Class - B.Tech 2nd yr. (ECE)
Sub: Signal & System
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Unit - III.

Topic : Fourier Series.

Fourier series representation.

To represent any periodic signal $x(t)$. Fourier developed an expression called fourier series. This is in terms of an Infinite sum of sines, and cosines or exponentials, Fourier series uses orthogonality Condition In another words a fourier series is an

for .....

Class Subject

Class Work Forecast

Home Work

an expansions of a periodic functions in terms of an infinite sums of sines and cosines The fourier series are various applications like used in applied mathematics and especially in physics and electronic to express periodic functions such as those that comprise communication signal waveforms

Types

Trigonometric

Exponential.

Trigonometric Fourier Series :-

To Complete orthogonal Interval (set) we need to include both Cosine and sines in terms.
Here the Complete orthogonal set includes all Cosine & sine terms that is
$\sin n\omega_0 t$, $\cos n\omega_0 t$ }

where $n = 0, 1, 2 - - - - -$

∴ Any functions $x(t)$ in the interval $\left(t_0, t_0 + \frac{2\pi}{\omega_0}\right)$

can be represented as :-

$$x(t) = a_0 \cos 0\omega_0 t + a_1 \cos 1\omega_0 t + a_2 \cos 2\omega_0 t + \cdots + a_n \cos n\omega_0 t + \cdots + b_0 \sin 0\omega_0 t + b_1 \sin 1\omega_0 t + \cdots + b_n \sin n\omega_0 t$$

$$= a_0 + a_1 \cos 1\omega_0 t + a_2 \cos 2\omega_0 t + \cdots + a_n \cos n\omega_0 t + \cdots + b_1 \sin 1\omega_0 t + \cdots + b_n \sin n\omega_0 t + \cdots$$

$$x(t) = a_0 + \sum_{n=1}^{\infty} (a_n \cos n\omega_0 t + b_n \sin n\omega_0 t)$$

$(t_0 < t < t_0 + T)$

Where

$$a_0 = \frac{1}{T} \int_{t_0}^{t_0+T} x(t)\,dt$$

$$a_n = \frac{2}{T} \int_{t_0}^{t_0+T} x(t) \cdot \cos n\omega_0 t\,dt$$

$$b_n = \frac{2}{T} \cdot \int_{t_0}^{t_0+T} x(t) \cdot \sin n\omega_0 t\,dt$$