



UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 5 Examination in Engineering: May 2023

Module Number: ME5204 Module Name: Production Planning and Control
[Three Hours]

[Answer all questions, each question carries twelve marks]

MRP Table is attached with the question paper. Attach the table in to the answer sheet for the Q5.

Q1 Production Planning and Control (PPC) is a set of functions concerned 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 PPC decisions? Briefly describe why PPC system is necessary for an organization?

[2.0 Marks]

b) What are the challenges created due to the economic crisis in Sri Lanka for manufacturing organizations concerning PPC decisions? Explain by providing examples.

[2.0 Marks]

c) One of your colleague believes that "even though demand and technology forecasting play vital roles in the manufacturing industry, economic forecasting is not at all important". Explain your view on this by providing suitable examples.

[4.0 Marks]

d) Asbestos has been used in various products for decades due to some of its superior properties; however, inhaling "Asbestos fibers" can lead to serious health issues. Therefore, you were asked to provide consultancy for introducing a sustainable alternative to "Asbestos". Explain how you use Qualitative Forecasting Techniques for making initial stage decisions.

[4.0 Marks]

Q2 A particular wooden fiberboard manufacturing company is surrounded by few villages. These villages were established before the company was installed, and the population of these villages is increasing day by day. Wood fibers (which are used as the main raw material) and dust emissions into the air and waterways by this factory are crucial problems faced by these villages. Furthermore, the roads have been damaged due to the frequent transportation of overweight vehicles with logs and finished products (finished fiberboards).

a) Do you satisfy with the selected location for this plant? Support your answer by considering the current situation that the company has to face.

[2.0 Marks]

- b) If you were a responsible person in the company who took decision regarding selecting the most appropriate plant location, what factors would you have considered before finalizing the most suitable location? Explain them briefly.

[3.0 Marks]

- c) **Figure Q2** illustrates the main processes associated with the manufacturing process of the previously mentioned fiberboards. Subprocesses of each main process are mentioned by letters S1 to S12 in **Table Q2**.

- i) Identify all the necessary departments required for the fiberboard manufacturing facility.

[2.0 Marks]

- ii) Draw a suitable plant layout for the fiberboard manufacturing facility.

[3.0 Marks]

- iii) Justify your plant layout and individual department location selection by considering the main principles in plant layout design (at least discuss two of them).

[2.0 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 the following terms related to the line balancing methods.

- i) Cycle time

- ii) Balance delay

[2.0 Marks]

- c) A new small electrical appliance is to be assembled on a production flow line. The total job of assembling the product has been divided into minimum rational work elements. The industrial engineering department has developed time standards based on previous similar jobs. This information is given in the **Table Q3**. In the right-hand column are the immediate predecessors for each element as determined by precedence requirements. The assembly line is set up to produce 360 units per six-hour shift under regular working conditions.

*Note: You may state any assumption you made when answering the questions.

- i) What is the desired cycle time?

[1.0 Mark]

- ii) What is the theoretical number of workstations?

[1.0 Mark]

- iii) What are the two conditions to satisfy when assigning work elements to stations? Why are they critical?

[2.0 Marks]

- 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 can be concerned as the major functions of production planning and control.

a) Briefly explain three reasons for keeping inventories. [3.0 Marks]

b) What is the impact of inventory control in a manufacturing company? [2.0 Marks]

c) Discuss the applicability of Just-In-Time (JIT) concept for the apparel industry. [3.0 Marks]

d) You are the "Capacity Planning Manager" of a reputed apparel manufacturing company whose export market is mainly based in Europe. One of your company's long-term customer requests an emergency delivery within a very short period of time. When considering the duration and the access to required resources, you understood that your company's current capacity is insufficient to fulfil the demand of this customer; however, your company does not like to lose this order. What possible options would you recommend if your company decided to fulfil this emergency order? [4.0 Marks]

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

a) What are the objectives of MRP and briefly describe three of them. [4.0 Marks]

b) Foley 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**. Foley Inc. 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.

i) Determine the planned order release for products A and Q (You may use the MRP Table provided with this paper).

ii) After planning the conditions stated above, Foley Inc. receives a request for an additional order of 50 units of product Q. The Foley 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]

TABLE Q2

| Order | Number of Subprocess | Process Description |
|-------|----------------------|--|
| 1 | S1 | Chipping logs into pieces |
| 2 | S2 | Storing chips temporarily |
| 3 | S3 | Producing wood fibers |
| 4 | S4 | Mixing fibers with glue |
| 5 | S5 | Storing fiber mixture |
| 6 | S6 | Sending fiber mixture to production line |
| 7 | S7 | Pre-compressing the fiberboards |
| 8 | S8 | Final pressing the fiberboards |
| 9 | S9 | Unloading the fiberboards |
| 10 | S10 | Cooling the fiberboards |
| 11 | S11 | Trimming the edges |
| 12 | S12 | Sanding the surface |

TABLE Q3

| Work Elements | Duration (T_{ej}), (min) | Precedence |
|---------------|------------------------------|------------|
| A | 0.2 | - |
| B | 0.4 | - |
| C | 0.7 | A |
| D | 0.1 | A, B |
| E | 0.3 | B |
| F | 0.11 | C |
| G | 0.32 | C |
| H | 0.6 | C, D |
| I | 0.27 | F, G, H |
| J | 0.38 | E, H |
| K | 0.5 | I, J |
| L | 0.12 | K |

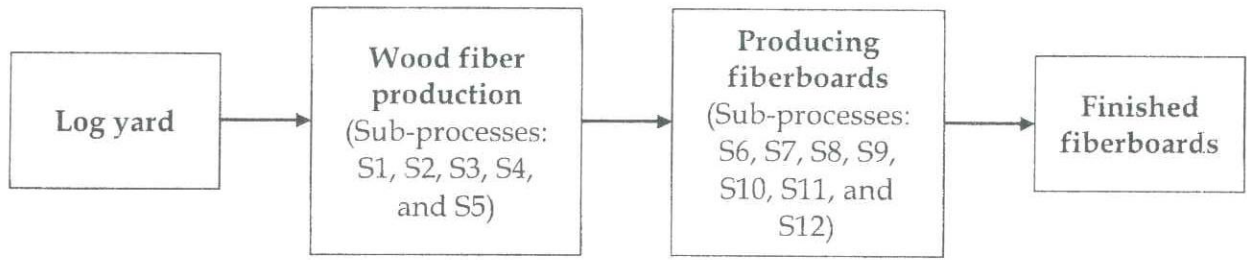


Figure Q2: Main and Subprocesses of Fiberboard Production

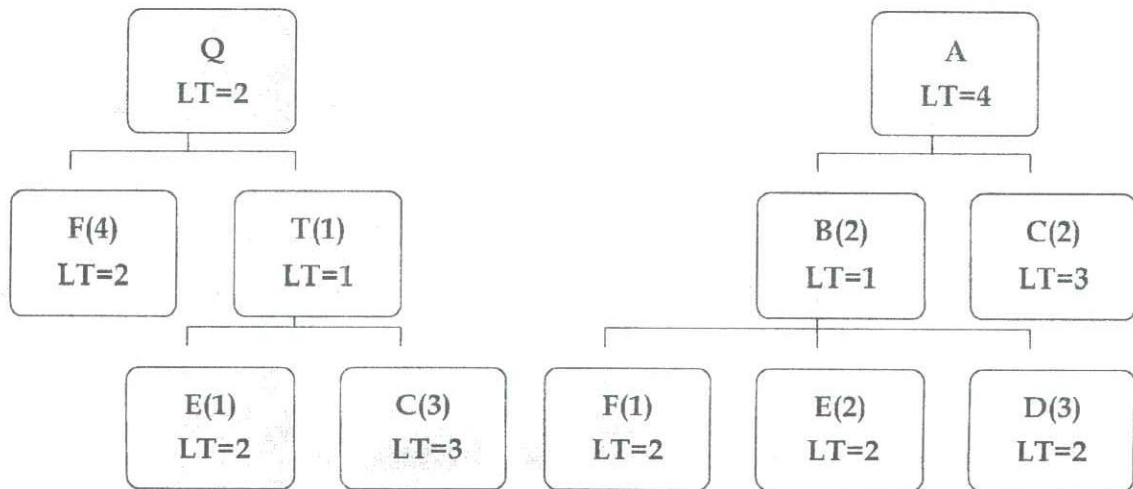


Figure Q5: Product Structures of A and Q

| 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 | | | | | | | | | |

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

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

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

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| | | | | | Project on hand | | | | | | | | | |
| | | | | | Net requirements | | | | | | | | | |
| | | | | | Planned order receipts | | | | | | | | | |
| | | | | | Planned order release | | | | | | | | | |

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

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| | | | | | Gross requirement | | | | | | | | | |
| | | | | | Project on hand | | | | | | | | | |
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