K23U 0525

Reg. No. : .....

Name : .....

VI Semester B.Sc. Degree (CBCSS-OBE-Regular/Supplementary/ Improvement) Examination, April 2023
(2019 and 2020 Admissions)
CORE COURSE IN PHYSICS
6B10PHY : Solid State Physics and Spectroscopy

Time : 3 Hours Max. Marks : 40

SECTION – A
(6 Marks)

Short answer **six** questions. Answer **all** questions. **Each** question carries **1** mark.

1. The numbers of lattice points in a primitive cell are _____
2. The numbers of tetrad axes of symmetry elements that are present in a cubic crystal are _____
3. The majority charge carriers in N type semiconductor are _____
4. When a molecule has all three moments of inertia identical, it is called a _____ molecule.
5. The vibrational spectrum lies in _____ region of the electromagnetic spectrum.
6. For Raman scattering, a molecular rotation or vibration must cause some change in component of _____

SECTION – B
(12 Marks)

Short answer eight questions. Answer **any six**. **Each** question carries **2** marks.

7. What are Bravais lattices ?
8. What is coordination number ? Write the coordination number for sc, bcc and fcc lattices.
9. What are Miller indices ? Determine the Miller indices of plane of intercepts on X, Y and Z axis are ½ a, 2a, – 2a.
10. Explain the effect of temperature on mobility of charge carriers.
11. What is the principle of microwave oven ?

P.T.O.

12. Write the expression for Morse function. Draw the Morse curve and the energy levels of a diatomic molecule.
13. What are overtone transitions in infrared spectroscopy ?
14. Distinguish between stokes lines and anti-stokes lines.

SECTION – C
(12 Marks)

Problem six questions. Answer **any four**. **Each** question carries **3** marks.

15. Deduce the relation between the density of crystal material and lattice constant in a cubic lattice.
16. Calculate the axial ratio for HCP.
17. In a P type semiconductor, the Fermi level lies 0.4 eV above the valence band. If the concentration of the acceptor atom is tripled, find the new position of the Fermi level.
18. The Hall coefficient of a certain silicon specimen was found to be $-7.35 \times 10^{-5} m^3 C^{-1}$ from 100 to 400 K. Further the electrical conductivity was found to be 200 $\Omega^{-1} m^{-1}$. Determine the nature of the semiconductor. Calculate the density and mobility of charge carriers.
19. The first line in the rotational spectrum of carbon monoxide has a frequency of $3.8424 cm^{-1}$. Calculate the rotational constant and hence the C–O bond length in Carbon monoxide. Avogadro number 6.022×10^{23}/mol.
20. The frequency of OH vibration in CH_3OH is $3300 cm^{-1}$. Estimate the frequency of OD stretching vibration in CH_3OD.

SECTION – D
(10 Marks)

Long essay four questions. Answer **any two**. **Each** question carries **5** marks.

21. Describe Bragg's x ray spectrometer and explain how it is used to determine the wavelength of x rays.
22. What are intrinsic and extrinsic semiconductors ? Discuss the location of Fermi levels under suitable limiting conditions.
23. Explain :
    i) Intensity of spectral line
    ii) Effect of isotopic substitution on the rotational spectra of rigid diatomic molecule.
24. Discuss the spectrum of a diatomic vibrating rotator.

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