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Reg. No.....

Name.....

B.C.A. DEGREE (SPECIAL MERCY CHANCE) EXAMINATION JANUARY 2025

First Semester

MATHEMATICS

(Prior to 2009 Admissions)

Time : Three Hours | Maximum : 75 Marks

Part A

Answer any **ten** *question.*
Each question carries 3 *marks.*

1. Find the inverse of $\begin{pmatrix} 1 & 8 \\ -2 & 4 \end{pmatrix}$.

2. Find $AB - B^TA^T$ given $A = \begin{pmatrix} 1 & -2 \\ 3 & 5 \\ 7 & -8 \end{pmatrix}$ $B = \begin{pmatrix} 6 & 1 & 3 \\ -1 & 0 & 5 \end{pmatrix}$.

3. Define and give an example of skew symmetric matrix (of order 3 or more).

4. Show that A (B + C) = AB + AC (A, B, C are matrices).

5. Form the partial differential equations of $u = x^2 + t^2$.

6. Find the second derivative of $\tan^2 x$.

7. Find d/dx $(e^{\sin x})$.

8. What is the period of $\cos 2x$?

9. What is the Euler's formula for Fourier co-efficients ?

10. Find Laplace transform of e^{at}.

11. Give examples of odd and even functions.

12. What is inverse Laplace transform of $1/s^2$?

(10 × 3 = 30)

Turn over

Part B

Answer **all** *questions.*

Each question carries 9 *marks.*

13. Solve the given set of equations using Cramer's rule.

$x + 2y + 3z = 20$, $7x + 3y + z = 13$, $x + 6y + 2z = 0$.

Or

Define rank of a matrix. Find the rank of $\begin{pmatrix} 3 & 0 & 2 & 2 \\ -6 & 42 & 24 & 54 \\ 21 & -21 & 0 & -15 \end{pmatrix}$ using determinants.

14. Show that $u = e^{-4t}\cos 3x$ and $e^{-t}\sin x$ are solutions of $u_t = c^2 u_{xx}$.

Or

Show that $u = \sin(ct)\sin x$ and $u = x^2 + t^2$ are solutions of $u_{tt} = c^2\, u_{xx}$.

15. Find the n^{th} derivative of : (i) $x^n \log x$; and (ii) $x\sin 3x$.

Or

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

16. Find the Fourier series for $f(x) = 2x$ in $(-1, 1)$, $p = 2L = 2$.

Or

Find Fourier cosine series of $f(x) = x^2$ where $0 < x < L$.

17. Find Laplace transform of $e^{2t}\cosh 3t$.

Or

Find inverse Laplace transform of $12 / (s - 3)^4$.

$(5 \times 9 = 45)$