Model Question Paper-1 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	Define the following with examples. i) Closed system ii) Isolated system iii) Extensive property and Intensive property	L2	10
	b	Water flows over a waterfall 100m in height. Consider 1 kg of the water and assume that no energy is exchanged between this 1 kg and its surroundings. Calculate the potential energy of the water at the top of the falls with respect to the base of the falls?	L3	10
		OR		
Q.02	a	Water is flowing in a straight insulated pipe of 25mm. There is a no device present for adding or removing energy as work. The upstream velocity is 10m/s. The water flows in a section where the diameter is suddenly increased. Calculate the change in enthalpy if the velocity at the downstream is 2.5 m/s?	L3	10
	b	Derive first law of thermodynamics for steady state flow process.	L2	6
	c	Differentiate between ideal and real gas	L4	4
		Module-2		
Q. 03	a	With a neat sketch explain PV diagram	L3 and L2	10
	b	Define the following: i) Isothermal compressibility ii) Volume of co-efficient expansion iii) compressibility factor iv) critical properties.	L1	10
		OR		
Q.04	a	Ten kilograms water at 375 K is mixed adiabatically with 30 kg water at 275 K. Evaluate the change in entropy? Assume that the specific heat of water is 4.2 KJ/kg K.	L5	10
	b	In a diesel cycle the atmosphere air at 300k and 1 bar is compressed reversibly and adibatically till the volume of the air reduces to 1/16 of the original value. Calculate the temperature and pressure of the air at the end of the compression and the amount of work done in compressing the gas. Treat air as an ideal gas.	L3	10
		Module-3		
Q. 05	a	Starting from fundamentals , derive Maxwells equation	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	L3	10

		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.		
		OR		
Q. 06	a	Derive Gibbs-Helmohtlz equation	L3	10
	b	Ether boils at 33.5 C at one atm pr. Evaluate its boiling point at 750 mm Hg of pressure. Given that latent heat of vaporization is 88.4 Cal/g. Mole.wt of ether is = 74	L3	10
Module-4				
Q. 07	a	Define chemical potential. Discuss the effect of temperature and pressure on chemical potential	L1	12
	b	Explain the following i) Fugacity ii) Activity iii) Henry' s law	L2	-8
		OR		
Q. 08	a	Differentiate ideal and non ideal solution	L4	10
	b	Derive Gibbs Duhems equation.	L3	10
		Module-5		
Q. 09	a	Evaluate the equilibrium constant at 298 K of the reaction $N_2O_4 \rightarrow 2NO_2$ 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	Explain the criteria for phase equilibria.	L2	10
		OR		
Q. 10	a	Develop the equation which relates equilibrium constant and Gibbs free energy.	L5	10
	b	Explain the Reaction Stoichiometry and Criteria of chemical reaction equilibrium	L2	10

*****Bloom's Taxonomy Level: Indicate as L1, L2, L3, L4, etc. It is also desirable to indicate the COs and POs to be attained by every bit of questions.