



**B.Tech VII Semester Regular/Supplementary Examinations, November 2022**

**OPERATIONS RESEARCH**  
(Mechanical Engineering)

**Maximum Marks: 70**

Date: 03.12.2022 Duration: 3 hours

- Note:
1. This question paper contains two parts A and B.
  2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
  3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
  4. Each question carries 10 marks and may have a, b, c, d as sub questions.

**Part-A**

All the following questions carry equal marks

(10x2M=20 Marks)

- 1 What are the phases of an operations research study?
- 2 What do you mean by canonical form of LPP?
- 3 What is the objective of the travelling salesman problem?
- 4 How do you convert the maximization assignment problem into a minimization one?
- 5 What are the types of inventories?
- 6 What is meant by saddle point in game theory?
- 7 Write Little's formula.
- 8 What is M/M/1 in queuing system?
- 9 What is dynamic programming?
- 10 Discuss the applications of simulation models.

**Part-B**

Answer All the following questions.

(5X10M=50Marks)

- 11 A. Explain the scope of Operations Research. 3M  
B. A company manufactures two products A and B. Each unit of B takes twice as long to produce as one unit of A and if the company were to produce only A it would have time to produce 2000 units per day. The availability of the raw material is sufficient to produce 1500 units per day of both A and B combined. Product B requiring a special Ingredient only 600 units can be made per day. If A fetches a profit of Rs.2 per unit and B a profit of Rs.4 per unit, Formulate the optimum product min. 7M

OR

- 12 Use Big M method to Maximize  $Z = 3x_1 + 2x_2$ , Subject to the constraints

$$\begin{aligned} 2x_1 + x_2 &\leq 2, \\ 3x_1 + 4x_2 &\geq 12, \\ x_1, x_2 &\geq 0 \end{aligned}$$

10M

- 13 A company has 4 machines to do 3 jobs. Each job can be assigned to one and only one machine. The cost of each job on each machine is given below. Determine the job assignments which will minimize the total cost. 10M

$$\begin{pmatrix} 18 & 24 & 28 & 32 \\ 8 & 13 & 17 & 18 \\ 10 & 15 & 19 & 20 \end{pmatrix}$$

OR

- 14 A Taxi owner estimates from his past records that the cost per year for operating a taxi whose purchase price when new is Rs.60,000 are as follows. 10M

Age	1	2	3	4	5
Operating Cost	10000	12000	15000	18000	20000

After 5 years the operating cost is Rs.6000 x k, where "k" is 6,7,8,9,10 (age). If the resale value decreases by 10% of purchase price each year, what is the best replacement policy?

- 15 Using Least Cost method and VAM, Solve the TP. 10M

	Destination				Availability
	D1	D2	D3	D4	
O1	5	2	4	3	22
O2	4	8	1	6	15
O3	4	6	7	5	8
Demand	7	12	17	9	

OR

- 16 Examine six jobs that are processed on two machines A and B. The job is processed in sequence so that B should follow A. Determine the optimal order in which the jobs should be sequenced. Also draw Gantt chart. 10M

Job	1	2	3	4	5	6
Processing time in Machine A	3	5	4	7	1	3
Processing time in Machine B	2	6	2	1	4	6

- 17 a) In a game of matching coins with 2 players, A wins 1 unit value when there are 2 heads, wins nothing when there are 2 tails and loses  $\frac{1}{2}$  unit value when there are one head and one tail. Determine Pay Off matrix and value. 5M
- b) Two players A&B match coins. If the coins match then A wins one unit value, if the coins do not match then B wins one unit of value. Determine pay-off matrix. 5M

OR

- 18 Find the optimal order quantity for a product when the annual demand for the product is 500 units. The Cost of storage per unit per year is 10% of the unit cost. Ordering cost per order is Rs. 180. The unit cost are given below: 10M

Quantity	Unit Cost(Rs.)
$0 < Q_1 < 500$	25
$500 \leq Q_2 \leq 1500$	24.80
$1500 \leq Q_3 < 3000$	24.60
$3000 \leq Q_4$	24.40

- 19 A self-service store employs one cashier at its counter. 9 Customers arrive on an average every 5 minutes. While the cashier can serve 10 customer in 5 minutes. Assuming Poisson Distribution for arrival rate and exponential distribution for service rate Find, 10M
- Average number of customer in the system
  - Average Number of customer in Queue.
  - Average time a customer spend in the system
  - Average time a customer wait before being Served.

OR

- 20 Solve the following LP problem using Dynamic Programming technique. 10M
- Maximize  $z = 10X_1 + 30X_2$   
Subject to  $3X_1 + 6X_2 \leq 168$ ,  $10X_1 + 12X_2 \leq 240$   
 $X_1$  and  $X_2 \geq 0$