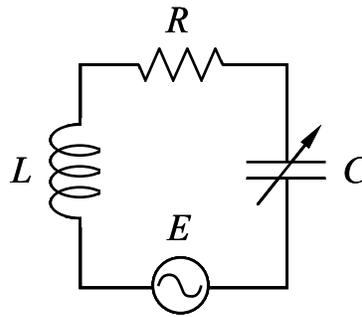


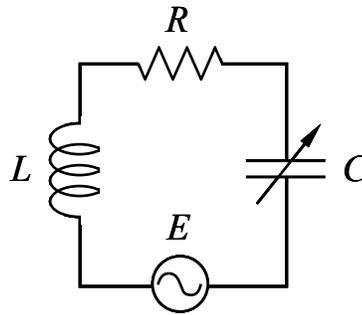
In the RLC circuit shown at right, the resistance  $R$  and inductive reactance  $X_L$  are set to the given values. The capacitor is of variable magnitude (indicated by the diagonal arrow). The AC generator puts out a peak EMF of  $\mathcal{E}_{\max} = 120 \text{ V}$ .



$$\begin{aligned} R &= 200 \, \Omega \\ X_L &= 450 \, \Omega \\ \mathcal{E}_{\max} &= 120 \text{ V} \end{aligned}$$

- 1) If the capacitance is set to  $C = 200 \, \mu\text{F}$ , the circuit is in resonance. Given this information, calculate the inductance  $L$  of the circuit and the frequency  $\omega$  of the generator. [5]
- 2) Leaving the frequency  $\omega$  and peak voltage  $\mathcal{E}_{\max}$  of the AC generator unchanged, the variable capacitor is now changed to  $C = 350 \, \mu\text{F}$ . This puts the circuit off resonance. What is the phase angle  $\phi$  of the generator EMF with respect to the current? [4]
- 3) Does the generator EMF lead or lag the current when  $C = 350 \, \mu\text{F}$ ? [3]

- 4) What is the impedance  $Z$  of the final circuit (with  $C = 350 \mu\text{F}$ )? [4]



$$\begin{aligned} R &= 200 \Omega \\ X_L &= 450 \Omega \\ E_{\max} &= 120 \text{ V} \end{aligned}$$

- 5) Draw the voltage phasor diagram ( $\mathcal{E}$ ,  $V_C$ ,  $V_L$ ,  $V_R$ ) for this final circuit, with the angles and lengths of the phasors indicated numerically. [4]

