Series PRT Code No. **PRTS/3**

Roll No. | | | | | | | |

- Please check that this question paper contains 4 printed pages.
- Code number given on the right hand side of the question paper should be written on the title page of the answer book by the candidate.
- Please check this question paper contains **14** questions.
- **Please write down the Serial Number of the question before attempting it.**

MATHEMATICS

Topic: Test (1), Test (2) and Test (3)

Time allowed: 90 minutes **maximum Marks: 48**

General Instructions:

(i) All questions are compulsory.

(ii) The question paper consists of 14 questions divided into four sections A, B C and D. Section A comprises of 2 questions of **one mark** each, Section B comprise of **4 questions of** two marks **each** Section C comprise 5 questions of four marks each **and section D comprise of** 3 **questions of** six marks each.

(iii) All questions in section A are to be answered in one word, one sentence or as per the exact requirement of the question.

(iv) There is no overall choice. However, internal choice has been provided in 2 questions of four marks each and 1 question of six marks each. You have to attempt only one of the alternatives in all such questions.

(v) Use of calculators is not permitted. You may ask for logarithmic tables, if required.

Section A

1 Find the value of p, so that the lines $\frac{1-x}{3}=\frac{7y-14}{p}=\frac{z-3}{2}$ and $\frac{7-7x}{3p}=\frac{y-5}{1}=\frac{6-z}{5}$ are perpendicular to each other.

2 Find the slope of tangent to the curve $y=\frac{x-1}{x-2}, x\neq 2$ at x = 10.

Section B

3 Find the slope of normal to the curve $x=1-a\sin\theta, y=b\cos^2\theta$ at $\theta=\frac{\pi}{2}$.

4 Find the intervals in which the function f given by $f(x)=2x^3-3x$ is (a) strictly increasing (b) strictly decreasing.

5 Using ERT find the inverse of $\begin{pmatrix}2 & 5\\ 1 & 3\end{pmatrix}$

6 IIf $x^{13}\cdot y^7=(x+y)^{20}$ then find $\frac{dy}{dx}$.

Section C

7 Show that the equation of normal at any point on the curve $x=3\cos\theta-\cos^3\theta, y=3\sin\theta-\sin^3\theta$ is $4(y\cos^3\theta-x\sin^3\theta)=3\sin 4\theta$

OR

Find the value of p for which the curves $x^2 = 9p(9-y)$ and $x^2 = p(y+1)$ cut each other at right angle.

8 Find the intervals in which $f(x) = \sin x + \cos x, 0 \le x \le 2\pi$ is strictly increasing or strictly decreasing.

OR

Find the intervals in which the function f given by $f(x) = \dfrac{4\sin x - 2x - x\cos x}{2 + \cos x}$ $0 \le x \le 2\pi$ is (i) increasing (ii) decreasing.

9 Find the SD of the lines $\dfrac{x-8}{3} = \dfrac{y+9}{-16} = \dfrac{z-10}{7}$ and $\dfrac{x-15}{3} = \dfrac{y-29}{8} = \dfrac{z-5}{-5}$

OR

Find the coordinates of foot of perpendicular drawn from the point $(0,2,3)$ on the line $\dfrac{x+3}{5} = \dfrac{y-1}{2} = \dfrac{z+4}{3}$. Also, find the length of perpendicular.

10 For what choice of a and b is the function $f(x) = \begin{cases} x^2, & x \le c \\ ax + b, & x > c \end{cases}$ differentiable at x = c ?

OR

Find the value sof a and b so that $f(x) = \begin{cases} x + a\sqrt{2}\sin x & 0 \le x < \dfrac{\pi}{4} \\ 2x\cos x + b & \dfrac{\pi}{4} \le x < \dfrac{\pi}{2} \\ a\cos 2x - b\sin x & \dfrac{\pi}{2} \le x < \pi \end{cases}$ is continuous $[0\ \pi]$.

11 If $y = x\log\dfrac{x}{(a+bx)}$, then show that $x^3 \cdot \dfrac{d^2y}{dx^2} = \left(x\dfrac{dy}{dx} - y\right)^2$.

Section D

12 Prove that : $\begin{vmatrix} b^2+c^2 & ab & ac \\ ab & c^2+a^2 & bc \\ ca & cb & a^2+b^2 \end{vmatrix} = 4a^2b^2c^2$.

OR

If $a+b+c=0$ and $\begin{vmatrix} a-x & c & b \\ c & b-x & a \\ b & a & c-x \end{vmatrix} = 0$, then show that

$x = 0\ OR\ x = \pm\sqrt{\frac{3}{2}\left(a^2+b^2+c^2\right)}$.

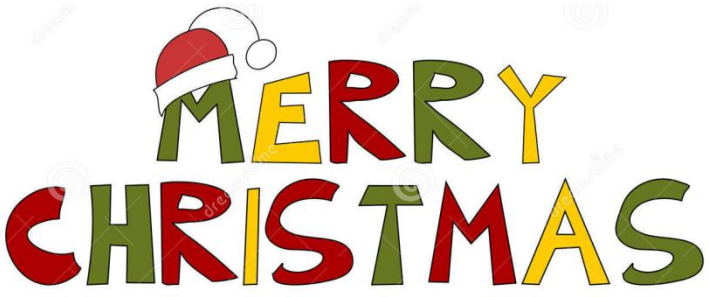
13 Find the product $\begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}\begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$, using the product solve the following system of equations :

$$\begin{cases} x-y=3 \\ 2x+3y+4z=17 \\ y+2z=7 \end{cases}$$

14 Prove that equation of tangent to the curve $\left(\frac{x}{a}\right)^n+\left(\frac{y}{b}\right)^n=1$ at (a,b) is $\frac{x}{a}+\frac{y}{b}=2$.

OR

Show that the straight line $x\cos\alpha+y\sin\alpha=p$ touches the curve $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, then prove that $a^2\cos^2\alpha+b^2\sin^2\alpha=p^2$.



Series PRT Code No. **PRTS/2**

Roll No. | | | | | | | |

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MATHEMATICS

Topic: Test (1) and Test (2)

Time allowed: 90 minutes **maximum Marks: 48**

General Instructions:

(i) All questions are compulsory.

(ii) The question paper consists of 14 questions divided into four sections A, B C and D. Section A comprises of 2 questions of **one mark** each, Section B comprise of **4 questions of** two marks **each** Section C comprise 5 questions of four marks each **and section D comprise of** 3 **questions of** six marks each.

(iii) All questions in section A are to be answered in one word, one sentence or as per the exact requirement of the question.

(iv) There is no overall choice. However, internal choice has been provided in 2 questions of four marks each and 1 question of six marks each. You have to attempt only one of the alternatives in all such questions.

(v) Use of calculators is not permitted. You may ask for logarithmic tables, if required.

Section A

1 Show by an example that $A \neq O$ and $B \neq O$ and $AB = O$.

2 Differentiate $\frac{8^x}{x^8}$

Section B

3 If A , B and C are the angles of the triangle then show that $\begin{vmatrix} -1 & \cos A & \cos B \\ \cos C & -1 & \cos A \\ \cos B & \cos A & -1 \end{vmatrix} = 0$

4 If A is a square matrix such that $A^2 = A$, then find the value of $(A-I)^3 + (A+I)^3 - 7A$

5 If $y = \tan^{-1}\frac{5x}{1-6x^2}$, then prove that $\frac{dy}{dx} = \frac{2}{1+4x^2} + \frac{3}{1+9x^2}$.

6 Discuss the differentiability of the function $f(x) = \begin{cases} 2x-1, & x < \frac{1}{2} \\ 3-6x, & x \geq \frac{1}{2} \end{cases}$ at $x = \frac{1}{2}$.

Section C

7 If $f(t)=\begin{vmatrix} \cos t & t & 1 \\ 2\sin t & t & 2t \\ \sin t & t & t \end{vmatrix}$ then find $\underset{t\to 0}{Lim}\dfrac{f(t)}{t^2}$.

OR

Using properties of determinants, prove that :

$$\begin{vmatrix} -bc & b^2+bc & c^2+bc \\ a^2+ac & -ac & c^2+ac \\ a^2+ab & b^2+ab & -ab \end{vmatrix} = (ab+bc+ca)^3$$

8 If $y=\sin\left(p\sin^{-1}x\right)$ then show that $(1-x^2)y_2 - xy_1 + p^2y = 0$.

9 If $f(x)=\begin{cases} \dfrac{\sin(a+1)x+2\sin x}{x}, & if\ x<0 \\ 2, & if\ x=0 \\ \dfrac{\sqrt{1+bx}-1}{x}, & if\ x>0 \end{cases}$ is continuous at x = 0, then

find the values of a and b.

OR

Find the value sof a and b so that

$$f(x)=\begin{cases} x+a\sqrt{2}\sin x & 0\le x<\dfrac{\pi}{4} \\ 2x\cos x+b & \dfrac{\pi}{4}\le x<\dfrac{\pi}{2} \\ a\cos 2x-b\sin x & \dfrac{\pi}{2}\le x<\pi \end{cases}$$ is continuous $[0\ \pi]$.

10 If $A=\begin{bmatrix} 3 & -5 \\ -4 & 2 \end{bmatrix}$ then find $A^2-5A-14I$. Hence obtain A^3.

11 If $x\cos(a+y)=\cos y$, then prove that $\frac{dy}{dx}=\frac{\cos^2(a+y)}{\sin a}$. Hence show that $\sin a\frac{d^2y}{dx^2}+\sin 2(a+y)\frac{dy}{dx}=0$.

Section D

12 Prove that : $\begin{vmatrix} b^2+c^2 & ab & ac \\ ab & c^2+a^2 & bc \\ ca & cb & a^2+b^2 \end{vmatrix}=4a^2b^2c^2$.

13 Find the inverse using ERT of matrix $\begin{bmatrix} 2 & 3 \\ 6 & 9 \end{bmatrix}$ than solve the system of equation using matrix inversion $2x+3y=5$ *and* $6x+9y=15$.

14 Show that the function $f(x)=\begin{cases} 3x-1, & 0<x\le 1 \\ 2x^2-x, & 1<x\le 2 \\ 5x-4, & x>2 \end{cases}$ is continuous at x = 2 but not differentiable at x = 2.

OR

Find the values of p and q, so that $f(x)=\begin{cases} x^2+3x+p, & if\ x\le 1 \\ qx+2\ , & if\ x>1 \end{cases}$ is differentiable at x = 1.

Series PRT Code No. **PRTS/1**

Roll No. | | | | | | | |

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MATHEMATICS

Topic: Matrics & Determinats

Time allowed: 90 minutes **maximum Marks: 48**

General Instructions:

(i) All questions are compulsory.

(ii) The question paper consists of 14 questions divided into four sections A, B C and D. Section A comprises of 2 questions of **one mark** each, Section B comprise of **4 questions of** two marks **each** Section C comprise 5 questions of four marks each **and section D comprise of** 3 **questions of** six marks each.

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(v) Use of calculators is not permitted. You may ask for logarithmic tables, if required.

Section A

1 For what value of k $\begin{bmatrix} 2k+3 & 4 & 5 \\ -4 & 0 & -6 \\ -5 & 6 & -2k-3 \end{bmatrix}$ is skew symmetric.

2 If $A=\begin{bmatrix} a & b \\ -b & a \end{bmatrix}$ and $B=\begin{bmatrix} a & -b \\ b & a \end{bmatrix}$ find AB.

Section B

3 If A is a square matrix such that $A^2=A$, then show that $(I+A)^3=7A+I$

4 For a non-singular matrix A, find $\left|adj\left(A^T\right)\right|$ if $A^{-1}=\begin{bmatrix} 1/5 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$.

5 If the matrix A is idempotent matrix then find the value of b where $A=\begin{bmatrix} -1 & b \\ -b & 2 \end{bmatrix}$.

6 Without expoanding , find the value of determinat $\begin{vmatrix} 42 & 1 & 6 \\ 28 & 7 & 4 \\ 14 & 3 & 2 \end{vmatrix}$.

Section C

7 If $A=\begin{bmatrix}7 & 6 & 3\\ -3 & 2 & -1\\ 6 & -1 & 3\end{bmatrix}$ and $B=\begin{bmatrix}1 & 3 & -3\\ 3 & -4 & 5\\ 0 & 2 & 6\end{bmatrix}$ Express $A-3B$ as the sum of symmetric and a skew symmetric matrices.

OR

Show that the matrix $B'AB$ is symmetric or skew-symmetric according as A is symmetric or skew – symmetric.

8 Find the value of x , y and z if the matrix $\begin{bmatrix}0 & 2y & z\\ x & y & -z\\ x & -y & z\end{bmatrix}$ satisfy $A^TA=I$.

9 If $\begin{bmatrix}1 & x & 1\end{bmatrix}\begin{bmatrix}1 & 3 & 2\\ 2 & 5 & 1\\ 15 & 3 & 2\end{bmatrix}\begin{bmatrix}1\\ 2\\ x\end{bmatrix}=0$, find x.

10 If x + y + z = 0, prove that $\begin{vmatrix}xa & yb & zc\\ yc & za & xb\\ zb & xc & ya\end{vmatrix}=xyz\begin{vmatrix}a & b & c\\ c & a & b\\ b & c & a\end{vmatrix}$.

OR

Prove that $\begin{vmatrix}a+b+nc & na-a & nb-b\\ nc-c & b+c+na & nb-b\\ nc-c & na-a & c+a=nb\end{vmatrix}=n\left(a+b+c\right)^3$

11 Evaluate the value of determinat $\Delta=\begin{vmatrix}1 & \sin x & 1\\ -\sin x & 1 & \sin x\\ -1 & -\sin x & 1\end{vmatrix}$.

Section D

12 Using elementary transformation, find the inverse of the matrix :

$$\begin{pmatrix} 1 & 3 & -2 \\ -3 & 0 & -1 \\ 2 & 1 & 0 \end{pmatrix}.$$

13 Find the product of $A = \begin{bmatrix} 2 & 3 & 4 \\ 5 & 4 & -6 \\ 3 & -2 & -2 \end{bmatrix}$, *and* $B = \begin{bmatrix} 20 & 2 & 34 \\ 8 & 16 & -32 \\ 22 & -13 & 7 \end{bmatrix}$ and use it to solve the system of equations $\frac{2}{x}+\frac{3}{y}+\frac{4}{z}=-3$; $\frac{5}{x}+\frac{4}{y}-\frac{6}{z}=4$ and $\frac{3}{x}-\frac{2}{y}-\frac{2}{z}=6$.

OR

If x , y , z are non-zero real numbers, then show that : $\begin{bmatrix} x & 0 & 0 \\ 0 & y & 0 \\ 0 & 0 & z \end{bmatrix}^{-1} = \begin{bmatrix} x^{-1} & 0 & 0 \\ 0 & y^{-1} & 0 \\ 0 & 0 & z^{-1} \end{bmatrix}$

14 Prove that : $\begin{vmatrix} \frac{a^2+b^2}{c} & c & c \\ a & \frac{b^2+c^2}{a} & a \\ b & b & \frac{c^2+a^2}{b} \end{vmatrix} = 4a^2b^2c^2$