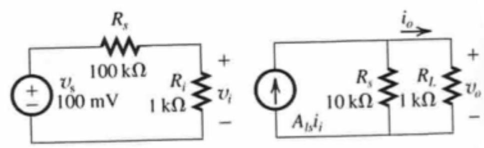
1.53



(a) Current gain $= \dfrac{i_O}{i_i}$

$$= A_{is}\frac{R_O}{R_O + R_L}$$

$$= 100\frac{10}{11}$$

$$= 90.9\frac{\text{A}}{\text{A}} = 39.2 \text{ dB}$$

(b) Voltage gain $= \dfrac{v_O}{v_S}$

$$= \frac{i_O}{i_i}\frac{R_S}{R_S + R_i}$$

$$= 90.9 \times \frac{1}{101}$$

$$= 0.9 \text{ V/V} = -0.9 \text{ dB}$$

(c) Power gain $= A_P = \dfrac{v_O i_O}{v_S i_i}$

$$= 0.9 \times 90.9$$

$$= 81.8 \text{ W/W} = 19.1 \text{ dB}$$

Ex: 1.12

$$v_o = 1 \times \frac{10}{10^6 + 10} \simeq 10^{-5}\text{ V} = 10\ \mu\text{V}$$

$$P_L = v_O^2 / R_L = \frac{(10 \times 10^{-6})^2}{10} = 10^{-11}\text{ W}$$

With the buffer amplifier:

$$v_O = 1 \times \frac{R_i}{R_i + R_S} \times A_{vo} \times \frac{R_L}{R_L + R_o}$$

$$= 1 \times \frac{1}{1 + 1} \times 1 \times \frac{10}{10 + 10} = 0.25\text{ V}$$

$$P_L = \frac{v_O^2}{R_L} = \frac{0.25^2}{10} = 6.25\text{ mW}$$

$$\text{Voltage gain} = \frac{v_O}{v_S} = \frac{0.25\text{ V}}{1\text{ V}} = 0.25\text{ V/V}$$

$= -12$ dB

$$\text{Power gain } (A_p) \equiv \frac{P_L}{P_i}$$

where $P_L = 6.25$ mW and $P_i = v_i i_1$,

$v_i = 0.5$ V and

$$i_i = \frac{1\text{ V}}{1\text{ M}\Omega + 1\text{ M}\Omega} = 0.5\ \mu\text{A}$$

Thus,

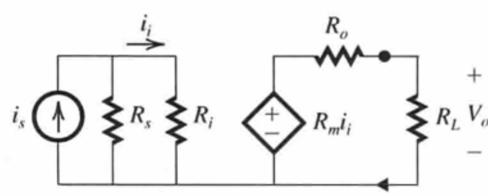
$P_i = 0.5 \times 0.5 = 0.25\ \mu$W

and,

$$A_p = \frac{6.25 \times 10^{-3}}{0.25 \times 10^{-6}} = 25 \times 10^3$$

$10 \log A_p = 44$ dB

Ex: 1.20 Using transresistance circuit model the circuit will be



$$\frac{i_i}{i_S} = \frac{R_S}{R_i + R_S}$$

$$V_O = R_m i_i \times \frac{R_L}{R_L + R_O}$$

$$\frac{V_O}{i_i} = R_m \frac{R_L}{R_L + R_O}$$

Now $\frac{V_O}{i_S} = \frac{V_O}{i_i} \times \frac{i_i}{i_S} = R_m \frac{R_L}{R_L + R_O} \times \frac{R_S}{R_i + R_S}$

$$= R_m \frac{R_S}{R_S + R_i} \times \frac{R_L}{R_L + R_O}$$