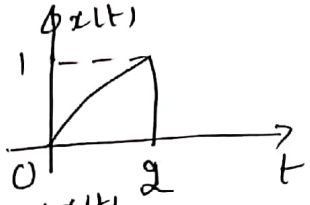
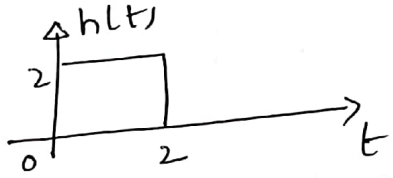
Tutorial – 2

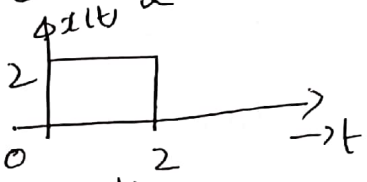
(1) Consider a discrete time LTI system with impulse Response $h(n)$. If the input $x(n)$ is a periodic sequence with period 'N' i.e, $x(n+N) = x(n)$, show that output $y(n)$ is also periodic with period 'N'.

(2) find the Convolution of the following signals.

(i) $x(t) = e^{-3t} u(t)$ & $h(t) = u(t-2)$ where $u(t)$ is unit step seq.

(ii) 

&


(iii) 

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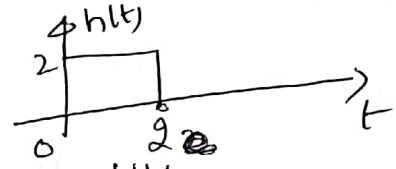
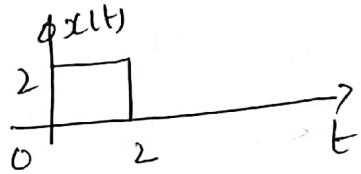


(iv) 

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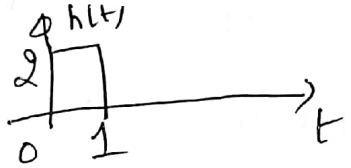


(3) prove the following properties of impulse signal

(i) $x(t) \circledast \delta_c(t) = x(t)$

(ii) $x(t) \circledast \delta_c(t-t_0) = x(t-t_0)$

(iii) $x(n) \circledast \delta_d(n) = x(n)$

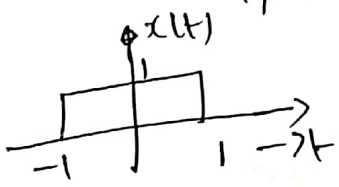
(iv) $x(n) \circledast \delta_d(n-n_0) = x(n-n_0)$

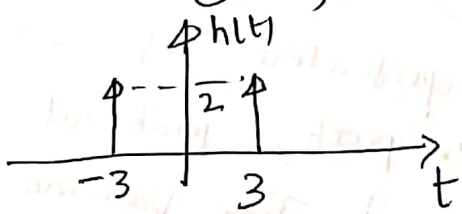
where $\circledast$ – Convolution

$\delta_c(t)$ – Continous impulse signal

$\delta_d(t)$ – discrete impulse signal

(4) plot the output $y(t) = x(t) \circledast h(t)$ where



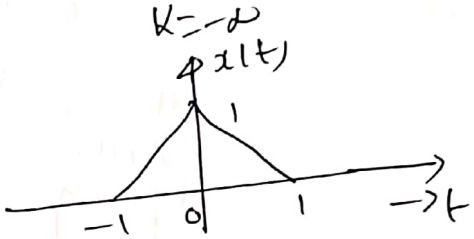


(5) find the Range of 'a' and 'b' for the impulse Response

$$h(n) = \begin{cases} a^n : n \geq 0 \\ b^n : n < 0 \end{cases}$$ to be stable.

Note :- Condition for stability is $\sum_{k=-\infty}^{\infty} |h(k)| < \infty$

(6) An input signal $x(t)$ shown in figure is applied to the System with impulse Response $h(t) = \sum_{k=-\infty}^{\infty} \delta_c(t - kT)$ find the output for the Values of (i) $T = 4$ (ii) $T = 2$



(7) A linear System with input $x(n)$ and output $y(n)$ related as $y(n) = \sum_{k=-\infty}^{\infty} x(k)\, g(n-2k)$ where $g(n) = u(n) - u(n-4)$. find $y(n)$ when $x(n) = \delta_d(n-3)$ where $u(n)$ = discrete step sequence.

(8) Prove the following properties of fourier Transform
(i) Time Reversal (ii) Time shifting
(iii) Time Scaling

(9) find the fourier Transform of following signals
(i) $x(t) = \delta(t)$ (ii) $x(t) = 1$ (iii) $x(t) = \text{Sgn}(t)$
(iv) $x(t) = u(t)$ (v) $x(t) = e^{-a|t|} : |a| < 1$

(10) (a) Show that, for a discrete x LTI System, its output can be represented as Convolution of input & impulse Response.
(b) In proof, point out where properties of Linear and Time Variance are used.

(11) A function is said to be Conjugate Symmetric ~~if $x(t) = x^*(t)$~~ if $x(t) = x^*(-t)$. Show that fourier transform of such function is Real.