

23U608

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Name:

Reg.No:

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2026

(CBCSS - UG)

(Regular/Supplementary/Improvement)

**CC19UPHY6B11 / CC20UPHY6B11 - STATISTICAL PHYSICS, SOLID STATE PHYSICS,
SPECTROSCOPY AND PHOTONICS**

(Physics - Core Course)

(2019 Admission onwards)

Time : 2.00 Hours

Maximum : 60 Marks

Credit : 3

Part A (Short answer questions)

Answer *all* questions. Each question carries 2 marks.

1. What are bosons? Give two examples.
2. Plot the Fermi-Dirac distribution function for temperatures $T = 0$ and $T > 0$. Show the region affected by temperature change by shading.
3. What is a black body?
4. Define (i) a crystal (ii) lattice points and (iii) crystal lattice?
5. What is meant by Miller indices ? What is their importance?
6. What is Spectroscopy?
7. How is the intensity of spectral lines related to transition probability?
8. What is a selection rule? Write down the selection rules for a rigid rotator.
9. What is zero point energy? What is its significance?
10. Write down Boltzmann's distribution law for population of energy levels and explain the symbols.
11. Explain the Einstein coefficient for stimulated emission.
12. What is Raman effect?

(Ceiling: 20 Marks)

Part B (Short essay questions - Paragraph)

Answer *all* questions. Each question carries 5 marks.

13. (a) Considering the numbers of heads and tails, how many macrostates are there when 5 coins are tossed.
(b) What is the total number of possible microstates in tossing 5 coins.
(c) Find the number of microstates for each macrostate.
14. Fermi energy of conduction electrons in silver is 5.48 eV. Calculate the number of such electrons per m^3

15. Calculate the number of carbon atoms per unit cell of diamond.
16. The Bragg angle for the first order reflection from (111) plane in a crystal is 60° . Calculate the interatomic spacing if X-ray of wavelength $1.8 \times 10^{-10}\text{m}$ is used.
17. What is Morse function? Draw its graphical representation and explain its features.
18. What are the characteristics of a laser beam?
19. With the help of energy band diagram discuss the working of a semiconductor laser.

(Ceiling: 30 Marks)

Part C (Essay questions)

Answer any *one* question. The question carries 10 marks.

20. Obtain the expressions for average speed, most probable speed and rms speed in Maxwell Boltzmann distribution.
21. Illustrate with theory how to determine the rotational constants of a diatomic molecule from the rotation vibration spectrum.

(1 × 10 = 10 Marks)
