Reg. No.										

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

DEPARTMENT OF MECHATRONICS

VII SEMESTER B.TECH. (MECHATRONICS)

END SEMESTER EXAMINATIONS, NOV/DEC 2023

SUBJECT: PRODUCTION OPERATIONS AND MANAGEMENT [MTE 4080]

(09.12.2023)

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.	Suggest a forecasting model that provides weightage to all historical demand. Justify the same with suitable discussion.	**2**	**1**	**1, 5**	**1, 2, 3**	**3**
1B.	The assembly of an electronic copier requires a total of 66 minutes. Table 1b shows the tasks, assembly time and sequence requirements for the copier.	**3**	**4**	**1, 2, 3, 4, 11**	**1, 2, 3, 5, 13**	**4**

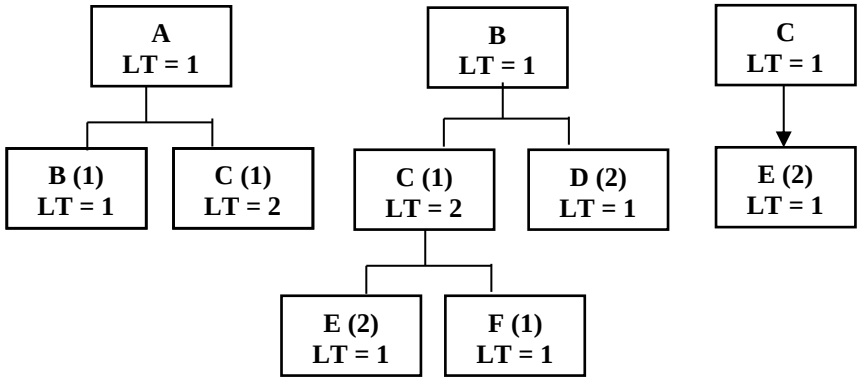
Table 1b Cycle time of activities

Tasks	Performance time (min.)	Task must follow those listed below.
A	10	--
B	11	A
C	5	B
D	4	B
E	12	A
F	3	C, D
G	7	F
H	11	E
I	3	G, H

1. Draw the precedence diagram for the above requirement.
2. If 600 productive minutes of work are available per day and if production schedule requires that 60 units be completed as output from the assembly line each day, the determine the cycle time and minimum number of workstations required.
3. Use the longest work element rule to assign jobs to workstations.

1C.	Potential locations X, Y, & Z have the cost structures shown below in table 1c: A product expected sell for Rs. 130. 1. Find the most economical location for an expected volume of 6000 units per year. 2. What is the expected profit if the site selected above is used? 3. Plot the data on the graph. 4. For what output range is each location best? **Table 1c** Cost structure of new locations Location | X | Y | Z Fixed cost/year (Rs) | 150000 | 200000 | 400000 Variable Cost (Rs/Unit) | 75 | 50 | 25	**5**	**5**	**1, 3, 4, 11, 12**	**1, 13**	**5**
2A.	Discuss briefly on different techniques under Load-Distance method used for facility location selection.	**2**	**5**	**1, 3, 4**	**1, 13**	**3**
2B.	An academic institute is planning to set up a new academic facility in a country to expand their reach. Currently the facility is located Manipal. The coordinates for each location and projected population measured in thousands is shown in the table 3 below. **Table 2b** New location coordinates Location | Aspirants Population (x 10^5) | X-Coordinate | Y-Coordinate Bangalore | 12 | 2.5 | 4.5 Kolkata | 8 | 2.5 | 2.5 Manipal | 5 | 5.5 | 4.5 Noida | 7 | 5 | 2 Hyderabad | 14 | 8 | 5 Pune | 11 | 7 | 2 Indore | 10 | 9 | 2.5 Calculate the possible nearest location using Center of Gravity method? Compare the load distance scores for the new possible location and the current location using rectilinear distance.	**3**	**5**	**1, 3, 4, 11, 12**	**1, 13**	**5**
2C.	Based on two years' worth of quarterly data, as indicated in Table 4, an automobile manufacturer sought a quarterly forecast of demand for the upcoming year. For the third-year projection, use the simple moving average approach; for the quarterly forecast, use the season index method. Using any appropriate technique, determine the forecasting error for the third-year forecast. **Table 2c** Quarterly sales data Quarter | Year 1 | Year 2 Jan-Mar | 1506 | 1855 Apr-Jun | 1810 | 2412 Jul-Sept | 1269 | 1301 Oct-Dec | 1415 | 1932	**5**	**1**	**1, 5**	**1, 2, 3**	**4**

<table>
<tr><td>3A</td><td>Draw a Purchase model with instantaneous delivery and with 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 A, B and C, which have demand, safety stock and product structure as shown in the below table 3c and the tree structure.

Table 3c Cost structure of new locations
<table>
<tr><td>Product</td><td>Safety Stock</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>A</td><td>35</td><td></td><td></td><td></td><td></td><td></td><td>180</td><td></td><td>120</td></tr>
<tr><td>B</td><td>0</td><td></td><td></td><td></td><td></td><td>100</td><td></td><td></td><td></td></tr>
<tr><td>C</td><td>30</td><td></td><td></td><td></td><td></td><td></td><td></td><td>150</td><td></td></tr>
</table>


On hand Inventory A = 60, C = 40 E = 50
The only scheduled receipts are 60 units of B due in period 3.
Lot size for C and F are 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 3 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 certain product is currently resulting in loss. It has annual fixed cost of Rs. 90,000 and total variable cost of Rs. 1,92,000 at a sales level at 12,000 units which accounts for a revenue of Rs. 2,40,000. The capacity of the plant is 25,000 units per year at 100% capacity. Evaluate the alternatives to avoid the losses.</td><td>3</td><td>2</td><td>1, 3, 4, 11</td><td>1, 2, 3, 9, 13</td><td>5</td></tr>
<tr><td>4C</td><td>Annual demand for an item is 36000 units. The production capacity is 10,500 units per month. Production cost per unit is Rs. 12.6. Inventory carrying cost is estimated to be 20% of average inventory. The set-up cost for each production run is Rs.225. Determine

EOQ
No. of set-ups per year
Production time per cycle
Max. Inventory
Total annual cost
Cycle time
Inventory period
</td><td>5</td><td>2</td><td>1, 3, 4, 11</td><td>1, 2, 3, 9, 13</td><td>4</td></tr>
</table>

<table>
<tr>
<td>5A</td>
<td>Suggest any two possible mixed strategies when a facility is working at regular time production.</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>Given the forecast requirements for the end item Y as shown below table 5b, complete the material requirements plan. Note that a schedule receipt of 60 units is due in period 2 and a safety stock 25 units to be maintained. Lead time is 2 weeks and order quantity are 60 units. The on-hand inventory is 50 units.

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><td>7</td><td>8</td><td>9</td><td>10</td></tr>
<tr><td>Gross Requirement</td><td>20</td><td>20</td><td>20</td><td>30</td><td>20</td><td>20</td><td>20</td><td>25</td><td>20</td><td>35</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>ABC Pvt. Ltd. company is setting up an assembly line to produce 280 units per 8-hour shift. The following table 5c identifies the work elements, time, and immediate predecessors.
Table 5c Tasks details
<table>
<tr><th>Elemental tasks</th><th>Immediate predecessors</th><th>Duration of the elements (Sec.)</th></tr>
<tr><td>A</td><td>---</td><td>65</td></tr>
<tr><td>B</td><td>A</td><td>40</td></tr>
<tr><td>C</td><td>A</td><td>35</td></tr>
<tr><td>D</td><td>B</td><td>60</td></tr>
<tr><td>E</td><td>B</td><td>85</td></tr>
<tr><td>F</td><td>B</td><td>75</td></tr>
<tr><td>G</td><td>D, E</td><td>45</td></tr>
<tr><td>H</td><td>F</td><td>70</td></tr>
<tr><td>I</td><td>C</td><td>35</td></tr>
<tr><td>J</td><td>C</td><td>35</td></tr>
<tr><td>K</td><td>I, J</td><td>60</td></tr>
<tr><td>L</td><td>K</td><td>55</td></tr>
<tr><td>M</td><td>G, H, L</td><td>40</td></tr>
<tr><td colspan="2">Total time (Sec.)</td><td>700</td></tr>
</table>
1. Draw Precedence diagram for the given information.
2. What is the desired cycle time?
3. What is the theoretical minimum number of stations?
4. Use the maximum followers task rule to balance the assembly line.
5. What are the resulting efficiency?
</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>
</table>