MANIPAL ACADEMY of HIGHER EDUCATION (Institution of Eminence Deemed to be University)

Reg.No.									

DEPARTMENT OF SCIENCES, M.Sc (PHYSICS)

FOURTH SEMESTER M.Sc (PHYSICS) END SEMESTER MAKE UP EXAMINATION, MAY 2023

SUB: STATISTICAL MECHANICS (PHY- 6201)

(REVISED CREDIT SYSTEM)

TIME: 3 HRS. **DATE: 29-05-2023 (9-12 PM)** **MAX. MARKS: 50**

NOTE: ANSWER ALL QUESTIONS

		Marks	CO	BL
1A	What do you mean by entropy? Show that for a reverible process $(S_f - S_i) = C_V \log_e\left(\frac{P_f}{P_i}\right) + C_P \log_e\left(\frac{V_f}{V_i}\right)$ Where symbols have their usual meanings.	2+3= 5	1	1, 2
1B	1 g of water at 12^0C is converted into ice at -5 ^{0}C at constant pressure. Specific heat of 1 g of water is 1 and that of ice is 0.5. Latent heat of fusion of ice at ^{0}C =80. Calculate the total change in the entropy of the system.	5	2	2
2A	Obtain an expression for (C_p-C_v) in terms of isothermal Bulk Modulus (E_T) and coefficient of Volume Expansion α. Where symbols have their usual meanings.	5	3	2
2B	What is adiabatic demagnetization? Explain how it could be utilized to achieve ultralow temperatures? Discuss the process of adiabatic cooling with the help of entropy-temperature behaviour of paramagnetic specimen.	1+4= 5	2	1
3A	Show that "the density of systems in the neighborhood of some given system in phase space remains constant in time". i.e. $\frac{d\rho}{\partial t} = \frac{\partial \rho}{\partial t} + \sum_{i=1}^{f}\left(\frac{\partial \rho}{\partial q_i}\dot{q}_i + \frac{\partial \rho}{\partial p_i}\dot{p}_i\right) = 0$	5	3	2
3B	What are virial coefficients? explain. Obtain virial coefficients of van der walls equation of gases in terms of critical temperature (Tc) and critical pressure (p_c).	2+3=5	4	2
4A	Obtain the condition for particle distribution of an ideal gas in equilibrium using Maxwell-Boltzmann statistics.	5	4	1, 3
4B	What do you mean by 'Thermodynamic Probability'? Explain. What are the basic differences between classical and quantum statistics? Explain.	2+3=5	5	3

5A	Obtain Maxwell's four Thermodynamic relations.	5	5	2
5B	Calculate the pressure at which water would boil at 160°C, if the change in specific volume when 1 g of water converted into steam is 1676 cc. Given $1\,\text{cal} = 4.2 \times 10^7$ erg, 1 atm $= 10^6$ dyne cm^{-2} and specific latent heat of vaporization of steam is $540\,\text{cal}\,\text{g}^{-1}$.	5	4	2

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