K24U 4024

Reg. No. : .....

Name : .....

First Semester B.Sc. Mathematics/B.Sc. Computer Science With AI and ML Degree (C.B.C.S.S. – OBE-Supplementary/Improvement) Examination, November 2024
(2019 to 2023 Admission)
Complementary Elective Course
1C01 MAT-CS : MATHEMATICS FOR COMPUTER SCIENCE – I

Time : 3 Hours Max. Marks : 40

PART – A

Answer **any 4** questions from this part. **Each** question carries **1** mark. **(4×1=4)**

1. Find $D^n \log(ax + b)$.
2. Find the Maclaurin's series expansion of the function sin x.
3. Evaluate $\lim_{x\to 0} \frac{\sin x}{x}$.
4. If the rank of the matrix $\begin{pmatrix} 10 & 8 \\ 5 & y \end{pmatrix}$ is one, then find y.
5. Define Equivalent matrices.

PART – B

Answer **any 7** questions from this part. **Each** question carries **2** marks. **(7×2=14)**

6. If $y = \frac{(ax+b)}{(cx+d)}$, show that $2y_1y_3 = 3y_2^2$.
7. Find $D^n[\sin (ax + b)]$.
8. Find the n^{th} derivative of $2^x \cos^9 x$.
9. Verify Cauchy's Mean-value theorem for the function $\log_e x$ and $\frac{1}{x}$ in the interval [1, e].

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10. Verify Rolle's theorem for $f(x) = x(x + 3)e^{\frac{-1}{2x}}$ in (–3, 0).

11. Evaluate $\lim_{x \to \frac{\pi}{2}} (\sin x)^{\tan x}$.

12. Are the vectors (2, 1, 1), (2, 0, –1), (4, 2, 1) linearly dependent ? Justify.

13. Reduce the matrix into normal form and hence find the rank.

$$A = \begin{pmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{pmatrix}$$

14. If $A = \frac{1}{3}\begin{pmatrix} 1 & 2 & a \\ 2 & 1 & b \\ 2 & -2 & c \end{pmatrix}$ is orthogonal, find a, b, c and A^{-1}.

15. Reduce the law $y = ae^{bx}$ into a linear law.

PART – C

Answer **any 4** questions from this part. **Each** question carries **3** marks. **(4×3=12)**

16. Given $y^2 = f(x)$, a polynomial of third degree, then evaluate $\frac{d}{dx}\left(y^3 \frac{d^2y}{dx^2}\right)$.

17. Find the n^{th} derivative of $\frac{1}{x^2 + a^2}$.

18. Prove that (if $0 < a < b < 1$), $\frac{b-a}{1+b^2} < \tan^{-1} b - \tan^{-1} a < \frac{b-a}{1+a^2}$. Hence show that $\frac{\pi}{4} + \frac{3}{25} < \tan^{-1}\frac{4}{3} < \frac{\pi}{4} + \frac{1}{6}$.

19. Expand $\log_e x$ in powers of $(x – 1)$ and hence evaluate $\log_e 1.1$ correct to 4 decimal places.

20. Using partition method, find the inverse of $\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 \\ 3 & 0 & 4 & 0 \\ 0 & 1 & 0 & 3 \end{pmatrix}$.

21. Solve the equations $x_1 - x_2 + x_3 + x_4 = 2$, $x_1 + x_2 - x_3 + x_4 = -4$, $x_1 + x_2 + x_3 - x_4 = 4$, $x_1 + x_2 + x_3 + x_4 = 0$, by finding the inverse by elementary row operations.

22. Write the working procedure to fit the parabola $y = a + bx + cx^2$ to a given data.

PART – D

Answer **any 2** questions from this part. **Each** question carries **5** marks. **(2×5=10)**

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

24. Find the value of a, b and c such that $\lim_{x\to 0} \frac{x(a + b\cos x) - c\sin x}{x^5} = 1$.

25. Test for consistency and solve : $x - 2y + 3t = 2$; $2x + y + z + t = -4$; $4x - 3y + z + 7t = 8$.

26. Fit a second degree parabola to the following data.

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

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