



Class No. : .....

**2027**

Name : .....

**SECOND YEAR HIGHER SECONDARY  
SECOND TERMINAL EXAMINATION, DECEMBER-2022**

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.

1. (i) Let  $f : \mathbb{R} \rightarrow \mathbb{R}$  be defined as  $f(x) = 3x$ , then

(A)  $f$  is one-one onto

(B)  $f$  is many-one onto

(C)  $f$  is one-one but not onto

(D)  $f$  is neither one-one nor onto

(1)

(ii) Show that the function  $f : \mathbb{R} \rightarrow \mathbb{R}$  defined as  $f(x) = x^2$  is neither one-one nor onto.

(2)

2. Find the value of  $x$ ,  $y$ , and  $z$  from 
$$\begin{bmatrix} x+y+z \\ x+z \\ y+z \end{bmatrix} = \begin{bmatrix} 9 \\ 5 \\ 7 \end{bmatrix}$$

(3)

3. If  $A = \begin{bmatrix} 1 & 2 \\ 4 & 2 \end{bmatrix}$ , then

(i) Find  $|A|$

(1)

(ii) Show that  $|2A| = 4|A|$

(2)

4. Discuss the continuity of the sine function.

(3)

5. Find the absolute maximum value and absolute minimum value of the function :

$$f(x) = x^3, x \in [-2, 2]$$

(3)

6. Find the general solution of the differential equation :

$$\frac{dy}{dx} + \frac{y}{x} = x^2$$

(3)

7. Find a vector in the direction of  $\vec{a} = \hat{i} - 2\hat{j}$  that has magnitude 7 units.

(3)

8. If  $\vec{a} = \hat{i} - 7\hat{j} + 7\hat{k}$  and  $\vec{b} = 3\hat{i} - 2\hat{j} + 2\hat{k}$ , find

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

(2)

(ii)  $|\vec{a} \times \vec{b}|$

(1)

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

(6 × 4 = 24)

9. (i) Let R be a relation defined on  $A = \{1, 2, 3\}$  by  $R = \{(1, 3), (3, 1), (2, 2)\}$ , R is  
(A) Reflexive  
(B) Symmetric  
(C) Transitive  
(D) Reflexive but not transitive (1)
- (ii) Show that the relation R in the set R of real numbers define as  $R = \{(a, b), a \leq b^2\}$  is neither reflexive nor symmetric nor transitive. (3)
10. (i) The principal value of  $\sin^{-1}\left(\frac{1}{2}\right) = \underline{\hspace{2cm}}$ . (1)
- (ii) Find the value of  $\tan^{-1}(1) + \cos^{-1}\left(-\frac{1}{2}\right) + \sin^{-1}\left(-\frac{1}{2}\right)$  (3)
11. (i) Construct a  $2 \times 2$  matrix  $A = [a_{ij}]$  whose elements are given by  $a_{ij} = i/j$ . (2)
- (ii) Find X and Y if  
$$X + Y = \begin{bmatrix} 7 & 0 \\ 2 & 5 \end{bmatrix}$$
$$X - Y = \begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$$
 (2)
12. (i) A square matrix A is singular if  $|A| = \underline{\hspace{2cm}}$ . (1)
- (ii) Find the area of the triangle whose vertices are (3, 8), (-4, 2), (5, 1). (3)
13. Find the intervals in which the function f given by  $f(x) = \sin x + \cos x, 0 \leq x \leq 2\pi$  is strictly (i) increasing (ii) decreasing. (4)
14. (i)  $\int_{-\pi/2}^{\pi/2} \sin^7 x \, dx = \underline{\hspace{2cm}}$   
(A) -1 (B) 0  
(C) 1 (D) 2 (1)
- (ii) Evaluate  $\int x \cos x \, dx$  (3)

15. Find the area of the region bounded by the curve  $y^2 = x$ ,  $x = 1$ ,  $x = 4$  and the  $x$ -axis in the first quadrant. (4)

16. (i) Write the order and degree of the differential equation :

$$\left(\frac{ds}{dt}\right)^4 + 3s \frac{d^2s}{dt^2} = 0. \quad (2)$$

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

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

(3 × 6 = 18)

17. (i) If  $A = \begin{bmatrix} 0 & 3 & a \\ b & 0 & -2 \\ 5 & 2 & 0 \end{bmatrix}$  is a skew symmetric matrix. Find a, b. (2)

(ii) Express  $A = \begin{bmatrix} 7 & 3 & -5 \\ 0 & 1 & 5 \\ -2 & 7 & 3 \end{bmatrix}$  as the sum of a symmetric and skew symmetric matrix. (4)

18. Solve the following system of equations by matrix method :

$$\begin{aligned} 3x - 2y + 3z &= 8 \\ 2x + y - z &= 1 \\ 4x - 3y + 2z &= 4 \end{aligned} \quad (6)$$

19. (i) Find  $\frac{dy}{dx}$  if  
 $x = a(\theta + \sin \theta)$  (3)

$$y = a(1 - \cos \theta)$$

(ii) If  $y = (\tan^{-1}x)^2$   
show that  
 $(x^2 + 1)^2 y_2 + 2x(x^2 + 1) y_1 = 2$  (3)

20. Find

(i)  $\int \frac{dx}{x + x \log x}$  (2)

(ii)  $\int \frac{dx}{x^2 - 6x + 13}$  (2)

(iii)  $\int_0^{\pi/2} \frac{\cos^5 x \, dx}{\sin^5 x + \cos^5 x}$  (2)