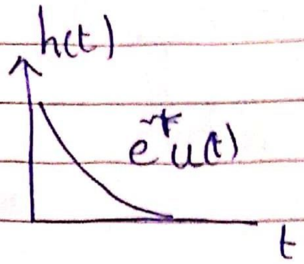
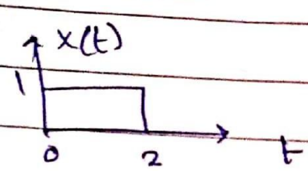
$h(t) \longrightarrow$ impulse response

$\delta(t) \longrightarrow \boxed{} \longrightarrow h(t)$

Why systems?

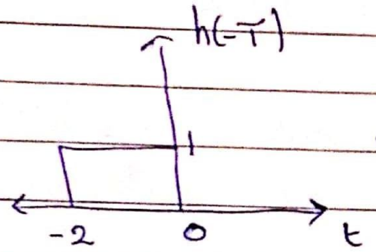


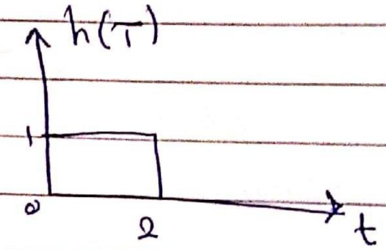
$y(t) = ?$

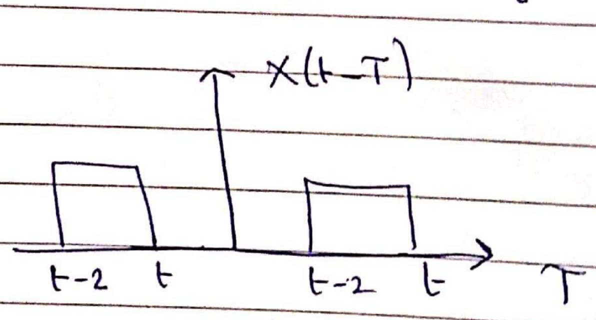


$$y(t) = \int_{-\infty}^{\infty} x(\tau)\, h(t-\tau)\, d\tau$$

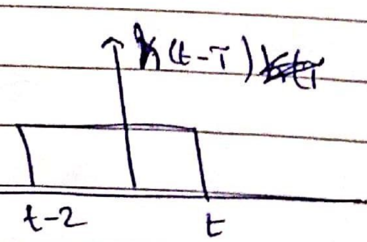
$$y(t) = \int_{-\infty}^{\infty} x(t-\tau)\, h(\tau)\, d\tau$$





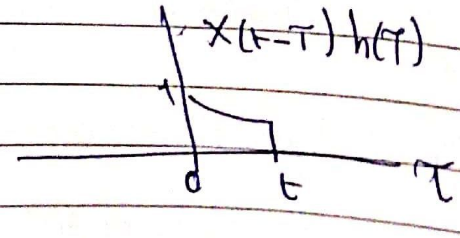


For $t \leq 0$ $y(t) = 0$



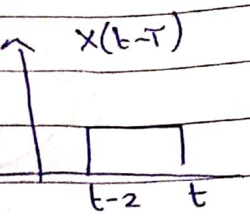
$0 \leq t \leq 2$ $y(t) = \int_0^t e^{-\tau}\, d\tau$

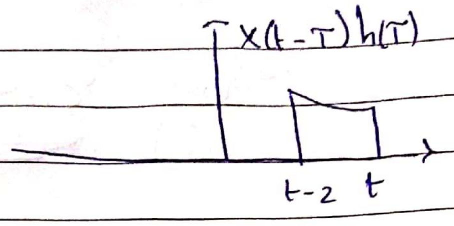
$= -e^{-\tau}\Big|_0^t = \boxed{1 - e^{-t}}$

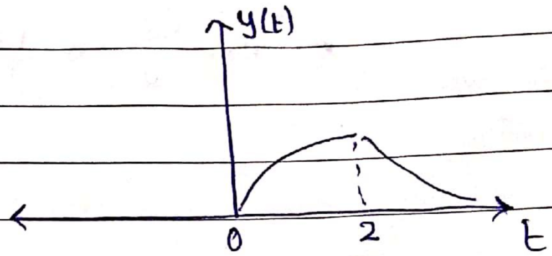


$t \geq 2 \quad y(t) = \int_{t-2}^{t} e^{-\tau}\, d\tau$

$= -e^{-t} + e^{2-t}$



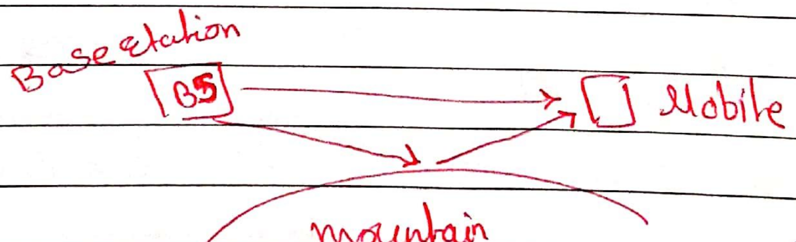




* System's approach is a quick way (alternative) to evaluate circuit behaviour

* Circuit approach may take more time with complicated circuits.

Multi_path Communication Channels



(direct sig. + reflected sig. (attenuated + delayed))

BS $\quad 0 \; 0 \; 0 \; 2 \; -2 \; 3 \; 0 \; 0 \; 0 \; 0$ (you receive [] of the sig.)

M $\quad 0 \; 0 \; 0 \; (2+\frac{1}{2}*0) \; \underset{-1}{(-2+\frac{1}{2}*2)} \; (3+\frac{1}{2}*-2)$

$(0+\frac{1}{2}*3) \; (0) \; (0) \; (0) \; ...$

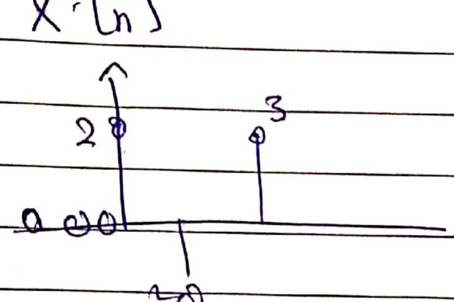
BS

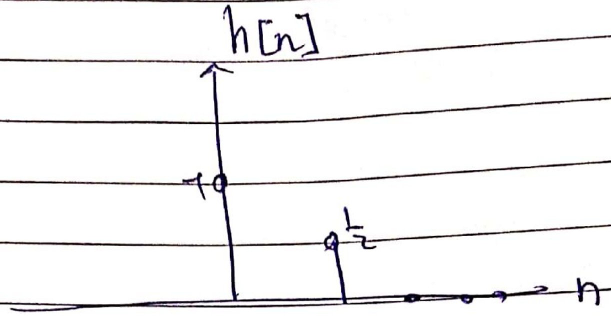
$x[n] \longrightarrow \boxed{} \longrightarrow y[n]$

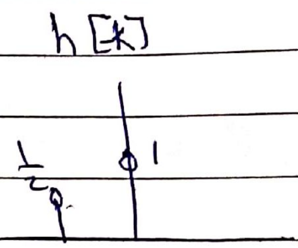
$y[n] = x[n] + \frac{1}{2}x[n-1]$

$h[n] = \delta[n] + \frac{1}{2}\delta[n-1]$

$y[n] = x[n] \circledast h[n]$

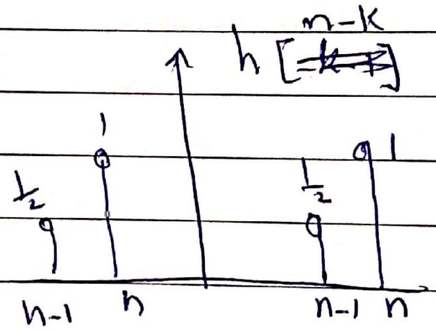






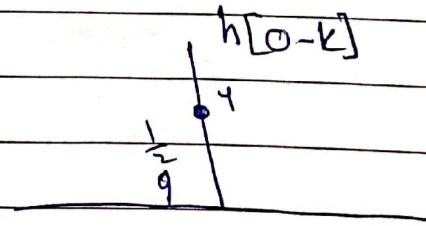
$n<0 \quad y[n]=0$

$n=0 \quad y[n]=2$



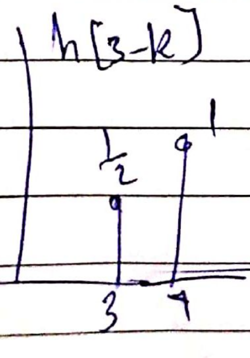
$n=1 \quad y[1] = -2+1 = -1$

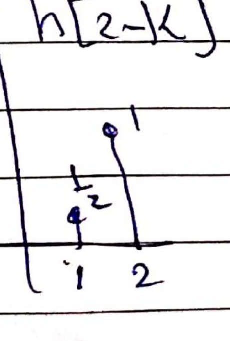
$n=2 \quad y[2] = 1\times 3 + -2\times\frac{1}{2}$
$= 2$

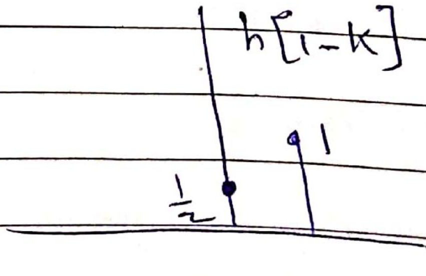


$n=3 \quad y[3] = \frac{1}{2}\times 3 = 3/2$

$n \geq 4 \quad y[n] = 0$







Conclusion:

we Can model Physical Phenomena by systems

* The Gain is simple Computer Programs