INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM

IMA221 Differential Equations and Transforms

Even Semester 2022-23: Assignment

Topics: Fourier Series : Dirichlets conditions General Fourier series Odd and even functions Half range Sine and Cosine series Complex form of Fourier series Parsevals identity differentiation and integration of Fourier series.

1. Expand $f(x) = \sqrt{1-\cos x}, 0 < x < 2\pi$ as a Fourier series and hence evaluate
$$\frac{1}{1.3} + \frac{1}{3.5} + \frac{1}{5.7} + \cdots$$
2. Expand $f(x) = e^{-x}$ as a Fourier series in the interval $(-l, l)$.
3. Find Fourier series representation for the function $|\sin x|$ in the interval $[-\pi, \pi]$.
4. Obtain a half range cosine series for
$$f(x) = \begin{cases} kx, & 0 \le x \le l/2 \\ k(l-x), & l/2 \le x \le l. \end{cases}.$$
5. Find $1 + \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \cdots$ by applying Parseval's identity to the function $f(x) = x$, $-\pi \le x \le \pi$.
6. Find the complex form of Fourier series of the function $f(x) = \cos ax, -\pi < x < \pi$.
7. Discuss any one real world application of Fourier series/ Fourier transform in detail.