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

I B.Tech Regular Examinations, May/Jun 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

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1. (a) Explain the forces between the two interacting atoms when they are brought nearer to form a molecule.
   (b) Derive the expression for the equilibrium spacing of two atoms for which the potential energy is minimum. [6+10]

2. (a) Explain de-Broglie hypothesis.
   (b) Describe G.P.Thomson's experiment in support of this hypothesis.
   (c) Find the wavelength associated with an electron rose to a potential 1600 V. [4+8+4]

3. (a) Distinguish between Drude-Lorentz theory and Sommerfeld's theory of metals.
   (b) Define Fermi level of electron.
   (c) Find the drift velocity of free electrons in a copper wire of cross-sectional area 10 mm^2, when the wire carries a current of 100 A. Assume that each copper atom contributes one electron to the electron gas. [Density of copper = 8.92 $\times$ 10^3 kg/m^3, Atomic weight of copper = 63.5 and Avogadro's number = 6.02 $\times$ 10^{26} per k-mol] [10+2+4]

4. (a) Explain the following:
      i. Dielectric constant
      ii. Electric susceptibility,
      iii. Electric Polarization and
      iv. Polarizability.
   (b) Write notes on:
      i. Ferro-electricity and
      ii. Piezo-electricity. [6+10]

5. (a) Explain the critical parameters and their significance in superconductors.
   (b) Write notes on:
      i. isotope effect and

ii. energy gap, in superconductors.

(c) A Josephson junction having a voltage of 8.50 μV across its terminals, then calculate the frequency of the alternating current. [Planck's constant = 6.626 $\times 10^{-34}$ J-sec] [4+8+4]

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) Derive an expression for the 'numerical aperture' of an optical fiber.

(b) Explain the advantages of optical communication system.

(c) The numerical aperture of an optical fiber is 0.39. If the difference in the refractive indices of the material of its core and the cladding is 0.05, calculate the refractive index of material of the core, when the light is launched into it in air. [8+4+4]

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

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

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

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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

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1. (a) What is Bragg's law? Explain.
   (b) Describe Laue's method for the determination of crystal structure.
   (c) The Bragg's angle in the first order for (2 2 0) reflection from nickel (FCC) is 38.2^0 when X-rays of wavelength 1.54 Å are employed in a diffraction experiment. Determine the lattice parameter of nickel. [4+8+4]

2. (a) Explain, in detail, the properties of matter waves.
   (b) Describe Davisson and Germer experiment to verify the wave nature of matter. [6+10]

3. (a) Distinguish between classical free electron theory and quantum free electron theory of metals.
   (b) Explain the Fermi-Dirac distribution function of electrons. Explain the effect of temperature on the distribution. [8+8]

4. (a) Explain the following:
      i. Dielectric constant
      ii. Electric susceptibility,
      iii. Electric Polarization and
      iv. Polarizability.
   (b) Write notes on:
      i. Ferro-electricity and
      ii. Piezo-electricity. [6+10]

5. (a) What is Meissner effect? Explain.
   (b) Describe the difference between Type-I and Type-II superconductors.
   (c) The critical field for niobium is 1×10^5 amp/m at 8 K and 2×10^5 amp/m at absolute zero. Find the transition temperature of the element. [4+8+4]

6. (a) Distinguish between spontaneous emission and stimulated emission

(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]

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

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

Answer any FIVE Questions
All Questions carry equal marks

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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) Discuss the de Broglie hypothesis of duality of matter particles.
   (b) Describe GP Thomsons experiment to verify the wave nature of matter.[6+10]

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) 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) Write a note on intrinsic semiconductors.
   (b) Derive an expression for the carrier concentration in n-type extrinsic semiconductors. [6+10]

6. (a) Distinguish between spontaneous emission and stimulated emission..
   (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) What are important features of optical fibers?
   (b) Describe the communication process using optical fibers.
   (c) Write the uses of fiber optics in different fields. [4+6+6]

8. (a) Write a detailed note on nanoscience and nanotechnology.
   (b) Write the important applications of nanomaterials in medicine. [10+6]

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

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

Answer any FIVE Questions
All Questions carry equal marks

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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) Distinguish between a matter wave and an electromagnetic wave.
   (b) Describe GP Thomson's experiment to study electron diffraction.
   (c) Find the wavelength associated with an electron rose to a potential 1600 V. [4+8+4]

3. (a) Explain the following:
      i. Electrical resistivity and
      ii. Fermi energy.
   (b) Explain briefly the quantum 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) Explain the hysteresis loop observed in Ferro-magnetic materials.
   (b) Explain clearly difference between hard and soft magnetic materials. [8+8]

5. (a) How are 'superconductors' classified? Explain their properties.
   (b) What is Meissner effect? Explain.
   (c) Write notes on the applications of superconducting materials. [6+4+6]

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 semiconductor laser. [6+10]

7. (a) Distinguish between light propagation in
      i. step index optical fiber and

ii. graded index optical fiber.

(b) Write a note on fiber optic medical endoscopy. [10+6]

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

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

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