

[4]

- OR iii. The following table gives the activities in a construction project and other related information: 7

- (a) Draw a PERT Diagram  
(b) Calculate the project duration  
(c) Mark critical path  
(d) Find the probability that the project will be completed in 50 days

Activity	Optimistic time $t_o$	Most likely time, $t_m$	Pessimistic time $t_p$
1-2	20	30	46
1-3	9	12	21
2-3	3	5	7
2-4	2	3	4
3-4	1	2	3
4-5	12	18	24

- Q.5 i. Define Simulation also write the names of different types of simulation. 3  
ii. Define the term Decision theory. Describe decision models based on the criterion of degree of certainty. 7

- OR iii. Solve the game whose payoff matrix is: 7

		A		
B		I	II	III
	I	1	7	2
	II	6	2	7
	III	5	1	6

- Q.6 i. Define: 3  
(a) Inventory carrying cost (b) Setup cost

- ii. The demand for an item is 8000 units per annum and the unit cost is Re.1/-. Inventory carrying charges of 20% of average inventory cost and ordering cost is Rs. 12.50 per order. Calculate optimal order quantity, optimal order time, optimal inventory cost and number of orders. 7

- OR iii. A company has a demand of 12,000 units per year for an item and it can produce 2000 items per month. The cost of one setup is Rs. 400/- and the holding cost per unit per month is Rs. 0.15. Find the optimum lot size and the total cost per year, assuming the cost of one unit as Rs.4/-. Also find the maximum inventory, manufacturing time and total time. 7

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Total No. of Questions: 6

Total No. of Printed Pages:4

Enrollment No.....



Faculty of Engineering  
End Sem (Even) Examination May-2022  
ME3EI02 Operations Research

Programme: B.Tech.

Branch/Specialisation: ME

Duration: 3 Hrs.

Maximum Marks: 60

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

- Q.1 i. Operations research is the application of \_\_\_\_\_ methods to arrive at the optimal solutions to the problems. 1  
(a) Economical (b) Scientific  
(c) Both (a) and (b) (d) Artistic
- ii. In operations research, the \_\_\_\_\_ are prepared for situations. 1  
(a) Mathematical models (b) Physical models diagrammatic  
(c) Diagrammatic models (d) None of these
- iii. Hungarian Method is used to solve: 1  
(a) A transportation problem (b) A travelling salesman problem  
(c) A LP problem (d) Both (a) and (b)
- iv. Which technique is used in finding a solution for optimizing a given objective, such as profit maximization or cost reduction under certain constraints? 1  
(a) Queuing Theory (b) Waiting Line  
(c) Both (a) and (b) (d) Linear Programming
- v. The Operations research technique which helps in minimizing total waiting time and service costs is: 1  
(a) Queuing Theory (b) Decision Theory  
(c) Both (a) and (b) (d) None of these
- vi. The time estimates made by the PERT planners; the maximum time that would be needed to complete an activity is called as \_\_\_\_\_. 1  
(a) Pessimistic time estimate (b) Optimistic time estimate  
(c) Expected time estimate (d) The most likely time estimate

P.T.O.

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- vii. The purpose of using simulation technique is to- **1**  
 (a) Imitate a real-world situation  
 (b) Understand properties & operating characteristics of complex real-life problems  
 (c) Reduce the cost of experiment on a model of real situation  
 (d) All of these
- viii. A two-person zero-sum game means that the: **1**  
 (a) The sum of losses to one player is equal to the sum of gains to other  
 (b) The sum of losses to one player is not equal to the sum of gains to other  
 (c) No any player gains or losses  
 (d) None of these
- ix. Which among the following components is calculated as the sum of the fixed costs that happen each time an item is ordered? **1**  
 (a) Carrying cost (b) Order cost  
 (c) Holding cost (d) Storing cost
- x. A company that maintains a sufficient safety margin by having extra inventory against certain situations is termed as \_\_\_\_\_. **1**  
 (a) Inventory (b) Lot size (c) Safety stock (d) Lead
- Q.2 i. Discuss the objective of Operations Research. **3**  
 ii. Solve the below problem using graphical method. **7**  
 Maximise  $Z = 5x + 7y$  s.t.  
 $1x + 1y \leq 4$   
 $3x + 8y \leq 24$   
 $10x + 7y \leq 35$  and  
 Both  $x$  and  $y$  are  $\geq 0$ .
- OR iii. Solve the below problem using simplex method. **7**  
 Maximise  $Z = 23a + 32b$  S.T.  
 $10a + 6b \leq 2500$   
 $5a + 10b \leq 2000$   
 $1a + 2b \leq 500$  and  
 Both  $a$  and  $b$  are  $\geq 0$ .
- Q.3 Write any three similarities between transportation model and general linear programming model. **3**

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- ii. The DREAM - DRINK Company has to work out a minimum cost transportation schedule to distribute crates of drinks from three of its factories X, Y, and Z to its three warehouses A, B, and C. The required particulars are given below. Find the least cost transportation schedule using- **7**  
 (a) Least cost Method (b) North-west Corner rule
- | Transportation cost in Rs per crate |      |     |     |                  |
|-------------------------------------|------|-----|-----|------------------|
| From / To                           | A    | B   | C   | Crates Available |
| X                                   | 75   | 50  | 50  | 1040             |
| Y                                   | 50   | 25  | 75  | 975              |
| Z                                   | 25   | 125 | 25  | 715              |
| Crates required                     | 1300 | 910 | 520 | 2730             |
- OR iii. There are 3 jobs A, B, and C and three machines X, Y, and Z. All the jobs can be processed on all machines. The time required for processing job on a machine is given below in the form of matrix. **7**  
 Make allocation to minimize the total processing time.
- Machines (time in hours)**
- | Jobs | X  | Y  | Z  |
|------|----|----|----|
| A    | 11 | 16 | 21 |
| B    | 20 | 13 | 17 |
| C    | 13 | 15 | 12 |
- Q.4 i. Define Kendall's notation. **3**  
 ii. The arrivals at a telephone booth are considered to be following Poisson law of distribution with an average time of 10 minutes between one arrival and the next. Length of the phone call is assumed to be distributed exponentially with a mean of 3 minutes. **7**  
 (a) What is the probability that a person arriving at the booth will have to wait?  
 (b) What is the average length of queue that forms from time to time?  
 (c) The telephone department will install a second booth when convinced that an arrival would expect to wait at least three minutes for the phone. By how much must the flow of arrivals be increased in order to justify a second booth?

P.T.O.

## Marking Scheme - ME3EI02 Operations Research

Q.1	i.	Operations research is the application of _____ methods to arrive at the optimal solutions to the problems.	1
		(b) Scientific	
	ii.	In operations research, the _____ are prepared for situations.	1
		(a) Mathematical models	
	iii.	Hungarian Method is used to solve:	1
		(b) A travelling salesman problem	
	iv.	Which technique is used in finding a solution for optimizing a given objective, such as profit maximization or cost reduction under certain constraints?	1
		(d) Linear Programming	
	v.	The Operations research technique which helps in minimizing total waiting time and service costs is:	1
		(a) Queuing Theory	
	vi.	The time estimates made by the PERT planners; the maximum time that would be needed to complete an activity is called as _____.	1
		(a) Pessimistic time estimate	
	vii.	The purpose of using simulation technique is to-	1
		(d) All of these	
	viii.	A two-person zero-sum game means that the:	1
		(a) The sum of losses to one player is equal to the sum of gains to other	
	ix.	Which among the following components is calculated as the sum of the fixed costs that happen each time an item is ordered?	1
		(b) Order cost	
	x.	A company that maintains a sufficient safety margin by having extra inventory against certain situations is termed as ____.	1
		(c) Safety stock	

Q.2	i.	Any 3 objective of Operations Research	(1*3) marks	3
	ii.	Plotting equations on graph	5 marks	7
OR		Final answer	2 marks	
	iii.	To draw first table	2 marks	7
		To draw second table	2 marks	
		To draw third table	2 marks	
		Final answer	1 mark	

Q.3	i	Any three similarities	(1*3) marks	3
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	ii.	The DREAM - DRINK		7
		(a) Finding solution Least cost Method	3.5 marks	
OR		(b) Finding solution North-west Corner rule	3.5 marks	
	iii.	Drawing first matrix	3 marks	7
		Making allocation using Hungarian method	2 marks	
Q.4		Final answer	2 marks	
	i.	Define Kendall's notation	3 marks	3
	ii.	The arrivals at a telephone		7
OR		(a) The probability that	2.5 marks	
		(b) The average length of queue	2.5 marks	
		(c) The telephone department	2 marks	
	iii.	(a) Draw a PERT Diagram	2 marks	7
		(b) Calculate the project duration	2 marks	
		(c) Mark critical path	2 marks	
		(d) Find the probability	1 marks	
Q.5	i.	Define Simulation	2 marks	3
		Writing types	1 marks	
	ii.	Define the term Decision theory	3 marks	7
OR		Describe decision models based	4 marks	
	iii.	Finding saddle point	1 mark	7
		Solving game using dominance	3 marks	
		Solving 2x2 matrix	2 marks	
		Final answer	1 mark	
Q.6	i.	Define:		3
		(a) Inventory carrying cost	1.5 marks	
		(b) Setup cost	1.5 marks	
	ii.	Calculate optimal order quantity	2 marks	7
		Optimal order time	2 marks	
		Optimal inventory cost	2 marks	
		Number of orders	1 marks	
	iii.	Find the optimum lot size	2 marks	7
OR		Total cost per year	2 marks	
		Maximum inventory	1 mark	
		Manufacturing time	1 mark	
		Total time	1 mark	