ABV- Indian Institute of Information Technology & Management, Gwalior

Semester I (2022-23)

Minor

Course Title: Engineering Mathematics

Course Code: ES102

MM: 40 – 50.5 **Duration: 120 minutes**

Note:

1. All parts of a question should be answered consecutively.
2. The question paper has six questions.
3. Questions no. 1 and 2 a), 6 b) are open questions, and the marks will be purely based on the justification and Mathematical explanations.
4. Question no. 5 a): you must show that the example is a commutative ring with identity but not a field

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1. Construct your own example of a system of Linear equations (Non-Homogeneous), where it is
   a) Inconsistent
   b) Consistent with a unique solution
   c) Consistent with Infinite solutions **(6-12)**

2. a) Define a rank of a Matrix (Mathematically) **(1.5-4.5)**
   b) Determine the non-singular matrices P and Q such that PAQ is in the normal form for A and find the rank of A.
   $$A = \begin{pmatrix} 3 & 2 & -1 & 5 \\ 5 & 1 & 4 & -2 \\ 1 & -4 & 11 & -19 \end{pmatrix}$$ **(5)**

3. Find the values of a and b for which the system has i) no solution, ii) unique solution, iii) infinitely many solutions for the following system,
   $2x_1 + 3x_2 + 5x_3 = 9, 7x_1 + 3x_2 - 2x_3 = 8, 2x_1 + 3x_2 + ax_3 = b$ **(5)**

4. Solve the following system using the Gauss-Jordon 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. a) Define a Field and give an example of a commutative ring with identity but not a field. **(4.5)**
   b) Justify your answer: Can we have a field of 1147 elements? **(1.5)**
   c) Find the multiplicative inverse of 31 mod 929 **(2)**

6. a) Define a Vector Space and its subspace. **(2.5)**
   b) Construct your own example of a Vector space and discuss any one subspace of the identified vector space. **(4.5-6)**

End of Question Paper
Best of Luck