INTEGRATED MSC DEGREE EXAMINATION, MARCH 2025

Sixth Semester

INTEGRATED MSC BASIC SCIENCE-PHYSICS

CORE - IPH6CR03 - STATISTICAL MECHANICS - II

2021 Admission Onwards

34A5DF2A

Time: 3 Hours   Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. Express the first law of thermodynamics in diffferential form.

2. What is the Boltzmann distribution for a system in the ground state with energy ($E\_0 = 0$), given that the partition function is Z?

3. What is phase space?

4. What are antisymmetric wavefunctions?

5. State Pauli's exclusion principle.

6. Explan ortho-hydrogen.

7. State the failure of Einstein's model of vibration.

8. Discuss the conservation rule when two atoms A and B react to form molecule AB.

9. What are the three main types of ensembles?

10. Explain Bose Einstein distribution function.

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. Discuss the significance of partition function.

12. Derive the expression for temperature from the probabilities of two states of a system.

13. Discuss the vibrational energy levels for diatomic molecules.

14. How does the partition function vary when the particles are indistinguishable?

15. Explain ultraviolet catastrophe.

16. How do we calculate chemical potential from Helmoltz free energy?

17. What is meant by the term phase? Explain the three important features of phase tranistion.

18. What are critical exponents in Ising model?

(6×2=12 weightage)

Part C (Essay Type Questions)

Answer any **two** *questions.*

Weight **5** *each.*

19. Derive the contribution of the translational motion of a single particle in one dimension to the heat capacity. Also discuss the case of three dimension.

20. Discuss waves as particles in view of Planck's distribution.

21. Discuss about thermal properties of a Fermi gas at different temperature regions.

22. Explain the non interacting Bos gas and deduce the expression for the number of Bose condensed particles.

(2×5=10 weightage)