NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING

B-Eng Hons Industrial and Manufacturing Engineering

Supplementary Examination

COURSE : MANUFACTURING SYSTEMS I

CODE : TIE 3112

DATE : AUGUST 2013

DURATION : 3 HOURS

INSRTUCTIONS AND INFORMATION TO CANDIDATE

1. Answer ANY five questions.
2. All questions carry **20 marks** each.
3. This paper contains seven **(7)** questions.
4. There are five **(4)** printed pages.

QUESTION 1

a) Outline the importance of a buffer in transfer line systems. [4]

b) A five station transfer line is being considered. All failures are expected to occur at workstations and be operation dependant. Average repair time will be 5 cycles for each station. Average failure rates are estimated to be 0.01, 0.02, 0.02, 0.03 and 0.02 respectively.

i) Calculate the effectiveness of the line if no buffers are used. [4]

ii) Suppose one buffer of size 10 is to be added, where should it be placed? [6]

iii) Calculate the effectiveness of the line with the buffer included. [6]

QUESTION 2

a) Outline the steps involved in systematic layout planning (SLP). [6]

b) Table Q2b shows five customers that can be served from any of the three locations A(x = 80, y=20), B(x = 100, y = 30) or C(x =50, y =30). The load/unload cost, L_k = \$2.50 per trip and the cost per unit distance, C_k = \$0.05/m for customers 1 and 2 and L_k = \$3.20 per trip and C_k = \$0.002/m for customers 3, 4, and 5. Determine the best location. [14]

Table Q2b: Customer Data or Question 2 b

Customer	Co-ordinate		No of trips per period	movement type
	x	y		
1	40	60	250	Straight line
2	60	70	165	Rectangular
3	80	70	201	Straight line
4	40	30	104	Straight line
5	10	80	306	Rectangular

QUESTION 3

An assembly line consists of eight work elements as shown in Table Q3. Assuming a cycle time of 20 minutes, you are required to design a well balanced assembly line.

Table Q3: Element Description and Data for Question 3

Task	T_{ej} (min)	Immediate Predecessor
1	11	-
2	8	1
3	9	2
4	5	2
5	8	3
6	12	3,4
7	10	5
8	3	6

i) Use the Ranked Positional Weight method to balance the assembly line. [14]

ii) Explain three ways of eliminating bottleneck stations in assembly lines. [6]

QUESTION 5

a) Distinguish the product layout from the process layout. [4]

b) The material flows between four equal sized departments are given in Table Q5. The cost of moving one unit per unit distance is $4.00. Assuming the given starting solution for the facility layout, use the pair-wise exchange method to refine the current given solution. [16]

Table Q5: Material Flow Matrix

		To dept			
		1	2	3	4
From Dept	1	-	15	40	25
	2		-	5	10
	3			-	15
	4				-

Starting Solution				
	1	2	3	4

QUESTION 6

a) The costs of setting up a given multi-model assembly and the succeeding models are shown in Table Q6. Use the Hungarian method to find the order of the model batches to minimize the total set-up costs. [10]

Table Q6: Cost of setting up line

	Succeeding Model			
	A	**B**	**C**	**D**
A	-	100	150	80
B	50	-	100	75
C	80	40	-	110
D	115	100	60	-

b) Distinguish between cellular layout and functional layout. [4]

c) Outline the advantages of cellular layout over functional layout . [6]

QUESTION 7

a) Explain the following reasons why a station may be "down":
   i) station failure
   ii) total line failure
   iii) station blocked
   iv) station starved [8]

b) Using an appropriate table describe the classes and the varieties of flow lines. [12]

END OF EXAMINATION