Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV /DEC 2024

First Semester

UMAT24102/MA3151 - Matrices and Calculus

(Common to all Branches)

Common to Regulations – 2021 & 2024

Duration : 3 Hrs *Maximum : 100 Marks*

*PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)*

Q.No	*Questions*	*BLT*	*CO*	*Marks*
1.	State any two properties of eigen values of a matrix.	RE	1	2
2.	Discuss the nature of the quadratic form $2x^2 + 3y^2 + 2z^2 + 2xy$.	UN	1	2
3.	Find $\frac{dy}{dx}$ if $y = \frac{3ax}{1+x^2}$.	RE	2	2
4.	Obtain $\frac{dy}{dx}$ from the first principles when $y = \sqrt{1+3x}$.	RE	2	2
5.	Find $\frac{dy}{dx}$ when $y\,sinx = x\,cosy$.	RE	3	2
6.	If $x = r\,cos\theta, y = r\,sin\theta$ find $\frac{\partial(x,y)}{\partial(r,\theta)}$.	RE	3	2
7.	Evaluate $\int_0^{\frac{\pi}{2}}(cosx + sinx)dx$.	UN	4	2
8.	Evaluate $\int_0^{\infty} e^{-3x} sin4x\,dx$.	UN	4	2
9.	Calculate the area of a circle of radius 'a' by double integration in polar co-ordinates.	UN	5	2
10.	Evaluate $\int_0^2 \int_0^1 4xy\,dx$.	UN	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)*

Q.No		*Questions*	*BLT*	*CO*	*Marks*
11.	a	Verify Cayley Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$ and hence find A^{-1}.	AP	1	16
		Or			
	b	Reduce the quadratic form $x_1^2 + 5x_2^2 + x_3^2 + 2x_1x_2 + 2x_2x_3 + 6x_3x_1$ into canonical form by orthogonal reduction.	AP	1	16
12.	a i	A function $f(x)$ is defined as follows. Discuss the continuity of $f(x)$ at $x = 1$ and $x = 2$. $$f(x) = \begin{cases} x, & x < 1 \\ 2 - x, & 1 \le x \le 2 \\ -2 + 3x - x^2, & x > 2 \end{cases}$$	UN	2	8
	ii	Examine the continuity and differentiability of $f(x)$ defined below at $x = 2$. $$f(x) = \begin{cases} 1 + x, & x \le 2 \\ 5 - x, & x > 2 \end{cases}$$	UN	2	8
		Or			

	b	i	Find $\frac{dy}{dx}$ for the relation $x^y + y^x = c$, where c is a constant.	UN	2	8
		ii	Find the maximum and minimum values of $y = \frac{x^3-3x^2+4}{x^2}$.	UN	2	8
13.	a	i	Expand $e^x cosy$ in powers of x and y as far as the terms of the third degree.	AP	3	8
		ii	If z is a function of x and y and u and v such that $u = lx + my$ and $v = ly - mx$. Show that $\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial y^2} = (l^2 + m^2)\frac{\partial^2 z}{\partial u^2} + \frac{\partial^2 z}{\partial v^2}$.	AP	3	8
			Or			
	b	i	Identify the saddle point and the extremum points of $f(x, y) = x^4 - y^4 - 2x^2 + 2y^2$.	AP	3	8
		ii	A rectangular box open at the top is to have a volume of 32cc. Find the dimension of the box, that requires the least material for its construction.	AP	3	8
14.	a	i	By using the substitution $x = sin\theta$ integrate $\int \frac{dx}{(1-x)\sqrt{(1-x^2)}}$.	UN	4	8
		ii	Use integration by parts to find $\int x^3 e^{2x} dx$.	UN	4	8
			Or			
	b	i	Integrate the irrational function $\int \frac{dx}{\sqrt{2x^3-7x+5}}$.	UN	4	8
		ii	Integrate by using partial fraction $\int \frac{x^2+x+1}{(x-1)(x-2)^2} dx$.	UN	4	8
15.	a		Change the order of integration and evaluate $\int_0^1 \int_0^x dy\, dx$.	AP	5	16
			Or			
	b		Find the volume of the sphere $x^2 + y^2 + z^2 = a^2$ by using triple integration.	AP	5	16