

# BME 194: Applied Circuits study sheet 1

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There is very little to memorize in this class. Here are the few concepts we've had so far that are worth having instantly available in your memory. Your studying should not be memorizing these few formulas, but using them to solve design and analysis problems for RC circuits.

## 1 Physics

$$Q = CV$$

$$I(t) = \frac{dQ(t)}{dt}$$

$$V = IR$$

## 2 Math

$$j = \sqrt{-1}$$

$$e^{j\theta} = \cos(\theta) + j \sin(\theta)$$

$$\frac{de^{j\omega t}}{dt} = j\omega e^{j\omega t}$$

$\omega = 2\pi f$ , angular frequency in radians/sec, frequency in Hz

## 3 Impedance

$$v(t) = i(t)Z$$

$$Z = R, \text{ resistor}$$

$$Z = \frac{1}{j\omega C}, \text{ capacitor, angular frequency} = \omega$$

$$Z_{series} = Z_1 + Z_2$$

$$Z_{parallel} = Z_1 \parallel Z_2 = \frac{1}{\frac{1}{Z_1} + \frac{1}{Z_2}} = \frac{Z_1 * Z_2}{Z_1 + Z_2}$$

$$\text{gain} = \frac{Z_{down}}{Z_{up} + Z_{down}}, \text{ for voltage divider}$$

Gain of simple RC circuit (one R, one C) is  $\sqrt{2}/2$  at the corner frequency.

$$2\pi f = \omega = \frac{1}{RC}, \text{ corner frequency}$$