INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR
## DEPARTMENT OF CHEMICAL ENGINEERING

MID SEMESTER EXAMINATION 2013-14 (SPRING)
COMPUTER AIDED PROCESS ENGINEERING (CH30016)
Number of students: 86 ;   Total time: 2 hrs.   Total marks 30
Answer ALL questions

1.

Stream No. and Type	CP (MW/ ^{o}C)	T_s (^{o}C)	T_t (^{o}C)
1. Hot	0.15	250	40
2. Hot	0.25	200	80
3. Cold	0.20	20	180
4. Cold	0.30	140	230

(a)   From the above stream table find out the Pinch Temperature and the minimum hot and cold utility required for the process. Assume minimum approach temperature between a hot and cold stream (ΔT_{min}) to be 10 ^{O}C.

(b)   Place the Heat Exchanger matches taking the above and below the Pinch process separately and then combine them for the overall design for maximum energy recovery (MER).

(c)   What is the minimum number of heat transfer unit for this heat exchanger network. Identify the "Loop"s across the Pinch and break it by relaxing energy along a "Path", thereby redesigning the heat exchanger network for minimum number of unit.   **(3 + 4 + 3 = 10)**

2.   (a) What is the significance of "Pinch Temperature" and ΔT_{min} in a process?

(b) Describe the algorithm for placing a Pinch-match. What are the logic behind the different stream splitting in that algorithm ?

(c) How do you place matches in the following hypothetical case:

                                                                                    (4 + 3 + 3 = 10)
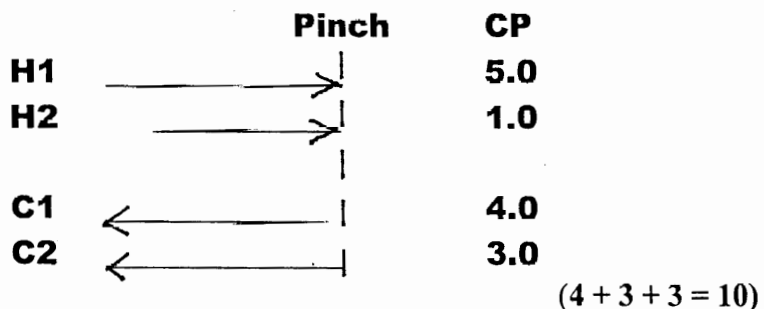
3. (a)   What do you mean by "Lumped parameter" and "Distributed parameter" model ?

(b)   Develop the Lumped parameter model of a jacketed CSTR having a reaction **A + B → C**. State the assumptions, identify the variables and the governing equations and develop the IFD of the solution scheme.

                                                                                    (2 + 8 = 10)

NOTE: Do not ask any question at the Examination Hall. If in doubt, make suitable assumptions and proceed. Handwriting and figures should be neat. Parts of a question should be answered together.