

Code No: 09A1BS02

**R09**

**Set No. 4**

**I B.Tech Regular Examinations, June 2010**

**ENGINEERING PHYSICS**

**Common to CE, ME, CHEM, BME, IT, MECT, MEP, AE, BT, AME, ICE, E.COMP.E, MMT, ETM, EIE, CSE, ECE, EEE**

**Time: 3 hours**

**Max Marks: 75**

**Answer any FIVE Questions  
All Questions carry equal marks**

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1. (a) Obtain an expression for Fermi energy at  $T > 0$  K.  
(b) Derive an expression for density of states of electrons.  
(c) Write short notes on:
  - i. De Broglie wavelength and
  - ii. Heisenberg's uncertainty principle. [4+7+4]
2. (a) Derive Bragg's law of crystal diffraction.  
(b) Describe, in detail, Debye-Scherrer method for the determination of crystal parameter.  
(c) A certain crystal reflects monochromatic X-rays strongly when Bragg's angle is  $21^\circ$  for the second order diffraction. Calculate the glancing angle for third order spectrum. [4+7+4]
3. (a) What is bonding in solids? Write the list of different types of bonding in solids.  
(b) Describe with suitable examples, the formation of covalent and Vander-Waal's bonds in solids.  
(c) What is bonding energy of a molecule? Explain. [4+7+4]
4. (a) Describe the top-down methods by which nanomaterials are fabricated.  
(b) Explain how X-ray diffraction can be used to characterize nanoparticles. [9+6]
5. (a) Discuss the propagation mechanism of light waves in optical fibers.  
(b) Derive the expression for the numerical aperture of an optical fiber.  
(c) A step index fiber has a numerical aperture of 0.16, and core refractive index of 1.45. Calculate the acceptance angle of the fiber and the refractive index of the cladding. [5+6+4]
6. (a) Using Kronig-Penney model show that the energy spectrum of an electron contains a number of allowed energy bands separated by forbidden bands.  
(b) Define effective mass of an electron. Explain its physical significance. [9+6]
7. (a) Show that the application of forward bias voltage across p-n junction causes an exponential increase in number of charge carriers in opposite regions.

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- (b) Write notes on "Liquid Crystal Display".
- (c) The current in a p-n junction at  $27^{\circ}\text{C}$ , is  $0.18 \mu\text{A}$  when a large reverse bias voltage is applied. Calculate the current when a forward bias of  $0.98 \text{ V}$  is applied. [7+4+4]
8. (a) Define the terms magnetic induction (B), magnetization (M) and magnetic field (H). Obtain an expression relating to these quantities.
- (b) What are ferrites? Prove that ferrites are superior to ferro-magnetic materials. Write the applications of ferrites.
- (c) The magnetic susceptibility of aluminum is  $2.3 \times 10^{-5}$ . Find its permeability and relative permeability. [6+5+4]

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