2731

Code : 20SC01T

Register Number | | | | | | | | | | |

I Semester Diploma Examination, March/April-2022

ENGINEERING MATHEMATICS

Time : 3 Hours] **[Max. Marks : 100**

Instructions: (i) Answer **one** full question from each section.
(ii) Each section carries **20** marks.
(iii) Answer **all** sections.

SECTION – I

1. (a) If the determinant value of the matrix $\begin{bmatrix} 2 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & x \end{bmatrix} = 8$, then find the value of 'x'. **4**

OR

For the matrix $A = \begin{bmatrix} 4 & -3 \\ -5 & 2 \end{bmatrix}$, find adj (A).

(b) In a mesh-analysis formulation, the following equations are obtained
$4i_1 + 2i_2 = 4$; $i_1 + i_2 = 2$
obtain the currents i_1 and i_2 using Cramer's rule. **6**

OR

If $A = \begin{bmatrix} 1 & 2 \\ 1 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 1 \\ 2 & 1 \end{bmatrix}$, find the product matrix AB and hence find its inverse matrix, if it exists.

(c) Find the characteristics roots of the matrix $A = \begin{bmatrix} 2 & 3 \\ 0 & 4 \end{bmatrix}$. **5**

OR

A manufacturer produces 100 units of Product 'X', 200 units of Product 'Y', 800 units of Product 'Z' and sells in an open market. If the unit sale price of Product 'X' is ₹ 2, Product 'Y' is ₹ 4 and Product 'Z' is ₹ 10, find the total revenue earned by the seller with the help of product of two matrices.

(d) If $A = \begin{bmatrix} 2 & 1 & 4 \\ 4 & 1 & 5 \end{bmatrix}$, $B = \begin{bmatrix} 3 & -1 \\ 2 & 2 \\ 1 & 3 \end{bmatrix}$, then can we perform AB and BA ? If so, write the order of AB and BA. 5

OR

If for a matrix A, $A + I = 0$, where I is identity matrix of order 3×3 and 0 is Null matrix of order corresponding to matrix A, then find A.

SECTION – II

2. (a) Observe the following tabulations : 4

P		Q	
PI	Equation of a straight line in intercept form with x-intercept 2 units, y-intercept 3 units.	Ql	$2x + y = 1$
P2	The equation of a line whose inclination is 45° with positive x-axis and passing through origin.	Q2	$\frac{x}{2} + \frac{y}{3} = 1$
		Q3	$y = x$

Giving all relevant steps and solution, fill up the relevant answer in the below tabular column.

Ans. →

P1	P2

OR

What are the conditions for the lines, $y = m_1x + c_1$ and $y = m_2x + c_2$ to be

(i) Parallel

(ii) Perpendicular

Also, check whether, the lines $x - 2y = 4$ and $2x + y = 3$ are parallel or perpendicular.

(b) If a straight line is inclined at an angle of 135° with the positive direction of x-axis, then what is its slope ? Further, if the same line passes through the point (1, 2), find its equation. 6

OR

Find the equation of the straight line passing through two points (6, 2) and (8, 4).

(c) Find the equation of the lines parallel to the line joining the points A(–2, 5) and B(2, –5). 5

OR

Find the equation of the line passing through the point (1, 3) and perpendicular to the line $2x + y = 1$.

(d) If the x-intercept of a line is 2 units and y-intercept of the line is twice the x-intercept, find the equation of a line. 5

OR

Find the tangent of the angle between the lines $x + 3y = 1$ and $3x - 5y = 2$.

SECTION – III

3. (a) Express 225° as a allied angle and hence find the value of sin 225°. 4

OR

Find the value of cos 15° using relevant compound angle.

(b) If $\tan A = \frac{1}{3}$ and $\tan B = \frac{1}{2}$, find tan (A + B). 6

OR

Show that $\sin 40° + \sin 20° - \cos 10° = 0$.

(c) Simplify : $\frac{\cos(360° - A)\tan(360° + A)}{\cot(270° - A)\sin(90° + A)}$ 5

OR

Find the value of 'θ' lying between 0 and 2π which satisfy the equation $2\cos\theta - 1 = 0$.

(d) Prove that : $\sin 20° \cdot \sin 40° \cdot \sin 80° = \frac{\sqrt{3}}{8}$. 5

OR

Show that $\cos 2\theta = 2\cos^2\theta - 1$.

SECTION – IV

4. (a) If $y = \frac{x+1}{x-1}$, then find the first derivative of 'y' with respect to 'x' at $x = 2$. 4

OR

If $y = x^4 + 4x^3$, find $\frac{dy}{dx}$ at $x = 1$.

(b) If $y = \log(\sin(x^3))$, obtain $\frac{dy}{dx}$ using Chain rule of differentiation. 6

OR

If $y = t^3 + 3t^2 + 6t + 1$ represents the chemical disintegration equation with respect to time 't', then calculate the rate of change of 'y' with respect to time 't', when $t = 2$ units.

(c) When brakes are applied to a moving car, the car travels a distance of 'S' feet in 't' seconds given by, $S = 10t - 20t^2$. When does the car stop ? Also, find the acceleration of the car. 5

OR

If $S = at^3 + bt$, find 'a' and 'b' given that at $t = 3$, the velocity is zero and acceleration is 14 units.

(d) Obtain the maximum and minimum values of the function
$f(x) = 2x^3 - 21x^2 + 36x - 20$. 5

OR

A moving particle traces the path given by the curve $y = x^3 + x^2$. What could be the equation of the tangent to the curve at a point (1, 2) ?

SECTION – V

5. (a) Find the integration of $x^3 + \sin x + e^x + 2$ w.r.t. x. 4

OR

Using the rule of integration by parts, evaluate $\int x \cdot \sin x \cdot dx$

(b) Evaluate : $\int \cos 7x \cdot \cos 3x \cdot dx$ 6

OR

Evaluate : $\int \sin^3 x \cdot dx$

(c) If the area bounded by the curve $y = x$ between the ordinates $x = 2$ and $x = k$ is 6 sq. units, then find the value of 'k'. 5

OR

As a definite integral, find the value of $\int_0^1 \frac{(\tan^{-1} x)^2}{1+x^2} \cdot dx$.

(d) Calculate the area converging due to radioactive decay of an element governed by the equation $y = x^3 + 1$ in between the ordinates $x = 0$ to $x = 1$, bounded by X-axis. 5

OR

Find the volume of the solid generated by the revolution of the curve $y^2 = x^3 + 5x$ between the ordinates $x = 2$ & $x = 4$ about X-axis.