PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MCA DEGREE EXAMINATION MAY 2026
(Second Semester)

Branch – **COMPUTER APPLICATIONS**

MATHEMATICAL OPTIMIZATION

Time: Three Hours Maximum: 75 Marks

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

Question. No.	Question	K Level	CO
1	In the _____ form of the LPP, all the constraints are expressed as equations. (i) canonical (ii) standard (iii) feasible (iv) basic	K1	CO1
2	The optimal solution of a LPP in a graphical method lies at _____ of the feasible region. (i) center (ii) corner points (iii) origin (iv) None of the above	K2	CO2
3	Which algorithm is commonly used to solve an assignment problem? (i) Simplex Algorithm (ii) Vogel's Approximation Method (iii) Hungarian Algorithm (iv) North-West Corner Rule	K1	CO1
4	When solving an assignment problem, ensure that the _____. (i) all entries are non-zero (ii) all entries are zero (iii) at least one entry is non-zero (iv) number of rows = number of columns	K2	CO2
5	To balance an unbalanced transportation problem where demand exceeds supply, you must add a _____. (i) dummy destination (ii) dummy source (iii) slack variable (iv) surplus variable	K1	CO1
6	The degenerate transportation problem occurs when the basic feasible solution has fewer than _____ occupied cells (i) m+n-1 (ii) m+n+1 (iii) m-n-1 (iv) m-n+1	K2	CO2
7	The critical path is defined as the _____. (i) Shortest path through the network (ii) Path with the maximum float. (iii) Longest path through the network. (iv) Path with the minimum number of activities.	K1	CO1
8	A dummy activity in a network diagram is used to represent ___ between two activities without requiring any actual work, resources, or time. (i) dependency (ii) non-dependency (iii) independency (iv) none of the above	K2	CO2
9	Which technique is most suitable for routine, repetitive projects like construction? (i) PERT (ii) CPM (iii) Both (iv) None	K1	CO1
10	Float is the amount of time that a project activity can be _____ without affecting the overall project schedule. (i) stopped (ii) postponed (iii) delayed (iv) all of the above	K2	CO2

SECTION - B (35 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Q.No.	Question	K Level	CO
11.a.	Give the mathematical formulation of LPP.	K1	CO1
	(OR)		
11.b.	Solve using graphical method: Minimize $Z = 4x_1 + 2x_2$ subject to $x_1 + 2x_2 \leq 2;\quad 3x_1 + x_2 \leq 3;\quad 4x_1 + 3x_2 \leq 6;\quad x_1, x_2 \geq 0$		

Cont...

12.a.	Solve the following assignment problem for maximization given the profit matrix (Profit in Rs.) ***MACHINE*** 1 2 3 4 ***JOB*** A: 16 10 14 11 B: 14 11 15 15 C: 15 15 13 12 D: 13 12 14 15	K3	CO3
	(OR)		
12.b.	Solve the following unbalanced assignment problem. ***Men*** 1 2 3 ***Task*** P: 9 26 15 Q: 13 27 6 R: 35 20 15 S: 18 30 20		
13.a.	State the difference between a Transportation and an Assignment Problem.	K2	CO2
	(OR)		
13.b.	Determine the initial solution for the following transportation problem using Least Cost Method. D1 D2 D3 D4 Supply O1: 1 2 3 4 6 O2: 4 3 2 5 8 O3: 5 2 2 1 10 Demand: 4 6 8 6		
14.a.	Draw the arrow diagram for the following list of activities and number the events according to Fulkerson's rule: Activity: A B C D E F G H I J K Predecessor: - - A A I, J, K B, D B, D F A G, H F	K4	CO4
	(OR)		
14.b.	Draw the AON diagram for the following list of activities: Activity: A B C D E F G H I J K L M Predecessor: - - B A C C F F H I D, E, G, J I K, L		
15.a.	For the following details, determine the critical path and the project completion time. Job: 1-2 1-3 2-3 2-5 3-4 3-6 4-5 4-6 5-6 6-7 Duration (Days): 15 15 3 5 8 12 1 14 3 14	K5	CO5
	(OR)		
15.b.	The utility data for a network are given below. Draw the network diagram, and calculate the total float for each activity. Activity: A B C D E F G Precedence: - A - C B D, E F Duration (days): 4 7 6 5 7 6 5		

SECTION -C (30 Marks)

Answer **ANY THREE** questions

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

<table>
<tr><th>Q. No.</th><th>Question</th><th>K Level</th><th>CO</th></tr>
<tr><td>16</td><td>An advertising company wishes to plan its advertising strategy in four different cities. The purpose of advertising is to reach as large a number of potential customers as possible. Following data has been obtained from market survey:
<table>
<tr><td></td><td>Chennai</td><td>Bangalore</td><td>Calcutta</td><td>Hyderabad</td></tr>
<tr><td>Cost of an advertising unit</td><td>Rs 30,000</td><td>Rs 20,000</td><td>Rs15,000</td><td>Rs10,000</td></tr>
<tr><td>No. of potential customers reached per unit</td><td>Rs2,00,000</td><td>Rs6,00,000</td><td>Rs1,50,000</td><td>Rs1,00,000</td></tr>
<tr><td>No. of female customers reached per unit</td><td>Rs1,50,000</td><td>Rs 4,00,000</td><td>Rs 70,000</td><td>Rs 50,000</td></tr>
</table>
The company wants to spend no more than Rs.4, 00,000 on advertising. Following are the further requirements that must be met:
i) At least 1million exposures take place among female customers.
ii) Advertising in Calcutta and Hyderabad be limited to Rs.1, 50,000.
iii) At least 3 advertising units be bought in Calcutta and 2 units in Hyderabad.
iv) The number of advertising units in Chennai and Bangalore should each be between 5 and 10.
Formulate an L.P. model for the problem.</td><td>K4</td><td>CO4</td></tr>
<tr><td>17</td><td>Solve the following assignment problem.
<table>
<tr><td></td><td>I</td><td>II</td><td>III</td><td>IV</td><td>V</td><td>VI</td></tr>
<tr><td>A</td><td>9</td><td>22</td><td>58</td><td>11</td><td>19</td><td>27</td></tr>
<tr><td>B</td><td>43</td><td>78</td><td>72</td><td>50</td><td>63</td><td>48</td></tr>
<tr><td>C</td><td>41</td><td>28</td><td>91</td><td>37</td><td>45</td><td>33</td></tr>
<tr><td>D</td><td>74</td><td>42</td><td>27</td><td>49</td><td>39</td><td>32</td></tr>
<tr><td>E</td><td>36</td><td>11</td><td>57</td><td>22</td><td>25</td><td>18</td></tr>
<tr><td>F</td><td>3</td><td>56</td><td>53</td><td>31</td><td>17</td><td>28</td></tr>
</table></td><td>K3</td><td>CO3</td></tr>
<tr><td>18</td><td>Find Solution using Vogel's Approximation method, also find optimal solution using MODI method.
<table>
<tr><td></td><td>D1</td><td>D2</td><td>D3</td><td>D4</td><td>Supply</td></tr>
<tr><td>S1</td><td>19</td><td>30</td><td>50</td><td>10</td><td>7</td></tr>
<tr><td>S2</td><td>70</td><td>30</td><td>40</td><td>60</td><td>9</td></tr>
<tr><td>S3</td><td>40</td><td>8</td><td>70</td><td>20</td><td>18</td></tr>
<tr><td>Demand</td><td>5</td><td>8</td><td>7</td><td>14</td><td></td></tr>
</table></td><td>K2</td><td>CO2</td></tr>
<tr><td>19</td><td>List out the errors in drawing a network.</td><td>K1</td><td>CO1</td></tr>
<tr><td>20</td><td>The following table shows the jobs of a network along with their time estimates.
<table>
<tr><td>Activity</td><td>1-2</td><td>1-6</td><td>2-3</td><td>2-4</td><td>3-5</td><td>4-5</td><td>6-7</td><td>5-8</td><td>7-8</td></tr>
<tr><td>Optimistic time estimate</td><td>1</td><td>2</td><td>2</td><td>2</td><td>7</td><td>5</td><td>5</td><td>3</td><td>8</td></tr>
<tr><td>Most likely time estimate</td><td>7</td><td>5</td><td>14</td><td>5</td><td>10</td><td>5</td><td>8</td><td>3</td><td>17</td></tr>
<tr><td>Pessimistic time estimate</td><td>13</td><td>14</td><td>26</td><td>8</td><td>19</td><td>17</td><td>29</td><td>9</td><td>32</td></tr>
</table>
Draw the project network and find the probability that the project is completed in 40 days.</td><td>K5</td><td>CO5</td></tr>
</table>

Z-Z-Z END