(Pages : 3) **M – 5999**

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Second Semester M.Sc. Degree Examination, March 2022

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)

Time : 3 Hours Max. Marks : 75

PART – A

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

1. What is Nerns't theorem and explain its importance.
2. What is Gibbs function and prove that Gibbs function decrease during isothermal isobaric process and is equal to the net work obtained.
3. What is the role of chemical potential in chemical equilibrium.
4. Explain Planks radiation law.
5. Derive Fermi Dirac distribution law.
6. Explain quantum mechanical tunneling.
7. Write a short note matrix representation of operators.
8. Write a short note on duterion.

(5 × 3 = 15 Marks)

P.T.O.

PART – B

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

9. State and derive Liouville's theorem.

OR

10. Derive an expression for the distribution of speeds of particles in a classical gas.

11. Derive Maxwells Boltzmans distribution law.

OR

12. Explain Fermi Dirac statistics and distrubution law.

13. Solve linear harmonic oscillator problem using Schrodinger method.

OR

14. Derive General Uncertainty principle, minimum uncertainty wave packet and energy time uncertainty relation.

(3 × 15 = 45 Marks)

PART – C

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

15. The partition function of a system is given by $Z = \exp(\alpha T^3 V)$ where α is a constant. Calculate the pressure, entropy and the internal energy of the system.

16. Obtain the expression for partition function in terms for every energy state of the given molecule.

17. What is the use of density matrix formulation? Obtain the equation of motion for the density matrix $\rho_{mn}(t)$.

18. Calculate the fermi energy in electron volts for sodium assuming that it has one free electron per atom. Given density of sodium is 0.97 gm/cm^3 atomic weight of sodium is 23.

19. Derive Geiger Nuttal Law representation.

20. Derive general uncertainty relation.

(3 × 5 = 15 Marks)
