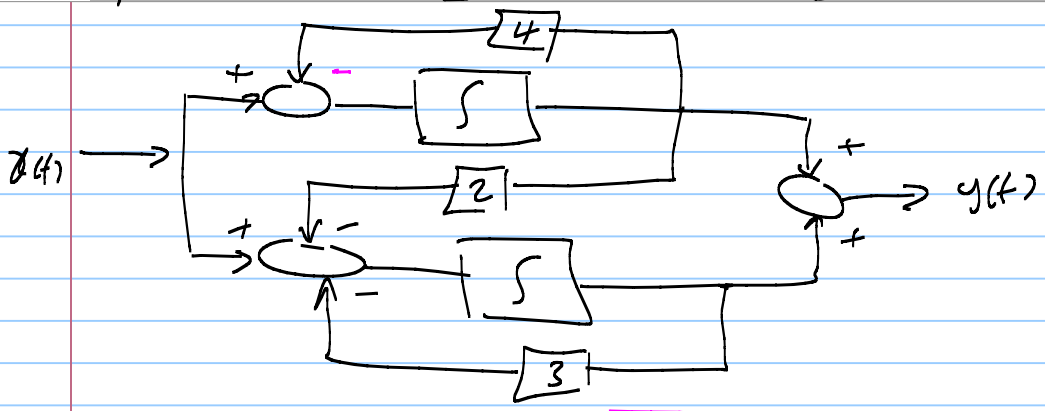
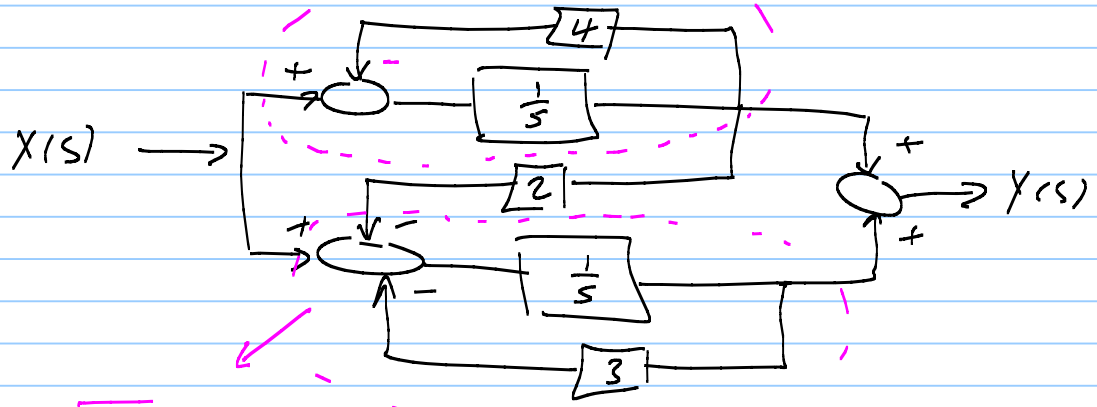
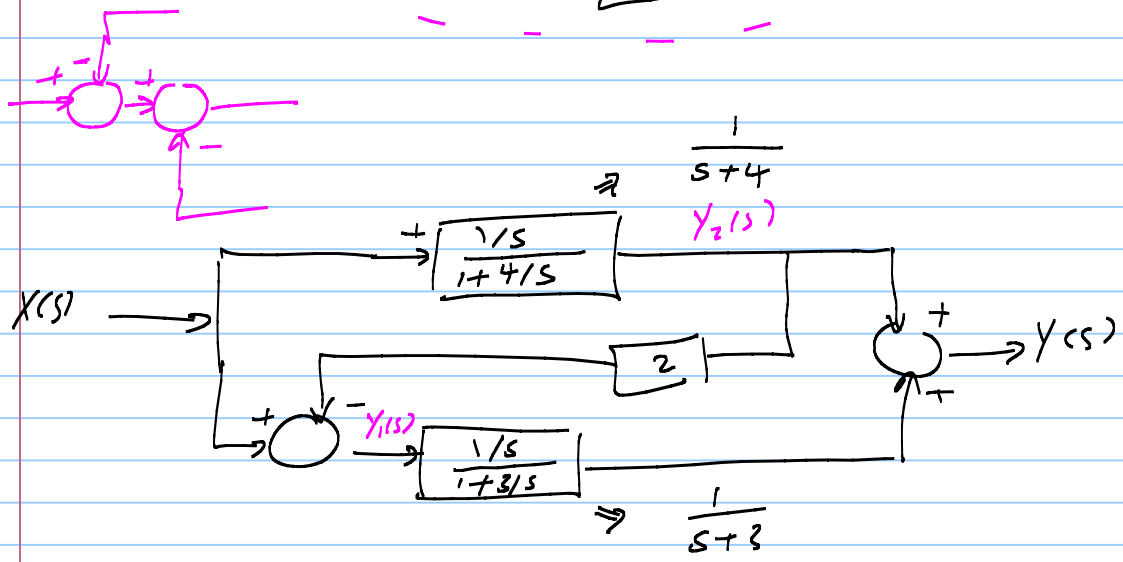
Note Title Review Session 3 EE352 Fall 2018 12/7/2018







$$Y(s) = X(s)\left(\frac{1}{s+4}\right) + Y_1(s)\left(\frac{1}{s+3}\right)$$

$$Y_1(s) = X(s) - 2Y_2(s) \Rightarrow Y_1(s) = X(s) - 2X(s)\left(\frac{1}{s+4}\right)$$

$$Y_2(s) = X(s)\left(\frac{1}{s+4}\right)$$

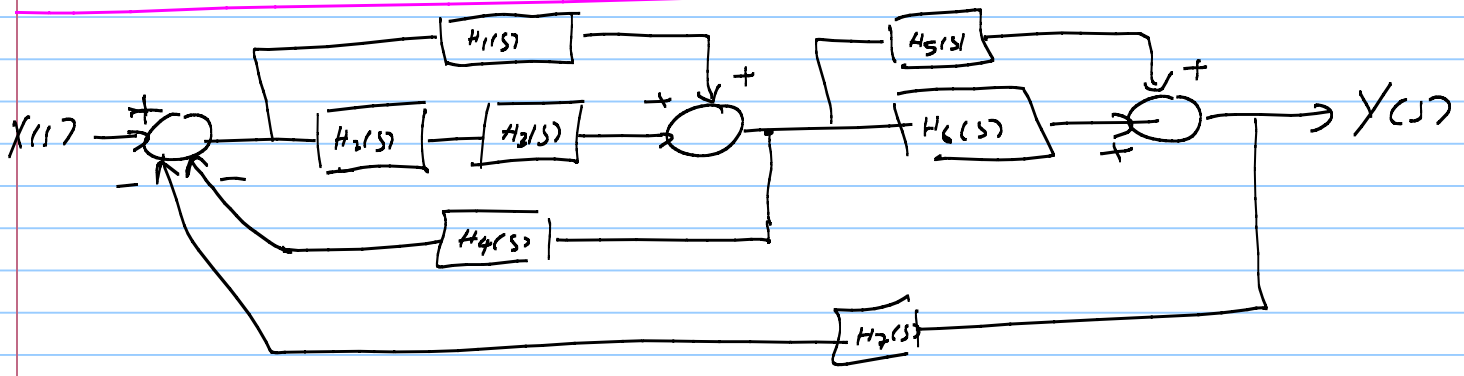
$$Y(s) = X(s)\left(\frac{1}{s+4}\right) + \left[X(s) - 2X(s)\left(\frac{1}{s+4}\right)\right]\left(\frac{1}{s+3}\right)$$

$$Y(s) = X(s)\left\{ \frac{1}{s+4} + \frac{1}{s+3} - \frac{2}{(s+4)(s+3)} \right\}$$

$$= X(s)\left\{ \frac{(s+3)+(s+4)-2}{(s+4)(s+3)} \right\}$$

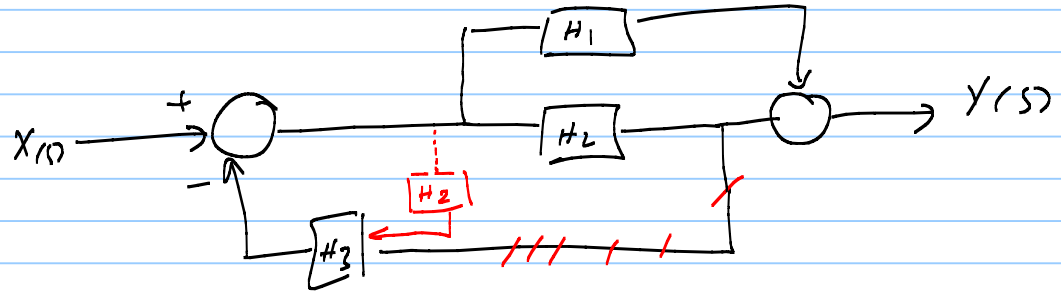
$$= X(s)\left\{ \frac{2s+5}{s^2+7s+12} \right\}$$

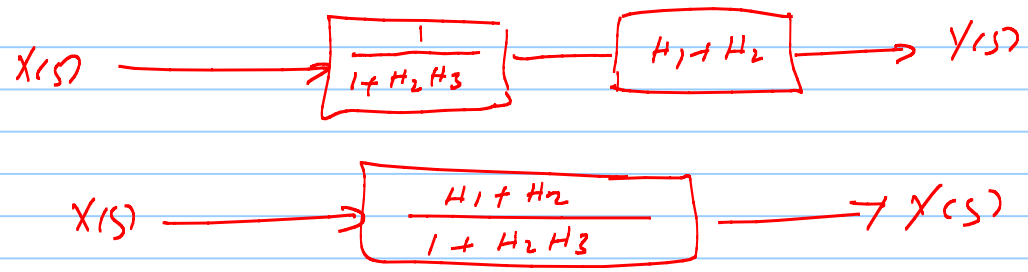
$$\therefore \boxed{H(s) = \frac{2s+5}{s^2+7s+12}}$$

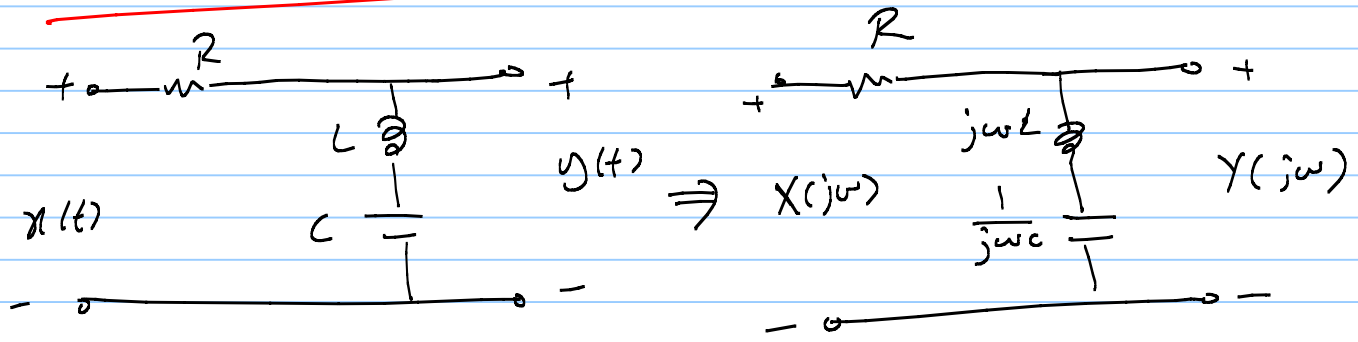


The solution is available online.

$$H(s) = \frac{\dfrac{(H_1 + H_2H_3)(H_5 + H_6)}{1 + H_4(H_1 + H_2H_3)}}{1 + H_7 \dfrac{(H_1 + H_2H_3)(H_5 + H_4)}{1 + H_4(H_1 + H_2H_3)}}$$







$\omega = 0 \Rightarrow |Y(j\omega)| = |X(j\omega)|$

$\Rightarrow |H(j\omega)| = 1$

$\angle Y(j\omega) = \angle X(j\omega)$

$\angle H(j\omega) = 0$

$\omega \to \infty \Rightarrow |Y(j\omega)| = |X(j\omega)|$

$\Rightarrow |H(j\omega)| = 1$

$\angle Y(j\omega) = \angle X(j\omega)$

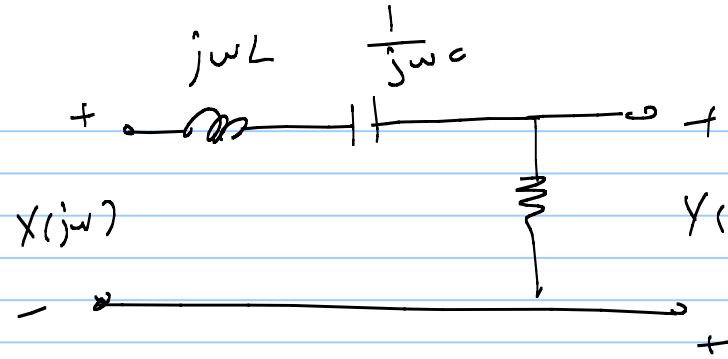
$\angle H(j\omega) = 0$

$j\omega L = \frac{-1}{j\omega C} \Rightarrow -\omega^2 L = \frac{-1}{C}$

$\omega = \sqrt{1/LC} = 1/\sqrt{LC}$

$\omega_s = 1/\sqrt{LC} \Rightarrow Y(j\omega_s) = 0$

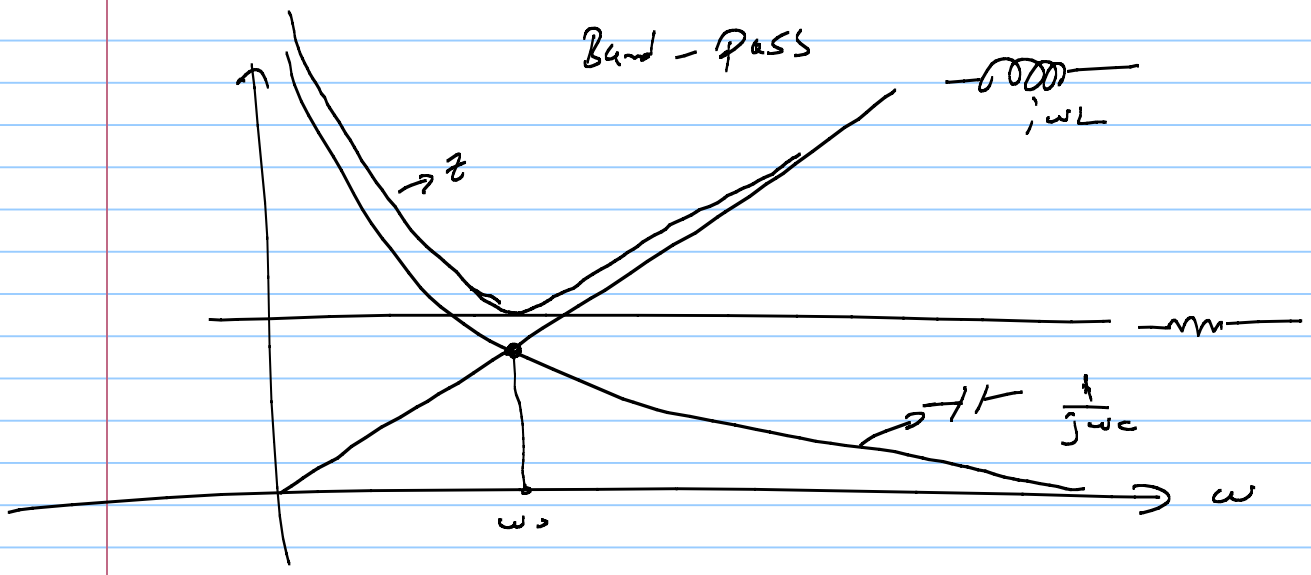
Band-stop

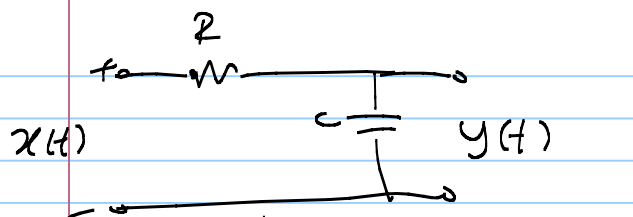


$\omega = 0 \Rightarrow |H(0)| = 0 \quad \& \quad \angle H(0) = 0$

$\omega \to \infty \Rightarrow |H(\infty)| = 0 \quad \& \quad \angle H(\infty) = 0$

$\omega = \omega_0 \Rightarrow |H(\omega_0)| = 1 \quad \& \quad \angle H(\omega_0) = 0$

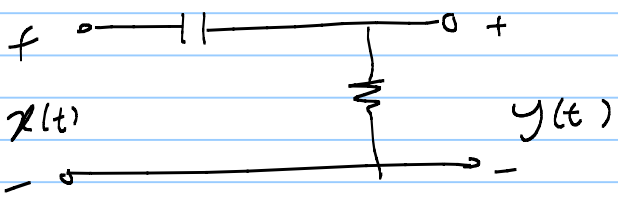




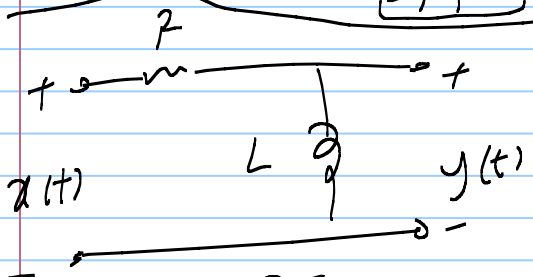
$\omega = 0 \Rightarrow \frac{1}{j\omega C} = \infty \Rightarrow H(0) = 1$

$\omega \to \infty \Rightarrow \frac{1}{j\omega C} = 0 \Rightarrow H(\infty) = 0$

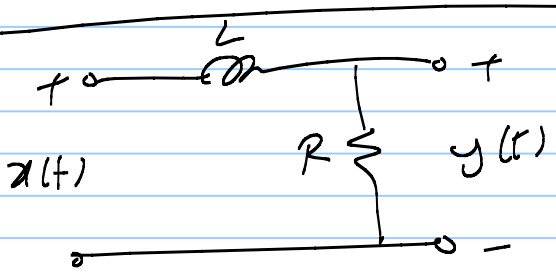
LPF



HPF



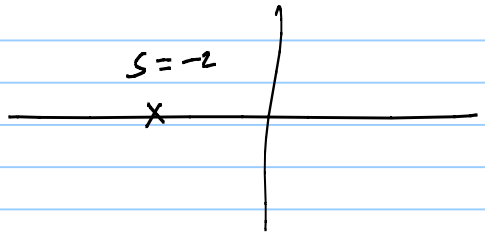
HPF



LPF

Laplace

$$\frac{A}{s+2} \Rightarrow A e^{-2t}$$



z - Transform

$$\frac{z}{z-2} \Rightarrow (2)^n u[n]$$

$$X(z) = \frac{z^2 + z}{z^2 + 2z + 1} \quad ; \quad x[n] = ?$$

$$\cos(\Omega n) u[n] \longleftrightarrow \frac{z^2 - \cos(\Omega) z}{z^2 - (2\cos(\Omega)) z + 1}$$

$$x[n] = \cos(\pi n) u[n]$$

OR $\quad X(z) = \dfrac{z}{z+1}$

$$x[n] = (-1)^n u[n]$$

$$X(z) = \frac{z+3}{z^2+9z+20}$$

$$\rightarrow \frac{X(z)}{z} = \frac{z+3}{z(z+4)(z+5)} = \frac{A}{z} + \frac{B}{z+4} + \frac{C}{z+5}$$

$$A = z\left(\frac{X(z)}{z}\right)\Big|_{z=0} = \frac{z+3}{(z+4)(z+5)}\Big|_{z=0} = \frac{3}{20}$$

$$B = (z+4)\left(\frac{X(z)}{z}\right)\Big|_{z=-4} = \frac{z+3}{z(z+5)}\Big|_{z=-4} = \frac{-1}{-4(-4+5)} = \frac{1}{4}$$

$$C = (z+5)\left(\frac{X(z)}{z}\right)\Big|_{z=-5} = \frac{z+3}{z(z+4)}\Big|_{z=-5}$$

$$= \frac{-5+3}{-5(-5+4)} = \frac{-2}{5}$$

$$\frac{X(z)}{z} = \frac{3}{20}\left(\frac{1}{z}\right) + \left(\frac{1}{4}\right)\left(\frac{1}{z+4}\right) - \left(\frac{2}{5}\right)\left(\frac{1}{z+5}\right)$$

$$X(z) = \frac{3}{20} + \left(\frac{1}{4}\right)\left(\frac{z}{z+4}\right) - \left(\frac{2}{5}\right)\left(\frac{z}{z+5}\right)$$

$$x[n] = \frac{3}{20}\delta[n] + \left(\frac{1}{4}\right)(-4)^n u[n] - \left(\frac{2}{5}\right)(-5)^n u[n]$$

$$u[n] = \frac{z}{z-1}$$

$$n^2 u[n] \longleftrightarrow \frac{z(z+1)}{(z-1)^3} \leftarrow \text{given}$$

$$x[n] = n^3 u[n] = n\left(n^2 u[n]\right)$$

$$X(z) = -z \frac{d}{dz}\left(\frac{z(z+1)}{(z-1)^3}\right)$$