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

CLASS: BTECH **SEMESTER: III**
BRANCH: CHEMICAL **SESSION: MO/2022**

SUBJECT: CL201 THERMODYNAMICS

TIME: 2 HOURS **FULL MARKS: 25**

INSTRUCTIONS:
1. The total marks of the questions are 25.
2. Candidates attempt for all 25 marks.
3. Before attempting the question paper, be sure that you have got the correct question paper.
4. The missing data, if any, may be assumed suitably.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

				CO	BL
Q1	(a)	**Show** that the Gibbs energy serves as a generating function for the other thermodynamic properties	[2]	CO201.1	2
Q1	(b)	A gas which occupies a volume of 0.2 m^3 at a pressure of 1 bar is expanded to a final pressure of 7.0 bar. The pressure of the gas varies according to the relation P = (1200 V + b), where P is in kPa, V is in m^3 and b is a constant. **Apply** the First Law of Thermodynamics to find the work done by the gas.	[3]	CO201.2	3
Q2	(a)	**Relate** Joule Thomson co-efficient in the following expression $\mu = -\frac{1}{C_p}[V - T\left(\frac{\partial V}{\partial T}\right)_p]$	[2]	CO201.1	2
Q2	(b)	**How** would you obtain the Clapeyron equation from Maxwell's equations? What are the assumptions involved in the derivation of Clausius–Clapeyron equation from the Clapeyronequation?	[3]	CO201.1	1
Q3	(a)	**Show** that $dS = \frac{C_p}{T}dT + (\frac{\partial V}{\partial T})_P dP$	[2]	CO201.3	2
Q3	(b)	A 40 kg steel casting (C_p = 0.5 kJ/Kg/K) at a temperature of 450^{0}C is quenched in 150 kg of oil (C_p = 2.5 kJ/Kg/K) at 25^{0}C. If there are no heat losses to environment, **estimate** (i) equilibrium temperature (ii) change in entropy of the steel casting and write **opinion** on the obtained value	[3]	CO201.3	5
Q4	(a)	**List** the names of categories of equations coming under Bridgman table	[2]	CO201.1	1
Q4	(b)	Steam with initial pressure of 10,000 kPa, internal energy of 3211 kJ and enthalpy of 3375 kJ enters a throttle valve and expands to 33.68 times its initial volume. **Evaluate** initial volume, final volume, final pressure and final internal energy, if ΔU = -2 kJ.	[3]	CO201.3	5
Q5	(a)	**Demonstrate** $\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$	[2]	CO201.1	2
Q5	(b)	**Explain** any two Equations of State briefly and **relate** the reasons for the need of EOS	[3]	CO201.2	2

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