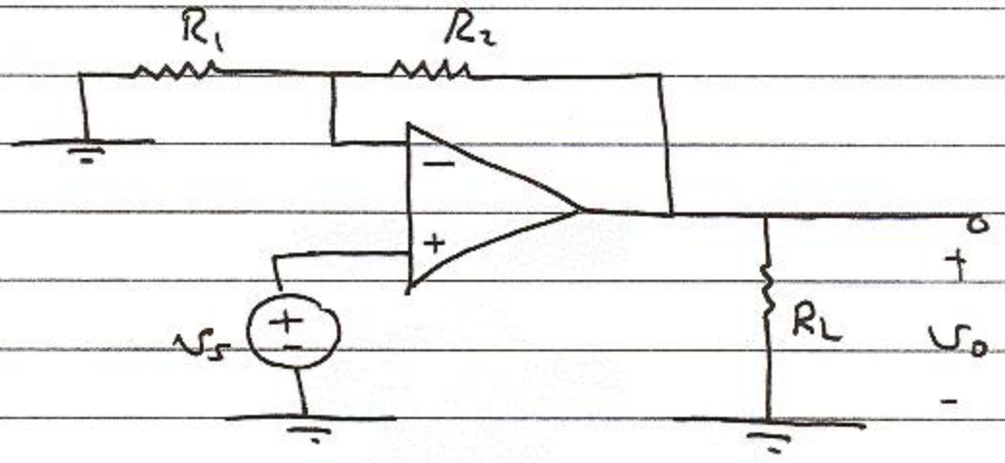
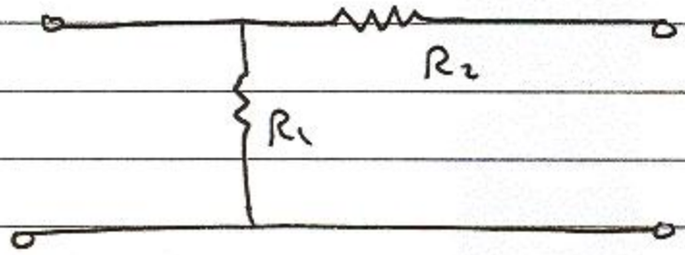
Homework Solution Electronics II EE338

8.26

a)



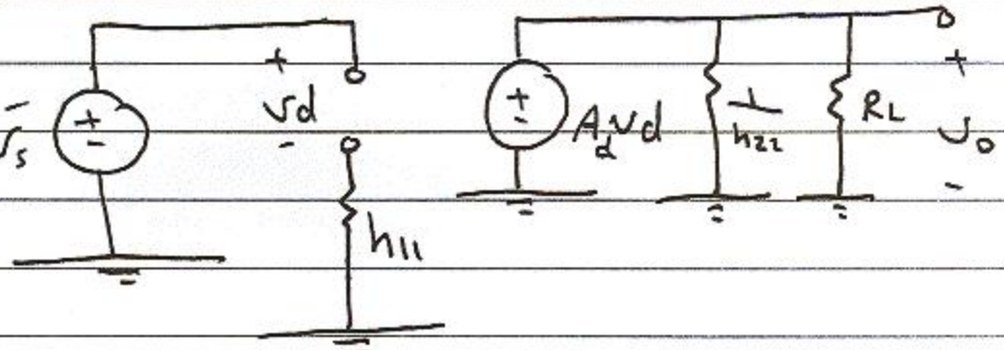
Sevier-shunt feedback



$$h_{11} = R_1 \| R_2 \quad , \quad h_{22} = \frac{1}{R_2 + R_1}$$

$$h_{12} = \beta = \frac{R_1}{R_1 + R_2}$$

To find A:



$$V_o = A_d V_d \quad ; \quad V_d = V_s$$

$$\therefore A = \frac{V_o}{V_s} = A_d \quad ; \quad A_f = \frac{A_d}{1 + A_d\beta} \approx \frac{1}{\beta} = \frac{R_1 + R_2}{R_1}$$

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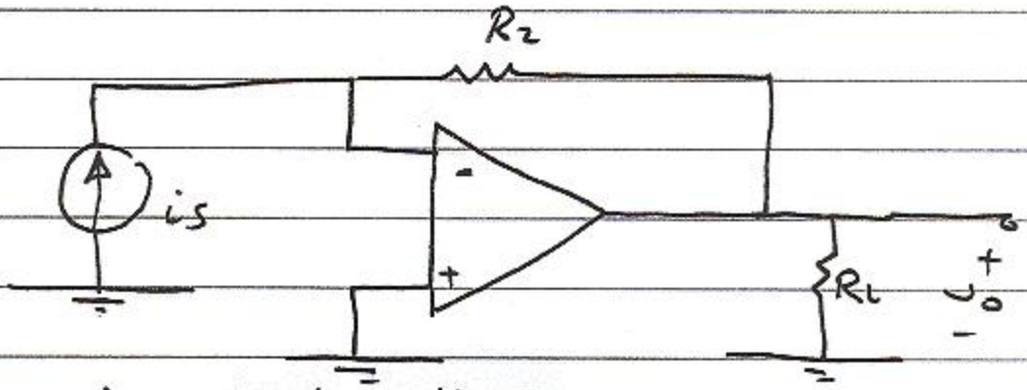
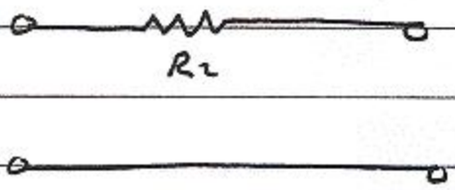
b)

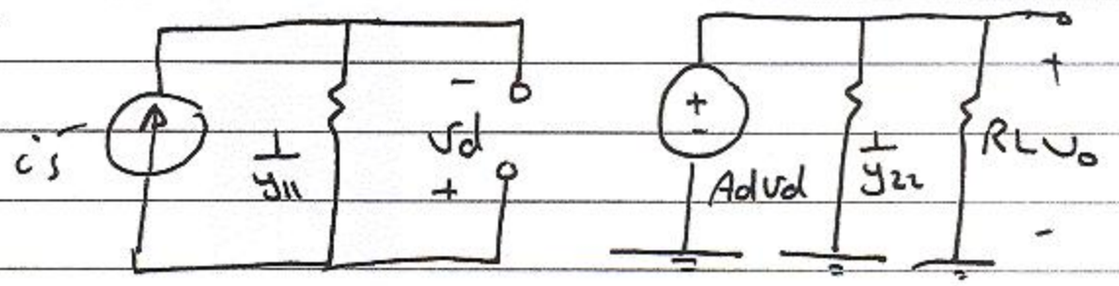


shunt - shunt feedback



$$y_{11} = \frac{1}{R_2} \quad ; \quad y_{22} = \frac{1}{R_2} \quad ; \quad y_{12} = \beta = -\frac{1}{R_2}$$

To find A



$$v_o = A_d v_d \quad ; \quad v_d = -i_s \cdot \frac{1}{y_{11}} = -i_s R_2$$

$$A = \frac{v_o}{i_s} = -A_d R_2$$

$$A_f = \frac{A}{1 + A\beta} = \frac{-A_d R_2}{1 + (A_d R_2)\left(\frac{1}{R_2}\right)}$$

$$A_f = \frac{-A_d R_2}{1 + A_d}$$

$$A_f \longrightarrow -R_2 = \frac{1}{\beta}$$

as $A_d \to \infty$

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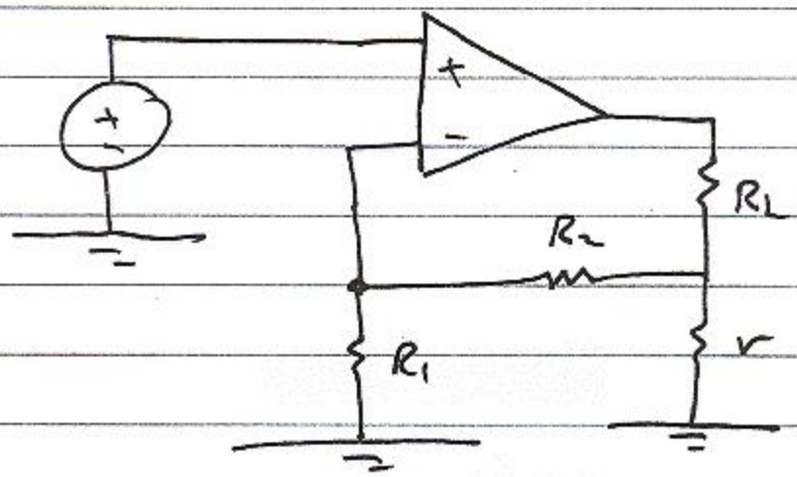
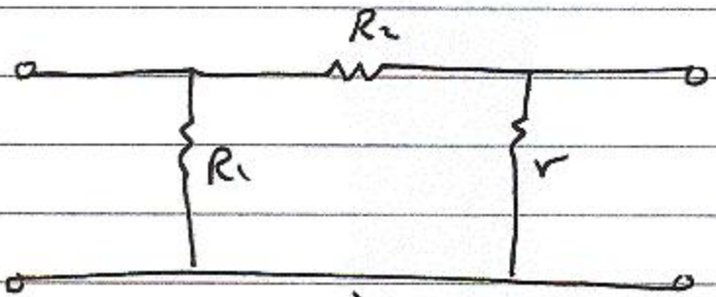
c)



Series – Series feedback

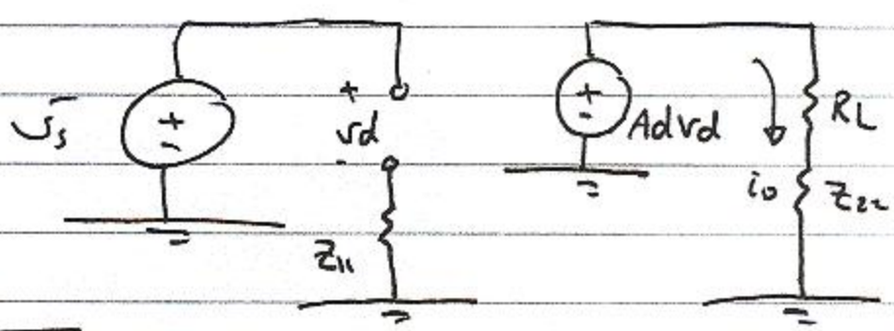


$$Z_{11} = R_1 \| (R_2 + r)$$

$$Z_{22} = r \| (R_1 + R_2)$$

$$Z_{12} = \beta = \frac{R_1 r}{r + R_1 + R_2}$$

To find A:



$$i_o = \frac{A_d v_d}{R_L + Z_{22}} \quad ; \quad v_d = v_s$$

$$A = \frac{i_o}{v_s} = \frac{A_d}{R_L + Z_{22}}$$

$$A_f = \frac{A}{1 + A\beta} = \frac{A_d / R_L + Z_{22}}{1 + \left(A_d / R_L + Z_{22}\right)\left(\frac{R_1 r}{r + R_1 + R_2}\right)} \simeq \frac{r + R_1 + R_2}{R_1 r} \quad \text{as } A_d \to \infty$$

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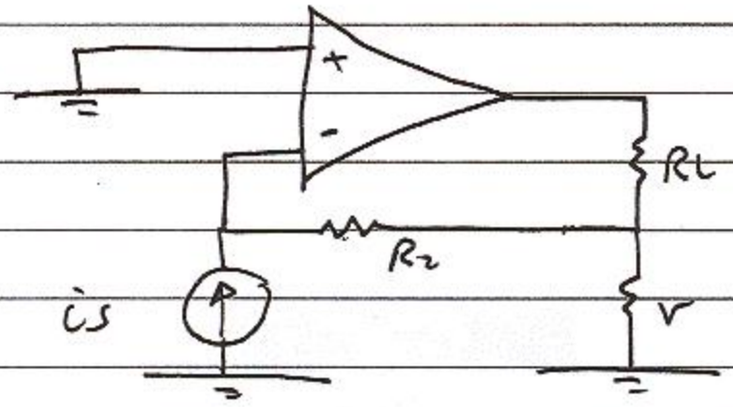
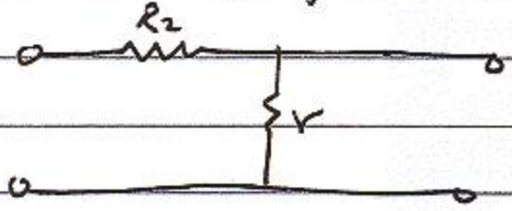
d)



shunt - Serier feedback

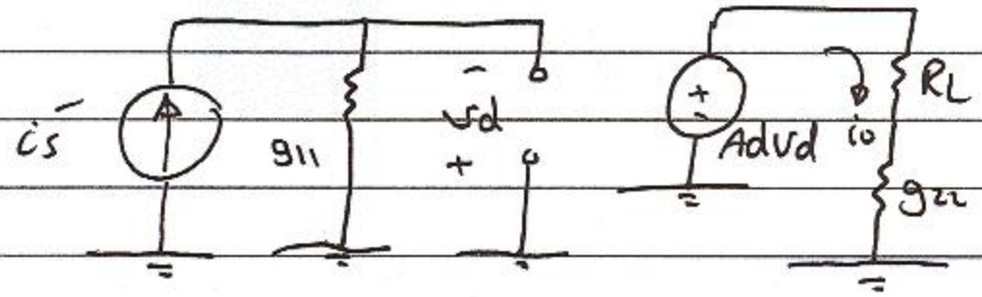


$$g_{11} = \frac{1}{R_2 + r}$$

$$g_{22} = r \| R_2$$

$$g_{12} = \beta = \frac{-r}{r + R_2}$$

To find A :



$$A = \frac{i_o}{i_s}$$

$$i_o = \frac{A_d v_d}{R_L + g_{22}} \quad ; \quad v_d = -i_s \left(\frac{1}{g_{11}}\right)$$

$$A = \frac{-A_d \left(\frac{1}{g_{11}}\right)}{R_L + g_{22}} = -A_d \frac{R_2 + r}{R_L + r \| R_2}$$

$$A_f = \frac{A}{1 + AB} = \frac{-A_d \frac{(R_2 + r)}{R_L + r \| R_2}}{1 + \frac{A_d (R_2 + r)}{R_L (r \| R_2)} \cdot \left(-\frac{r}{r + R_2}\right)}$$

$$A_f \simeq -\frac{r + R_2}{r}$$