



K24U 0551

Reg. No. : .....

Name : .....

First Semester B.Sc. Artificial Intelligence and Machine Learning Degree  
(CBCSS – OBE – Regular – 2023 Admission) Examination, November 2023

Complementary Elective Course

1C01MAT – AIML : DIFFERENTIATION AND MATRIX THEORY

Time : 3 Hours

Max. Marks : 40

SECTION – A

Answer **all** questions.

(6×1=6)

1. State Leibnitz's theorem for  $n^{\text{th}}$  derivatives.
2. What is the  $n^{\text{th}}$  derivative of  $y = e^{ax}$  ?
3. Define a function.
4. What is partial ordering ?
5. Define normal form of a matrix.
6. State Rouche's theorem.

SECTION – B

Answer **any 6** questions.

(6×2=12)

7. Find the  $n^{\text{th}}$  derivative of  $y = \sin 6x \cos 4x$ .
8. Find the  $n^{\text{th}}$  derivative of  $y = \sin(ax + b)$ .
9. Check whether the function  $f(x) = x + 1$  from  $\mathbb{R}$  to  $\mathbb{R}$  is one-one or not.

P.T.O.



10. Let  $f_1$  and  $f_2$  be functions from  $\mathbb{R}$  to  $\mathbb{R}$  such that  $f_1(x) = x^2$  and  $f_2(x) = x - x^2$ .  
What are the functions  $f_1 + f_2$  and  $f_1 f_2$ ?
11. Define partition of a set. Give one example.

12. Row reduce the given matrix to echelon form  $A = \begin{bmatrix} 1 & 2 & -5 \\ -4 & 1 & -6 \\ 6 & 3 & -4 \end{bmatrix}$ .

13. Find the rank of  $A = \begin{bmatrix} 1 & 3 & 5 \\ 2 & -1 & 4 \\ -2 & 8 & 2 \end{bmatrix}$ .

14. What is linear homogeneous system of equations?

### SECTION - C

Answer any 4 questions.

(4×3=12)

15. Find the  $n^{\text{th}}$  derivative of  $\frac{1}{1-5x+6x^2}$  using partial fraction.
16. If  $y = x + \tan x$ . Show that  $\cos^2 x \frac{d^2y}{dx^2} - 2y + 2x = 0$ .
17. Let  $R$  be the relation on the set of real numbers such that  $aRb$  if and only if  $a - b$  is an integer. Then show that  $R$  is an equivalence relation.
18. Let  $f$  and  $g$  be the functions from the set of integers to the set of integers defined by  $f(x) = 2x + 3$  and  $g(x) = 3x + 2$ . What is  $f \circ g(x)$  and  $g \circ f(x)$ ?

19. Find the rank of matrix  $A$  by using the row echelon form :  $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 4 \\ 3 & 0 & 5 \end{bmatrix}$ .

20. Solve the following system of equations using Cramer's rule

$$3x - y = 10$$

$$x + y = 6$$



SECTION – D

Answer **any 2** questions.

(2×5=10)

21. If  $y = \log(x + \sqrt{1+x^2})$ , prove that  $(1 + x^2)y_{n+2} + (2n + 1)xy_{n+1} + n^2y_n = 0$ .

22. Define bijective function. Also prove that the given function from  $\mathbb{R} \rightarrow \mathbb{R}$  defined by  $f(x) = 5x - 4$  is a bijective function.

23. Find the inverse of  $A = \begin{bmatrix} 1 & 2 & -4 \\ -1 & -1 & 5 \\ 2 & 7 & -3 \end{bmatrix}$  using Gauss-Jordan method.

24. Test the consistency of the following system of equations and if consistent find the solution.

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

$$x + y + z = 6$$

$$x - y + z = 2$$

