Reg. No. | | | | | | | |

G. VENKATASWAMY NAIDU COLLEGE (AUTONOMOUS), KOVILPATTI – 628 502.

UG DEGREE END SEMESTER EXAMINATIONS - NOVEMBER 2025.
(For those admitted in June 2023 and later)

PROGRAMME AND BRANCH: B.Sc., STATISTICS

SEM	CATEGORY	COMPONENT	COURSE CODE	COURSE TITLE
V	PART - III	CORE ELECTIVE - 1	U23ST5E1A	OPERATIONS RESEARCH

Date & Session:08.11.2025/FN **Time : 3 hours** **Maximum: 75 Marks**

Course Outcome	Bloom's K-level	Q. No.	**SECTION – A (10 X 1 = 10 Marks)** **Answer ALL Questions.**
CO1	K1	1.	In a Linear Programming Problem, the objective function is: a) Always linear b) Always non-linear c) May be linear or non-linear d) Constant
CO1	K2	2.	In the Simplex Method, a basic feasible solution must satisfy: a) Only non-negativity constraints b) Only equality constraints c) Both equality and non-negativity constraints d) Only the objective function
CO2	K1	3.	The primary objective of a transportation problem is: a) To maximize the profit of shipments b) To minimize the total transportation cost c) To balance supply and demand exactly d) To determine the shortest route
CO2	K2	4.	In Vogel's Approximation Method (VAM), the penalty is calculated as: a) Difference between the highest and second highest cost in a row or column b) Difference between the lowest and second lowest cost in a row or column c) Sum of the smallest costs in each row d) Maximum value in the row or column
CO3	K1	5.	In Game Theory, a saddle point in the payoff matrix represents: a) The point of maximum gain for the column player b) The point of minimum loss for the row player and maximum gain for the column player c) The point of maximum loss for both players d) The highest value in the matrix
CO3	K2	6.	The principle of dominance in Game Theory is used to: a) Replace a strategy with a better one b) Find the saddle point directly c) Convert a 2x2 game to a 3x3 game d) Eliminate the need for a payoff matrix

CO4	K1	7.	The objective of a replacement policy is to: a) Minimize the number of replacements b) Maximize the working life of an asset c) Minimize the average cost per period d) Reduce the depreciation of the asset
CO4	K2	8.	When the value of money changes over time, the replacement decision is based on: a) Average cost method b) Present worth method c) Scrap value method d) Equal cost method
CO5	K1	9.	In CPM, the focus is primarily on: a) Probabilistic time estimates b) Minimizing project cost c) Deterministic time estimates d) Resource leveling
CO5	K2	10.	In a project network, slack for an activity is: a) The delay allowed without affecting project completion time b) The total project duration c) The earliest start time of an activity d) The difference between earliest and latest event times
Course Outcome	**Bloom's K-level**	**Q. No.**	**SECTION – B (5 X 5 = 25 Marks)** **Answer ALL Questions choosing either (a) or (b)**
CO1	K3	11a.	Solve the following LPP graphically: Maximize $Z=3x+2y$ Subject to: $x+y\leq4$, $x\leq2$, $y\leq3$, $x, y\geq0$ **(OR)**
CO1	K3	11b.	A furniture manufacturer produces tables (x_1) and chairs (x_2). The profit contribution is ₹4 per table and ₹3 per chair. Due to production capacity limits: • Each table requires 1 hour of cutting and 2 hours of polishing. • Each chair requires 3 hours of cutting and 2 hours of polishing. • The cutting department can work at most 8 hours per day. • The polishing department must work at least 12 hours per day to meet contractual obligations. Formulate the Linear Programming Problem in standard form so that the profit is maximized.
CO2	K3	12a.	A company has three warehouses W1, W2, W3 and three retail stores S1, S2, S3. The supply from each warehouse and demand at each store are given below. Find the initial basic feasible solution using the North-West Corner Rule.

	S_1	S_2	S_3	Supply
W_1	2	7	4	5
W_2	3	3	1	8
W_3	5	4	7	7
Demand	7	9	4	

(OR)

CO2	K3	12b.	Solve the following Assignment Problem using the Hungarian Method to find the minimum cost:

	A	B	C	D
P_1	82	83	69	92
P_2	77	37	49	92
P_3	11	69	5	86

			P_4	8	9	98	23

CO3	K4	13a.	Solve the following game using the Maximin and Minimax criterion. Find the value of the game and the optimal strategies. Payoff Matrix (for Player A):

	B_1	B_2
A_1	4	6
A_2	2	8

(OR)

CO3	K4	13b.	Apply the principle of dominance to reduce the matrix and find the value of the game.

	B_1	B_2	B_3
A_1	2	4	6
A_2	3	2	5
A_3	4	3	4

CO4	K4	14a.	The maintenance cost of a machine over its years of service is given below. The value of money is constant. Find the optimal replacement time.

Year	1	2	3	4	5
Maintenance Cost (₹)	1000	1200	1500	1900	2500
Purchase Price = ₹5000, Scrap Value = ₹1000					

(OR)

CO4	K4	14b.	A company owns a delivery van that costs ₹3,00,000. The maintenance costs increase each year as shown below. Scrap value is ₹20,000. The value of money is constant. Determine the optimal replacement time.

Year	1	2	3	4	5
Maintenance Cost (₹)	20,000	25,000	32,000	42,000	55,000

CO5	K5	15a.	A small project has the following activities:

Activity	Predecessor	Duration (days)
A	–	4
B	A	5
C	A	3
D	B, C	6

Draw the network diagram and find the project completion time.

(OR)

CO5	K5	15b.	The following data is given for a project:

Activity	Predecessor	Duration (days)
A	–	2
B	A	5
C	A	4
D	B	6
E	C	3
F	D, E	2

Find the critical path and total float for activity C.

Course Outcome	Bloom's K-level	Q. No.	**SECTION – C (5 X 8 = 40 Marks)** **Answer ALL Questions choosing either (a) or (b)**
CO1	K3	16a.	Solve using the Simplex Method: Maximize $Z=2x_1+3x_2$ Subject to: $x_1+x_2\le4$ $x_1+3x_2\le6$, $x_1,x_2\ge0$
			(OR)
CO1	K3	16b.	Solve using the Big-M Method: Minimize $Z=4x_1+6x_2$ Subject to: $x_1+x_2\ge2$, $3x_1+2x_2\ge6$, $x_1,x_2\ge0$
CO2	K4	17a.	Find the initial basic feasible solution using Vogel's Approximation Method (VAM) and compute the transportation cost. (table below)
			(OR)
CO2	K4	17b.	Using the MODI Method, determine the optimal solution for the transportation problem given below (initial BFS from Least Cost Method): (table below)
CO3	K4	18a.	Solve the following 2×2 game without a saddle point: (table below)
			(OR)
CO3	K4	18b.	Solve the following game using the Graphical Method (2×n game): (table below)
CO4	K5	19a.	A truck costs ₹6,00,000. The maintenance costs and resale values for each year are given below. The value of money remains constant. Find the optimal replacement time.

Table for 17a:

	D_1	D_2	D_3	Supply
S_1	19	30	50	7
S_2	70	30	40	9
S_3	40	8	70	18
Demand	5	8	21	

Table for 17b:

	D_1	D_2	D_3	Supply
S_1	8	6	10	60
S_2	9	12	13	50
S_3	14	9	16	40
Demand	30	70	50	

Table for 18a:

	B_1	B_2
A_1	1	3
A_2	4	2

Table for 18b:

	B_1	B_2	B_3
A_1	4	2	6
A_2	5	3	2

Year	Maintenance Cost (₹)	Resale Value (₹)
1	50,000	4,00,000
2	55,000	3,00,000
3	70,000	2,00,000
4	90,000	1,20,000
5	1,20,000	80,000

(OR)

CO4	K5	19b.	A machine costs ₹5,00,000. The maintenance costs and scrap values are given below. The value of money changes at a discount rate of 10% per year. Find the optimal replacement period using the Present Worth Method.

Year	Maintenance Cost (₹)	Scrap Value (₹)
1	40,000	3,50,000
2	55,000	2,40,000
3	75,000	1,60,000
4	1,05,000	1,00,000

CO5	K5	20a.	A project has the following activities with three time estimates (in weeks):

Activity	Predecessor	a	m	b
A	–	2	4	6
B	A	3	5	9
C	A	2	3	4
D	B, C	4	6	8

Using PERT,

1. Calculate the expected time for each activity.
2. Find the critical path and expected project completion time.

(OR)

CO5	K5	20b.	A construction project involves the following activities:

Activity	Predecessor	Duration (days)
A	–	5
B	–	7
C	A	6
D	A	8
E	B, C	5
F	D, E	4

1. Draw the project network diagram.
2. Find the critical path, project completion time, and total float for activity D.