18.

K22U 0425

Reg. No. : .....

Name : .....

VI Semester B.Sc. Degree (CBCSS – OBE – Regular) Examination, April 2022
(2019 Admission)
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 nearest neighbor distance in the case of *bcc* structure is _____.
2. The wavelength of X-rays is of the order of _____ nm.
3. Minority carriers in a P-type semiconductor are _____.
4. The frequency range corresponds to X-ray spectrum is _____ Hz.
5. In a diatomic vibrating rotator, spectral line corresponds to $\Delta J = +1$ corresponds to _____.
6. The lines on the high frequency side of Raman spectra are called _____.

SECTION – B **(12 Marks)**

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

7. What are Miller indices and write important features of Miller indices of crystal planes ?
8. What are intrinsic and extrinsic semiconductors ?

P.T.O.

9. Write a note on symmetric top molecules.
10. What are hot bands ?
11. Explain how X-rays are used for determining the crystal structure.
12. What is Zero point energy ?
13. How will you evaluate the bond length of a molecule from rotational constant ?
14. Explain Raman Effect.

SECTION – C **(12 Marks)**

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

15. Derive the packing factor of face centered cubic structure.
16. A plane makes intercepts of 1, 2 and 0.5A° on the crystallographic axis of an orthorhombic crystal with a : b : c = 3 : 2 : 1. Determine the Miller indices of this plane.
17. Evaluate the moment of inertia of a diatomic molecule.
18. What is the change in rotational constant B when ^{12}C of carbon monoxide ($^{12}C\ ^{16}O$) is replaced by ^{13}C. B of $^{12}C\ ^{16}O$ is 1.92118 cm^{-1} ?
19. The fundamental and first overtone transitions of CO are centered at 2143.3 cm^{-1} and 4260.0 cm^{-1}. Calculate the equilibrium oscillation frequency, anharmonicity constant and force constant of the molecule.
20. Show that the spacing of vibrational energy levels of a diatomic molecules as a harmonic oscillator are equally spaced.

SECTION – D **(10 Marks)**

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

21. What are Miller indices ? Draw neat diagrams to indicate Miller indices of the important plane systems in a simple cubic crystal. Obtain a relation between the interplanar spacing and cube edge.
22. Obtain an expression for the rotational energy levels of a diatomic molecule taking it as a rigid rotator.
23. Discuss the theory of rotation-vibration spectrum of a diatomic molecule.
24. What is Hall Effect and write about its applications ?

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