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Reg. No. : .....

Name : .....

Second Semester M.Sc. Degree Examination, January 2024

Physics with Specialization in Nano Science/Physics with Specialization in Space Physics

PHNS 522/PHSP 522 : THERMODYNAMICS, STATISTICAL PHYSICS AND BASIC QUANTUM MECHANICS

(2020 Admission Onwards)

Time : 3 Hours Max Marks : 75

SECTION – A

Answer any **five** questions. Each question carries 3 marks.

1. What do you mean by partition function.
2. Explain is Nernst's Theorem and explain its importance.
3. What is the role of chemical potential in chemical equilibrium?
4. What is Gibbs function and prove that Gibbs function decrease during isothermal isobaric process and is equal to the network obtained.
5. What is planks radiation law?
6. Explain quantum mechanical tunneling.
7. Distinguish first order and second order phase transitions.
8. Briefly explain Schrodinger representation or Schrodinger picture.

(5 × 3 = 15 Marks)

P.T.O.

SECTION – B

Answer **all** questions. Each question carries **15** marks.

9. Derive Maxwell's thermodynamic relations and hence derive Clausius Clapeyton equation.

OR

10. What is Partition function and establish the relation between partition function and thermodynamical quantities.

11. Explain Fermi dirac statistics and distribution law.

OR

12. State and derive Liouville's theorem.

13. Solve linear harmonic oscillator problem using Schrodinger method.

OR

14. Explain and compare the three evolution pictures in quantum mechanics.

(3 × 15 = 45 Marks)

SECTION – C

Answer **any three** of the following questions. Each question carries **5** marks.

15. With the help of Maxwell's relations, show that

$$Tds = C_v dT + T\left(\frac{\partial P}{\partial T}\right)_v dV \text{ and } TdS = C_p dT - T\left(\frac{\partial V}{\partial T}\right)_p dP$$

16. Derive the co-relation of partition function Z with entropy S for ideal gas obeying classical statistics.

17. Derive Fermi Dirac distribution function and how it differs from that of Bose Einstein distribution.

18 Derive Richardson Dushman equation of thermionic emission.

19 Show that the zero point energy of $\frac{1}{2}\hbar\omega$ of a linear harmonic oscillator is a manifestation of the uncertainty principle.

20 Derive general uncertainty relation.

(3 × 5 = 15 Marks)
