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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION- 2025

B.Tech-I Semester (BT/BI)

COURSE CODE (CREDITS): 25B11MA112

MAX. MARKS: 15

COURSE NAME: MLS I

COURSE INSTRUCTOR: PKP

MAX. TIME: 1 Hour

**Note:** (a) All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems.

Q.No.	Question	CO	Marks
Q1	<p>A researcher studies three species in an ecosystem. The transition matrix of population growth from one year to the next is given by:</p> $M = \begin{bmatrix} 0.4 & 0.1 & 0.2 \\ 0.2 & 0.6 & 0.1 \\ 0 & 0.2 & 0.6 \end{bmatrix}$ <p>Compute the matrix <math>M^2</math> that is <math>M \times M</math>. Also, check whether <math>M^2</math> is a symmetric matrix or not.</p>	1	3
Q2	<p>Consider the gene expression matrix, given by:</p> $G = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 2 \\ 2 & 3 & 0 \end{bmatrix}$ <p>Compute <math>G^{-1}</math> if it exists.</p>	1	3
Q3.	<p>Consider a simplified metabolic flux balance system represented by the matrix <math>A = \begin{bmatrix} 0.2 &amp; 0.1 &amp; 0 \\ 0.1 &amp; 0.2 &amp; 0.1 \\ 0 &amp; 0.1 &amp; 0.2 \end{bmatrix}</math>.</p> <p>Convert matrix <math>A</math> in Row echelon form and hence find its rank.</p>	1	3
Q4.	<p>A doctor prescribes dosage of three drugs, say <math>x_1</math> mg, <math>x_2</math> mg, <math>x_3</math> mg related by following equations:  <math>x_1 + 2x_2 + x_3 = 7</math>, <math>2x_1 + x_2 + 3x_3 = 14</math>, <math>2x_2 + 3x_1 + x_3 = 11</math>.            Using inverse matrix method compute <math>x_1, x_2, x_3</math>.</p>	1	3
Q5.	<p>A dietitian needs to create a snack mix with 106 calories, 9.2g fiber, and 8g protein using broccoli, radishes, and cauliflower. Each cup:</p> <ul style="list-style-type: none"> <li>• Broccoli: 31 calories, 2.4 g fiber, 2.6 g protein.</li> <li>• Radishes: 19 calories, 1.9 g fiber, 0.8 g protein.</li> <li>• Cauliflower: 25 calories, 2.5 g fiber, 2 g protein.</li> </ul> <p>Find cups of broccoli (<math>x</math>), radishes (<math>y</math>), cauliflower (<math>z</math>), using Gauss elimination method.            Hint: <math>31x + 19y + 25z = 106</math>, <math>2.4x + 1.9y + 2.5z = 9.2</math>,  <math>2.6x + 0.8y + 2z = 8</math>.</p>	1	3