STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 86
(For candidates admitted from the academic year 2023 – 2024 and thereafter)

B.B.A DEGREE EXAMINATION, APRIL 2026
BUSINESS ADMINISTRATION
FOURTH SEMESTER

COURSE : ALLIED CORE
PAPER : QUANTITATIVE TECHNIQUES FOR MANAGERS
SUBJECT CODE : 23BA/AC/QT45
TIME : 3 HOURS MAX. MARKS: 100

SECTION A

Q. No.	Answer all the questions: (5 x 2 = 10)	CO	KL
1.	Define Operations Research.	CO1	K1
2.	Draw the network diagram. Activities: 1-2, 1-3, 2-3, 2-4, 3-4, 4-5 Duration: 20, 25, 10, 12, 6, 10	CO1	K1
3.	Differentiate between Balanced and Unbalanced Assignment Problem.	CO1	K1
4.	The payoff matrix of a game is given below. Find the solution of the game to A and B. **Player B**: I, II, III, IV, V **Player A**: I (-4, -2, -2, 3, 1); II (1, 0, -1, 0, 0); III (-6, -5, -2, -4, 4); IV (3, 1, -6, 0, -8)	CO1	K1
5.	An activity has: Earliest Start (ES) = 5 days, Duration = 7 days. Find Earliest Finish (EF).	CO1	K1

SECTION B

Q. No.	Answer any four questions: (4 x 5 = 20)	CO	KL
6.	Discuss the scope of Operations Research.	CO2	K2
7.	Explain the applications of PERT and CPM.	CO2	K2
8.	There are 9 jobs, each of which has to go through the Machine A and B in the order of AB. Processing times in hours are given as: **Machine A**: 5, 3, 12, 15, 6, 10, 11, 9, 5 **Machine B**: 6, 8, 10, 10, 6, 12, 1, 3, 7 Determine an optimal sequence of these jobs.	CO2	K2
9.	Solve the following transportation problem using Least Cost Method: S1: 4, 8, 6, 20 S2: 5, 3, 7, 30 S3: 6, 4, 5, 25 Demand: 30, 25, 20, 75	CO2	K2

<table>
<tr><td>10.</td><td>Solve the following game and find the optimal strategies and value of the game:
<table>
<tr><th>Player A/Player B</th><th>B_1</th><th>B_2</th></tr>
<tr><td>A_1</td><td>1</td><td>4</td></tr>
<tr><td>A_2</td><td>3</td><td>2</td></tr>
</table></td><td>CO2</td><td>K2</td></tr>
<tr><td>11.</td><td>Four workers (A, B, C, D) are to be assigned to four jobs (J1, J2, J3, J4). The cost matrix (in ₹) is given below:
<table>
<tr><th></th><th>J1</th><th>J2</th><th>J3</th><th>J4</th></tr>
<tr><td>A</td><td>9</td><td>2</td><td>7</td><td>8</td></tr>
<tr><td>B</td><td>6</td><td>4</td><td>3</td><td>7</td></tr>
<tr><td>C</td><td>5</td><td>8</td><td>1</td><td>8</td></tr>
<tr><td>D</td><td>7</td><td>6</td><td>9</td><td>4</td></tr>
</table>
Find the optimal assignment to minimize total cost.</td><td>CO2</td><td>K2</td></tr>
<tr><td></td><td>SECTION C</td><td></td><td></td></tr>
<tr><td>Q. No.</td><td>Answer all the questions :(Internal Choice) (4 x 10 = 40)</td><td>CO</td><td>KL</td></tr>
<tr><td>12.</td><td>a) A company manufactures two products Y and Z on which profits earned per unit are Rs. 12 and Rs. 16, respectively. Each product is processed on two machines M_1 and M_2. Product Y requires 10 minutes of processing time M_1 and 8 minutes of processing on M_2 while processing of product Z requires 20 minutes on M_1 and 8 minutes on M_2. Machine M_1 is available for not more than 2 hours, while machine M_2 is available for 80 minutes during any working day. Find the number of units of products Y and Z need to be manufactured to get maximum profit. Formulate the above as a LPP and solve by graphical method.
(or)
b) Solve the following LPP by Simplex method:
Maximize
$Z = 3x_1 + 5x_2$
Subject to:
$x_1 + x_2 \leq 4$
$2x_1 + x_2 \leq 6$
$x_1, x_2 \geq 0$</td><td>CO3</td><td>K3</td></tr>
<tr><td>13.</td><td>a) Using the VAM method find the initial basic solution of the transportation problem.
<table>
<tr><th></th><th>D_1</th><th>D_2</th><th>D_3</th><th>D_4</th><th>SUPPLY</th></tr>
<tr><td>S_1</td><td>21</td><td>16</td><td>25</td><td>13</td><td>11</td></tr>
<tr><td>S_2</td><td>17</td><td>18</td><td>14</td><td>23</td><td>13</td></tr>
<tr><td>S_3</td><td>32</td><td>27</td><td>18</td><td>41</td><td>19</td></tr>
<tr><td>DEMAND</td><td>6</td><td>10</td><td>12</td><td>15</td><td>43</td></tr>
</table>
(or)
b) Find the initial basic feasible solution using North–West Corner Rule.
<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>20</td></tr>
<tr><td>S2</td><td>9</td><td>12</td><td>13</td><td>30</td></tr>
<tr><td>S3</td><td>14</td><td>9</td><td>16</td><td>25</td></tr>
<tr><td>Demand</td><td>25</td><td>25</td><td>25</td><td>75</td></tr>
</table></td><td>CO3</td><td>K3</td></tr>
</table>

14. **a)** Find the optimal solution for the assignment problem with the following cost matrix. CO4 K4

		Area			
		W	**X**	**Y**	**Z**
Salesman	**A**	11	17	8	16
	B	9	7	12	6
	C	13	16	15	12
	D	14	10	12	11

(or)

b) The utility data for a network are given below. i. Draw the network diagram. ii. Compute the Earliest Start time and Latest Completion time and identify the critical path. iii. Determine the total project duration. iv. Compute the total float, free float for all activity.

Activity	0-1	1-2	1-3	2-4	2-5	3-4	3-6	4-7	5-7	6-7
Duration	2	8	10	6	3	3	7	5	2	8

15. **a)** Reduce the following game by dominance and find the game value: CO4 K4

		PLAYER B			
		I	**II**	**III**	**IV**
PLAYER A	**I**	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

(or)

b) An engineer wants to assign four new methods to three work centers. The assignment of the new methods will increase productions and they are given below. If only one method can be assigned to a work center, determine the optimal assignment.

	Increase in Production (Unit)		
	Work Centers		
Methods	**A**	**B**	**C**
1	10	7	8
2	8	9	7
3	7	12	6
4	10	10	8

SECTION D

Q. No.	**Answer any two questions: (2 x 15 = 30)**	**CO**	**KL**
16.	Solve the following LPP by Graphical method: Maximize $Z = 3x + 5y$ Subject to: $x + y \leq 4$ $2x + y \leq 6$ $x \geq 0, y \geq 0$	CO5	K5

<table>
<tr>
<td>17.</td>
<td>Find the initial basic feasible solution of the following transportation problem by Northwest corner cell method and then optimize the IBFS (Initial Basic Feasible Solution) using U-V Method.
<table>
<tr><td></td><td colspan="4">Destination</td><td></td></tr>
<tr><td>Sources</td><td>1</td><td>2</td><td>3</td><td>4</td><td>Supply</td></tr>
<tr><td>1</td><td>4</td><td>6</td><td>8</td><td>8</td><td>40</td></tr>
<tr><td>2</td><td>6</td><td>8</td><td>6</td><td>7</td><td>60</td></tr>
<tr><td>3</td><td>5</td><td>7</td><td>6</td><td>8</td><td>50</td></tr>
<tr><td>Demand</td><td>20</td><td>30</td><td>50</td><td>50</td><td></td></tr>
</table>
</td>
<td>CO5</td>
<td>K5</td>
</tr>
<tr>
<td>18.</td>
<td>The time estimate (in weeks) for the activities of a PERT network is given below.
<table>
<tr><th>Activity</th><th>t_o</th><th>t_m</th><th>t_p</th></tr>
<tr><td>1-2</td><td>1</td><td>1</td><td>7</td></tr>
<tr><td>1-3</td><td>1</td><td>4</td><td>7</td></tr>
<tr><td>1-4</td><td>2</td><td>2</td><td>8</td></tr>
<tr><td>2-5</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>3-5</td><td>2</td><td>5</td><td>14</td></tr>
<tr><td>4-6</td><td>2</td><td>5</td><td>8</td></tr>
<tr><td>5-6</td><td>3</td><td>6</td><td>15</td></tr>
</table>
a) Draw the project network and identify all the paths through it.
b) Determine the expected project length.
c) Calculate the standard deviation and variance of the project length.
</td>
<td>CO5</td>
<td>K5</td>
</tr>
</table>

****