

# CBCS SCHEME

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18MR751

## Seventh Semester B.E. Degree Examination, July/August 2022 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 suitable statistical table is permitted.

### Module-1

- 1 a. Define operations research. Explain all the phases involved in operations research. (10 Marks)  
b. A company produces 2 types of products. The first type requires twice as much labour time as a second type. If all the products are of the second type, then the company can produce a total of 500 products a day. The market limits daily sales of the first and second type to 150 and 250. Assuming that the profit per product are Rs. 8/- for type 1 and Rs. 5/- for type – II. Formulate the problem as a linear programming model and determine the number of products to be produced of each type so as to maximize the profit. (10 Marks)

OR

- 2 a. Explain the limitations and applications of operations research. (10 Marks)  
b. Egg contains 6 units of vitamin A per gram and 7 units of vitamin B per gram and costs 12 paise per gm. Milk contains 8 units of vitamin A per gm and 12 units of vitamin B per gm and costs 20 paise per gram. Daily requirements of vitamin A and vitamin B are 100 units and 120 units respectively. Find the optimal products mix. (10 Marks)

### Module-2

- 3 a. Define surplus, slack and artificial variables. (05 Marks)  
b. Solve the following using Simplex Method :  
Max  $Z = 2x_1 + x_2$   
Subject to,  $4x_1 + 3x_2 \leq 12$   
 $4x_1 + x_2 \leq 8$   
 $4x_1 - x_2 \leq 8$   
 $x_1, x_2 \geq 0.$  (15 Marks)

OR

- 4 a. List the assumptions made in LPP. (05 Marks)  
b. Use Big.M method to solve the following LPP  
Minimize  $Z = 4x_1 + x_2$   
Subject to,  $3x_1 + x_2 = 3$   
 $4x_1 + 3x_2 \geq 6$   
 $x_1 + 2x_2 \leq 4$   
 $x_1, x_2 \geq 0.$  (15 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 equations written eg.  $42+8=50$ , will be treated as malpractice.

**Module-3**

- 5 a. Explain the differences between assignment problem and transportation problem. (05 Marks)
- b. A product is produced by four factories A, B, C and D. The unit production costs in them are Rs. 2, Rs. 3, Rs. 1 and Rs.5 respectively. Their production capacities are : factory A : 50 units, B : 70 units, C : 30 units and D : 50 units. These factories supply the product to 4 stores, the demand of which are 25, 35, 105 and 20 units respectively. Unit transportation cost in rupees from each factory to each store is given in the table below :

		Stores →			
		1	2	3	4
Factories ↑	A	2	4	6	11
	B	10	8	7	5
	C	13	3	9	12
	D	4	6	8	3

Determine the extent of deliveries from each of the factories to each of the stores so that the total production and transportation cost is minimum. (10 Marks)

- c. A company has 4 salesmen A, B, C and D. These salesmen are to be allotted 4 cities, 1, 2, 3 and 4. The estimated profit per day for each salesman in each city is given in the following table :

	1	2	3	4
A	16	10	14	11
B	14	11	15	15
C	15	15	13	12
D	13	12	14	15

What is the optimum assignment which will yield maximum profit? (05 Marks)

**OR**

- 6 a. Explain the characteristic queuing system. (06 Marks)
- b. Arrival rate of telephone call at a telephone booth are average time of a 9 minutes between two consecutive arrivals. The length of telephone call is assumed to be exponentially distributed with mean 3 minutes.
- Determine the probability that a person arriving at the booth will have to wait.
  - Find the average queue length
  - The telephone company will install a second booth when convinced that an arrival would expect to have to wait at least 4 minutes for the phone. Find the increase in flow rate of arrivals which will justify a second booth.
  - What is the probability that he will have to wait for more than 1- minutes before the phone is free. (14 Marks)

**Module-4**

- 7 a. Define : i) Total elapsed time ii) Idle time. (04 Marks)
- b. List the assumptions of sequencing problems. (05 Marks)
- c. A machine operator has to perform three operations turning, threading and knurling on a number of different jobs. The time required to perform these operations (in minutes) for each job is known. Determine the order in which the jobs should be processed in order to minimize the total time required to turn out all the jobs. Also find the idle times for the three operations. (11 Marks)

Job	Time for turning (minutes)	Time for threading (minutes)	Time for Knurling (minutes)
1	3	8	13
2	12	6	14
3	5	4	9
4	2	6	12
5	9	3	8
6	11	1	13

OR

- 8 a. What are the characteristics of games? (06 Marks)
- b. Two players A and B are playing a game of tossing a coin simultaneously; player A wins 1 unit of value when there are two heads, wins nothing when there are two tails and loses  $\frac{1}{2}$  unit of value when there is one head and one tail. Determine the pay off matrix, the best strategies for each player and the value of the game. (07 Marks)
- c. Solve the following problem by using dominance principle.

	1	2	3	4
1	3	2	4	0
2	2	4	3	4
3	4	2	4	0
4	0	4	0	8

(07 Marks)

**Module-5**

- 9 a. Define the following terms with reference to PERT :
- Total float
  - Free float
  - Independent float.
- b. A project schedule has the following characteristics. (06 Marks)

Activity	Time (weeks)	Activity	Time (weeks)
1 – 2	4	5 – 6	4
1 – 3	1	5 – 7	8
2 – 3	1	6 – 8	1
3 – 4	1	7 – 8	2
3 – 5	6	8 – 10	5
4 – 9	5	9 – 10	7

- Draw the network and find the critical path.
- Compute EST, EFT, LST, LFT total float for each activity. (14 Marks)

OR

- 10 a. What are applications of PERT/CPM techniques? (06 Marks)
- b. A small project consists of activities from 'A' to 'I'. The following table indicates the precedence relationship among activities and the three time estimates – optimistic, most – likely and pessimistic time for each activity in days.

Activity	Predecessor Relationship	Optimistic, time 't <sub>o</sub> '	Most likely time 't <sub>m</sub> '	Pessimistic time 't <sub>p</sub> '
A	–	2	5	8
B	A	6	9	12
C	A	6	7	8
D	B, C	1	4	7
E	A	8	8	8
F	D, E	5	14	17
G	C	3	12	21
H	F, G	3	6	9
I	H	5	8	11

- Draw the project network. Determine the expected time and variance for each activity.
- Obtain the total expected duration of the project and critical path
- What is the probability of completing the project in 50 days? (14 Marks)

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