Model Question Paper-1 with effect from 2021-22 (CBCS Scheme)

Sixth Semester B.E. Degree Examination

Subject Title: Biochemical Thermodynamics and Bioenergetics

Time : 3 hours Max marks: 100

Note : Answer any FIVE full questions, choosing ONE full questions from each module					
Module-1					
1	a.	Define the following with suitable examples: (i) Closed and open system. Intensive and extensive properties	CO1	L1	10
	b.	Explain the carnot cycle with P-V coordinates and give the equation for efficiency of reversible heat engine.	CO1	L2	10
Or					
2	a.	A system consisting of some fluid is stirred in a tank. The rate of work done on the system by the stirrer is 2.25 hp. The heat generated due to stirring is dissipated to the surroundings. If the heat transferred to the surrounding is 3400 KJ/h, determine the change in internal energy.	CO1	L3	10
	b.	Derive first law of thermodynamics for steady state flow process	CO1	L2	10
Module-2					
3	a.	With a neat sketch, explain PVT behaviour of pure fluids.	CO2	L1	10
	b.	Derive the equation to calculate the workdone in an adiabatic process from fundamental	CO2	L2	10
Or					
4	a.	Prove that Cp-Cv = R	CO3	L2	10
	b.	Write a note on law of corresponding states and compressibility factor chart	CO3	L2	10
Module-3					
5	a.	Derive the Maxwell's equation, from thermodynamics.	CO4	L2	10
	b.	Calculate the fugacity of liquid water at 303 K and 10 bar if the saturation pressure at 303 K is 4.241 KPa and the specific volume of liquid water at 303 K is 1.004 □10^{-3} m^3/kg.	CO4	L3	10
Or					
6	a.	Differentiate between reference properties, energy properties and derived properties.	CO4	L2	10
	b.	Explain the effect of temperature and pressure on fugacity	CO4	L2	10
Module-4					
7	a.	Derive Gibbs Duhem equation and static its uses	CO5	L3	10
	b.	Define chemical potential and derive an expression to show how it varies with temperature and pressure	CO5	L1	10
Or					
8	a.	Briefly explain Azeotropes with suitable systems and VLE plots.	CO5	L2	10
	b.	Explain consistency test for VLE (Vapour Liquid Equilibria) data using slope of ln□ curves	CO5	L3	10
Module-5					
9	a.	A gas mixture containing 3 mol CO_2, 5 mol H_2 and 1 mol water is undergoing the followingreactions:	CO5	L3	10

		CO_2 □ $3H_2$ □ CH_3OH □ H_2O CO_2 □ H_2 □ CO □ H_2O Develop expressions for the mole fraction of the species in terms of the extent of reaction.			
	b.	Show that equilibrium constant and standard free energy change is given by □G$^{\llcorner}$ □ □RT*l*nK	CO5	L4	10
		Or			
10	a.	The standard heat of formation and standard free energy of formation of ammonia at 298 K are □ 46,100 J/mol and 16,500 J/mol respectively. Calculate the equilibrium constant for the reaction, N2 (g) + 3H2 (g) → 2NH3 (g) at 500 K assuming that the standard heat of reaction is constant in the temp range 298 to 500 K.	CO5	L4	10
	b.	Discuss heterogeneous reaction equilibria for, (i) Reactions in solutions and Equilibria involving pure solids and liquids.	CO5	L3	10