11.19) $h(t) = \frac{d}{dt} g(t) = \frac{d}{dt}\left[15(e^{-10t} - e^{-30t})\right] u(t)$

10

$= \left[-150e^{-10t} + 450e^{-30t}\right] u(t)$

11-22) $G(s) = \frac{0.5}{s} - \frac{0.5}{s+100}$ ; $X(s) = \frac{10}{s+200}$

10

$H(s) = s\left(G(s)\right) = s\left(\frac{0.5}{s} - \frac{0.5}{s+100}\right) = 0.5 - \frac{0.5s}{s+100}$

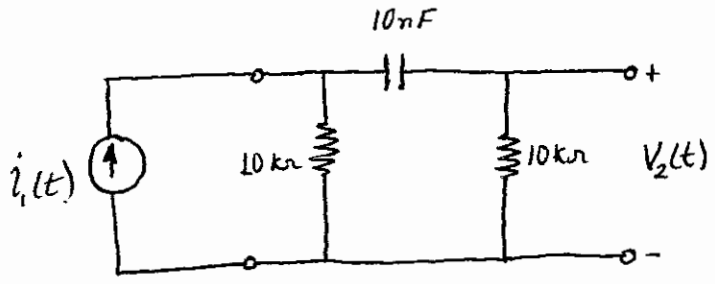
$y(t) = \mathcal{L}^{-1}\left[H(s) \cdot X(s)\right] = \mathcal{L}^{-1}\left[\left(0.5 - \frac{0.5s}{s+100}\right) \cdot \left(\frac{10}{s+200}\right)\right]$

$= \mathcal{L}^{-1}\left[\frac{500}{(s+100)(s+200)}\right] = \mathcal{L}^{-1}\left[\frac{5}{s+100} - \frac{5}{s+200}\right]$

$= 5\left(e^{-100t} - e^{-200t}\right) u(t)$

11.30)

10




$T_z(s) = \frac{R}{2R + \frac{1}{Cs}}$

$= \frac{10^4}{2\times10^4 + \frac{1}{10^{-8}s}}$

$= \frac{5000s}{s + 5000}$

$$T_z(j\omega_A) = T_z(j5000) = \frac{5000(j5000)}{j5000 + 5000} = 2500 + j2500$$

$$= 3535\, e^{+j45^\circ}$$

$$\Rightarrow V_{2ss} = 35.4 \cos(5000t + 45^\circ)\ V$$

For $i_1(t) = 5\cos(2500t)$ mA

$\omega = 2500 \Rightarrow T_z(j2500) = \dfrac{5000(j2500)}{5000 + j2500}$

$= 1000 + j2000 = 2236 \angle 63.4^\circ$

$$\Rightarrow V_{2ss} = |T_z(j2500)| \times 5\times10^{-3} \cos(2500t + 63.4^\circ)$$

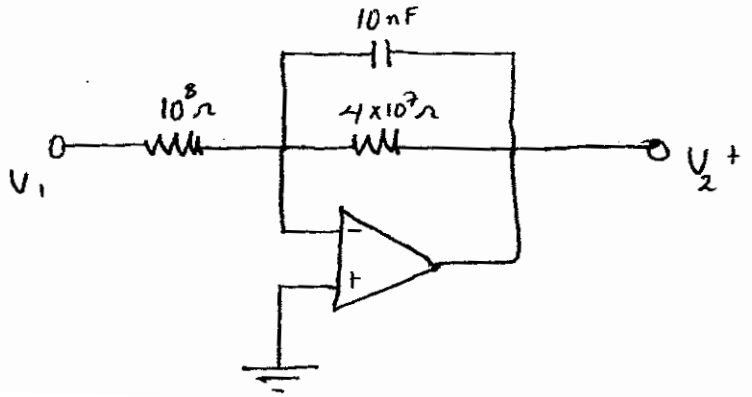
$$= 11.18 \cos(2500t + 63.4^\circ)$$

11-52)

$$T_V(s) = \pm \frac{100(s+1000)}{(s+250)(s+2000)} = \left(\frac{-100}{s+250}\right)\left(\frac{s+1000}{s+2000}\right)$$

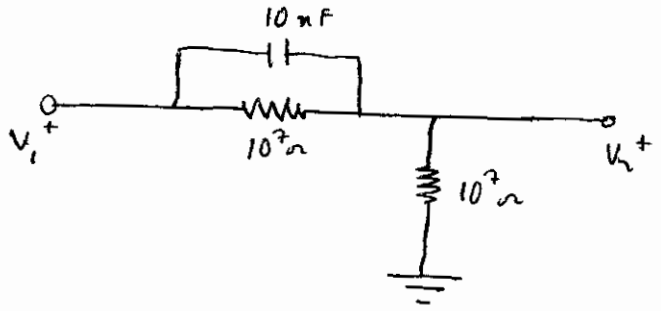
let $T_{V1}(s) = \dfrac{-100}{s+250} = \dfrac{-1/R_1}{1/R_2 + Cs} \Rightarrow$ $C = 10\,nF$, $R_1 = 10^8\,\Omega$, $R_2 = 4\times10^7\,\Omega$

$\Rightarrow$



$$T_{V2}(s) = \frac{s + 1000}{s + 2000} = \frac{1/R_1 + Cs}{\frac{1}{R_1} + \frac{1}{R_2} + Cs}$$

$$\Rightarrow \begin{cases} \text{if } C = 10\,nF \\ R_1 = 10^7\,\Omega \\ R_2 = 10^7\,\Omega \end{cases}$$

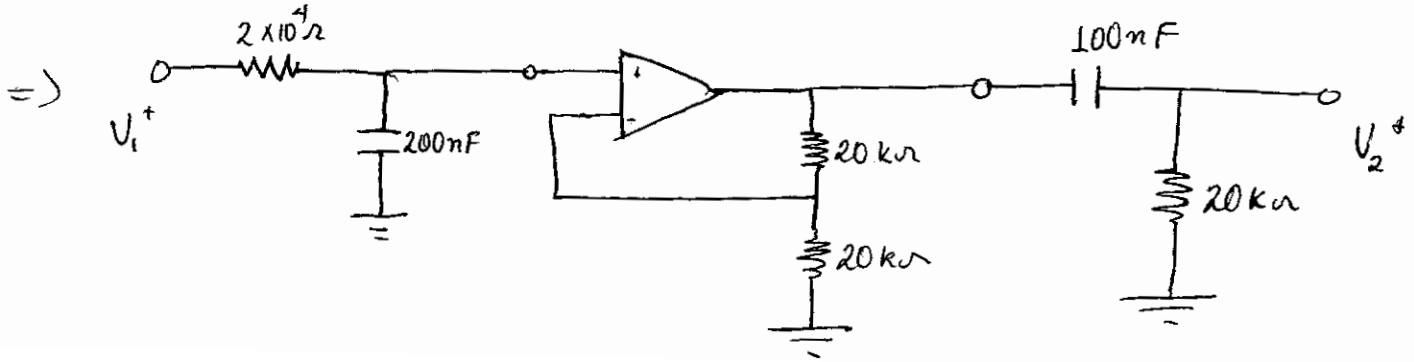



11.53)

$$T_V(s) = \frac{1000\,s}{(s+500)(s+1000)} = \frac{500/s}{1 + 500/s} \times 2 \times \frac{1}{1 + 1000/s}$$

$$= \frac{\frac{1}{C_1 s}}{R + \frac{1}{C_1 s}} \times k \times \frac{R}{R + \frac{1}{C_2 s}}$$

$$\Rightarrow \begin{cases} \text{if } R = 20 \times 10^3\,\Omega \\ C_1 = 2 \times 10^{-7}\,F \\ C_2 = 10^{-7}\,F \end{cases}$$



11 - 54)

$$T_V(s) = \frac{s^2}{(s+2000)(s+4000)} = \frac{s^2}{s^2 + 6000s + 8\times10^6}$$

10

$$= \frac{s}{s + 6000 + \frac{8\times10^6}{s}} = \frac{Ls}{Ls + R + \frac{1}{Cs}}$$

$$\Rightarrow \begin{cases} \text{if} \quad L = 5\times10^{-3}\ H \\ \quad\ R = 300\ \Omega \\ \quad\ C = 2.5\ \mu F \end{cases}$$