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(Pages : 2)

Name.....

Reg. No.....

SIXTH SEMESTER U.G. (CBCSS-UG) DEGREE EXAMINATION, MARCH 2024

Physics/Applied Physics

PHY6B11/APH 6B 11—STATISTICAL PHYSICS, SOLID STATE PHYSICS, SPECTROSCOPY AND PHOTONICS

(2019 Admission onwards)

me : Two Hours

Maximum : 60 Marks

The symbols used in this question paper have their usual meanings.

Section A - Short Answer type

Answer **all** *questions in two or three sentences, each correct answer carries a maximum of 2 marks.*

1. Explain the term distribution function.
2. What are Bosons ? Give two examples.
3. Differentiate between classical and quantum statistics.
4. What are Bravais lattices ? Give an example.
5. Define crystallographic axis.
6. What is meant by resolving power of an optical instrument ?
7. Give the selection rules for rotational spectroscopy.
8. What is an asymmetric top molecule ? Give an example.
9. What are hot bands ?
10. What is pumping ? Give two examples of pumping mechanisms.
11. What are Stokes' lines and anti-Stokes' lines ?
12. Which are the essential components of a laser ?

(Ceiling 20 marks)

Section B - Paragraph / Problem type

Answer **all** *questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks.*

13. Comment on the applications of Bose-Einstein statistics.
14. On a simple cubic lattice of spacing = 1, draw the [100], [010], [110], and [111] directions.

Turn over

15. How does the Rayleigh - Jeans law fail to explain the black body spectrum ?

16. Explain the quantization of energy and the regions of the electromagnetic spectrum.

17. Explain the an harmonic vibration spectrum of a diatomic molecule.

18. Find the energy in cm^{-1} of the photon absorbed when an NO molecule undergoes transition J" = 0 state to $v = 1$, J' = 1 state where v is the vibrational quantum number and J is the rotational quantum number. Assume that B is the same in both states. Given $\upsilon_e = 1.904$, $\chi_e = 0.00733$, $_rNO = 0.1151$ nm, rotational constant of NO = 1.672 cm^{-1}.

19. Discuss the quantum theory of Raman scattering.

Section C - Essay type

Essays - Answer in about two pages, any ***one*** *question.*
Answer carries 10 marks.

20. Obtain the Maxwell Boltzmann distribution law.

21. Explain, with necessary diagrams, the construction and working of a He- Ne Laser.