# OP AMP
# Design Problems

**1.** A non-inverting amplifier has Ri of 1KΩ and $R_f$ of 100 KΩ. Determine $V_f$ and B if $V_{out}$ = 5V.

$$B = \frac{R_i}{R_i + R_f} = \frac{1.0\,\text{k}\Omega}{101\,\text{k}\Omega} = \mathbf{9.90 \times 10^{-3}}$$

$$V_f = BV_{out} = (9.90 \times 10^{-3})5\ \text{V} = 0.0495\ \text{V} = \mathbf{49.5\ mV}$$

**2.** For the non-inverting amplifier shown in figure (1). Determine $A_{cl(NI)}$ , $V_{out}$, and $V_f$.

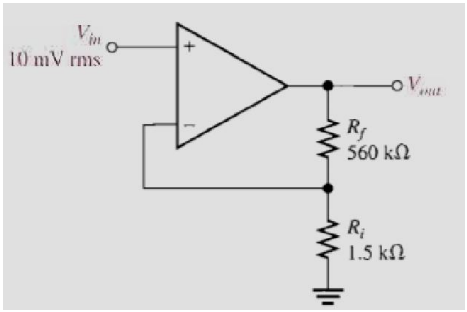


**Figure (1)**

(a) $$A_{cl(\text{NI})} = \frac{1}{B} = \frac{1}{1.5\,\text{k}\Omega / 561.5\,\text{k}\Omega} = \mathbf{374}$$

(b) $$V_{out} = A_{cl(\text{NI})}V_{in} = (374)(10\ \text{mV}) = \mathbf{3.74\ V\ rms}$$

(c) $$V_f = \left(\frac{1.5\,\text{k}\Omega}{561.5\,\text{k}\Omega}\right)3.74\ \text{V} = \mathbf{9.99\ mV\ rms}$$

**3.** Calculate the closed loop gain for non-inverting amplifier has $R_1$=4.7KΩ, $R_F$=47KΩ, and $A_{OL}$=150,000.

ACL= 1 + Rf/R1 = 11

**4.** For an inverting amplifier with closed loop gain of -300, and $R_1$ of 10KΩ, calculated the value required to $R_f$ to satisfy this gain.

$$\frac{R_f}{R_i} = A_{cl(\text{I})}$$

$$R_f = -R_i(A_{cl(\text{I})}) = -10\ \text{k}\Omega(-300) = \mathbf{3\ M}\Omega$$

**5.** Determine the approximate values for $I_{in}$, $I_f$, Vout, $A_{cl}$ in figure (2).

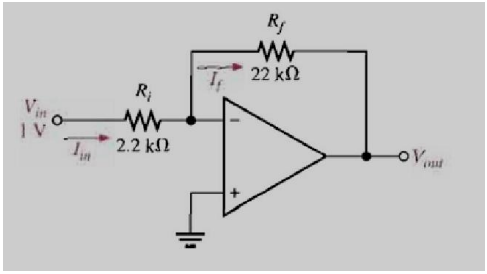


**Figure (2)**

(a) $I_{in} = \dfrac{V_{in}}{R_{in}} = \dfrac{1\,\text{V}}{2.2\,\text{k}\Omega} = \mathbf{455\ \mu A}$

(b) $I_f \cong I_{in} = \mathbf{455\ \mu A}$

(c) $V_{out} = -I_f R_f = -(455\ \mu\text{A})(22\ \text{k}\Omega) = \mathbf{-10\ V}$

(d) $A_{cl(\text{I})} = -\left(\dfrac{R_f}{R_i}\right) = -\left(\dfrac{22\,\text{k}\Omega}{2.2\,\text{k}\Omega}\right) = \mathbf{-10}$