

**VIT[®]**Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

REG.NO:

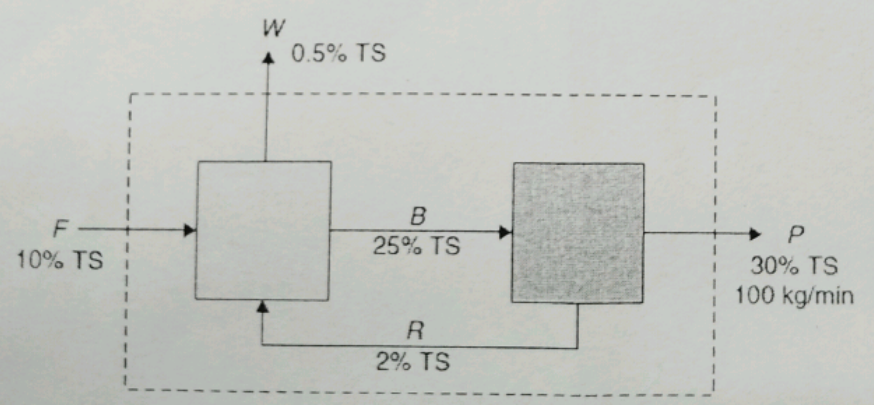
**SCHOOL OF BIO SCIENCES AND TECHNOLOGY
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2024-2025**

SLOT: F1+TF1

Programme Name & Branch : B.Tech & Biotechnology
Course Code and Course Name : Principles of Chemical Engineering & BBIT201L
Faculty Name(s) : Dr. V. Shanthi and Dr. Dhanya V
Class Number(s) : VL2024250101094 & VL2024250101092
Date of Examination : 18-Oct-2024
Exam Duration : 90 minutes
Maximum Marks: 50

General instruction(s):

- Answer All Questions
- M - Max mark; CO - Course Outcome; BL - Blooms Taxonomy Level (1 - Remember, 2 - Understand, 3 - Apply, 4 - Analyse, 5 - Evaluate, 6 - Create)
- Course Outcomes
CO2: Summarize the material balances of biochemical processes and equipment.
CO3: Develop the energy balance calculations for various processes in chemical engineering.
CO4: Solve problems involving recycle, purge and bypass in a process or unit.
CO5: Asses different non-dimensional numbers and relating the variables using theorems.

Q. No	Questions	M	CO	BL
1.	A membrane separation system is used to concentrate total solids (TS) in a liquid food from 10% to 30%. The concentration is accomplished in two stages with the first stage resulting in release of a low-total-solids liquid stream. The second stage separates the final concentration product from a low-total-solids stream, which is returned to the first stage. Determine the magnitude of the recycle stream when the recycle contains 2% TS, the waste stream contains 0.5% TS, and the stream between stages 1 and 2 contains 25% TS. The process should produce 100 kg/min of 30% TS. 	10	4	5
2.	Ethylene dichloride is manufactured by the oxychlorination of ethylene: $2\text{C}_2\text{H}_4 + 4\text{HCl} + \text{O}_2 \rightarrow 2\text{C}_2\text{H}_4\text{Cl}_2 + 2\text{H}_2\text{O}$	10	3	3

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	Though ethylene and air are supplied respectively. 5% and 10% in excess over those required for the complete conversion of hydrogen chloride, the conversion attained is found to be only 90%. For 500 kmol of HCl supplied, calculate the following: a. The moles of the reactant and products b. The mass of reactants and products c. The composition of the reactant stream in weight percent. d. The composition of the product stream in weight percent			
3.	Pure ethylene is heated from 30°C to 250°C at a constant pressure. Calculate the heat added per kmole $C_p = 2.83 + 28.601 \times 10^{-3}T - 87.26 \times 10^{-7}T^2$ where C_p is in kcal/kmole K and T in K	10	2	4
4.	Internal energy is a thermodynamic property whereas kinetic and potential energy are not a thermodynamic property-Justify the statement. Show by dimensional analysis that the equation: $p + \frac{1}{2} \rho v^2 + \rho g z = H$ is a possible relationship between pressure p, velocity v, and height z for a frictionless flow along a streamline of a fluid of density ρ , and determine the dimension of H	2 8	5	2
5.	The enthalpy of combustion of glucose $C_6H_{12}O_6$ (s) is $-2816 \text{ kJ mol}^{-1}$ at 25° C. Calculate ΔH_f° $C_6H_{12}O_6$. The H_f° values for CO_2 (g) and H_2O (l) are -393.5 and $-285.9 \text{ kJ mol}^{-1}$, respectively. $C_6H_{12}O_6(s) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(l)$	10	3	5
