D 53673 (Pages : 3) Name.....

Reg. No.....

FIRST SEMESTER (CBCSS—UG) DEGREE EXAMINATION
NOVEMBER 2023

Information Technology

BIT 1C 01—MATHEMATICAL FOUNDATIONS OF IT

(2019—2023 Admissions)

Time : Two Hours Maximum : 60 Marks

Section A (Ceiling 20 Marks)

Each question carries 2 *marks.*

1. Find the cofactors of the matrix $A = \begin{pmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{pmatrix}$.

2. Show that the matrix $\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$ is singular.

3. Find the values of x, y, z and t satisfying the matrix equation $\begin{pmatrix} x+3 & 2y+3 \\ z-2 & 2t-3 \end{pmatrix} = \begin{pmatrix} 0 & 7 \\ 8 & t \end{pmatrix}$.

4. If a and b are vectors such that $a = b = \sqrt{2}$ and $a.b = -1$ find the angle between a and b.

5. Find $a \times b$ if $a = (2, -1, 1)$ and $b = (3, 4, -1)$.

6. Find the derivative of x^n using first principle.

7. Differentiate $x^4 - 2\cos x + 3\sin x$ with respect to x.

8. Find the derivative of $5^x/x^5$ with respect to x.

9. Evaluate $\int \sin\sqrt{x}\, dx$.

10. Evaluate $\int (5x-2)^3\, dx$.

Turn over

11. Find $\int_a^b \frac{\log x}{x}\,dx$.

12. If $x = a\,(\theta - \sin\theta)$ and $y = a\,(1 - \cos\theta)$ find $\frac{dy}{dx}$.

Section B (Ceiling -30 marks)

Each question carries 5 *marks.*

13. Find the inverse of the matrix $A = \begin{pmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{pmatrix}$.

14. If $A = \begin{pmatrix} 1 & 2 & -1 \\ 3 & 0 & 2 \\ 4 & 5 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 0 & 1 & 3 \end{pmatrix}$ verify that $(AB)^1 = (BA)^1$.

15. Find the eigen values of the matrix $\begin{pmatrix} 5 & 4 \\ 1 & 2 \end{pmatrix}$.

16. Show that the three points given by $a - 2b + 3c$, $2a + 3b - 4c$, $-7b + 10c$ are collinear.

17. If $a = 3i + j + 2k$ and $b = 2i + 2j + 4k$ find :

    (a) The magnitude of $a \times b$.

    (b) A unit vector perpendicular to both a and b.

18. If $y = (\sin x)^{\tan x} + (\cos x)^{\sec x}$ find dy/dx.

19. Find $\int \frac{2x+1}{(x+1)(x-2)}\,dx$.

Section C (10 marks)

Answer any **one** *question.*

20. (a) Solve the following system of equations by Gauss elimination method :

$$x - 2y + z = 1$$
$$-2x + y + z = 1$$
$$x + y - 2z = -2.$$

(b) Evaluate $\int_1^2 \frac{(1+\log x)^3\, dx}{x}$.

21. (a) If $A = \begin{pmatrix} 1 & 1 & 1 \\ 1 & 2 & -3 \\ 2 & -1 & 3 \end{pmatrix}$ verify that $A\,(adj\ A) = (adj\ A)\,A = \det A I_3$.

(b) Find $\frac{dy}{dx}$ if $y = \frac{1+\log x}{1-\log x}$.

(1 × 10 = 10 marks)