

Code: ME6T3

**III B.Tech - II Semester – Regular /Supplementary Examinations
March 2020**

**OPERATIONS RESEARCH
(MECHANICAL ENGINEERING)**

Duration: 3 hours

Max. Marks: 70

PART – A

Answer *all* the questions. All questions carry equal marks

11x 2 = 22 M

1.

- a) What is an Operations Research model? Enumerate any four Operations Research models.
- b) Define and explain the significance of slack variable and artificial variable in solving linear programming problems.
- c) What do you mean by unbalanced assignment problem? What steps you take to resolve unbalance in assignment problem?
- d) Describe the steps in Johnson's rule to solve sequencing problem.
- e) A student wants to buy a laptop by borrowing Rs 50,000 from State Bank of India, Vijayawada branch at the interest rate of 10% per annum. How much he/she need to payback after 4 years to the bank as onetime payment.
- f) Explain Maximin and Minimax principles with respect to game theory.
- g) Why do you consider the study of waiting line or queuing model as an important aspect?

- h) Distinguish between deterministic models and probabilistic models of inventory.
- i) When you will prefer to solve dual form of linear programming problem instead of primal form.
- j) State Bellman's principle of optimality.
- k) Write any two advantages and disadvantages of simulation.

PART – B

Answer any *THREE* questions. All questions carry equal marks.

3 x 16 = 48 M

2. a) Write the dual form of the following LPP and solve the dual form for its optimality.

Maximize, $Z = x_1 + x_2 + 3x_3$

Subjected to

$$3x_1 + 2x_2 + x_3 \leq 3$$

$$2x_1 + x_2 + 2x_3 \leq 2$$

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

10 M

- b) A small manufacturer employs 5 skilled men and 10 semi-skilled men for making a product in two qualities: a deluxe model and an ordinary model. The production of a deluxe model requires 2-hour work by a skilled man and 2-hour work by a semi-skilled man. The ordinary model requires 1-hour work by a skilled man and 3-hour work by a semi-skilled man. According to workers union rules, no man can work more than 8 hours per day. The profit of the deluxe model is Rs. 1200 per unit and that of the ordinary model is Rs. 1000 per unit. Formulate a linear programming model for this manufacturing situation to determine the production volume of each model such that the total profit is maximized.

6 M

3. a) Consider the problem of assigning four persons to four different operations as shown in Table below such that the total processing times is minimum.

		Operation			
		Drilling	Milling	Turning	Grinding
Workers	Singh	10	22	12	14
	Joseph	16	18	22	10
	Ali	24	20	12	18
	Bharat	16	14	24	20

The cell entries represent processing times in minutes. Find the optimal allocation of the persons to different jobs. 8 M

- b) The demand pattern for a product at four consumer centers A, B, C and D are 5000 units, 7000 units, 4000 units and 2000 units respectively. The supply for these centers is from three factories X, Y and Z. The capacities for the factories are 3000 units, 6000 units and 9000 units respectively. The unit transportation cost in rupees from a factory to consumer center is given below in the matrix. Develop an optimal transportation schedule and find the optimal cost.

From	To			
	A	B	C	D
X	8	9	12	8
Y	3	4	3	2
Z	5	3	7	4

8 M

4. a) A firm is considering replacement of an equipment by a new equipment whose first cost is Rs. 1,750 and the scrap value is negligible at any year. Based on the experience, it

is found that the maintenance cost is zero during the first year and it increases by Rs. 100 every year thereafter. When should the equipment be replaced if $i = 12\%$. 8 M

- b) Consider the payoff matrix of player A as given below and solve it optimally using graphical method. 8 M

		Player B			
		I	II	III	IV
Player A	I	3	4	10	12
	II	8	4	3	2

5. a) A barber with a one-man shop takes exactly 25 minutes to complete one hair cut. If customers arrive in a Poisson fashion at an average rate of every 40 minutes, how long on the average must a customer wait for service? 4 M

- b) Annual demand for an item is 3000 units. Ordering cost is Rs. 300 per order. Inventory carrying cost is 10% of the purchase price/unit/year. The price breakups are shown below. Find the optimal order size. 12 M

Quantity	Price (in Rs.) per unit
$0 \leq Q_1 < 1000$	10
$1000 \leq Q_2 < 2000$	9
$2000 \leq Q_3$	8

6. a) Explain the steps involved in solving shortest route problem using dynamic programming. 8 M

- b) Demonstrate Monte Carlo simulation with suitable example. 8 M