REG.NO.:

VIT
Vellore Institute of Technology

NAME OF THE SCHOOL
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2024-2025

SLOT:

Programme Name & Branch	: B.Tech Chemical Engineering
Course Code and Course Name	: BCHE203L, Chemical Process Calculations
Faculty Name(s)	: Dr.S.Velu (10386)
Class Number(s)	: VL2024250103079
Date of Examination	: 13.10.2024
Exam Duration	: 90 minutes

Maximum Marks: 50

General instruction(s):

M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

Course Outcomes:

CO3. Estimate the extent of reaction in material balances for systems involving chemical reactions.

CO4. Analyse the recycle and bypass processes involving chemical reactions.

CO5. Apply simultaneous material and energy balance to industrial processes.

Q. No	Answer All Questions 5×10=50 marks	M	CO	BL
1.	Methane oxidation reactions are $CH_4+O_2 \rightarrow HCHO + H_2O$ $CH_4+2O_2 \rightarrow CO_2+2H_2O$ If 150 Kmole of methane is charged to the reactor. The product stream is found contain 20 Kmole of CO_2 and 50 Kmole of HCHO. Calculate [i] Percentage conversion of CH_4 [ii] Percentage yield of HCHO.	10	3	3
2.	Soda ash is manufactured as per the reaction $2NaHCO_3 \longrightarrow Na_2CO_3+CO_2+H_2O$ In an experimental investigation, wet $NaHCO_3$ containing 8% water is pre-mixed with recycled dry soda ash so as to reduce the water content to 5% before introducing into the calciner. The calciner is being fed with 2000kg of wet bicarbonate per hour. Calculate: (i) Quantity of soda ash produced per hour as the final product. (ii) Quantity of off gages produced per hour (iii)Mole ratio of CO_2 to H_2O in the off gases. (iv)Quantity of soda ash recycled per hour.	10	4	3
3.	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: (i) The volume of air at NTP supplied to the burner per hour. (ii) The volume of the resulting product of combustion per hour at 750°C. (iii) The volumetric composition of combustion product.	10	5	3

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4.	Butane is burnt with 20% excess air. Calculate the following: [i] Air/fuel ratio by weight [ii] Air/fuel ratio by volume [iii] Weight of dry exhaust gas formed per unit weight of fuel [iv] Mole of O_2 in the exhaust per unit weight of fuel [v] Mole of water vapour in the exhaust per unit weight of fuel [vi] Volume of exhaust gas at 1atm at 260°C per unit weight of fuel. Specific gravity of butane is 0.584.	10	5	3
5.	The ultimate analysis of a fuel oil sample is as given as C = 88%, H= 10%, S= 2% (by weight) It is used as a fuel in a power generating boiler with 30% excess air calculate (i) The theoretical dry air requirement. (ii) The actual dry air supplied. (iii) The composition of flue gas.	10		5