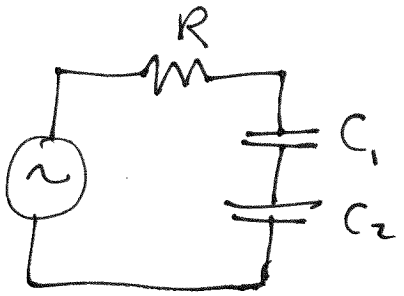
Ch. 15 Prob. 24



$R = 50\,\Omega$

$C_1 = 5.0\,\mu F = 5.0 \times 10^{-6}\,F$

$C_2 = 10\,\mu F = 10 \times 10^{-6}\,F$

$f = 2.0\,kHz$

C_1 + C_2 are in series, so

$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{1}{5} + \frac{1}{10} = \frac{2}{10} + \frac{1}{10} = \frac{3}{10}$$

$$\therefore C_T = \frac{10}{3} = 3.33\,\mu F = 3.33 \times 10^{-6}\,F$$

$$\omega = 2\pi f = 2\pi\,(2{,}000\ Hz) = 4000\pi\ \frac{rad}{s}$$

$$= 12{,}570\ \frac{rad}{s}$$

$$X_C = \frac{1}{\omega C_T} = \frac{1}{\left(12{,}570\ \frac{rad}{s}\right)\left(3.33 \times 10^{-6}\,F\right)}$$

$$= 23.9\,\Omega$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{(50)^2 + (0 - 23.9)^2}$$

$$\boxed{Z = 55.4\,\Omega}$$