

**SECOND YEAR HIGHER SECONDARY EXAMINATION, MARCH 2023**

Part – III

Time : 2 Hours

**MATHEMATICS (SCIENCE)** 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.
- Read the instructions carefully.
- 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.

**വിദ്യാർത്ഥികൾക്കുള്ള പൊതുനിർദ്ദേശങ്ങൾ :**

- നിർദ്ദിഷ്ട സമയത്തിന് പുറമെ 15 മിനിറ്റ് 'കൂൾ ഓഫ് ടൈം' ഉണ്ടായിരിക്കും.
- 'കൂൾ ഓഫ് ടൈം' ചോദ്യങ്ങൾ പരിചയപ്പെടാനും ഉത്തരങ്ങൾ ആസൂത്രണം ചെയ്യാനും ഉപയോഗിക്കുക.
- ഉത്തരങ്ങൾ എഴുതുന്നതിന് മുമ്പ് ചോദ്യങ്ങൾ ശ്രദ്ധാപൂർവ്വം വായിക്കണം.
- നിർദ്ദേശങ്ങൾ മുഴുവനും ശ്രദ്ധാപൂർവ്വം വായിക്കണം.
- കണക്ക് കൂട്ടലുകൾ, ചിത്രങ്ങൾ, ഗ്രാഫുകൾ, എന്നിവ ഉത്തരപേപ്പറിൽ തന്നെ ഉണ്ടായിരിക്കണം.
- ചോദ്യങ്ങൾ മലയാളത്തിലും നല്കിയിട്ടുണ്ട്.
- ആവശ്യമുള്ള സ്ഥലത്ത് സമവാക്യങ്ങൾ കൊടുക്കണം.
- പ്രോഗ്രാമുകൾ ചെയ്യാനാകാത്ത കാൽക്കുലേറ്ററുകൾ ഒഴികെയുള്ള ഒരു ഇലക്ട്രോണിക് ഉപകരണവും പരീക്ഷാഹാളിൽ ഉപയോഗിക്കുവാൻ പാടില്ല.



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

(6 × 3 = 18)

1. Let  $A = \{1, 2, 3\}$

$$B = \{2, 3, 4, 5\}$$

and  $f: A \rightarrow B$  defined by  $f(x) = \{(x, y) : y = x + 1\}$ .

(i) Write  $f$  in roster form.

(1)

(ii) Check whether ' $f$ ' is one-one and onto.

(2)

2. Find the matrices  $X$  and  $Y$  so that  $X + Y = \begin{bmatrix} 7 & 0 \\ 2 & 5 \end{bmatrix}$  and

$$X - Y = \begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}.$$

(3)

3. Find the equation of line through the points  $A(1, 3)$  and  $B(0, 0)$  using determinants. (3)

4. Find the value of ' $a$ ' and ' $b$ ' if

$$f(x) = \begin{cases} 10 & \text{if } x \leq 3 \\ ax + b & \text{if } 3 < x < 4 \\ 20 & \text{if } x \geq 4 \end{cases}$$

is a continuous function.

(3)

5. Find the local maxima or local minima of the function  $f(x) = \sin x + \cos x$ ,  $0 < x < \frac{\pi}{2}$  if it exists. (3)

6. Consider the vectors :

$$\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$$

$$\vec{b} = 3\hat{i} + 2\hat{j} + \hat{k}$$

(i) Find  $\vec{a} \cdot \vec{b}$ .

(1)

(ii) Find the angle between  $\vec{a}$  and  $\vec{b}$ .

(2)

7. Find the Vector and Cartesian equation of the line passing through  $(1, 2, 3)$  and parallel to the vector  $3\hat{i} + 2\hat{j} - 2\hat{k}$ . (3)

8. If A and B are two events such that  $P(A) = \frac{1}{2}$ ,  $P(B) = \frac{7}{12}$  and  $P(A' \cup B') = \frac{1}{4}$ .

- (i) Find  $P(A \cap B)$ . (1)  
 (ii) Check whether A and B are independent events. (2)

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

**(6 × 4 = 24)**

9. (i) Let R be a relation on the set Z, set of integers defined by

$$R = \{(a, b) : 2 \text{ divides } (a - b)\}$$

Choose the right answer :

- (A)  $(2, 4) \in R$  (B)  $(3, 8) \in R$   
 (C)  $(7, 6) \in R$  (D)  $(8, 7) \in R$  (1)

- (ii) Check the above relation R is an equivalence relation. (3)

10. (i) The principal value of  $\sin^{-1}\left(\frac{1}{2}\right)$  is \_\_\_\_\_. (1)

- (ii) Find  $\tan^{-1}\left[2 \cos\left(2 \sin^{-1} \frac{1}{2}\right)\right]$  (3)

11. (i) Which among the following is not true ?

- (A)  $(A')' = A$  (B)  $(A + B)' = A' + B'$   
 (C)  $(AB)' = A' \cdot B'$  (D)  $(kA)' = k \cdot A'$  (1)

- (ii) If  $A = \begin{bmatrix} 1 & 5 \\ 6 & 7 \end{bmatrix}$ , then verify that  $(A + A')$  is symmetric and  $(A - A')$  is skew-symmetric.

[A' denotes the transpose of the matrix A] (3)

12. Using integration find the area enclosed by the ellipse  $\frac{x^2}{9} + \frac{y^2}{4} = 1$ . (4)

13. (i) The degree of the differential equation  $\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + \left(\frac{dy}{dx}\right) + 1 = 0$ .

(A) 1

(B) 2

(C) 3

(D) Not defined

(1)

(ii) Solve the differential equation  $\frac{dy}{dx} = (1 + x^2)(1 + y^2)$ .

(3)

14. Consider the vectors :

$$\vec{a} = \hat{i} - 7\hat{j} + 7\hat{k}$$

$$\vec{b} = 3\hat{i} - 2\hat{j} + 2\hat{k}$$

(i) Find  $\vec{a} \times \vec{b}$ .

(2)

(ii) Find the unit vector perpendicular to both  $\vec{a}$  and  $\vec{b}$ .

(1)

(iii) Find the area of parallelogram whose adjacent sides are  $\vec{a}$  and  $\vec{b}$ .

(1)

15. Find the shortest distance between the lines :

(4)

$$\vec{r} = (\hat{i} + 2\hat{j} + \hat{k}) + \lambda(\hat{i} + \hat{j} + \hat{k}) \text{ and}$$

$$\vec{r} = (2\hat{i} - \hat{j} + 4\hat{k}) + \mu(2\hat{i} + \hat{j} + 2\hat{k})$$



16. Bag-I contains 3 red and 4 black balls, while Bag-II contains 5 red and 6 black balls. One of the bag is selected at random and a ball is drawn out of it. If the ball drawn is found to be red, find the probability that it was from Bag-II. (4)

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

(3 × 6 = 18)

17. Solve the following system of equations using matrix method :

$$x + y + z = 3$$

$$2x + y + z = 4$$

$$2x - y + z = 2 \quad (6)$$

18. (i) If  $y = x^x$  find  $\frac{dy}{dx}$ . (2)

- (ii) If  $x = at^2$  and  $y = 2at$ , find  $\frac{dy}{dx}$ . (2)

- (iii) The radius of a circle is increasing uniformly at the rate of 5 cm/sec. Find the rate at which the area of the circle is increasing when the radius is 8 cm. (2)

19. (i)  $\int \frac{1}{x^2 - a^2} dx = \underline{\hspace{2cm}}$ . (1)

- (ii) Find :  $\int \frac{1}{x^2 + 4x - 5} dx$  (2)

- (iii) Evaluate :  $\int_2^3 \frac{x}{1+x^2} dx$  (3)

20. Solve the LPP graphically :

(6)

Maximize

$$Z = 250x + 75y$$

subject to

$$5x + y \leq 100$$

$$x + y \leq 60$$

$$x \geq 0$$

$$y \geq 0$$

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