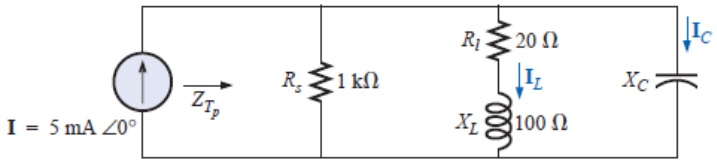
Spring 2025

ECE101: Basic Electrical and Electronic Circuits
Tutorial -10

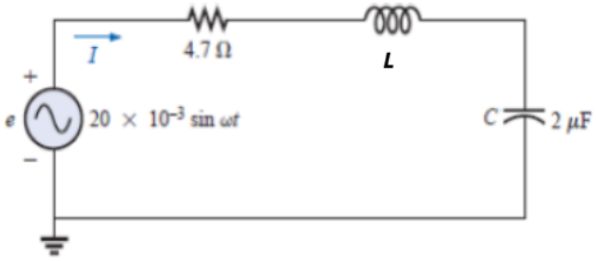
Q. 1. For the networks given below:



a. Find the value of X_C at resonance (f_p).
b. Find the total impedance Z_{Tp} at resonance (f_p).
c. Find the currents I_L and I_C at resonance (f_p).
d. If the resonant frequency is 20,000 Hz, find the value of L and C at resonance.
e. Find Q_p and the BW. Hint: $BW = f_2 - f_1 = \frac{f_p}{Q_p}$

Q.2. A constant voltage at a frequency of 1 MHz is applied to an inductor in series with a variable capacitor. When the capacitor is set 500 pF, the current has its maximum value while it is reduced to one-half when the capacitance is 600 pF.
Find (i) the resistance, (ii) the inductance, (iii) the Q-factor of the inductor.

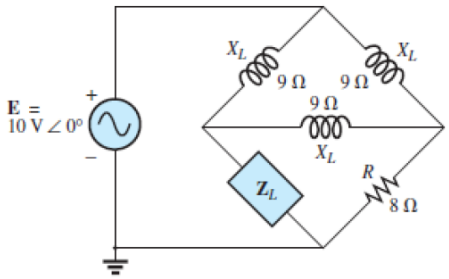
Q.3. For the circuit shown below:



a. Find the value of L in milli henries if the resonant frequency is 1800 Hz.
b. Calculate X_L and X_C at resonance. How do they compare?
c. Find the magnitude of the current I_{rms} at resonance.
d. Find the power dissipated by the circuit at resonance.
e. What is the apparent power delivered to the system at resonance?
f. What is the power factor of the circuit at resonance?
g. Calculate the Q of the circuit and the resulting bandwidth.
h. calculate half power cutoff frequencies and the power dissipated by the circuit at half power cutoff frequencies.
Hint: For series resonance

$$f_1 = \frac{1}{2\pi}\left[-\frac{R}{2L} + \frac{1}{2}\sqrt{\left(\frac{R}{L}\right)^2 + \frac{4}{LC}}\right] \qquad f_2 = \frac{1}{2\pi}\left[\frac{R}{2L} + \frac{1}{2}\sqrt{\left(\frac{R}{L}\right)^2 + \frac{4}{LC}}\right]$$

Q.4.



Find load impedance to transfer maximum power and maximum power to the load. [Hint: use delta to star transformation (i.e. Δ-Y)].

Ans: $\mathbf{Z}_L = 0.72\ \Omega - j\,5.46\ \Omega$

P_{max}= 25.32 W