Exam Date & Time: 02-Dec-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

MIT MPL - BTech VII Semester - End Semester Examination - Nov-Dec 2023

Process Integration for Petroleum Industries [CHE 4054]

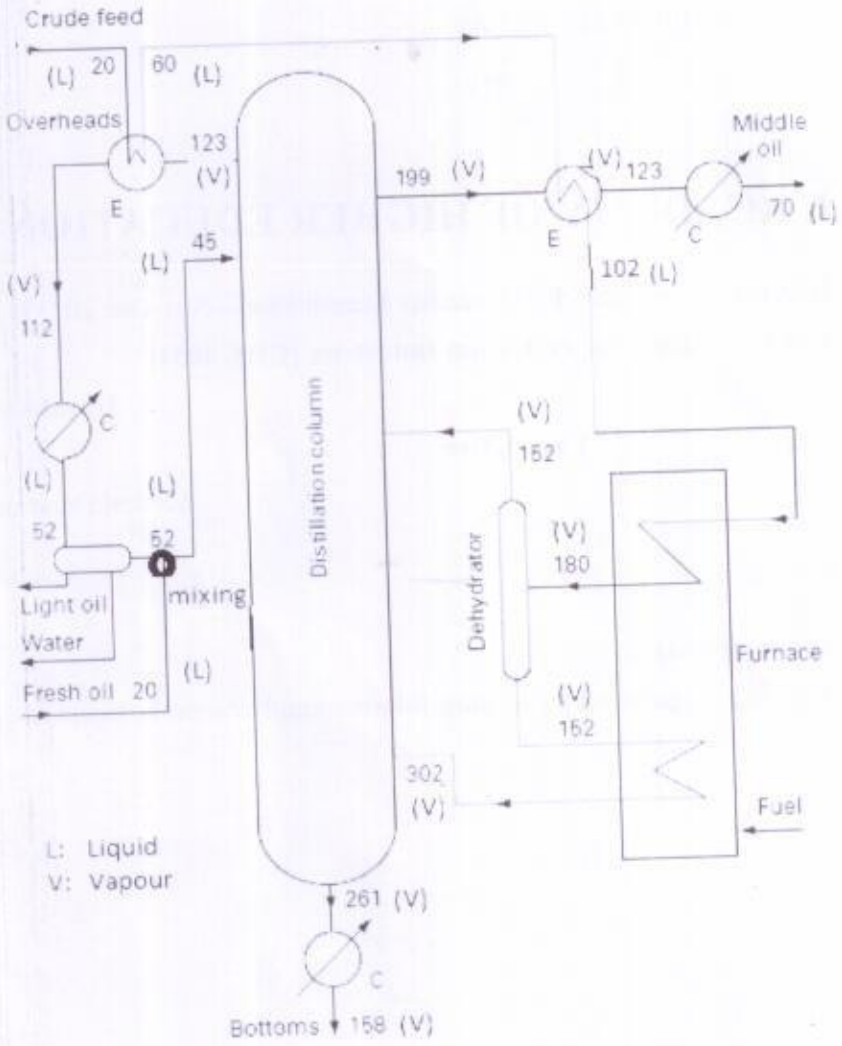
Marks: 50 **Duration: 180 mins.**

Descriptive

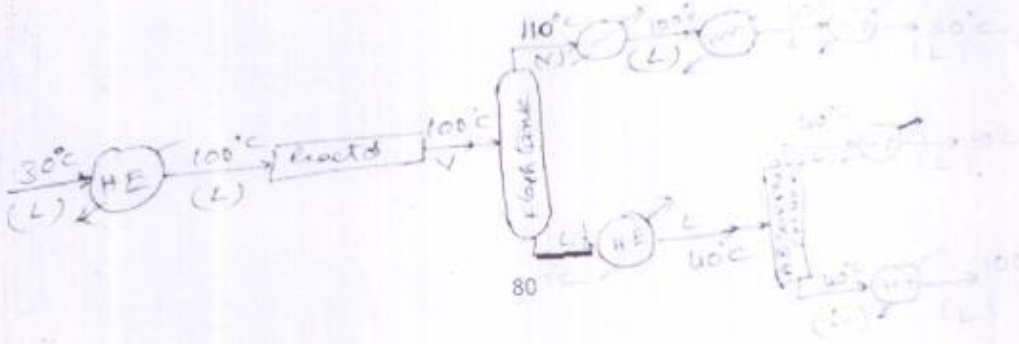
Answer all the questions. Section Duration: 180 mins

* Answer all questions.
* Assume the missing data suitably.
* Write neatly and legibly.
* Give suitable examples wherever necessary.

1) Examine the following diagram list the streams information. Notation L: liquid and V: vapor ? (3)



2) Examine the following diagram and list the streams information. Notation L: liquid and V: vapor ? (3)



3) Calculate the slopes of various intervals of hot composite curve? (4)

T in (°C)	T out(°C)	CP KW/°C
290	100	6
180	70	3
190	40	1.5
240	20	3
100	30	2

4) Construct the algorithm for stream splitting above and below pinch? (3)

5) Why the correction factor (F_T) required in log mean temperature difference in heat transfer calculations (2)

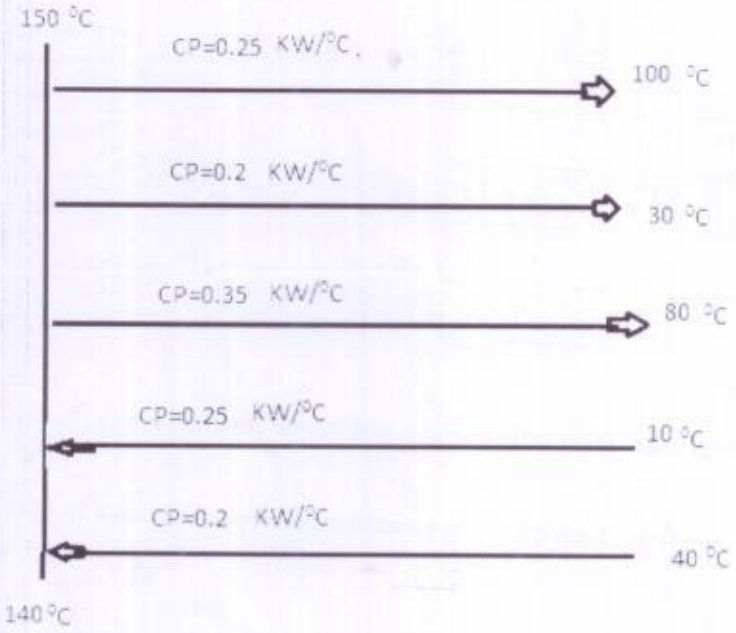
6) Calculate the tube length of shell and tube heat exchanger where hot and cold fluids are flowing counter currently to exchange the heat with given data. Hot fluid is entering at 280° C and leaving 175 °C and cold fluid 80 °C and 165 °C . Assume the overall heat transfer coefficient is 5000 W/m^2 ^{0}C. The tube diameter is 12.7 mm, number of tubes are 300 and CP of cold fluid is 3.5 KW/°c. If the flow is changed to cross flow, what could be the length of each tube (5)

7) Explain atleast two golden rules of heat integration in Pinch technology (2)

8) Assess the types of combined heat and power systems in Industry (3)

9) Identify the heat exchanger network (suitable process heat transfer matchings) in below the pinch temperature of given data

(5)



10) Briefly explain the plate heat exchangers (2)

11) Briefly explain the Recuperative exchangers (3)

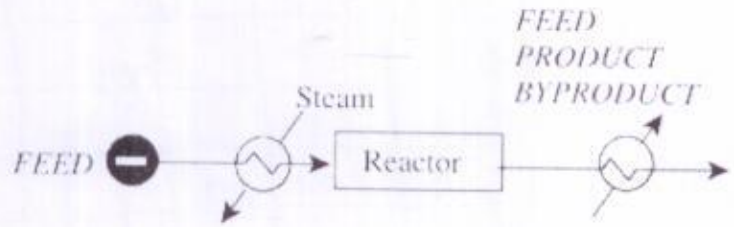
12) Construct the GCC curve and obtain the hot and cold utility from graph. What actual temperatures of these hot and cold utility required in the process if the Del T_{min}=30 ^{0}C ? (5)

Shifted temperature °C	ΔH, KW
155	110
150	105
135	60
95	0
45	125
35	120
15	150

13) Estimate the cold and hot utilities and pinch temperature of given streams using problem table algorithm for DelT_{min}=10 ^{0}C ? (4)

Stream	Type	Shifted T	shifted T	ΔH KW	CP KW/C
Reactor 1 feed	Cold	50	180	48.0	0.3
Reactor 1 product	Hot	250	50	-31.5	0.15
Reactor 2 feed	Cold	140	230	31.5	0.35
Reactor 2 product	Hot	200	80	-30.0	0.25

14) Use the following flow diagram to suggest two different heat recovery/transfer mechanisms with help of separation processes. Assume that feed, product and by-products are having different boiling points. (4)



15) Briefly explain the limitations of del T_{min} (for low and high values) (2)

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