The Open University of Sri Lanka
Faculty of Engineering Technology

Study Programme	:	Diploma in Technology / Bachelor of Technology (Engineering)
Name of the Examination	:	Final Examination
Course Code and Title	:	**MEX6340 Industrial Engineering**
Academic Year	:	2012/13
Date	:	August 09, 2013
Time	:	0930 hrs. – 1230 hrs.
Duration	:	3 hours

General instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of 8 questions. All questions carry equal marks.
3. Answer any 5 questions only.

Question 1

1.1 Describe what do you mean by productivity as applied to a production line, and discuss the different aspects which should be considered by the Industrial Engineer for improving the productivity of a manual assembly line.

1.2 Quoting practical examples from a manual assembly line, describe five flow chart symbols that can be used for representing the activities for a method study.

1.3 Explain why a flow chat is inadequate in analyzing the material flow and explain how a travel chart can be effectively employed, in designing complex factory layouts. Also list quantitative indicators of layout efficiency?

Question 2

A manufacturing organization is contemplating to construct a new manufacturing facility in a new location with a capacity of 800 product units, mainly to reduce the distribution costs of the product. The unit transportation costs from the proposed new location to the markets M1, M2 and M3 are Rs. 15, 7 and 5 respectively. The unit transport costs, the demand and the capacity of the existing system are shown in the Table Q2.

Factory	Market store			Production Capacity (Units/week)
	M1	M2	M3	
1	10	4	2	1000
2	6	11	9	800
Demand (units/week)	500	1200	700	

Table Q2

2.1 Construct a transportation table for the application of an optimization algorithm. Obtain a basic feasible solution using the north-west corner rule.

2.2 By the use of shadow cost coefficients obtain an optimal solution to the transportation problem. Develop an alternative optimal solution and calculate the total cost of the optimal transport plan?

2.3 To solve the problem by simplex linear programming method, write down constraints and the objective function.

Question 3

3.1 Describe the objectives of production planning and control, and the main roles of work scheduling and machine loading.

3.2 Explain what is meant by the following.

3.2.1 Forward scheduling

3.2.2 Backward scheduling

3.2.3 Loading to infinite capacity

3.2.4 Loading to finite capacity

3.3 Discuss why a good loading system should be involved with a combination of infinite and finite loading.

Question 4

4.1 What are the information inputs and outputs for a Material Requirements Planning (MRP) computational process?

4.2 Describe what is meant by netting, explosion and consolidation in MRP computations.

4.3 A section of the MRP worksheet for a stock item showing the net requirement schedule is given in Table Q4.

Week No.	1	2	3	4	5	6	7	8	9	10
Net requirement (units)	0	50	40	40	50	70	60	30	60	0
Batched requirements										
Planned order releases										

Table Q4

The ordering cost for the item is Rs. 500 per order, regardless of the order quantity and the stock holding cost is Rs. 4 per unit per week. The opening stock is zero. Based on the average demand for the 10 periods, derive equation $(2DC_O/C_H)^{1/2}$ from fundamentals and calculate the economic order quantity (EOQ) using $(2DC_O/C_H)^{1/2}$. Using the EOQ and assuming that there is no requirement to carry a safety stock, determine the planned order release schedule based on an ordering lead time of 2 weeks.

4.4 Recalculate the planned order release schedule for the problem 3.3 based on least unit-cost (part-period) algorithm. Show calculations clearly.

Question 5

Discuss any two (02) of the following,

5.1 Why and how MRP systems provide provisions for incorporating safety stock considerations into the planning of orders and list what management action is required in order to reduce or to eliminate safety stock in production systems.

5.2 Explain important human factors which should be considered to improve productivity of manual-work in a factory.

5.3 Discuss the role of an Industrial Engineer in the present day production environment.

Question 6

6.1 A production system has two order processing divisions A and B. The orders are processed first on division A and then on division B. Given that it is required to process five orders shown in Table Q6 to minimize the total throughput time of the set of orders, schedule the orders using Johnson's algorithm and also illustrate by a Gantt chart.

Serial number of order	Processing time in hours	
	In A	In B
1	8	10
2	14	5
3	5	10
4	7	6
5	15	12

Table Q6

6.2 If the five orders in 6.1 are batches of discrete parts which can be transferred from A to B in small lots, discuss the effect of splitting the batch into two equal transport batches (you may use the Gantt chart as an aid). What will be the impact on the final completion time of the set of orders?

6.3 Explain why network scheduling methods are more powerful than simple Gantt chats for scheduling production activities.

Question 7

7.1 Discuss the importance of the following in planning and controlling of project activities.

7.1.1 Float

7.1.2 Critical activities

7.1.3 Crashing durations

7.2 A project consists of 7 activities as shown in Table Q7.

Activity	Immediate predecessor activity	Normal duration (days)	Normal Cost (Rs.)	Crash time (days)	Increase in cost per day crashed (Rs.)
A	None	4	8,500	2	3,000
B	None	5	16,000	4	2,500
C	None	15	75,000	12	5,000
D	A	8	25,000	6	3,500
E	A, B	6	30,000	6	-
F	D,E	1	12,000	1	-
G	F, C	3	18,000	2	8,000

Table Q7

7.2.1 Construct the project network and determine the critical activities and also the minimum duration of the project.

7.2.2 If the project duration is 15 days only, crash activities economically and determine the total cost of the project. Also list the critical activities.

Question 8

8.1 Formulate a linear programming model of the production problem explained below in order to compute the number of liters of each product needed to be produced to maximize the profit. Do not solve the model.

The production problem: The company produces four types of cordials using orange, mango and pineapple juice. The product prices are given in Table Q8.

Product	Price per liter (Rs.)
Orange juice	100
Mango juice	90
Pineapple juice	80
Mixed fruit juice	110

Table Q8

Each product is sold in one-liter bottles. Mixed fruit juice has equal parts of orange, mango and pineapple juice. The quantities available for production are 3000 liters of orange juice, 2000 liters of mango juice and 1000 liters of pineapple juice. The cost per liter is Rs. 45 for orange juice, Rs. 36 for mango juice and Rs. 30 for pineapple juice. The marketing manager wants the ratio of the number of containers of orange juice to mango juice to be 5 to 3 and at least 40% of the total production to be mixed fruit.

8.2 A manufacturer produces two models of refrigerator: X and Y. The manufacturing process has fabrication and assembly work. Each unit of X requires 4 hours of fabrication work and 2 hours of assembly work. Each unit of Y requires 2 hours of fabrication work and 6 hours of assembly work. The fabrication division has 600 hours per week and the assembly division has 480 hours per week. Each X contributes Rs. 2000 to profits and each Y contributes Rs. 1500 to profits. Formulate the problem for solution by linear programming and obtain the optimal solution by the graphical method.

All Rights Reserved