## SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2023
### (CBCSS - UG)
(Regular/Supplementary/Improvement)
## CC19U PHY6 B11 / CC20U PHY6 B11 - STATISTICAL PHYSICS, SOLID STATE PHYSICS, SPECTROSCOPY AND PHOTONICS
(Physics - Core Course)
(2019, 2020 Admissions)

Time : 2.00 Hours                                              Maximum : 60 Marks

Credit : 2

**Part A** (Short answer questions)

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

1. What is Fermi-Dirac Distribution?

2. Write down Planck blackbody formula.

3. How would you generate a crystal structure from lattice and basis?

4. What is screw axis symmetry?

5. Draw the direction [110] in a cubic crystal.

6. What is the function of modulator in spectrometer?

7. What is a selection rule? Write down the selection rules for a rigid rotator.

8. Show that the vibrational energy levels of a diatomic molecule modelled as a harmonic oscillator are equally spaced.

9. What are the selection rules for the rotation-vibration spectra of a diatomic molecule? What are P and R branches in the spectrum?

10. What are the conditions to be satisfied to have large stimulated emission?

11. Explain what is a metastable state.

12. Distinguish between Raman scattering and Rayleigh scattering.

**(Ceiling: 20 Marks)**

**Part B** (Short essay questions - Paragraph)

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

13. Consider the distribution of two units of energy to a gas of four identical but distinguishable particles. With the help of this system explain microstate, macrostate and multiplicity (Particles can assume energy in integral units including zero)

14. Distinguish between classical and quantum statistical mechanics.

15. Explain the crystal structure of zinc sulphide and ceasium chloride.

16. Derive Bragg's law. Derive an expression for the interplanar distance.

17. Explain the factors on which the width and intensity of spectral lines depend.

18. What are the characteristics of stimulated emission?

19. Describe the working of semiconductor laser.

**(Ceiling: 30 Marks)**

**Part C** (Essay questions)

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

20. With the help of Maxwell-Boltzmann statistics, find the distribution of energies among the molecules of an ideal gas. Also find the molecular speed distribution.

21. Discuss the rotational spectra of a diatomic molecule as a (a) harmonic oscillator and (b) anharmonic oscillator.

**(1 × 10 = 10 Marks)**

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