

# CBCS SCHEME

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17ME81

## Eighth Semester B.E. Degree Examination, Jan./Feb. 2023 Operations Research

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. Use of Normal distribution table permitted.

### Module-1

- 1 a. Define Operation Research and discuss the phases in Operation Research. (10 Marks)  
b. Solve graphically the given LP problem,  
Minimize  $z = 3a + 5b$   
Subjected to constraints,  $-3a + 4b \leq 12$   
 $2a - 1b \geq -2$   
 $2a + 3b \geq 12$   
 $1a + 0b \geq 4$   
 $0a + 1b \geq 2$   
 $a, b \geq 0$  (10 Marks)

OR

- 2 a. List any 4 characteristics and limitations of OR. (08 Marks)  
b. Two alloys A and B are made from four different metals I, II, III and IV according to the following specifications. 'A' at most 80% of I at most 30% of II, at least 50% III. 'B' between 40% and 60% of II, at least 30% of III, at most 70% of IV. The four metals are extracted from 3 different ores whose constituents percentage of these metals, maximum available quantity and cost per tonne are as follows :

| Ore | Max Quantity | Constituent % |    |     |    | Others | Price (Rs./Tonne) |
|-----|--------------|---------------|----|-----|----|--------|-------------------|
|     |              | I             | II | III | IV |        |                   |
| 1   | 1000         | 20            | 10 | 30  | 30 | 10     | 30                |
| 2   | 2000         | 10            | 20 | 30  | 30 | 10     | 40                |
| 3   | 3000         | 5             | 5  | 70  | 20 | 0      | 50                |

Assuming the selling price of alloys A and B are Rs.200 and Rs.300/tonne respectively. Formulate the above as a linear programming problem selecting appropriate objectives and constraints functions. (12 Marks)

### Module-2

- 3 a. Solve the following LPP by Simplex method:  
Maximize  $z = 12x_1 + 16x_2$   
Subject to Constraints  $10x_1 + 20x_2 \leq 120$   
 $8x_1 + 8x_2 \leq 80$   
 $x_1$  and  $x_2 \geq 0$ . (10 Marks)
- b. Minimize  $z = 7x_1 + 15x_2 + 20x_3$   
Subject to Constraints  $2x_1 + 4x_2 + 6x_3 \geq 24$   
 $3x_1 + 9x_2 + 6x_3 \geq 30$   
 $x_1, x_2, x_3 \geq 0$   
using Big M method. (10 Marks)

OR

- 4 a. Solve the following LPP by simplex,

$$Z \text{ Min} = 2x_1 - 3x_2 + 6x_3$$

$$\text{Subject to Constraints } 3x_1 - x_2 + 2x_3 \leq 7$$

$$2x_1 + 4x_2 \geq 12$$

$$-4x_1 + 3x_2 + 8x_3 \leq 10$$

$$x_1, x_2, x_3 \geq 0$$

(10 Marks)

- b. Solve by dual simplex method.

$$\text{Min } z = 5x_1 + 6x_2$$

$$\text{Subject to Constraints } x_1 + x_2 \geq 2$$

$$4x_1 + x_2 \geq 4$$

$$x_1, x_2 \geq 0$$

(10 Marks)

**Module-3**

- 5 a. Obtain an Initial basic feasible solution to the transportation problem using North West corner rule and least cost method.

|        |                | Destination    |                |                |    |
|--------|----------------|----------------|----------------|----------------|----|
|        |                | D <sub>1</sub> | D <sub>2</sub> | D <sub>3</sub> |    |
| Origin | O <sub>1</sub> | 2              | 7              | 4              | 5  |
|        | O <sub>2</sub> | 3              | 3              | 1              | 8  |
|        | O <sub>3</sub> | 5              | 4              | 7              | 7  |
|        | O <sub>4</sub> | 1              | 6              | 2              | 14 |
|        |                | 8              | 8              | 18             |    |

(06 Marks)

- b. There are 3 factories A, B, C supplying goods to four dealers D<sub>1</sub>, D<sub>2</sub>, D<sub>3</sub> and D<sub>4</sub>. The production capacities and requirements are given in the table. The project in Rs. is also given. Determine the optimum solution to maximize the profits.

|             | D <sub>1</sub> | D <sub>2</sub> | D <sub>3</sub> | D <sub>4</sub> | Capacity |
|-------------|----------------|----------------|----------------|----------------|----------|
| A           | 22             | 26             | 20             | 21             | 450      |
| B           | 21             | 24             | 20             | 19             | 300      |
| C           | 18             | 20             | 19             | 20             | 250      |
| Requirement | 200            | 300            | 150            | 270            |          |

(14 Marks)

OR

- 6 a. A company has 3 plants at location A, B and C which supplies to warehouses located at D, E, F, G and H. Monthly plant capacities are 800, 500 and 900 units respectively. The monthly warehouse requirement are 400, 400, 500, 400 and 800 units respectively. Unit transportation cost is given below. Determine the optimum distribution such that the company minimizes the cost.

|   | D | E | F | G | H |
|---|---|---|---|---|---|
| A | 5 | 8 | 6 | 6 | 3 |
| B | 4 | 7 | 7 | 6 | 6 |
| C | 8 | 4 | 6 | 6 | 4 |

(16 Marks)

- b. List any 4 applications of Transportation problems.

(04 Marks)



**Module-4**

- 7 a. State and explain the characteristics of queuing system. (06 Marks)  
 b. Data of a project is given below :

| Activity | Immediate Predecessor | Optimistic Time Hrs | Most likely Time Hrs | Pessimistic Time (Hrs) |
|----------|-----------------------|---------------------|----------------------|------------------------|
| A        | -                     | 4                   | 6                    | 8                      |
| B        | -                     | 1                   | 4.5                  | 5                      |
| C        | A                     | 3                   | 3                    | 3                      |
| D        | A                     | 4                   | 5                    | 6                      |
| E        | A                     | 0.5                 | 1                    | 1.5                    |
| F        | B, C                  | 3                   | 4                    | 5                      |
| G        | B, C                  | 1                   | 1.5                  | 5                      |
| H        | E, F                  | 5                   | 6                    | 7                      |
| I        | E, F                  | 2                   | 5                    | 8                      |
| J        | D, H                  | 2.5                 | 2.75                 | 4.5                    |
| K        | G, I                  | 3                   | 5                    | 7                      |

- (i) Draw the network diagram.  
 (ii) Find out the ES, EF, LS, LF and slack for each activity.  
 (iii) Find out the variance and standard deviation for the critical path.  
 (iv) Determine the probability of completing the project in 24 hours. (14 Marks)

**OR**

- 8 a. Define  
 (i) Critical activity and critical path.  
 (ii) Total float.  
 (iii) Free float.  
 (iv) AOA and AON diagram. (08 Marks)
- b. In a railway yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 minutes.  
 Calculate the following :  
 (i) The average number of trains in the queue.  
 (ii) The probability that the queue size exceed 10.  
 (iii) Expected waiting time in the queue.  
 (iv) Average number of trains in the queue.  
 (v) If the input of trains increase to an average 33 per day, what would be the changes in (i) and (ii) ? (12 Marks)

**Module-5**

- 9 a. Consider the following single machine sequencing :

| Job             | J <sub>1</sub> | J <sub>2</sub> | J <sub>3</sub> | J <sub>4</sub> | J <sub>5</sub> |
|-----------------|----------------|----------------|----------------|----------------|----------------|
| Processing Time | 14             | 8              | 6              | 4              | 16             |

Obtain

- (i) Optimal sequence by STP rule.  
 (ii) Completion time of all the jobs.  
 (iii) Mean flow time.  
 (iv) Number of Tardy jobs if due date is 20 days. (08 Marks)

- b. Obtain the optimal strategies for both persons and the value of the game for 2 person zero sum game whose payoff matrix is as follows :

|          |                | Player B       |                |
|----------|----------------|----------------|----------------|
|          |                | B <sub>1</sub> | B <sub>2</sub> |
| Player A | A <sub>1</sub> | 1              | -3             |
|          | A <sub>2</sub> | 3              | 5              |
|          | A <sub>3</sub> | -1             | 6              |
|          | A <sub>4</sub> | 4              | 1              |
|          | A <sub>5</sub> | 2              | 2              |
|          | A <sub>6</sub> | -5             | 0              |

(12 Marks)

OR

- 10 a. Use graphical method to minimize the time needed to process the following jobs on the machines A B C D and E. For each machine find which jobs is to be loaded first. Calculate the total time required to process the jobs. The time given is in hours. The machining order for Job 1 is A B C D E and takes 3, 4, 2, 6, 2 hours respectively on the machines. The order of machines for Job 2 is B C A D E and takes 5, 4, 3, 2, 6 hours respectively for processing. (12 Marks)
- b. Solve the following game by using concept of dominance.

|          |                | Player B       |                |                |                |
|----------|----------------|----------------|----------------|----------------|----------------|
|          |                | B <sub>1</sub> | B <sub>2</sub> | B <sub>3</sub> | B <sub>4</sub> |
| Player A | A <sub>1</sub> | 3              | 2              | 4              | 0              |
|          | A <sub>2</sub> | 3              | 4              | 2              | 4              |
|          | A <sub>3</sub> | 4              | 2              | 4              | 0              |
|          | A <sub>4</sub> | 0              | 4              | 0              | 8              |

(08 Marks)

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17ME835

## Eighth Semester B.E. Degree Examination, Jan./Feb. 2023 Product Life Cycle Management

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. Define product life cycle management. Explain the product life cycle management model with a neat sketch. (10 Marks)  
b. Explain the need and benefits of product life cycle management. (10 Marks)

**OR**

- 2 a. What is strategy? Explain the impact of strategy on product life cycle management. (10 Marks)  
b. What is PDM (Product Data Management) System? Explain the basic components of a PDM system. (10 Marks)

### Module-2

- 3 a. Discuss the role of concurrent engineering in product design and development. (10 Marks)  
b. What is design for X in product design? List the various techniques in design for X system. (10 Marks)

**OR**

- 4 a. Discuss the various steps involved in product design. (10 Marks)  
b. Explain clearly the concepts involved in organizing and decomposition in product design. (10 Marks)

### Module-3

- 5 a. Define New Product Development (NPD) and discuss the need for NPD. (10 Marks)  
b. What is Decision Support System (DSS)? Discuss the components for building DSS. (10 Marks)

**OR**

- 6 a. Explain the different financial control technique involved in new product development. (10 Marks)  
b. Discuss the steps involved in product redesign. (10 Marks)

### Module-4

- 7 a. Classify technology forecasting and briefly explain the different methods under each classification. (10 Marks)  
b. Discuss the various methodologies and tools in the product innovation process. (10 Marks)

**OR**

- 8 a. Write short notes on:  
(i) Delphi technique  
(ii) Scenario writing  
(iii) Growth curve (12 Marks)  
b. Discuss the use of morphological analysis in technological forecasting. (08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equation, written eg, 42+8 = 50, will be treated as malpractice.



**Module-5**

- 9 a. Discuss the need and benefits of virtual product development. (10 Marks)  
b. What is data model? Discuss the different types of data models stating their merits and demerits. (10 Marks)

**OR**

- 10 a. Discuss 3D CAD system and digital mockup in virtual product development. (10 Marks)  
b. Discuss any two common techniques for analyzing virtual product models. (10 Marks)

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