Register No : ___________________

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

UG/PG DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL/MAY 2026

First Semester

MA3151 / UMAT24102 – MATRICES AND CALCULUS

(*Common to all Branches)*

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.	If A= $\begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$ then find eigen values of A^{-1}.	L3	1	2
2.	Define Cayley-Hamilton Theorem.	L1	1	2
3.	Find the domain of the function $f(x) = \frac{2x^3-5}{x^2+x-6}$.	L2	2	2
4.	Evaluate $\lim_{x\to 1} \frac{x^2-4x}{x^2-3x-4}$.	L2	2	2
5.	If $z = x^2 + y^2$ & $x = t^2, y = 2at$ $find$ $\frac{dz}{dt}$.	L2	3	2
6.	If $u = \frac{y^2}{x}, v = \frac{x^2}{y}$ find $\frac{\partial(u,v)}{\partial(x,y)}$.	L3	3	2
7.	Determine whether the following integral is convergent or divergent $\int_0^\infty e^x\,dx$.	L1	4	2
8.	Find the value of $\int_0^{\frac{\pi}{2}} sin^6x\,dx$.	L2	4	2
9.	Evaluate $\int_0^1\int_0^2\int_0^3 xyz\,dx\,dy\,dz$.	L3	5	2
10.	Evaluate $\int_1^2\int_2^5 xy\,dx\,dy$.	L3	5	2

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

Q.No			*Questions*	*BLT*	*CO*	*Marks*
11.	a	i	Find the Eigen values and Eigen vectors of the matrix A= $\begin{bmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{bmatrix}$	L3	1	8
		ii	Verify Cayley - Hamilton theorem and find the inverse of the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{bmatrix}$	L3	1	8
			Or			
	b		Reduce the quadratic form $6x^2 + 3y^2 + 3z^2 - 4xy - 2yz + 4xz$ into a canonical form through orthogonal transformation.	L3	1	16

12.	a	i	Find $\frac{dy}{dx}$ if (i)y = $x^2e^{2x}(x^2+1)^4$ (ii) $x^y = y^x$.	L3	2	8
		ii	If $y = \mathrm{acos}(logx) + bsin(logx)$, prove that $x^2y_{n+2} + (2n+1)xy_{n+1} + (n^2+1)y_n = 0$.	L3	2	8
			Or			
	b	i	Find the maximum and minimum value of the equation $f(x) = x^4 - 8x^2 + 16$.	L3	2	8
		ii	If $f(x) = xe^x$ then find $f'(x)$ and also find n[th] derivative of $f^{(n)}(x)$.	L3	2	8
13.	a	i	Give the transformations $u = e^x \cos y$ &$v = e^x siny$ and that f is a function of u and v and also of x and y show that $\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} = (u^2+v^2)(\frac{\partial^2 f}{\partial u^2} + \frac{\partial^2 f}{\partial v^2})$.	L3	3	8
		ii	Expand $e^x \log(1+y)$ in powers of x and y up to third degree term.	L3	3	8
			Or			
	b	i	A rectangular box open at the top is to have volume of 32 cubic feet. Find the dimensions of the box requiring least material for its construction.	L3	3	8
		ii	If $u = sin^{-1}[\frac{x^3-y^3}{x+y}]$ then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 2\tan u$.	L3	3	8
14.	a	i	Evaluate $\int \frac{3x+1}{(x-1)^2(x+3)}\, dx$ by using partial fraction method.	L2	4	8
		ii	Evaluate$\int x^2e^x dx$ by using integration by parts.	L2	4	8
			Or			
	b	i	Evaluate $\int \frac{\sqrt{9-x^2}}{x^2} dx$.	L3	4	8
		ii	Evaluate $\int \frac{x+\sin x}{1+\cos x}\, dx$.	L3	4	8
15.	a	i	Change the order of integration in $\int_0^{4a}\int_{x^2/4a}^{2\sqrt{ax}} xy$and hence evaluate it.	L3	5	8
		ii	Find the area of the region R enclosed by the parabola $y = x^2$ and $y = x + 2$.	L3	5	8
			Or			
	b	i	Evaluate $\int_0^{2a}\int_0^{x}\int_y^{x} xyz\, dxdydz$.	L3	5	8
		ii	Evaluate $\int_0^a\int_y^a \left(\frac{x}{x^2+y^2}\right) dxdy$ by changing Cartesian into polar coordinates.	L3	5	8