Model Question Paper Mathematics (Science)

HSE II

Time: 2.30 Hours **Cool-off time: 15 Minutes**

General Instruction to Candidates :

There is a 'cool-off time' of 15 minutes in addition to the writing time of 2. 30 Hrs. You are not allowed to write your answer nor to discuss anything with others during the 'cooloff' time.

Use the 'cool-off' time to get familiar with questions and to plan answers.

Read questions carefully before answering.

When you select a question, all the sub- questions must be answered from the same question itself.

I) i) Show that the relation R in the set A = $\{1.2.3.4.5.\}$ given by R= $\{(a,b) : |a-b| \text{ is }$ (2)even } is a equivalence relation

ii) Let
$$\begin{array}{c} \star \\ be a binary operation on z defined by a \\ \end{array} \begin{array}{c} \star \\ b = a+b-15 \text{ for } a, b \in z \end{array}$$

(3)

a)show that ***** is commutative and associative b) Find the identity element

II) Match the following

III) L et A =
$$\begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$$

1)Find A²
2)Find K, so that A² = KA+ 2 I
3)Find A⁻¹ using elementary row transformations
(2)

IV)
1) Find value of
$$\begin{vmatrix} \sin\theta & -\cos\theta \\ \cos\theta & \sin\theta \end{vmatrix}$$
 (2)
2) Using the properties of determinants prove that
 $\begin{vmatrix} x + y + 2z & x & y \\ z & y + 2 = 2z & y \\ z & x & z + x + 2y \end{vmatrix}$ = 2 (x+y+z)³ (3)

V) Find the value of a and b such that the function defined by if $x \le 2$ 5

$$f(x) = \begin{cases} ax + b & \text{if } 2 < x < 10 \text{ is a continuous function} \end{cases}$$
(2)
(2)
(2)
(2)
(3)
(3)

VI) 1) Find dy/dx if
$$x = a (\theta + sin\theta)$$
 (2)
 $y = a(1-\cos\theta)$
2) $x^{y} + y^{x} = 1$ find dy/dx (2)
VII) 1) Prove that the curve $x = y^{2}$ and $xy = k$ cut at right angle if $8k^{2}=1$ (2)

$$1)\int dx/(\sqrt{7-6x-x^2})$$
 (2)

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	2) $\int sinx/sin(x+a) dx$	(2)	
	3)∫ x logx dx	(2)	
IX)	1) Evaluate ∫ ₀ ¹ √ <i>stn</i> ₽.Cos⁵₽d₽	(2)	
	2) Evaluate using the limit of a sum $\int_{0}^{2} (x+4) dx$	(2)	
X)	1) Sketch the graph of the curve $x^2=4y$ and $x = 4y-2$ 2) Find the area between the above two curves	(2) (4)	
XI)	Using integration find the area of the triangle whose vertices are (2,0), (4,5), (6,3) Consider $x^2 \frac{dy}{dx} = 2xy + y^2$	(6)	
	10Write order and degree of the above deferential equation 2)Solve the above differential equation 3)Find the particular solution of the differential equation $\frac{dy}{dx} + y \operatorname{Cot} x = 2x + y$		(1) (2)
XII)	x^2 Cotx given $x \neq 0$ and $y=0$, when $x = \pi/2$ if $\vec{a} = 2\hat{i} - 3\hat{j} - \hat{k}$	(3)	
	$\vec{b} = \hat{\imath} + 4\hat{\jmath} - 2\hat{k}$		
	1) Find a.b		(1)
,	2) Find $\vec{a} \times \vec{b}$		(1)
-	3) Find a unit vector perpenticular to \vec{a} and \vec{b}		(2)
XIII	1) If \vec{a} is unit vector and $(\vec{x} \cdot \vec{a}) \cdot (\vec{x} + \vec{a}) = 8$ then find $ \vec{x} $	(2)	
	2) Find the angle between the vectors $\mathbf{i} - 2\mathbf{j} + 3\mathbf{k}$ and $3\mathbf{i} - 2\mathbf{j} + \mathbf{k}$	(2)	
XIV)	1) Find the shortest distance between the lines $\frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}$ and		
	$\frac{x-3}{1} = \frac{y-5}{2} = \frac{z-7}{1}$	(3)	
	2) Find the equation of the plane passing thorugh the point (2,3,4) and parallel to the plane $5x - 6x + 7a = 2$	(3)	
	3) Find the distance of apoint (2,5,-3) from the plane \vec{r} . ($\vec{6i} - \vec{3j} + 2\vec{k}$) = 4	(2)	
	Consider the lines		
	$\frac{1-x}{2} = \frac{7y}{14} = \frac{z-3}{2}$		
	3 - 2p - 2		
	$\frac{7-7x}{2} = \frac{y-5}{z} = \frac{6-z}{z}$		
	3p 1 5 1) Find the direction ratio's of the above line		(2)
	2)Write the vector form of the lines		(2) (3)
XV)	3)Find the value of 'P' if the above lines are at right angles Slove graphically		(3)
	subject to constraints $x+y \le 50$		
	$3\mathbf{x} + \mathbf{y} \le 90$ $\mathbf{x} \ge 0$ $\mathbf{y} \ge 0$	(6)	
XVI)	1) If P (A) = 7/13 P(B) = 9/13 and P (A \cap B) = 4/13 Evaluate P (A/B)	(2)	
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2) A man is known to speak truth 3 out of 4 times. He throws a die and report that it is a six. Find the probability that it is actually a six.

(3)

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