Code No: R05010201 **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

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

2. (a) What are Miller indices? Explain. [4]
   (b) Derive an expression for the interplanar spacing between two adjacent planes of Miller indices (h k l) in a cubic lattice of edge length 'a'. [8]
   (c) Calculate the interplanar spacing for (321) planes in a simple cubic crystal whose lattice constant is 4.2 A.U. [4]

3. (a) What are matter waves? Explain their properties. [6]
   (b) Derive the expression for de-Broglie wave length. [6]
   (c) Calculate the wavelength associated with an electron having energy 2000 eV. [4]

4. (a) What is Fermi level? [2]
   (b) Explain Fermi-Dirac distribution for electrons in a metal. Discuss its variation with temperature. [8]
   (c) Calculate the free electron concentration, mobility and drift velocity of electrons in aluminum wire of length of 5 m and resistance 0.06 Ω carrying a current of 15 A, assuming that each aluminum atom contributes 3 free electrons for conduction.
   Given: Resistivity for aluminum = 2.7×10^{-8} Ω-m.
   Atomic weight = 26.98
   Density = 2.7×10^3 kg/ m^3
   Avagadro number = 6.025×10^{23} [6]

5. (a) What are the properties of diamagnetic materials? [4]
   (b) Explain why the diamagnetic materials repel the magnetic lines of force. [6]
   (c) Explain the properties of paramagnetic materials. [6]

6. (a) Distinguish between metals, semiconductors and insulators. [6]
   (b) Explain the effect of temperature on resistivity of a semiconductor. [4]
   (c) Derive an expression for the number of electrons per unit volume in the conduction band of an intrinsic semiconductor. [6]

7. (a) Explain the terms:
      i. temporal coherence
      ii. population inversion
      iii. metastable state
      iv. stimulated emission [10]
   (b) Why is the optical resonator required in lasers? Illustrate your answer with neat sketches. [6]

8. (a) Explain the principle of an optical fibre. [4]
   (b) Explain how the optical fibres are classified. [8]
   (c) Calculate the angle of acceptance of a given optical fibre if the refractive indices of the core and the cladding are 1.563 and 1.498 respectively. [4]

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Code No: R05010201 **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

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1. (a) Explain the terms [6]
   i. basis
   ii. space lattice and
   iii. unit cell.
   (b) Describe the seven crystal systems with diagrams. [10]
2. (a) State and explain Bragg's law. [6]
   (b) Describe with suitable diagram, the powder method for determination of crystal structure. [6]
   (c) A beam of X-rays of wavelength 0.071 nm is diffracted by (110) plane of rock salt with lattice constant of 0.28 nm. Find the glancing angle for the second order diffraction. [4]
3. (a) Distinguish between Frenkel and Schottkey defects. [8]
   (b) Derive an expression for the energy change due to creation of vacancies inside a solid. [8]
4. (a) Explain the origin of energy bands in solids. [6]
   (b) Assuming the electron - lattice interaction to be responsible for scattering of conduction electrons in a metal, obtain an expression for conductivity in terms of relaxation time and explain any three draw backs of classical theory of free electrons. [6]
   (c) Find the temperature at which there is 1% probability of a state with an energy 0.5 eV above Fermi energy. [4]
5. (a) Discuss the spin arrangements in ferromagnetic, ferrimagnetic and anti-ferromagnetic materials. [10]
   (b) How does an anti-ferromagnetic substance differ from diamagnetic substance? [6]

6. (a) Explain the applications of Hall effect. [6]
   (b) Write a note on diffusion length. [6]
   (c) The resistivity of an intrinsic semiconductor is 4.5 ohm-m at 20 ^oC and 2.0 ohm-m at 32 ^oC. What is the energy band gap? [4]

7. (a) Explain the characteristics of a laser beam. [4]
   (b) Describe the construction and working of a ruby laser. [8]
   (c) Discuss how lasers are helpful in induced fusion and isotope separation processes. [4]

8. (a) Distinguish between light propagation in
      i. step index and
      ii. graded index optical fibres. [6]
   (b) Discuss the various advantages of communication with optical fibres over the conventional coaxial cables. [6]
   (c) Calculate the refractive indices of core and cladding of an optical fibre with a numerical aperture of 0.33 and their fractional difference of refractive indices being 0.02. [4]

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Code No: R05010201 **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

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1. (a) Explain the terms [6]
   i. basis
   ii. space lattice and
   iii. unit cell.
   (b) Describe the seven crystal systems with diagrams. [10]

2. (a) Sketch the planes with Miller indices (123) and (221) in the case of a simple cubic structure. [4]
   (b) Derive Bragg's law for X-ray diffraction in crystals. [8]
   (c) When a beam of X-rays of λ=1.8 A.U. is incident on a crystal surface, the second order maximum is obtained at a glancing angle of 15^o. Calculate the corresponding inter-planar spacing. [4]

3. (a) Derive time independent Schrodinger's wave equation for a free particle. [8]
   (b) Explain the physical significance of wave function. [4]
   (c) An electron is bound in a one-dimensional infinite well of width 1×10^{-10}m. Find the energy values in the ground state and first two excited states. [4]

4. (a) Explain the origin of energy bands in solids. [6]
   (b) Assuming the electron - lattice interaction to be responsible for scattering of conduction electrons in a metal, obtain an expression for conductivity in terms of relaxation time and explain any three draw backs of classical theory of free electrons. [6]
   (c) Find the temperature at which there is 1% probability of a state with an energy 0.5 eV above Fermi energy. [4]

5. (a) Explain ferro-electric hysteresis curve. [4]
   (b) What are the mechanisms of polarization in dielectrics? Discuss the polarization of ionic dielectrics not having permanent dipoles. [8]

(c) A parallel plate capacitor of area 650 mm^2. and plate separation of 4 mm has a charge of 2 $\times$ 10^{-10} C on it. What is the resultant voltage across the capacitor when a material of dielectric constant 3.5 is introduced between the plates? [4]

6. (a) Describe Meissner effect. [6]

(b) Write notes on Type-I and Type -II superconductors. [6]

(c) Calculate the critical current which can flow through a superconductor wire of aluminium of diameter 10^{-3} m. The critical magnetic field for aluminium is 7.9 $\times$ 10^{-3} amp/m. [4]

7. (a) Explain with a neat diagram

i. absorption

ii. spontaneous emission and

iii. stimulated emission of radiation. [8]

(b) What is population inversion? How it is achieved by optical pumping? [8]

8. (a) Derive expressions for the numerical aperture and the fractional index change of an optical fibre. [8]

(b) Write a note on the applications of optical fibres. [4]

(c) Calculate the fractional index change for a given optical fibre if the refractive indices of the core and the cladding are 1.563 and 1.498 respectively. [4]

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Code No: R05010201 **Set No. 4**

I B.Tech Supplimentary Examinations, Aug/Sep 2008
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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 terms [6]
   i. basis
   ii. space lattice and
   iii. unit cell.
   (b) Describe the seven crystal systems with diagrams. [10]
2. (a) State and explain Bragg's law. [6]
   (b) Describe with suitable diagram, the powder method for determination of crystal structure. [6]
   (c) A beam of X-rays of wavelength 0.071 nm is diffracted by (110) plane of rock salt with lattice constant of 0.28 nm. Find the glancing angle for the second order diffraction. [4]
3. (a) Explain the various point defects in a crystal. [8]
   (b) Obtain the expression for the equilibrium concentration of vacancies in a solid at a given temperature. [8]
4. (a) Explain the origin of energy bands in solids. [6]
   (b) Assuming the electron - lattice interaction to be responsible for scattering of conduction electrons in a metal, obtain an expression for conductivity in terms of relaxation time and explain any three draw backs of classical theory of free electrons. [6]
   (c) Find the temperature at which there is 1% probability of a state with an energy 0.5 eV above Fermi energy. [4]
5. (a) Define the terms magnetic susceptibility, magnetic induction and permeability. How is magnetic susceptibility of a material measured? [10]
   (b) Explain the salient features of anti-ferromagnetic materials. [6]
6. (a) What is meant by superconductivity? Explain. [6]

(b) Show that the superconductors are perfect diamagnetic materials. [6]

(c) Write some of the applications of superconductors. [4]

7. (a) Describe the principle, construction and working of a semiconductor laser.[10]

(b) Write the applications of laser. [6]

8. (a) Write notes on:

i. fibre materials

ii. light sources for fibre optics

iii. photo-detectors for fibre optics [6]

(b) Explain the terms

i. numerical aperture and

ii. acceptance angle of a fibre.

Derive expressions for them. [10]

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