

THE KAVERY ENGINEERING COLLEGE*(An Autonomous Institution)***B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL-MAY 2025***Third Semester**Biomedical Engineering***MA3351 – Transforms and Partial Differential Equations***Common to Civil Engineering & Mechanical 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.	Form a partial differential equation by eliminating arbitrary constants a and b from $z = ax + by$.	L3	1	2
2.	Solve $px + qy = z$.	L3	1	2
3.	Define Dirichlet's condition in Fourier series.	L1	2	2
4.	Determine the value of b_n in the expansion of x^2 as a Fourier series in $(-\pi, \pi)$.	L1	2	2
5.	Classify the partial differential equation $4U_{xx} + 4U_{xy} + U_{yy} + 2U_x - U_y = 0$	L1	3	2
6.	In the wave equation $U_{tt} = a^2 U_{xx}$, What does the constant a^2 stand for?	L1	3	2
7.	State Fourier integral theorem.	L1	4	2
8.	State Parseval's identity on Fourier Transform.	L1	4	2
9.	Obtain Z-transform of $\frac{1}{n}$.	L1	5	2
10.	Find $Z^{-1} \left[\frac{z}{z+3} \right]$.	L2	5	2

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

Q.No	Questions	BLT	CO	Marks
11. a	Solve $(3z - 4y)p + (4x - 2z)q = 2y - 3x$.	L3	1	16
	Or			
b	Solve $(D^2 + DD' - 6D'^2)z = x^2y + e^{3x+y}$.	L3	1	16
12. a i	Expand $f(x) = x^2$ as a fourier series in $0 < x < 2\pi$.	L3	2	8
	ii Obtain the half range fourier sine series for $f(x) = x$ in $(0, \pi)$.	L3	2	8
	Or			
b	Compute fourier series upto second harmonic for $y = f(x)$ in $(0, 2\pi)$ defined by the table of values given below.	L3	2	16

x	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$
y	1	1.4	1.9	1.7	1.5	1.2

13. a A string is stretched and fastened to two points $x = 0$ and $x = l$ apart. Motion is started by displacing the string into the form $y = k(lx - x^2)$ from which it is released at time $t = 0$. Find the displacement of any point on the string at a distance of x from one end at time t . L3 3 16

Or

- b A rod 30 cm long has its ends A and B kept at 20° and 80° respectively until steady state conditions prevail the temperature at each end is then suddenly reduced to $0^\circ C$ and kept so. Find the resulting temperature function $u(x, t)$ taking $x = 0$ at A. L3 3 16

14. a i Find the fourier sine transform of $\frac{1}{x}$. L3 4 8

- ii Obtain fourier cosine transform of $f(x) = \begin{cases} 1, & \text{for } 0 < x < a \\ 0, & \text{for } x > a \end{cases}$ L3 4 8

Or

- b Determine fourier transform of $\begin{cases} 1 - x^2 & \text{if } |x| < 1 \\ 0 & \text{if } |x| > 1 \end{cases}$ L3 4 16

Hence show that $\int_0^\infty \frac{\sin x - x \cos x}{x^3} \cos \frac{x}{2} dx = \frac{3\pi}{16}$ and also show that $\int_0^\infty \frac{(x \cos x - \sin x)^2}{x^6} dx = \frac{\pi}{15}$.

15. a i Using partial fraction method find $Z^{-1} \left[\frac{10z}{(z-1)(z-2)} \right]$. L2 5 8

- ii Find $Z^{-1} \left[\frac{z^2}{(z-a)^2} \right]$ using convolution theorem. L2 5 8

Or

- b Solve $y_{n+1} - 2y_n = 0$ given $y_0 = 3$. L2 5 16