K25U 3438

Reg. No. : ....

Name : ....

First Semester B.Sc. Artificial Intelligence and Machine Learning Degree (C.B.C.S.S. – O.B.E.-Supplementary) Examination, November 2025
(2023 Admission)
Complementary Elective Course
1C01MAT-AIML : DIFFERENTIATION AND MATRIX THEORY

Time : 3 Hours Max. Marks : 40

SECTION – A

Answer **all** questions. **(6×1=6)**

1. If f(x) is a polynomial function of degree less than n where $n \in N$, then what is the n^{th} derivative of f(x) ?
2. Define bijective function.
3. What is total ordering ?
4. Find rank of $A = \begin{bmatrix} 1 & 3 \\ 1 & 5 \end{bmatrix}$.
5. If $y = \frac{1}{ax+b}$, then what is the n^{th} derivative of y ?
6. When do we say a system of linear equations is inconsistent ?

SECTION – B

Answer **any 6** questions. **(6×2=12)**

7. If $y = ae^{nx} + be^{-nx}$, then show that $y_2 = n^2y$.
8. Find y_2 of the function $y = e^{3x+2}$.
9. How many relations are there on a set with n elements ?

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10. Let R be the relation on the set of positive integers defined as R = {(a, b) | a divides b}. Check whether the relation R is an equivalence relation or not ?

11. Define composition of two functions.

12. Find the rank of $A = \begin{bmatrix} 0 & 2 & 3 \\ 0 & 4 & 6 \\ 0 & 6 & 9 \end{bmatrix}$.

13. Determine the rank of the matrix $A = \begin{bmatrix} 1 & 2 & 3 & -1 \\ 3 & 6 & 9 & -3 \\ 2 & 4 & 6 & -2 \end{bmatrix}$ by reducing to echelon form.

14. Explain Non-homogeneous and Homogeneous systems of linear equations.

SECTION – C

Answer **any 4** questions. **(4×3=12)**

15. Find n^{th} derivative y_n, if $y = x^2 e^{ax}$.

16. If $y = a\cos(\log x) + b\sin(\log x)$, prove that $x^2 y_2 + x y_1 + y = 0$.

17. What are the sets in the partition of the integers arising from congruence modulo 4 ?

18. Show that the relation $\subseteq$ (subset of) is a partial ordering on the power set of a set S.

19. Find the inverse of the matrix $A = \begin{bmatrix} 1 & 0 & 2 \\ 2 & -1 & 3 \\ 4 & 1 & 8 \end{bmatrix}$.

20. Test for consistency of the system.

$x - y + 2z = 2$

$2x + y + 4z = 7$

$4x - y + z = 4$

SECTION – D

Answer **any 2** questions. **(2×5=10)**

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

22. For the given functions $f(x) = 2x$ and $g(x) = x^2 + 1$, find out the values of $f \circ g(x)$ and $g \circ f(x)$ at $x = 2$.

23. Reduce $A = \begin{bmatrix} 1 & 2 & 0 & -1 \\ 3 & 4 & 1 & 2 \\ -2 & 3 & 2 & 5 \end{bmatrix}$ to normal form.

24. Solve the system using Cramer's rule.

$x + y + z = 6$

$2x + 3y - z = 5$

$6x - 2y - 3z = -7$