VII Sem

Exam Date & Time: 28-Nov-2022 (09:00 AM - 12:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

IV Semester End Semester Examination
Process Integration for Petroleum Industries (CHE 4054)

Process Integration for Petroleum Industries [CHE 4054]

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

Descriptive Questions

Answer all the questions. Section Duration: 180 mins

1) The overall design process is effectively represented by Onion diagram. Draw the onion diagram and Justify the statement?

A) (3)

B) Extract the streams information from the diagram, Notation L: liquid and V: vapor (Check Figure 1 from supplement sheet)? (3)

C) Calculate the slopes of different intervals in given streams data and tabulate?

s.no	Type of stream	supply temp (°C)	Target temp (°C)	Mass flow rate Kg/s	Specific heat capacity (KJ/kg.°C)
1	Cold	10	145	0.5	4
2	Hot	200	80	0.2	1.5
3	Cold	35	120	0.15	3.5
4	Hot	150	60	0.25	3.6
5	cold	20	100	0.15	5.2

(4)

2) Draw the cold composite curve using the data given below?

A) (5)

s.no	supply temp (°C)	Target temp (°C)	CP (kW/°C)
1	190	290	4
2	90	190	3
3	40	190	1.5
4	20	240	3
5	50	100	2

B) Explain the three golden rules of heat integration in Pinch technology (2)

C) Explain the types of combined heat and power (at least two types) systems in Industry (3)

3) Estimate the cold and hot utilities and pinch temperature of given streams using problem table algorithm with $\Delta T_{min} = 10\ ^{O}C$?

A)

s.no	Type of stream	supply temp (°C)	Target temp (°C)	CP (kW/°C)
1	Hot	180	60	3
2	Cold	30	135	2
3	Hot	150	30	1
4	cold	80	140	5

(5)

B) Obtain the process heat transfer, cold and hot utility from composite curve (Check Figure 2 from supplement sheet) (2)

C) Draw the algorithm for stream splitting above and below pinch (3)

4) Briefly explain the significance of ΔT_{min} (2)

A)

B) Identify the heat exchanger network (suitable process heat transfer matchings) in below the pinch temperature of given data. (Check Figure 3 from supplement sheet) (5)

C) Calculate the number of tubes required for given heat exchanger with counter current flow of hot and cold fluids. Assume the overall heat transfer coefficient is 5000 $W/m^2\ ^OC$. The tube diameter is 2.54 mm and length may be assumed as 1 m.

s.no	supply temp (°C)	Target temp (°C)	CP (kW/°C)
1	170	90	3
2	80	140	4

(3)

5) Identify the process heat exchange network (suitable process heat transfer matchings) in above the pinch temperature of given data.. (Check Figure 4 from supplement sheet) (5)

A)

B) Why the correction factor (F_T) required to be incorporated in log mean temperature difference in heat transfer calculations. (2)

C) Extract the streams information from the diagram, Notation L: liquid and V: vapor (Check Figure 5 from supplement sheet) (3)

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