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 21^0 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.

(b) Write notes on "Liquid Crystal Display".

(c) The current in a p-n junction at 27^0C, is 0.18 μA when a large reverse bias voltage is applied. Calculate the current when a forward bias of 0.98 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 materils. Write the applications of ferrites.

(c) The magnetic susceptibility of aluminum is 2.3×10^{-5}. Find its permeability and relative permeability. [6+5+4]

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