

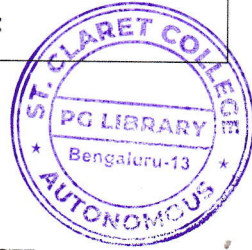
6

St. Clare College

Autonomous, Bengaluru

ROLL NO:

DATE:



PG END SEMESTER EXAMINATION-SEPT 2026

MBA SECOND SEMESTER

MBA 2624: QUANTITATIVE TECHNIQUES AND OPERATIONS RESEARCH

TIME: 3 hours.

MAX. MARKS: 70

This paper contains FOUR printed pages and FOUR parts

Instructions:

1. Verify and ensure that the question paper is completely printed.
2. Any discrepancies or questions about the exam paper must be reported to the COE within 1 hour after the examination.
3. Students must check the course title and course code before answering the questions.

PART-A

Answer SEVEN questions out of NINE. Each answer carries TWO marks.

[2x7 = 14]

1. Define Operations Research and state its objectives.
2. What is queuing theory, and what are its key models?
3. State two differences between Balanced and Unbalanced Transportation Problems.
4. Write the standard form with slack variables for the following LPP: Max $Z = 4x_1 + 3x_2$, subject to $2x_1 + x_2 \leq 8$; $x_1 + 2x_2 \leq 10$; $x_1, x_2 \geq 0$.
5. Differentiate between PERT and CPM with respect to time estimates.
6. Describe two real-world applications of simulation modeling.
7. What are the different replacement models?
8. Distinguish between the terms "event" and "activity" as used in the context of network analysis techniques.
9. Elaborate on Game Theory and also state its application.

PART-B

Answer any FOUR questions out of SIX. Each answer carries FIVE marks.

[4x5=20]

10. Explain the scope and significance of Operations Research in management decision-making.
11. A person repairing radios finds that the time spent on radio sets has an exponential distribution with a mean 20 minutes, and the radios are repaired in order of coming in, which is Poisson and at an average rate of 15 for 8 hours. What is the idle time of the repairman, and how many radios are waiting in the queue?

12. A company uses a machine whose cost of maintenance increases with its age. The details are given below:

Age of Machine (Years)	Maintenance Cost (₹)
1	500
2	700
3	1000
4	1400
5	2000

The purchase price of a new machine is ₹8000. The scrap value is ₹2000. Determine the optimal replacement policy using the replacement model of items that deteriorate with time.

13. Find the sequence of the jobs, if the machines are in the processing order M1, M2. Also, find the total elapsed time and idle time of the system

Job	Machine 1	Machine
1	3	8
2	12	10
3	5	9
4	2	6
5	9	3
6	11	1

14. A company has three warehouses and three retail outlets. The transportation cost per unit (in ₹) is given below.

Warehouse	Outlet 1	Outlet 2	Outlet 3	Supply
W1	4	6	8	20
W2	2	5	7	15
W3	3	6	9	25
Demand	10	25	25	

Obtain an initial feasible solution using Vogel's Approximation Method.

15. Consider the following payoff matrix for a two-person zero-sum game (payoffs are for Player A):

	B1	B2
A1	2	6
A2	4	2

- Check whether the game has a saddle point.
- If not, solve using mixed strategies and determine the value of the game.

PART-C

Answer any TWO questions out of FOUR. Each answer carries TEN marks.

[10x2=20]

16. Solve the following Transportation problem using the North-West Corner Rule and obtain an optimal solution.

Sources	D1	D2	D3	Supply
S1	4	8	8	20
S2	2	5	6	30
S3	3	6	9	25
Demand	10	35	30	

17. A project consists of the following activities with estimated durations (in weeks).

Activity	Predecessor	Optimistic (t_o)	Most Likely (t_m)	Pessimistic (t_p)
A	—	2	4	6
B	—	3	5	7
C	A	2	3	8
D	B	4	6	10
E	C	3	4	5
F	D	2	3	4
G	E, F	1	2	3

- Construct the PERT network diagram.
- Calculate the expected time (t_e) and variance (σ^2) for each activity.
- Identify the critical path and compute the expected project duration.
- If the company wants to complete the project within 16 weeks, compute the probability of meeting the deadline.
- What is the probability that the project will be completed? If the due date is reduced by 2 weeks

18. A company manufactures 30 items per day. The sale of these items depends on the demand, which has the following distribution:

Sales (units)	Probability
27	10%
28	15%
29	20%
30	35%
31	15%
32	5%

Use the following random numbers 10, 99, 65, 98, 95, 01, 79, 11, 16, 20. Simulate the demand for the next 10 days and also estimate the total loss or profit of the company on these days, if the profit per unit is Rs 15 and the loss is Rs 5 per unit.

19. A decision has to be made for group replacement versus individual replacement policy for 500 fluorescent tubes of a particular make in a university campus. The failure rates for the tubes were recorded as follows:

End of the Month	1	2	3	4	5	6
Probability of Failure	0.11	0.30	0.25	0.20	0.10	0.04

Cost of replacing an individual tube is Rs. 55, and when replaced in a group, it is Rs. 35. Suggest if they should go for group replacement or individual replacement policy.

PART-D

Answer the following.

[16x1=16]

20. Solve the following LPP using the Simplex method: $\text{Max } Z = 2x_1 + 3x_2$,

subject to $x_1 + x_2 \leq 4$, $x_1 + 2x_2 \leq 6$,

$x_1, x_2 \geq 0$.
