CH620003 Process Modelling and Simulation

Assignment 2 Deadline to submit: **13 Feb 2025 (before 5 PM)**

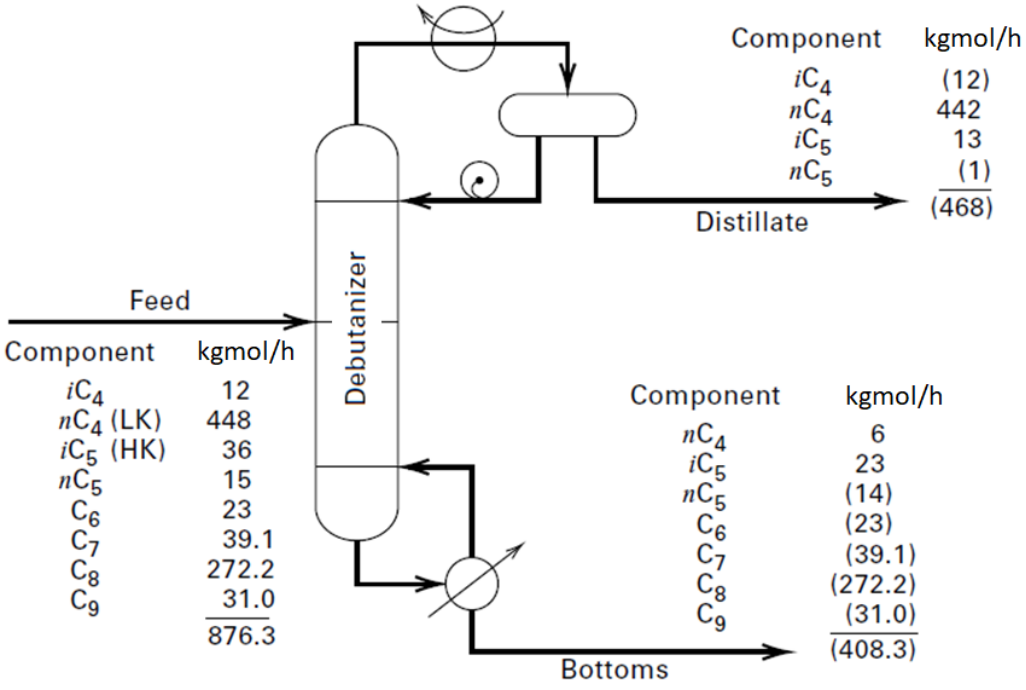
Q1: FUG TECHNIQUE

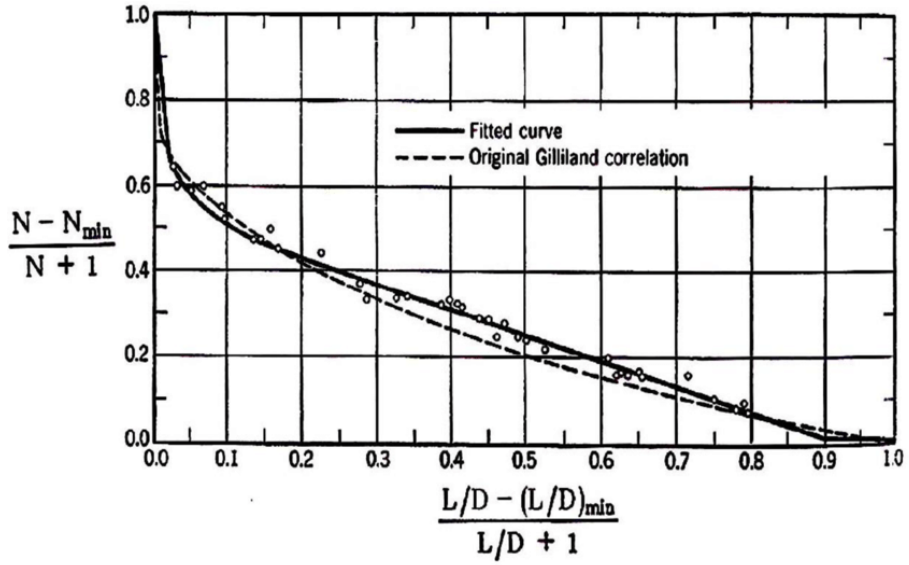
(a) For the debutanizer shown here, estimate the N_{min} by the Fenske equation. Assume a uniform operating pressure of 80 psia (552 kPa) throughout and utilize the ideal K-values.

(b) Estimate the product distributions for nonkey components by the Fenske equation.

(c) Calculate the minimum reflux, based on Underwood equation.

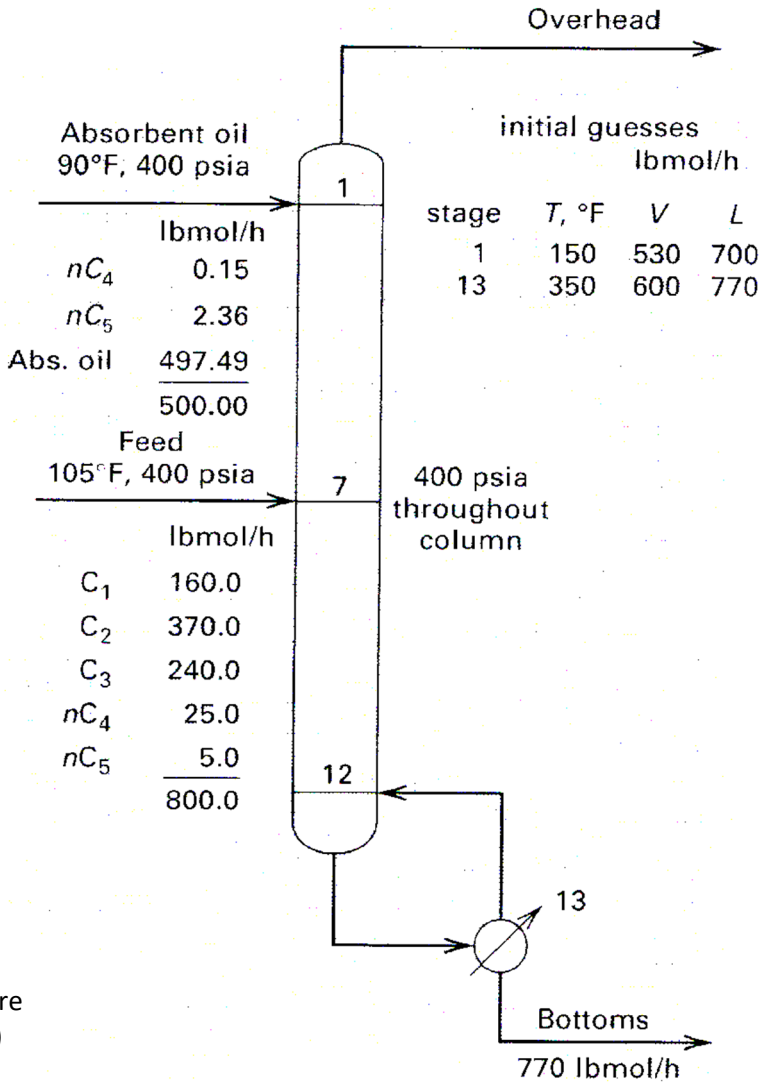
(d) Use the Gilliland chart (included below) to estimate the number equilibrium-stage required for the debutanizer, for a reflux 30% greater than the minimum reflux.



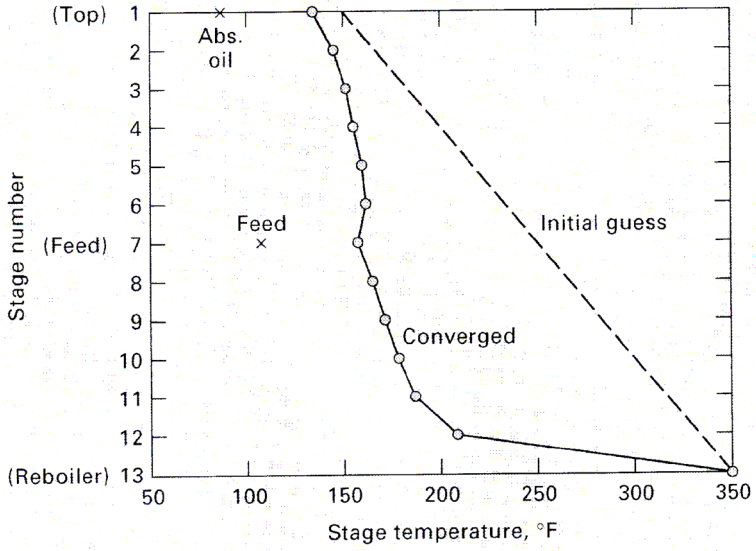


Q2: SIMULATANEOUS – CORRECTION (SC) METHOD

A reboiled absorber is used for the separation of a hydrocarbon vapour feed. Here the absorbent oil in *n*-decane. The 770 lbmol/h of bottom feed corresponds to the amount of C_3 and heavier in the two feeds, so the column is designed as a deethanizer. Calculate the stage temperatures, interstage vapour and liquid component flow rates, and reboiler duty using the SC method.



Sample solution for the stage temperature
(for validating your calculations / results)



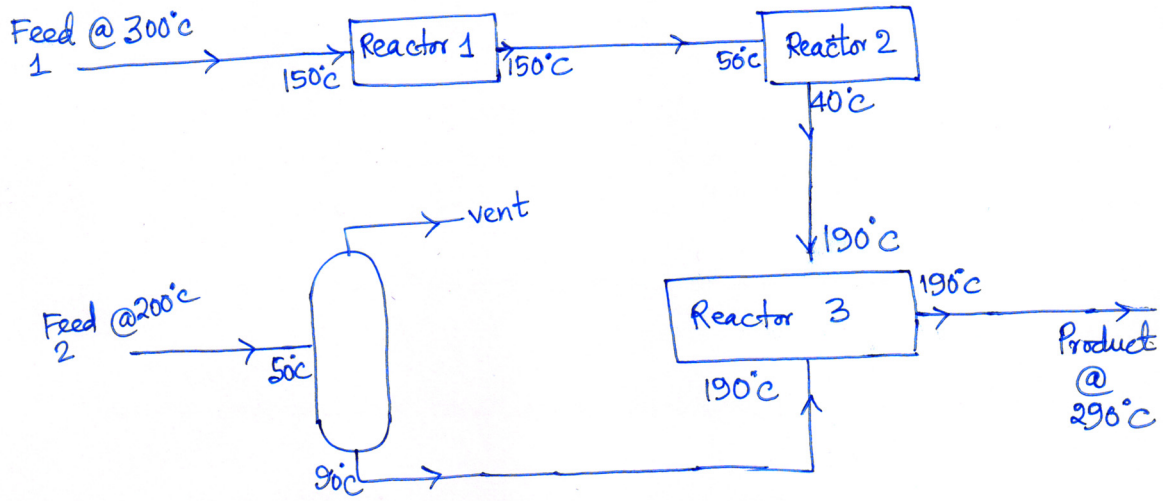
Q3: PINCH ANALYSIS AND HEAT EXCHANGER NETWORK INTEGRATION

(a) Prepare the composite temperature-enthalpy curve for $\Delta T_{min} = 10^{o}C$. Estimate the minimal heating and cooling loads, and identify the pinch temperature.

(b) Estimate the pinch temperature from the temperature cascade procedure and check with the result from the T-H diagram.

(c) Design an optimized heat exchanger network connection that requires minimal hot and cold utility energies.

(d) Prepare a new process flowsheet integrating the heat exchangers in the process flow diagram.



Stream No.	Flowrate, $\dot{m}$ (kg/s)	C_p (kJ/kg°C)	T_{in} (°C)	T_{out} (°C)
1	10.00	0.8	300	150
2	2.50	0.8	150	50
3	3.00	1.0	200	50
4	6.25	0.8	190	290
5	10.00	0.8	90	190
6	4.00	1.0	40	190

IF THE COMPUTER CODES / PROGRAMS / HAND NOTES ARE COPIED, YOU WILL BE CALLED TO EXPLAIN YOUR WORK, FAILURE ON WHICH TO DO SO, YOUR SUBMISSION WILL NOT BE CONSIDERED.