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**WT—122—2024**

**FACULTY OF SCIENCE**

**M.Sc. (First Year) (Second Semester) EXAMINATION**

**NOVEMBER/DECEMBER, 2024**

**(CBCS New Pattern)**

**PHYSICS**

**Paper PH-202**

**(Statistical Mechanics)**

**(Friday, 13-12-2024)**

**Time : 10.00 a.m. to 1.00 p.m.**

*Time—3 Hours*

*Maximum Marks—75*

*N.B. :—* (1) Attempt *All* questions.

(2) Each question carries equal marks.

(3) Figures to the right indicate full marks.

1. (a) State and explain Liouville's theorem. 7

(b) Derive an expression for Planck radiation formula for energy density of a perfectly black body. 8

*Or*

(c) Explain Brownian motion for the displacement of the particles. 7

(d) State and explain Landau's theory of Liquid He. 8

2. (a) Discuss about phase space, phase trajectory and phase volume. 7

(b) Obtain energy and pressure of a slightly degenerate F-D gas. 8

P.T.O.

*Or*

- (c) Explain the principle of equipartition of energy and derive an expression for mean energy of a particle per degree of freedom. 7
- (d) Derive F-D distribution law for the distribution of particles obeying F-D Statistics. 8
3. (a) Explain Ising model in one-dimension. 7
- (b) Explain the phenomenon of B-E condensation using B-E distribution law at  $T < T_0$ . 8

*Or*

- (c) Derive Clausius-Clapeyron equations of phase transition. 7
- (d) Calculate entropy of a perfect gas in canonical ensemble. 8
4. (a) Distinguish between Microcanonical, Canonical and Grand canonical ensembles. 7
- (b) What is Gibbs' paradox and how can it be removed ? 8

*Or*

- (c) Derive an expression for the most probable distribution according to B-E statistics. 7
- (d) Show that for a grand canonical ensemble; grand partition function is the sum of canonical partition function. 8
5. Write short notes on (any *three*) : 15
- (a) Virial equation of state and Virial coefficients
- (b) Fluctuation of energy in canonical ensemble
- (c) Difference between particles obeying M-B, B-E and F-D statistics
- (d) Richardson-Dushman equation for thermionic emission.