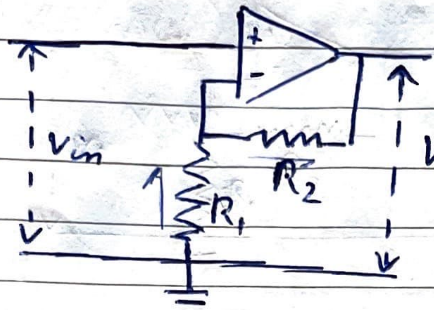
Q2 Ans 6 QIP 135



$Z_f = R_f$ $\quad -\frac{R_f}{R_i}$

$Z_i = R_i$

Q: show here Gain $= 1 + \frac{R_2}{R_1}$

$I_2 = \frac{V_{out} - V^-}{R_2}$ $\quad I_1 = \frac{V^- - 0}{R_1}$ $\quad V^+ = V_{in}$

$\Rightarrow$ taking $I_2 = I_1$ $\Rightarrow \frac{V_{out} - V^-}{R_2} = \frac{V^-}{R_1}$

$\Rightarrow V^- \frac{R_2}{R_1} = V_{out} - V^-$

$\Rightarrow V^-\left(\frac{R_2}{R_1} + 1\right) = V_{out}$ (1) $\longrightarrow V^- = \frac{1}{\frac{R_2}{R_1}+1} V_{out}$ (2)

$V_{out} = A(V^+ - V^-)$ (eq 19)

$\Rightarrow V_{out} = AV^+ - AV^-$

$\Rightarrow V_{out} = AV_{in} - AV^-$ using $v^+ = v_{in}$

$\Rightarrow V_{out} = AV_{in} - AV_{out}\frac{1}{\frac{R_2}{R_1}+1}$ using (2)

$\Rightarrow V_{out}\left(1 + A\frac{1}{\frac{R_2}{R_1}+1}\right) = AV_{in}$

$\Rightarrow \frac{V_{out}}{v_{in}} = \frac{A}{1 + A\frac{1}{\frac{R_2}{R_1}+1}} = \frac{A}{\frac{\frac{R_2}{R_1}+1+A}{\frac{R_2}{R_1}+1}} = \frac{A\left(\frac{R_2}{R_1}+1\right)}{\left(\frac{R_2}{R_1}+1\right)+A}$

Assume open loop Gain A is ∞

$$\frac{V_{out}}{V_{in}} = \lim_{A\to\infty} \frac{A\left(\frac{R_2}{R_1}+1\right)}{\left(\frac{R_2}{R_1}+1\right)+A} = \boxed{\frac{R_2}{R_1}+1}$$