

Con. 3088-11.

RK-1068

(2 Hours)

[Total Marks : 75

- N.B. :** (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** questions from Question Nos. 2 to 7.
 (3) Assume **suitable** data and symbols if **required**.
 (4) **Figures to the right** indicate **full marks**.

$$h = 6.63 \times 10^{-34} \text{ J-sec}, c = 3 \times 10^8 \text{ m/s}, m_e = 9.1 \times 10^{-31} \text{ kg}, e = 1.6 \times 10^{-19} \text{ C},$$

$$N = 6.023 \times 10^{26}$$

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| 1. | Attempt any three :- | 15 |
| | (a) Derive an expression for the edge element of a cubic crystal in terms of the density of the crystal material. | |
| | (b) Explain : Drift current and diffusion current. | |
| | (c) Explain the application of ultrasonic in Agglomeration and non-destructive testing. | |
| | (d) How can the Lissajous figures be obtained on CRO screen and how are they used to find unknown frequency ? | |
| 2. | (a) An impurity of 0.01 ppm (particles per million) is added to Si. The semiconductor has a resistivity of 0.25 ohm/m at 300 k. Calculate the hole concentration and its mobility. Also comment on the result.
Atomic weight of Si 28.1, density of Si = $2.4 \times 10^3 \text{ kg/m}^3$. | 7 |
| | (b) What are ferro-electric materials ? Explain the Hysteresis curve for a ferro-electric material. Define ferro-electric curic temperature. Give two examples of ferro-electric materials. | 8 |
| 3. | (a) State direct and inverse piezoelectric effect. Explain with neat labelled diagram, the construction and working of piezoelectric oscillator. | 8 |
| | (b) Explain the difference between Schottky and Frankel defect.
Calculate the ratio of the number of vacancies to the number of atoms when the average energy required to create a vacancy is 1.95 eV at 500 k ($k = 1.38 \times 10^{-23} \text{ J/k}$). | 7 |
| 4. | (a) Explain zero resistance and persistent current in lieu of superconductor. Explain with proper equations that a superconductor is perfectly diamagnetic. | 8 |
| | (b) The radiation of an X-ray tube operated at 50 kV are diffracted by a cubic KCl crystal of molecular weight 74.6 and density $1.99 \times 10^3 \text{ kg/m}^3$. Calculate:
(i) the shortest wavelength of the spectrum from the tube and
(ii) glancing angle for first order reflection from the reflecting planes of the crystal for that wavelength. | 7 |

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5. (a) Explain the principle of Electrostatic Lens while proving Bethe's Law. 8
 (b) What is echelon effects ? 7

The noise from an acroplane engine 100 m from on observer is 40 dB in intensity. What will be the intensity when the aeroplane flies overhead at an attitude of 2 km.

6. (a) Show that in uniform magnetic field pitch remains constant. 8

In a CRT the distance from screen to the centre of the coil is 0.2 m. The length of the magnetic field along the axis is 5 cm. Calculate the flux density 'B' required to produce a deflection of 1cm on the screen, if the anode voltage is 1000 volt.

- (b) What is Hall effect ? Define Hall voltage. The Hall coefficient of a specimen is $3.66 \times 10^{-4} \text{ m}^3/\text{c}$. Its resistivity is $8.93 \times 10^{-3} \Omega \text{ m}$. Find μ and n . 7

7. (a) Show that the atomic packing for FCC and HCP Lattices are the same. 8

- (b) The volume of room is 600 m^3 . The wall area of the room is 220 m^2 , the floor area is 120 m^2 and the ceiling area is 120 m^2 . The average sound absorption coefficient :

- (i) for the walls is 0.03
- (ii) for the ceiling is 0.8
- (iii) for the floor is 0.06.

Calculate the average sound absorption coefficient and the reverberation time.