School of Engineering and Applied Science (SEAS), Ahmedabad University

Name: _____ Roll no.: _____

B. Tech. (VI, Chemical)
Process Synthesis and Integration: End Term Exam (Winter Sem.:2024-2025); Marks: 40M
CHE400 **May 1, 2025, Thursday, 11.00 AM – 12.30 PM**

Read the below instructions carefully:

Instructions:

This is a *No Book –No Notes Examination*. Answer all sections. Please do not raise any queries with the invigilators. All parts of a question must be answered together. In case of insufficient information, if any, make and mention suitable assumptions and proceed further.

1. **This exam will be conducted in two sections, and all Sections are compulsory.**
2. **Submit Section A answers in the answer script provided by the University.**
3. **Section B question paper will be distributed by the invigilator after completion of Section A.**
4. **The time duration for each section is mentioned in each question paper.**

Answer the Questions

Section A

Q-1: The stream data for a case study is given below:

Stream	Flow rate x Specific heat, kW/°C	Supply Temperature, °C	Target Temperature, °C
H1	8	120	60
H2	10	160	40
C1	2	10	100
C2	60	80	115

(a) For $\Delta T_{min}=20^0C$, calculate the requirement of minimum hot utility, minimum cold utility, the location of pinch for hot streams and for the cold streams. **[5M]**

(b) Using the pinch design method, design a heat exchanger network (HEN) for maximum energy recovery that features the minimum number of units. Your diagram must include the heat loads on all the exchangers, and the terminal temperatures across every exchanger. **[10M]**

Q-2: A problem table analysis on this data reveals that the minimum hot and cold utility requirements for the process are 20 kW and 60 kW. The analysis also reveals that the pinch is located at a temperature of 85 °C. a) Design the Heat Exchanger Network (HEN) by using the pinch design method. (c) Identify the scope to reduce the number of units by manipulating loops and utility paths by sacrificing energy consumption. Design a network to realize this scope and restore ΔT_{min}=10° C.Your diagram must include the heat loads on all the exchangers, and the terminal temperatures across every exchanger. **[15M]**

Type of Stream	T_s (°C)	T_t (°C)	CP (kW/(°C))
H1	170	60	3
H2	150	30	1.5
C1	20	135	2
C2	80	140	4