(Pages : 4) S – 1622

Reg. No. : .....

Name : .....

Fifth Semester B.A./B.Sc./B.Com. Degree Examination, December 2023

First Degree Programme Under CBCSS

Mathematics

Open Course

MM 1551.1/MEC 1551.1 – OPERATIONS RESEARCH

(2013 Admission Onwards)

Time : 3 Hours Max. Marks : 80

SECTION – I

All the first **ten** questions are compulsory. They carry **1** mark each.

1. What do you mean by a constraint set in an LPP?
2. When do we say that an LPP has unbounded solution?
3. Write the standard form of a maximization LPP with m constraints and n variables.
4. When do we say that two system of equations are equivalent?
5. What is an unbalanced transportation problem?
6. Expand CPM.
7. What is an event?
8. Define critical path.
9. What is the slack time of a job?
10. What do you mean by the normal completion time of a job?

(10 × 1 = 10 Marks)

P.T.O.

SECTION – II

Answer any **eight** questions. These questions carry **2** marks each.

11. What is the feasible region of an LPP? When do we say that an LPP is infeasible?

12. Convert the following maximization problem to minimization problem.
Maximize $z = -40x_1 - 36x_2$
Subject to $x_1 \leq 8$

$$x_2 \leq 10$$
$$5x_1 + 3x_2 \geq 45$$
$$x_1 \geq 0, x_2 \geq 0$$

13. What is the function of the inner product rule in the simplex method?
14. What is stepping stone method?
15. Write a short note on origin of PERT.
16. Write a short note on uses of CPM.
17. How can we apply linear programming in project management problem?
18. Distinguish between basic feasible solution and optimal solution.
19. Can we use transportation algorithm to solve assignment problem? Explain.
20. Compare PERT and CPM.
21. What are artificial variables in LPP?
22. What is sensitivity analysis? Why do we use it?

(8 × 2 = 16 Marks)

SECTION – III

Answer any **six** questions. These questions carry **4** marks each.

23. Solve using graphical method:
Maximize $z = x_1 + 2x_2$
Subject to $x_1 + 2x_2 \leq 10$

$$x_1 + x_2 \geq 1$$
$$x_2 \leq 4$$
$$x_1 \geq 0, x_2 \geq 0$$

24. Write a short note on computational problems that may arise while using simplex method.

25. What do you mean by a transportation problem? Write its linear programming formulation.

26. Explain VAM.

27. Find a basic feasible solution for the following transportation problem using least cost rule. There are three warehouses and four markets. The warehouse capacities are $a_1 = 3$, $a_2 = 7$ and $a_3 = 5$. The market demands are $b_1 = 4$, $b_2 = 3$, $b_3 = 4$ and $b_4 = 4$. The unit cost of shipping is given by the following table.

	M_1	M_2	M_3	M_4
W_1	2	2	2	1
W_2	10	8	5	4
W_3	7	6	6	8

28. Write a short note on Hungarian method.

29. Find the optimal assignment of fourjobs to four machines when the cost of assignment is as follows.

	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

30. Draw the network of the project consisting of 5 jobs A, B, C, D and E with the following job sequence.
Job A precedes C and D, Job B precedes D and Job C and D precede E.

31. For an activity with optimistic time of completion 3 days, pessimistic time of completion 5 days and most probable time of completion 4 days, find its expected time of completion and variance of the job time.

($6 \times 4 = 24$ Marks)

SECTION – IV

Answer any **two** questions. These questions carry **15** marks each.

32. Solve using graphical method:
Minimize $z = 40x_1 + 36x_2$
Subject to $x_1 \leq 8$
$x_2 \leq 10$
$5x_1 + 3x_2 \geq 45$
$x_1 \geq 0, x_2 \geq 0$

33. (a) Find an initial basic feasible solution for the following data.

Origin (Surplus Area)	Destination (Shortage Area)			Supply
	1	2	3	
1	$50	100	100	110
2	200	300	200	160
3	100	200	300	150
Demand	140	200	80	420 / 420

(b) Write a short note on degeneracy in basic feasible solution.

34. Draw a project consisting of seven activities for which relevant data are given below, identify the critical path and find the project completion time.

Activity	Preceding activities	Duration (days)
A	–	4
B	–	7
C	–	6
D	A, B	5
E	A, B	7
F	C, D, E	6
G	C, D, E	5

35. Consider the network in the following figure which starts at node 1 and ends at node 6. Time required to complete each activity is given in the arrow. Find the earliest start time, latest completion time for each node and the critical path. Construct a time schedule which levels the man power requirement during the project duration.

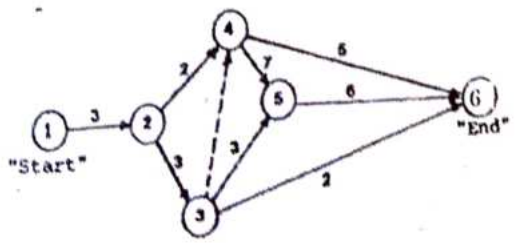

Table 1

Activity	Number of men	Activity	Number men
1, 2	5	3, 6	1
1, 3	7	4, 5	2
2, 4	3	4, 6	5
3, 5	2	5, 6	6

(2 × 15 = 30 Marks)