St. JOSEPH'S COLLEGE OF ENGINEERING, CHENNAI – 119

St.JOSEPH'S INSTITUTE OF TECHNOLOGY, CHENNAI – 119

SUB NAME & CODE: MA 6351-TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

ASSIGNMENT – I

UNIT – II FOURIER SERIES

PART – A

1. State Dirichlet's conditions for the existence of Fourier series of f(x) in the interval$(0, 2\pi)$.

2. 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.

3. Find the constant term in the expression of $\cos^2 x$ as a Fourier series in the interval $(-\pi, \pi)$.

4. Determine the value of a_n & a_0 in the Fourier series expansion of $f(x) = x^3$ in $-\pi < x < \pi$

5. Find the Fourier constant b_n for $x \sin x$ in $-\pi < x < \pi$, when expressed as a Fourier series.

6. Find the root mean square value of the function f(x) = x in $(0, l)$.

7. To which value, the half range sine series corresponding to f(x) = x^2 expressed in the interval (0, 5) converges at x =5 ?

8. What you meant by Harmonic analysis?

PART – B

1. a) If $f(x) = \left(\frac{\pi - x}{2}\right)^2$ in $0 < x < 2\pi$. Hence show that

(i) $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots\dots\dots\dots = \frac{\pi^2}{6}$. (ii) $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots = \frac{\pi^2}{12}$.

b) Find the Fourier series for $f(x) = |\sin x|$ in $-\pi < x < \pi$.

2. a) Obtain the Fourier series to represent the function *f(x)* = | *x* | is $-\pi < x < \pi$ and deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots\dots\dots\dots = \frac{\pi^2}{8}$.

b) Find the first two 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

3. a) Find the complex form of the Fourier series of $f(x) = e^{-x}$ in $\boldsymbol{-1 \le x \le 1}$

b) Find the half range Fourier sine series for $f(x) = x(\pi - x)$ in the interval $(0, \pi)$ and deduce that $\frac{1}{1^3} + \frac{1}{3^3} + \frac{1}{5^3} + \frac{1}{7^3} + \dots\infty$

4. a) Find the Fourier series expansion for the function $f(x) = 2x - x^2$ in the interval *(0,2)*

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.