1/4 B.Tech. FIRST SEMESTER

CS 1T3 **ENGINEERING PHYSICS** **Credits: 4**

(Common to ECE,EEE,ECM,CSE, IT)

Required

Lecture: 4 periods/week **Internal assessment: 20+10=30 marks**

Tutorial: 1 period /week **Semester end examination: 70 marks**

Course Context and Overview: Students will develop a creative approach to solving engineering type problems. The programme includes practical, theoretical and skill-based studies in Materials Science, Electronics, and Computer Modelling. Graduates will have the knowledge and skills required by both industry and service sectors, as well as being well prepared for a research career..

Prerequisites: -

Objectives:

1. To have knowledge and to solve problems in quantum mechanics.
2. To study the structure of crystal and X-ray diffraction techniques.
3. To know the electrical properties of conducting materials and band theory of solids.
4. To study the properties of Dielectric materials.
5. To have the knowledge about the magnetic materials and super conductivity.
6. To learn the theory of semiconductors and solar cells.
7. To learn about the theory with applications of lasers and fundamentals of optical fibers.
8. To understand the production properties and application of nano materials.

Learning Outcomes:

The student will be able to

1. Acquire the knowledge of quantum mechanics and by which he can solve the problems in quantum mechanics .
2. Learn about the crystal structure and X-ray diffraction techniques by which he will learn to determine crystal structure .
3. Gain the knowledge about the materials (conductors, semi-Conductors, insulators and magnetic materials).
4. Comprehend the basic concepts of Advanced topics such as lasers, Optical fibers and super conductivity.
5. Examine the advances in material science such as nano – materials.

UNIT-I

Quantum Mechanics:

Introduction - Planckls black body theory of radiation - Debroglie hypothesis – Properties of matter waves – Davison and Germer experiment – G.P. Thomson experiment – Heisenberg uncertainity principle - Schrödinger wave equation – physical significance of wave function – particle in a one dimensional box.

UNIT-II

Crystal Structure& X-ray Diffraction:

Introduction – Space lattice – Basis - unit cell - Lattice parameters – Bravais lattices – Crystal systems – Structure and packing fraction of simple , bcc , fcc crystals .

Directions and planes in crystals – miller indices – separation between successive (h,k,l) Parallel planes – Diffraction of X rays – Bragg's law -Laue method and Powder method.

UNIT-III

Free Electron Theory of metals:

Classical free electron theory- Drift velocity – Relaxation time – Relation between relaxation time and mean collision time - Quantum free electron theory- Fermi Dirac distribution functions- causes of electrical resistance.

Bloch theorem- Kronig penny model(qualitative treatment)- Classification of materials – effective mass of an electron.

UNIT-IV

Dielectrics

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Dielectric constant – Types of Dielectrics- electronic, ionic and orientation polarizations– internal fields in solids – Clausius Mossotti relation –Frequency dependence of dielectric constant and polarizability- Ferro electricity and piezoelectricity – Applications.

UNIT-V

Magnetic Properties & Superconductivity:

Origin of magnetic moment – classification of magnetic materials – domain and weiss field theory – Hysteresis curve – soft and hard magnetic materials- applications. Superconductivity – general properties – meissner effect – penetration depth – Type I & Type II superconductors – BCS theory – applications of superconductor.

UNIT-VI

Semiconductors

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Introduction – intrinsic semiconductor and carrier concentration- Fermi level in intrinsic semiconductor - equation for conductivity – extrinsic semiconductor - Fermi level in extrinsic semiconductor – Drift and diffusion current – Einstein's relation – continuity equation – Recombination –Direct and Indirect band gap semiconductors.

Solar radiation and conversion efficiency – p-n junction – solar cells- Hetro junction – interface and thin solar cell – applications.

UNIT-VII

Lasers Characteristics of lasers–spontaneous and stimulated emission of radiation–Einstien coefficients – population inversion – pumping – Ruby, Helium-Neon & Semiconductor lasers.Applications of lasers.

Fiber optics Principle of optical fiber–Acceptance angle and numerical aperture–types offibers and refractive index profile – Attenuation in optical fibers – applications of optical fibers.

UNIT-VIII

Physics of Nonmaterial's:

Introduction – Surface to volume ratio- Quantum confinement effect- properties and preparation of nanomaterial – quantum wires – quantum dots – quantum wells - nanotubes –

SWNT- MWNT- Fabrication of AFM, SEM, TEM, STM, MRFM, - Applications of nanomaterials.

Learning Resources

Text Books:

1. Solid state Physics by S.O.Pillai. (New Age International Publications).
2. Physics of Semiconductors by S.M.Sze.

Reference Books:

1. Engineering physics by Gaur and Gupta. (Dhenpat Rai Publications).
2. Engineering physics by D.K.Bhattacharya and A.Bhaskaran. (Oxford Publications).
3. Engineering physics by M.R.Srinivasan (New Age International Publications).