UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 5 Examination in Engineering: August 2014

Module Number: ME5315   Module Name: Production Planning and Control

[Three Hours]

[Answer all questions, each question carries 12 marks]

Q1. a) Many practitioners currently update their Material Requirement Plan (MRP) weekly or biweekly. Would it be more valuable if it were updated daily? Discuss.

[2.0 Marks]

   b) Product X is made of 02 units of Y and 03 units of Z. The component Y is made of 01 unit of A and 02 units of B. The component Z is made of 02 units of A and 04 units of C. Lead times for each product/component : X 01 week, Y 02 weeks, Z 03 weeks, A 02 weeks, B 01 week and C 03 weeks.

   I.   Draw the Product Structure tree.
   II. If 100 units of X are need in week 10 develop a Material Requirement Plan showing when each item should be ordered and in what quantity.
   III. Develop a Material Requirement Plan if there are currently on hand stock 20 of X, 40 of Y, 30 of Z, 50 of A, 100 of B and 900 of C. (Use the given Table Q1)

[10.0 Marks]

Q2. a) What is the purpose of aggregate planning?

[2.0 Marks]

   b) Describe four demand and capacity options for implementing plans.

[4.0 Marks]

   c) A factory employs a permanent workforce that is capable of providing a normal production capacity of 400 units per month. In addition to the normal capacity, 50 additional units can be produced by using overtime. The variable cost of carrying stock is Rs. 200/= per unit per period. The opportunity cost of lost sales (unmet demand) is estimated to be Rs. 500/= per unit. There is an additional cost of Rs. 100/= per unit under overtime production. The demand pattern for first half of year 2002 is given in Table Q2.
   A constant workforce planning strategy has been proposed to produce only a constant quantity of 350 units per period under normal production.

   I.   Tabulate the closing stock and lost sales for each period and calculate the resulting total cost for the given production planning strategy.
   II. State the weaknesses of the production plan.
   III. Propose an alternative plan and calculate the resulting total cost.

[6.0 Marks]

Q3. a) What are the main advantages of using quantitative techniques in demand forecasting? What limitations do quantitative techniques have?

[2.0 Marks]

b) Explain some of the consequences of poor forecasts.

[2.0 Marks]

c) What is the difference between a trend, a cyclic and a seasonal pattern?

[2.0 Marks]

d) What factors enter into the choice of a value for the smoothing constant in exponential smoothing?

[2.0 Marks]

e) What are the advantages of using the adjusted exponential smoothing method over the linear trend line method to forecast a demand having a trend pattern?

[2.0 Marks]

f) How does the linear trend line forecasting model differ from a linear regression model for forecasting?

[2.0 Marks]

Q4. Air travel by the passengers using Sri Lankan Airlines for the past 12 weeks is shown in Table Q4.

a) Explain why an averaging technique would not be appropriate for forecasting in future travel demand.

Hint: You may plot the given data on a sheet of graph paper.

[2.0 Marks]

b) Use the following two techniques to develop a forecast for the expected number of passengers for the weeks 11 to 13.
   I. Trend adjusted exponential smoothing with $\alpha=0.40$ and $\beta=0.30$
   II. Use of a Trend equation

[8.0 Marks]

c) From the above two methods (b. I and b. II), which method gives the higher accuracy in calculating Mean Absolute Deviation (MAD).

[2.0 Marks]

Q5. a) The Rocky Mountain Arsenal, formerly a chemical warfare manufacturing site, is said to be one of the most polluted locations in the United States. Cleanup of chemical waste storage basins will involve two operations.
   Operation 1: Drain and clean the basin
   Operation 2: Incinerate materials.
   The time estimates (in days) for each operation is shown in Table Q5. Management's objective is to minimize the makespan of the cleanup operations. All storage basins are available for processing right now.

   I. Find a schedule that minimizes the makespan.

II. Calculate the minimum total elapsed time.

[3.0 Marks]

III. What is the idle time at Operation 2?

[2.0 Marks]

IV. Calculate the average flow time of a storage basin through the two operations.

[1.5 Marks]

V. Display the schedule in a Gantt Chart.

[1.5 Marks]

b) Briefly explain at least <u>five</u> priority sequencing rules.

[2.5 Marks]

Table Q2: The demand pattern for first half of year 2002

Period	Demand (units)
Jan	300
Feb	400
Mar	300
Apr	750
May	400
June	500

Table Q4: Use of Sri Lankan Airlines by the passengers

Week	No. of Passengers
1	405
2	410
3	412
4	415
5	412
6	420
7	424
8	433
9	438
10	440
11	446
12	451

Table Q5: Time estimates for cleaning of chemical waste storage basins

	Storage Basin									
	A	B	C	D	E	F	G	H	I	J
Operation 1	3	4	3	6	1	3	2	1	8	4
Operation 2	1	4	2	1	2	6	4	1	2	8

Table Q1: MRP Table for Question Q1.(c)

Part	Description	Week									
		01	02	03	04	05	06	07	08	09	10
	Gross Requirements										
	Scheduled Receipts										
	Projected Available Balance										
	Net Requirements										
	Planned Order Receipts										
	Planned Order Release										
	Gross Requirements										
	Scheduled Receipts										
	Projected Available Balance										
	Net Requirements										
	Planned Order Receipts										
	Planned Order Release										
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	Scheduled Receipts										
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