Solution for tutorial 5

1)

a) At resonant frequency Z = R = 10ohm

resonant freqency fr = $1/(2\pi \sqrt{(LC)}) = 5.03KHz$

b) At f= 4.03KHz

Xc = 3.95Kohm
X_L = 2.53Kohm
Z = 1.42Kohm

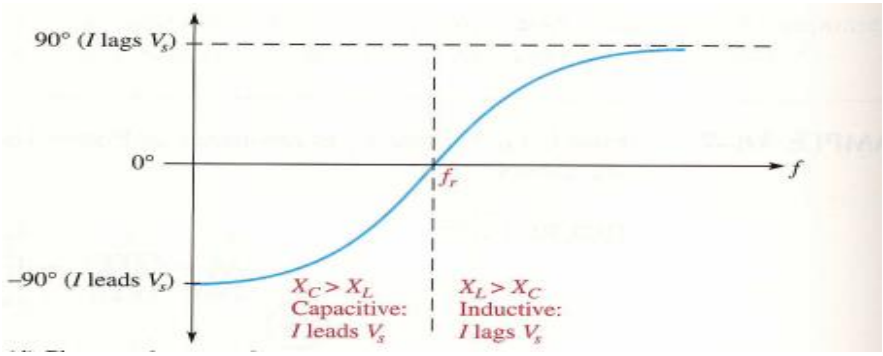
c) At f= 6.03KHz

Xc = 2.64Kohm
X_L = 3.79Kohm
Z = 1.15Kohm

2) For low frequencies C is open hence impedence is high and falls as inversely proportional to omega . Minimum resistance R at resonance. At high frequency L is open and impedence again increases proportional to frequency. From problem 1 minimum value is 10 ohm at 5.03KHz, 1.42Kohm at 4.03KHz and 1.15Kohm at 6.03KHz

Current magnitude plot can be obtained from impedence magnitude plot by dividing voltage with impedence.

At frequencies below resonance, Xc > X_L, and the current leads the source voltage. The phase angle decreases as the frequency approaches the resonant value and is 0 at resonance. At frequencies above resonance, X_L> X_C, ard the current lags the source voltage, as indicated in part (c). As the frequency goes higher, the phase angle approaches 90.



3) Find the total impedence and equate imaginary term to zero at resonance

L=2mH, C=0.5mF, R= 1 ohm

a) Resonant frequency Wr = $\sqrt{((1/LC)-(R/L)^2}$

= 866.05 rad/sec

b) Resonant frequency $Wr = \sqrt{(1/LC)}$
$= 316.2$ rad/sec

4)

a) Resonant frequency = 1.59MHz
$Q = X_L / R = 200$
BW = 7.95KHz

b) Resonant frequency = 22.5MHz
$Q = X_L / R = 14.1$
BW = 1.6KHz