C 20659 (Pages : 2) Name.....

Reg. No.....

SIXTH SEMESTER U.G. DEGREE EXAMINATION, MARCH 2022

(CBCSS—UG)

Physics/Applied Physics

PHY 6B 11/APH 6B 11—STATISTICAL PHYSICS, SOLID STATE PHYSICS, SPECTROSCOPY AND PHOTONICS

(2019 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in question paper have their usual meanings.

Section A (Short Answer Type)

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. What are Fermions ? Give an example. What do you mean by Pauli principle ?
2. Plot the specific heat versus temperature graph of liquid helium at low temperatures. What do you mean by lambda point ?
3. Using a suitable figure, discuss the lattice parameters of a unit cell.
4. What do you mean by a symmetry operation in a unit cell ? What are the point group symmetry operations ?
5. Draw an NaCl lattice structure.
6. Distinguish between microwave active and microwave inactive molecules. Give examples.
7. Distinguish between symmetric top and spherical top molecules.
8. Explain the term "zero point energy" of an IR active molecule.
9. What are hot bands ? Why are they called so ?
10. Explain population inversion.
11. Discuss the basic components of a laser.
12. Mention any four applications of lasers.

(8 × 3 = 24 marks)

Turn over

Section B (Paragraph/Problem Type)

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. Show that the most probable speed of the Maxwell speed distribution is $(2kT / m)^{1/2}$.

14. Using Fermi-Dirac distribution, obtain an expression for the Fermi energy at absolute zero.

15. Find the interplanar spacing for the lattice planes of Miller indices (3, 2, 1), (2, 1, 0) and (1, 1, 1) for a cubic lattice with a = 5.62Å.

16. Discuss the various regions of the electromagnetic spectrum.

17. Draw the energy levels and the allowed transitions between them in the rotational spectrum of a rigid diatomic molecule. Give the corresponding spectrum.

18. Explain the processes spontaneous emission and stimulated emission.

19. Discuss the construction, energy levels involved in lasing action and emission wavelengths of a ruby laser.

(5 × 5 = 25 marks)

Section C (Essay Type)

Answer any **one** *question.*
The question carries 11 *marks.*

20. Discuss briefly the Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac distributions. Plot the corresponding distribution functions.

21. Obtain Bragg's law of X-ray diffraction. Discuss the basic principle of powder method.

(1 × 11 = 11 marks)