BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2025)

CLASS: BSc **SEMESTER : II**
BRANCH: CHEMISTRY **SESSION : SP/2025**

SUBJECT: BE210 THERMODYNAMICS OF CHEMICAL & BIOLOGICAL SYSTEMS

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	Write a short note on the Quasi-Static Process in Thermodynamics.	[2]	1	1
Q.1(b)	From the following properties/functions, categorize them into state functions, path functions, and intrinsic & extrinsic properties. Note: A property can belong to multiple categories. Properties/functions: Internal energy, enthalpy, Specific heat capacity, melting point, heat, temperature, work, refractive index	[3]	1	1,2
Q.2(a)	For a quasi-static process where PV = C, with n and C being constants. Calculate the PdV work (W) done during this process.	[2]	1	2
Q.2(b)	The temperature t on a thermometric scale is defined in terms of a property K by the relation t = a ln K + b; where a and b are constants. The values of K are found to be 1.83 and 6.78 at the ice point and the steam point, the temperatures of which are assigned the numbers 0 and 100 respectively. Determine the temperature corresponding to a reading of K equal to 2.42 on the thermometer.	[3]	1,2	3
Q.3	At the beginning of the compression stroke of a two-cylinder internal combustion engine the air is at a pressure of 101.325 kPa. Compression reduces the volume to 1/5 of its original volume, and the law of compression is given by $pv^{1.2}$ = constant. If the bore and the stroke of each cylinder is 15cm and 25cm, respectively, determine the power absorbed in kW by compression strokes when the engine speed is such that each cylinder undergoes 30000 compression strokes per hour.	[5]	1,2	4
Q.4(a)	Explain the concept of the critical point in the P-v and T-v diagrams of a pure substance.	[2]	2	1,2
Q.4(b)	A rigid vessel of volume 0.86 m^3 contains 1 kg of steam (liquid and vapor) at a pressure of 2 bar. Evaluate the dryness fraction, internal energy, enthalpy, and entropy of steam. Properties at 2 bar: T_{sat} = 120.2°C; v_f = 0.001061 m^3/kg; v_g = 0.885 m^3/kg; h_f = 504.7 kJ/kg; h_{fg} = 2201.6 kJ/kg; s_f = 1.5301 kJ/kg K; s_{fg} = 5.5967 kJ/kg K	[3]	2	3,4

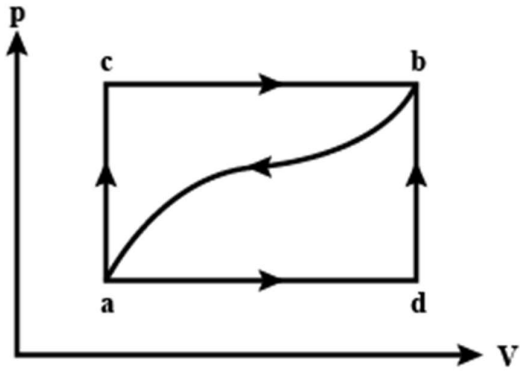
PTO

Q.5 When a system is taken from state *a* to state *b* along the path *acb* (see figure below), 84 kJ of heat flows into the system and the system does 32 kJ of work. [5] 2 3

(a) How much heat flows into the system along path *adb* if the work done by the system is 10.5 kJ?

(b) When the system is returned from *b* to *a* along the curved path, the work done on the system is 21 kJ. Does the system absorb or liberate heat, and how much?

(c) If $U_a = 0$ and $U_d = 42$ kJ, find the heat absorbed in the process *ad* and *db*.



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