Seat No: _____ **Enrollment No: _____**

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B. Tech Summer Exam 2021-22 Examination

Semester: VIII **Date: 28/03/2022**
Subject Code: 203109453/3109451 **Time: 10:30 am to1:00pm**
Subject Name: Operation Research and Optimization Techniques **Total Marks: 60**

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Objective Type Questions. **(15)**

1. What is degeneracy in simplex method?
2. When dummy is required in transportation problem?
3. What do you mean by "utilization factor" in queuing?
4. What is an unbalanced assignment problem?
5. What do you mean by "safety stock" in inventory management?
6. _____ method usually gives a very good optimal solution to the transportation problem.
7. If all the constraints are ≤ type (assuming that RHS constraints are non-negative), then in such a case _____ solution will not arise.
8. EOQ stands for _____.
9. In order for a transportation matrix which has 3 rows and 4 columns, not to be degenerate, than _____ must be the number of allocated cells in the matrix.
10. If traffic intensity of a system is given to be 0.64, then _____ percent of time the system would be idle.
11. If there are 3 variables & 5 constraints are in a primal LPP, then dual LPP will have _____ variables and _____ constraints respectively.
12. In graphical method of LPP, optimum solution lies at the _____ of the feasible region.
13. From simplex table, how will you identify the alternate optimum solution?
14. State any two applications of optimization in engineering.
15. State any two applications of operation research in college campus.

Q.2 Answer the following questions. (Attempt any three) **(15)**

A) Construct the dual of the following LPP.

Maximize $Z = 3X_1 + 17 X_2 + 9X_3$

Subject to the constraints,

$X_1 - X_2 + X_3 \geq 3$,

$-3X_1 + 2X_3 \leq 1$,

$X_1, X_2, X_3 \geq 0$.

B) Four different jobs can be done on four different machines. The matrix below gives the cost in hundreds of rupees of producing jobs i on machine j.

		Machines			
		M_1	**M_2**	**M_3**	**M_4**
Jobs	**J_1**	5	7	11	6
	J_2	8	5	9	6
	J_3	4	7	10	7
	J_4	10	4	8	3

How should the jobs be assigned to the various machines so that the total cost is minimized?

C) The purchase price of a machine is Rs. 52000. The installation charges amount to Rs. 14400 and its salvage value is only Rs. 6400. The maintenance cost in various years is given below:

Year	1	2	3	4	5	6	7	8	9
Maintenance Cost in Rs.	1000	3000	4000	6000	8400	11600	16000	19200	22600

When should the machine be replaced and the AAC during this period?

D) Briefly discuss the phases of operation research.

Q.3 A) (i) Write a short note on "ABC analysis" of inventory control technique. **(07)**

(ii) Derive the EOQ formula when the rate of demand is constant and no shortage is allowed. Clearly mention the assumptions made.

B) (i) Define the following terms related to games theory: pay-off matrix, saddle point, pure strategy, mixed strategy. **(08)**

(ii) Customers arriving at the ticket counter of a theater at the rate of 12 per hour according to poisson's distribution. There is one clerk serving the customers at the rate of 30 per hour according to exponential distribution. Calculate: (1) What is the probability that there is no customer at the ticket counter? (2) What is the probability that a customer is being served and nobody is waiting? (3) What is the probability that there are more than 2 customers at the ticket counter? (4) What is the probability that a customers arriving at the ticket counter will have to wait?

OR

B) (i) Define the following terms relating the customer's behavior in queue: balking, reneging, jockeying, collusion. **(08)**

(ii) In a game of matching coins, Player A wins Rs. 2, if there are two heads, wins nothing if there are two tails and loses Rs. 1 when there are one head and one tail. Determine the payoff matrix, best strategies for each player and the value of the game to Player A.

Q.4 A) Solve the following LPP by using Big M method. **(07)**

Minimize $Z = 3X_1 + 8X_2$

Subject to the constraints,

$X_1 \leq 80$,

$X_2 \geq 60$,

$X_1 + X_2 = 200$,

and $X_1, X_2 \geq 0$.

OR

A) A firm manufactures two product A & B on which the profit earned per unit are Rs. 3 and Rs.4, respectively. Each product is processed on two machines M_1 and M_2. Product A requires one minute of processing time on M_1 and two minutes on M_2, while product B requires one minute of processing time on M_1 and one minute on M_2. Machine M_1 is available for not more than 7 hrs and 30 minutes, while machine M_2 is available for not more than 10 hrs during any working day. Formulate & Solve the LPP. **(07)**

B) (i) What is degeneracy in transportation problem? **(08)**

(ii) A company manufacturing air-coolers has 2 plants located at Mumbai and Bangalore with a capacity of 200 units and 100 units per week respectively. The company supplies the air-coolers to its 4 showrooms situated at Surat, Vadodara, Rajkot & Ahmedabad which have a maximum demand of 75,100,100 and 30 units respectively. Due to the differences in raw material cost and transportation cost, the profit per unit in rupees differs which is shown in the table below:

	Surat	**Vadodara**	**Rajkot**	**Ahmedabad**
Mumbai	90	90	100	110
Bangalore	50	70	130	85

Find out I.B.F.S. by VAM method to maximize the profit of a company.