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	:	2013/14
Date	:	August 22, 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 State two methods, which can be used to solve a linear programming model.

1.2 What are the assumptions you make in "transportation algorithm" technique.

1.3 A calculator manufacturing company produces a scientific calculator and a graphing calculator. Long-term projections indicate an expected demand of at least 100 scientific calculators and at least 80 graphing calculators each day. Because of limitations of the production capacity, maximum of 200 scientific calculators and 170 graphing calculators could be manufactured per day. To satisfy a shipping contract, a total of at least 200 calculators must be shipped each day.

The company is having a Rs. 200.00 loss by selling one scientific calculator, but each graphing calculator sold would make *Rs.* 500.00 profit.

How many of each type of calculator should be produced daily to maximize net profits?

Question 2

A company makes two products (X and Y) using two machines (A and B). Each unit of X that is produced requires 50 *minutes* processing time on machine A and 30 *minutes* processing time on machine B. Each unit of Y that is produced requires 24 *minutes* processing time on machine A and 33 *minutes* processing time on machine B.

At the start of the current week there are 30 units of X and 90 units of Y in stock. Available processing time on machine A is forecasted to be 40 *hours* and on machine B is forecasted to be 35 hours.

The demand for X in the current week is forecasted to be 75 units and for Y is forecasted to be 95 units. Company policy is to maximise the combined sum of the units of X and the units of Y in stock at the end of the week.

2.1 Formulate the problem deciding how much of each product should be made in the current week as a linear program.

2.2 Solve this linear program graphically.

Question 3

3.1 Just-in-time (JIT) and Material Requirement Panning (MRP) are two different techniques used in controlling production processes. It is often said that; MRP is a 'Push' system and JIT is a 'Pull' system.

Do you agree to the above statement? Justify your answer.

3.2 What is Enterprise Resource Planning (ERP)? Briefly explain the key application modules that can be found in ERP system.

3.3 What is Supply Chain Management? Describe five basic components of Supply Chain Management.

3.4 Describe the term 'Out-Sourcing' and explain why a firm would want adopt the outsourcing techniques.

Question 4

OP Lanka Ltd is a manufacturing company which introduces various industrial machineries to the local market. Presently the company is planning to introduce a new hydraulic press machine. The schedule of activities in manufacturing the machine, respective durations and the respective manpower requirements for each activity of the project is given in Table.Q4.

Activity	Duration in days	Immediate predecessor Activity	Number of people required
A	4	-	3
B	1	-	2
C	4	B	4
D	5	B	2
E	2	B	3
F	5	C	3
G	2	D	4
H	6	A,E	3
I	2	H	4
J	4	F,G,I	5
K	3	J	6

Table.Q4

The cost per man-day is *Rs*. 1000.00. Activities G and I cannot be conducted simultaneously due to resource constraints.

You are required to,

4.1 Draw up a network to represent the above schedule and identify the critical activities. What is the shortest time required to complete the job?

4.2 Draw up a chart to show the manpower required for each day for the total duration of the job and estimate the cost if the job is to be completed in the shortest possible time.

4.3 If the number of people available is limited to a maximum of 10 on any given day, what minimum adjustments would you make in the chart prepared under 4.2, of this question.

Question 5

5.1 Discuss 'Planned order release' and 'Planned order receipt' in the context of Material Requirement Panning.

5.2 The Table.Q5 defines the activities within a small project.

Activity	Start Node	End Node	Completion time (weeks)
1	1	2	2
2	1	3	3
3	1	4	2
4	2	5	3
5	3	6	7
6	4	6	5
7	5	7	4
8	6	7	9
9	7	8	3

Table.Q5

In addition to the above information the activity 7 cannot be started until the completion of activity 5.

5.2.1 Draw the network diagram.

5.2.2 Calculate the minimum overall project completion time.

5.2.3 Calculate the float time for each activity and hence identify the activities which are critical.

Question 6

6.1 Why would a 'make to stock' manufacturer, wishes to become a 'make to order' manufacturer? What trends in today's society contribute to the ability and/or to the necessity to become 'making to order'?

6.2 Describe difference between "fixed order quantity rule (FOQ)" and "fixed period requirements rule (FPR)" of Materials requirement planning.

6.2 An energy related parts supplying organization sells *Hardy*-brand batteries. The annual demand is approximately 1,200 batteries. The supplier pays *Rs.* 2,800.00 for each battery and estimates that the annual holding cost is 30 percent of the battery's value. It costs approximately *Rs.* 2,000.00 to place an order (managerial and clerical costs). The supplier currently orders 100 batteries per month.

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

    6.2.2 Determine the economic order quantity (EOQ).

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

    6.2.4 Determine the ordering, holding, and total inventory costs for the EOQ.

Question 7

7.1 What are the essential features of an effective 'plant layout', designed for a factory?

7.2 State specific details needed to be considered in designing a plant layout for a conventional manufacturing system which produces wide range of engineering components of small batch sizes.

7.3 Briefly explain the basics of an algorithm used in any computer software package known to you for layout planning, and explain briefly how you would make use of such software for developing layouts.

Question 8

8.1 What are the objectives and benefits of a Material Requirement Planning (MRP) module in an Enterprise Resource Planning (ERP) system?

8.2 Assume you are required to develop a MRP system for VSW (Pvt) Ltd, discuss 3 types of information you would include in the developed MRP system.

8.3 Discuss the MRP calculations you would conduct in the above system.

8.4 The VSW (Pvt) Ltd is engaged in manufacturing two products, A and B. The Bill of Materials (BOM) and normal manufacturing lead times (in weeks) for the products A and B are given in Figure.Q8. L, M, N, P, Q and R are different items needed to manufacture A and B which the respective number of each items required are given in the brackets.

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        A (Lead Time=3)                          B (Lead Time=2)
     ┌────────┼────────┐                      ┌──────────┼──────────┐
   L (1)    M (3)    N(2)                    L (1)                 N(1)
     │                                         │
  ┌──┼──┐                                  ┌───┼───┐
P (1) Q (1) R(1)                         P (1) Q (1) R (1)
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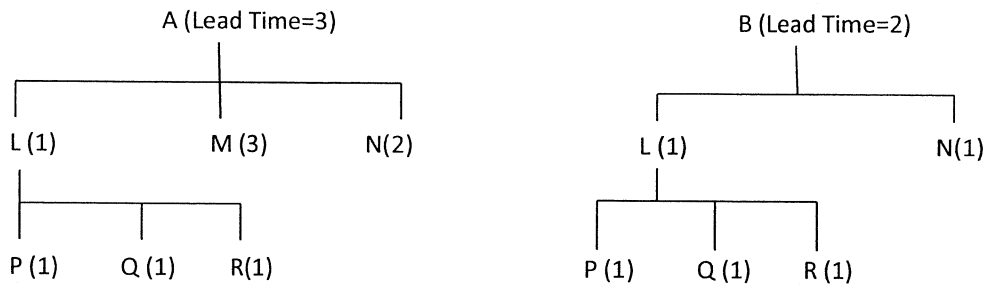
Figure.Q8

Planned dispatches of the products A and B. The current stock status is given in Table 8.1 and 8.2 respectively. Using the worksheet provided and considering the current stocks, prepare order release schedule for all components and sub-assemblies. Assume that there are no lot sizing rules and no restrictions on quantities to be ordered.

Week no.	W4	W5	W6	W7	W8
A	10	5	-	20	-
B	-	20	-	-	10

Table.8.1 - Planned Dispatches

Item	A	B	L	M	N	P	Q	R
Lead Time	3	2	2	3	1	2	1	1
Available Stock	25	5	5	10	5	5	7	10

Table.8.2 – Lead time & Current stock status

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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