16

3/3/23

D6BPH2002 (PAGES 2) Reg.No.....

Name: .....

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2023

(Regular/Improvement/Supplementary)

PHYSICS

GPHY6B11T: STATISTICAL PHYSICS, SOLID STATE PHYSICS, SPECTROSCOPY & PHOTONICS

Time: 2 Hours **Maximum Marks: 60**

SECTION A: Answer the following questions. Each carries *two* marks.

(Ceiling 20 Marks)

1. Distinguish between unit cell and primitive cell.
2. Sketch (110) planes of a unit cubic crystal.
3. Explain why polar molecules are microwave active while nonpolar molecules are microwave inactive.
4. Spherical top molecule does not show rotational spectrum. Why? Give one example for a spherical top molecule.
5. What are hot bands? Why they are called hot bands?
6. What is meant by Pumping? What are the different types of pumping mechanism used in Laser?
7. Why Stokes'lines are more intense than antistokes' lines in Raman spectra.
8. Distinguish between macro and microstates.
9. Sketch vibrational energy levels of a diatomic molecule. Treat molecule as ideal harmonic oscillator
10. Write down Fermi -Dirac distribution Function. Sketch Fermi-Dirac distribution function at T=0 and T > 0
11. Differentiate between spontaneous and stimulated emission.
12. Explain the properties of Laser beam.

SECTION B: Answer the following questions. Each carries *five* marks.

(Ceiling 30 Marks)

13. Differentiate between NaCl and Diamond Structure.
14. Explain rotational spectra of rigid diatomic rotator.
15. Briefly explain the working of He-Ne Laser. Draw its energy level diagram.
16. Find the Fermi energy in copper on the assumption that each copper atom contributes one free electron to the electron gas. The density of copper is 8.94×10^3 kg/m^3 and its atomic mass is 63.5 u.
17. The fundamental and first overtones of CO are centered at 2143.3 cm^{-1} and 4260 cm^{-1}. Calculate the equilibrium oscillation frequency, the anharmonicity constant and force constant of CO molecule. The atomic mass of C and O are 12.01 amu and 15.999 amu respectively.

(PTO)

18. Find the interplanar spacing for the lattice planes of Miller indices (111) and (220) for a cubic lattice with a=5.62 Å. What is the corresponding first order Bragg angle for these planes if diffraction is carried with Cu - Kα radiation of wavelength 1.54 Å.
19. Write a short note on Width and Intensity of Spectral Transitions

SECTION C: Answer any *one* question. Each carries *ten* marks.

20. Deduce Bragg's law in X-ray diffraction. Describe powder method of crystal structure analysis.
21. Compare Maxwell-Boltzmann, Fermi-Dirac and Bose- Einstein Statistics. Derive Planks radiation law using B.E. Statistical distribution law

(1 × 10 = 10 Marks)