Ch. 15. Prob. 42

$L = 20.0\ H$ $\quad f_o = 100\ Hz$

$R = 200\ \Omega$ $\quad Q = 10$

a) Find the capacitance that gives $f_o = 100\ Hz$

first $\omega_o = 2\pi f = 2\pi(100\ Hz) = 200\pi\ rad/s$

But $\omega_o = \frac{1}{\sqrt{LC}} \rightarrow \omega_o^2 \frac{1}{LC} \rightarrow C = \frac{1}{\omega_o^2 L}$

$$C = \frac{1}{\left(200\pi \frac{rad}{s}\right)^2 (20.0\,H)} = 1.27 \times 10^{-7}\ F$$

$$\boxed{C = 0.127\ \mu F}$$

b) Find the resistance in series that gives $Q = 10$

$$Q = \frac{\omega_o L}{R} \rightarrow R = \frac{\omega_o L}{Q}$$

$$R = \frac{(200\pi\ rad/s)(20.0\,H)}{10} = 400\pi$$

$$= 1257\ \Omega$$

since $200\ \Omega$ is already in the circuit, the additional resistance in series is

$$R_+ = 1257 - 200 = \boxed{1057\ \Omega}$$