UNIT-1

(Lecture-5)

Complex Frequency

Elementary Signals

Sinusoidal & Exponential Signals

- Sinusoids and exponentials are important in signal and system analysis because they arise naturally in the solutions of the differential equations.
- Sinusoidal Signals can expressed in either of two ways :

cyclic frequency *form*- $A \sin 2\Pi f_o t = A \sin(2\Pi/T_o)t$

radian frequency form- $A \sin \omega_o t$

$\omega_o = 2\Pi f_o = 2\Pi/T_o$

T_o = Time Period of the Sinusoidal Wave

Sinusoidal & Exponential Signals Contd.

$x(t) = A \sin(2\Pi f_o t + \theta)$

$= A \sin(\omega_o t + \theta)$ } **Sinusoidal signal**

$x(t) = Ae^{at}$ Real Exponential

$= Ae^{j\omega t} = A[\cos(\omega_o t) + j \sin(\omega_o t)]$ Complex Exponential

θ = Phase of sinusoidal wave

A = amplitude of a sinusoidal or exponential signal

f_o = fundamental cyclic frequency of sinusoidal signal

ω_o = radian frequency

Discrete Time Exponential and Sinusoidal Signals

- DT signals can be defined in a manner analogous to their continuous-time counter part

  $x[n] = A \sin(2\Pi n/N_o + \theta)$ **Discrete Time Sinusoidal Signal**

  $= A \sin(2\Pi F_o n + \theta)$

  $x[n] = a^n$ **Discrete Time Exponential Signal**

  n = the discrete time

  A = amplitude

  θ = phase shifting radians,

  N_o = Discrete Period of the wave

  $1/N_0 = F_o = \Omega_o/2\Pi$ = Discrete Frequency

Discrete Time Sinusoidal Signals