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

I B.Tech Examinations,December 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) Derive an expression for density of holes in intrinsic semiconductors.
   (b) What is Hall effect? Derive an expression for Hall coefficient for n-type semiconductor. [7+8]
2. (a) What is bonding in solids? Write the list of different types of bonding in solids.
   (b) Explain, in detail, the formation and properties of Vander-Waal's bond.
   (c) What is bonding energy of a molecule? Explain. [4+7+4]
3. (a) Explain, in detail, the terms:
      i. Dielectric constant,
      ii. Electric susceptibility and
      iii. Displacement vector.
   (b) Distinguish between Ferroelectricity and Piezoelectricity.
   (c) The radius of a gaseous atom is 0.062 nm. Calculate the polarizability of the gas and its relative permittivity. Given that the number of atoms of the gas is 2.70×10^{25} per m^3. [6+5+4]
4. (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 effective mass of the electron and wave number, and explain. [9+6]
5. (a) Describe any three processes by which nanomaterials are fabricated.
   (b) Describe the important applications of nanotechnology. [9+6]
6. (a) How the X-ray diffraction can be employed to determine the crystal structure? Explain.
   (b) Describe, in detail, powder method to determine the crystal parameter.
   (c) A crystal plate is mounted on a X-ray spectrometer. The glancing angles of incidence for three reflection are $5^0 58'$, $12^0 01'$ and $18^0 12'$. Show that these are successive orders of reflection from the same crystal plane. [4+7+4]
7. (a) Explain Fermi-Dirac distribution function. Illustrate the effect of temperature on the distribution.

(b) What are the important conclusions of G.P.Thomson experiment?

(c) Show that if the uncertainty in the location of a particle is equal to the de Broglie wavelength, then the magnitude of uncertainty in its velocity is equal to the magnitude of the velocity of the particle. [7+4+4]

8. (a) How is light amplification achieved in a laser system?

(b) Explain the following terms:

i. Population inversion and

ii. Pumping.

(c) Discuss briefly the different methods of producing laser light. [4+4+7]

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

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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) 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]
2. (a) What is meant by sound absorption coefficient of a material? Describe an experimental method to measure it.
   (b) What are the requisites for good acoustics? Explain. [7+8]
3. (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]
4. (a) Explain the origin of the internal potential barrier and hence derive the relation for contact potential.
   (b) Derive the current equation for reverse biased p-n junction.
   (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. [6+5+4]
5. (a) What is Bloch theorem? Explain.
   (b) Write a detailed notes on Brillouin zones.
   (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. [4+7+4]
6. (a) What are matter waves? Derive an expression for the wavelength of matter waves.
   (b) Describe an experiment to establish the wave nature of electron.
   (c) Calculate the de Broglie wavelength of a dust particle of mass 0.002 mg and moving with velocity of 3.50×10^4 m/s. [6+5+4]
7. (a) Describe with a suitable example, the formation of covalent bond in solids.
   (b) Compare the properties of metallic and hydrogen bonds in solids.
   (c) What is Madelung constant? Explain. [4+7+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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Code No: 09A1BS02 **R09** **Set No. 1**

I B.Tech Examinations,December 2010
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) Give an account of the phenomenon of superconductivity.
   (b) Discuss the effect of a magnetic field on a super-conductor.
   (c) Write notes on:
      i. Flux quantization and
      ii. SQUID. [5+5+5]
2. (a) Write about:
      i. Origin of nanotechnology and
      ii. Surface to volume ratio of nanoparticle.
   (b) Explain how X-ray diffraction can be used to characterize nanoparticles.
   (c) Write the applications of nanotechnology in Industrial field. [4+7+4]
3. (a) What is bonding in solids? Write the list of different types of bonding in solids.
   (b) Explain, in detail, the formation and properties of molecular bond.
   (c) What is dissociation energy of a molecule? Explain. [4+7+4]
4. (a) What is Bragg's law of X-ray diffraction? Explain.
   (b) Describe, in detail, Laue method in the determination of a 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 0 1) planes occurs at θ. If the lattice parameter is 0.433 nm, find the value of θ. [4+7+4]
5. (a) Explain the variation of Fermi level with
      i. Donor concentration and
      ii. Acceptor concentration, in the case of extrinsic semiconductors.
   (b) What is Hall effect? Derive an expression for Hall coefficient for p-type semiconductor.
   (c) A metallic slab carrying a current of 30 A is subjected to a magnetic field of 1.75 tesla. The magnetic field is perpendicular to the plane of the slab and to the current. The thickness of the slab is 0.35 cm. The concentration of free electrons in the metal is 6.55×10^{28} electrons/m^3. Calculate the Hall Voltage developed across the width of the slab. [4+7+4]

6. (a) Derive an expression for density of states of electrons.
   (b) Write short notes on:
      i. De Broglie wavelength and
      ii. Heisenberg's uncertainty principle.
   (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. [7+4+4]

7. (a) Discuss with suitable mathematical expressions, the motion of an electron in a periodic potential.
   (b) Explain how the above theory leads to the concept of band structure of solids.
   (c) What is effective mass of electron? [7+4+4]

8. (a) Explain the different methods used for pumping of atoms.
   (b) Describe the construction and working of a He-Ne laser.
   (c) Find the relative population of the excited state with respect to the lower energy state of a semiconductor laser that produces a laser beam of wavelength 1.05 μm at 300 K. [4+7+4]

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

I B.Tech Examinations,December 2010
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) 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]
2. (a) Discuss the essential features of a laser beam.
   (b) Explain the various pumping mechanisms that are adopted in lasers.
   (c) Explain the uses of lasers in industry and medical fields. [5+5+5]
3. (a) What is reverberation time? Derive Sabine's formula for the determination of reverberation time.
   (b) Describe a method to determine the sound absorption coefficient of a material.
   (c) An auditorium has a volume of 5000 m^3. What should be the total absorption in the auditorium if the reverberation time of 1.25 seconds is to be maintained? [6+5+4]
4. (a) Explain the terms:
      i. Magnetic induction,
      ii. Magnetic susceptibility,
      iii. Permeability of a medium and
      iv. Intensity of magnetization.
   (b) What is anti-ferromagnetism? Explain, in detail, its properties.
   (c) A magnetic material has a magnetization of 3300 amp/m, and flux density of 0.0044 weber/sq.m. Calculate the magnetizing force and the relative permeability of the material. [6+5+4]
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) Write notes on surface defects in crystals.
   (b) What is Burger's vector? What is Burger's circuit? Explain.

(c) Find the number of vacancies per atom in thermal equilibrium in a crystal at temperatures 350 K and 500 K, assuming that the energy required to form a vacancy is 1.2 eV. [5+6+4]

7. (a) Derive an expression for density of electrons in intrinsic semiconductors.

(b) Explain the variation of Fermi level with temperature in the case of p-type semiconductors.

(c) If the effective mass of holes in a semiconductor is 5 times that of electrons, at what temperature would the Fermi level be shifted by 15% from the middle of the forbidden energy gap? [Given that the energy gap for the semiconductor is 1.20 eV]. [7+4+4]

8. (a) Write notes on:

i. Bloch theorem and

ii. Effective mass.

(b) Explain, in detail, the origin of energy gap using energy band theory of solids. [6+9]

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