3.1(c)

$$Q(s)\,Q(-s) = s^4 + 1.75\,s^2 + 4$$

$$s^2 = \frac{-1.75 \pm j\,3.5969}{2} = -0.875 \pm j\,1.7984$$

$$= 2 \angle 115.94$$

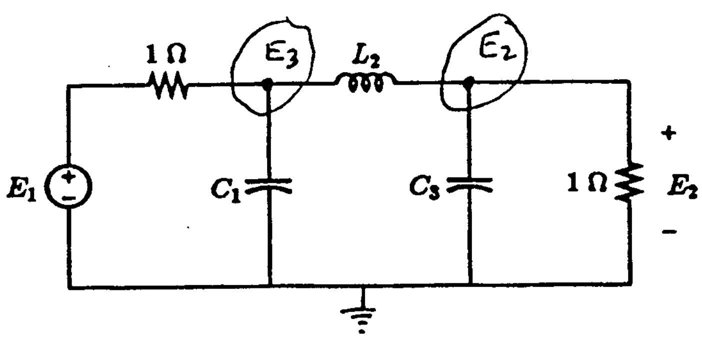
$$s = 1.414 \angle 57.97^\circ = 0.75 + j\,1.19896$$

$$Q = (s + 0.75 + j1.19896)(s + 0.75 - j\,1.19896)$$

$$= s^2 + 1.5s + 2$$

$$H(s) = \frac{s+2}{s^2 + 1.5s + 2}$$

3.5 Node equations are



$$\frac{E_3 - E_1}{1} + sC_1 E_3 + \frac{E_3 - E_2}{sL_2} = 0$$

$$\frac{E_2 - E_3}{sL_2} + sC_3 E_2 + E_2 = 0$$

Solving we get

$$\frac{E_2}{E_1} = \frac{\frac{1}{2}}{\frac{C_1 L_2 C_3}{2} s^3 + \frac{C_1 L_2 + L_2 C_3}{2} s^2 + \frac{C_1 + L_2 + C_3}{2} s + 1}$$

Hence $K = \frac{1}{2}$. Set $\frac{C_1 L_2 C_3}{2} = 1$, $\frac{C_1 L_2 + L_2 C_3}{2} = 2$, $\frac{C_1 + L_2 + C_3}{2} = 2$

Solving gives $C_1 = 1$, $C_3 = 1$, $L_2 = 2$.

3.6 $10\log(1+\epsilon^2)=0.4 \qquad \epsilon=0.310609$

$$v=\frac{1}{3}\sinh^{-1}\left(\frac{1}{\epsilon}\right)=0.628552$$

$$\sinh v=0.670766 \qquad \cosh v=1.204129$$

$$s_{1,2}=\sin\frac{7\pi}{6}\sinh v\pm j\cos\frac{7\pi}{6}\cosh v$$

$$=-0.335383\pm j1.042806$$

$$s_3=-\sinh v=-0.670766$$

$$H(s)=\frac{K}{(s+0.335383\pm j0.1042806)(s+0.670766)}$$

$$=\frac{K}{(s^2+0.670766s+1.19993)(s+0.670766)}$$

$$=\frac{K}{s^3+1.341531s^2+1.649853s+0.804869}$$

$$K=0.804869$$

3.11

$$H(s)=\frac{K\left(s^2+\frac{1}{\omega_1^2}\right)\left(s^2+\frac{1}{\omega_2^2}\right)\cdots\left(s^2+\frac{1}{\omega_N^2}\right)}{s^{2N}+b_{2N-1}s^{2N-1}+\cdots+b_1s+b_0}$$

$$H^2(\infty)=K^2=\frac{1}{1+\frac{\epsilon^2}{\omega_1^4\omega_2^4\cdots\omega_N^4}}, \quad K=\frac{\omega_1^2\omega_2^2\cdots\omega_N^2}{\sqrt{\epsilon^2+\omega_1^4\omega_2^4\cdots\omega_N^4}}$$

$$H^2(0)=\left(\frac{K}{b_0\omega_1^2\omega_2^2\cdots\omega_N^2}\right)^2=\frac{1}{1+\epsilon^2\omega_1^4\omega_2^4\cdots\omega_N^4}$$

$$b_0=\frac{K\sqrt{1+\epsilon^2\omega_1^4\omega_2^4\cdots\omega_N^4}}{\omega_1^2\omega_2^2\cdots\omega_N^2}$$