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

SCHOOL OF CHEMICAL ENGINEERING
CONTINUOUS ASSESSMENT TEST - I
WINTER SEMESTE R 2025-2026

SLOT:A1+TA1+TAA1

Programme Name & Branch	:	**B Tech Chemical Engineering**
Course Code	:	**BACHE102**
Course Name	:	**Chemical Process Calculations**
Faculty Name(s)	:	**Dr. Mahesh Ganesapillai**
Class Number(s)	:	**VL 2025 26050 3965**
Exam Duration	: **90 minutes**	**Maximum Marks: 50**

General instruction(s):

- **Data book /conversion chart is permitted**
- **Assume relevant missing data**

Q. No	Question	Marks	Course Outcome (CO)	Bloom's Taxonomy (BL)
1.	A concentrated aqueous solution of hydrochloric acid (HCl) has a specific gravity of 1.18 and contains 36% (w/w) HCl. The molar mass of HCl is 36.5 g mol^{-1}. (a) Calculate the density of the HCl solution in g mL^{-1}. (b) Determine the molarity (M) of the concentrated HCl. (c) Calculate the normality (N) of the solution. (d) Find the molality (m) of the HCl solution.	10	1	2
2.	A gas mixture used in an industrial reactor contains Component — Mass Nitrogen (N_2) — 2.8 lb Oxygen (O_2) — 1.6 kg Carbon dioxide (CO_2) — 900 lb Methane (CH_4) — 0.5 kg Argon (Ar) — 200 g (a) Convert all component masses to kg and calculate the total mass of the mixture. (b) Determine the mass fraction and mole fraction of each component.	10	1	2

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3.	An aqueous solution containing acetone is treated in a single-stage liquid–liquid extractor using methyl isobutyl ketone (MIBK) as the solvent. - Feed to the extractor: 2.5 m^3/h of aqueous solution - Acetone concentration in feed: 8 wt% - Density of aqueous feed: 1000 kg/m^3 - Solvent flow rate: 1800 kg/h (pure MIBK) During extraction, it is observed experimentally that 70% of the acetone entering the extractor is transferred to the solvent phase. (a) Convert the aqueous feed flow rate from m^3/h to kg/h. (b) Calculate the mass flow rate of acetone entering the extractor. (c) Determine the mass flow rate of acetone in the solvent (extract) phase and in the aqueous raffinate. (d) Calculate the weight percent of acetone remaining in the aqueous raffinate.	10	3	3
4.	An evaporator is fed continuously with 50000 kg/h of a solution containing 10% NaOH, 10% NaCl, and the rest water by weight. During evaporation, water is removed as vapour and salt NaCl precipitates as crystals and is removed by filtration. The concentrated liquor leaving the evaporator contains 50% NaOH, 2% NaCl, and the rest water. Determine (a) the mass of water evaporated per hour; (b) the mass of salt precipitated per hour; (c) the mass of concentrated liquor produced per hour	10	3	3
5.	It is required to make 1000 kg mixed acid containing 60% H2SO4, 32% HNO3 and 8% water by blending (i) spent acid containing 10% HNO3, 50% H2SO4, 40% H2O (ii) aqueous 90% HNO3 (iii) aqueous 98% H2SO4. All percentages are by weight. Calculate the quantities of each of three acids required for blending.	10	3	3