Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

DEPARTMENT OF MECHATRONICS

VII SEMESTER B.TECH. (MECHATRONICS)

END SEMESTER MAKEUP EXAMINATIONS, JAN 2024

SUBJECT: PRODUCTION OPERATIONS AND MANAGEMENT [MTE 4080]

(15.01.2024)

Time: 180 MINUTES **MAX. MARKS: 50**

Instructions to Candidates:
- Answer **ALL** the questions.
- Missing data if any can be suitably assumed.

Q. No	QUESTIONS	M	CO	PO	LO	BL
1A.	List out different types of forecasting models.	**2**	**1**	**1, 5**	**1, 2, 3**	**3**
1B.	A company is setting up an assembly line to produce 192 units per 8 hour shift. The following table 1b identifies the work elements, time and immediate predecessors.	**3**	**4**	**1, 2, 3, 4, 11**	**1, 2, 3, 5, 13**	**4**

Table 1b Cycle time of activities

Tasks	Performance time (min.)	Task must follow those listed below.
A	--	40
B	A	80
C	D, E, F	30
D	B	25
E	B	20
F	B	15
G	A	120
H	G	145
I	H	130
J	C, I	115

1. What is the desired cycle time?
2. What is the theoretical minimum number of stations?
3. Use the longest work element time rule balance the assembly line.
4. What are the resulting efficiency and delay percentages.?

1C. A company is considering 4 alternative locations for a new plant & the relevant cost are as shown in the table 1c below: Determine the most suitable location for an output in the range of 50,000 to 1,30,000 Units per year. Also plot the data.

5 | **5** | **1, 3, 4, 11, 12** | **1, 13** | **5**

Table 1c Cost structure of new locations

Location	6,00,000	4,50,000	5,00,000	5,75,000
Fixed cost/year (Rs)	1	1.8	1.3	0.8
Variable Cost (Rs/Unit)	6,00,000	4,50,000	5,00,000	5,75,000

2A. How center of Gravity method is used for finding the new location.

2 | **5** | **1, 3, 4** | **1, 13** | **3**

2B. A larger and more modern main port office is to be constructed at a new location due to the shifting pattern of population density. Seven mail source points have been identified from where mail is picked up and delivered in bulk. The coordinates and trips per day to and from the seven mail source points and the current main port office 'M' are shown in the following table 2b. M will continue to act as a mail source point after relocation.

3 | **5** | **1, 3, 4, 11, 12** | **1, 13** | **5**

Table 2b New location coordinates

Mail Source Point	Round trips per day	X, Y-coordinates (miles)
1	6	(2,8)
2	3	(6,1)
3	3	(8,5)
4	3	(13,3)
5	2	(15,10)
6	7	(6,14)
7	5	(18,1)

a. Calculate the center of Gravity as a possible location for the new facility (round to the nearest number).
b. Compare the load distance scores for the location in part (a) and the current location using rectilinear distance.

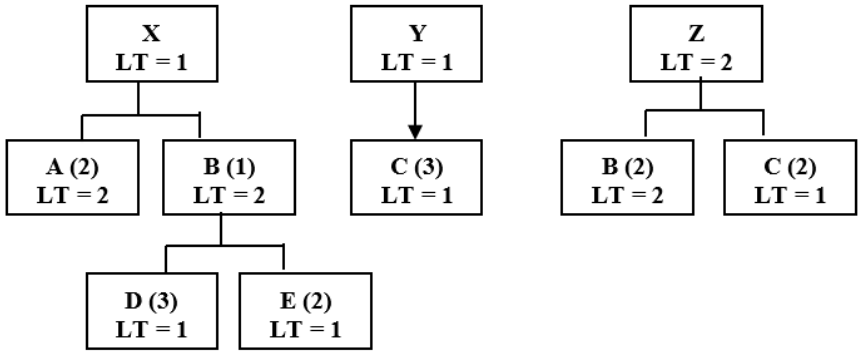
2C. A food processing company wants to forecast the next month's demand. The actual demand in the past 9 months is as shown table 2c below.

5 | **1** | **1, 5** | **1, 2, 3** | **4**

Table 2c: Historical demand data

Week	1	2	3	4	5	6	7	8	9
Patient Arrival	105	106	110	110	114	121	130	134	137

a. Determine the exponential smoothing forecast for 10th month. For a given period of time calculate smoothing constant.
b. Also calculate Mean Absolute Percentage error for the given trend.

<table>
<tr><td>3A</td><td>Draw a Manufacturing model with instantaneous delivery and without shortages, represent all suitable notations.</td><td>2</td><td>3</td><td>1, 2, 3, 4, 11</td><td>1, 2, 3, 5</td><td>3</td></tr>
<tr><td>3B</td><td>Discuss the basic functions of production cycle followed in manufacturing facility in general.</td><td>3</td><td>1</td><td>1, 5</td><td>1, 2, 3</td><td>3</td></tr>
<tr><td>3C</td><td>ABC Ltd. produces three products namely X, Y and Z, which have demand, safety stock and product structure as shown in the below table 3c and the tree structure:
Table 3c: Product tree structure
<table>
<tr><th>Product</th><th>Safety Stock</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th></tr>
<tr><td>X</td><td>40</td><td></td><td></td><td></td><td></td><td></td><td>120</td><td></td><td>120</td></tr>
<tr><td>Y</td><td>40</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>200</td></tr>
<tr><td>Z</td><td>40</td><td></td><td></td><td></td><td></td><td></td><td></td><td>180</td><td></td></tr>
</table>


1. On hand Inventory X = 100, Y= 100. A = 50, C = 80, E = 80.
2. The only scheduled receipts are 60 units of Z due in period 4.
3. Lot size for B is 50 and D is 50.

Determine the order quantities and order release dates for all requirements using the MRP format.</td><td>5</td><td>4</td><td>1, 2, 3, 4, 11</td><td>1, 2, 3, 5, 13</td><td>4</td></tr>
<tr><td>4A</td><td>How do you schedule n jobs on 2 machines, discuss the methodology.</td><td>2</td><td>3</td><td>1, 2, 3, 4, 11</td><td>1, 2, 3, 5</td><td>3</td></tr>
<tr><td>4B</td><td>A manufacturing organization has received an order to produce 50000 boxes and has the option of meeting the order in their present job shop layout or setting up a new production line. The cost associated with the 2 options is shown in table 4b below.
Table 4b: Production facility details
<table>
<tr><td colspan="2">Present Layout</td><td colspan="2">Production Line</td></tr>
<tr><td>Production Planning</td><td>Rs. 6000</td><td>Re-layout</td><td>Rs. 50000</td></tr>
<tr><td>Tooling</td><td>Rs. 4000</td><td>Special equipment</td><td>Rs.50000</td></tr>
<tr><td>Setup cost</td><td>Rs.6000</td><td>Production Planning</td><td>Rs.5000</td></tr>
<tr><td>Unit variable cost</td><td>Rs.6/Unit</td><td>Training</td><td>Rs.5000</td></tr>
<tr><td></td><td></td><td>Unit variable cost</td><td>Rs.3/unit</td></tr>
</table></td><td>3</td><td>2</td><td>1, 3, 4, 11</td><td>1, 2, 3, 9, 13</td><td>5</td></tr>
</table>

<table>
<tr><td></td><td>a. Select the best option using break-even analysis and illustrate graphically. What is the cost of wrong decision.
b. If the order quantity is to be reduced to 30000 units, what is your comment.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4C</td><td>The demand for an item is 18000 units/year. The purchase price is Rs. 1 per unit. Purchasing cost or ordering cost is Rs. 400 per order. Inventory carrying cost is 120% of unit cost per unit per year. No shortage are allowed. Assume instantaneous supply or infinite delivery rate and determine-
1. EOQ
2. Total annual cost
3. No. of orders per year
4. Cycle time or time between orders</td><td>5</td><td>2</td><td>1, 3, 4, 11</td><td>1, 2, 3, 9, 13</td><td>4</td></tr>
<tr><td>5A</td><td>Suggest 4 possible strategies used for aggregate planning.</td><td>2</td><td>2</td><td>1, 3, 4, 11</td><td>1, 2, 3, 9, 13</td><td>3</td></tr>
<tr><td>5B</td><td>Product X is zero level item. Component Y is level 1 item. 2 units of Y are needed in X. X has a lead time of 2 weeks. Y has a lead time of 1 week. Y is purchased in order to quantity of 600 units. At the beginning of week 1 of current schedule, 600 units of Y are scheduled to be received. Also 150 units of Y are available at the beginning f week 1. 60 units are used as safety stock for Y. The independent demand for X and Y are as shown in table 5b for the 6 weeks. Show the MRP working for the component Y in the current schedule.

Table 5b Gross requirement data for product Y
<table><tr><td>Week</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>Product : X</td><td>---</td><td>---</td><td>150</td><td>200</td><td>---</td><td>250</td></tr><tr><td>Component: Y</td><td>80</td><td>80</td><td>50</td><td>50</td><td>100</td><td>80</td></tr></table></td><td>3</td><td>4</td><td>1, 2, 3, 4, 11</td><td>1, 2, 3, 5, 13</td><td>4</td></tr>
<tr><td>5C</td><td>Johnson cogs wants to setup a line to produce 60 units per hour. The work element and precedence relationships are mentioned in table 5c.
Table 5c Tasks details
<table><tr><td>Elemental tasks</td><td>Immediate predecessors</td><td>Duration of the elements (Sec.)</td></tr><tr><td>A</td><td>40</td><td>--</td></tr><tr><td>B</td><td>30</td><td>A</td></tr><tr><td>C</td><td>50</td><td>A</td></tr><tr><td>D</td><td>40</td><td>B</td></tr><tr><td>E</td><td>6</td><td>B</td></tr><tr><td>F</td><td>25</td><td>C</td></tr><tr><td>G</td><td>15</td><td>C</td></tr><tr><td>H</td><td>20</td><td>D, E</td></tr><tr><td>I</td><td>18</td><td>F, G</td></tr><tr><td>J</td><td>30</td><td>H, I</td></tr></table>1. What is the desired cycle time?
2. What is the theoretical minimum number of stations?
3. Compare the efficiencies achieved using longest work element rule and maximum no of followers rule.</td><td>5</td><td>4</td><td>1, 2, 3, 4, 11</td><td>1, 2, 3, 5, 13</td><td>4</td></tr>
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