

**VIT**Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)**SCHOOL OF CHEMICAL ENGINEERING
CONTINUOUS ASSESSMENT TEST -II
WINTER SEMESTER 2025-2026****SLOT:A 1 +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

Maximum Marks: 50 General Instruction(s):

Q.No.	Question	Max. Marks	CO	BL
1	An air (B)-water (A) sample has a dry bulb temperature 55°C and an absolute humidity 0.030 kg water/kg dry air at 1 std. atm pressure. Calculate: (i) The percentage humidity (ii) The molal absolute humidity (iii) The partial pressure of water vapour in the sample (iv) The relative humidity (v) Dew point (vi) Humid volume (vii) Humid heat (viii) Enthalpy.	10	2	1
2	Fresh juice contains 15% solids and 85% water by weight and is to be concentrated to contain 40% solids by weight. In a single-stage evaporation system, it is found that volatile constituents of juice escape with water leaving the concentrated juice with a flat taste. To overcome this problem, part of the fresh juice bypasses the evaporator. Input: Fresh juice (100 kg, 15% solids) splits into two streams. Stream 1: Enters an Evaporator. Evaporator Output: 55% Solid stream and <u>another stream that combines with the bypass juice.</u> Stream 2: Bypass juice (15% solids). Final Output: Concentrated Juice (40% solids). Calculate: a) The fraction of juice that bypasses the evaporator. b) The concentrated juice produced (containing 40% solids) per 100 kg of fresh juice fed to the process.	10	2	2

3	A limestone analysis is shown as $\text{CaCO}_3 = 91.89\%$, $\text{MgCO}_3 = 6.41\%$, Insoluble = 1.70% (all percentages are by weight). - How many pounds of CaO can be made from 8 tonnes of this limestone? - How many kilograms of CO_2 can be recovered per 20 kg of limestone? - How many grams of limestone are needed to make 200 pounds of lime?	10	4	3
4	In a thermal power plant, coal containing C = 88%, H = 7%, S = 0.4%, O = 2.4%, N = 2.2% and of gross calorific value of 40,000 kJ/kg and specific gravity 1.1 is burnt with air at a rate of 50 kg/h. Assuming that 30% excess air is used and the combustion is complete, Calculate: - The volume of air at NTP supplied to the burner per hour. - The volume of the resulting product of combustion per hour at 750°C. - The volumetric composition of combustion product.	10	4	3
5	The Oxidation of ethylene to produce ethylene oxide proceeds according to the equation $\text{C}_2\text{H}_4 + \text{O}_2 \rightarrow \text{C}_2\text{H}_4\text{O}$ The feed in the reactor contains 200 kmol C_2H_4 and 200 kmol O_2. - Which reactant is limiting? - What is the percentage excess of the other reactant? - If the reaction proceeds to completion, how much of the excess reactant will be left; how much $\text{C}_2\text{H}_4\text{O}$ will be formed and what is the extent of the reaction? - If the reaction proceeds to a point where the fractional conversion of the limiting reactant is 0.50, How much of each reactant (will be left) and product will be formed at the end, and what will be the extent of reaction? - If the reaction proceeds to a point where 40 kmol of O_2 is left, what is the fractional conversion of $\text{C}_2\text{H}_4\text{O}$? What is the extent of the reaction?	10	2	2