Name : . . . .

Reg No : . . . .

SY–HSS

SECOND YEAR HIGHER SECONDARY SAMPLE QUESTION PAPER -2023

Part III

Time:2Hours

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.
- Give equations wherever necessary.
- Electronic devices except non-programmable calculators are not allowed in the Examination Hall.

PART-1

Answer any six questions from 1 to 8 each carries 3 score.

(6×3 =18)

1. Let $R : R \to R$ such that $R = \{(x, y)$: x-y is divisible by $2\}$ .Show that R is an equivalance relation.

2. Express the matrix A= $\begin{bmatrix} 3 & 5 & 6 \\ 1 & -1 & 5 \\ 2 & 3 & -1 \end{bmatrix}$ as the sum of symmetric and skew symmetric matrices.

3. If A = $\begin{vmatrix} 3 & 1 \\ -1 & 2 \end{vmatrix}$ show that $A^2 - 5A + 7I = 0$ (3)

4. (a) Find $\frac{dy}{d\theta}$ if $y = a(\theta + sin\theta)$ (1)

   (b) Find the value of K so that the function
   $f(x) = \begin{cases} 2kx + 3 & \text{if } x \leq 5 \\ 3x - 8 & \text{if } x > 5 \end{cases}$ is continous. (2)

5. If $y = sin^{-1}x$, then show that $(1 - x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} = 0$ (3)

6. (a) The direction ratios of the line $\frac{x-3}{4} = \frac{y-2}{1} = \frac{z+1}{3}$ is
a) (3,2,-1) b) (-3,2,1) c) (4,1,3) d) (1,0,0)) (1)

(b) Find equation of the straight line passing through the point (2,-3,1) and is parallel to the above line . (2)

7. (a) If $\vec{a} = 2\hat{i} - \hat{j} + 3\hat{k}$ and $\vec{b} = 4\lambda\hat{i} + 2\hat{j} - 2\hat{k}$ are perpendicular to each other then find λ (1)

(b) Find the area of the parallelogram having adjecent sides $\vec{a}$ and $\vec{b}$ (2)

8. (a) A and B are two independent events then $P(A \cap B) = \ldots\ldots$ (1)

(b) Probabilitry of solving a specific problem independently by A and B are $\frac{1}{2}$ and $\frac{1}{3}$ respectively . If both try to solve the problem independently . Find the probability that exactly one of them solve the problem . (2)

Answer any 6 questions from 9-16. Each carries 4 scores **($6 \times 4 = 24$)**

9. (a) Let R be the relation in the set set of natural numbers N given by $R = \{(a, b) : a = b - 2, b > 6\}$ choose the correct answer
a) $(2, 4) \in R$ b) $(3, 8) \in R$ c) $(6, 8) \in R$ d) $(8, 7) \in R$ (1)

(b) Let $f : R \to R$ defined by $f(x) = 3 - 4x$ state whether the function is bijective . Justify your answer.

10. (a) Write the principal value of $sin^{-1}sin(\frac{2\pi}{3})$ (1)

(b) Prove that $sin^{-1}(3x - 4x^3) = 3sin^{-1}x$ (2)

11. (a) Construct a 2×2 matrix $A = [a_{ij}]$ whose elements are given by $a_{ij} = \frac{1}{2}|i - 3j|$ (2)

(b) If A= $\begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$ and I= $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ Find K so that $A^2 = KA - 2I$ (2)

12. (a) Write the order and degree of the differential equation $\left(\frac{d^2s}{dt^2}\right)^2 + \left(\frac{ds}{dt}\right)^3 + 4 = 0$ (1)

(b) Consider the differential equation $\frac{dy}{dx} + \frac{2xy}{1+x^2} = \frac{cotx}{1+x^2}$

13. (a) Area of the region bounded by the curve $y = f(x)$, x axis and between the ordinates $x = a$ and $x = b$ is $\ldots\ldots$ (1)

(b) using integration find the area of the region bounded by the circle $(x - 2)^2 + y^2 = 4$. (3)

14. Find the shortest distance between the lines whose vector eqautions are $\vec{r} = \hat{i} + \hat{j} + \hat{k} + \lambda(2\hat{i} - \hat{j} + \hat{k})$ and $\vec{r} = 2\hat{i} - \hat{j} - \hat{k} + \mu(3\hat{i} - 5\hat{j} + 2\hat{k})$

15. A bag contains 5 red and 6 black balls and another bag contains 4 red and 7 black balls .One bag is chosen at random and a ball is drawn from it then find

(a) the probability that drawn ball is red.

(b) the probability that the selected ball is from bag 2.

16. If $A(1, 2, 4$,$B(-2, 1, 3$ are two points

(a) Find $\vec{AB}$ (1)

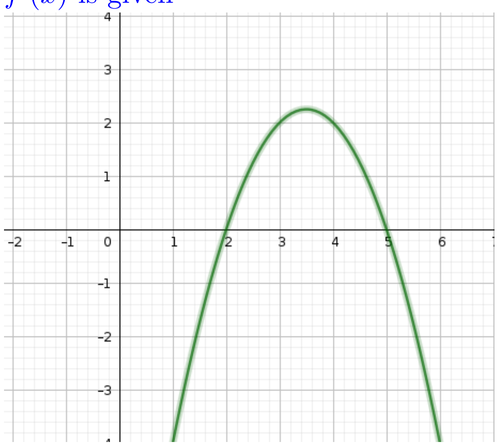
(b) Find unit vector along $\vec{AB}$ (1)

(c) Find λ when the projection of $\vec{a} = \hat{i} + \lambda\hat{j} + 4\hat{k}$ on $\vec{r} = 6\hat{i} + 2\hat{j} + 3\hat{k}$ is 8 units . (2)

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

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

18. (a) Find the point of local maxima and local minima of the functio f(x) ,graph of its derivative $f'(x)$ is given



(1)

(b) A stone is droped in to a quiet lake and waves move in a circle at a speed of 4cm per second . At the instant when the radius of circular wave is 10cm , how fast is enclosed area increasing. (2)

(c) Find the intervals in which the function f given by $f(x) = 4x^3 - 6x^2 - 72x + 30$ is
a) increasing b) decreasing (3)

19. (a) $\int_0^{\frac{\pi}{2}} xsinxdx$ (2)

(b) $\int \frac{1}{(x+1)(x+2)}, dx$ (2)

(c) If $\frac{d}{dx}f(x) = \frac{tan^{-1}}{1+x^2}$ then find f(x) (2)

20. Solve the following linear programing problem graphically :
Maximise $Z = x + 2y$ subject to the constraints
$x + 2y \geq 100, \quad 2x - y \leq 0 \quad, 2x + y \leq 200 \quad x \geq 0 y \geq 0.$

Prepared by
SREEHARI BALAKRISHNAKURUP (HSST,MOONNIYUR HSS)
NIZA F(HSST GHSS THIRURANGADI)
KUSIMA P(HSST,GHSS TIRURANGADI)
BINDU GM(HSST,KHMHSS VALAKKULAM)
PREBHAKUMARY.R(HSST KMHSS KUTTOOR NORTH)
FASILA KP(HSST , GVHSS CHETTIYAN KINAR)
JYOTHIRMAYI P V(HSST ,CPPHMHSS,OZHUR)
PRATHIBHA R (HSST ,PPTMYHSS CHERUR
FARHATH NT(HSST , PPTMYHSS CHERUR)