

Government Engineering College-Bhuj

Mathematics-III(BE03000211)

Tutorial of Fourier Series

Sr. No.	Content	Marks
1	Find the Fourier series of $f(x) = x^2$ in the interval $(0, 2\pi)$ and hence, deduce that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \dots$	7
2	Find the Fourier series for $f(x) = e^x$ in $(0, 2\pi)$, $a > 0$.	7
3	Find the Fourier series of $f(x) = \sqrt{1 - \cos x}$ in the interval $(0, 2\pi)$. Hence, deduce that $\frac{1}{2} = \sum_{n=1}^{\infty} \frac{1}{4n^2 - 1}$.	7
4	Find the Fourier series of $f(x) \begin{cases} = x^2: 0 < x < \pi \\ = 0: \pi \leq x \leq 2\pi \end{cases}$	7
5	Find the Fourier series of $f(x) = x + x^2$ in the interval $(-\pi, \pi)$ and hence, deduce that (i) $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \dots$ (ii) $\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots$	7
6	Find the Fourier series of $f(x) = x + x$ in the interval $-\pi < x < \pi$	7
7	Find the Fourier series of $f(x) = \begin{cases} -\pi: -\pi < x < 0 \\ x: 0 < x < \pi \end{cases}$. Hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$	7
8	Find the Fourier series of $f(x) = \begin{cases} 0: -\pi < x < 0 \\ \sin x: 0 < x < \pi \end{cases}$. Hence deduce that $\frac{1}{2} = \frac{1}{1 \cdot 3} + \frac{1}{3 \cdot 5} + \frac{1}{5 \cdot 7} + \dots$	7
9	For the function $f(x) \begin{cases} x: 0 \leq x \leq 2 \\ x: 2 \leq x \leq 4 \end{cases}$, find its Fourier series. Hence, deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$	7
10	Find the Fourier series of $f(x) = \frac{\pi^2}{12} - \frac{x^2}{4}$ in the interval $(-\pi, \pi)$ and deduce that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \dots$	7
11	Find the Fourier series of $f(x) = \cosh ax$ in the interval $(-\pi, \pi)$.	7
12	Find the Fourier series of $f(x) = e^{- x }$ in the interval $(-\pi, \pi)$	7
13	Find the half-range cosine series of $f(x) = x$ in the interval $(0, \pi)$	7
14	Find the half-range cosine series of $f(x) = \sin x$ in the interval $(0, \pi)$ and hence deduce that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots$	7
15	Find the half-range cosine series of $f(x) = \begin{cases} x: 0 < x < \frac{\pi}{2} \\ \pi - x: \frac{\pi}{2} < x < \pi \end{cases}$	5
16	Find the half-range sin series of $f(x) = lx - x^2$ in the interval $(0, l)$ and, hence, deduce that $\frac{\pi^3}{32} = 1 - \frac{1}{3^3} + \frac{1}{5^3} - \dots$	5
17	Find the half-range cosine series of $f(x) = \begin{cases} kx: 0 \leq x \leq \frac{l}{2} \\ k(l - x): \frac{l}{2} \leq x \leq l \end{cases}$. Hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$	5