ESE305 Homework #3

(DUE 9/30/99)

3.1(a)

(i) $y(t) = \int_{-\infty}^{\infty} \tau u(\tau)u(t-\tau)d\tau = \int_0^t \tau d\tau = \frac{t^2}{2}u(t)$

(ii) $y(t) = \int_{-\infty}^{\infty} u(\tau)u(t-\tau)d\tau = \int_0^t d\tau = tu(t)$

(iii) $y(t) = \int_{-\infty}^{\infty} e^{-5\tau}u(\tau)u(t-\tau)d\tau = \int_0^t e^{-5\tau}d\tau = \frac{1}{5}(1-e^{-5t})u(t)$

(iv) $y(t) = \int_{-\infty}^{\infty} u(\tau+2)u(t-\tau)d\tau = \int_{-2}^t d\tau = (t+2)u(t+2)$

3.5(a)

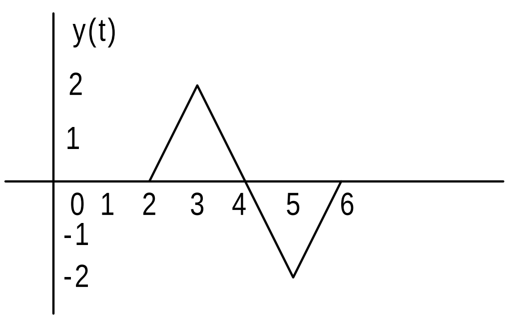
$$x(t) = 2[u(t-2)-u(t-4)]; h(t) = u(t)-2u(t-1)+u(t-2)$$

$$y(t) = 2[u(t-2)*u(t)-2u(t-2)*u(t-1)+u(t-2)*u(t-2)-u(t-4)*u(t) + 2u(t-4)*u(t-1)-u(t-4)*u(t-2)]$$

Using the result of Problem 3.4(a):

$$y(t) = 2[(t-2)u(t-2)-2(t-3)u(t-3)+(t-4)u(t-4)-(t-4)u(t-4) + 2(t-5)u(t-5)-(t-6)u(t-6)]$$

$$= 2[(t-2)u(t-2)-2(t-3)u(t-3)+2(t-5)u(t-5)-(t-6)u(t-6)]$$

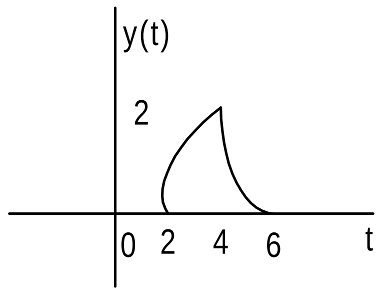


3.5(c)

$$h(\tau) = (-\tau+2)u(\tau)-(\tau-2)u(\tau-2)$$

$$x(t-\tau) = u(\tau-(t-4))-u(\tau-(t-2))$$

$$y(t) = \begin{cases} 0, & t \le 2 \\ -\frac{t^2}{2}+4t-6, & 2 < t \le 4 \\ \frac{t^2}{2}-6t+18, & 4 < t \le 6 \\ 0, & t > 6 \end{cases}$$



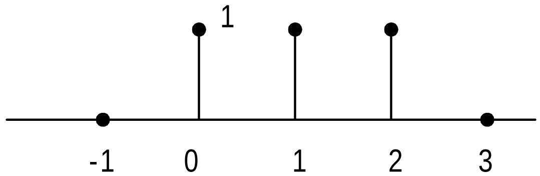
3.11(a) $h(t) = \delta(t-5)$

3.11(b) $h(t) = u(t-5)$

3.18(a) stable and non-causal

3.18(c) not stable and causal

10.7(a)



10.7(b)

$$y[n] = \sum_{k=-\infty}^{\infty}(u[k]-u[k-3])x[n-k]$$

$$= \sum_{k=0}^{2} x[n-k]$$

$$= \delta[n+1]+\delta[n]+\delta[n-1]+3(0.6)^{n}(u[n]-u[n-3])+3(0.6)^{n-1}(u[n-1]-u[n-4])$$

$$+3(0.6)^{n-2}(u[n-2]-u[n-5])$$

10.9(a)

$$y[n] = u[n]+u[n-1]+u[n-4]+u[n-5]$$

$$= \begin{cases} 0, & n<0 \\ 1, & n=0 \\ 2, & n=1,2,3 \\ 3, & n=4 \\ 4, & n\geq 5 \end{cases}$$

10.9(b)

$$y[n] = \begin{cases} 0, & n < 0, n \geq 7 \\ 1, & n = 0 \\ 2, & n = 1 \\ 1, & n = 2 \\ 0, & n = 3 \\ 1, & n = 4 \\ 2, & n = 5 \\ 1, & n = 6 \end{cases}$$

10.12(a)

$$h[n] = h_1[n] * h_2[n] = \sum_{k=-\infty}^{\infty} 0.8^k u[k] 0.8^{n-k} u[n-k] = (n+1)0.8^n u[n]$$

10.12(b)

$$h[n] = \delta[n-6]$$

10.17(a) causal and stable

10.17(c) causal and not stable