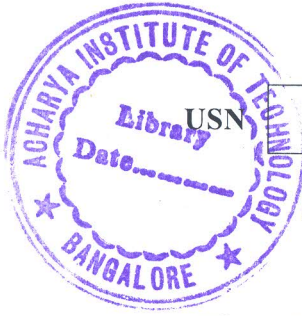


CBCS SCHEME



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17BT44

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020 Bioprocess Principles and Calculations

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Calculate the equivalent moles of Na_2SO_4 in 1288gm of $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ crystals. (05 Marks)
- b. Define the following:
 - i) Normality
 - ii) Molarity
 - iii) Molality
 - iv) PPM. (08 Marks)
- c. Prove that pressure % = mole % = volume %. (07 Marks)

OR

- 2 a. A gas mixture contain 0.28 kg mole of HCl , 0.34 kmol of N_2 and 0.09 kg mol of O_2 . Calculate: i) Average molecular weight ii) Volume occupied by this mixture at 4 atm and 303K. (08 Marks)
- b. Write the material balance equation for the following and represent the operation with sketch i) distillation ii) evaporation iii) extraction iv) crystallization. (12 Marks)

Module-2

- 3 a. A feed to continuous fractionating column analyze be weight, 28% benzene and 72% toluene. The analysis of distillate shows 52% benze and 5% wt benzene was found in the bottom product. Calculate the amount of distillate and bottom product per 1000kg of feed per hour. Calculate the percentage recovery of benzene. (12 Marks)
- b. A evaporator is fed with 4000 kg/h of weak liquor containing 17% Caustic by weight is concentrated to get thick liquor containing 40% by weight caustic (NaOH), Calculate: i) Amount of water evaporated ii) Amount of thick liquor obtained. (08 Marks)

OR

- 4 a. How do you classify fuels based on physical state? Explain with example. (06 Marks)
- b. Write a note on calorific value of fuels. (04 Marks)
- c. A coke contains 85% carbon and 15% non-combustible material by weight, calculate:
 - i) The amount of oxygen theoretically required to burn 120kg of coke completely
 - ii) The composition of gases in the product stream if 60% of excess air supplied. (10 Marks)

Module-3

- 5 a. Write a note on Recycle and by pass operation. (06 Marks)
- b. Calcium oxide is formed by decomposing limestone pure CaCO_3 . In Kiln, the reaction goes to 70% completion.
 - i) What is the composition of solid product withdrawn from Kiln?
 - ii) What is the yield in kg of CO_2 to produce per kg of limestone charged? (14 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 6 a. Define the following:
- Limiting reactant
 - Excess reactant
 - Percentage of excess reactant
 - Percentage conversion
 - Selectivity.
- (10 Marks)
- b. In production of SO_3 , 50 kg mol of SO_2 and 100kg mol of O_2 are fed to the reactor. The product stream is found to contain 40kg mol of SO_3 . Determine the percentage of conversion.
- (10 Marks)

Module-4

- 7 a. Define the following:
- Heat of formation
 - Heat of reaction
 - Standard Heat of reaction
 - Heat of solution
 - Heat of mixing.
- (10 Marks)
- b. Calculate the standard heat of reaction when gaseous NH_3 is dissolved in water to form 3% by weight of solution:

Component	ΔH_f° (k cal/mol)
$\text{NH}_3(\text{g})$	-11.93
$\text{NH}_4\text{OH}(\text{l})$	-86.26
$\text{H}_2\text{O}(\text{l})$	-68.26

(10 Marks)

OR

- 8 Obtain an empirical equation for calculating the heat of reaction at any temperature 'T' for the following reaction $\text{CO}(\text{g}) + 2\text{H}_2(\text{g}) \rightarrow \text{CH}_3\text{OH}(\text{g})$
- $\Delta H_R^\circ = -21.59 \text{ Kcal/mol}$
- $C_p = a + bT + cT^2 + dT^3 \text{ cal/mol K}$

Component	a	$b \times 10^3$	$c \times 10^6$	$d \times 10^9$
$\text{CO}(\text{g})$	29.03	-2.82	11.64	-4.71
$\text{H}_2(\text{g})$	28.61	1.02	-0.51	0.77
$\text{CH}_3\text{OH}(\text{g})$	21.14	70.84	25.87	-28.50

(20 Marks)

Module-5

- 9 a. Explain the History and development of bioprocess technology, mentioning important contributions.
- (10 Marks)
- b. Explain bioprocess principles and generalized process flow sheet.
- (10 Marks)

OR

- 10 a. Discuss various upstream and down stream involved in biotechnology.
- (14 Marks)
- b. Explain the theory of microbial growth and product formation.
- (06 Marks)
