
Sheet (1) - Solution

1. **(a)** What are the connections to a basic OP-AMP?

solution *:*

Inverting input, noninverting input, output, positive and negative supply voltages

(b) Compare a practical OP-AMP to an ideal OP-AMP and describe some of the characteristics of a practical OP-AMP?

Solution

Practical op-amp: High open-loop gain, high input impedance. low output impedance, and high CMRR.
Ideal op-amp: Infinite open-loop gain, infinite input impedance, zero output impedance, and infinite CMRR.

A practical op-amp has very high input impedance, very low output impedance, and very high voltage gain.

(c) List the amplifier stages in a typical OP-AMP?

solution *:*

Differential amplifier, voltage amplifier, and push-pull amplifi

(d) What does a differential amplifier amplify?

solution *:*

The difference between its two input voltages

(e) Distinguish between differential and single – ended inputs?

solution *:*

Differential input is between two input terminals. Single-ended input is from one input terminal to ground (with other input grounded).

(f) For a given value of open loop gain, does a higher CMRR result in a higher or lower Common Mode Gain?

solution *:*

A higher CMRR results in a lower common-mode gain.

(g) Two – IC OP-AMP are available to you their characteristics are listed below. Choose the one you think is more desirable.
OP-AMP 1 : Z_{in} = 5MΩ , Z_{out} = 100Ω , A_{OL}=100,000.
OP-AMP 2 : Z_{in} = 10MΩ , Z_{out} = 75Ω , A_{OL}=150,000.

solution :

Op amp 2 is more desirable because it has a higher input impedance, a lower output impedance, and a higher open-loop gain.

2. Identify the type of input mode for each OP-AMP in the Figure 1.

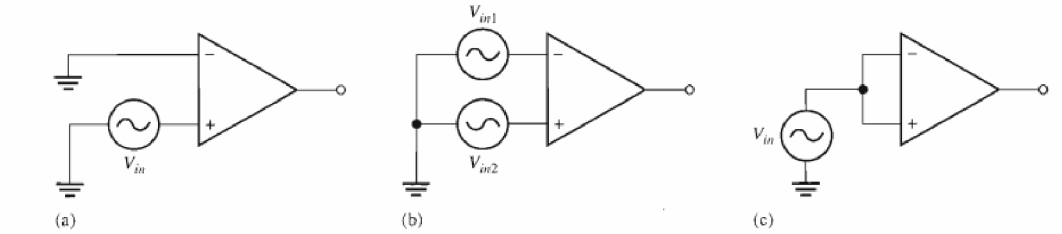

Figure (1)

solution :

(a) Single-ended input
(b) Differential input
(c) Common-mode

3. The open loop gain of a certain OP-AMP is 175,000. Its common Mode gain is 0.18. Determine CMRR in Decibel.

solution :

$$\text{CMRR(dB)} = 20\log\left(\frac{A_{ol}}{A_{cm}}\right) = 20\log\left(\frac{175{,}000}{0.18}\right) = \mathbf{120\ dB}$$

4. Determine the bias current I_{Bias} , given that the input currents to an OP-AMP are 8.3μA and 7.9 μA and then calculate the input offset current.

solution :

$$I_{BIAS} = \frac{8.3\ \mu A - 7.9\ \mu A}{2} = \mathbf{8.1\ \mu A}$$

Input bias current is the average of the two input currents. Input offset current is the difference between the two input currents.

$$I_{OS} = |8.3\ \mu A - 7.9\ \mu A| = \mathbf{400\ nA}$$

5. How long does it make the output voltage to go from -10V to +10V, if the slew rate is 0.5V/ μs.

solution :

$$\Delta t = \frac{\Delta V_{out}}{\text{slew rate}} = \frac{20\ \text{V}}{0.5\ \text{V}/\mu s} = \mathbf{40\ \mu s}$$