

**SECOND YEAR HIGHER SECONDARY SAMPLE QUESTION PAPER 2023  
MATHEMATICS (SCIENCE)**

**Part- III**

**Time : 2 Hours  
Cool - off time : 15 minutes**

**Maximum : 60 Scores**

General Instructions to Candidates :

- There is a ' cool off time ' of 15 minutes in addition to the writing time.
- Use the 'Cool off time ' to get familiar with questions and to plan your answers.
- Read questions carefully before answering.
- Calculations, figures and graphs should be shown in the answer sheet itself.
- Malayalam version of the questions is also provided.
- Give equations wherever necessary.
- Electronic devices except non-programmable calculators are not allowed in the examination Hall.

## Part A

Questions 1 to 8 carry 3 scores each. Answer any 6 questions.

( 6 X 3 = 18)

1. a) If a matrix A has 12 elements ,which is not the possible order of A.

[ 3X4 , 2X6 , 3X5 , 1X12 ] [1]

b) Find the values of x , if

$$\begin{vmatrix} 4 & 6 \\ 8 & 10 \end{vmatrix} = \begin{vmatrix} x & 3 \\ 2x & 5 \end{vmatrix} \quad [2]$$

2. Determine whether the relation R in the set A ={1,2,3,...14} defined as R= {(x,y) : 3x-y=0 } is Reflexive,Symmetric and Transitive.

3. a) Which of the following function is neither increasing nor decreasing in its domain.

[ i)  $e^x$  ii)  $\log x$  iii)  $x^3$  iv)  $x^2$  ] [1]

b) Find the intervals in which the function f given by  $f(x) = x^2 - 4x + 6$  is strictly increasing. [2]

4. a) If  $\vec{a} = 2\vec{i} + 2\vec{j} - 5\vec{k}$  and  $\vec{b} = 2\vec{i} + \vec{j} + 3\vec{k}$  ,Find  $\vec{a} + \vec{b}$  [1]

b) Find the magnitude of  $\vec{a} + \vec{b}$  [1]

c) Find the unit vector in the direction of  $\vec{a} + \vec{b}$  . [1]

5. BagI contains 3 Red and 4 Black balls,while another BagII contains 5 Red and 6 Black balls.One ball is drawn at random from one of the bags and it is found to be Red .Find the probability that it was drawn from BagII.

6. Consider the Differential Equation

$$x \frac{dy}{dx} + 2y = x^2 \cdot (x \neq 0)$$

i) Find the Integrating Factor. [1]

ii) Solve the Differential Equation. [2]

7. Construct a 2X3 matrix whose elements are given by  $a_{ij} = 2i - j$  .

8. Find the value of  $k$ , if the function

$$f(x) = \begin{cases} kx+1, & \text{if } x \leq 5 \\ 3x-5, & \text{if } x > 5 \end{cases} \quad \text{is continuous at } x = 5.$$

### Part B

Questions 9 to 16 carry 4 scores each. Answer any 6 questions.

( 6 X 4 = 24 )

9. a) Find the Principal Value of  $\cos^{-1}\left(\frac{-1}{2}\right)$ . [2]

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

10. Consider the function  $f : \mathbb{R} \rightarrow \mathbb{R}$  given by

$$f(x) = \begin{cases} 1, & x > 0 \\ 0, & x = 0 \\ -1, & x < 0 \end{cases}$$

i) Find  $f(5)$ ,  $f(-5)$  [2]

ii) Show that  $f(x)$  is neither one-one nor onto. [2]

11. Express the matrix  $A = \begin{bmatrix} 2 & 3 & -1 \\ 2 & 6 & 1 \\ 3 & -3 & 1 \end{bmatrix}$  as the sum of a symmetric and a skew symmetric matrix.

12. Find  $\frac{dy}{dx}$  if

i)  $x^2 + y^2 + xy = 100$ . [2]

ii)  $x = a(\theta + \sin \theta)$ ,  $y = a(1 - \cos \theta)$  [2]

13. a) Find the angle between the vectors

$$\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k} \text{ and } \vec{b} = 3\hat{i} - 2\hat{j} + \hat{k} \quad [2]$$

b) Find the area of a Parallelogram having adjacent sides

$$\vec{a} = 3\hat{i} + \hat{j} + 4\hat{k} \text{ and } \vec{b} = \hat{i} - \hat{j} + \hat{k} \quad [2]$$

14. a) The radius of a circle is increasing at the rate of 5cm/sec. Find the rate at which the area of the circle increasing when the radius is 8cm. [2]

b) Find the maximum value of the function  $f(x) = \sin x + \cos x$  in  $[0, \frac{\pi}{2}]$ . [2]

15. Find the area of the region bounded by the Ellipse  $\frac{x^2}{4} + \frac{y^2}{9} = 1$

16. Let A and B be two independent events ,such that  $P(A) = \frac{1}{7}$  and

$P(B) = \frac{1}{5}$  . Find i)  $P(A \cap B)$  [1]

ii)  $P(A \cup B)$  [2]

iii)  $P( (A \cap B^I) \cap (B \cap A^I) )$  [1]

### Part C

**Questions from 17 to 20 carries 6 scores each. Answer any 3 questions.  
( 3X6 = 18)**

17. Solve the following system of equations by Matrix method.

$$2x + y - z = 2$$

$$x + y - 2z = -1$$

$$x - y + 2z = 5.$$

18. a) Find the angle between the Lines

$$\frac{x-2}{3} = \frac{y-1}{2} = \frac{z}{4} \quad \text{and} \quad \frac{x+1}{1} = \frac{y-2}{4} = \frac{z+2}{3} . \quad [2]$$

b) Find the Shortest Distance between the Lines

$$\vec{r} = ( \hat{i} + \hat{j} + \hat{k} ) + \lambda ( 3 \hat{i} - \hat{j} + \hat{k} ) \text{ and}$$

$$\vec{r} = ( \hat{i} - \hat{j} + \hat{k} ) + \mu ( 2 \hat{i} + \hat{j} + 3 \hat{k} ) . \quad [4]$$

19. Find the following.

i)  $\int \frac{1}{x+x \log x} dx$  [2]

ii)  $\int \frac{1}{(x+1)(x+2)} dx$  [2]

iii)  $\int_0^{\frac{\pi}{2}} \frac{\text{Sin}x}{1+\cos^2 x} dx$  [2]

20. Solve the following Problem Graphically.

Maximize :  $Z = x + y$

Subject to  $x + 2y \leq 14$  ,

$3x + y \leq 24$  ,

$x \geq 0, y \geq 0$  .

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