Model Question Paper-2 with effect from 2019-20 (CBCS Scheme)

USN | | | | | | | | | | |

Fourth Semester B.E. Degree Examination
Subject Title: Chemical Engineering Thermodynamics

TIME: 03 Hours **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.
02. Use of steam table is permitted

		Module -1	*Bloom's Taxonomy Level	Marks
Q.01	a	Differentiate the following with examples i) Reversible and irreversible process ii) Sate and path functions Closed iii) Extensive property and Intensive property	L4	10
	b	Steam at a flow rate of 1500 kg/hr enters a nozzle at 15 bar, 600 c with a velocity of 30 m/s. It leaves the nozzle saturated at 1.5 bar. Evaluate the velocity and the diameter at the exit.	L5	14
		OR		
Q.02	a	With a neat sketch derive the equation for first law of thermodynamics for steady state flow process.	L2	10
	b	A spherical balloon of diameter 0.5m contains a gas at 1 bar and 300K. The gas is heated and the balloon is allowed to expand. The pressure inside the balloon is found to vary linearly with the diameter. What would be the work done by the gas when the pressure inside reaches 5 bar?	L3	10
		Module-2		
Q. 03	a	Develop an equation for work done and PVT relation for adiabatic process.	L4	10
	b	An ideal gas is undergoing a series of operations. The gas is heated at constant volume from 300k and 1 bar to a pressure of 2 bar. It is expanded in a reversible adiabatic process to a pressure of 1 bar. It is cooled at constant pressure of 1 bar to 300K. Determine the heat and works effect. C_p = 29.3 kJ/kmol K.	L3	10
		OR		
Q.04	a	One kg of air at 1 bar and 15 C is heated in a cylinder under constant pressure conditions to 150C .Find the final volume , the work done and the change in internal energy. (Cp= 0.992KJ/kg K).	L3	10
	b	Explain the following i) Vanderwaal's equation of state ii) Virial equation of state	L1	10
		Module-3		
Q. 05	a	Derive clausius clapeyron equation.	L3	10
	b	Explain reference, energy and derived properties with examples	L1	10
		OR		
Q. 06	a	Derive the relation between specific heat at constant pressure and constant volume.	L3	10

	b	Mercury has a density of 13.69 x 10^3 kg/m^3 in the liquid state and 14.193x 10^3 kg/m^3 in the solid state, both measured at the melting point of 234.33 K at 1 bar. If the heat of fusion of mercury is 9.7876 kJ/kg, what is the melting point of mercury at 10 bar.	L3	10
Module-4				
Q. 07	a	Define fugacity, activity and activity coefficient. Explain the effect of temperature on activity.	L1	12
	b	Explain partial molar properties.	L2	8
		OR		
Q. 08	a	Differentiate between ideal and non ideal solution.	L4	6
	b	Explain the effect of temperature and pressure on fugacity.	L2	14
		Module-5		
Q. 09	a	Evaluate the equilibrium constant at 298 K of the reaction N_2O_4 -> $2NO_2$ Given that the standard free energies of formation at 298 K are 97,540 J/mol for N_2O_4 and 51310J/mol for NO_2.	L6	10
	b	Derive Van't hoff equation.	L3	10
		OR		
Q. 10	a	Derive the relation between Gibbs free energy and Equilibrium constant.	L3	10
	b	Explain phase rule for reacting systems.	L2	10