19/12/2013

F.E Sem I (CBGS)
App. Physics

26-10-13-DTP6- PM-1

Con. 5552 -13

GX-10030

(Revised Course)

(2 Hours) **[Total Marks : 60**

N.B. : (1) Question No.**1** is **compulsary.**

(2) Attempt any **three** questions from Question No. 2 to 6.

(2) Use **suitale** data wherever **required.**

(3) **Figures** to the right indicate **full** marks.

1. Solve any **five** from the following :- **15**

(a) Define the term space lattice, unit cell and lattice parameter.

(b) Find the interplaner spacing between the family of planes (111) in a crystal of lattice constant 3A°.

(c) Represent the following in the cubic unit cell :-

(1T2), (002), [121]

(d) Define drift current, diffusion current and mobility of charge carriers.

(e) Explain the use of P-N junction as a solar cell.

(f) State with neat diagram direct and inverse Piezoelectric effect.

(g) What is magnetic circuit ? Explain Ohm's Law in case of magnetic circuit.

2. (a) Explain the Hall effect in metal ? Derive the formulae to determine the density and mobility of the electrons. **8**

(b) Define ligeancy and critical radius ratio in case of ionic solid. Write the conditions for stability of ionic crystal in 3-D ? Determine critical radius ratio for ligancy 6. **7**

3. (a) Explain with neat diagram construction of Bragg's X-ray spectrometer ? Write the procedure to determine crystal structure. Calculate the maximum order of diffraction if X-rays of wavelength 0·819 A° is incident on a crystal of lattice spacing 0·282 nm. **8**

(b) Calculate the number of turns required to produce a magnetic flux of 4×10^5 wb, if an iron rod of length 50 cm and cross sectional area 4 cm^2 carrying an electric current 1A is in the form of ring. *(Permeability of iron is 65×10^{-4} H/m).* **7**

4. (a) What is mesomorphic state of matter ? Explain with neat diagram cholesteric phase. **5**

(b) What is dielectric polarization and dielectric susceptibility ? Find the relation between them ? **5**

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(c) The resistivity of intrinsic InSb at room termperatrue is $2 \times 10^{-4}\ \Omega$ cm. If the mobility of electron is 6 m^2/V-sec and mobility of hole is 0·2 m^2/V-sec. Calculate its instrinsic carrier dentsity. **5**

5. (a) Identify the crystal structure if its density is $9{\cdot}6 \times 10^2$ kg/m^3, lattice constant is 4·3 A° and atomic weight is 23. **5**

(b) Explain the formation of depletion region in P-N junction. **5**

(c) Define reverberation time ? State Sabine's formula and explain the terms involved in it ? **5**

6. (a) What are soft and Hard magnetic material ? State their properties and applications. **5**

(b) What is Fermi level in semiconductor ? Show that in intrinsic semiconductor Fermi level always at the middle between the forbidden energy gap ? **5**

(c) An Ultrasonic sound wave is used to detect the position of defect in a steel bar of thickness 50 cm. If the echo times are 40 and 90 μ–sec. Locate the position of defect. **5**

F.E Sem I (CBGS)
Applied Physics I

(REVISED COURSE) QP Code : **NP-17709**

(2 Hours) [Total Marks :60

N.B.:— (1) Question no.**1** is **compulsory.**
(2) **Attempt** any **three** questions from Q.2 to 6
(3) Use suitable data wherever required.
(4) **Figures** to the right indicate **full** marks.

1. Solve any **five** from the following:— **15**
   (a) What is x-rays? Why the x-rays are preferred to study crystalline solid.
   (b) Represent the following in a cubic unit cell (021), (123) , [121]
   (c) Find the miller indices of a set of parallel panes which makes intercepts in the ratio 3a:4b on the x and y axes and parallel to Z-axis.
   (d) What is Fermi level and Fermi energy? Write Fermi-Dirac distribution function.
   (e) Explain the concept of hole in a semiconductor.
   (f) Draw the structure of quartz crystal and explain its various axes.
   (g) State and explain ohm`s law in magnetic circuit?

2. (a) Describe the formation of energy band in solid? Explain how it helps to classify the solids in to conductors, insulators and semiconductors with proper diagram. **8**
   (b) Explain Dimond crystal structure with proper diagram and determine its APF? **7**

3. (a) Derive the Bragg`s law and describe the powder method to determine crystal structure of powdered specimen. **8**
   (b) The magnetic field strength of copper is 10^6 ampere / metre. and magnetic susceptibility is -0.8×10^{-3}. Calculate magnetic flux density and magnetisation in copper. **7**

4. (a) What is liquid crystal state of matter? Draw the diagram to describe molecular arrangement in their different phases? **5**
   (b) Mention different types of polarizability in a dielectric? Explain electronic polarizability? **5**
   (c) Calculate electron and hole concentration in intrinsic silicon at room temperature if its electrical conductivity is 4×10^{-4} mho/m. (mobility of electron = 0.14 m^2/v-s & mobility of hole=0.040 m^2/v-s) **5**

5. (a) Explain with neat diagram construction and working of solar cell. **5**
   (b) State the acoustic requirements of good auditorium. Explain how these requirements can be achieved. **5**
   (c) If the x-rays of wavelength 1.549 A° will be reflected from crystal having spacing of 4.255 A°, calculate the smallest glancing angle and highest order of reflection that can be observed. **5.**

6. (a) Explain with neat diagram Hysterisis effect in ferromagnetic material. **5**
   (b) Explain piezoelectric oscillator to produce USW? **5**
   (6) Explain the formation of barrier potential in P-N Junction. **5**

FE/Sem-I (CGS) 29/5/13

A.P. I

P4–RT–Exam.–Feb.–13–3–137

Con. 6874–13. **(REVISED COURSE)** **GS–5193**

(2 Hours) **[Total Marks : 60**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **three** questions from remaining Question Nos. **2** to **6**.
(3) Assume **suitable** data wherever **required**.
(4) **Figures** to the **right** indicate marks.

1. Attempt any **five** (Each carry equal weightage) :– **15**

(a) Draw unit cells showing position of the atoms for –
(i) a monoatomic BCC Crystal
(ii) a monoatomic SC Crystal
(iii) CsCl Crystal.

(b) Fermi level in K is 2.1 ev. What are the energies for which the probabilities of occupancy at 300 K are 0·99 and 0·01.

(c) Draw the energy band diagram of an unbiased p-n junction and mark the barrier potential and depletion region.

(d) Write the relation between polarization and dielectric susceptibility and the relation between dielectric susceptibility and dielectric constant.

(e) Why soft magnetic material are used in core of transformers.

(f) Calculate the change in intensity level when the intensity of sound increases 1000 times its original intensity.

(g) Explain cavitation effect.

2. (a) Derive an expression for Fermi level for an intrinsic semiconductor. ~~(1+1+1+1)~~ 04

Draw the energy level diagram only, to show the effect of
(i) temperature (ii) impurity atom concentration in low range and (iii) impurity atom concentration in high range. (1+1+1+1)

(b) An elemental crystal has a density of 8570 kg/m^3 packing fraction is 0·68. Determine **7**

the mass of one atom if the nearest neighbour distance is 2·86 Å.

3. (a) Prove that in a ferromagnetic material, power loss per unit volume in a hysteresis cycle is equal to the area under hysteresis loop. **(4 + 4)**
An iron ring of mean circumferential length 30 cm and cross sectional area 1 cm^2 is wound uniformly with 300 turns of a wire. When a current of 0·032 Amp flows in it, the flux produced in the ring is 2×10^{-6} wb. Find the flux density, magnetic field intensity and permeability of iron.

(b) Derive Bragg's law. Explain why x rays and not γ-ray are used for crystal structure analysis. What data about the crystal structure can be obtained from the x-ray diffraction pattern of a crystal. **(4 + 2+1)**

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4. (a) Find out the critical radius ratio of an ionic crystal in ligancy 6 configuration. What is the maximum size of cation in ligancy 6 configuration when the radius of anion is 2·02 $\mathring{A}$. **5**

   (b) In an n type semiconductor the Fermi level lies 0·4 ev below the conduction band. If the concentration of donor atom is doubled, find the new position of the Fermi level w.r.t. the conduction band. **5**

   (c) Explain the origin of electronic, ionic and orientational polarization and temperature dependence of respective polarizability. **5**

5. (a) Find out the intercepts made by the planes. (1 0 1) and (4 1 4) in a cubic unit cell. Draw $[\bar{1}\,2\,1)$ and [1 2 4] in a cubic unit cell. **5**

   (b) A bar of n type Ge of size 0·010m × 0·001m × 0·001m is mounted in a Magnetic field of 2 x 10^{-1}T. The electron density in the bar is 7 × $10^{21}/m^3$. If one millivolt is applied across the long ends of the bar, determine the current through the bar and the voltage between Hall electrodes placed across the short dimensions of the bar. Assume $\mu_e = 0{\cdot}39\ m^2/vs$. **5**

   (c) Define reverberation time. Write Sabine's formula explaining every term. What are the factors which determine the average absorption co-efficient of a material. **5**

6. (a) Explain the differences between three different liquid crystal phases w.r.t. the order in the arrangement of molecules, with the help of diagram. Which property of the liquid crystal is used for display. **5**

   (b) How a p-n junction diode is used to generate a potential difference in a photovoltaic solar cell. **5**

   (c) What is piezoelectric effect. Explain the working of a piezoelectric oscillator used to produce ultrasonic wave. **5**
