22STU518N

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2025
(Fifth Semester)

Branch – **STATISTICS**

OPERATIONS RESEARCH

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	The objective function in a linear programming problem is: a) Always linear b) Always quadratic c) Always exponential d) May be non-linear	K1	CO1
	2	When more than one optimal solution exists in an LPP, it means: a) The objective function is parallel to a constraint line over the feasible region b) The problem is infeasible c) The problem is unbounded d) The simplex method cannot be applied	K2	CO1
2	3	In a transportation table with *m* origins and *n* destinations, the number of basic variables in a feasible solution is a) m + n b) m + n – 1 c) m × n d) m × n – 1	K1	CO2
	4	The North-West Corner Rule is used to a) Find the optimal solution directly b) Obtain an initial basic feasible solution c) Check for degeneracy d) Solve assignment problems	K2	CO2
3	5	In an assignment problem, the objective is to a) Minimize total time or cost of performing all jobs b) Maximize total time taken for all jobs c) Balance the number of jobs and machines d) Minimize transportation cost	K1	CO3
	6	In the Travelling Salesman Problem (TSP), the objective is to a) Visit each city exactly once and return to the starting city at minimum cost b) Visit as many cities as possible c) Visit only the nearest cities d) Minimize total distance ignoring return path	K2	CO3
4	7	A 2×2 game without a saddle point can be solved by: A) Graphical method B) Linear programming method C) Arithmetic method (formulas for mixed strategies) D) Dominance method only	K1	CO4
	8	When a strategy is dominated, it means: a) It gives higher payoff than another in all conditions b) It gives lower payoff than another in all conditions c) It gives same payoff as another d) None of the above	K2	CO4

Cont...

5	9	The main objective of network analysis is to a) Minimize total cost b) Minimize total project time c) Ensure project completion on time and within budget d) Increase project complexity	K1	CO5
	10	PERT differs from CPM because PERT a) Considers time-cost trade-off b) Uses probabilistic time estimates c) Is used for repetitive works d) Ignores uncertainty	K2	CO5

SECTION - B (35 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	A small factory makes three items: Study Tables, Chairs and Stools. Profit per unit is ₹1200 for a Table, ₹450 for a Chair and ₹200 for a Stool. Each Table requires 6 hours of carpentry and 3 hours of polishing; each Chair requires 3 hours of carpentry and 2 hours of polishing; each Stool requires 1 hour of carpentry and 1 hour of polishing. The factory has at most 300 carpentry hours and 160 polishing hours per week. Market demand limits production to at most 30 Tables per week. Formulate an LPP to maximize weekly profit.	K2	CO1
		(OR)		
	11.b.	Explain about the graphical method of solving LPP.		
2	12.a.	Define: i) Transfortation problem ii) Feasible Solution iii) Degeneracy	K3	CO2
		(OR)		
	12.b.	**From \ To** **D1** **D2** **D3** **D4** **Supply** S1 8 6 10 9 **120** S2 9 12 13 7 **200** S3 14 9 16 5 **160** **Demand** **100** **150** **120** **110** Solve the above transportation problem by VAM method.		
3	13.a.	Explain the sequential problem of *n* jobs *3* machines.	K3	CO3
		(OR)		
	13.b.	Solve the following assignment problem by Hungarian method. **J1** **J2** **J3** **J4** **W1** 82 83 69 92 **W2** 77 37 49 92 **W3** 11 69 5 86 **W4** 8 9 98 23		
4	14.a.	Payoff matrix (A's payoffs): **Column 1** **Column 2** Row 1 4 2 Row 2 1 3 Find optimal mixed strategies and the value.	K2	CO4
		(OR)		
	14.b.	Describe dominance property and modified dominance property.		

<table>
<tr><td rowspan="3">5</td><td>15.a.</td><td colspan="7">Explain the phases of project management.</td><td rowspan="3">K3</td><td rowspan="3">CO5</td></tr>
<tr><td colspan="7">(OR)</td></tr>
<tr><td>15.b.</td><td colspan="7">A project has the following time schedule:
<table><tr><td>Activity</td><td>1-2</td><td>1-3</td><td>1-4</td><td>2-5</td><td>3-6</td><td>3-7</td></tr><tr><td>Time in Weeks</td><td>2</td><td>2</td><td>1</td><td>4</td><td>8</td><td>5</td></tr><tr><td>Activity</td><td>4-6</td><td>5-8</td><td>6-9</td><td>7-8</td><td>8-9</td><td></td></tr><tr><td>Time in Weeks</td><td>3</td><td>1</td><td>5</td><td>4</td><td>3</td><td></td></tr></table>
Construct PERT network and compute
i) Total float for each activity
ii) Critical path and its duration.</td></tr>
</table>

SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

<table>
<tr><th>Module No.</th><th>Question No.</th><th>Question</th><th>K Level</th><th>CO</th></tr>
<tr><td>1</td><td>16</td><td>Solve by big-M method:
Maximise $Z=3X_1 + 2X_2$
subject to
$X_1 + X_2 \leq 4$, $X_1 + 2X_2 \geq 2$, and $X_1, X_2 \geq 0$.</td><td>K3</td><td>CO1</td></tr>
<tr><td>2</td><td>17</td><td>A manufacturer has 3 warehouses (W1, W2, W3) with a stock of 30, 25, and 35 units respectively. These are to be supplied to 4 retail shops (R1, R2, R3, R4) with requirements of 20, 25, 15, and 30 units respectively. The transportation costs are as follows:
<table><tr><td></td><td>R1</td><td>R2</td><td>R3</td><td>R4</td></tr><tr><td>W1</td><td>6</td><td>4</td><td>8</td><td>13</td></tr><tr><td>W2</td><td>4</td><td>5</td><td>6</td><td>8</td></tr><tr><td>W3</td><td>8</td><td>10</td><td>6</td><td>7</td></tr></table>Determine the optimal cost using the MODI method.</td><td>K3</td><td>CO2</td></tr>
<tr><td>3</td><td>18</td><td>Write the algorithm for n jobs and m machines in a sequencing problem.</td><td>K2</td><td>CO3</td></tr>
<tr><td>4</td><td>19</td><td>Solve the following 2 x 4 game by graphic method.
<table><tr><td></td><td>B_1</td><td>B_2</td><td>B_3</td><td>B_4</td></tr><tr><td>A_1</td><td>3</td><td>3</td><td>4</td><td>0</td></tr><tr><td>A_2</td><td>5</td><td>4</td><td>3</td><td>7</td></tr></table></td><td>K4</td><td>CO4</td></tr>
<tr><td>5</td><td>20</td><td>A project has the following activities and time estimates (in weeks):
<table><tr><td>Activity</td><td>Predecessor</td><td>t_o</td><td>t_m</td><td>t_p</td></tr><tr><td>A</td><td>–</td><td>1</td><td>2</td><td>3</td></tr><tr><td>B</td><td>A</td><td>2</td><td>3</td><td>8</td></tr><tr><td>C</td><td>A</td><td>3</td><td>4</td><td>5</td></tr><tr><td>D</td><td>B, C</td><td>4</td><td>6</td><td>10</td></tr></table>(a) Construct the PERT network.
(b) Compute the expected project duration and variance.
(c) What is the probability that the project will be completed in 12 weeks?</td><td>K4</td><td>CO5</td></tr>
</table>

Z-Z-Z END