Department of Chemical Engineering, Indian Institute of Technology Delhi
CHL 712: Computer Aided Design in Chemical Engineering
Semester II, 2008-2009

Closed Book & Notes **Major Examination**
Date: 01/05/09 **Time: 2 hr** **Marks: 35**

1. [14 Marks] Design a HEN to meet MER targets with ΔT_{min} = 10 ^{0}C for the following streams. What is the minimum number of heat exchangers for the network? Show all the cycles in the network that can be used to reduce the number of heat exchangers.

Stream	T^s (^{0}C)	T^t (^{0}C)	C (kW/^{0}C)
H1	200	50	2
H2	150	40	4
C1	60	180	4
C2	30	130	3

2. Answer the following in one or two sentences (descriptive answers will not be evaluated)
   a. [3 Marks] List the various distinct regions in a P&ID.
   b. [3 Marks] List down at least four considerations (point-wise) used in the design of suction pipe line of a centrifugal pump.
   c. [2 Marks] In shortcut distillation method, what does a negative value of reflux ratio imply?
   d. [2 Marks] ESI is used to decide the optimal distillation column configuration for a separation of a ternary mixture. How is ESI calculated?
   e. [2 Marks] Define Marginal vapor rate. Justify why it is a good measure of the annualized cost of a distillation column? Is it sensitive to the value of reflux ratio? Why?
   f. [2 Marks] When is purging used and when is it preferred over recycle?
   g. [3 Marks] How is chemical state defined? What are the different steps used in process synthesis step to eliminate difference in the chemical states of raw materials and products?

3. [4 Marks] Derive the equation of a residue curve. Given a point on a residue curve, how is the tie line constructed at the point?