| Reg. No. | | | | | | | | | | |
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# MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

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## VII SEMESTER B. TECH (IP ENGG.) END SEMESTER EXAMINATIONS, DECEMBER 2018 (Make UP)

SUBJECT: PRODUCTION AND OPERATIONS MANAGEMENT [MME 4112]

**REVISED CREDIT SYSTEM**

Time: 3 Hours MAX. MARKS: 50

**Instructions to Candidates:**

- Answer **ALL** the questions.

**1A.** A medical group is planning to set up a new health care facility in a state to serve seven possible locations. The coordinates for each location and projected population measured in thousands is shown in the table below. Customers will travel from their respective locations to the new facility when they need health care. Location C and Location F are considered as possible locations for the new facility using rectilinear distance and population a louds which location is better in terms of its total LD score? **03**

| Location | Population X $10^3$ | X-coordinate | Y-Coordinate |
|---|---|---|---|
| A | 2 | 2.5 | 4.5 |
| B | 5 | 2.5 | 2.5 |
| C | 10 | 5.5 | 4.5 |
| D | 7 | 5 | 2 |
| E | 10 | 8 | 5 |
| F | 20 | 7 | 2 |

| | | | |
|---|---|---|---|
| **G** | 14 | 9 | 2.5 |

**1B.** A manufacturer of an industrial product is faced with tough competition. He is considering either to modify the existing product or market a new product. Demand with the two options can be low or high with probabilities of 0.25 and 0.75 for the 1st option (modification) and 0.5 & 0.5 for the 2nd option (new product). The expected pay off in case the demand is high with the modification option is Rs. 4, 50,000 and with the new product option is Rs. 6, 50,000. In case the demand is low the manufacturer may consider whether or not to go for advertising which may result in low or high demand with their respective probabilities and expected pay offs as shown below. Draw the decision tree and determine the best course of action so as to maximize the expected pay off. **04**

| **Options** | | **Advertise (a)** | | **Do not Advertise (na)** | |
|---|---|---|---|---|---|
| | | **Low** | **High** | **Low** | **High** |
| **(A) Modify Project** | **Probability** | **0.2** | **0.8** | **0.9** | **0.1** |
| | **Expected pay off** | **40,000** | **2,00,000** | **20,000** | **1,00,000** |
| **(B) New Project** | **Probability** | **0.2** | **0.8** | **0.95** | **0.05** |
| | **Expected pay off** | **50,000** | **3,00,000** | **30,000** | **1,20,000** |

**1C.** A turning dept. wants to install enough number of semi-automatic lathes to produce 4, 00,000 good components per year. The turning operation requires 2 minutes per component, but it is observed that the output of the lathes will have 6% defectives. How many lathes are required if each one is available for 1800 hours of capacity per year **03**

**2A.** Shoram Pvt. Ltd. manufactures a single product having a marginal cost of ₹ 1.50 per unit. Fixed cost is ₹ 30,000 per annum. The market is such that up to 40,000 units can be sold at a price of ₹ 3.00 per unit, but any additional sale must be made at ₹ 2.00 per unit. Company has a planned profit of ₹ 50,000. How many units must be made and sold? **03**

**2B.** Purvanchala Automation Pvt. Ltd. has developed a forecast for an item that has the following demand. **03**

| *Month* | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* |
|---|---|---|---|---|---|---|---|---|
| *Demand* | 225 | 172 | 460 | 610 | 400 | 206 | 132 | 304 |

Cost of carrying inventory = ₹ 50/unit/month
Cost of RT = ₹ 10/unit
Cost of OT = ₹ 20/unit
Cost of subcontracting = ₹ 200/unit
The management decides to maintain a constant production rate of 200 units/month or RT basis and permit 15% of RT production as OT, whenever the demand exceeds

the RT production rate. Moreover, to meet the further demand, the firm opts for subcontracting strategy. Find the total cost of this mixed strategy.

**2C.** The following table shows the actual demand and forecast data of a manufacturer for the last eight months. Calculate CFE, MAD, MSE & Tracking signal for this product. **04**

| **Month** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| **Demand** | 400 | 480 | 600 | 540 | 460 | 520 | 420 | 550 |
| **Forecast** | 450 | 440 | 570 | 580 | 500 | 480 | 500 | 480 |

**3A.** A manufacturer of a certain product feels that the pattern of yearly sales of his product is reflected by one of the 4 economic indices. The past six years data is given as under. **04**

Which of the 4 indices must be chosen for sales forecasting purpose.

Determine equation by the method of least squares.

Find the forecast for 7th year if the indices are 200,115, 350 and 240 respectively.

| **Year** | **Sales (1000 units)** | **Index I** | **Index II** | **Index III** | **Index IV** |
|---|---|---|---|---|---|
| 1 | 4.25 | 160 | 105 | 150 | 200 |
| 2 | 5.0 | 165 | 100 | 180 | 250 |
| 3 | 5.0 | 175 | 95 | 180 | 230 |
| 4 | 6.0 | 180 | 100 | 220 | 250 |
| 5 | 9.5 | 185 | 105 | 360 | 220 |
| 6 | 8.5 | 190 | 110 | 320 | 260 |

**3B.** Five aircrafts have to be processed through a sheet metal center (work center 1) and a painting center (work center 2) in an aircraft repair facility. The time durations required for the 5 aircrafts at the two work centers are shown below. **03**

| Work Centers | Aircrafts | | | | |
|---|---|---|---|---|---|
| | A | B | C | D | E |
| 1 | 4 | 17 | 14 | 9 | 11 |
| 2 | 5 | 7 | 12 | 2 | 6 |

Determine the optimal sequence, total elapsed time and idle times for both the work centers.

**3C.** Six jobs are to be processed on a particular machine. The processing time in days and the due dates are shown below. **03**

| Job | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Processing Time (days) | 5 | 4 | 2 | 7 | 3 | 5 |
| Due date (days hence) | 12 | 10 | 9 | 20 | 18 | 14 |

Schedule the jobs using SPT rule, determine the optimum sequence and calculate mean flow time, average job lateness & average number of jobs in the system.

**4A.** A farmer is strongly convinced that his yield in a year is dependent on the rainfall in the year and has maintained the following records. If the rainfall for the year 2011 is 3.7 meters, what yield should he expect? **04**

| Year | Rainfall, x (m) | Yield (Rs. Lakhs) (y) |
|---|---|---|
| 2005 | 3 | 1.3 |
| 2006 | 3.4 | 1.7 |
| 2007 | 2.8 | 1.2 |
| 2008 | 3.6 | 1.9 |
| 2009 | 3.5 | 1.7 |
| 2010 | 3.3 | 1.4 |

**4B.** Annual demand for an item is 5235 units. Ordering cost is ₹ 450 per order. Inventory carrying cost is 22% of the purchase price. The price breaks are as shown: **03**

| Quantity (units) | 0 – 1200 | 1201 – 2000 | 2001 and more |
|---|---|---|---|
| Price (₹) | 10 | 9 | 8 |

Determine the optimal order size. Also determine the optimal order size if the ordering cost is changed to ₹ 225 per order.

**4C.** Identify whether the following statements are **TRUE** or **FALSE** **02**

i. Approaches to aggregate planning in the service sector differ based upon the nature of the service provided.
ii. The goal of the aggregate planning process is usually to minimize costs over the planning period.

**5A.** Derive the equation for determining EOQ and total cost for Purchase Model with shortages and instantaneous delivery. **05**

**5B.** Product X is a zeroth level item. Component A is a first level item. 3 units of Y are needed in X. The item X has a lead time of 1 week. Y has a lead time of 2 weeks. Item X follows fixed order quantity of 150 and Y is purchased in LFL. At the beginning of first week of current schedule, 120 units of Y are scheduled to be received. In addition, 250 units of Y are available at the beginning of first week. 30 units are used as safety stock for Y. The independent demand for X and Y are as listed in the table for 6 weeks. Construct the MRP tables. **03**

| *Week* | *1* | *2* | *3* | *4* | *5* | *6* |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| *Product X* | - | 150 | - | 250 | - | 50 |
| *Product Y* | 180 | 80 | 100 | 50 | 100 | 280 |

**5C.** Define MRO and Transactional inventories. **02**