



# UNIVERSITY OF RUHUNA

## Faculty of Engineering

End-Semester 6 Examination in Engineering: December 2015

Module Number: ME 6304

Module Name: Production Planning and Control

[Three Hours]

[Answer all questions, each question carries ten marks]

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- Q1. Production Planning and Control (PPC) is a set of functions which includes the effective utilization of limited resources, management of material flow through the resources, satisfy the customer demand and create profit for the organization.
- a) What are the key functions (decisions) used in PPC? Briefly describe why a PPC system is necessary for an organization? [2.0 Marks]
- b) Write down three qualitative and three quantitative techniques used in demand forecasting. [2.0 Marks]
- c) Sunrise Inc., has produced ships for last 6 years as shown in **Table Q1**. Forecast the number of ships that company would produce in next year using the *Linear Regression Model*. Measure the forecast accuracy using Mean Absolute Deviation (MAD) and Mean Square Error (MSE). [6.0 Marks]
- Q2. Plant location or the facilities location is an important strategic level decision making for an organization. One of the key features of a conversion process (manufacturing system) is the efficiency with which the products (services) are transferred to the customers.
- a) What are the types of influential factors to be considered in deciding the plant location? Write at least three factors from each type. [3.0 Marks]
- b) What is the meaning of "Break Even Analysis" related to manufacturing company? Define the "Break Even Point" using suitable diagrams. [3.0 Marks]
- c) Potential locations X, Y and Z have the cost structures as shown in **Table Q2**. The ABC company has a demand of 130,000 units for a new product. Select the most suitable location and also identify the volume ranges where each location is best suited? [4.0 Marks]
- Q3. Line Balancing is the process of assigning tasks to workstations in such a way that the workstations have approximately equal time requirements.
- a) What are the types of assembly lines? [1.0 Mark]

- b) Define following terms related to the line balancing methods
- i) Minimum Production Work Element
  - ii) Cycle time
- [2.0 Marks]
- c) A company is setting up an assembly line to produce 192 units per eight-hour shift. **Table Q3** represents the work elements, element processing times and immediate predecessors.
- i) What is the desired cycle time?
 

[1.0 Mark]
  - ii) What is the theoretical number of workstations in above assembly line?
 

[1.0 Mark]
  - iii) Use the *Largest Candidate Rule* to work out a solution with required precedence diagram.
 

[4.0 Marks]
  - iv) Find the efficiency and the balance delay.
 

[1.0 Mark]

Q4. Aggregate Planning and Inventory Control are two major functions of production planning and control.

- a) What are the reasons for keeping inventories? Briefly explain two of them.
 

[2.0 Marks]
- b) Briefly explain the costs associated with the inventories.
 

[2.0 Marks]
- c) Define the term "Aggregate Planning" and write the related strategies of it.
 

[2.0 Marks]
- d) The Shader Electronics Company produces two products: (1) the Shader Walkman (a portable CD/DVD player), and (2) the Shader Watch-TV (a wristwatch-size internet-connected color television). The production process of each product is similar in which both processes require a certain number of hours of electronic work and a certain number of labor-hours in the assembly department. Each Walkman takes 4 hours of electronic work and 2 hours in the assembly shop. Each Watch-TV requires 3 hours in electronics and 1 hour in assembly. During the current production period, 240 hours of electronic time is available, while 100 hours of assembly department time is also available. Each Walkman sold yields a profit of \$7; while each Watch-TV may be sold for a \$5 profit. Shader's problem is to determine the best possible combination of Walkman and Watch-TVs to manufacture to reach the maximum profit. Identify the decision variables and formulate the combination as a linear programme model.
 

[4.0 Marks]

Q5. Material Requirements Planning (MRP) is a technique for determining the quantity and timing for the acquisition of dependent demand which needed to satisfy the Master Production Schedule.

- a) Briefly describe following terms related to MRP.
  - i) Master Production Schedule
  - ii) Bill of Materials

[2.0 Marks]

- b) Extrema, Inc. has received an order for each of 60 units of product A and product Q, to be delivered in 8 weeks. The product structure trees for products A and Q are shown in **Figure Q5**. Extrema has on hand (available) 350 units of component C and 300 units of component E; there is no stock on hand or on order for other components.
- Determine the planned order release for products A and Q (You may use the MRP Table provided with this paper).
  - After planning the conditions stated above, Extrema receives a request for an additional order of 50 units of product Q. The Extrema sales representative wants to know if he can promise delivery within 7 weeks or earlier if possible, to the potential customer. As a production planner, realizing that your assembly operation can, at most work on assembling 50 units of product Q at any given time, what is your response to the sales representative's inquiry?  
[8.0 Marks]

Q6. Loading, Sequencing and Scheduling can be considered as one set of key sections of production planning and control which optimize the production process of a manufacturing organization.

- Briefly describe the terms of Loading, Sequencing and Scheduling.  
[2.0 Marks]
- What are the priority sequencing rules used to assign the waiting jobs to a sequence?  
[2.0 Marks]
- Five different jobs to be performed in five different machines. **Table Q6** shows the machining cost (in Rupees) of each job on respective machines. How the jobs should be assigned to the machines so that the total cost of assignment is minimum.  
[6.0 Marks]

**TABLE Q1**

Year	1	2	3	4	5	6
Demand (No. of ships)	45	50	48	52	56	58

**TABLE Q2**

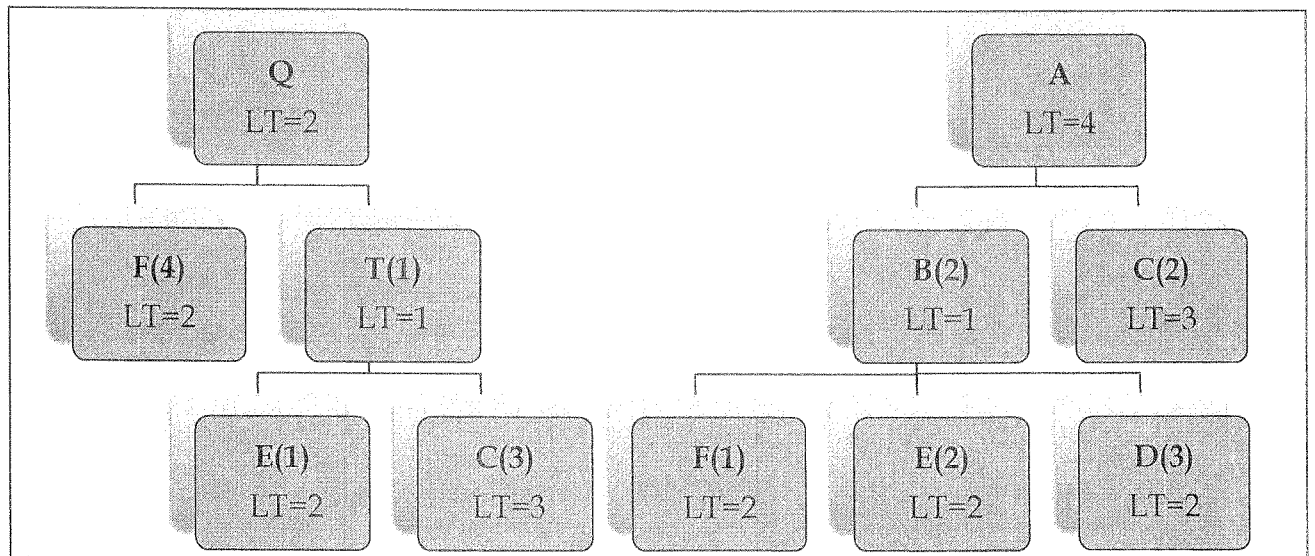
	Location X	Location Y	Location Z
Fixed Costs (Rs.)	150,000	350,000	950,000
Variable Costs (Rs.)	10	8	6

**TABLE Q3**

Work Element	Time (Sec)	Preceded by	Work Element	Time (Sec)	Preceded by
A	40	-	F	15	B
B	80	A	G	120	A
C	30	D,E,F	H	145	G
D	25	B	I	130	H
E	20	B	J	115	C,I

**TABLE Q6**

Job	Machines				
	A	B	C	D	E
I	5	6	4	8	3
II	6	4	9	8	5
III	4	3	2	5	4
IV	7	2	4	5	3
V	3	6	4	5	5



**Figure Q5: Product Structures of A and Q**

Lot Size	Lead Time	On Hand	Low level code	Item	MRP TABLE	Period								
						1	2	3	4	5	6	7	8	
					Gross requirement									
					Project on hand									
					Net requirements									
					Planned order receipts									
					Planned order release									

					Gross requirement									
					Project on hand									
					Net requirements									
					Planned order receipts									
					Planned order release									

					Gross requirement									
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