RRV GIRLS HIGHER SECONDARY SCHOOL, KILIMANOOR

SECOND YEAR HIGHER SECONDARY PRE MODEL EXAMINATION – 2023

MATHEMATICS (SCIENCE)

Time: 2 Hours   Cool-Off time : 15 mnt

Maximum Score : 60

Answer any 6 questions from 1 to 8. Each carries 3 scores. (6 x 3 = 18)

1. (a) The maximum number of ordered pairs to form a non-zero reflexive relation on a

    set of 4 elements   (1)

    (i) 2^4 (ii)   4   (iii)   2   (iv)   8

    (b) Show that the relation R in the set {1, 2, 3} given by R= {(1,1), (2,2), (3,3), (1,3), (3,2)} is reflexive but not symmetric nor transitive   (2)

2. (a) If $\begin{bmatrix} x & 0 \\ 1 & y \end{bmatrix} = \begin{bmatrix} -2 & 0 \\ 1 & 5 \end{bmatrix}$

    Find the value of x and y.   (1)

    (b) If $A^1 = \begin{bmatrix} 1 & 2 \\ -1 & 3 \\ 0 & 4 \end{bmatrix}$ and B= $\begin{bmatrix} 3 & 4 & -1 \\ 2 & 1 & 3 \end{bmatrix}$

    Find A-B.   (2)

3. (a) The value of $\begin{vmatrix} x & x-1 \\ x+1 & x \end{vmatrix}$ is _____.   (1)

    (b) Find the value of λ if A= $\begin{bmatrix} \lambda & 1 \\ 6 & 3 \end{bmatrix}$ is singular   (2)

4. Find the value of k, so that the function $f(x) = \begin{cases} kx^2, & If\ x \geq 1 \\ 4, & If\ x < 1 \end{cases}$

    Is continuous at x=1   (3)

5. Find $\frac{dy}{dx}$ if $x^y = y^x$ (3)

6. Consider two vectors $\vec{a} = \hat{\imath} - \hat{\jmath} + \hat{k}$

    And $\vec{b} = \hat{\imath} + \hat{\jmath} - \hat{k}$

    (i)   Find $|\vec{a}|$ and $|\vec{b}|$ (1)

    (ii)   Find $\vec{a} \cdot \vec{b}$ (1)

    (iii) Find the angle between $\vec{a}$ & $\vec{b}$ (1)

7. Find the cartescan equation of the line which passes through the point (-2, 4, -5) and is parallel to the line.

$$\frac{x+3}{3} = \frac{y-4}{-5} = \frac{z+8}{6}$$

(3)

8. (a) If P(A) -= 0.4, P(B) = k and P(A∪B) = 0.7 find k if A and B are independent events. (1)

(b) If A and B are two events such that P(A)= $\frac{1}{4}$, P(B) = $\frac{1}{2}$ and P(AηB) =$\frac{1}{8}$

Find P (not A and not B) (2)

Answer any 6 questions from 9 to 16. Each carries 4 scores. (6 x 4 = 24)

9. (a) A function f: A → B, where A = {1, 2, 3} and B = {4, 5, 6} defined by f = {(1,6), (2,4), (3, 5)} then f is

    (i)   One – one (ii)   onto   (iii)   bijection   (iv)   neither one-one not onto (1)

    (ii)   Show that the modulus function given by f(x) = |x| is neither one-one nor onto. (3)

10. (a) $\sin^{-1} \sin \frac{2\pi}{3} =$ _____

    (i) $\frac{2\pi}{3}$ (ii) $\frac{\pi}{4}$ (iii) $\frac{\pi}{2}$ (iv) $\frac{\pi}{3}$ (1)

    (ii)   *Write the value of* $\tan^{-1} [2 \sin (2 \cos^{-1} \sqrt{3}/_2)]$ (3)

11. If A= $\begin{bmatrix} 3 & 3 & -1 \\ -2 & -2 & 1 \\ -4 & -5 & 2 \end{bmatrix}$

    (i)   Find A+A^1 and A- A^1 (2)

    (ii)   Express A as the sum of a symmetric and a skew-symmetric matrix. (2)

12. (a) Find the area of the curve y^2 = x and the line x=4 and the x-axis in first quadrant. (1)

(b) Find the area of the region bounded by the curve $x^2+y^2= 9$ (3)

13. (a) The degree of the differential equation $x^4 \frac{d^2y}{dx^2} = 1 + \left(\frac{dy}{dx}\right)^3$ is

        (i)   1   (ii)   4   (iii)   3   (iv)   2   (1)

    (b) Find the general solution of the differential equation y log y dx – x dy = 0   (3)

14. Consider two vectors $\vec{a} = 2\hat{i} + 3\hat{j} + 4\hat{k}$ and $\vec{b} = -\hat{j} - 2\hat{k}$

    (i) Find $\vec{a} \times \vec{b}$ and $\left| \vec{a} \times \vec{b} \right|$ (2)

    (ii) Find the unit vector perpendicular to the vectors $\vec{a}$ and $\vec{b}$.   (1)

    (iii) Find the area of the parallellogram whose adjacent sides are $\vec{a}$ and $\vec{b}$.   (1)

15. Find the shortest distance between the lines

    $\vec{\gamma} = (\hat{i} + 2\hat{j} + \hat{k}) + \lambda\,(\hat{i} - \hat{j} + \hat{k})$

    $and\ \vec{\gamma} = (2\hat{i} - \hat{j} - \hat{k}) + \lambda\,(2\hat{i} + \hat{j} + 2\hat{k})$ (4)

16. A man is known to speak truth 3 out of 4 times. He throws a die and reports that it is a six. Find the probability that it is actually a six.   (4)

Answer any 3 questions from 17 to 20. Each carries 6 scores (3 x 6 = 18)

17. Consider the linear equations

    x -y+z = 4

    2x+ y-3z = 0

    x+y+z = 2

    (i)   Write the above equation as a matrix equation.   (1)

    (ii)   Solve the system using matrix method.   (5)

18. (a) f(x) is a strictly increasing function if f^1(x) is _____

        (i)   Zero (ii)   Negative   (iii)   positive   (iv)   None. (1)

    (b) Find the intervals in which the function f(x) = x^2 - 4x + 6 is strictly decreasing.

                                                           (2)

    (c) Show that of all rectangles with a given area, the square has the least perimeter.

                                                           (3)

19. Evaluate

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

(b) $\int \log x \ dx$ (1)

(c) $\int_{o}^{\pi/2} \frac{\sin^4 x}{\sin^4 x + \cos^4 x} dx$ (3)

20. Consider the $\mathcal{LPP}$

Maximise $Z = 3x + 2y$ subject to

$$x + 2y \leq 10$$
$$3x + y \geq 15$$
$$x, y \geq 0$$

(a) Draw its feasible region (3)

(b) Find the corner points of the feasible region. (2)

(c) Find the maximum value of z (1)

Prepared by

Shiny G S
HSST Mathematics
RRVGHSS
Kilimanoor
9495243274