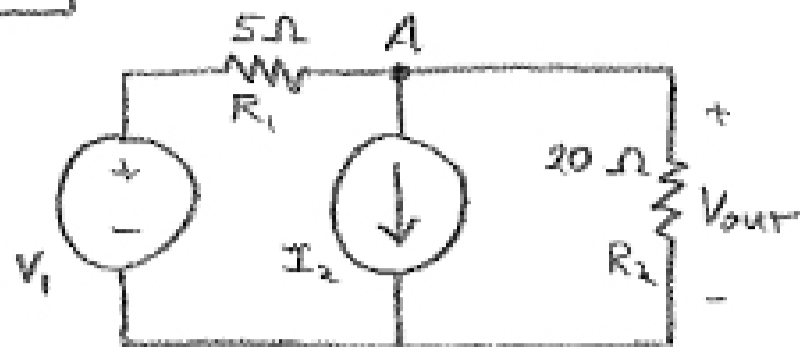


5-1



A) Node equation @ A: $\frac{V_{out} - V_1}{5} + I_2 + \frac{V_{out}}{20} = 0$

$\Rightarrow 4V_{out} - 4V_1 + 20I_2 + V_{out} = 0$

$\Rightarrow 5V_{out} = 4V_1 - 20I_2 \Rightarrow V_{out} = \frac{4}{5}V_1 - 4I_2 \Rightarrow \begin{cases} \alpha = 4/5 \\ \beta = -4 \end{cases}$

B) $V_1(t) = 10 \cos(10t) V$ $I_2 = 2A$

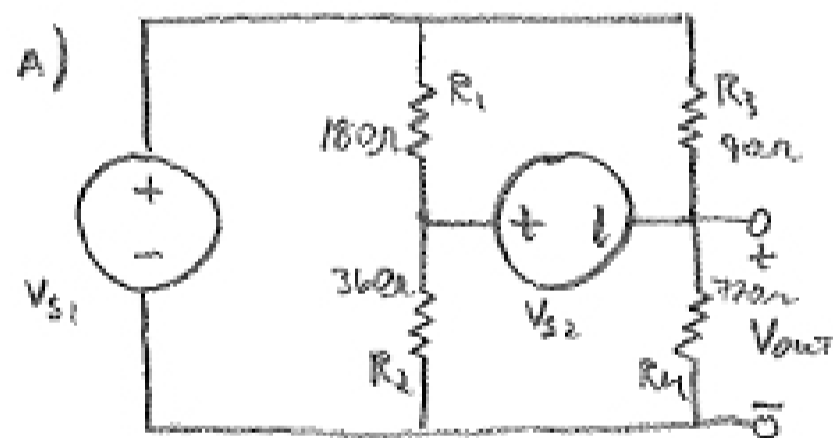
$\Rightarrow V_{out}(t) = \frac{4}{5} [10 \cos(10t)] - 4(2) = \boxed{8 \cos(10t) - 8 V}$

C) $G_1(V_{out} - V_1) + I_2 + G_2(V_{out}) = 0$

$\Rightarrow V_{out}(G_1 + G_2) = G_1 V_1 - I_2 \Rightarrow \boxed{V_{out} = \frac{G_1}{G_1 + G_2} V_1 - \frac{1}{G_1 + G_2} I_2}$

$\alpha_1 = \frac{G_1}{G_1 + G_2}$ $\beta = -\frac{1}{G_1 + G_2}$

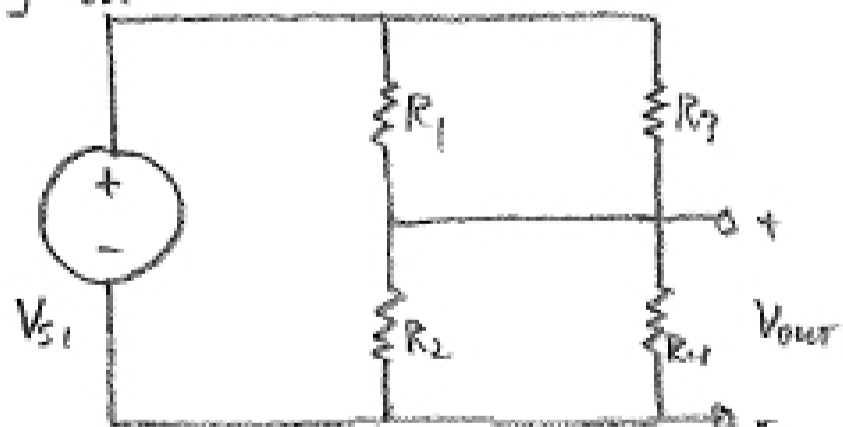
5-2



Zeroing V_{s2} : $R_1 // R_3, R_2 // R_4$

$V_{out} = V_{s1} \cdot \frac{R_2 // R_4}{R_1 // R_3 + R_2 // R_4}$
 $= V_{s1} \cdot \frac{240}{60 + 240} = \frac{4}{5} V_{s1}$

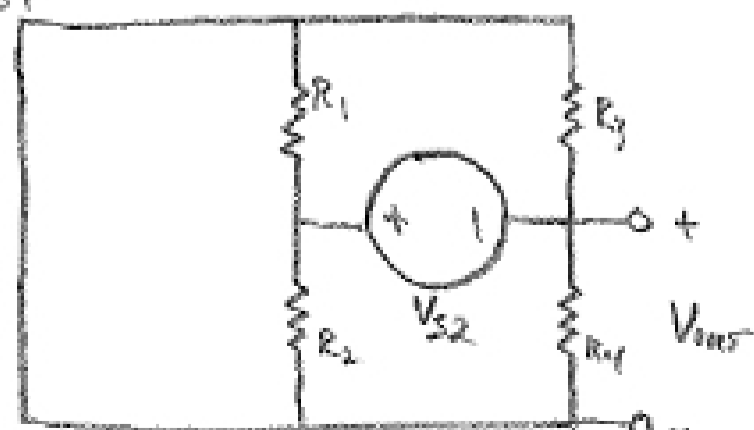
Zeroing V_{s1}



Zeroing V_{s1} : $R_1 // R_2, R_3 // R_4$

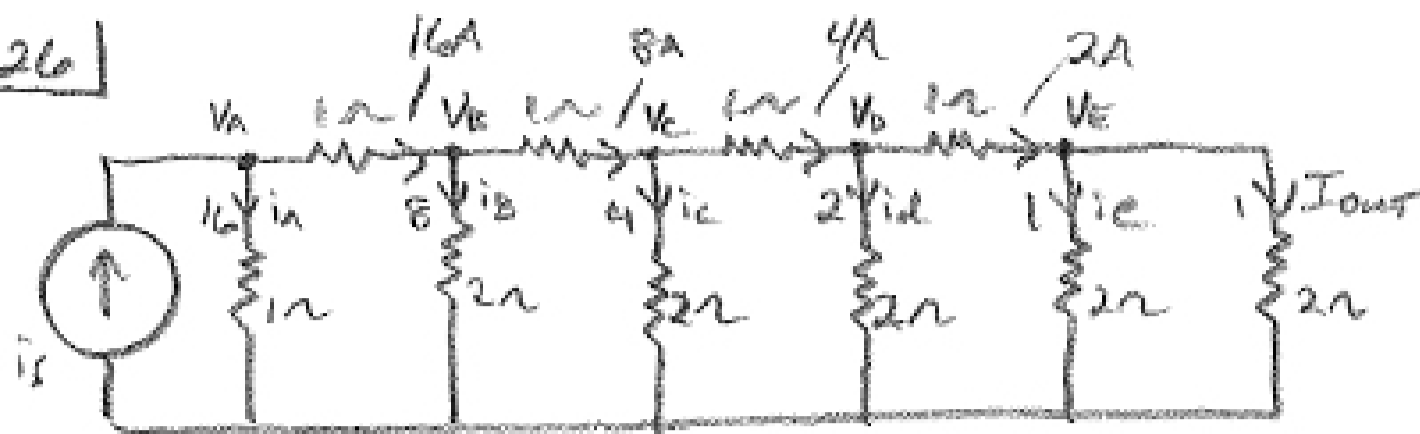
$-V_{out} = V_{s2} \cdot \frac{R_3 // R_4}{R_1 // R_2 + R_3 // R_4}$
 $= V_{s2} \cdot \frac{80}{80 + 120} = \frac{2}{5} V_{s2}$

Zeroing V_{s2}



$\Rightarrow \boxed{V_{out} = \frac{4}{5} V_{s1} + \frac{2}{5} V_{s2}}$

S-26



$$i_s = 64 \text{ mA}$$

$$I_{out}' = 1 \text{ A} \Rightarrow V_E = 2 \text{ V} \Rightarrow i_e = 1 \text{ A}$$

$$\text{So } i_{DE} = 2 \text{ A} \Rightarrow V_D = V_E + 2 \text{ V} = 4 \text{ V} \quad \text{So } i_d = \frac{4 \text{ V}}{2 \Omega} = 2 \text{ A}$$

$$V_C = 4 \text{ V} + V_D = 8 \text{ V} \quad \text{So } i_c = 4 \text{ A}$$

$$V_B = 8 \text{ V} + V_C = 16 \text{ V} \quad i_b = \frac{16 \text{ V}}{2 \Omega} = 8 \text{ A}$$

$$V_A = 16 \text{ V} + V_B = 32 \text{ V} \quad i_a = 32 \text{ A} \Rightarrow i_s' = 48 \text{ A}$$

$$\frac{i_e'}{i_s} = \frac{I_{out}'}{I_{out}} \Rightarrow I_{out} = I_{out}' \cdot \frac{i_s}{i_s'} = 1 \text{ A} \cdot \frac{64 \text{ mA}}{48 \text{ A}} = \boxed{\frac{4}{3} \text{ mA}}$$