**MAY 2025** **U/ID 32519/UEM6A**

Time : Three hours Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer any TEN questions.

1. Define Optimization.
2. When can the dual Simplex method be applied?
3. Write the formulation of LPP steps.
4. List some application of the assignment model.
5. What are the transient nodes in a transportation problem?
6. What is meant by degeneracy in a transportation model?
7. Define Zero sum game.
8. What is a game?
9. What is meant by queue length?
10. What is a Queue?
11. What are the limitations of PERT/CPM?
12. Define Activity.

PART B — (5 × 5 = 25 marks)

Answer any FIVE questions.

13. Solve the following problem by simplex method

Maximise $6x_1 + 2x_2 + 4x_3$

Subject to

$2x_1 + 3x_2 + x_3 \leq 28$

$3x_1 + x_2 + 2x_3 \leq 24$

$x_1 + 2x_2 + 3x_3 \leq 35$

$x_1, x_2, x_3 \geq 0$

14. Solve the following linear programming problem graphically:

Maximise $Z = 4x + y$

subject to the constraints:

$x + y \leq 50$

$3x + y \leq 90,\ x, y \geq 0$

15. Distinguish transportation problem and assignment problem.

16. What are the methods to solve transportation problem and show its basic structure?

17. Consider a two-person zero-sum game matrix which represents payoff to the player A. Find the optimal strategy, if any

| | | Player B | | | | |
|---|---|---|---|---|---|---|
| | | I | II | III | IV | V |
| | I | -2 | 0 | 0 | 5 | 3 |
| Player A | II | 4 | 2 | 1 | 3 | 2 |
| | III | -4 | -3 | 0 | -2 | 6 |
| | IV | 5 | 3 | -4 | 2 | -6 |

18. Explain the components of queuing system.

19. List the steps involved for interactive procedure of determining the critical path.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

20. Solve the following problem graphically:

Minimise and Maximise $Z = 3x + 9y$

subject to the constraints:

$x + 3y \leq 60$

$x + y \geq 10$

$x \leq y$

$x \geq 0, y \geq 0$

21. Explain the steps for Hungarian Method of Solving an Assignment Problem.

22. Determine the sequence of 7 jobs and 3 machines given below and calculate total elapsed time.

| Job | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| Machine-$M_1$ | 3 | 8 | 7 | 4 | 9 | 8 | 7 |
| Machine-$M_2$ | 4 | 3 | 2 | 5 | 1 | 4 | 3 |
| Machine-$M_3$ | 6 | 7 | 5 | 11 | 5 | 6 | 12 |

23. Show that for an M/M/1 queueing system $E[Nq \setminus Nq > 0] = 1/(1-p)$.

24. The following are the time estimates and the precedence relationships of the activities in a project network. Draw the project network diagram. Determine the critical path and the project completion time.

| Activity | Immediate predecessor Activity | Time estimate (weeks) |
|---|---|---|
| A | - | 4 |
| B | - | 7 |
| C | - | 3 |
| D | A | 6 |
| E | B | 4 |
| F | B | 7 |
| G | C | 6 |
| H | E | 10 |
| I | D | 3 |
| J | F,G | 4 |
| K | H,I | 2 |