Example 2 is a series circuit illustrated in which a capacitor of 200 µf is connected in series with a 10 ohm resistor. *[Figure 9-26]* What is the value of the impedance, the current flow, and the voltage drop across the resistor?

Solution:
First, the capacitance is changed from microfarads to farads. Since 1 million microfarads equal 1 farad, then 200 µf = 0.000200 farads.

Next solve for capacitive reactance:

$$X_C = \frac{1}{2\pi fC}$$

$$X_C = \frac{1}{2\pi(60)(.00020)}$$

$$X_C = \frac{1}{0.07536}$$

$$X_C = 13\Omega$$

To find the impedance,

$$Z = \sqrt{R^2 + X_C^2}$$

$$Z = \sqrt{10^2 + 13^2}$$

$$Z = 16.4\Omega$$

Since this circuit is resistive and capacitive, there is a phase shift where current leads voltage:

To find the current:

$$I_T = \frac{E}{Z}$$

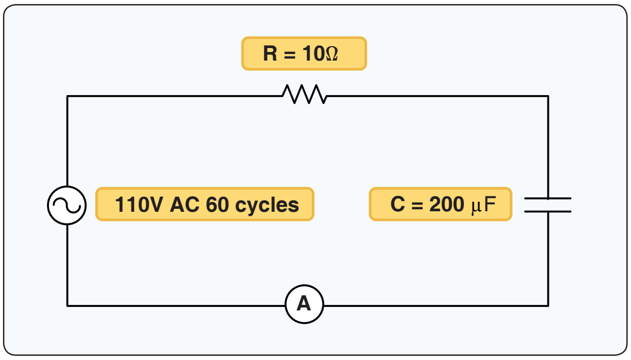

Figure 9-26. *A circuit containing resistance and capacitance.*

$$I_T = \frac{110V}{6.4\Omega}$$

$$I_T = 6.7 \text{ amps}$$

To find the voltage drop across the resistor (E_R):

$$E_R = I \times R$$

$$E_R = 6.7A \times 10\Omega$$

$$E_R = 67 \text{ volts}$$

To find the voltage drop over the capacitor (E_C):

$$E_C = I \times X_C$$

$$E_C = 6.7A \times 13\Omega$$

$$E_C = 86.1 \text{ volts}$$

The sum of these two voltages does not equal the applied voltage, since the current leads the voltage. Use the following formula to find the applied voltage:

$$E = \sqrt{(E_R)^2 + (E_C)2}$$

$$E = \sqrt{67^2 + 86.1^2}$$

$$E = \sqrt{4{,}489 + 7{,}413}$$

$$E = \sqrt{11{,}902}$$

$$E = 110 \text{ volts}$$

When the circuit contains resistance, inductance, and capacitance, the following equation is used to find the impedance.

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$