Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

V SEMESTER B.TECH. (CHEMICAL ENGINEERING)

MAKE-UP EXAMINATIONS, DECEMBER 2018

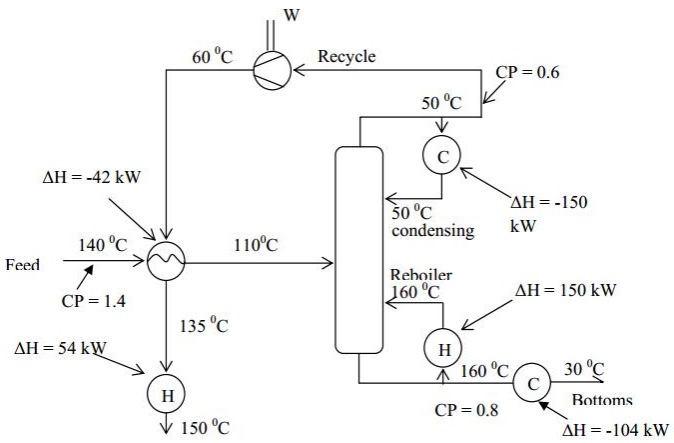
SUBJECT: PINCH TECHNOLOGY [CHE4021]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** questions.
- Use of linear graph sheets is permitted.
- Missing data may be suitably assumed.

1A	Explain the importance of energy integration in process industries.	**03**
1B	Explain the key steps in Pinch Technology procedure	**04**
1C	A process flow diagram of a typical process is shown in figure below. Extract the stream data for this process 	**03**
2A	Explain the step by step procedure to construct composite curves for pinch method.	**04**
2B	Find the minimum utilities required for four stream case for load integration with ΔTmin =10 ^{0}C. The stream data given below.	**06**
3A	Explain the importance of Minimum temperature difference for Pinch Design Method. Show the effect of ΔT_{min} on cost with approximate composite curve.	**04**

stream	T_S (^{o}C)	T_t (^{o}C)	CP (kW/^{o}C)
C1	25	160	2
C2	80	135	3
H1	150	40	2
H2	90	40	6

3B	Define the threshold problem in pinch technology method and explain how this will affect the energy integration process	**04**
3C	List out the basic heuristic rules to be followed for data collection in Pinch Technology and explain the same	**02**
4A	Explain the significance of grand composite curve in pinch design method.	**04**
4B	The stream data for the process is given in Table below. For this process compute the amount of hot and cold utility required by considering ΔTmin as 10°C using Problem Table Algorithm (PTA) analysis.	**06**

Stream Name	Stream Type	T_S (^{0}C)	T_T (^{0}C)	CP (kW/^{0}C)
1	Cold(C1)	10	45	120
2	Hot(H1)	45	15	110
3	Cold(C2)	50	85	5
4	Hot(H2)	85	15	5
5	Cold(C3)	10	75	25
6	Cold(C4)	45	80	20
7	Hot(H3)	40	10	120

5A	List out the different feasibility criteria in detail for Pinch Design Methods of Heat Exchange Networks (HENS) Synthesis. (Minimum two points to be explained in detail)	**04**
5B	For a particular process, the total area targeted found to be 5000 m^2 using Pinch Design Methods. Also, the present problem requirement of minimum hot and cold utility are found to be 5 MW and 3 MW, respectively. The Cost of hot utility=100 ($\$.kW^{-1}.y^{-1}$), Cost of cold utility =10 ($\$.kW^{-1}.y^{-1}$), Installed capital cost = $40000 \times A^{0.83}$, Rate of interest = 10% and Plant life = 5 year. Target the cost for this process (Total Annual Cost). Conversion of the capital cost into annual capital cost using conversion factor as: $=\frac{i(1+i)^n}{(1+i)^n-1}$. Target the cost for this process (Total Annual Cost).	**04**
5C	Classify the types of utilities used in process industry.	**02**

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