53

Reg.No.:												

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 20016

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – JAN. / FEB. 2026
First Semester
Computer Science and Engineering
U23MA101 – MATRICES AND CALCULUS
(Common to All)
(Regulation 2023)

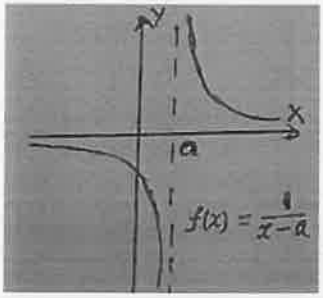
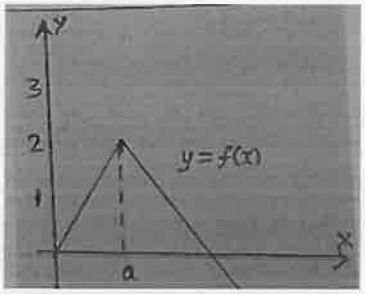
Time : Three Hours | Maximum : 100 Marks

Answer ALL the questions

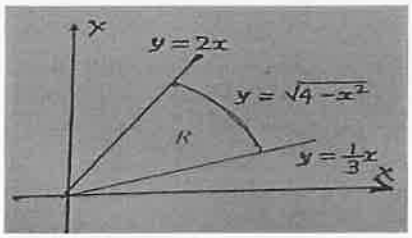
Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	If 1 and 2 are the eigenvalues of a 2×2 matrix A, what are the eigenvalues of A^2 and A^{-1} ?	2	K2	CO1
2.	Two eigenvalues of the matrix $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ are equal and are 1/5 times to the third. Find the eigenvalues of A.	2	K2	CO1
3.	Discuss the limits of the function at $x = a$ for the following graphs.  	2	K2	CO2
4.	Find the two x-intercepts of the function $f(x) = x^2 - 5x + 4$ and confirm that $f'(c) = 0$ at some point "c" between those intercepts.	2	K1	CO2
5.	Given that $u = x^2 + 1$, $v = y^2 - 2$. Find $\frac{\partial(u,v)}{\partial(x,y)}$.	2	K1	CO3
6.	Find $\frac{dy}{dx}$, if $x^2 + y^2 = 3axy$.	2	K1	CO3
7.	Evaluate $\int log_e x dx$.	2	K1	CO4
8.	Calculate $\int x cosx dx$.	2	K1	CO4

9.	Sketch roughly the region of integration for $\int_0^1 \int_{x^2}^{x} f(x,y)dydx$.	2	K2	CO5
10.	Express $\int_R \int f(r,\theta)drd\theta$ of the region R given in the figure below as a polar integral.	2	K2	CO5



PART – B

(5 x 16 = 80 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	Use Cayley-Hamilton theorem to find the value of the matrix given by $A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 2A + I$ Where $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$.	16	K3	CO1
		(OR)			
	b)	Reduce the following quadratic form to canonical form by orthogonal transformation. Also find the rank, index, signature and nature of the quadratic form $Q = 2x_1^2 + 2x_2^2 + 2x_3^2 - 2x_1x_2 - 2x_3x_2 + 2x_1x_3$	16	K3	CO1
12.	a)	i. Find $\frac{dy}{dx}$, if $y = \frac{sinxsecx}{1+xtanx}$	8	K4	CO2
		ii. Use both first and second derivative tests to show that $f(x) = 3x^2 - 6x + 1$ has a relative maximum.	8	K4	
		(OR)			
	b)	i. If $f(x) = 2x^3 + 3x^2 - 36x$, find the intervals on which the function increasing or decreasing, the local maximum and minimum values.	8	K4	CO2
		ii. Verify that the hypothesis of the Mean value theorem are satisfied on the given interval and find all values of "c" in that interval that satisfies the conclusion of the theorem for the function $f(x) = x^3 + x - 4; [-1,2]$.	8	K4	
13.	a)	i. Expand $f(x,y) = sinx\ siny$ about the origin using Taylor's series (cubic approximation).	8	K4	CO3
		ii. Examine $f(x,y) = x^3 + y^3 - 12x - 3y + 20$ for its extreme values.	8	K3	
		(OR)			

	b)	i.	The temperature at a point (x,y) on a metal plate is $T(x,y) = 4x^2 - 4xy + y^2$. An ant on the plate walks around the circle of radius 5 centered at the origin. What are the highest and lowest temperatures encountered by the ant?	8	K4	CO3
		ii.	If $u = sin^{-1}\left(\frac{x^3-y^3}{x+y}\right)$, then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 2tanu.$	8	K3	
14.	a)	i.	Evaluate $\int xtan^{-1}xdx.$	8	K3	CO4
		ii.	Find $\int sin^n dx$ using reduction formula and evaluate $\int_0^{\pi/2} sin^n xdx.$	8	K3	
			(OR)			
	b)	i.	Using integration by parts, find $\int (logx)^3 dx$ by.	8	K3	CO4
		ii.	Evaluate $\int_{-\infty}^{\infty} xe^{-x^2} dx.$	8	K3	
15.	a)	i.	Write an equivalent integral of $\int_0^2 \int_{y/2}^1 e^{x^2}\, dxdy$, with the order of integration reversed and evaluate the same.	8	K3	CO5
		ii.	Using triple integration, find the volume of the tetrahedron bounded by the lines $x = 0, y = 0, z = 0$ and $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1.$	8	K3	
			(OR)			
	b)	i.	Sketch the region of integration and find the area of the region bounded in the first quadrant by $y = x^2$, $y = 5$ and $x = 0$ using double integration.	8	K3	CO5
		ii.	Find the volume of the solid that is bounded above by the cylinder $z = x^2$ and below by the region enclosed by the parabola $y = 2 - x^2$ and the line $y = x$ in the $xy -$ plane.	8	K3	