Code No: 07A1BS05 **Set No. 1**

I B.Tech Supplimentary Examinations, Aug/Sep 2008
APPLIED PHYSICS
(Common to Electrical & Electronic Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Control Engineering, Computer Science & Systems Engineering, Electronics & Telematics, Electronics & Computer Engineering and Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Define coordination number and packing factor of a crystal.
   (b) Describe BCC crystal structure, with a suitable example.
   (c) Obtain an expression for the packing factor of FCC structure. [4+6+6]

2. (a) Derive 3-dimensional, time independent Schrodinger wave equation for an electron.
   (b) What is the physical significance of wave function?
   (c) Deduce the expression for energy of an electron confined to a potential box of width 'x'. [6+4+6]

3. (a) Discuss with suitable mathematical expressions, the Kronig-Penney model for the energies of an electron in a metal.
   (b) Explain the classification of metals, semiconductors and insulators based on band theory. [10+6]

4. (a) Explain the following:
      i. Electric Polarization and
      ii. Polarizability.
   (b) Derive Clausius-Mosotti relation in dielectrics subjected to static fields.
   (c) Argon gas contains 2.70×10^{25} atoms/m^3 at 0 ^{0}C and at 1 atm. pressure. Calculate the dielectric constant, if the diameter of argon atom is 0.384 nm. [4+8+4]

5. (a) Distinguish between intrinsic and extrinsic semiconductors with suitable examples.
   (b) Derive an expression for the density of holes in valence band of an intrinsic semiconductor. [8+8]

6. (a) What is population inversion relating to laser action? Explain.
   (b) Show that the ratio of Einstein's coefficient of spontaneous emission to Einstein's coefficient of absorption, is proportional to the cube of the frequency of the incident photon. [6+10]

7. (a) Describe the structure of an optical fiber.
   (b) Explain, in detail, the basic principle of an optical fiber.
   (c) Write the applications of fiber optics in medicine and industry. [6+6+4]

8. (a) Write a detailed note on nanoscience.
   (b) Why nanomaterials exhibit different properties? Explain. [6+10]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: 07A1BS05 **Set No. 2**

I B.Tech Supplimentary Examinations, Aug/Sep 2008
APPLIED PHYSICS
(Common to Electrical & Electronic Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Control Engineering, Computer Science & Systems Engineering, Electronics & Telematics, Electronics & Computer Engineering and Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Explain the formation of an ionic crystal, with a suitable example.
   (b) Derive an expression for the cohesive energy of an ionic crystal. [6+10]
2. (a) Show that the energies of a particle in a 3-dimensional potential box, are quantized.
   (b) Discuss, in detail, the physical significance of wave function.
   (c) A neutron beam of kinetic energy 0.04 eV is diffracted at the plane (1 0 0) of a simple cubic crystal for which d_{110} is 0.314 nm. Calculate the glancing angle at which first order Bragg diffraction will be observed. [6+4+6]
3. (a) Discuss with suitable mathematical expressions, the Kronig-Penney model for the energies of an electron in a metal.
   (b) Explain the classification of metals, semiconductors and insulators based on band theory. [10+6]
4. (a) What are the sources of permanent dipole moment in magnetic materials?
   (b) Explain the hysteresis loop observed in Ferro-magnetic materials.
   (c) Write notes on Ferro-electricity. [6+6+4]
5. (a) Write notes on direct band gap and indirect band gap semiconductors.
   (b) Show that for a p-type semiconductor the Hall coefficient, $R_H = (1/ne)$.[8+8]
6. (a) Explain the characteristics of a LASER.
   (b) Describe the construction and working of a semiconductor laser.
   (c) Write any four applications of laser. [4+8+4]
7. (a) What is the basic principle of holography? Explain.
   (b) How to construct and reconstruct a hologram? [6+10]
8. (a) Write a detailed note on nanoscience and nanotechnology.
   (b) Write the important applications of nanomaterials in medicine. [10+6]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: 07A1BS05 **Set No. 3**

I B.Tech Supplimentary Examinations, Aug/Sep 2008
APPLIED PHYSICS
(Common to Electrical & Electronic Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Control Engineering, Computer Science & Systems Engineering, Electronics & Telematics, Electronics & Computer Engineering and Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Explain the terms
   i. basis
   ii. space lattice
   iii. lattice parameters and
   iv. unit cell.
   (b) Deduce the expression for the inter-planar separation in terms of Miller indices for a cubic structure. [6+10]
2. (a) Derive one-dimensional, time independent Schrodinger wave equation for an electron.
   (b) What is the physical significance of wave function?
   (c) An electron is confined to a box of length 10^{-8}m. Calculate the minimum uncertainty in velocity. [8+4+4]
3. (a) Explain the terms (i) mean free path, (ii) relaxation time and (iii) drift velocity of an electron in a metal.
   (b) Discuss the origin of electrical resistance in metals.
   (c) Calculate the mobility of the electrons in copper obeying classical laws. Given that the density of copper = 8.92 $\times$ 10^3 kg/m^3, Resistivity of copper = 1.73 $\times 10^{-8}$ ohm-m, atomic weight of copper = 63.5 and Avogadro's number = 6.02 $\times 10^{26}$ per k-mol. [6+6+4]
4. (a) Explain the terms:
   i. Magnetic flux density
   ii. Magnetic field strength
   iii. Magnetization and
   iv. Magnetic susceptibility. How they are related to each other?
   (b) What are hard and soft magnetic materials? Write their characteristic properties and applications. [8+8]
5. (a) Write a note on intrinsic semiconductors.

(b) Derive an expression for the number of electrons per unit volume in the conduction band of an intrinsic semiconductor. [6+10]

6. (a) Describe the various methods to achieve population inversion relating to lasers.

(b) With the help of a suitable diagram, explain the principle, construction and working of a helium-neon laser. [6+10]

7. (a) Explain the principle of an optical fiber.

(b) Explain how the optical fibers are classified.

(c) Calculate the angle of acceptance of a given optical fiber, if the refractive indices of the core and the cladding are 1.563 and 1.498 respectively. [6+6+4]

8. (a) What are nanomaterials? Explain.

(b) Nanomaterials exhibit different properties. Explain the reasons. [6+10]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: 07A1BS05 **Set No. 4**

I B.Tech Supplimentary Examinations, Aug/Sep 2008
APPLIED PHYSICS
(Common to Electrical & Electronic Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Control Engineering, Computer Science & Systems Engineering, Electronics & Telematics, Electronics & Computer Engineering and Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Describe, in detail, the seven crystal systems with diagrams.
   (b) Sketch the planes (1 2 0), (2 $\bar{1}$ 3) and directions [1 0 0] and [2 1 1] [10+6]

2. (a) Discuss the de Broglie hypothesis of duality of matter particles.
   (b) Describe, in detail, with a neat diagram, Davisson and Germer experiment to show that particles behave like waves. [6+10]

3. (a) Distinguish between Drude-Lorentz theory and Sommerfeld's theory of metals.
   (b) Explain the Fermi-Dirac distribution function of electrons.
   (c) For a metal having 6.5×10^{28} conduction electrons per m^3, calculate relaxation time of electrons, if the metal has the resistivity 1.43×10^{-8} ohm-m. [Mass of electron = 9.1×10^{-31} Kg]. [6+6+4]

4. (a) Explain the following:
      i. Polarization vector and
      ii. Electric displacement.
   (b) Deduce an expression for Lorentz field relating to a dielectric material.
   (c) The radius of the helium atom is 0.55 Å.Calculate the polarizability of He and its relative permittivity. The number of He atoms in a volume of one metre cube is 2.70×10^{25} atoms. [permittivity of free space = 8.85×10^{-12} F/m] [4+8+4]

5. (a) Distinguish between intrinsic and extrinsic semiconductors with suitable examples.
   (b) Derive an expression for the density of electrons in conduction band of an intrinsic semiconductor. [8+8]

6. (a) What is population inversion relating to laser action? Explain.
   (b) Distinguish between homo-junction semiconductor laser and hetero-junction semiconductor laser.

(c) A semiconductor diode laser has a peak emission wavelength of 1.55 μm. Find its band gap in eV. [4+8+4]

7. (a) Derive the expressions for
   i. acceptance angle and
   ii. numerical aperture, of an optical fiber.

   (b) Describe different types of fibers by giving the refractive index profiles and propagation details. [8+8]

8. (a) How the physical and chemical properties of nano-particles vary with their size?

   (b) Write the important applications of nanomaterials. [10+6]

⋆ ⋆ ⋆ ⋆ ⋆