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LB—116—2023

FACULTY OF SCIENCE

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

APRIL/MAY, 2023

(NEW/CBCS PATTERN)

PHYSICS

(PH-202)

(Statistical Mechanics)

(Monday, 8-5-2023) **Time : 10.00 a.m. to 1.00 p.m.**

Time—Three Hours *Maximum Marks*—75

N.B. :— (*i*) Attempt *all* questions.

(*ii*) Each question carries equal marks.

(*iii*) Figures to the right indicate full marks.

1. (*a*) Derive Clausius-Clapeyron equations of phase transition. 8

(*b*) Distinguish between Microcanonical, Canonical and Grand canonical ensembles. 7

Or

(*x*) Discuss fluctuation in energy for canonical ensemble. 7

(*y*) Show that the grand partition function is the sum of canonical partition function. 8

P.T.O.

2. (*a*) Explain the principle of equipartition of energy and derive an expression for mean energy of a particle per degree of freedom. 8

(*b*) What is Gibbs paradox and how it can be removed ? 7

Or

(*x*) Explain first and second order phase transition. 7

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

3. (*a*) Obtain energy and pressure of a strongly degenerate F-D gas at T = 0. 8

(*b*) Show that the number of phase cells in phase space for the three-dimensional particle is $\frac{4\pi V(2mE)^{3/2}}{3h^3}$. 7

Or

(*x*) Derive M-B distribution law for the distribution of particles obeying M-B statistics and also obtain partition function from it. What will be the degeneracy if the distribution is classical ? 8

(*y*) Critical exponents in phase transition. 7

4. (*a*) Explain the phenomenon of B-E condensation using B-E distribution law at $T < T_0$. 8

(*b*) Calculate entropy of a perfect gas in microcanonical ensemble. 7

Or

(*x*) State and explain Landau's theory of liquid He. 8

(*y*) Derive an expression for M-B disrtibution law of velocity for particles. 7

5. Write short notes on (any *three*) : 15

(*a*) Derive an equation for mean square displacement in Brownian motion.

(*b*) Discuss Virial equation of state and Virial coefficients

(*c*) Liouville's theorem.

(*d*) Discuss Ising model in one dimension.