K25U 3371

Reg. No : .....

Name : .....

First Semester B.Sc. Degree (C.B.C.S.S. – O.B.E. – Supplementary) Examination, November 2025
(2019 to 2023 Admission)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
1C01MAT – 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. **(4×1=4)**

1. Show that $\frac{d}{dx}\left(\cos^{-1}x\right) = \frac{-1}{\sqrt{1-x^2}}$.
2. Find the derivative of $\sqrt{1+\sin^2 x}$.
3. Write the dual of the following statement :
   $a + b = a$.
4. Find the rank of the matrix $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & -1 \end{pmatrix}$.
5. Show that A^{-1} is orthogonal if A is orthogonal.

SECTION – B

Questions **6-15**, answer **any seven** questions. **Each** question carries **two** marks. **(7×2=14)**

6. Derive the derivative of $\log_e x$.
7. Given that $y = \log(\sin x)$. Prove that $y_2 + y_1^2 + 1 = 0$.
8. Find the n^{th} derivative of $\cos(2x)$.
9. Given that $x = t^2$, $y = 2t$. Find $\frac{d^2y}{dx^2}$.

P.T.O.

10. For any x in a Boolean algebra B, prove that $x * x = x$.

11. Give an example for a Boolean algebra with two elements.

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

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 relation between a and b such that the rank of the matrix $\begin{pmatrix} 1 & a & b \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{pmatrix}$ is 2.

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

SECTION – C

Questions **16-22**, answer **any four** questions. **Each** question carries **three** marks. **(4×3=12)**

16. Derive the derivative of $\cot^{-1} x$.

17. Find $\frac{dy}{dx}$, if $y = \frac{\sqrt{1+x^2}\left(1-x^2\right)^{3/2}}{\left(1+x^4\right)}$.

18. Given that $ax^2 + 2hxy + by^2 = 0$. Prove that $\frac{dy}{dx} = \frac{-(ax+hy)}{(hx+by)}$.

19. Find the n^{th} derivative of $e^{-x} \sin x$.

20. State and prove the associative laws in a Boolean algebra B.

21. Solve the system of equations $x + y - 2z = 0$, $x - y + 4z = 1$, $x - y = -1$ using Crammer's rule.

22. Show that the vectors $x_1 = (1, 2, 3)$, $x_2 = (2, 0, 3)$, $x_3 = (1, 0, 0)$ are linearly independent.

SECTION – D

Questions **23-26**, answer **any two** questions. **Each** question carries **five** marks. **(2×5=10)**

23. If $y = \tan^{-1}x$, prove that $(1 + x^2)y_{n+1} + 2nxy_n + n(n - 1)y_{n-1} = 0$.

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

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

    b) $y = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$.

25. State and prove the De Morgan's laws in a Boolean algebra B.

26. Find the value of 'a' for which the equations $(a - 1)x + (3a + 1)y + 2az = 0$, $(a - 1)x + (4a - 2)y + (a + 3)z = 0$, $2x + (3a + 1)y + 3(a - 1)z = 0$ are consistent and solve them if they consistent.