BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSC **SEMESTER : III**
BRANCH: PHAYSICS **SESSION : MO/2022**

SUBJECT: PH201 THERMAL PHYSICS

TIME: 3:00 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Answer to the following questions should not exceed one sentence: i. If the macroscopic expression of pressure is $P = nRT/V$, how this macroscopic pressure is expressed microscopically? ii. Write an expression for the ratio of coefficient of volume expansion over isothermal compressibility. iii. How much kJ of work is required to raise the temperature of 1 Kg of water through $1^{\circ}\,\mathrm{C}$ as per James Joule theory of mechanical equivalent of heat *J* ? iv. Write an expression for the Joule coefficient μ_J for the free expansion of a gas. v. Write an expression for the Joule-Kelvin coefficient μ_{JK} for the throttling process.	[5]	CO1	2
Q.1(b)	Fill in the blanks with a few words only. i. The work done during isothermal processes is path_____. ii. The work done during adiabatic processes is path_____. iii. The coefficient of performance of any refrigerator_____as the temperature difference between the source and the surrounding increases. iv. In the thermodynamic square for the magnetic system volume is replaced by_____. v. In thermal Physics, especially in the study of transport and diffusion of molecules, flux of momentum is known as_____.	[5]	CO1	2
Q.2(a)	Write the name of scientist who coined the term *plasma* as a fourth state of matter. How this fourth phase can be represented on the typical PVT surface?	[5]	CO2	6
Q.2(b)	A paramagnetic salt is magnetized isothermally and reversibly from zero applied magnetic field to a final value of B_0. It obeys the Curie law $\chi_m = C/T$, where *C* is Curie constant and T is absolute temperature. Utilizing the function $S = S(T, B_0)$, show that the heat of magnetization is $Q = -\frac{CV}{T\mu_0}\frac{B_0^2}{2}$ where *S* and *V* is the volume of the salt and entropy of the thermodynamic system, respectively.	[5]	CO2	5
Q.3(a)	Develop the following Expression: $C_P - C_V = -T\left(\frac{\partial V}{\partial T}\right)_P^2\left(\frac{\partial P}{\partial V}\right)_T$	[5]	CO3	3
Q.3(b)	Estimate the final temperature, the work done, and the change in internal energy when 0.04 moles of CO at 25°C undergoes a reversible adiabatic expansion from 200 L to 800 L. The constant volume molar heat capacity of CO at 25°C is 20.16 J/mole-K.	[5]	CO3	5

PTO

Q.4(a)	Due to heterogeneity of mass, which transport property arises, develop the numerical expression for the same.	[5]	CO4	3
Q.4(b)	Demonstrate that the second order derivative of Maxwellian distribution function $\frac{d^2 f_v}{dv^2} < 0$, for the most probable speed.	[5]	CO4	2
Q.5(a)	What is the theory of the porous plus experiment and what do you understand by regenerative cooling?	[5]	CO5	1
Q.5(b)	Estimate all critical constants in terms of Van der Waal coefficients.	[5]	CO5	5

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