - Solid State physics
3. R.K.Puri and V.K.Bubber - Solid state physics and Electronics,

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/