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SARDAR PATEL UNIVERSITY
B.Sc.(SEMESTER I) EXAMINATION
Monday , 2^{nd} Dec., 2013
US01EMTH02
(MATHEMATICS)

Time : 02.30 p.m. to 04.30 p.m. **Maximum Marks:70**

Que.1 Fill in the blanks. 10

(1) $f : \mathbb{N} \to \mathbb{N}$ defined by $f(x) = 2x + 1$. then $R_f =$ .....

(a) {1,3,5,7,...} (b){3,5,7,9,...} (c){2,4,6,8,...} (d){3,6,9,12,...}

(2) If $f : \mathbb{N} \to \mathbb{N}$ defined by $f(x) = x^2 + 1$ and $g : \mathbb{N} \to \mathbb{N}$ defined by $g(x) = x^3$ then $fog(x) =$ .....

(a) $x^6 + 1$ (b) $x^5 + 1$ (c) x^6 (d) None of these

(3) $i^{13} =$ .....

(a) 1 (b) i (c) $-i$ (d) -1

(4) $log_5 5 =$ .....

(a) 0 (b) 1 (c) -1 (d) 5

(5) $\sin(150^0) =$ .....

(a) $\frac{\sqrt{3}}{2}$ (b) 0 (c) $\frac{1}{2}$ (d) $\frac{1}{\sqrt{2}}$

(6) $\begin{vmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 2 & 4 & 6 \end{vmatrix} =$ .....

(a) 4 (b) -1 (c) 0 (d) 1

(7) If A is skew symmetric matrix then $A^T =$ .....

(a) $-A$ (b) A (c) A^{-1} (d) None of these

(8) If $\overline{x} = (\cos\alpha, \sin\alpha)$, $\overline{y} = (\cos\beta, \sin\beta)$ then $|\overline{x}| + |\overline{y}| =$ .....

(a) 1 (b) 0 (c) 2 (d) -1

(9) $(1,0,0) \times (0,1,0) =$ .....

(a) (1 , 0 , 0) (b) (0 , 1 , 0) (c) (0 , 0 , 1) (d) None of these

(10) If $\overline{x} = (\ a\ ,\ 4\ )$, $\overline{y} = (\ a\ ,\ -1\ )$ and $\overline{x} \perp \overline{y}$ then $a =$ .....

(a) 2 (b) $-\sqrt{2}$ (c) 0 (d) 1

Que.2 Answer the following (Any ten) 20

(1) If $f : \mathbb{R} \to \mathbb{R}$ defined by $f(x) = x^2 - 2x + 3$ then find fof .

(2) Find $\alpha \in \mathbb{C}$ which satisfy the equation $(-4, 6) - \alpha = (3, 7)$.

(3) Solve the equation $2x(x - 7) = 3(2 - x)$.

(4) Prove that $1 + \tan^2\theta = \sec^2\theta$.

(5) Check that whether $\sin 141^0 + \cos 141^0$ is positive or negative .

(6) Simplify $log_{11}\left(\frac{121\sqrt{14641}}{\sqrt[3]{1331}}\right)$.

(7) If $A = \begin{bmatrix} 1 & 2 \\ 3 & -1 \end{bmatrix}$, $B = \begin{bmatrix} 2 & -3 \\ 4 & 0 \end{bmatrix}$ then find BA .

(8) $A = \begin{bmatrix} \sin\theta & \cos\theta \\ -\cos\theta & \sin\theta \end{bmatrix}$ then prove that $A^{-1} = A^T$.

(9) Prove that

$$\begin{vmatrix} a & b & c \\ b & c & a \\ a+b & b+c & c+a \end{vmatrix} = 0.$$

(10) If $\overline{x} = (3, 2, 1)$, $\overline{y} = (1, 5, 6)$ then find $3\overline{x} - 4\overline{y}$.

(11) If $\overline{x} = (1, 2, 3)$, $\overline{y} = (-1, 3, 5)$ then find $\overline{x} \times \overline{y}$.

(12) Solve the equation $x(1, 2) + y(2, 1) = (3, 3)$.

Que.3 (a) Let $f : \mathbb{N} \to \mathbb{N}$ defined by $f(x) = 2x - 1$. Is f one - one ?. Is f onto ? . Check it . 5

(b) Find conjugate and Modulus of $(3 - 7i)^2$. 5

OR

Que.3 (a) If $f : \mathbb{R} \to \mathbb{R}$ defined by $f(x) = x^2 + x + 1$, $g : \mathbb{R} \to \mathbb{R}$ defined by $g(x) = x - 1$ and $h : \mathbb{R} \to \mathbb{R}$ defined by $h(x) = 2x$ then find fog , foh , $(fog)oh$. 5

(b) Solve the equation $(3 + x)^2 = 4x - 1$. 5

Que.4 (a) Solve the equation $log2 + log(x + 2) - log(3x - 5) = log3$. 5

(b) Prove that $\left(\frac{1 - \tan\theta}{1 - \cot\theta}\right)^2 = \frac{1 + \tan^2\theta}{1 + \cot^2\theta}$. 5

OR

Que.4 (a) If $\cos\theta - \sin\theta = \sqrt{2}\sin\theta$, then prove that $\cos\theta + \sin\theta = \sqrt{2}\cos\theta$. 5

(b) Prove that $sin\left(\frac{10\pi}{3}\right) cos\left(\frac{11\pi}{6}\right) + cos\left(\frac{2\pi}{3}\right) sin\left(\frac{5\pi}{6}\right) = 1$. 5

Que.5 (a) Prove that

$$\begin{vmatrix} x^2 & y^2 & z^2 \\ x & y & z \\ 1 & 1 & 1 \end{vmatrix} = -(x-y)(y-z)(z-x).$$

5

(b) If $A = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 4 \\ 2 & 5 \end{bmatrix}$ then check $(AB)^T = B^T A^T$. 5

OR

Que.5 (a) Prove that

$$\begin{vmatrix} 6^2 & 8^2 & 10^2 \\ 7^2 & 24^2 & 25^2 \\ 9^2 & 40^2 & 41^2 \end{vmatrix} = 0.$$

5

(b) Solve the equations $2x + 3y - 8 = 0$; $5x - 4y + 3 = 0$ by using Cramer's rule . 5

Que.6 (a) If $\overline{x} = (1,1,2)$, $\overline{y} = (1,2,1)$, $\overline{z} = (2,1,1)$ then find $\overline{x} \times (\overline{y} \times \overline{z})$. 5

(b) If $\overline{x} = (a,3,-2)$, $\overline{y} = (a,-a,2)$ are orthogonal then find a . 5

OR

Que.6 (a) Evaluate $(1,2,3) \cdot ((2,3,4) \times (-1,2,-3))$. 5

(b) If the measure of the angle between $\overline{i} + \sqrt{3}\,\overline{j}$ and $\sqrt{3}\,\overline{i} + a\overline{j}$ is $\pi/3$ then find a . 5

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