Problem 7.1

a)

$$f_0 = \frac{\omega_0}{2\pi} = \frac{1}{2\pi\sqrt{LC}} = 4594Hz$$

b)

$$V_R = V_{RMS}$$

c)

$$V_L = V_{RMS}\frac{\omega_0 L}{R}$$

$$Q = \frac{V_L}{V_R} = \frac{\omega_0 L}{R} = 3.4641$$

d)

$$V_R = V_{RMS}\frac{R}{\sqrt{R^2 + (1.15\omega_0 L - \frac{1}{\omega_0 C})^2}} = 0.8874V_{RMS}$$

Percent Decrease = 11.26%

e)

The resonance peak will be higher with a smaller bandwidth if the resistance if lower. Suppose the resistance has to increase by a factor of m.

$$\frac{V_R}{V_{RMS}} = \frac{mR}{\sqrt{(mR)^2 + (1.02\omega_0 L - \frac{1}{\omega_0 C})^2}} = 0.95$$

$$m = \sqrt{\frac{0.95^2(1.02\omega_0 L - \frac{1}{\omega_0 C})^2}{(1 - 0.95^2)R^2}} = 0.2108$$

Therefore, R needs to be decreased by $1 - 0.2108 = 78.92\%$. The new value is $R = 0.2108 \times 50\Omega = 10.54\Omega$

f)

$$Q = 16.4331$$