SNS College of Technology, Coimbatore-35.
(An Autonomous Institution)
Internal Assessment -I
Academic Year 2023-2024 (Odd)
Third Semester
19MAT201– TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS
(REGULATION 2019)
Answer Key

B

Time: 1.30 Hours **Maximum Marks: 50**

		PART – A (5 x 2 = 10 MARKS) ANSWER ALL QUESTIONS	Blooms
1.		$a_0 = \frac{\pi}{2}$	(App)
2.		The process of find the Fourier series for the function given by the numerical value is known as Harmonic analysis	(Rem)
3.		$f(x) = \frac{\pi^2}{\sqrt{5}}$	(Und)
4.		$F(s) = \sqrt{\frac{2}{\pi}} \left(\frac{\sin as}{s}\right)$	(App)
5.		$\int_{-\infty}^{\infty} \lvert f(s)\rvert^2 ds = \int_{-\infty}^{\infty} \lvert f(x)\rvert^2 dx$	(Rem)
		PART –B (13+13+14 = 40 MARKS) ANSWER ALL QUESTIONS	
6.	a) i)	$a_0 = \frac{2}{3} l^2$, $a_n = \frac{4l^2}{n^2\pi^2}$, $b_n = 0$ $f(x) = \frac{l^2}{3} + \frac{4l^2}{\pi^2} \sum_{n=1}^{\infty} \frac{1}{n^2} \cos \frac{n\pi x}{l}$	(App) (7)
	ii)	$b_n = \begin{cases} 0 & n \text{ is even} \\ \frac{8}{\pi n^3} & n \text{ is odd} \end{cases}$ $f(x) = \frac{8}{\pi}\left[\frac{1}{1^3}\sin x + \frac{1}{3^3}\sin 3x + \frac{1}{5^3}\sin 5x\right]$	(App) (6)

	b)	$F(s) = \frac{2}{\sqrt{2\pi}}\left(\frac{1-\cos as}{s^2}\right)$ Using Fourier Inverse formula sub $x=0$, $a=2$ we get $\int_0^\infty \left(\frac{\sin t}{t}\right)^2 dt = \pi/2$ Apply Parseval's identity $\int_0^\infty \left(\frac{\sin t}{t}\right)^4 dt = \frac{\pi}{3}$	(App) (13)
7.	a)	$a_0 = \frac{2\pi^2}{3}$ $a_n = \frac{4}{n^2}(-1)^n$ $b_n = 0$ $f(x) = \frac{\pi^2}{3} + 4\sum_{n=1}^{\infty} \frac{(-1)^n}{n^2}\cos nx$ put $x=0 \Rightarrow \frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\dots = \frac{\pi^2}{12}$ Put $x=\pi \Rightarrow \frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\dots = \pi^2/6$ Adding above two $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\dots = \frac{\pi^2}{8}$	(App) (13)
	b) i)	$b_n = \frac{8}{n^2\pi^2}\sin\left(\frac{n\pi}{2}\right)$ $f(x) = \sum_{n=1}^{\infty} \frac{8}{n^2\pi^2}\sin\left(\frac{n\pi}{2}\right)\sin\left(\frac{n\pi x}{2}\right)$	(App) (7)
	ii)	$b_n = \frac{-2(-1)^n}{n}$ $f(x) = \sum_{n=1}^{\infty} \frac{(-2)(-1)^n}{n}\sin nx$	(App) (6)
8.	a)	$F(s) = \frac{4}{\sqrt{2\pi}}\left[\frac{-as\cos sa + \sin sa}{s^3}\right]$ Apply Fourier Inverse transform & deduce $\int_0^\infty \left(\frac{\sin t - t\cos t}{t^3}\right)dt = \frac{\pi}{4}$ Using Parseval's identity $\int_0^\infty \left(\frac{\sin t}{t}\right)^2 dt = \frac{\pi}{2}$	(App) (14)
	b)	$a_0 = 2\left(\frac{\Sigma y}{N}\right) = 2\left(\frac{8.7}{6}\right) = 2.9$ $b_1 = 2\left(\frac{\Sigma y\sin x}{N}\right)$ $a_1 = 2\left(\frac{\Sigma y\cos x}{N}\right) = 2\left(\frac{-1.1}{6}\right)$ $= 2\left(\frac{0.5796}{6}\right) = 0.17$ $= -0.37$ $= 0.17$ $b_2 = -0.06$ $f(x) = 1.45 - 0.37\cos x - 0.1\cos 2x + 0.17\sin x - 0.06\sin 2x$	(Ana) (14)