Model Question Paper-1 with effect from 2022 (CBCS Scheme)

USN

Fourth Semester B.E. Degree Examination

Bioprocess Principles &Stoichiometry

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

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

		Module -1	***Bloom's Taxonomy Level**	**Marks**
Q.01	a	A chemist is interested in preparing 500ml of 1normal, 1molar and 1 molal solution of H2SO4. Assuming the density of H2SO4 solution to be 1.075gm/cc,calculate the quantitiesofH2SO4 to be taken to prepare the above solutions	L1	10
	b	A mixture of N2 and CO2at 298K and 101.325KPa has an average molecular weight of 31. Find the mole% of N2 and CO2 Also find the partial pressure of N2.	L2,	10
		OR		

Q.02	a	A product gas from a reaction has the composition by weight. Cl_2—67%, Br_2—28%, O_2—5%, using the ideal gas law calculate
		  i. the composition of gas by volume
		  ii. the density of the mixture in g/L at 25°C
		  iii. Specific gravity of the mixture.
		  iv. Average molecular weight of the mixture.
			L2	08

	b	A compound whose molecular weight is 103, analyses C—81.5%, H2—4.9% and N2—13.6%. What is its molecular formula?	L2	08
	c	What is the molarity of a solution containing 8g of EDTA in 300 cm^3 of it?	L1	04
		Module-2		
Q. 03	a	Feed containing 50% of benzene and 50% of toluene is fed to the distillation column at a rate of 5,000 kg/hr. Distillate contains 95% benzene and bottom product contains 92% toluene. All percentages are by weight percentage. I. Calculate the mass flow rate of distillate and bottom product % Recovery of Benzene	L3	10
	b	2000kg of wet solids by weight containing 70% solid by weight are fed to a tray drier and is dried by hot air.The product finally obtained is found to contain 1% moisture and 99% solids by weight. Calculate i) kg of water removed from wet solids ii) kg of product obtained	L3	10
OR				
Q.04	a	A liquid adhesive, which is used to make laminated boards, consists of a polymerdissolved in a solvent. The amount of polymer in the solution has to be carefully controlled for this application. When the supplier of the adhesive receives an order for 3000 kg of an adhesivesolution containing 13 wt % polymer, all it has on hand is (1) 500 kg of a 10 wt % solution, (2) avery large quantity of a 20 wt % solution, and (3) pure solvent. Calculate the weight of each of the three stocks that must be blended together to fill the order.	L3	12

	b	A single effect evaporator is fed with 10000 kg / h of weak liquor containing 15 % caustic by weight and is concentrated to get thick liquor containing 40 % by weight caustic. Calculate: (a) kg / h of water evaporated and (b) kg / h of thick liquor	L3	08
Module-3				
Q. 05	a	Explain the importance of recycle and bypass using block diagram.	L2	08
	b	Fresh juice contains 12% solids & the rest water. It is concentrated to contain 42% solids. The evaporator is bypassed with a fraction of fresh juice. Juice that enters the evaporator is concentrated to 58% solids and is mixed with bypassed juice to achieve the desired concentration. Calculate the amount of concentrated juice per kg of fresh juice.	L2,L3	12
OR				
Q. 06	a	The gross heating value of gaseous propane (C_3H_8 at 298 K is 2219.5 kJ/mol. Calculate its net heating value considering latent heat of water vapour at 298K is 2442.5 kJ/kg obtain the amount of water from reduction.	L3	08
	b	Write a note on types and characteristics of fuels and biofuels	L1	12
Module-4				
Q. 07	a	Define the following i) Heat of reaction ii) Heat of formation iii) Heat of combustion	L1	03
	b	The temperature of O_2 is raised from 350 K to 1500K. Calculate the amount of heat that must be supplied for raising the temperature of 1 kmol of O_2 using C_p data given. $C_p = 26.0257 + 11.7551 \times 10^{-3}$ T $- 2.3426 \times 10^{-6}$ T^2 $- 0.5623 \times 10^{-9}$ T^3 kJ/mol K.	L2,	10
	c	Calculate the heat of formation of methane gas from the following heat of combustion data. $CH_4(g) + 2O_2 (g) \longrightarrow CO_2(g) + 2H_2O$ (l) $\Delta H_{298} = -890.94$ kJ $C(g) + O_2 (g) \longrightarrow CO_2(g)$ $\Delta H_{298} = -393.78$ kJ $H_2(g) + 1/2O_2 (g) \longrightarrow H_2O(l)$ $\Delta H_{298} = -286.03$ kJ	L3	07
OR				
Q. 08	a	A stream flowing at a rate of 15000 mol/hr containing 25 mol% N_2 and 75 mol% H_2 is to be heated from 298 K to 473 K. Calculate the that must be transferred using Cp data given below, $C_p = a + bT + cT^2 + dT^3$ kJ/mol K 	Gas	a	b x 10^{-3}	C x10^{-6}	d x 10^{-9}	 	---	---	---	---	---	 	N_2	29.5909	-5.41	13.1829	-4.968	 	H_2	28.6105	1.0194	-0.1476	0.769		L3	10
	b	Calculate the standard heat of formation of n-propanol liquid using the following data: Standard heat of formation of $CO_2(g)$ = -393.51 kJ/mol Standard heat of formation of H_2O= -285.83 kJ/mol Standard heat of Combustion of n-propanol[C_3H_7OH] (l) = -2028.19 kJ/mol	L2	10
Module-5				
Q. 09	a	Explain the different downstream process involved in production of Ethanol.	L2	10
	b	Write a note on development of bioprocess technology.	L1	10
OR				
Q. 10	a	Assume that experimental measurements for a certain organism have shown that cellscan convert two-thirds (wt/wt) of the substrate carbon to biomass.i) Calculate the stoichiometric coefficients for the following biological C6H12O6 +aO2 + bNH3 --→ c (C4.4H7.3 N0.86 O.1.2) +dH2O +eCO2 ii) Calculate the yield coefficients Y X/S(g dw cell/g substrate), YX/O(g dw cell/gsubstrate) for both reactions	L3	10

	b	Explain the different downstream process involved in production of Pencillin.	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.