1062

Code : 20SC01T

ENGINEERING MATHEMATICS

Time : 3 Hours]

[Max. Marks : 100

Instructions : (i) Answer **one** full question from each Section.

(ii) One full question carries **20** marks.

SECTION – I

1. (a) Define a square matrix. Write a 3 × 3 identity matrix. **4**

OR

If $A = \begin{bmatrix} 0 & 2 \\ 3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix}$ then find 3A − 2B.

(b) If $A = \begin{bmatrix} 1 & 0 & 2 \\ 1 & 3 & -1 \\ 2 & -1 & 0 \end{bmatrix}$ then find the A^{-1}. **6**

OR

Find the characteristic roots of $A = \begin{bmatrix} -2 & 1 \\ 3 & 0 \end{bmatrix}$.

(c) Applying Cramer's rule solve the system of linear equations $4x - 3y = 5$ and $3x + y = 7$. **5**

OR

A Book shop has 10 dozen Chemistry books, 8 dozen Physics books and 10 dozen Mathematics books. Their selling prices are ₹ 80, ₹ 60 and ₹ 40 each respectively. Find the total amount the book shop will receive from selling all the books using matrix algebra.

(d) If $A = \begin{bmatrix} 8 & 4 \\ 6 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 2 \\ 3 & 1 \end{bmatrix}$ then find AB and BA. Also check if AB = BA. 5

OR

For the given matrix $A = \begin{bmatrix} 2 & 1 \\ 4 & 0 \end{bmatrix}$ verify A. adj A = | A | I. Where 'I' is the unit matrix of the order 2.

SECTION – II

2. (a) Find the slope, x-intercept and y-intercept of the line $2x + 5y - 3 = 0$. 4

OR

Check whether the lines $2x + 3y + 1 = 0$ and $3x - 2y + 5 = 0$ are parallel or perpendicular to each other.

(b) Find the equation of straight line passing through the point $(3, -3)$ and inclined at 45° to the positive x-axis. 6

OR

Find the equation of the straight line passing through the point $(1, 4)$ and parallel to $5x - 7y + 2 = 0$.

(c) Using two point form of straight line, find the equation of line passing through $(2, -3)$ and $(1, 0)$. 5

OR

Find the equation of the straight line with y-intercept 5 units and parallel to the line joining the points $(2, 4)$ & $(1, 3)$.

(d) If $A(2, 1)$, $B(3, 2)$ & $C(x, y)$ are the vertices of a right angled triangle, then find the equation of the side AC. 5

OR

Find the angle between the lines $2x + 3y - 1 = 0$ and $x + y + 2 = 0$.

SECTION – III

3. (a) Convert 450° into radians and $\dfrac{5\pi}{3}$ into degrees. 4

OR

Find the value of tan 75 using relevant compound angle formula.

(b) Prove that $\cos 3A = 4 \cos^3 A - 3 \cos A$.   6

OR

Simplify $\sin^2 45 + \sin^2 135 + \sin^2 225 + \sin^2 315$ without using tables or calculator.

(c) Prove that $\cos(90 + \theta) + \cos(180 - \theta) + \sin(90 + \theta) + \sin(180 - \theta) = 0$.   5

OR

Show that $\cos 50 + \sin 20 - \cos 10 = 0$.

(d) If $\tan A = \dfrac{3}{4}$ and $\tan B = \dfrac{1}{5}$, find $\tan(A - B)$.   5

OR

Show that $\sin^2 A = \dfrac{1 - \cos 2A}{2}$

SECTION – IV

4. (a) Differentiate $x^2 + \sin x + 2 \log x + 2$ w.r.t. 'x'.   4

OR

If $y = (1 + x^2) \tan^{-1} x$, then find $\dfrac{dy}{dx}$.

(b) Find the maximum and minimum of $f(x) = x^3 - 6x^2 + 9x + 6$.   6

OR

A body is travelling according to the equation $S = t^3 - 5t^2 + 20t - 7$, find the Initial velocity and also find the velocity and acceleration when $t = 2$ units.

(c) If $y = \sin ax + \cos ax$, then prove that $\dfrac{d^2y}{dx^2} + a^2 y = 0$.   5

OR

Find the derivative of the function $y = \sin^{-1}(\cos x)$ w.r.t. 'x'.

(d) Find the equation of the tangent to the curve $y = 5x^2 - 2$ at the point $(1, 3)$.   5

OR

If $y = \dfrac{2 + \tan x}{2 - \tan x}$ then find $\dfrac{dy}{dx}$.

[Turn over

SECTION – V

5. (a) Find the integration of $\frac{3}{x} + \sec^2 x - e^{-2x} + 1$ w.r.t. dx.   4

OR

   Integrate $\frac{1 + \cos x}{\sin^2 x}$ with respect to x.

   (b) Evaluate $\int\limits_{0}^{\frac{\pi}{2}} \cos^2 x \, dx$.   6

OR

   Evaluate $\int\limits_{0}^{\frac{\pi}{4}} 2 \sin 3x \cdot \cos x \, dx$.

   (c) Using definite integrals, find the area bounded by the line $y = 5x + 7$, X-axis and the ordinates $x = 2$ and $x = 8$.   5

OR

   Find the volume of the solid generated by revolving the line $y = x + 2$ between the ordinates $x = 0$ and $x = 2$ about X-axis.

   (d) Using integration by parts evaluate the indefinite integral $\int x \cdot \log x \cdot dx$.   5

OR

   Evaluate $\int\limits_{0}^{1} (2x + 3)(x^2 + 3x + 4)^5 \, dx$.