

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. 7
 Atomic weight of Si 28.1, density of Si = $2.4 \times 10^3 \text{ kg/m}^3$.
- (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. 7
 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 ($k=1.38 \times 10^{-23} \text{ J/k}$).
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: 7
- (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.

5. (a) Explain the principle of Electrostatic Lens while proving Bethe's Law. 8

(b) What is echelon effects? 7

The noise from an aeroplane engine 100 m from an observer is 40 dB in intensity. What will be the intensity when the aeroplane flies overhead at an altitude 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 : 7

(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.
