

Department of Chemical Engineering
CHL 701 Process Engineering

Major Examination

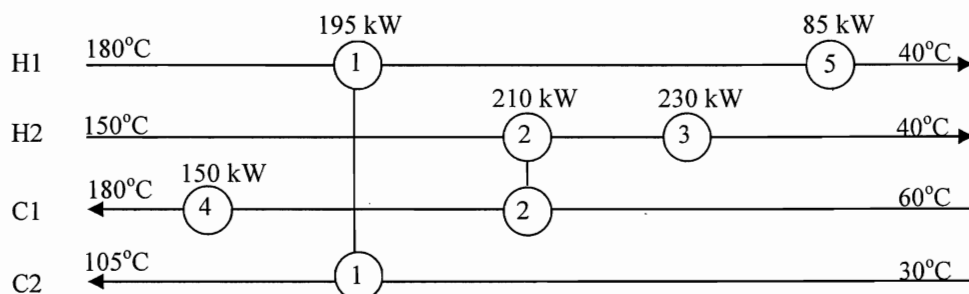
Maximum Marks = 40

Date: 21/11/08

1. A design engineer must choose either a batch or a continuous system (Level-1 decision). The batch system offers a lower initial expenditure but, owing to high labor requirements, exhibits a higher operating cost. The cash flows relevant to this problem have been estimated as follows. For each system, determine (a) the net present worth based on an annual interest rate of 10 %, and (b) the investor's rate of return. Help the design engineer make this decision if the company requires a minimum rate of return of 10 %. [10 M]

	Year	
	0	1-10
Batch	– \$20,000	\$5600
Continuous	– \$30,000	\$7650

2. To exchange heat between four streams with $\Delta T_{\min} = 20^\circ\text{C}$, the heat exchanger network shown below (MNE) is proposed. Derive this network using pinch design method. [20 M]



3. A fertilizer company mixes three different types of chemicals in their Premium blend which sells for \$1.00 per pound. Their less expensive blend (Regular) sells \$0.80 per pound and contains only two types of chemicals. The mixing formula for both blends is shown below. The remainder of each blend is inert filler material which comes from a nearby mine at a cost of \$0.10/lb. An unlimited supply of filler is available. The cost per pound of type A, type B and type C chemicals is \$0.30, \$0.25, and \$0.21, respectively.

	Chemicals		
Blends:	Type A	Type B	Type C
Premium	10 %	5 %	5 %
Regular	0 %	15 %	5 %
Max amount available	400 lb	300 lb	500 lb

- (a) Formulate the model as a Linear Programming (LP) problem (use minimum number of decision variables) and (b) solve using simplex method to determine the optimal amount of each blend that should be prepared. [10 M]