PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BCom DEGREE EXAMINATION MAY 2026
(Second Semester)

Branch – **COMMERCE (BUSINESS ANALYTICS)**

OPTIMIZATION TECHNIQUES FOR BUSINESS ANALYTICS

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	A factory produces two products A and B. Profit per unit of is Rs.5 and B is Rs. 3 which of the following function represents the objective function i) Maximize Z = 5A + 3B ii) Minimize Z = 5A − 3B iii) Maximize Z = A + B iv Minimize Z = 5 + 3	K1	CO1
	2	Slack variable is added to i) ≥ constraint ii) ≤ constraint iii) = constraint iv) Objective function	K2	CO1
2	3	A transportation problem aims at i) Maximizing profit ii) Minimizing transportation cost iii) Maximizing production iv) Allocating jobs	K1	CO2
	4	Assignment problem is a special case of i) LPP ii) Transportation problem iii) Sequencing problem iv) Game theory	K2	CO2
3	5	A zero-sum game means i) Total gain equals total loss ii) No loss situation iii) Random outcome iv) All players win	K2	CO3
	6	Saddle point exists when i) Maximin = Minimax ii) Maximin ≠ Minimax iii) No solution iv) Mixed strategy	K1	CO3
4	7	Critical path is i) Longest Path ii) Shortest Path iii) Medium Path iv) Optional Path	K1	CO4
	8	Expected time in PERT is i) (a+m+b)/3 ii) (a+4m+b)/6 iii) (a+b)/2 iv) m only	K2	CO4
5	9	Sequencing objective is to i) Maximize idle time ii) Minimize total elapsed time iii) Increase jobs iv) Reduce machines	K2	CO5
	10	Idle time is i) Working Time ii) Waiting Time ii) Completion Time iv) Total Time	K2	CO5

Cont...

SECTION - B (35 Marks)

Answer **ALL** questions

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

<table>
<tr><th>Module No.</th><th>Question No.</th><th>Question</th><th>K Level</th><th>CO</th></tr>
<tr><td rowspan="3">1</td><td>11.a.</td><td>Formulate the mathematical model of LPP and convert the following into standard form and solve graphically:
Max Z = 5x + 3y
3x + 2y ≤ 18
x + y ≤ 8</td><td rowspan="3">K2</td><td rowspan="3">CO1</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>11.b.</td><td>Explain the steps involved in formulating an LPP.</td></tr>
<tr><td rowspan="3">2</td><td>12.a.</td><td>Solve the following transportation problem
<table>
<tr><th></th><th>D1</th><th>D2</th><th>D3</th><th>Supply</th></tr>
<tr><td>S1</td><td>6</td><td>4</td><td>1</td><td>50</td></tr>
<tr><td>S2</td><td>3</td><td>8</td><td>7</td><td>40</td></tr>
<tr><td>Demand</td><td>30</td><td>30</td><td>30</td><td></td></tr>
</table></td><td rowspan="3">K3</td><td rowspan="3">CO2</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>12.b.</td><td>Solve the following maximization assignment problem.
<table>
<tr><th></th><th>S1</th><th>S2</th><th>S3</th><th>S4</th></tr>
<tr><td>A</td><td>62</td><td>75</td><td>80</td><td>93</td></tr>
<tr><td>B</td><td>75</td><td>80</td><td>82</td><td>85</td></tr>
<tr><td>C</td><td>80</td><td>75</td><td>81</td><td>98</td></tr>
<tr><td>D</td><td>78</td><td>82</td><td>84</td><td>80</td></tr>
</table></td></tr>
<tr><td rowspan="3">3</td><td>13.a.</td><td>Solve the following 2 × 4 game using graphical method and find optimal mixed strategies:
<table>
<tr><th></th><th>B1</th><th>B2</th><th>B3</th><th>B4</th></tr>
<tr><td>G1</td><td>2</td><td>4</td><td>6</td><td>8</td></tr>
<tr><td>G2</td><td>7</td><td>5</td><td>3</td><td>1</td></tr>
</table></td><td rowspan="3">K3</td><td rowspan="3">CO3</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>13.b.</td><td>Reduce the following game matrix using dominance rule and then solve the reduced game.
<table>
<tr><th></th><th>X1</th><th>X2</th><th>X3</th></tr>
<tr><td>Y1</td><td>1</td><td>7</td><td>2</td></tr>
<tr><td>Y2</td><td>6</td><td>2</td><td>7</td></tr>
<tr><td>Y3</td><td>5</td><td>1</td><td>6</td></tr>
</table></td></tr>
<tr><td rowspan="3">4</td><td>14.a.</td><td>A project consists of the following activities:
<table>
<tr><th>Activity</th><th>Predecessor</th><th>Duration (Days)</th></tr>
<tr><td>V</td><td>—</td><td>4</td></tr>
<tr><td>U</td><td>V</td><td>6</td></tr>
<tr><td>W</td><td>V</td><td>5</td></tr>
<tr><td>X</td><td>W</td><td>3</td></tr>
<tr><td>Y</td><td>X</td><td>4</td></tr>
<tr><td>Z</td><td>X,Y</td><td>2</td></tr>
</table>
Draw the network diagram and identify Critical Path</td><td rowspan="3">K3</td><td rowspan="3">CO4</td></tr>
<tr><td colspan="2">(OR)</td></tr>
</table>

<table>
<tr><td rowspan="4">4</td><td rowspan="4">14.b.</td><td>Using the following data:
<table><tr><th>Activity</th><th>a</th><th>m</th><th>b</th></tr><tr><td>A</td><td>1</td><td>2</td><td>3</td></tr><tr><td>B</td><td>2</td><td>4</td><td>6</td></tr><tr><td>C</td><td>3</td><td>5</td><td>9</td></tr></table>Calculate expected duration and variance.</td><td rowspan="4">K2</td><td rowspan="4">CO5</td></tr>
<tr><td rowspan="3">5</td></tr>
<tr><td>Five jobs are to be processed on two machines MX and MY in the order MX → MY. Processing times (in hours) are:
<table><tr><th>Job</th><th>MX</th><th>MY</th></tr><tr><td>J1</td><td>4</td><td>7</td></tr><tr><td>J2</td><td>6</td><td>3</td></tr><tr><td>J3</td><td>5</td><td>8</td></tr><tr><td>J4</td><td>2</td><td>6</td></tr><tr><td>J5</td><td>9</td><td>5</td></tr></table>Determine Optimal sequence using Johnson's Rule.</td></tr>
<tr><td>15.a.</td></tr>
<tr><td></td><td colspan="3">(OR)</td></tr>
<tr><td></td><td>15.b.</td><td>Five jobs must be processed on two machines in the order MA → MB.
<table><tr><th>Job</th><th>MA</th><th>MB</th></tr><tr><td>J1</td><td>3</td><td>8</td></tr><tr><td>J2</td><td>12</td><td>6</td></tr><tr><td>J3</td><td>5</td><td>4</td></tr><tr><td>J4</td><td>2</td><td>7</td></tr><tr><td>J5</td><td>9</td><td>3</td></tr></table>Determine optimal sequence and Idle time of machines.</td><td>K2</td><td>CO5</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 the following LPP using the graphical method and find the optimum solution:
Maximize Z = 4x + 6y
Subject to Constraint
$x + y \leq 8$
$2x + y \leq 10$
$x + 3y \leq 15$
$x, y \geq 0$</td><td>K2</td><td>CO1</td></tr>
<tr><td>2</td><td>17</td><td>Solve the following transportation problem using MODI's Method
<table><tr><th></th><th>D1</th><th>D2</th><th>D3</th><th>Supply</th></tr><tr><td>S1</td><td>8</td><td>6</td><td>10</td><td>70</td></tr><tr><td>S2</td><td>9</td><td>7</td><td>4</td><td>50</td></tr><tr><td>S3</td><td>3</td><td>4</td><td>2</td><td>30</td></tr><tr><td>Demand</td><td>40</td><td>60</td><td>50</td><td></td></tr></table></td><td>K3</td><td>CO2</td></tr>
<tr><td>3</td><td>18</td><td>Solve the following 2 × 3 game graphically and determine the value of the game.
<table><tr><th></th><th>B1</th><th>B2</th><th>B3</th></tr><tr><td>A1</td><td>1</td><td>4</td><td>2</td></tr><tr><td>A2</td><td>3</td><td>2</td><td>5</td></tr></table></td><td>K2</td><td>CO3</td></tr>
</table>

Cont...

<table>
<tr>
<td>4</td>
<td>19</td>
<td>Draw the network and determine: i) Critical Path ii)Project Duration
<table>
<tr><th>Activity</th><th>Predecessor</th><th>Duration</th></tr>
<tr><td>A</td><td>—</td><td>2</td></tr>
<tr><td>B</td><td>—</td><td>4</td></tr>
<tr><td>C</td><td>A</td><td>3</td></tr>
<tr><td>D</td><td>A</td><td>5</td></tr>
<tr><td>E</td><td>B</td><td>6</td></tr>
<tr><td>F</td><td>C, D</td><td>4</td></tr>
<tr><td>G</td><td>E</td><td>3</td></tr>
<tr><td>H</td><td>F, G</td><td>5</td></tr>
</table></td>
<td>K3</td>
<td>CO4</td>
</tr>
<tr>
<td>5</td>
<td>20</td>
<td>A workshop has 6 jobs to process on three machines. Processing times are:
<table>
<tr><th>Job</th><th>Machine 1</th><th>Machine 2</th><th>Machine 3</th></tr>
<tr><td>J1</td><td>5</td><td>3</td><td>6</td></tr>
<tr><td>J2</td><td>6</td><td>4</td><td>5</td></tr>
<tr><td>J3</td><td>4</td><td>5</td><td>7</td></tr>
<tr><td>J4</td><td>7</td><td>6</td><td>4</td></tr>
<tr><td>J5</td><td>3</td><td>4</td><td>6</td></tr>
<tr><td>J6</td><td>5</td><td>7</td><td>5</td></tr>
</table>
Find optimal schedule and minimum elapsed time.</td>
<td>K3</td>
<td>CO5</td>
</tr>
</table>

Z-Z-Z END