Code No: Z0221 / R07 **Set No. 1**

I B.Tech - Regular Examinations, June 2009
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 & 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 various types of bonding in solids with suitable examples.
   (b) The Madelung constant of KCl is 1.75. Its neighbour separation is 0.314 nm. Find the cohesive energy per atom. [Given that the Repulsive exponent value = 5.77; Ionization energy of potassium = 4.1 eV; Electron affinity of chlorine = 3.6 eV] [10+6]

2. (a) Derive one-dimensional time independent Schrodinger wave equation for an electron.
   (b) Show that the energies of a particle in a potential box, are quantized. [10+6]

3. (a) Explain the following:
      i. electrical conductivity and
      ii. Fermi energy.
   (b) Explain briefly the classical free electron theory of metals.
   (c) On the basis of band theory how the crystalline solids are classified into metals, semiconductors and insulators? [4+6+6]

4. (a) Describe the various processes of electric polarization.
   (b) A capacitor uses aluminium oxide as the dielectric with relative permittivity of 8. An effective surface area of 360 sq.cm. gives a capacitance of 6μF. Calculate the field strength and the total dipole moment induced in the oxide layer if a potential difference of 15 V exists across the capacitor. [permittivity of free space = 8.85 $\times 10^{-12}$ F/m] [10+6]

5. (a) What is meant by superconductivity?
   (b) What are Type-I and Type-II superconductors?
   (c) Calculate the critical magnetic field of a superconductor at 4.2 K. Given that the critical temperature of the material is 7.18 K and the critical magnetic field at 0 K is 6.5 $\times$ 10^4 amp/m. [4+8+4]

6. (a) Explain the terms which are related to lasers:

i. absorption
ii. spontaneous emission
iii. stimulated emission
iv. population inversion
v. pumping mechanism and
vi. optical cavity

(b) Write any four applications of laser. [12+4]

7. (a) Distinguish between light propagation in (i) step index and (ii) graded index optical fibers.

(b) Discuss the various advantages of communication with optical fibers over the conventional coaxial cables.

(c) Calculate the refractive indices of core and cladding of an optical fiber with a numerical aperture of 0.33 and their fractional difference of refractive indices being 0.02. [6+6+4]

8. (a) Write a detailed note on nanoscience.

(b) Why nanomaterials exhibit different properties? Explain. [6+10]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: Z0221 / R07 **Set No. 2**

I B.Tech - Regular Examinations, June 2009
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 & 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) Describe the seven crystal systems with diagrams. [6+10]
2. (a) Explain the properties of matter waves.
   (b) Describe GP Thomson's experiment to verify the wave nature of matter. [6+10]
3. (a) What are the salient features of Sommerfeld theory of metals? Explain.
   (b) Explain the Fermi-Dirac distribution function of electrons.
   (c) Use the Fermi distribution function to obtain the value of F(E) for E - E_F = 0.01 eV at 200 K. [6+6+4]
4. (a) Explain the terms:
   i. magnetic induction
   ii. magnetic susceptibility
   iii. permeability of a medium and
   iv. intensity of magnetization.
   (b) Explain the origin of magnetic moment. Find the magnetic dipole moments due to orbital and spin motions of an electron.
   (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. [permeability of vacuum = $4\pi \times 10^{-7}$ H/m] [6+6+4]
5. (a) Write a note on Meissner effect relating to superconductivity.
   (b) Compare the differences between soft and hard superconductors.

(c) Calculate the critical current that flow through a long thin superconducting wire of aluminium of diameter 10^{-3} m. (Given critical magnetic field = 7.9×10^3 A/m). [4+8+4]

6. (a) Explain the need of a cavity resonator in a laser.
   (b) With the help of a suitable diagram describe the construction and working of a semiconductor laser.
   (c) Write any four applications of laser. [4+8+4]

7. (a) Explain the transmission of a signal through the step-index fiber.
   (b) Discuss different losses in optical fibers.
   (c) An optical fiber has a core material of refractive index of 1.55 and cladding material of refractive index 1.50. The light is launched into it from air. Calculate its numerical aperture. [6+6+4]

8. (a) What are nanomaterials? Explain.
   (b) Describe the various types of carbon nanotubes.
   (c) Explain the fabrication of carbon nanotubes. [4+6+6]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: Z0221 / R07 **Set No. 3**

I B.Tech - Regular Examinations, June 2009
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 & Computer Engineering and Instrumentation & Control Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) State and explain Bragg's law.
   (b) Describe with suitable diagram, the powder method for determination of crystal structure.
   (c) A beam of X-rays of wavelength 0.071 nm is diffracted by (1 1 0) plane of rock salt with lattice constant of 0.28 nm. Find the glancing angle for the second order diffraction. [4+8+4]

2. (a) Show that the wavelength (λ) of an electron accelerated by a potential difference of V volts, is $\lambda = \frac{12.27}{\sqrt{V}}$ Å. for non-relativistic case.
   (b) Describe an experiment with a neat diagram, to establish the wave nature of electrons.
   (c) Calculate the velocity and kinetic energy of an electron of wavelength 1.66 Å. [6+6+4]

3. (a) What is Bloch theorem? Explain.
   (b) Discuss Kronig-Penney model for the motion of an electron in a periodic potential. [6+10]

4. (a) Describe the phenomenon of electronic polarization and obtain an expression for electronic polarizability.
   (b) Write notes on:
      i. Ferro-electricity and
      ii. Piezo-electricity. [8+8]

5. (a) Explain in detail the following
      i. Meissner effect and
      ii. Penetration depth of a superconductor.
   (b) What are hard and soft superconductors?
   (c) Discuss the important applications of super conductors. [6+6+4]

6. (a) What is population inversion relating to laser action? Explain.

(b) Distinguish between homo-junction semiconductor laser and hetero-junction semiconductor laser.

(c) Calculate the wavelength of emitted radiation from GaAs which has a band gap of 1.44 eV. [4+8+4]

7. (a) Distinguish between light propagation in (i) step index and (ii) graded index optical fibers.

(b) Discuss the various advantages of communication with optical fibers over the conventional coaxial cables.

(c) Calculate the refractive indices of core and cladding of an optical fiber with a numerical aperture of 0.33 and their fractional difference of refractive indices being 0.02. [6+6+4]

8. (a) Write a detailed note on nanoscience.

(b) Why nanomaterials exhibit different properties? Explain. [6+10]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: Z0221 / R07 **Set No. 4**

I B.Tech - Regular Examinations, June 2009
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 & Computer Engineering and Instrumentation & Control Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Plot and explain the variation of (i) attractive potential energy (ii) repulsive potential energy and (iii) resultant potential energy with inter-atomic distance, when two atoms are brought nearer.
   (b) The Madelung constant of KCl is 1.75. Its neighbour separation is 0.314 nm. Find the cohesive energy per atom. [Given that the Repulsive exponent value = 5.77; Ionization energy of potassium = 4.1 eV; Electron affinity of chlorine = 3.6 eV] [10+6]

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) What is Fermi energy? Explain.
   (b) Explain the Fermi-Dirac distribution function of electrons. Illustrate graphically the effect of temperature on the distribution.
   (c) The Fermi energy of silver is 5.5 eV. An electron in silver has an energy which is 1% above Fermi energy. At what temperature we can expect a 10% probability of electron at this energy level? [4+8+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) Explain the characteristics of a LASER.
   (b) Describe the construction and working of Ruby laser.
   (c) Write any four applications of laser. [4+8+4]

7. (a) Explain the advantages of optical fiber in communication.
   (b) Discuss different losses in optical fibers.
   (c) The refractive indices of core and cladding are 1.53 and 1.42 respectively. Then calculate its critical angle. [6+6+4]

8. (a) What are nanomaterials? Explain.
   (b) Describe the various types of carbon nanotubes.
   (c) Explain the fabrication of carbon nanotubes. [4+6+6]

⋆ ⋆ ⋆ ⋆ ⋆