

Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 4 – EXAMINATION – SUMMER 2026

Subject Code: BE04000201

Date: 02/06/2026

Subject Name: Operation Research

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q.1**
- (a) Discuss the scope of Operation Research in Medical and Health sector. **03**
 - (b) Explain the characteristics of Operation Research. **04**
 - (c) An advertising firm has decided to advertise in magazines. Magazine I have reach of 2000 customers and magazine II has reach of 3000 customers per advertisement. The cost per advertisement is Rs. 400 and Rs. 600 in magazines I and II respectively. The firm has monthly budget of Rs. 60000. The other requirement is that advertisement must reach at least 40000 customers having yearly income Rs. 2.5 Lakhs. In that respect magazine I and magazine II has 400 and 200 reach of such customers. Formulate the LP such that advertisement maximizes the reach to the customers. Solve LPP Graphically. **07**
- Q.2**
- (a) Transportation and Assignment Problems are special case of Linear Programming. Justify this statement. **03**
 - (b) What do you mean by degeneracy for LPP? How it can be solved? **04**
 - (c) Solve the following LPP by Big M method: **07**
Maximize $Z = 3x_1 - x_2$
Subject to $2x_1 + x_2 \leq 2$
 $x_1 + 3x_2 \geq 3$
 $x_2 \leq 4$ and $x_1, x_2 \geq 0$.

OR

- Q.2**
- (c) Construct the dual of the following primal problem. Solve the problem by generated dual LPP. **07**
Maximize $Z = 3x_1 + 2x_2$
Subject to $2x_1 + x_2 \leq 5$
 $x_1 + x_2 \leq 3$ and $x_1, x_2 \geq 0$
- Q.3**
- (a) Discuss Transshipment Problem. Explain solving procedure. **03**
 - (b) Discuss the significance of Saddle point in terms of Game theory. **04**

- (c) Find an optimal solution to an assignment problem with following cost matrix. Also find the alternate optimal solution if possible.

07

	J ₁	J ₂	J ₃	J ₄
M ₁	10	9	7	8
M ₂	5	8	7	7
M ₃	5	4	6	5
M ₄	2	3	4	5

OR

- Q.3 (a) Discuss the step by step procedure for Stepping stone method. 03
- (b) Explain decision tree diagram by taking suitable example related to Engineering Problem's solution. 04
- (c) A transportation company has 5, 10, 7 and 3 trucks available at four different sites A, B, C and D. Its customers have requirement of 5, 8 and 10 trucks at the three different destinations X, Y and Z respectively. The distance (in kms.) from an origin to destination is summarized in the following table. Formulate above problem as transportation problem and determine strategy for a company using VAM. Test the optimality of VAM solution and determine optimum strategy for the transport company. 07

	X	Y	Z
A	70	30	60
B	40	60	80
C	50	80	40
D	80	40	30

- Q.4 (a) What do you understand by EOQ? Derive formula when demand is constant, lead times are known and fixed, and that all inventory arrives at once. 03
- (b) For queuing theory, explain Kendall's Notations. 04
- (c) A copy maker has one copy making machine and he operates as the order comes. The order arrival is poisson distribution having interval time of 0.5 min. The average time to serve a copy is distributed with mean of 0.3 min. Determine the following: 07
- 1) Utilization factor of the machine
 - 2) Idle time for machine in a day having working hours of 10 hours
 - 3) No. of persons waiting in the system
 - 4) No. of persons waiting in the queue
 - 5) Average waiting time in the queue

OR

- Q.4 (a) Discuss the applicability of Group Replacement theory with proper applications in the industry. 03
- (b) For Inventory control, justify the synchronization of ABC analysis and VED analysis. 04

- (c) Following percentage failure (at the month end) have been observed for certain type of light bulbs:

07

Month	1	2	3	4	5
% Failure	10	25	50	80	100

There are total 1000 bulbs in use and it costs Rs. 10 to replace an individual bulb which has fused out. If all bulbs are replaced simultaneously, it would cost Rs. 4 per bulb. Two policies are being considered for replacement of bulbs; First, replace all bulbs simultaneously at fixed interval whether failed or not and do individual replacement in intermediate periods. Secondly, individual replacement of bulbs as and when it fails. Determine the optimum policy for replacement of bulbs based on above failure data and costs.

- Q.5**
- (a) Explain different types of floats with formulas. 03
- (b) Which factors are considered in decision making process under high level of uncertainty? Explain through flow chart. 04
- (c) Solve the following pay-off matrix for player A and B. Also find out the optimal strategies and value of the game using algebraic method. 07

		Player B	
		B ₁	B ₂
Player A	A ₁	-5	5
	A ₂	-6	4
	A ₃	8	4

OR

- Q.5**
- (a) What is crashing in terms of Project management? Discuss its importance in Project Management. 03
- (b) Discuss at least four applications of Minimax Strategy and Maximin Strategy each. 04
- (c) The details of activity in project management is as below. Find: 07
- (I) Critical Path and project duration.
- (II) Optimum project cost with considering indirect cost is Rs. 100 per day.

Activities	Normal		Crash	
	Time	Cost	Time	Cost
1-2	3	300	2	400
2-3	6	480	4	520
2-4	7	2100	5	2500
2-5	8	400	6	600
3-4	4	320	3	360
4-5	5	500	4	520
