ECEN3714 **Homework #07**

Lab on__ Wed __Thu ___Fri_____ Name (PRINT): Bennett, Roger
(LAST NAME) (Frist Name)

(Pay attention to the notation completeness and rigor of analytics).

7.1. Find inverse LT of the following functions:

(a) $X(s) = \frac{1}{s^2(s+2)(s+3)}$ (4 points)

(b) $Y(s) = \frac{1}{s(s+1)^2}$ (4 points)

(c) $H(s) = \frac{s^2+1}{s^2+4}e^{-8s}$ (2 points)

a)

$$X(s) = \frac{1}{s^2(s+2)(s+3)}(s^2) = \frac{K_1}{s^2}(s^2) + \frac{K_2}{s+2}(s^2) + \frac{K_3}{s+3}(s^2) \Rightarrow \frac{1}{(s+2)(s+3)} = K_1 + \frac{K_2}{s+2}(s^2) + \frac{K_3}{s+3}(s^2) \quad s=0$$

$$\Rightarrow \frac{1}{6} = K_1$$

$$X(s) = \frac{1}{s^2(s+2)(s+3)}(s+2) = \frac{K_1}{s^2}(s+2) + \frac{K_2}{s+2}(s+2) + \frac{K_3}{s+3}(s+2) \Rightarrow \frac{1}{s^2(s+3)} = \frac{K_1}{s^2}(s+2) + K_2 + \frac{K_3}{s+3}(s+2) \quad s=-2$$

$$\Rightarrow \frac{1}{4} = K_2$$

$$X(s) = \frac{1}{s^2(s+2)(s+3)}(s+3) = \frac{K_1}{s^2}(s+3) + \frac{K_2}{s+2}(s+3) + \frac{K_3}{s+3}(s+3) \Rightarrow \frac{1}{s^2(s+2)} = \frac{K_1}{s^2}(s+3) + \frac{K_2}{s+2}(s+3) + K_3 \quad s=-3$$

$$\Rightarrow -\frac{1}{6} = K_3$$

$$X(s) = \frac{1}{s^2(s+2)(s+3)} = \frac{6}{s^2} + \frac{4}{s+2} - \frac{6}{s+3}$$

$\Downarrow$ I.L.T.

$$x(t) = 6t^2 + 4e^{-2t}u(t) - 6e^{-3t}u(t) = \boxed{6t^2[4e^{-2t} - 6e^{-3t}]u(t)}$$

(b) $Y(s) = \dfrac{1}{s(s+1)^2}$

$$S = 0$$

$$Y(s) = \frac{1}{s(s+1)^2}(s) = \frac{K_1}{s}(s) + \frac{K_2}{(s+1)^2}(s) \Rightarrow \frac{1}{(s+1)^2} = K_1 + \frac{K_2}{(s+1)^2}(s) \Rightarrow 1 = K_1$$

$$S = -1$$

$$Y(s) = \frac{1}{s(s+1)^2}(s+1)^2 = \frac{K_1}{s}(s+1)^2 + \frac{K_2}{(s+1)^2}(s+1)^2 \Rightarrow \frac{1}{s} = \frac{K_1}{s}(s+1)^2 + K_2 \Rightarrow -1 = K_2$$

$$Y(s) = \frac{1}{s(s+1)^2} = \frac{1}{s} - \frac{1}{(s+1)^2}$$

$\Downarrow$ I.L.T

$$y(t) = u(t) - t e^{-t} u(t) = \boxed{[1 - te^{-t}]\, u(t)}$$

(c) $H(s) = \dfrac{s^2+1}{s^2+4} e^{-8s}$ (2 points)

$$H(s) = \frac{s^2+1}{s^2+4} e^{-8s} = 1 - \frac{3}{s^2+4} e^{-8s}$$

$\Downarrow$ I.L.T.

$$\boxed{h(t) = \delta(t-8) - \frac{3}{2}\sin(2(t-8))}$$