SECTION – D

Answer **any 2** questions out of 4 questions. **Each** question carries **6** marks.

27. For the problem Min $x_1 + x_2$ subject to $2x_1 + x_2 \geq 8$, $3x_1 + 7x_2 \geq 21$, $x_1, x_2 \geq 0$. Find the dual and solve graphically the primal and dual, verify the optimal values.

28. Find the minimum cost solution for the following assignment problem :

	1	2	3	4	5
1	– 2	– 4	– 8	– 6	– 1
2	0	– 9	– 5	– 5	– 4
3	– 3	– 8	– 9	– 2	– 6
4	– 4	– 3	– 1	0	– 3
5	– 9	– 5	– 8	– 9	– 5

29. Explain economical interpretation of duality.

30. Find the minimum time of completion of the project, when time (in days) of completion of each task is as follows :

Task	A	B	C	D	E	F	G	H	I
Time	23	8	20	16	24	18	19	4	10

The relation among the task are A < D, E; B, D < F; C < G; B, G < H; F, G < I (W < X, Y mean X and Y cannot start until W is completed, X, Y < W means W cannot start until X and Y both are completed). **(2×6=12)**

Reg. No. : .....

Name : .....

K19U 0763

VI Semester B.Sc. Hon's (Mathematics) Degree (Reg.) Examination, April 2019
(2016 Admission)
BHM 603 : OPERATIONS RESEARCH

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **any 4** questions out of 5 questions. **Each** question carries **1** mark.

1. Define slack variable.
2. In a set of m × n equations (m < n) what is the maximum number of corner points ?
3. Define an optimal solution.
4. Name the three methods to find the basic feasible solution of a transportation problem.
5. What are the different methods to solve shortest route algorithm ? **(4×1=4)**

SECTION – B

Answer **any 6** questions out of 9 questions. **Each** question carries **2** marks.

6. Show that the system of linear equation $2x_1 + x_2 - x_3 = 2$ and $3x_1 + 2x_2 + x_3 = 3$ has a degenerate solution.
7. Write the LPP in the standard form
   Maximize $f = 2x_1 + x_2 - x_3$,
   Subject to $2x_1 - 5x_2 + 3x_3 \leq 4$,
   $3x_1 + 6x_2 - x_3 \geq 2$,
   $x_1 + x_2 + x_3 = 4$, $x_1, x_2, x_3 \geq 0$.

8. Write the dual of the LPP

Maximize $f = 2x_1 + x_2 - x_3$,

Subject to $2x_1 - 5x_2 + 3x_3 \leq 4$,

$3x_1 + 6x_2 - x_3 \geq 2$,

$x_1 + x_2 + x_3 = 4$, $x_1, x_2, x_3 \geq 0$.

9. Which formula is used to economically interpret dual constraint ?

10. Define artificial variable along with an example.

11. Define any two estimates of PERT Network.

12. What is meant by average duration time and variance in PERT ?

13. Define critical and non-critical activity.

14. Solve the assignment problem.

	A	B	C
1	120	100	80
2	80	90	110
3	110	140	120

(6×2=12)

SECTION – C

Answer **any 8** questions out of 12 questions. **Each** question carries **4** marks.

15. Describe Floyd's algorithm.

16. Explain Dijkstra's algorithm and find the shortest route from city 1 to city 5 with allowed routes between them and given length in miles as follows :

Routes	(1, 2)	(1, 3)	(2, 3)	(4, 2)	(3, 4)	(3, 5)	(4, 5)
Length	100	30	20	15	10	60	50

17. Explain Linear Programming model for shortest route problem.

18. Write the algorithm for Vogel's Approximation Method and North West Corner Rule.

19. Mathematically represent transportation and assignment model.

20. Find the minimum cost of transportation of the following source and destination.

	1	2	3	4	
1	10	2	20	11	15
2	12	7	9	20	25
3	4	14	16	18	10
	5	15	15	15	

21. Prove that dual of a dual problem is primal.

22. Check the optimality and feasibility of LPP with basic variable (x_2, x_4) and

inverse = $\begin{pmatrix} 1/7 & 0 \\ -2/7 & 1 \end{pmatrix}$

23. Compare CPM and PERT, explain similarities and mention where they differ with atleast five points.

24. Explain the algorithm of II phase method.

25. Solve using dual simplex method

Minimize $f = x_1 + 3x_2 - 2x_3$,

Subject to $4x_1 - 5x_2 + 7x_3 \leq 8$,

$2x_1 - 4x_2 + 2x_3 \geq 2$,

$x_1, x_2, x_3 \geq 0$

26. Solve graphically the following LPP

Maximize $5x_1 + 3x_2$

Subject to $4x_1 + 5x_2 \leq 10$,

$5x_1 + 2x_2 \leq 10$,

$3x_1 + 8x_2 \leq 12$,

$x_1, x_2 \geq 0$

(8×4=32)