SECOND YEAR HIGHER SECONDARY EXAMINATION AUGUST 2025

PARTIII

MATHEMATICS(COMMERCE)

HSE II

Max Mark: 60

Time :2hrs

Cool-off Time :15mts

Part A

Answer any 6 questions from 1 to 8. Each carries 3 score. $(6 \times 3 = 18)$

1. (a) Consider the function $f : \mathbb{R} \to \mathbb{R}$ is defined by $f(x) = 2x - 1$. Choose the correct answer (1)
   A. f is one-one B. f is many- one onto
   C. f is one-one but not onto D. f is neither one-one nor onto
   (b) Show that the relation R in the set $\{1, 2, 3\}$ given by $R = \{(1, 2), (2, 1)\}$ is symmetric but neither reflexive nor transitive. (2)
2. Find the matrice X and Y such that $X + Y = \begin{bmatrix} 2 & -2 \\ -1 & 5 \end{bmatrix}$, and $X - Y = \begin{bmatrix} 2 & 3 \\ 4 & 0 \end{bmatrix}$ (3)
3. if $A = \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then find k so that $A^2 = kA - 2I$. (3)
4. (a) if $A = \begin{bmatrix} 0 & -1 & x-2 \\ 1 & 0 & 4 \\ 3 & -4 & 0 \end{bmatrix}$ is a skew-symmetric matrix , then find the value of x. (1)
   (b) Let $A = \begin{bmatrix} -1 & 2 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 4 \\ -2 \\ 0 \end{bmatrix}$, Verify that $(AB)' = B'A'$ (2)
5. Using the determinants, find the equation line passing through the poin $A(1, 2)$ and $B(3, 6)$ (3)
6. Show that the relation $\mathbb{R}$ on $\mathbb{Z}$ defined by $\mathbb{R} = \{(a, b) : |a - b| \text{ is even } \}$ is an equivalence relation . (3)
7. Discuss the continuity of the function f defined by $f(x) = \begin{cases} x + 2 & \text{if } x \leq 1 \\ x - 2 & \text{if } x > 1 \end{cases}$ (3)
8. (a) Find the principal value of $sin^{-1}\left(\frac{-1}{2}\right)$. (1)
   (b) Evaluate $cos^{-1}\left(\frac{1}{2}\right) + 2\ sin^{-1}\left(\frac{1}{2}\right)$ (2)

Part B

Answer any 6 questions from 9 to 16. Each carries 4 score. $(6 \times 4 = 24)$

9. Find $\frac{d^2y}{dx^2}$ (i) $y = x^3 + 3x^2 + 5x$ (ii) $y = \sin(3x + 7)$ (4)
10. (a) Find $\frac{dy}{dx}$ if $y = 3^x$ (1)
    (b) Prove that $\sin(x^2)$ is a continuous function. (3)

11. (a) If $y = \sin^{-1} x$ then $\frac{dy}{dx} = - - - - - -$ (1)

(b) Find the value of k so that the function $f(x) = \begin{cases} 2x & , \textbf{if } x \leq 5 \\ k & , \textbf{if } x > 5 \end{cases}$ (3)

12. Let A=$\mathbb{R}$-{3} and B= $\mathbb{R}$- {1} consider the function $f : A \to B$ defined by $f(x) = \frac{x-2}{x-3}$, Verify that f is bijiective. (4)

13. (a) Which among the following is a possible number of elements of a square matrix ? (1)
(A) 18 (B) 36 (C) 45 (D) 24

(b) If $\begin{bmatrix} a & b \\ c & d \end{bmatrix} + \begin{bmatrix} a & 0 \\ 0 & d \end{bmatrix} = \begin{bmatrix} 4 & 3 \\ 2 & 6 \end{bmatrix}$ find the value a,b,c and d (3)

14. Construct a 2x2 matrix A= $\left[a_{ij}\right]$ where $a_{ij} = \frac{(i+j)^2}{2}$ (2)

(a) write the tanspose of A (1)

(b) Show that A is symmetric (1)

15. If $y = 5\cos x + 3\sin x$, Prove that $\frac{d^2y}{dx^2} + y = 0$ (4)

16. (a) The principal value branch of $\sin^{-1} x = - - - - - -$ (1)

(b) Show that $\sin^{-1}(2x\sqrt{1-x^2}) = 2\sin^{-1} x, \quad \frac{-1}{\sqrt{2}} \leq x \leq \frac{1}{\sqrt{2}}$ (3)

Part C

Answer any 3 questions from 17 to 20. Each carries 6 score. $(6 \times 3 = 18)$

17. Solve the system of linear equations by matrix method. (6)
$3x - 2y + 3z = 8$
$2x + y - z = 1$
$4x - 3y + 2z = 4$

18. (a) Express the matrix $A = \begin{bmatrix} 1 & 3 & 4 \\ 3 & 2 & 4 \\ 5 & 0 & 6 \end{bmatrix}$ as the sum of symmetric and skew symmetric matrices. (3)

(b) Find $A^2 - 5A + 6$ if $A = \begin{bmatrix} 2 & 0 \\ 1 & -1 \end{bmatrix}$ (3)

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

(a) $2x + 3y = sinx$ (2)

(b) $x = at^2 \quad y = 2at$ (2)

(c) $y = log(logx)$, $x > 1$ (2)

20. (a) Find $\frac{dy}{dx}$ if $x^y = y^x$ (3)

(b) Find $\frac{dy}{dx}$ if $x = a(\theta - \sin\theta)$, $y = a(1 + \cos\theta)$ (3)