23MSU207/ 23ISU208/ 23RMU207/ 23BLU207

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BBA DEGREE EXAMINATION MAY 2025
(Second Semester)

Common to Branches – **BUSINESS ADMINISTRATION/ BUSINESS ADMINISTRATION (IS)/ BUSINESS ADMINISTRATION (RM) / BUSINESS ADMINISTRATION (LOGISTICS)**

APPLIED 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	Which of the following accurately describes the nature and features of Operation Research (O.R.)? a) O.R. primarily focuses on historical data analysis. b) O.R. originated during World War II to solve military logistics problems. c) O.R. deals exclusively with qualitative decision-making processes. d) O.R. is limited to a specific set of industries such as manufacturing.	K1	CO1
	2	In linear programming, what does the term "feasible solution" refer to? a) A solution that is practical to implement in real-world scenarios. b) A solution that satisfies all constraints of the problem. c) A solution that maximizes the objective function. d) A solution that involves non-linear equations.	K2	CO1
2	3	Which method is specifically used for testing optimality in the Transportation Problem? a) MODI Method b) Dual Simplex Method c) Big M Method d) Revised Simplex Method	K1	CO1
	4	Which method is commonly used to solve simple instances of the Assignment Problem? a) Genetic Algorithm b) Dijkstra's Algorithm c) Hungarian Algorithm d) Particle Swarm Optimization	K2	CO1
3	5	Which principle aims to maximize the minimum possible payoff in a zero-sum game? a) Maximin principle b) Minimax principle c) Saddle point principle d) Dominance property	K1	CO1
	6	Which characteristic of a queuing system refers to the average number of customers in the system, including those being served and waiting? a) Arrival rate b) Service rate c) Utilization factor d) Queue length	K2	CO1
4	7	Which of the following best defines the Sequencing Problem? a) Arranging elements in a particular order b) Allocating resources efficiently c) Solving mathematical equations d) Classifying data into categories	K1	CO1
	8	What does the Replacement Problem entail? a) Determining when to replace outdated equipment b) Identifying system failures c) Allocating resources efficiently d) Enhancing system reliability	K2	CO1

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5	9	In a PERT/CPM network, what do nodes represent? a) Resources required for each task b) Activities or tasks to be completed c) Time intervals for each task d) Project milestones or checkpoints	K1	CO1
	10	What does the critical path represent in a PERT/CPM network? a) The path with the longest duration b) The path with the shortest duration c) The path with the most activities d) The path with the least amount of resources required	K2	CO1

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.	Explain the nature of Operations Research and its key features distinguishing it from other problem-solving methodologies.	K3	CO1
		(OR)		
	11.b.	Solve the given linear programming problems graphically: Maximize: $Z = 8x + y$ Constraints are, $x + y \leq 40$ $2x + y \leq 60$ $x \geq 0, y \geq 0$		
2	12.a.	Solve the transportation problem by VAM Source / Destination: D1, D2, D3, D4 / Supply O1: 3, 1, 7, 4 / 300 O2: 2, 6, 5, 9 / 400 O3: 8, 3, 3, 2 / 500 Demand: 250, 350, 400, 200 / 1200	K4	CO2
		(OR)		
	12.b.	Explain how an Assignment Problem can be formulated mathematically.		
3	13.a.	Solve by graphical method B1 B2 A1 -2 0 A2 3 -1 A3 -3 2 A4 5 -4	K3	CO4
		(OR)		
	13.b.	In a self-service store with one cashier, 8 customers arrive on an average of every 5 mins. and the cashier can serve 10 in 5 mins. If both arrival and service time are exponentially distributed, then determine a) Average number of customers waiting in the queue for average. b) Expected waiting time in the queue c) What is the probability of having more than 6 customers in the system		
4	14.a.	Find the sequence that minimizes the total elapsed time required to complete the following tasks on two machines: Task: A, B, C, D, E, F, G, H, I Machine I: 2, 5, 4, 9, 6, 8, 7, 5, 4 Machine II: 6, 8, 7, 4, 3, 9, 3, 8, 11	K3	CO3
		(OR)		
	14.b.	A firm is considering replacement of a machine, whose cost price is Rs. 12,200 and the scrap value is Rs. 200. The running (maintenance and operating) cost are found from experience are as follows: Year: 1, 2, 3, 4, 5, 6, 7, 8 Running Cost: 200, 500, 800, 1200, 1800, 2500, 3200, 4000 When should the machine be replaced?		

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<table>
<tr><td>5</td><td>15.a.</td><td>Explain the concept of network scheduling using PERT/CPM techniques. Discuss the significance of PERT/CPM in project management and scheduling.</td><td rowspan="3">K2</td><td rowspan="3">CO5</td></tr>
<tr><td></td><td colspan="2">(OR)</td></tr>
<tr><td></td><td>15.b.</td><td>A project has the following time schedule
<table>
<tr><td>Activity</td><td>1-2</td><td>1-3</td><td>2-4</td><td>3-4</td><td>3-5</td><td>4-9</td><td>5-6</td></tr>
<tr><td>Times in Weeks</td><td>4</td><td>1</td><td>1</td><td>1</td><td>6</td><td>5</td><td>4</td></tr>
<tr><td>Activity</td><td>5-7</td><td>6-8</td><td>7-8</td><td>8-9</td><td>8-10</td><td>9-10</td><td></td></tr>
<tr><td>Times in Weeks</td><td>8</td><td>1</td><td>2</td><td>1</td><td>8</td><td>7</td><td></td></tr>
</table>
Construct the network and compute 1. TE and TL for each event 2. Float for each activity 3. 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 Simplex method
Maximize $Z = 40x_1 + 30x_2$
Subject to: $x_1 + x_2 \leq 12$
$2x_1 + x_2 \leq 16$
$x_1 \geq 0; x_2 \geq 0$</td><td>K3</td><td>CO1</td></tr>
<tr><td>2</td><td>17</td><td>Solve the transportation problem by MODI Method:
<table>
<tr><td rowspan="2">Source</td><td colspan="4">Destination</td><td rowspan="2">Supply</td></tr>
<tr><td>A</td><td>B</td><td>C</td><td>D</td></tr>
<tr><td>1</td><td>5</td><td>4</td><td>2</td><td>6</td><td>20</td></tr>
<tr><td>2</td><td>8</td><td>3</td><td>5</td><td>7</td><td>30</td></tr>
<tr><td>3</td><td>5</td><td>9</td><td>4</td><td>6</td><td>50</td></tr>
<tr><td>Demand</td><td>10</td><td>40</td><td>20</td><td>30</td><td></td></tr>
</table></td><td>K4</td><td>CO2</td></tr>
<tr><td>3</td><td>18</td><td>Solve by graphical method
<table>
<tr><td></td><td>B1</td><td>B2</td><td>B3</td></tr>
<tr><td>A1</td><td>4</td><td>-1</td><td>0</td></tr>
<tr><td>A2</td><td>-1</td><td>4</td><td>2</td></tr>
</table></td><td>K3</td><td>CO4</td></tr>
<tr><td>4</td><td>19</td><td>Find the sequence that minimises the total time required in performing the following jobs on three machines in the order ABC. Processing times (in hours) are given in the following table:
<table>
<tr><td>Job</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>Machine A</td><td>8</td><td>10</td><td>6</td><td>7</td><td>11</td></tr>
<tr><td>Machine B</td><td>5</td><td>6</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>Machine C</td><td>4</td><td>9</td><td>8</td><td>6</td><td>5</td></tr>
</table></td><td>K3</td><td>CO3</td></tr>
<tr><td>5</td><td>20</td><td>Find out the time required to complete the following project and the critical activities:
<table>
<tr><td>Activity</td><td>Predecessor Activity</td><td>Optimistic time estimate (to days)</td><td>Most likely time estimate (tm days)</td><td>Pessimistic time estimate (tp days)</td></tr>
<tr><td>A</td><td>-</td><td>2</td><td>4</td><td>6</td></tr>
<tr><td>B</td><td>A</td><td>3</td><td>6</td><td>9</td></tr>
<tr><td>C</td><td>A</td><td>8</td><td>10</td><td>12</td></tr>
<tr><td>D</td><td>B</td><td>9</td><td>12</td><td>15</td></tr>
<tr><td>E</td><td>C</td><td>8</td><td>9</td><td>10</td></tr>
<tr><td>F</td><td>D,E</td><td>16</td><td>21</td><td>26</td></tr>
<tr><td>G</td><td>D,E</td><td>19</td><td>22</td><td>25</td></tr>
<tr><td>H</td><td>F</td><td>2</td><td>5</td><td>8</td></tr>
<tr><td>I</td><td>G</td><td>1</td><td>3</td><td>5</td></tr>
</table></td><td>K2</td><td>CO5</td></tr>
</table>

Z-Z-Z END