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Department of Chemical Engineering, Indian Institute of Technology Delhi
CHL 712: Computer Aided Design in Chemical Engineering
Semester II, 2006-2007

Closed Book & Notes **Major Examination**
Date: 04/05/07 **Time: 2 hr** **Marks: 35**

1. [16 Marks] Design a HEN to meet MER targets with at most 15 exchangers (including utility heaters) and $\Delta T_{min} = 10^0C$ for the following streams.

Stream	T^s (K)	T^t (K)	C (kW/^{0}C)
H1	140	50	10
H2	320	20	9
H3	370	20	8
C1	50	130	10
C2	130	430	8
C3	100	300	6
C4	30	230	5
C5	30	130	4
C6	30	430	1

2. Answer the following in one or two sentences (descriptive answers will not be evaluated)
   a. [2.5 Marks] Define distillation line and show that for condition at which distillation line is defined $x_n = y_{n+1}$ (x and y are liquid and vapor compositions of n^{th} and $(n+1)^{th}$ tray; tray number starting from top of the column).
   b. [2.5 Marks] Define threshold temperature difference (in context of pinch analysis of heat integration). How does the utility cost behave with change in ΔT below threshold temperature?
   c. [2 Marks] What are the plausible reasons for not using Petlyuk distillation column in process industries?
   d. [1 Mark] In separation of a ternary mixture by distillation, it is desired to obtain each of the three components as products. When is a single column with side-stream product likely to be the optimum design?

3. Consider the problem of separation by ordinary distillation of propane (A), isobutene (B), n-butane (C), isopentane (D) and n-pentane (E). Using the heuristics discussed in lecture class, develop flowsheet for
   a. [3.5 Marks] Equimolar feed with product streams A, (B,C) and (D,E)
   b. [3.5 Marks] Feed consisting of A = 10, B = 10, C = 60, D = 10, and E = 20 (mol %) with products A, B, C, D, E.

4. [4 Marks] Carry out degree of freedom analysis of a stream mixer.