THE OPEN UNIVERSITY OF SRI LANKA

FACULTY OF ENGINEERING TECHNOLOGY

BACHELOR OF TECHNOLOGY – LEVEL 06

FINAL EXAMINATION – 2010/11

MEX6340 – INDUSTRIAL ENGINEERING

LIBRARY
01 NOV 2011
The Open University of Sri Lanka

DATE : ***April 05, 2011***
TIME : ***1400 HRS. – 1700 HRS.***
DURATION : ***THREE HOURS***

ANSWER ANY FIVE (05) QUESTIONS. ***ALL QUESTIONS CARRY EQUAL MARKS.***

Question 1.

a. What are the objectives and benefits of a Material Requirement Planning (MRP)?

b. What is the role of Buffer stock in a MRP system?

c. Discuss the terms 'Planned Order Release' and 'Scheduled Order Receipt' used in MRP.

d. Consider the requirement planning for two products, P1 and P2. Product P1 is made of one unit of sub-assembly A and 4 units of sub-assembly B. Sub-assembly A is made of 4 units of component X, while sub-assembly B is made up of 2 units of X, one unit of Y and 3 units of Z.

Similarly, product P2 is made of 3 units of sub-assembly C and 2 units of sub-assembly B. Sub-assembly C is made up of 2 units of component x and 4 units and of component Z. Sub-assembly B, in product P2, is made up of same composition of components X, Y and Z as defined in case of P1.

The manufacturing lead time in weeks for P1, P2, A, B and C is 1, 2, 1, 1, and 1 week respectively. The procurement lead-time for components X, Y and Z is 4, 6 and 1 week respectively

The inventory on-hand status is 50, 20, 10, 20 and 10 units for A, B, C, X and Y respectively. The master production schedule is as shown in Table.01. **Use MRP approach to make a procurement schedule.**

Weeks / Product	07	08	09	10	11
P1		5	2	–	6
P2		10	5	2	–

Table.01

Question 2.

A project consists of 8 activities identified as A, B, C, D, E, F, G and H.

Construct a network to satisfy the scheduling requirements shown in Table.02.

Activity	Completion time (days)	Immediate predecessor activities
A	3	-
B	6	A
C	7	A
D	5	A
E	13	B,C
F	8	C,D
G	11	D,F
H	6	G,E

Table.02

Find the least time required to complete the whole project and identify the activities along the critical path.

How is the project completion time affected, if F, E and G are modified as specified below?

- activity F is delayed by 3 days.
- activity E is delayed by 7 days.
- activity G is finished 7 days early.

Question 3.

a. Explain the use of statistical methods in determining sample size for stop-watch time study and how it is carried out on a work cycle.

b. What is Predetermined Time Standard (PTS)? What are the advantages and disadvantages of PTS, compared to stop watch time study?

c. What is meant by 'Work measurement'? What is its relationship with method study? What are the objectives of Work Measurement in an industry

d. Explain what ergonomics is and its purpose, within the context of Industrial Engineering.

Question 4.

Part 1:

An auto parts supplier sells Hardy-brand batteries to car dealers and auto mechanics. The annual demand is approximately 1,200 batteries. The supplier pays Rs. 28 000 for each battery and estimates that the annual holding cost is 30 percent of the battery's value. It costs approximately Rs. 20 000 to place an order (managerial and clerical costs). The supplier currently orders 100 batteries per month.

a. Determine the ordering, holding, and total inventory costs for the current order quantity.

b. Determine the economic order quantity (EOQ).

c. How many orders will be placed per year using the EOQ?

d. Determine the ordering, holding, and total inventory costs based on the EOQ. How would ordering cost change and what is the saving to the company?

Part 2:

Foster Drugs (Pvt.) Ltd handles a variety of health and beauty aid products. A particular hair conditioner product costs Foster Rs. 295 per unit. The annual holding cost rate is 20 percent. Using an EOQ model, they determined that an order quantity of 300 units should be used. The lead time to receive an order is one week, and the demand is normally distributed with a mean of 150 units per week and a standard deviation of 40 units per week.

a. What is the reorder point if the firm is willing to tolerate a 1-percent chance of a stockout during an order cycle?

b. What safety stock and annual safety stock cost are associated with your recommendation in part *(a)*?

c. Foster is considering making a transition to a periodic-review system in an attempt to coordinate ordering of some of its products. The review period would be two weeks and the delivery lead time would remain one week. What target inventory level would be needed to ensure the same 1-percent risk of stockout?

d. What is the safety stock associated with your answer to part *c*? What is the annual cost associated with holding this safety stock?

e. Compare your answers to parts *b* and *d*. If you were the manager of Foster Drugs, would you choose a continuous- review system or periodic-review system?

Question 5.

a. Describe the basic assumptions of linear models

b. TriCity Manufacturing (TCM) makes Styrofoam cups, plates and sandwich and meal containers. Next week's schedule calls for the production of 80,000 small sandwich containers, 80,000 large sandwich containers, and 65,000 meal containers. To make these containers, Styrofoam sheets are melted and formed into final products using three machines: M1, M2, and M3. Machine M1 can process Styrofoam sheets with a maximum width of 300*mm*. The width capacity of machine M2 is 400*mm*, and the width capacity of machine M3 is 500*mm*. The small sandwich containers require 250*mm*-wide Styrofoam sheets; thus these containers can be produced on each of the three machines.

The large sandwich containers require 300*mm*-wide sheets; thus these containers can also be produced on each of the three machines. However, the meal containers require 400*mm*-wide Styrofoam sheets, so the meal containers cannot be produced on machine M1. Waste is incurred in the production of all three containers because Styrofoam is lost in the heating and forming process as well as in the final trimming of the product. The amount of waste generated varies depending on the container produced and the machine used. The following table shows the waste in square millimeters for each machine and product combination. The waste material is recycled for future use.

	Waste (mm^2)		
Machine	**Small Sandwich**	**Large Sandwich**	**Meal**
M1	**12 500**	**9 375**	**-**
M2	**15 000**	**17 500**	**11 250**
M3	**20 000**	**21 875**	**22 500**

Production rates also depend upon the container produced and the machine used. The following table shows the production rates in units per minute for each machine and product combination. Machine capacities are limited for the next week. Time available is 35*hours* for machine M1, 35*hours* for machine M2, and 40*hours* for machine M3.

	Product Rate (*units/minute*)		
Machine	**Small Sandwich**	**Large Sandwich**	**Meal**
M1	**30**	**25**	**-**
M2	**45**	**40**	**30**
M3	**60**	**52**	**44**

i. Costs associated with reprocessing the waste material have been increasing. Thus, TCM would like to minimize the amount of waste generated in meeting next week's production schedule. Formulate a linear programming model that can be used to determine the best production schedule.

ii. Solve the linear program formulated in part (a) to determine the production schedule subject to the constraints. How much waste is generated?

Question 6.

a. Discuss the difference between 'batch repetitive flow line' and 'mixed model repetitive flow line'.

b. Differentiate between the terms "manufacturing strategy" and "corporate strategy" as applicable to production organization of your choice.

c. "Manufacturing Policy is the result of translating corporate strategy to a long range plan for the production function of an organization." Discuss the above statement with suitable examples.

d. Describe how you would coordinate the product life cycle with the manufacturing system life cycle for best results.

Question 7.

a. What is an operation process chart and what are its drawbacks?

b. Why is the flow diagram superior to both operation process chart and flow process chart in layout planning?

c. What type of location would you recommend for an industry which is hazardous and also causes a lot of pollution? Describe your answer.

d. List out the factors influencing plant location.

Question 8.

a. Elimination of waste is vital for any organization. Describe the seven prominent types of wastes defined by the 'Toyota Production System'.

b. Taking an example from a manufacturing, or a service organization, identify the types of wastes you may have come across and suggest possible methodology to eliminate them.

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Formulas for Inventory Management Problems

Fixed-Quantity System (Q System)

$$\text{EOQ: } Q^* = \sqrt{\frac{2DS}{H}} \qquad \text{TC} = \frac{D}{Q}S + \frac{Q}{2}H \qquad H = ic$$

$$R = dL + z\sigma_L \qquad \sigma_L = \sigma_d\sqrt{L}$$

Fixed-Period System (P System)

$$T = d(P + L) + z\sigma_{P+L} \qquad \sigma_{P+L} = \sigma_d\sqrt{P + L}$$

Table of Normal Demand Percentages

z	Service Level (%)	Stockout Risk (%)
0.0	50.0	50.0
0.5	69.1	30.9
1.0	84.1	15.9
1.1	86.4	13.6
1.2	88.5	11.5
1.3	90.3	9.7
1.4	91.9	8.1
1.5	93.3	6.7
1.6	94.5	5.5
1.7	95.5	4.5
1.8	96.4	3.6
1.9	97.1	2.9
2.0	97.7	2.3
2.1	98.2	1.8
2.2	98.6	1.4
2.3	98.9	1.1
2.4	99.2	0.8
2.5	99.4	0.6
2.6	99.5	0.5
2.7	99.6	0.4
2.8	99.7	0.3
2.9	99.8	0.2
3.0	99.9	0.1

MRP sheet for Question No.1

Product	On Hand		1	2	3	4	5	6	7	8	9	10	11
		Gross Requirement On hand Net Requirement Planned order receipt Planned order release											
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