

HIGHER SECONDARY FIRST TERMINAL EXAMINATION - 2025

	Part - III	Max. Score	: 60
HSE II	MATHEMATICS	Time	: 2 Hrs
		Cool – Off Time	: 15 Mts

Answer any 6 questions from 1 to 8. Each carries 3 scores.

- 1.(i) Let $A = \{1, 2, 3\}$. Then number of equivalence relations containing $(1, 2)$ is
(A) 1 (B) 2 (C) 3 (D) 4 [1]
- (ii) Let $f : \mathbb{R} \rightarrow \mathbb{R}$ and $g : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = \cos x$ and $g(x) = 2x^3$
Show that $f \circ g \neq g \circ f$ [2]
2. (i) If A and B are symmetric matrices, then $AB - BA$ is matrix [1]
- (ii) Find X, if $Y = \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$ and $2X + Y = \begin{bmatrix} 1 & 0 \\ -3 & 2 \end{bmatrix}$ [2]
3. (i) A system of linear equations is said to be, if it has solution. [1]
- (ii) Find values of x if $\begin{vmatrix} 2 & 4 \\ 5 & 1 \end{vmatrix} = \begin{vmatrix} 2x & 4 \\ 6 & x \end{vmatrix}$ [2]
4. Check whether the relation R defined in the set $\{1, 2, 3, 4, 5, 6\}$ as
 $R = \{(a, b) : b = a + 1\}$ is reflexive, symmetric or transitive. [3]
5. Write the function in the simplest form : $\tan^{-1} \left(\frac{x}{\sqrt{a^2 - x^2}} \right), |x| < a$ [3]
6. If $x = a(\theta + \sin\theta)$, $y = a(1 - \cos\theta)$ where θ is the parameter, find $\frac{d^2y}{dx^2}$ [3]
7. Prove $3 \cos^{-1} x = \cos^{-1}(4x^3 - 3x)$, $x \in \left[\frac{1}{2}, 1\right]$ [3]
8. If $y = \tan^{-1} \left(\frac{3x - x^3}{1 - 3x^2} \right)$, $-\frac{1}{\sqrt{3}} < x < \frac{1}{\sqrt{3}}$, find $\frac{dy}{dx}$ [3]

Answer any 6 questions from 9 to 16. Each carries 4 scores.

9. Show that each of the relation R in the set $A = \{x \in \mathbb{Z} : 0 \leq x \leq 12\}$, given by
 $R = \{(a, b) : |a - b| \text{ is a multiple of } 4\}$ is an equivalence relation. [3]
- Find the set of all elements related to 1 in each case. [1]

10. Show that the matrix $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ satisfies the equation $A^2 - 5A + 7I = O$

Using this equation, find A^{-1} [4]

11. If $x = \sqrt{a^{\sin^{-1} t}}$, $y = \sqrt{a^{\cos^{-1} t}}$ show that $\frac{dy}{dx} = -\frac{y}{x}$ [4]

12. (i) Find the value of $\cos^{-1}\left(\cos \frac{13\pi}{6}\right)$ [2]

(ii) $\sin^{-1}(2x\sqrt{1-x^2}) = 2 \sin^{-1} x$, $-\frac{1}{\sqrt{2}} \leq x \leq \frac{1}{\sqrt{2}}$ [2]

13. Find the value of a, b, c, and d from the equation: $\begin{bmatrix} a-b & 2a+c \\ 2a-b & 3c+d \end{bmatrix} = \begin{bmatrix} -1 & 5 \\ 0 & 13 \end{bmatrix}$ [4]

14. (i) If $A = \begin{bmatrix} 1 & -2 \\ -5 & 3 \end{bmatrix}$ then show that $|2A| = 4|A|$ [2]

(ii) Find the area of the triangle whose vertices are (3, 8), (-4, 2) and (5, 1) [2]

15. Find the values of a and b such that the function defined by

$f(x) = \begin{cases} 5, & \text{if } x \leq 2 \\ ax + b, & \text{if } 2 < x < 10 \\ 21, & \text{if } x \geq 10 \end{cases}$ is a continuous function [4]

16. (i) $\sin^{-1}\left(\sin \frac{5\pi}{6}\right) = \dots\dots\dots$ [1]

(ii) Prove that $\sin^{-1} \frac{8}{17} + \sin^{-1} \frac{3}{5} = \tan^{-1} \frac{77}{36}$ [3]

Answer any 3 questions from 17 to 20. Each carries 6 scores.

17.(i) Construct a 2 X 2 matrix $A = [a_{ij}]$ where $a_{ij} = i - 2j$ [2]

(ii) Prove that for any square matrix A with real number entries, $A + A'$ is a symmetric matrix and $A - A'$ is a skew symmetric matrix. [4]

18.(i) If $e^y(x+1) = 1$, show that $y_2 = (y_1)^2$ [3]

(ii) Find $\frac{dy}{dx}$ if $x^3 + x^2y + xy^2 + y^3 = 81$ [3]

19.(i) Find the number of all one-one functions from the set $\{1, 2, 3, \dots, n\}$ to itself. [1]

(ii) Let $f : \mathbb{R} \rightarrow \mathbb{R}$ be defined as $f(x) = 10x + 4$.

Find the function $g : \mathbb{R} \rightarrow \mathbb{R}$ such that $g \circ f = f \circ g = 1_{\mathbb{R}}$. [5]

20. Solve the following system of equations by matrix method.

$3x - 2y + 3z = 8$; $2x + y - z = 1$; $4x - 3y + 2z = 4$ [6]

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