K22U 3425

Reg. No. : ...................................

Name : ...................................

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

Time : 3 Hours

Max. Marks : 40

SECTION – A

Questions 1 – 5, answer **any four** questions. **Each** question carries **one** mark.

1. Find the derivative of $\sec^2 x$.

2. Find the derivative of $\tan^{-1}\left(\dfrac{1-\tan x}{1+\tan x}\right)$.

3. Write the dual of the following statement :

   $x + (y * z) = (x + y) * (x + z)$

4. Find the rank of the matrix $\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}$.

5. Show that $A'$ is orthogonal if $A$ is orthogonal.

SECTION – B

Questions 6 – 15, answer **any seven** questions. **Each** question carries **two** marks.

6. Find the derivative of $\log\left(\sqrt{x^2+1}\right)$.

7. Given that $y = 3\sin x - \cos x$. Prove that $y_2 = y$.

8. Find the $n^{th}$ derivative of $\sin(2x)$.

P.T.O.

9. Given that $x = \cos t$, $y = \sin t$. Find $\dfrac{d^2y}{dx^2}$.

10. Prove that in a Boolean algebra B, $x'' = x$ for all $x \in B$.

11. Prove that in a Boolean algebra B, $(x * y)' = 0$ if and only if $x * y = x$.

12. Find the normal form of the matrix $\begin{pmatrix} 1 & -2 & 0 \\ 2 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}$.

13. Show that the matrix $\begin{pmatrix} \cos t & -\sin t \\ \sin t & \cos t \end{pmatrix}$ is orthogonal for all values of t.

14. Find the value of 'a' such that the rank of the matrix $\begin{pmatrix} 1 & 2 & 0 \\ 2 & a & 0 \\ 0 & 1 & a \end{pmatrix}$ is 2.

15. Does the set of equations $2x + y = 0$, $x - y = -1$ are consistant ? Justify your answer.

## SECTION – C

Questions 16 – 22 answer any four questions. Each question carries three marks.

16. Show that $\dfrac{d}{dx}\left(\tan^{-1} x\right) = \dfrac{1}{1 + x^2}$.

17. Find $\dfrac{dy}{dx}$, if $y = \dfrac{\sin x + \cos x}{\sin x - \cos x}$.

18. Given that $x^2 + y^2 + xy + x + y + 1 = 0$. Find $\dfrac{dy}{dx}$.

19. Find the $n^{th}$ derivative of $\cos^2(3x)$.

20. Prove the following :

    For any x in a Boolean algebra B. $x + x = x$.

21. Solve the system of equations $x + 2y - z = 3$. $x - z = 1$, $-x + 4y + z = 5$ using Crammer's rule.

22. Show that the vectors $x_1 = (1. 2. 3)$. $x_2 = (2. 1. 3)$, $x_3 = (1. -2. 3)$ are linearly independent.

## SECTION – D

Questions **23 – 26**, answer **any two** questions. **Each** question carries **five** marks.

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

24. Find $\dfrac{dy}{dx}$ for the following

    a) $y = x^x + (\sin x)^x$

    b) $y = \log (1 + \sin x)$.

25. If $x + y = 1$ and $x.y = 0$ in a Boolean Algebra B, prove that $y = x'$.

26. Test for consistency of the system of linear equations and solve them if consistant :

    $x - y = 0$, $x + z = 2$, $x + y + z = 3$.