ABV- Indian Institute of Information Technology & Management, Gwalior

Semester I (2024-25) **Midsemester** **Course Title: Mathematics-I**

Course Code: MA-101

MM: 41 – 47.5 **Duration: 120 minutes**

Note:

1. All parts of a question should be answered consecutively. Each answer should start from a new page.
2. The question paper has six questions.
3. Questions no. 1 a) is an open question, and the marks will be purely based on the justification and Mathematical explanations. You can use your own examples for the elaborated answer.

1. a) Define Rank of a matrix and discuss its use in Linear Algebra **(4.5-11)**
   b) Define: Field, Vector Space and give one example of each **(4)**
   c) List out any five properties (not obvious) of Eigen values and Eigen vectors **(2.5)**

2. Find the non-singular matrix P, Q such that the normal form of a given matrix is PAQ and find the rank of a matrix using it. **(6)**

$$\begin{pmatrix} 1 & 2 & 3 & -2 \\ 2 & -2 & 1 & 3 \\ 3 & 0 & 4 & 1 \end{pmatrix}$$

3. Find a inverse of the following matrix by using a Gauss-Jordan Method **(6)**

$$\begin{pmatrix} 2 & 4 & 3 & 2 \\ 3 & 6 & 5 & 2 \\ 2 & 5 & 2 & -3 \\ 4 & 5 & 14 & 14 \end{pmatrix}$$

4. Solve the following system using Gauss-Jordan Elimination method **(7.5)**

$$10x_1 - 7x_2 + 3x_3 + 5x_4 = 6;\ -6x_1 + 8x_2 - x_3 - 4x_4 = 5;$$
$$3x_1 + x_2 + 4x_3 + 11x_4 = 2;\ 5x_1 - 9x_2 - 2x_3 + 4x_4 = 7$$

5. Find the eigen values and eigen vectors of the following matrix **(5)**

$$\begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}$$

6. Find the values of b for which the system has non-trivial solutions and find them **(5.5)**

$$2x_1 + 3bx_2 + (3b+4)x_3 = 0;$$
$$x_1 + (b+4)x_2 + (4b+2)x_3 = 0;$$
$$x_1 + 2(b+1)x_2 + (3b+4)x_3 = 0$$

End of Question Paper***Best of Luck***