

Quiz # 7

$$1) y[n] = -x[n]$$

assume: $x_1[n]$

$$y_1[n] = -x_1[n] ; \text{ shift}$$

$$y_1[n-T] = -x_1[n-T]$$

let $z[n] = x_1[n-T]$; check if time-invariant

$$z[n] \rightarrow z[3n] ; \text{ substitute: } [1 - (1-n)]x + [(1-n)]x =$$

$$[1 - (1-n)]x + [(1-n)]x = -x_1[3(n-T)] \neq -x_1[3n-T] \quad \text{therefore - shift } \neq x$$

\therefore Not Time-Invariant, NOT LTI

$$2) y[n] = 2 + x[n]$$

assume: $x_1[n], x_2[n]$

$$y_1[n] = 2 + x_1[n]$$

$$y_2[n] = 2 + x_2[n] ;$$

$$ay_1[n] + by_2[n] = a(2 + x_1[n]) + b(2 + x_2[n])$$

$$\text{let } z[n] = ax_1[n] + bx_2[n]$$

$$z[n] \rightarrow 2 + z[n]$$

$$= 2 + ax_1[n] + bx_2[n] \neq a(2 + x_1[n]) + b(2 + x_2[n])$$

\therefore Not linear, NOT LTI

$$3) y[n] = n(x[n])$$

assume: $x_1[n]$

$$y_1[n] = n(x_1[n]) ; \text{ shift}$$

$$y_1[n-T] = n(x_1[n-T])$$

$$\text{let } z[n] = x_1[n-T] ; \quad \text{therefore } n \Rightarrow n-T$$

$$z[n] \rightarrow n(z[n])$$

$$= (n-T)(x_1[n-T]) \neq n(x_1[n-T])$$

\therefore Not Time-Invariant, Not LTI

$$4) y[n] = 2x[-n] + x[2n-1]$$

assume: $x_1[n]$

$$y_1[n] = 2x_1[-n] + x_1[2n-1] ; \text{shift}$$

$$y_1[n-T] = 2x_1[-n-T] + x_1[2n-1-T]$$

$$\text{let } z[n] = x_1[n-T] ; n \rightarrow n-T$$

$$z[n] \rightarrow 2z[-n] + z[2n-1]$$

$$= 2x_1[-(n-T)] + x_1[2(n-T)-1]$$

$$= 2x_1[-n+T] + x_1[2n-2T-1] \neq 2x_1[-n-T] + x_1[2n-1-T]$$

\therefore Not Time-Invariant, Not LTI