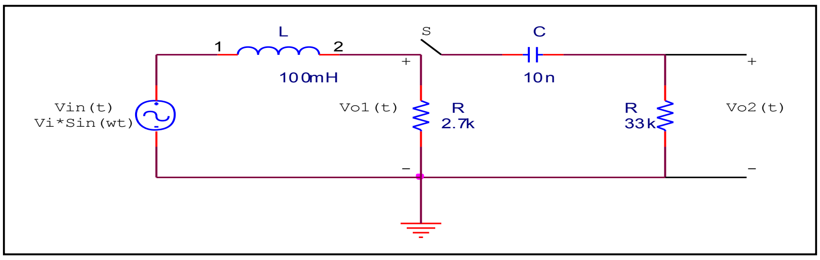
ECE 232-Lab6

Band-pass filters

1- Consider the high pass filter (switch S is closed) fibelow its frequency response is $H(jw)=V_{o2}(jw)/V_{in}(jw)$



Fill in the table below due to your observations on the oscilloscope and sketch the magnitude and phase response (only due to the observations in YT mode) using MATLAB.

Band-pass filter	YT-mode	YT-mode	XY-mode	XY-mode
f(Hz)	$\lvert H(jw)\rvert$	$\angle H(jw)$	$\lvert H(jw)\rvert$	$\angle H(jw)$
f≈20				
f=200				
$f=f_{c1}$ (first corner frequency)				
$f=f_o$ (resonant frequency)				
f_{c2} (second corner frequency)				
f=20000				

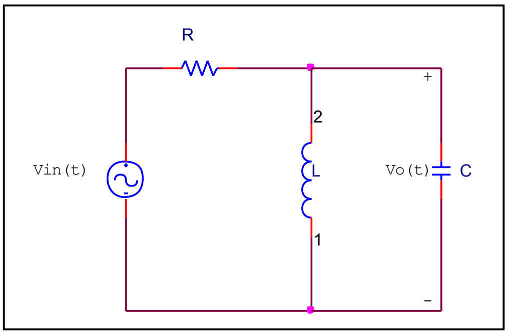
What is the resonant frequency of this circuit?

What are the corner frequencies of this circuit?

What is the band-width?

What is the quality factor?

2- Consider the circuit below which is a band-pass filter. Theoretically the resonant frequency of this circuit is 10000 rad/sec (nearly 1592 hertz)



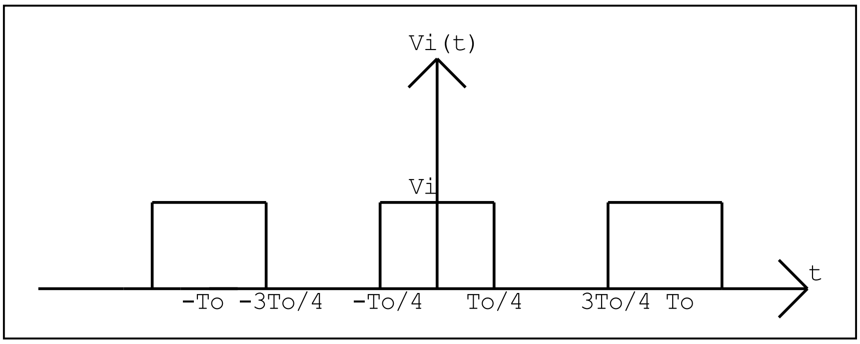
L=0.1H, C=100 nanoFarad, R=10 kOhm

a) Find practically resonant frequency of this circuit f_0

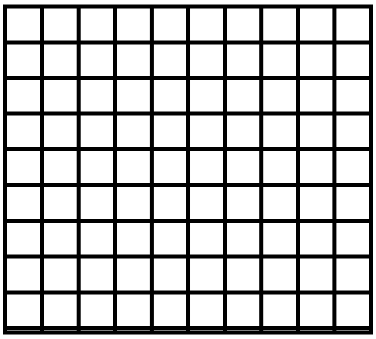
b) A square wave with a DC component of 1 Volt and peak-to-peak value of 2 Volt with frequency $f_0=w_o/2\pi$ (note that this frequency is equal to the resonant frequency of the circuit) is applied to the circuit above. Since the input is periodic with period To=1/fo seconds, it can be represented as a linear combination of sinusoids (Fourier series representation)

$$Vin(t)=Vi[(1/2)+(2/\pi)(\cos(w_0t)-(2/3\pi)(\cos(3w_0t)+(2/5\pi)(\cos(5w_0t).....] \text{ Volt}$$

Where Vi=2



Draw Vin(t) and Vout(t)



Experimental Work:

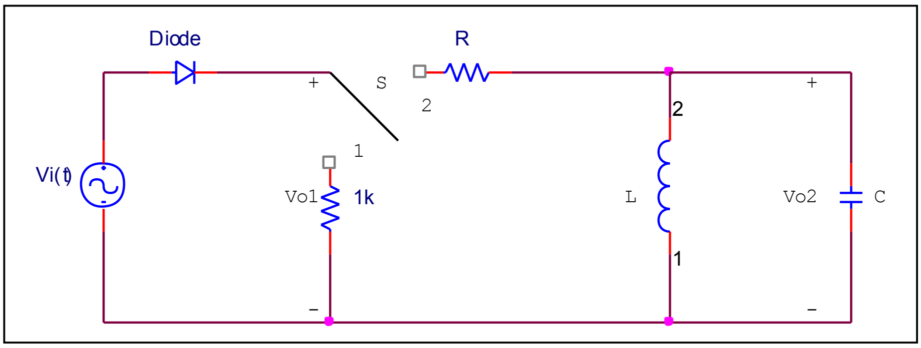
1. Set up the circuits in part 3.b of preliminary work determine and sketch the magnitude and phase characteristics of the frequency response function H(jw)=Vo(jw)/Vin(jw). Find the practical wo and compare it with the theoretical one.

2. Set up the circuits in part 3.c of preliminary work, Plot Vi(t) and Vo(t) together. In what way the input and the output are related. Explain.

V (volt)

t

3. Set up the circuit in figure below using the element values as in the preliminary work part 3.b.



For S in position 1 observe and plot Vo1(t). For S at position 2 observe and plot Vo1(t) and Vo2(t). Comment on the results.

Vo1(t) V S at 1

Vo1(t) V S at 2

Vo2(t) V S at 2