EE#301

Tut#1

محمد بن صالح آل الشيخ

fac.KSU.edu.sa/MalShaykh

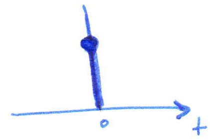
Signals

continuous — CT $x(n)$

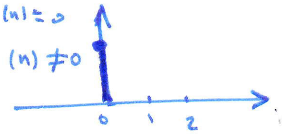
Discrete — DT $X(n)$

Impulse:

$$\delta(t) = \begin{cases} \infty & (t) = 0 \\ \text{zero} & (t) \neq 0 \end{cases}$$

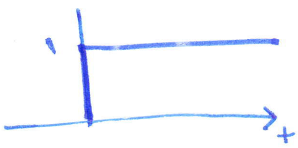


$$u(n) = \begin{cases} 1 & (n) = 0 \\ 0 & (n) \neq 0 \end{cases}$$

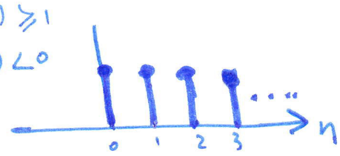


unit step:-

$$u(t) = \begin{cases} 1 & (t) \geq 0 \\ 0 & (t) < 0 \end{cases}$$

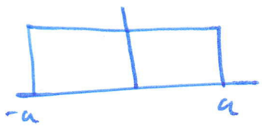


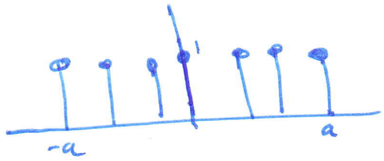
$$u(n) = \begin{cases} 1 & (n) \geq 1 \\ 0 & (n) < 0 \end{cases}$$



Rectangular pulse:

$$P_a(t) = \begin{cases} 1 & -a \leq (t) \leq a \\ 0 & \text{o.w} \end{cases}$$





• Basic Operations:-

$f(t-T)$:- Shift Right

$f(t+T)$:- Shift left

(Note:- T is +ve)

$f(-t)$: Time reversal

$f(\alpha t)$: multiply by $\frac{1}{|\alpha|}$ (if $\alpha > 1$; compressing; $\alpha < 1$; Stretching)

General form:-

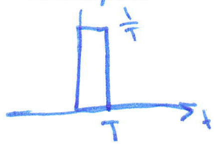
$$\boxed{y(t) = \underbrace{a}_{3}\, x(\underbrace{\alpha}_{1}(t + \underbrace{T}_{2}))}$$

1 reverse

1.2 scale of time axis

• 2.5) Mathematical Description of Impulse function:-

• Area of $\delta(t)$ is 1



$\delta(t) = \delta(-t)$

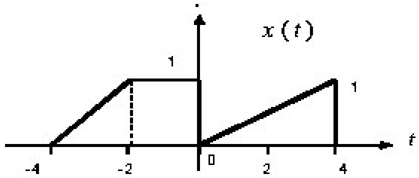
$$\therefore \int_{-\infty}^{\infty} \delta(t)\, dt = 1$$

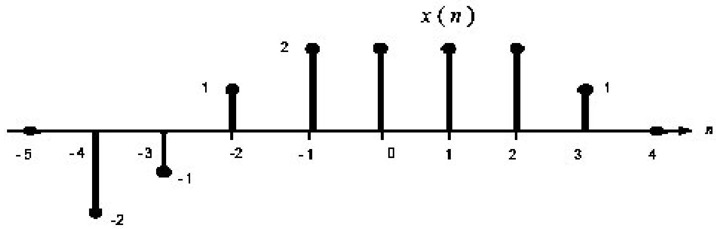
• $$\boxed{\delta(t) = \frac{du(t)}{dt}}$$

• $f(t) \cdot \delta(t - t_0) = f(t_0) \cdot \delta(t - t_0)$

$$\therefore \int_{-\infty}^{\infty} f(t)\, \delta(t - t_0)\, dt = f(t_0)$$

Q1) Given the continuous-time (CT) and discrete-time (DT) signals x(t) and x(n) shown below, sketch and label carefully the signals in (a),(b), and (c). [Note: u(t), u(n) denote the CT and DT unit step signals respectively]





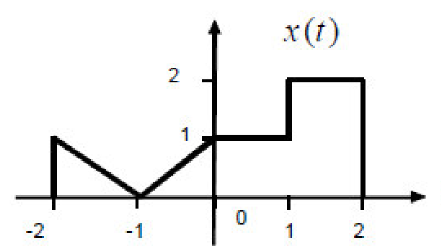
(a) (i) $y(t) = x[(-2t+4)]$

(ii) $y(t) = x(t)[u(-t+3) - u(t+3)]$

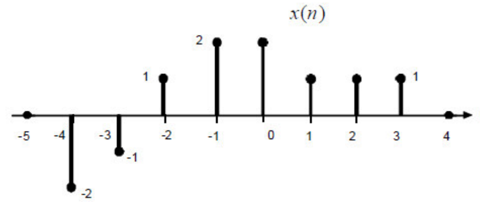
(b) $y[n] = x[2n^2 + 1]$

(c) For the following x(t) and x[n] find:-

(i) $y(t)=2x(2t+1)$



(ii) y[n] = x[3n+1] u[n]



Q2) Evaluate the following

- $\sin(\tau)\ \delta(\tau+3)\ d\tau =$

- $\int_{0}^{\infty} \cos(t-\tau)\ \sin(\tau)\ \delta(\tau+3)\ d\tau =$

- $\int_{-\infty}^{\infty} e^{-t}\ \delta(2t-1)\, dt =$

- $\int_{0}^{\infty} \delta(-t+4) \sin(\frac{\pi t}{8})\, dt =$