REG.NO.:

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

SCHOOL OF CHEMICAL ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2024-2025

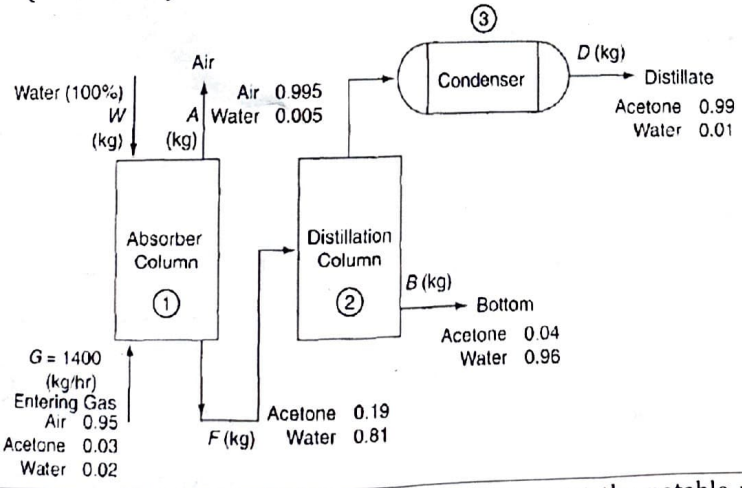
SLOT: A1+TA1+TAA1

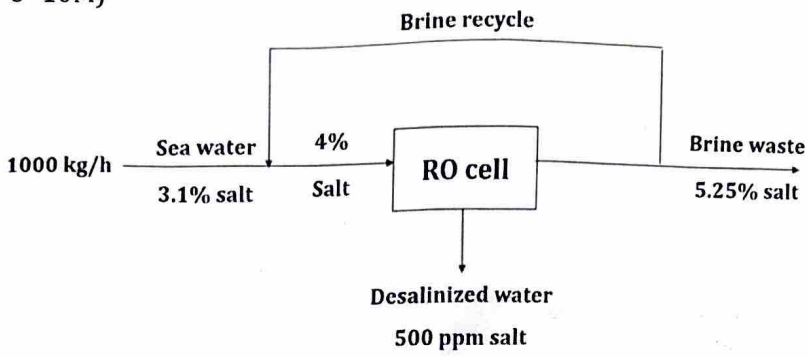
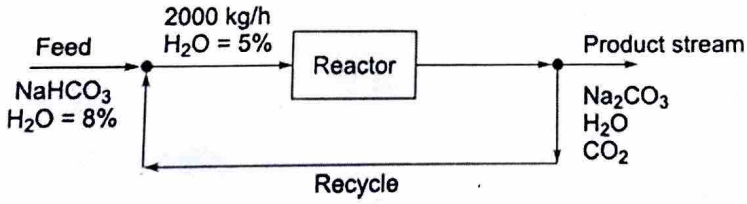
Programme Name & Branch	**: B.Tech Chemical Engineering**
Course Code and Course Name	**: BCHE203L and Chemical Process Calculations**
Faculty Name(s)	**: Dr. Shishir Kumar Behera (15296)**
Class Number(s)	**: VL2024250102651**
Date of Examination	**: 13.10.2024**
Exam Duration	**: 90 minutes**

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. Understand the method of solving steady state material balances without chemical reactions.
  CO3. Estimate the extent of reaction in material balances for systems involving chemical reactions.
  CO4. Analyze the recycle and bypass processes involving chemical reactions.

Q. No	Question	M	CO	BL
1.	In order to meet the requirement of Na_2CO_3 in a glass manufacturing company, 1000 kg of solution containing 30% Na_2CO_3 is subjected to evaporative cooling, during which 20% of the water present in the solution is evaporated. From the concentrated solution Na_2CO_3, $10H_2O$ crystallizes out. Calculate the amount of crystals that would be produced if the solubility of Na_2CO_3, $10H_2O$ is 21.5 gm per 100 gm of water.	10	2	3
2.	Acetone is used in the manufacture of many chemicals and also as a solvent. However, during the use as a solvent, many restrictions are placed on the release of acetone to the environment. You are asked to design an acetone recovery system using the flow sheet given in the Figure. All the compositions for both gases and liquids are specified in weight%. Calculate the amount of water entering to the absorber (W), air leaving the absorber (A), feed to the distillation column (F), bottom product (B) and top product (D) obtained from the distillation column per hour. (5×2M=10M) 	10	2	3
3.	Sea water is desalinized by reverse osmosis (RO) to meet the potable water requirement in a company. Using the data given in the figure, determine: (a) the rate of brine waste removal; (b) the rate of desalinized water (potable water)	10	2	3

	production; and (c) the fraction of the brine leaving the RO cell that is recycled. (3+2+5=10M)  			
4.	The catalytic vapor-phase chlorination of CS_2 gives carbon tetrachloride: $CS_2 + 3Cl_2 \longrightarrow CCl_4 + S_2Cl_2$ The products leaving the converter is analyzed as: 26% CCl_4, 26% S_2Cl_2, 17.5% CS_2, and 30.5% Cl_2. Determine the following: (a) Identify the excess reactant and the percent excess. (4M) (b) Percentage conversion. (4M) (c) Quantity of CCl_4 obtained (in kg) per 100 kg of chlorine admitted. (2M)	10	3	3
5.	Soda ash (Na_2CO_3) is often used to soften water by removing the hardness causing agents such as calcium and magnesium from water. The stoichiometry of soda ash manufacture is given as: $2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$  For the sake of feasibility analysis, wet $NaHCO_3$ containing 8% water was pre-mixed with recycled dry soda ash so as to reduce the water content to 5% before introducing into the reactor. The reactor was fed with 2000 kg of wet $NaHCO_3$ per hour. Calculate (a) Quantity of soda ash produced per hour as the final product; and (b) Quantity of soda ash recycled per hour. (5+5=10M)	10	4	3

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