ENGINEERING PHYSICS - II

Lectures	: 3 periods / week	Sessional Marks	: 40
Tutorials	: 1 period / week	Semester End Exam Marks	: 60
Semester End Exam	: 3 hrs	Credits	: **3**

Course objectives:

- The evaluation of modern physics is required to explain the microscopic phenomena occurred in nature through quantum physics was introduced. The formation of the band structure and distinction of solids was explained by introducing the famous Kronig-penny model its salient features.
- Semiconductor concepts such as Energy band formation and classification of solids, intrinsic & extrinsic semiconductors, Hall effect & its uses are presented in the first part of the unit.
- Optoelectronics is the technology that combines optics and electronics. To understand the various optical phenomenon, photo diode, LED and LCD are presented second part of the unit.
- Various magnetic materials and their characterisation are presented to enable the student with materials science. Now,a days, the super-conducting materials are widely used in the production of very strong magnetic fields, loss less electric power transmissions, in moving the Hi-Tech trains, switching circuits, memory devices in computers and electronic instruments. So, the student is made to acquaint himself with the super conductivity property and their related phenomena.
- Understanding of dielectric properties with respect to the frequency, temperature and their phenomena is essential for usage of the materials in engineering applications.
- The buzzword in present science & technology is nanotechnology & nano science which deals with the confinement of at least one dimension less than 100 n.m. The reduction of size influences the surface to volume ratio thus the properties of the materials are drastically varied in nano realm. The student was introduced to the basics of nano world and the various applications that are presently marketed are discussed with XRD and Transmission electron microscope (TEM).

Course out comes: After going through these units, the students will be able to understand:

- Debroglie concept of matter waves and its experimental evidence.
- Uncertainty principle and its significance in microscopic phenomena.
- Wave function and wave equation and its application for one dimensional box.
- Periodic wave function(Bloch) and its significance, Kronig-Penny model and its salient features in explaining the formation the bands.
- Energy band formation and classification of solids, intrinsic & extrinsic semiconductors, Hal effect & its uses
- Devices based on interaction of light and electrons especially on the basis of junction diode, Liquid crystals.
- Classification of Magnetic materials, characterization and their properties.
- Critical parameters of superconducting materials and their classification, applications.
- Various types of polarizations, dependence on frequency/temperature, applications.
- Nano scale, preparation of nano materials(sol-gel, CVD), properties & applications.

UNIT-I

Principles of Quantum Mechanics:

de Broglie's concept of matter waves, Davisson and Germer experiment, Heisenberg's uncertainty principle-experimental verification, time independent Schrodinger's wave equation, physical significance of the wave function, particle in a box (one dimensional).

Electron Theory of metals:

Failures of Classical free electron theory and quantum free electron theory (qualitative).

Band theory of Solids:

Bloch theorem (Qualitative), Kronig-Penney model (Qualitative treatment), effective mass of electron.

UNIT-II

Semiconductor Physics:

Energy band formation in solids, Classification of solids into metals, semiconductors and insulators, intrinsic & extrinsic semiconductors, density of states, intrinsic semiconductor carrier concentration, Hall effect and its uses.

Optoelectronic devices:

Photo diode, LED,LCD and solar cell (qualitative treatment).

Unit -III

Magnetic Materials:

Introduction, orbital magnetic moment of an electron, Bohr magneton, classification of dia, para and ferro magnetic materials on the basis of magnetic moment, Hysteresis curve, soft and hard magnetic materials, Ferrites and their applications.

Superconductivity:

Introduction, critical parameters (T_c, H_c, I_c), Meissner effect, types of superconductors, entropy, specific heat, energy gap and isotope effect, BCS Theory(in brief), applications of superconductors, high T_c superconductors(qualitative).

Unit –IV

Dielectric Materials:

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

Nano Technology :

Basic Concepts of Nanotechnology, nano scale, introduction to nano materials, surface to volume ratio, fabrication of nano materials (sol-gel and chemical vapour deposition methods), applications of nano materials. XRD, Transmission Electron Microscope(TEM).

TEXT BOOKS

1. Applied Physics- P. K. Palanisamy, Scitech Publications.
2. Materials Science - M.Arumugam, Anuradha Publications, Chennai, 5th Edition , 2006.

REFERENCE BOOKS

1. Materials science – M. Vijaya and G. Rangarajan, TMH, New Delhi
2. Solid state physics by A. J. Dekkar
3. Physics of atom – Wehr and Richards.
4. Engineering Physics – B. K. Pandey & S. Chaturvedi, Cengage Learning India Pvt. Ltd., Delhi.

WEB REFERENCES:

http://nptel.iitm.ac.in/courses/115104043/1
http://people.seas.harvard.edu/~jones/ap216/lectures/lectures.html
http://galileo.phys.virginia.edu/classes/252/home.html
www.rvrjcce.ac.in/moodle/first year/2011-12/engineeringphysics