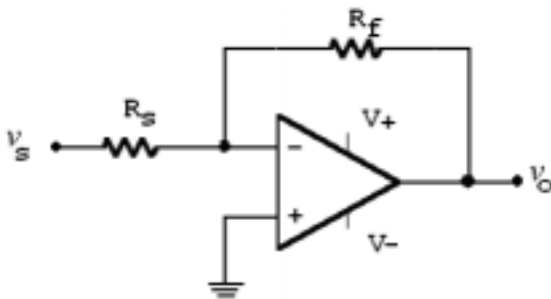


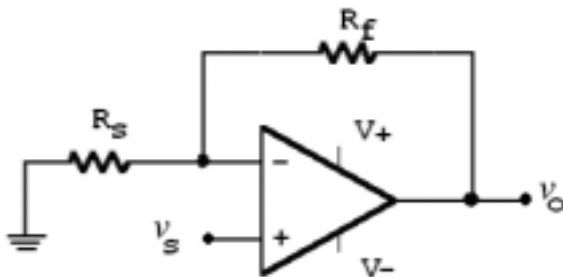
## Note 21: Summary of Chapter 5 (Op Amp)

1. The op amp is a high-gain amplifier that has high input resistance and low output resistance.
2. An ideal Op Amp has an infinite input resistance, a zero output voltage, and an infinite gain.
3. For an ideal Op Amp, the current into each of its two input terminals is zero, and the voltage across its input terminals is negligibly small (i.e., two input terminal voltages are the same.)
4. Op Amp circuits can be cascaded without changing their input-output relationships.
5. Op amp circuits

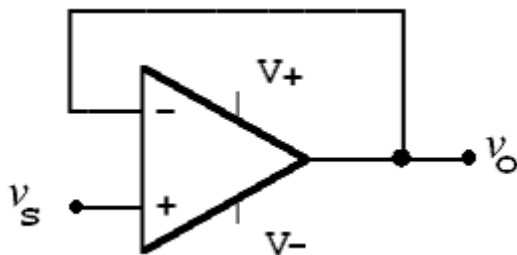
(a) Inverting Amplifier  $\{ V_o = -\frac{R_f}{R_s} V_s \}$



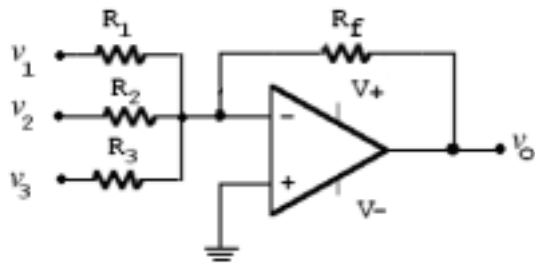
(b) Non-inverting Amplifier  $\{ V_o = (1 + \frac{R_f}{R_s}) V_s \}$



(c) Voltage Follower  $\{ V_o = V_s \}$



(d) Summer  $\{ V_o = -\left( \frac{R_f}{R_1} V_1 + \frac{R_f}{R_2} V_2 + \frac{R_f}{R_3} V_3 \right)$



(e) Difference Amplifier  $\{ V_o = -\frac{R_2}{R_1} (V_2 - V_1) \}$

