Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

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

Third Semester

Mechanical Engineering

MA3351 Transforms and Partial Differential Equations

(Common to Civil Engineering & Biomedical Engineering)

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 PDE from $z = f(x^2 + y^2)$.	AP	1	2
2.	Solve $(D - 2D' + 3)(D + D' - 2)z = 0$.	AP	1	2
3.	Define Dirichlet's conditions for a given function to expand in Fourier series.	RE	2	2
4.	If $f(x) = x^2$ in $(-\pi, \pi)$, find RMS value of $f(x)$.	AP	2	2
5.	Classify the PDE $3u_{xx} + 4u_{xy} + 3u_y - 2u_x = 0$.	AP	3	2
6.	Recall the possible solutions of one-dimensional wave equation.	RE	3	2
7.	Define Fourier Transform pair.	RE	4	2
8.	Find the Fourier Cosine Transform of e^{-x}.	AP	4	2
9.	Define the initial value theorem and final value theorem.	RE	5	2
10.	Find the difference equation from$y_n = (a + nb)2^n$.	AP	5	2

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

Q.No		*Questions*	*BLT*	*CO*	*Marks*
11.	a	Solve$z = px + qy + \sqrt{1 + p^2 + q^2}$.	AP	1	16
		Or			
	b i	Solve $(mz - ny)p + (nx - lz)q = ly - mx$.	AP	1	8
	ii	Solve $\left(D^2 - 3DD' + 2D'^2\right)z = sinxcosy$.	AP	1	8

12.	a	i	Find $f(x) = (\pi - x)^2$ as a Fourier series of period 2π in the interval $0 < x < 2\pi$.	AP	2	8
		ii	Find the Fourier series to represent x^2 from $x = -l$ to $x = l$.	AP	2	8
			Or			
	b	i	Find the half range sine series for $f(x) = x(\pi - x)$ in $(0, \pi)$.	AP	2	8
		ii	Find the first three harmonic of the Fourier series of $f(x)$ given by the following table.	AP	2	8

X	0	1	2	3	4	5
y	9	18	24	28	26	20

13.	a	A tightly stretched string with fixed end points $x = 0$ and $x = l$ is initially at rest in its equilibrium position. If it is set vibrating giving each point a velocity $\lambda x(l - x)$. Identify the displacement of $y(x, t)$.	AP	3	16
		Or			
	b	A rod of length 20 cm has its ends A and B kept at temperature 30°c and 90°c respectively until steady state conditions prevail. If the temperature at each end is then suddenly reduced to 0°c and maintained so, Identify the temperature distribution at a distance from A at time t.	AP	3	16
14.	a	Show that the Fourier Transform of $f(x) = \begin{cases} a^2 - x^2, & \lvert x \rvert \le a \\ 0, & otherwise \end{cases}$ is $2\sqrt{\frac{2}{\pi}}\left(\frac{\sin as - as\cos as}{s^3}\right)$. Hence deduce that $\int_0^\infty \frac{\sin t - t\cos t}{t^3} dt = \frac{\pi}{4}$ .using Parseval's Identity, Prove that $\int_0^\infty \left(\frac{\sin t - t\cos t}{t^3}\right)^2 dt = \frac{\pi}{15}$.	EV	4	16
		Or			
	b	i	Find the Fourier cosine transform of e^{-ax}. Hence prove that $\int_0^\infty \frac{dx}{(x^2 + a^2)(x^2 + b^2)} = \frac{\pi}{2ab(a+b)}$.	EV	4	8
		ii	Prove that $f(x) = e^{\frac{-x^2}{2}}$ is self-reciprocal with respect to Fourier transform.	EV	4	8

15.	a	i	Apply the Z-transform, Find $z\left[\frac{1}{(n+1)(n+2)}\right]$.	AP	5	8
		ii	Apply Partial fraction method, find the inverse Z- transform of $\frac{z^2}{(z-1)^2(z-2)}$.	AP	5	8
			Or			
	b	i	Apply Convolution theorem, evaluate $z^{-1}\left[\frac{8z^2}{(2z-1)(4z-1)}\right]$.	AP	5	8
		ii	Apply Z -transform, solve $y_{n+2}-4y_n=0$, given that $y_0=2$, $y_1=-1$.	AP	5	8