Code No: 09A1BS02 **R09** **Set No. 2**

I B.Tech Examinations,December-January, 2011-2012
ENGINEERING PHYSICS
Common to CE, ME, CHEM, BME, IT, MECT, MEP, AE, BT, AME, ICE, E.COMP.E, MMT, ETM, EIE, CSE, ECE, EEE, MIM, MIE
Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What are single mode, multimode and graded index fibres? Explain.
   (b) Derive an expression for numerical aperture of an optical fibre.
   (c) What is a displacement sensor? Draw its sensitivity curve. [6+5+4]
2. (a) What is space lattice? Calculate the packing fraction for BCC and FCC crystals.
   (b) Describe, in detail, the structure of CsCl crystal.
   (c) If the cube edge of diamond is 0.36 nm, calculate the number of atoms per unit volume. [6+5+4]
3. (a) Explain the terms:
      i. Magnetic induction,
      ii. Magnetic susceptibility,
      iii. Permeability and
      iv. Intensity of magnetization.
   (b) Explain the domain theory of ferromagnetism.
   (c) For a paramagnetic material the susceptibility at 340 K is 1.76×10^{-4}. Calculate its susceptibility at 310 K. [6+6+3]
4. (a) What is Bloch theorem? Explain.
   (b) On the basis of band theory how the crystalline solids are classified into conductors, semiconductors and insulators?
   (c) For an electron under motion in a periodic potential, plot the curve between the effective mass of the electron and wave number, and explain. [5+5+5]
5. (a) Explain the concept of dual nature of the light.
   (b) What are the important conclusions of G.P.Thomson experiment?
   (c) Derive the Schrodinger's wave equation for the motion of an electron.[4+4+7]
6. (a) What is Bragg's law of X-ray diffraction? Explain.
   (b) Describe, in detail, powder method to determine the crystal structure.
   (c) When a monochromatic X-ray beam of X-rays of wavelength 0.1542 nm is used, the first order reflection from (1 1 1) planes occurs at θ. If the lattice parameter is 0.433 nm, find the value of θ. [4+7+4]

7. (a) Derive an expression for carrier concentration of p-type semiconductors.
   (b) Explain the variation of Fermi level with
      i. Donor concentration and
      ii. Acceptor concentration, in the case of extrinsic semiconductors.
   (c) Calculate the intrinsic carrier concentration for Ge at 27^0C. [for Ge, Atomic weight = 72.6, Density = 5400 kg/m^3, Band gap = 0.7 eV]. [7+4+4]

8. (a) Define the term 'reverberation'? What is reverberation time?
   (b) Describe any two methods by which the sound absorption coefficient of a material can be determined.
   (c) A hall of volume 85000 m^3 is found to have a reverberation time of 2.2 sec. If the area of the sound absorbing surface is 7500 m^2, calculate the average sound absorption coefficient. [4+7+4]

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Code No: 09A1BS02 **R09** **Set No. 4**

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Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive the Schrodinger's wave equation for the motion of an electron.
   (b) Write the physical significance of wave function.
   (c) A body has a mass of 0.55 gm and moves with a velocity 3.50×10^5 cm/s. What is the de Broglie wavelength associated with it. [7+4+4]

2. (a) Define the terms:
      i. Magnetizing field,
      ii. Intensity of magnetization,
      iii. Magnetic susceptibility and
      iv. Magnetic induction.
   (b) Explain the origin of spontaneous magnetization in ferro-magnets on the basis of spin-spin interaction. Explain magnetization curve on the basis of domain movement. [6+9]

3. (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]

4. (a) Show that the Kronig-Penney model leads to energy band structure in solids.
   (b) For an electron under motion in a periodic potential, plot the curve between the effective mass of the electron and wave number, and explain. [9+6]

5. (a) Draw the energy band diagram of
      i. An intrinsic,
      ii. n-type and
      iii. p-type semiconductors. Indicate Fermi, donor and acceptor levels, wherever present.
   (b) What is Hall effect and its importance? Derive a relation between Hall voltage and Hall coefficient.

(c) A semiconductor plate having thickness of 1.25 mm is subjected to a magnetic field of 0.55 tesla, parallel to its thickness. If one milli-ampere current flows along the length of the plate, calculate the Hall voltage developed. [Given that Hall coefficient = 3.45×10^{-4} m^3/coulomb]. [4+7+4]

6. (a) Explain, in detail, the terms:
   i. Space lattice,
   ii. Unit cell,
   iii. Coordination number and
   iv. Miller indices.

   (b) Show that the face centered cubic structure possesses maximum packing density among the cubic structures.

   (c) Draw the (1 1 2), (1 2 0), (3 2 1) and (0 1 0) crystal planes of simple cubic crystal. [4+7+4]

7. (a) Explain the characteristics of a laser beam.

   (b) Describe the construction of He-Ne laser and discuss with relevant ELD, the working of He-Ne laser.

   (c) What are the differences between a laser diode and an LED? [4+7+4]

8. (a) Define:
   i. Reverberation,
   ii. Reverberation time and
   iii. Sound absorption coefficient of a material.

   (b) Explain how the reverberation time of hall is affected by
   i. The size of the hall,
   ii. Nature of wall surfaces and
   iii. Audience.

   (c) Write an essay on acoustincs of buildings. [4+4+7]

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Code No: 09A1BS02 **R09** **Set No. 1**

I B.Tech Examinations,December-January, 2011-2012
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Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (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]
2. (a) Discuss the band theory of solids and explain the formation of bands and concept of holes.
   (b) For an electron under motion in a periodic potential, plot the curve between the energy of the electron and wave number, and explain.
   (c) For an electron under motion in a periodic potential, plot the curve between the effective mass of the electron and wave number, and explain. [7+4+4]
3. (a) Describe the sources of permanent dipole moment in magnetic materials.
   (b) Distinguish between diamagnetic and paramagnetic materials.
   (c) Explain, in detail, the characteristics of B-H curve of ferromagnetic material. What are hysteresis losses? Explain. [4+5+6]
4. (a) Describe any three processes by which nanomaterials are fabricated.
   (b) Describe the important applications of nanotechnology. [9+6]
5. (a) Explain the types of defects in metallic lattices:
      i. Vacancy,
      ii. Frenkel defect and
      iii. Interstitial defect.
   (b) Derive an expression for concentration of Schottky defect in an ionic crystal. [8+7]
6. (a) Distinguish between step index fiber and graded index fiber.
   (b) Describe the various advantages of communication with optical fibers over the conventional coaxial cables.
   (c) Write notes on attenuation in optical fibers. [5+5+5]
7. (a) Derive an expression for carrier concentration of n-type semiconductors.

(b) Explain the variation of Fermi level with

i. Donor concentration and

ii. Acceptor concentration, in the case of extrinsic semiconductors.

(c) For a semiconductor, the Hall coefficient is -6.85 $\times$ 10^{-5} m^3/coulomb, and electrical conductivity is 250 $m^{-1}\Omega^{-1}$. Calculate the density and mobility of the charge carriers. [7+4+4]

8. (a) Mention the ideas which prompted de Broglie to propose his concept of matter waves.

(b) Derive an expression for the de Broglie wavelength of an electron.

(c) Describe the experimental verification of matter waves using Davisson-Germer experiment. [6+4+5]

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Code No: 09A1BS02 **R09** **Set No. 3**

I B.Tech Examinations,December-January, 2011-2012
ENGINEERING PHYSICS
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Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Distinguish between spontaneous emission and stimulated emission of radiation.
   (b) Describe, in detail, the construction and working of ruby laser.
   (c) Explain the purpose of an active medium in a gas laser. [4+7+4]
2. (a) What is statistical mechanics? Write notes on Bose-Einstein statistics.
   (b) Write notes on black body radiation.
   (c) Calculate the energies that can be possessed by a particle of mass 8.50×10^{-31}kg which is placed in an infinite potential box of width 10^{-9}cm. [6+5+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 ionic and metallic bonds in solids.
   (c) What is bonding energy of a molecule? Explain. [4+7+4]
4. (a) Derive an expression for density of electrons in the conduction band of n-type semiconductors.
   (b) Explain the variation of Fermi level with temperature in the case of p-type semiconductors.
   (c) For an intrinsic semiconductor having band gap of 0.78 eV, find the carrier concentration at 37^0C. [Given that the effective mass of electron = effective mass of hole = rest mass of electron]. [7+4+4]
5. (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]
6. (a) Write about:
      i. Origin of nanotechnology and
      ii. Nano-scale.
   (b) Discuss quantum confinement effect on nanoparitcles.
   (c) Explain how Transmission Electron Microscopy can be used to characterize nanoparticles. [4+4+7]

7. (a) Define the terms magnetic induction (B), magnetization (M) and magnetic field (H). Obtain an expression relating to these quantities.
   (b) Explain, in detail, the hysteresis of a ferromagnetic material.
   (c) The magnetic susceptibility of aluminum is 2.3×10^{-5}. Find its permeability and relative permeability. [6+5+4]

8. (a) How are the crystal defects classified? Explain.
   (b) What is Burger's vector? In what direction do the Burger's vector lie with respect to
      i. An edge dislocation,
      ii. Screw dislocation.
   (c) The formation energy for a vacancy in pure gold is 0.98 eV. Calculate the equilibrium concentration of vacancies per cubic meter at 827^0C and 27^0C. [Atomic weight of gold = 196.97 and density = 19320 kg/m^3]. [6+5+4]

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