FE - sem - I - Old - AP - I

1/6/16

Q.P. Code : 28529

(OLD CORSE)
(2 Hours) **[Total Marks : 75**

Note:
1. Q.1 is compulsory.
2. Answer any FOUR from the Q. 2 to Q.7
3. Symbols have their usual meanings.
4. Assume suitable data wherever necessary.

Q.1 Attempt any FIVE of the following

a) Draw the following in cubic unit cell. [03]
   1. (1 2 0) 2. $(1\bar{2}3)$ 3. [1 0 1]

b) Define continuous X-ray spectra and characteristic X-ray Spectra. [03]

c) Write the expression for Fermi level in n-type semiconductor and also mention the meaning of terms in it. [03]

d) Define Hall effect and list some of its applications. [03]

e) Define superconductivity, critical temperature and critical magnetic field. [03]

f) State Sabine's formula and explain terms involved in it. [03]

g) Define direct and inverse piezoelectric effect. [03]

Q.2 A Draw BCC crystal structure with proper diagram and calculate atomic radius, Coordination number, Atomic Packaging Factor and Void space. [08]

B A Copper specimen having length 1 meter, width 1 cm and thickness 1 mm is conducting 1 ampere current along its length and is applied with magnetic field of 1 tesla along its thickness. It experiences Hall effect and a Hall voltage of 0.074 micro Volts appear along its width. Calculate Hall coefficient and the mobility of electron in Copper. Conductivity of Copper is $\sigma = 5.8 \times 10^7 (\Omega m)^{-1}$. [07]

Q.3 A Define superconductivity. Explain Type – II superconductors. [08]

B Ni has FCC structure. Its lattice constant is 3.52 A.U., atomic weight is 58.71. Give Avogadro number is 6.023×10^{26} /Kg-mole. Calculate its radius, Atomic Packaging Factor and density. [07]

Q.4 A Define Packing efficiency. Calculate atomic packing efficiency for Diamond unit cell. [05]

B Draw the neat labelled energy band and Fermi level for intrinsic, n-type and p-type semiconductor. [05]

C A Hall of volume $6000m^3$ has a reverberation time 3 sec. if the absorbing surface of the hall has an area of $4000m^2$. Calculate the average coefficient of absorption. [05]

Q.5 A Silicon has the same structure as that of diamond. Its density is 2.3×10^3 Kg/m^3 and atomic weight 28.9. Calculate lattice constant and atomic radius of it. [05]

B How a depletion region is formed in P-N junction diode explain with neat diagram. [05]

C Explain construction and working of Magnetostriction oscillator with neat circuit diagram. [05]

Q.6 A The Bragg angle corresponding to the first order reflection from (111) planes of a crystal is 30°. Wavelength of X-ray is 1.75A. Determine inter-planer spacing and lattice constant of the crystal. [05]

B Describe Meissner effect. Show that superconductors are perfect diamagnetic below their critical temperature. [05]

C Find the depth of sea water from a ship on the sea surface if the time interval of 2 seconds is required to receive the signal back. Given the temperature of sea water is 20 °C and salinity is 10 gm/lit. [05]

Q.7 A Define liquid crystal and describe nematic phase. [05]

B Calculate the thickness of quartz plate which is used to produce ultrasonic waves of 2MHz. [05]

C Explain electrostatic focusing. [05]