Reg. No. : | | | | | | | | | | |

Question Paper Code: 93D04

B.E./B.Tech. DEGREE EXAMINATION, DEC 2021

Third Semester

Bio technology

19UBT304- Applied Thermodynamics for Biotechnologists

(Regulation 2019)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1.	A system consisting of some fluid is stirred in a tank. The rate of work done on the system by the stirrer is 2.25hp. The heat generated due to stirring is dissipated to the surroundings. If the heat transferred to the surroundings is 3400 KJ/h, determine the change in internal energy.	CO2- App
2.	Determine the molecular volume of any perfect gas at 600 N/m^2 and 30°C.	CO2- App
3.	Calculate the Specific weight, density, specific gravity of one liter of liquid which weighs 7N.	CO2 App
4.	Calculate the density, specific weight and weight of one liter of petrol of specific gravity is 0.7.	CO2 App
5.	Determine the change in enthalpy when 2 kg of gas at 277K is heated at constant volume to a temperature of 368K. Take the specific heat at constant volume is 1.42 KJ/Kg.K	CO2- App
6.	Calculate the entropy change when 1 Kmol of an ideal gas at 300K and 10 bar expands through a throttle to a pressure of 1 bar, both pressure being maintained constant during the process by suitable means.	CO2-App
7.	State Gibbs phase rule of pure substance.	CO1- U
8.	Define Rauolts Law and also the assumptions.	CO1- U
9.	State the criterion of chemical reaction equilibrium	CO1- R
10.	What is stoichiometric coefficient?	CO1- R

PART – B (5 x 16= 80 Marks)

11.	(a)	An ideal gas is undergoing a series of three operations, if the gas is heated from constant volume at 300K and at 1 bar to a pressure of 2 bars. Determine the heat for each steps.	CO2- App	(16)
		Or		
	(b)	90 kJ of heat is supplied to a system at a constant volume. The system rejects 95 kJ of heat at constant pressure and 18 kJ of work is done on it. The system is brought to original state by adiabatic process. Determine (i) The adiabatic work (ii) The values of internal energy at all states if initial value is 105 kJ.	CO2- App	(16)
12.	(a)	Calculate the pressure developed by 1 kmol gaseous ammonia contained in a vessel of 0.6 m^3 capacity at a constant temperature of 473 K by the following methods (i) Using the ideal gas equation (ii) using the vander waals equation of state given that a= 0.4233 Nm^4/mol^2 b=3.73x10^{-5} m^3/mol (iii) Using the Redlich-Kwong equation given that P_c = 112.8 bar and T_c= 405.5 K.	CO2- App	(16)
		Or		
	(b)	Determine the molar volume of gaseous methane at 300K and 600 bar by the following methods (i)Using the ideal gas equation (ii) Using the Van der waals equation given that a= 0.2285 Nm^4/mol^2 b=4.27x10^{-5} m^3/mol (iii) Using the Redlich-Kwong equation given that P_c = 46.4 bar and T_c= 191.1 K.	CO2- App	(16)
13.	(a)	(i) Explain briefly about carnot theorem.	CO1- U	(8)
		(ii) Derive an expression for Entropy change of ideal gas in a closed system in terms of pressure, temperature, volume relations.	CO1- U	(8)
		Or		
	(b)	(i) Derive the Maxwell relations and explain their importance in thermodynamics	CO1- U	(8)
		(ii) Derive an expression for the entropy change for a Real gas.	CO1- U	(8)

14.	(a)	Describe the methods used for testing the thermodynamic consistency of experimentally determined vapor-liquid equilibrium data for binary systems.	CO1- U	(16)
		Or		
	(b)	Derive the Gibbs-Duhem equation and their applications in solution thermodynamics.	CO1- U	(16)
15.	(a)	Derive the equation relating equilibrium constant and standard free energy change.	CO1- U	(16)
		Or		
	(b)	Discuss in detail about criteria for homogenous chemical reactions and equilibrium constants for gas and liquid phase reactions.	CO1- U	(16)