K22U 3424

Reg. No. : ....

Name : ....

I Semester B.Sc. Degree (C.B.C.S.S. – O.B.E. – Regular/Supplementary/ Improvement) Examination, November 2022
(2019 Admission Onwards)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
1C01 MAT-CS : Mathematics for Computer Science – I

Time : 3 Hours Max. Marks : 40

PART – A

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

1. Find $D^n(ax + b)^m$.

2. Find the Maclaurin's series expansion of the function cos x.

3. Evaluate $\lim_{x\to 0}\frac{\log x}{\cot x}$.

4. Define rank of a matrix.

5. If the rank of the matrix $\begin{pmatrix} 12 & 9 \\ y & 3 \end{pmatrix}$ is one, then find y.

PART – B

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

6. If x = a(cos t + t sin t), y = a(sin t – t cos t), find $\frac{d^2y}{dx^2}$.

7. Find $D^n[e^{ax}\cos(bx + c)]$.

8. Find the n^{th} derivative of $e^x(2x + 3)^3$.

9. Verify Cauchy's Mean-value theorem for the function e^x and e^{-x} in the interval (a, b).

10. Verify Rolle's theorem for $f(x) = (x + 2)^2 (x - 3)^4$ in (– 2, 3).

P.T.O.

11. Evaluate $\lim_{x \to 0} \left(\frac{\tan x}{3} \right)^{\frac{1}{x^2}}$.

12. Are the vectors $x_1 = (1, 3, 4, 2)$, $x_2 = (3, -5, 2, 2)$, $x_3 = (2, -1, 3, 2)$ linearly dependent ? If so express one of these as a linear combination of the others.

13. Using Gauss-Jordan method, find the inverse of the matrix $\begin{pmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{pmatrix}$.

14. Show that the transformation $y_1 = 2x_1 + x_2 + x_3$, $y_2 = x_1 + x_2 + 2x_3$, $y_3 = x_1 - 2x_3$ is regular. Write down the inverse transformation.

15. Reduce the law $y = mx^n + c$ into a linear law.

PART – C

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

16. If $x^3 + y^3 = 3axy$, prove that $\frac{d^2y}{dx^2} = -\frac{2a^2xy}{(y^2 - ax)^3}$.

17. Find the n^{th} derivative of $\frac{x}{(x-1)(2x+3)}$.

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 $e^{a \sin^{-1} x}$ in ascending powers of x.

20. Using partition method, find the inverse of $\begin{pmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{pmatrix}$.

21. Test for consistency and solve
$5x + 3y + 7z = 4$, $3x + 26y + 2z = 9$, $7x + 10y + 2z = 5$.

22. Write the working procedure to fit the straight line $y = a + bx$ to a given data.

PART – D

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

23. If $y = e^{a\sin^{-1}x}$, prove that $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 + a^2)y_n = 0$. Hence find that value of y_n when $x = 0$.

24. Evaluate $\lim_{x \to 0} \dfrac{(1+x)^{\frac{1}{x}} - e}{x}$.

25. Find that value of λ for which the equations

    $(\lambda - 1)x + (3\lambda + 1)y + 2\lambda z = 0$

    $(\lambda - 1)x + (4\lambda - 2)y + (\lambda + 3)z = 0$

    $2x + (3\lambda + 1)y + 3(\lambda - 1)z = 0.$

    are consistent and find the ratios of $x : y : z$ when λ has the smallest of these values. What happens when λ has the greatest of these values.

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

x	1989	1990	1991	1992	1993	1994	1995	1996	1997
y	352	356	357	358	360	361	361	360	359

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