St. JOSEPH'S INSTITUTE OF TECHNOLOGY, CHENNAI-119
DEPARTMENT OF MATHEMATICS
SUB NAME&CODE: MA6351 – TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS
ASSIGNMENT – I UNIT II – FOURIER SERIES
SEMESTER : III (COMMON TO ALL BRANCHES) YEAR: II

PART - A

1.	Write the sufficient conditions for a function *f(x)* to be expanded as a Fourier series in given interval.
2.	Find the Fourier constant b_n for $x \sin x$ in $-\pi < x < \pi$, when expressed as a Fourier series.
3.	Find the value of the Fourier series for $f(x) = \begin{cases} x, & 0 \le x < 1 \\ 2, & 1 < x < 2 \end{cases}$ at $x=1$.
4.	If $f(x) = e^x$ in $-\pi < x < \pi$, find a_n.
5.	If $x^2 = \frac{\pi^2}{3} + 4\sum_{n=1}^{\infty} \frac{(-1)^n}{n^2} \cos nx$, deduce that $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \ldots = \frac{\pi^2}{6}$ in $[-\pi, \pi]$
6.	Find the constant term of the Fourier series for the function $f(x) = x^2$, $-\pi < x < \pi$
7.	If $f(x) = x^2 + x$ is expressed as a Fourier series in the interval *(-2,2)* to which value this series converges at $x = 2$?
8.	Find the root mean square value of the function $f(x) = x$ in $(0,l)$

PART – B

1.	a)	Find the Fourier series $f(x) = \left(\frac{\pi - x}{2}\right)^2$ in $0 < x < 2\pi$. Hence show that (i) $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \ldots\ldots\ldots\ldots = \frac{\pi^2}{6}$. (ii) $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots = \frac{\pi^2}{12}$.
	b)	Find the complex form of the Fourier series of $f(x) = \cos ax$ in $(-\pi, \pi)$, where *a* is not an integer.
2.	a)	Obtain the Fourier series for *f(x)* of period *2l* and defined as follows $f(x) = \begin{cases} l - x, & 0 < x \le l \\ 0, & l \le x < 2l \end{cases}$. Hence deduce that (i) $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots = \frac{\pi}{4}$ (ii) $1 + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \ldots = \frac{\pi^2}{8}$
	b)	Find the half range Fourier sine series for $f(x) = x(\pi - x)$ in the interval $(0, \pi)$ and deduce that $\frac{1}{1^3} + \frac{1}{3^3} + \frac{1}{5^3} + \frac{1}{7^3} + \ldots\infty$
3.	a)	Find the Fourier series for $f(x) = \lvert x \rvert$ in $-\pi < x < \pi$ and deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots\ldots\ldots = \frac{\pi^2}{8}$.
	b)	Find the first three harmonic of the Fourier series of f (x) given by x: 0, 1, 2, 3, 4, 5 f (x): 9, 18, 24, 28, 26, 20
4.	a)	Find the Fourier series expansion of $f(x) = \begin{cases} x, & 0 \le x \le 3 \\ 6 - x, & 3 \le x \le 6 \end{cases}$ and hence deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots.$
	b)	The following table gives the variations of a periodic function over a period T *x*: *0*, *T/6*, *T/3*, *T/2*, *2T/3*, *5T/6*, *T* *f(x)*: 1.98, 1.3, 1.05, 1.3, - 0.88, - 0.25, 1.98 find *f(x)* upto first harmonic.