Exam Date & Time: 02-Dec-2023 (02:30 PM - 05:30 PM)

# MANIPAL ACADEMY OF HIGHER EDUCATION

**Production Planning and Control [MME 4048]**

**Marks: 50** **Duration: 180 mins.**

**Descriptive**

**Answer all the questions.**

1A) A manufacturing company has a seasonal demand pattern, with the demand forecast for the first six months of the next year and the working days available as shown in the table below. The company plans to end the current year with 100 units of inventory.

| | Jan. | Feb. | March | April | May | June |
|---|---|---|---|---|---|---|
| Demand (units) | 860 | 1152 | 960 | 120 | 512 | 768 |
| Work days | 25 | 20 | 24 | 25 | 20 | 24 |

(5)

The company has a constant workforce of 40 workers and each unit requires 10 worker hours to produce at a labour cost of $ 6 per hour. Working hours are 8 hours per day. If the company plans to resort to the strategy of building inventory at a cost of $10 per unit per month and encourages the customers to accept back orders at a penalty of $ 30 per unit per month, determine the total cost of the plan if the manufacturing cost excluding the labour cost is $120 per unit?

1B) The quarterly sales data for an umbrella manufacturing company experiencing seasonal pattern for the past two years is as shown below

| | Quarters | | | |
|---|---|---|---|---|
| **Year** | **Q1** | **Q2** | **Q3** | **Q4** |
| **2021** | 200 | 400 | 500 | 100 |
| **2022** | 260 | 520 | 650 | 130 |

(3)

If the company expects that the likely volume of sales in 2023 is 2028, forecast the volume of sales for each quarter of the year

1C) Identify and briefly explain the general characteristics of a production activity manufacturing automobile four wheelers. (2)

2A) A farmer strongly believes that the wheat yield in his farm in a year is dependent on the rainfall in that year and has maintained the following record. (5)

| Year | Rainfall in Meters | Yield (tons) |
|---|---|---|
| 1 | 3 | 1.3 |
| 2 | 3.4 | 1.7 |
| 3 | 2.8 | 1.2 |
| 4 | 3.6 | 1.9 |
| 5 | 3.5 | 1.8 |
| 6 | 3.3 | 1.4 |

If the likely rainfall next year is 3.7 metres, what yield should he expect?

2B) Five jobs will have to be processed through 3 Machines A, B and C in the order A first, B next and C last. Processing times in hours are given below in the following table. (3)

| Job | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Machine A | 16 | 20 | 12 | 14 | 22 |
| Machine B | 10 | 12 | 4 | 6 | 8 |
| Machine C | 8 | 18 | 16 | 12 | 10 |

Determine the sequence that minimizes the total time required for processing all the jobs and the idle times for the 3 machines.

2C) Explain the characteristics of the Aggregate Planning strategies having an impact on society due to unemployment. (2)

3A) The demand for an item is 50000 units per year. The ordering cost is Rs.400 per order. The inventory carrying cost is Rs.4per unit per year. The purchase price depends on the order quantity and is shown in the table below (5)

| Range of order quantity (units) | Upto 2999 | 3000-5999 | 6000 & above |
|---|---|---|---|
| Price (Rs./unit) | 20 | 19.9 | 19.8 |

Determine the optimum ordering policy. (Graphical illustration not required)

3B) How does a manufacturing organization determine the Reorder Point for inventory items by fixing the safety stock using different approaches based on past experience? (3)

3C) The quarterly demand for an item is 4,500 units with a purchase price is Rs.40 per unit and ordering cost of Rs. 30 per order. Inventory carrying cost is Rs. 1/- per unit per month. Assume no shortages and instantaneous replenishment, determine the total inventory carrying cost per cycle. (2)

4A) Each unit of end product P requires 2 units of sub component R. The lead time for P is one week and the standard order quantity is 120 units. The current availability for P is 105 units. Gross requirements for the next 6 weeks are 75, 90, 60, 45, 75 and 270 units (5)

respectively. For item R lead time is two weeks, standard order quantity is 240 units, safety stock is 180 units and current availability is 270 units. A scheduled receipt of 240 units of R is due in week 1. Develop the MRP schedule for P & R showing the safety stock as part of on hand/available inventory and considering the replacement demand of 120 and 540 units for component R in the 3rd and 6th week respectively.

4B) The monetary value of the annual consumption of an item is Rs.65,000. The procurement expenses are Rs.60 per order. Inventory carrying expenses per unit per year are Rs.0.25. The cost of the item is Rs.60 per dozen. Determine EOQ and the total cost of the inventory inclusive of the purchase cost of the items. If the procurement lead time is 2 weeks calculate ROP and safety stock. Represent the results graphically. The safety stock is 20% of lead time consumption. (3)

4C) Highlight the actions initiated by the inventory section of a manufacturing organization after conducting ABC analysis. (2)

5A) The assembly of an electronic copier requires a total of 66 minutes. Table below gives the tasks, assembly time and sequence requirements for the copier.

| Task | A | B | C | D | E | F | G | H | I | |
|---|---|---|---|---|---|---|---|---|---|---|
| Task time (minutes) | 10 | 11 | 5 | 4 | 12 | 3 | 7 | 11 | 3 | Total: 66 Mins |
| Preceding Task | - | A | B | B | A | C,D | F | E | G,H | |

(5)

Draw the precedence diagram and balance the assembly line if the desired output rate is 40 units per eight-hour shift using the most following tasks heuristic to assign jobs to the workstations and calculate the efficiency.

5B) Annual demand for an item is 90,000 units. The production capacity is 15,000 units per month. Inventory carrying cost is Rs.9/unit/year. The set up cost for each production run is Rs.225. Determine the quantity of inventory consumed during the buildup period. (3)

5C) Green Grass Ltd. company, a manufacturer of lawn and garden equipment is designing an assembly line to produce a new fertilizer spreader, Model FR200. It plans to produce 2400 units per week for at least the next 3 months. The plant operates 40 hours per week. Determine the lines cycle time and the efficiency if the company is able to balance the assembly line involving 9 tasks requiring a total of 244 seconds with the lowest possible number of stations. (2)

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