

B.Sc.(Honours), Artificial Intelligence  
Semester - I  
**MATHEMATICAL FOUNDATION FOR AI**

Total marks – 70

Time : 3hrs

**SECTION - A**

Answer the any FIVE Questions. Each Question carries 4 marks.

5x4=20 marks

1. Put the matrix A into reduced row echelon form

$$A = \begin{bmatrix} 2 & 1 & -1 & 4 \\ 1 & -1 & 2 & 12 \\ 2 & 2 & -1 & 9 \end{bmatrix}$$

2. Test for Consistency

$$2x - 3y + 7z = 5$$

$$3x + y - 3z = 13$$

$$2x + 19y - 47z = 22$$

3. Create a Venn diagram to show the relationship among the sets. U is the set of whole numbers from 1 to 15, A is the set of multiples of 3, B is the set of primes, C is the set of odd numbers.
4. Find  $A \cup B \cup C$ , where  $A = \{1, 2, 3\}$ ,  $B = \{2, 3, 4, 5\}$ ,  $C = \{1\}$ .
5. Find the inverse of the function  $f(x) = 4x - 3$ .
6. If  $f(x) = 3x + 2$  and  $g(x) = x^2 - 1$ . Find  $f(g(-3))$ .
7. If  $\vec{F} = 4xz\vec{i} - y^2\vec{j} + yz\vec{k}$ , then find divergence of  $\vec{F}$ .
8. What is the probability of getting a sum of 7 when two dice are thrown?

**SECTION - B**

Answer ALL Questions. Each question carries 10 marks.

5x10=50 marks

9. Solve the system of Linear equations using Gauss's Elimination method.

$$x + 2y + 3z = 9$$

$$x + 3y + 4z = 11$$

$$-6y - 10z = 24$$

**(OR)**

10. Test the following system for consistency and solve it

$$x + y + z = 6$$

$$2x + y + 3z = 13$$

$$5x + 2y + z = 12$$

11. Let A, B, and C be the sets of multiples of 3, 6 and 10 in  $\mathbb{N}$ , respectively. Obtain  $A \cap B \cap C$ . Also, draw a Venn diagram to represent all these sets.

**(OR)**

12. For any three sets A, B, C, show that  $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ .

13. If  $f(x) = x^2$ ,  $h(x) = x^3$  and  $g(x) = \sqrt{x}$ , calculate  $h \circ (g \circ f)(x)$ .

**(OR)**

14. Let  $\mathbb{R}$  be the set of all real numbers. Let  $f: \mathbb{R} \rightarrow \mathbb{R}: f(x) = \cos x$  and let  $g: \mathbb{R} \rightarrow \mathbb{R}: g(x) = 3x^2$ . Show that  $(g \circ f) \neq (f \circ g)$ .

15. Find the directional derivative of the function  $\phi(x, y, z) = x^2yz + 4xz^2$  at  $(1, -2, -1)$  in the direction of the vector  $2\bar{i} - \bar{j} - 2\bar{k}$ .

**(OR)**

16. Find the angle between the surfaces  $x^2 + y^2 + z^2 = 9$ ;  $x^2 + y^2 - z = 3$  at  $(2, -1, 2)$ .

17. The average of 10 numbers is 20. If 5 of them have an average of 15, what is the Average of the remaining 5?

**(OR)**

18. Three factories produce light bulbs to supply the market. Factory A produces 20%, 50% of the tools are produced in factories B and 30% in factory C. 2% of the bulbs produced in factory A, 1% of the bulbs produced in the factory are defective. A bulb is selected at random in the market and found to be defective. What is the probability that this bulb was produced by factory B?