LAB I: IDEAL FILTERS

The objective of this exercise is to examine the reasons why an ideal filter is neither realizable nor desirable.

Requirements:
MatLab software

Procedure:
We have already found the impulse response of an ideal low pass filter to be given as

$$h_{LP}(t) = \frac{\omega_c}{\pi} sinc\left(\frac{\omega_c t}{\pi}\right) \qquad (i)$$

a. On the same set of axes, plot the impulse response of the ideal low pass filter against time for the following values of cutoff frequency: 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz. Name this plot ***figure 1***.

   Is the impulse response causal?
   What is the effect of increasing cutoff frequency on $h_{LP}(t)$?
   Where do zero crossings of the plotted function occur?

b. Obtain the output signal $y(t)$ of this filter when the input signal is the unit step function $u(t)$.

$$y(t) = h_{LP}(t) * u(t) \qquad (ii)$$

   On a separate set of axes, plot y(t) against time for all four values of cutoff frequency listed in part *a.* Name this plot ***figure 2***.

   How does the causal property of $h_{LP}(t)$ manifest itself in $y(t)$?
   Can you identify the effects of ringing on the output signal?

Expected results:

Figure 1

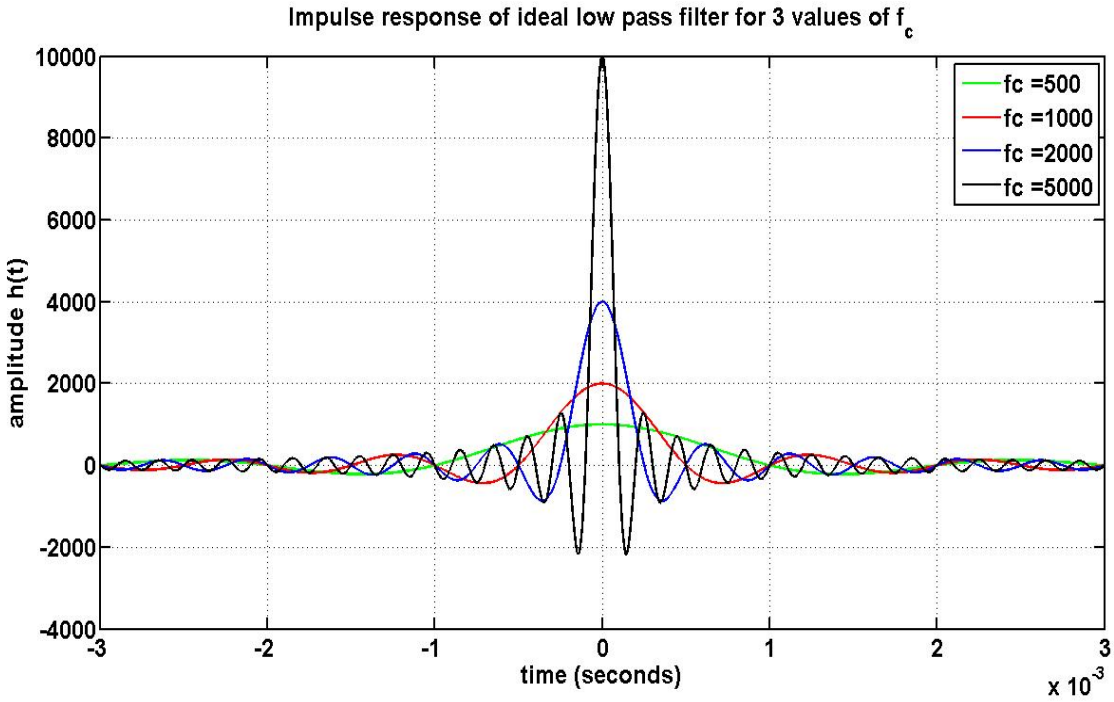
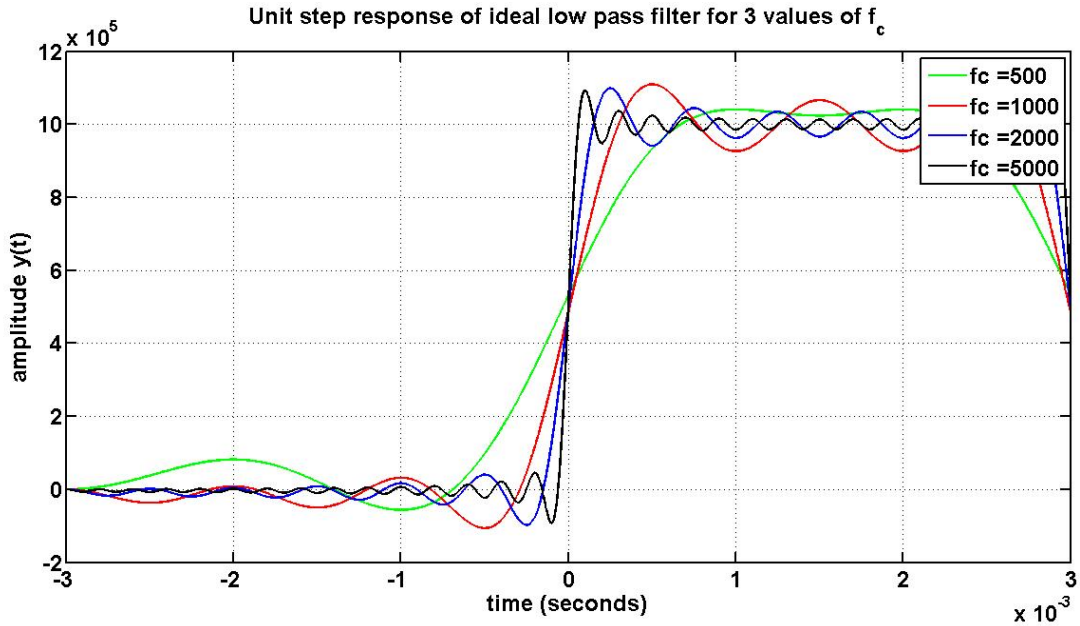


Figure 2



NB. Your plots must have a title, labeled axes and a legend