Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL-MAY 2025

Fourth Semester

Chemical Engineering

MA3451 – Transform Techniques

Regulations – 2021

Duration : 3 Hrs ***Maximum : 100 Marks***

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

Q.No	*Questions*	*BLT*	*CO*	*Marks*
1.	Find the values of a,b,c such that the following vector is irrotational. $\vec{F} = (x+2y+az)\vec{i} + (bx-3y-z)\vec{j} + (4x+cy+2z)\vec{k}$.	L2	1	2
2.	Find the unit normal vector to the surface $x^2 + y^2 = z$ at $(1,-2,5)$.	L2	1	2
3.	State Dirichlet's conditions.	L1	2	2
4.	State Parseval's identity in Fourier series.	L1	2	2
5.	State Fourier integral theorem.	L1	3	2
6.	If the Fourier Transform of f(x) is F(s) then find the Fourier Transform of $f(x)\cos ax$.	L2	3	2
7.	State change of scale property.	L1	4	2
8.	Find $L\left(e^{-at}\cos bt\right)$.	L2	4	2
9.	State Final value theorem.	L1	5	2
10.	Find the z-transform of a^n.	L2	5	2

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

Q.No			*Questions*	*BLT*	*CO*	*Marks*
11.	a		Verify the Gauss divergence theorem for $\vec{F} = x^3\vec{i} + y^3\vec{j} + z^3\vec{k}$ taken over the cube bounded by x = 0, x = a, y = 0, y = a, z = 0 and z = a.	L3	1	16
			Or			
	b		Verify Stoke's theorem for $\vec{F} = (y-z+2)\vec{i} + (yz+4)\vec{j} - (xz)\vec{k}$ where S is the open surface of the cube x = 0, x = 2, y = 0,y = 2,z= 0 and z = 2 above the xy-plane.	L3	1	16
12.	a	i	Expand the Fourier series for $f(x) = x(2\pi - x)$ in $(0,2\pi)$.	L3	2	10
		ii	Expand the function $f(x) = x, 0 < x < \pi$ in the Fourier sine series.	L3	2	6
			Or			
	b	i	Obtain the function $f(x) = \sin x, 0 < x < \pi$ in Fourier cosine series.	L3	2	6
		ii	Obtain the first two harmonics in the Fourier cosine series of $y = f(x)$ using the following table.	L2	2	10

x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	2π
y	1.8	0.3	0.5	2.16	1.3	1.76	1.8

13. a i Find the Fourier cosine transform of e^{-ax}. Hence find Fourier sine transform of xe^{-ax}. L3 3 8

i i Verify Convolution theorem for Fourier transform, if $f(x)=g(x)=e^{-x^2}$. L3 3 8

Or

b Obtain the Fourier transform of $f(x)=\begin{cases}1-|x| & if\ |x|<1\\ 0 & if\ |x|>1\end{cases}$ hence deduce that $\int_0^\infty\left(\frac{\sin t}{t}\right)^2 dt=\frac{\pi}{2}$ using Parseval's identity find the value of $\int_0^\infty\left(\frac{\sin t}{t}\right)^4 dt$. L3 3 16

14. a i Find $L^{-1}\left(\frac{1}{(s+a)(s+b)}\right)$ using Convolution theorem. L3 4 8

i i Find $L^{-1}\left(\frac{10s+1}{(s-2)^2(s+1)}\right)$. L3 4 8

Or

b Find the Laplace transform of $f(t)=\begin{cases}t, & 0<t<a\\ 2a-t, & a<t<2a\end{cases}$ and $f(t+2a)=f(t)$ L3 4 16

15. a i Find $Z(\cos n\theta)$ and $Z(\sin n\theta)$. L3 5 8

i i Find $Z^{-1}\left(\frac{4z^3}{(2z-1)^2(z-1)}\right)$. L3 5 8

Or

b i Using convolution theorem, find the inverse z-transform of $\frac{z^2}{(z-2)(z-3)}$. L3 5 8

i i Using z-transform, solve $y_{n+2}+4y_{n+1}+2y_n=3^n$ given that $y_0=0, y_1=1$. L2 5 8