

16EC201

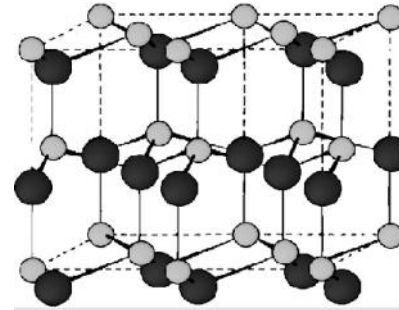
MATERIALS FOR ELECTRONICS ENGINEERING

Hours Per Week :

L	T	P	C
3	-	-	3

Total Hours :

L	T	P	W/RA	SSH/HSB	CS	SA	S	BS
45	-	-	20	20	-	-	2	2



Course Description and Objectives:

This course deals with the different materials used for electronic device fabrication and their properties. The objective of the course is to introduce the students to structure and properties of materials, that are required for the design and construction of solid state devices. In addition, it provides introduction to the interrelations of the structure, properties and processing of materials.

Course Outcomes:

The student will be able to:

- understand the fundamentals of the physical, mechanical, thermal and electronic properties of materials.
- applications of materials in the development of various electronic devices.

UNIT - 1**L-9**

BONDING AND CRYSTALLOGRAPHY: Bonding forces and energies, Primary inter-atomic bonds, Secondary bonding or van der waals bonding, Fundamental concepts of crystallography, Unit cells, Metallic crystal structures, Polymorphism and allotropy, Crystal systems, Packing densities, Point coordinates, Crystallographic directions, Crystallographic planes, Linear and planar densities, Close-packed crystal structures.

UNIT - 2**L-9**

SOLID STATE DIFFUSION AND MECHANICAL PROPERTIES: Introduction to diffusion, Diffusion mechanisms, Steady-state diffusion, Nonsteady-state diffusion, Factors that influence diffusion, Diffusion in semiconducting materials, Materials of importance - Aluminum for integrated circuit interconnects introduction to mechanical properties; Concepts of stress and strain, Stress-strain behavior of materials.

UNIT - 3**L-9**

ELECTRICAL AND DIELECTRIC PROPERTIES: Introduction, Ohm's Law, Electrical conductivity, Electronic and ionic conduction, Energy band structures in solids, Conduction in terms of band and atomic bonding models, Electron mobility, Electrical resistivity of metals, Electrical characteristics of commercial alloys, Intrinsic semiconduction, Extrinsic semiconduction, The temperature dependence of carrier concentration, Factors that affect carrier mobility, The hall effect, Semiconductor devices, Conduction in Ionic materials, Electrical properties of polymers capacitance, Field vectors and types of polarization, Frequency dependence of the dielectric constant, Dielectric strength, Dielectric materials, Ferroelectricity, Piezoelectricity.

UNIT - 4**L-9**

MAGNETIC PROPERTIES: Introduction to magnetic properties, Basic concepts, Diamagnetism and paramagnetism, Ferromagnetism, Anti-ferromagnetism and ferrimagnetism, The influence of temperature on magnetic behavior, Domains and hysteresis, Magnetic anisotropy, Soft magnetic materials, Materials of importance - An Iron-silicon alloy that is used in transformer cores, Hard magnetic materials, Magnetic storage, Superconductivity.

UNIT - 5**L-9**

OPTICAL PROPERTIES: Introduction to optical properties, Electromagnetic radiation, Light interactions with solids, Atomic and electronic interactions, Optical properties of metals, Optical properties of nonmetals, Refraction, Reflection, Absorption, Transmission, Color, Opacity and translucency in insulators, Luminescence, Materials of importance - Light-emitting diodes, Photoconductivity, Lasers, Optical fibers in communications, Nano materials.

TEXT BOOK:

1. W.D. Callister, "Materials Science and Engineering: an Introduction", 8th edition, Wiley, 2010.

REFERENCE BOOKS:

1. W. F. Smith, "Foundations of Materials Science and Engineering", 5th edition, McGraw Hill, 2015.
2. V. Raghavan, "Materials Science and Engineering", 5th edition, PHI, 2012.