

Material Science

Course Objective – It will help students to learn basics of materials, properties of magnetism , technology related to semiconductor and issues and challenges of E- waste .

Course Contents

Introduction – Classification of materials, relationships in materials , atomic structure, electron in atoms, periodic table , quantum states , origin of permanent magnetic moment and magnetic parameters, types of metal alloys. Optical fibre and its properties, Toxic heavy materials with pros and cons, built – up of CRT, LCD and LED.

Magnetic materials – terminology and classification , electron spin , ferromagnetism , domain structure, hysteresis loop, soft and hard magnetic materials. Structure of crystalline solids – face centered ,body centered , hexagonal closed packed crystal structure. Ceramic crystal: radius ratio rules and ceramic density computations, polymer structure- crystallinity and polymer crystals.

Semiconductor Technology and Measurements – crystal growth and wafer preparation , methods of p – n junction formation , growth and deposition of dielectric layers, metal decomposition techniques, bipolar and MOS integration. Parameters for measurements conductivity type, resistivity, drift mobility and diffusion length, minority carrier lifetime.

E- Basics of E-Waste, Generation of E-Waste in india, Composition of E-waste, Component of E-waste, Life Cycle of E-waste, E-waste generation in organized sector and unorganized sector, E-waste in the global context, Growth of electrical and electronic industry in India, Environment concerns & health hazards, Laws regarding E-waste management.

Mechanism of WEEE/E-waste Trade, WEEE/E-waste Life Cycle, Components of WEEE/E- waste Management, Waste Electrical and Electronic Equipment (WEEE) Directive in the European Union, Obligations of the Producer under the WEEE, Barriers to Recycling of WEEE, Restrictions of Hazardous Substances (RoHS) Directive, Comparative WEEE/e-waste management in Switzerland and India, E-waste projection and recycling.

Course outcome –

1. Understanding of magnetic materials , properties of toxic heavy materials .
2. Learning of crystalline solids and polymer structures
3. Creating understanding of semiconductor technology and measurements
4. Learning basics of E- waste management

References:

1. R Balasubramaniam “Callister’s Material Science and Engineering Second edition” ,Wiley
2. M S Tyagi “ Introduction to Semiconductor Materials and Devices” , Wiley
3. Charles M. Gilmore “Materials Science and Engineering Properties ” Cengage Learning
4. http://rajyasabha.nic.in/rsnew/publication_electronic/E-Waste_in_india.pdf
5. <https://www.epa.gov/sites/production/files/2014-05/documents/india.pdf>
6. NPCS Board of Consultants & Engineers "The Complete Technology Book on E-Waste Recycling(Printed Circuit Board, LCD, Cell Phone, Battery, Computers)", Asia Pacific Business Press Inc.