

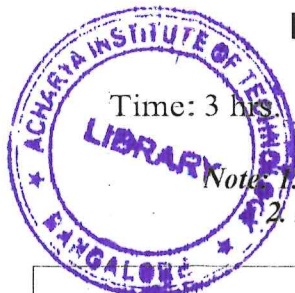
CBCS SCHEME

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BBT405C

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2026 Bioprocess Principles and Stoichiometry



Time: 3 hrs

Max. Marks: 100

*Notes: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks, L: Bloom's level, C: Course outcomes.*

Module – 1			M	L	C
Q.1	a.	The density of the liquid is 1500 kg/m^3 , what is the specific gravity? What volume does 140 pounds of this material will occupy?	8	L1	CO1
	b.	A chemist is interested in preparing 500 ml of 1 normal, 1 molar and 1 molal solution of H_2SO_4 . Assuming the density of H_2SO_4 to be 1.075 g/cm^3 . Calculate the quantities of H_2SO_4 to be taken to prepare the above solutions.	12	L2	CO1
OR					
Q.2	a.	A mixture of N_2 and CO_2 at 298 K and 101.325 KPa has an average molecular weight of 31. Find the mol % of N_2 and CO_2 . Also find the partial pressure of N_2 .	8	L2	CO1
	b.	A compound whose molecular weight is 103, analysis C – 81.5 %, H_2 – 4.9 % and N_2 – 13.6 %. What is its molecular formula?	8	L2	CO1
	c.	What is the molarity of a solution containing 8 g of EDTA in 300 cm^3 of it?	4	L1	CO1
Module – 2					
Q.3	a.	5000 kg/h of a 50 wt. % benzene and 50 wt % toluene is fed to a distillation column. Distillate contains 95 % benzene and bottom 92 % toluene. Calculate distillate and bottom flow rates.	10	L3	CO2
	b.	2000 kg of wet solids (70% solids) are dried to 99 % solids. Calculate i) kg of water removed ii) kg of dry product.	10	L3	CO2
OR					
Q.4	a.	A liquid adhesive supplier has 500 kg of 10 wt % polymer solution and unlimited 20 wt % polymer solution and solvent. Calculate quantities needed to prepare 3000 kg of 13 wt % solution.	10	L3	CO2
	b.	A single effect evaporator concentrates weak liquor (15 % caustic) to thick liquor (40% caustic). Find water evaporated and thick liquid produced per hour, for 10000 kg/h feed.	10	L3	CO2
Module – 3					
Q.5	a.	Explain the importance of recycle Bypass and Purge using block diagram.	8	L2	CO3

	b.	Fresh juice contains 12% solids and the rest water. It is concentrated to 42% solids. The evaporator is by passed with a fraction of fresh juice. Juice that enters the evaporator is concentrated to 58% solids and is mixed with by passed juice to achieve the desired concentration. Calculate the kg of concentrated juice per kg of fresh juice.	12	L3	CO3
OR					
Q.6	a.	A sample of coal contains 84 % carbon , 6 % hydrogen , 8 % oxygen and 2 % ash. Calculate the theoretical air required for complete combustion per kg of coal.	10	L3	CO3
	b.	Briefly explain the classification and characteristics of fuels and biofuels.	10	L2	CO3
Module – 4					
Q.7	a.	Define the following : i) Heat of Reaction ii) Heat of formation iii) Heat of combustion.	3	L1	CO4
	b.	Oxygen is heated from 350 K and 1500 K. Find the heat supplied for 1 K mol O ₂ using Cp data : $C_p = 26.0257 + 11.7551 \times 10^{-3} T - 2.3426 \times 10^{-6} T^2 - 0.5623 \times 10^{-9} T^3$ kJ/mol.K	10	L2	CO4
	c.	Calculate the heat of formation of CO gas , given $C + \frac{1}{2} O_2 \rightarrow CO$; $\Delta H_c (C) = -393.5 \text{ kJ/mol}$; $\Delta H_c (CO) = -1105 \text{ kJ/mol}$	7	L3	CO4
OR					
Q.8	a.	Air is heated from 300 K to 600 K at constant pressure. Calculate the amount of heat required for 1 Kmol of air, assuming air has constant $C_p = 29.3 \text{ kJ/ Kmol. K}$.	10	L3	CO4
	b.	Calculate the standard heat of formation of n – Propanol liquid using following data : $\Delta H_f (CO_2)_{(g)} = -393.51 \text{ kJ/mol}$. $\Delta H_f (H_2O)_{(l)} = -285.83 \text{ kJ/mol}$; $\Delta H_c (C_3H_7OH)_{(l)} = -2028.19 \text{ kJ/mol}$.	10	L3	CO4
Module – 5					
Q.9	a.	Enumerate the downstream process steps involved in the ethanol production.	10	L4	CO5
	b.	Write a short note on development of Bioprocess technology.	10	L4	CO5
OR					
Q.10	a.	Assume the experimental measurements for a certain organism have shown that cells can convert two – thirds (wt / wt) of the substrate carbon to biomass i) Calculate the stoichiometric co-efficients for the following reactions. $C_6H_{12}O_6 + aO_2 + bNH_3 \rightarrow c(C_{4.4} H_{7.3} N_{0.86} O_{1.2}) + dH_2O + eCO_2$ ii) Calculate $Y_{x/s}$ and Y_{x/O_2}	10	L4	CO5
	b.	Enumerate downstream processing steps for Penicillin production with a suitable schematic representation.	10	L4	CO5