

17914

13141

3 Hours / 100 Marks

Seat No.

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- Instructions* –
- (1) All Questions are *Compulsory*.
 - (2) Answer each next main Questions on a new page.
 - (3) Illustrate your answers with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Assume suitable data, if necessary.
 - (6) Use of Non-programmable Electronic Pocket Calculator is permissible.
 - (7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any TEN of the following :

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a) Find x if $\begin{vmatrix} x & 5 \\ 2 & x \end{vmatrix} = \begin{vmatrix} x & 3 \\ 2 & 3 \end{vmatrix}$

b) Find x and y if $\begin{vmatrix} 3 & -1 \\ 2 & 5 \end{vmatrix} \begin{vmatrix} -7 \\ 4 \end{vmatrix} = 2 \begin{vmatrix} x \\ y \end{vmatrix}$

c) Prove that $A + A^T = 0$ if $A = \begin{vmatrix} 0 & 4 & -3 \\ -4 & 0 & -2 \\ 3 & 2 & 0 \end{vmatrix}$ where 0 is

zero matrix of order 3.

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- d) If $A = \begin{vmatrix} 1 & -5 \\ 6 & 4 \end{vmatrix}$ and $B = \begin{vmatrix} 2 & 3 \\ 4 & -5 \end{vmatrix}$ find the matrix $AB - 2I$ where I is the unit matrix of order 2.
- e) Find A and B if $\frac{x+4}{x^2+x} = \frac{A}{x} + \frac{B}{x+1}$
- f) Prove that $\cos 2\theta = \frac{1 - \tan^2 \theta}{1 + \tan^2 \theta}$
- g) Prove that $\sin\left(\frac{\pi}{2} + \theta\right) = \cos \theta$
- h) Find $\sin \alpha$ if $\tan\left(\frac{\alpha}{2}\right) = \frac{1}{\sqrt{3}}$
- i) Find α and β if $\sin 80^\circ + \sin 50^\circ = 2\sin \alpha \cdot \cos \beta$
- j) Prove that $\sin^{-1}(-x) = -\sin^{-1}(x)$
- k) Find the distance from the point $(-2, 1)$ to the line $2x - 3y + 5 = 0$
- l) The coefficient of range for the data is 0.5. Find x if the data is 120, 100, 130, 150, x where x is the smallest observation in the data.

2. Attempt any **FOUR** of the following :

a) Using Cramer's rule to solve the equations :

$$x + 3y - z = 5; \quad 2x + y - 3z = 4; \quad y + z = 7 + x$$

b) If $A = \begin{bmatrix} 2 & 7 \\ 1 & 0 \end{bmatrix}$ find $A^2 - 6A + I$ where I is unit matrix.c) Given : $\left\{ 3 \begin{bmatrix} 4 & 1 & 3 \\ 0 & -1 & -3 \end{bmatrix} - 2 \begin{bmatrix} 3 & 2 & 4 \\ -6 & 1 & 3 \end{bmatrix} \right\} \begin{bmatrix} 1 \\ 3 \\ -2 \end{bmatrix} = \begin{bmatrix} x \\ y \end{bmatrix}$ Find x and y .d) Verify that $(AB)^T = B^T A^T$ if $A = \begin{bmatrix} 3 & 4 \\ -2 & 1 \\ 1 & 0 \end{bmatrix}$ and

$$B = \begin{bmatrix} -1 & 2 & -4 \\ 3 & 5 & -3 \end{bmatrix}$$

e) Resolve into Partial fraction : $\frac{2x+5}{3x^3-7x^2+4x}$ f) Resolve into Partial fraction : $\frac{x^2+1}{(x-2)(x^2+1)}$

3. Attempt any **FOUR** of the following :

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- a) Use matrix inversion method to solve the system of equations : $x + 3y + 2z = 6$; $3x - 2y + 5z = 5$; $2x - 3y + 6z = 7$
- b) Resolve into Partial fraction : $\frac{3x-5}{x^2(x-1)}$
- c) Resolve into partial fraction : $\frac{x^4}{x^3-1}$
- d) Prove that $\tan\left(\frac{\pi}{4} + \frac{A}{2}\right) = \sec A + \tan A$
- e) Prove that $2\cos\frac{\pi}{13} \cdot \cos\frac{9\pi}{13} + \cos\frac{3\pi}{13} + \cos\frac{5\pi}{13} = 0$
- f) Prove that $\cos^{-1}\left(\frac{4}{5}\right) + \tan^{-1}\left(\frac{3}{5}\right) = \tan^{-1}\left(\frac{27}{11}\right)$

4. Attempt any **FOUR** of the following :

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- a) Prove that $\sin(A - B) = \sin A \cdot \cos B - \cos A \cdot \sin B$
- b) Prove that $\sin 3A = 3\sin A - 4\sin^3 A$
- c) Prove that $\frac{\cos 2A + 2\cos 4A + \cos 6A}{\cos A + 2\cos 3A + \cos 5A} = \cos A - \sin A \cdot \tan 3A$

- d) In any $\triangle ABC$, prove that

$$\cos A + \cos B - \cos C = 4\cos\left(\frac{A}{2}\right)\cos\left(\frac{B}{2}\right)\sin\left(\frac{C}{2}\right) - 1$$

- e) Prove that $\sin^{-1}\left(\frac{3}{5}\right) + \sin^{-1}\left(\frac{8}{17}\right) = \sin^{-1}\left(\frac{77}{85}\right)$
- f) Prove that $\tan^{-1}\left(\frac{1}{8}\right) + \cot^{-1}(5) = \tan^{-1}\left(\frac{1}{3}\right)$

5. Attempt any **FOUR** of the following :

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- a) Find the value of $3\cos 2\theta + 2\sin 2\theta$ if $\tan \theta = \frac{2}{3}$.
- b) Prove that $\sin A \sin(60^\circ - A) \sin(60^\circ + A) = \frac{1}{4} \sin 3A$
- c) Prove that $\operatorname{cosec}^{-1}x + \sec^{-1}x = \frac{\pi}{2}$.
- d) If θ is the acute angle between the lines with slope m_1 and m_2 then $\tan \theta = \left| \frac{m_1 - m_2}{1 + m_1 m_2} \right|$. Prove it.
- e) Find the perpendicular distance between the parallel lines $5x - 12y + 1 = 0$ and $10x = 24y + 1$
- f) Find the equation of a straight line passing through the point $(2, -4)$ and the midpoint of the line segment joining the points $A(6, -1)$ and $B(5, 7)$.

6. Attempt any **FOUR** of the following :

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- a) If a line makes 'a' and 'b' as x-intercept and y-intercept respectively then prove that the equation of line can be

written as $\frac{x}{a} + \frac{y}{b} = 1$.

- b) Find the equation of straight line passing through the point of intersection of the lines $2x + 5y + 3 = 0$ and $x + 7y + 6 = 0$ and parallel to the line $4x + y - 7 = 0$.
- c) Find the range and coefficient of range for the data :

Maximum Temperature	25-26	27-28	29-30	31-32	33-34	35-36
No. of days	2	11	12	10	4	1

- d) Find the mean deviation from the mean for the following data :

Wt. in grams	10-15	15-20	20-25	25-30	30-35	35-40	40-45
No. of items	7	12	16	25	19	15	6

- e) Find the variance and coefficient of variance for the data :

Rainfall	70-80	80-90	90-100	100-110	110-120	120-130	130-140	140-150
No. of places	6	7	12	19	21	18	11	6

- f) In two factories A and B, engaged in the same area of the industry, the average weekly wages (in Rs.) and standard deviations are as follows :

Factory	Average wages	S.D.
A	34.5	5.0
B	28.5	4.5

Which of the factory is more consistent ?

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