Electronics Equations

For Resistors in series:

$$R_{total} = R_1 + R_2 + R_3 + ..$$

For Resistors in parallel:

$$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + ..$$

Voltage and Current Relationships:

$$V = I \cdot R \qquad I = \frac{V}{R} \qquad R = \frac{V}{I}$$

Capacitors in series:

$$\frac{1}{C_{total}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + ..$$

Capacitors in parallel:

$$C_{total} = C_1 + C_2 + C_3 + ...$$

Impedance of an RC circuit:

$$Z = \frac{1}{2 \cdot \pi \cdot f \cdot R \cdot C} \qquad Z = \frac{1}{\omega \cdot R \cdot C}$$

Charging an RC Circuit:

$$i(t) = \frac{V_{in}}{R} \cdot e^{-\left(\frac{t}{R \cdot C}\right)}$$

$$V_R(t) = V_{in} \cdot e^{-\left(\frac{t}{R \cdot C}\right)}$$

$$V_C(t) = V_{in} \cdot \left[1 - e^{-\left(\frac{t}{R \cdot C}\right)}\right]$$

Low Pass Filter:

$$A = \frac{1}{\sqrt{\omega^2 \cdot R^2 \cdot C^2 + 1}} \qquad A = \frac{1}{\sqrt{(2 \cdot \pi \cdot f \cdot R \cdot C)^2 + 1}}$$

$$\phi = -\tan^{-1} \cdot \left(\frac{-1}{\omega \cdot R \cdot C}\right) - \frac{\pi}{2} \qquad \phi = -\operatorname{atan} \cdot \left(\frac{-1}{2 \cdot \pi \cdot f \cdot R \cdot C}\right) - \frac{\pi}{2}$$

High Pass Filter:

$$A = \frac{\omega \cdot R \cdot C}{\sqrt{\omega^2 \cdot R^2 \cdot C^2 + 1}} \qquad A = \frac{2 \cdot \pi \cdot R \cdot C}{\sqrt{(2 \cdot \pi \cdot f \cdot R \cdot C)^2 + 1}}$$

$$\phi = \operatorname{atan} \cdot \left(\frac{1}{\omega \cdot R \cdot C}\right) - \frac{\pi}{2} \qquad \phi = \operatorname{atan} \cdot \left(\frac{1}{2 \cdot \pi \cdot f \cdot R \cdot C}\right) - \frac{\pi}{2}$$