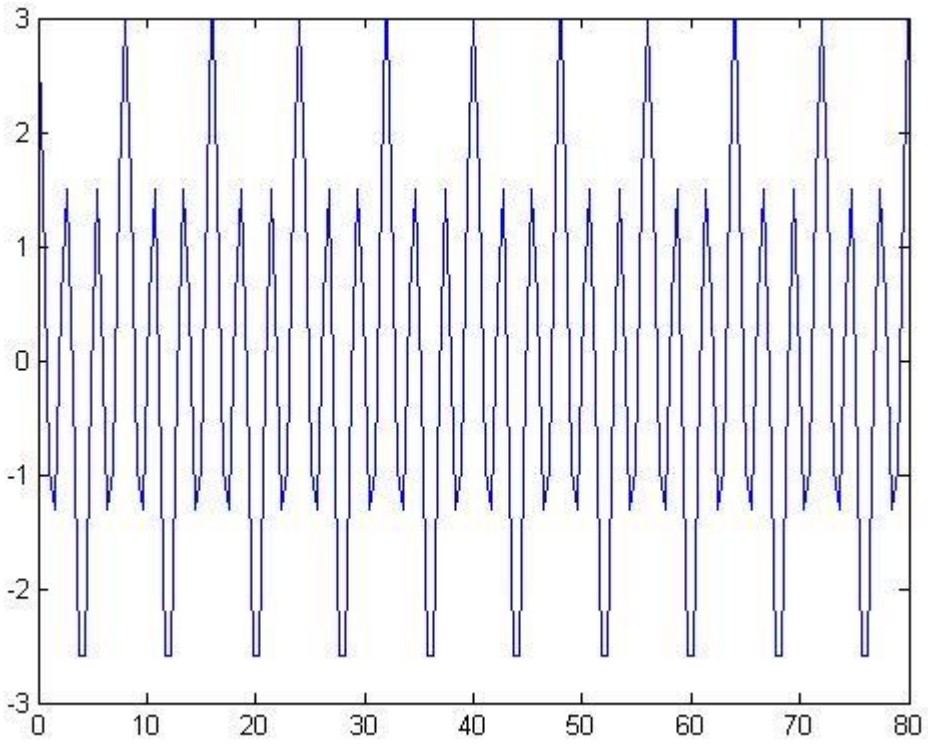
Signals and Systems Project

EE210

140100024 140100034 14D110001

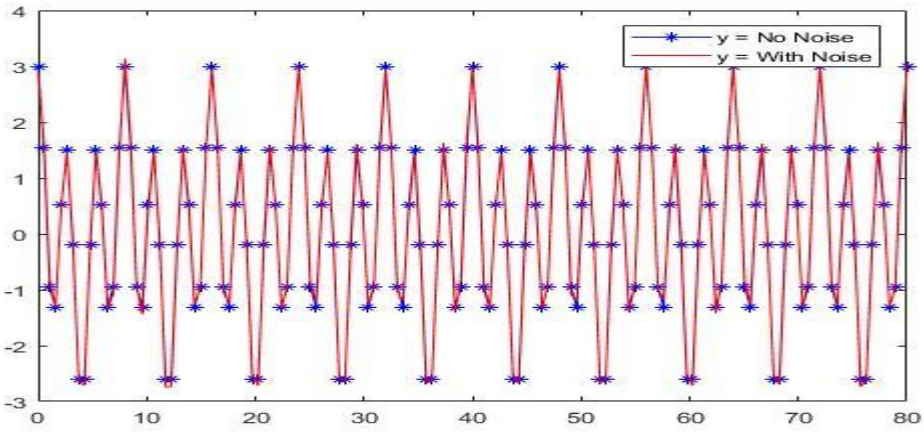
Q1)



10 cycles of the signal with no noise.10 cycles of the common frequency. Sampling at the appropriate frequency.

The graph is not very smooth. The effect of sampling can be seen.

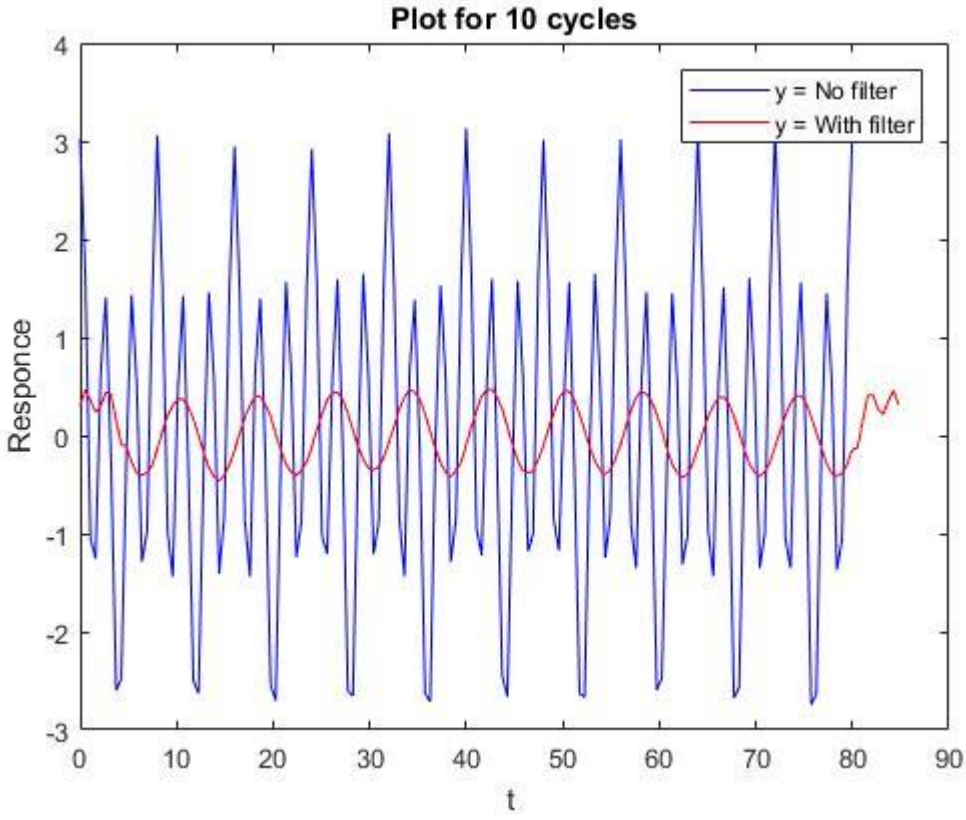
Q2)



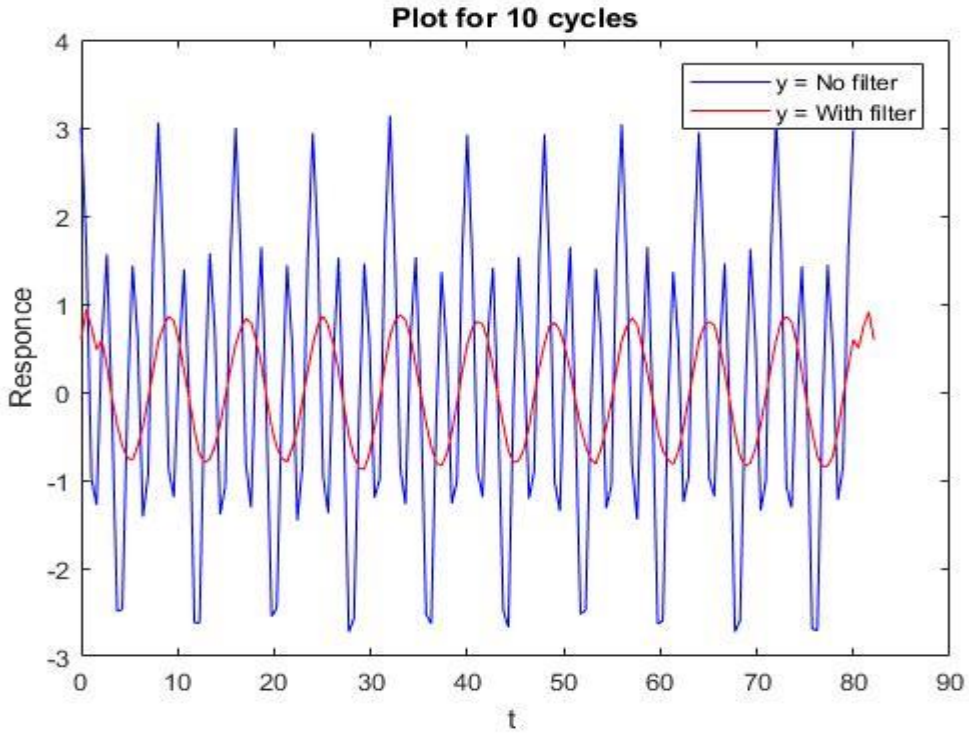
As the noise is very less there is too little of a difference between the signal with noise and without noise.

Q3) and Q4)a

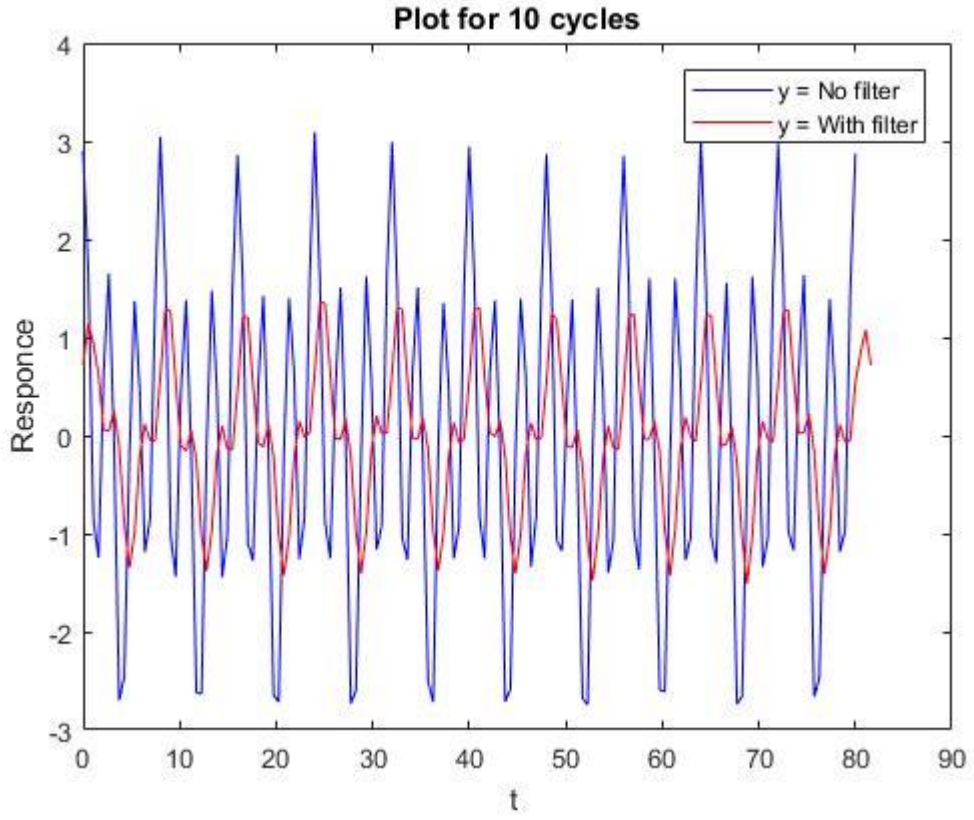
M=10



M=5


Plot for 10 cycles
y = No filter
y = With filter
Responce
t
4
3
2
1
0
-1
-2
-3
0
10
20
30
40
50
60
70
80
90

M=4



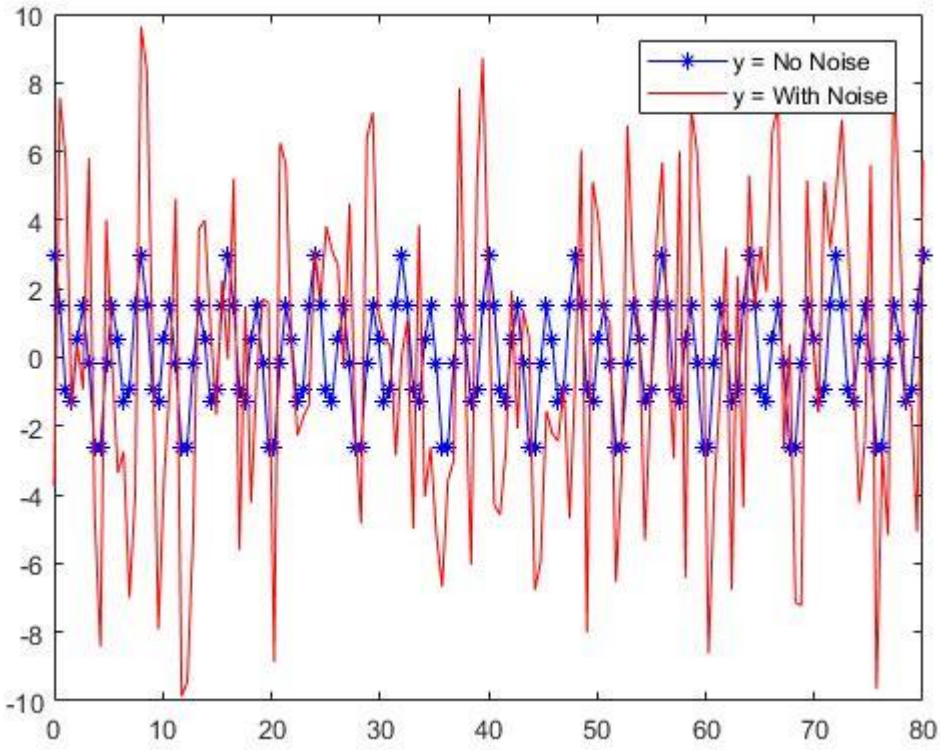
OBSERVATIONS AND INFERENCES FOR Q3 and Q4)a

The amplitudes of the filtered signals are inversely proportional to the M values as expected

When M= 10 or M=5 the filtered signal consists of mainly only one frequency. This main frequency is the same for both M=10 and M=5.The signal without filtering contains more than 1 frequency component. These observations indicate that the filter works properly. These above filters filter the high frequency component (omega = 3/4pi).The component that remains is omega = pi/4.The frequency for this omega is 0.125Hz.The time period is 8s.This is visible in the above graphs. The amplitude after filtering decreases for higher M's as the filter response is proportional to 1/M.This shows that if we require higher lower frequencies to pass for the same low pass filter,the output would have lesser amplitude,hence more difficult to detect and more prone to noise.

When M=4, the filtered signal consists of more than one main frequency, indicating that the higher frequency is not getting filtered completely.The extra frequency may also be due to noise.

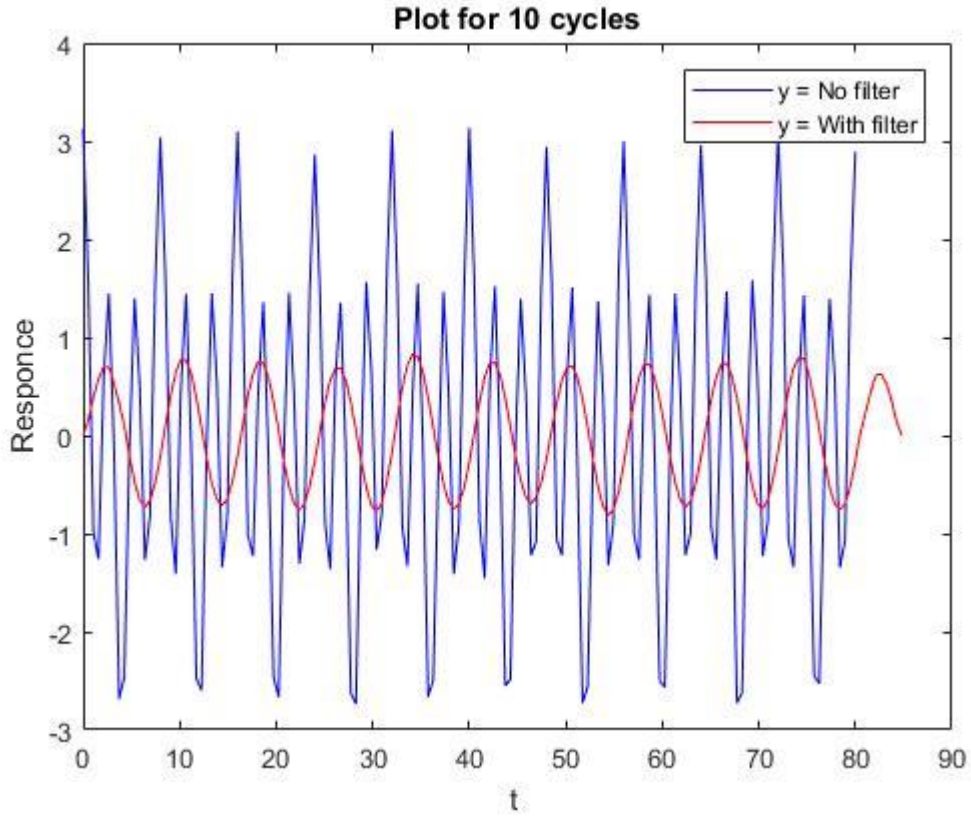
Q4)b



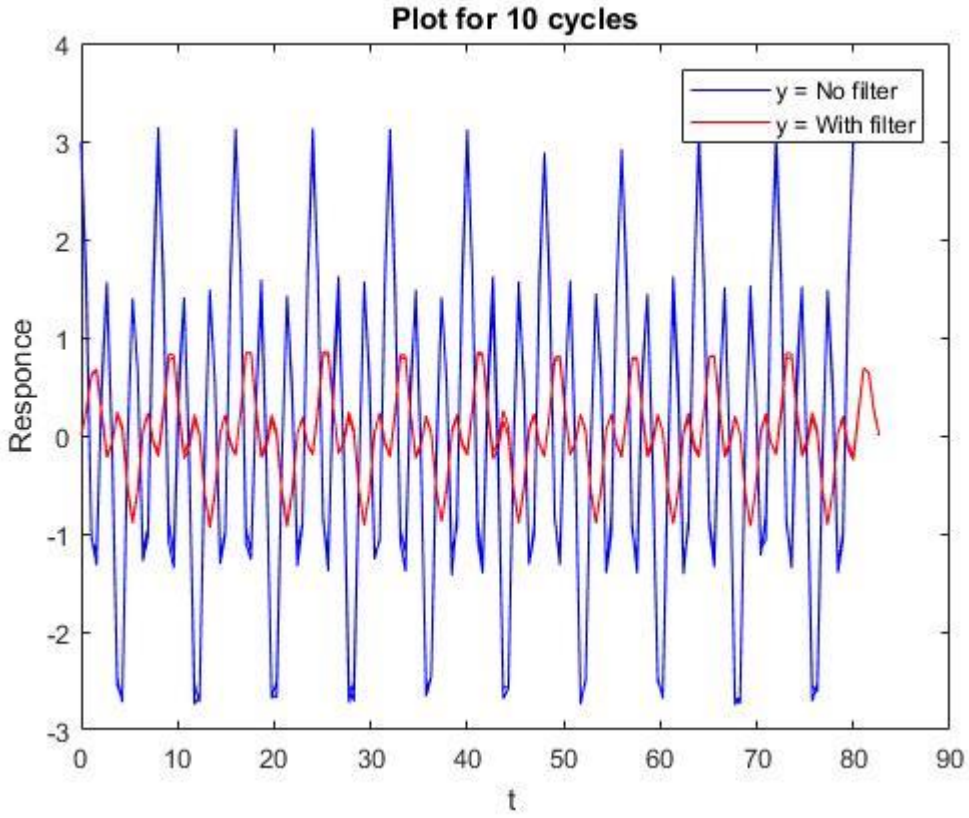
Large amount of noise added .Shows the distortion in the signal. The effects of sampling also are even more dominant with large noise. Although there are distortions the frequency components are unaffected.

Q4)c

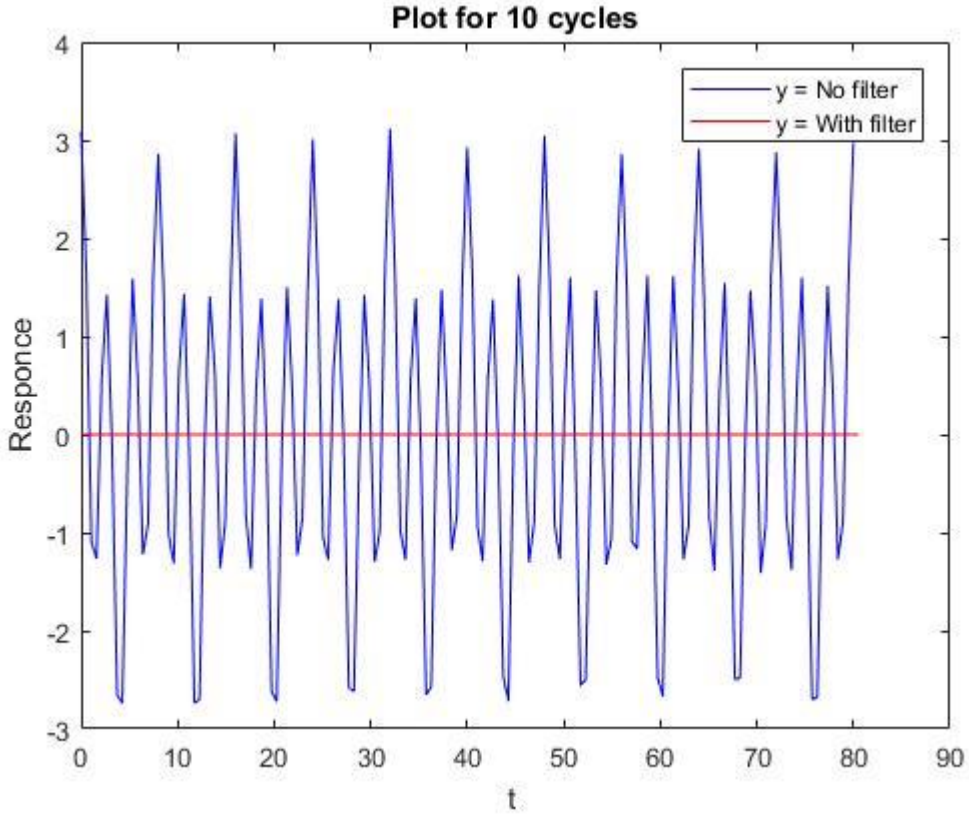
M=10 triangle filter



M=6 triangle filter



M=2 triangle filter



OBSERVATIONS AND INFERENCES FOR Q4c)

For M=10 a perfect sinusoidal signal is obtained. There is almost no noise and one frequency component.The lower frequency one.

For M=6 a mixture of different frequencies is observed.Maybe be as the filter ends before the high frequency component and the amplitude is decreasing for other frequencies, these extra frequencies are observed.

In the M=2 filter there is a zero signal that is seen. This may be as the filter continues only till M=2 while the other frequencies are beyond it.

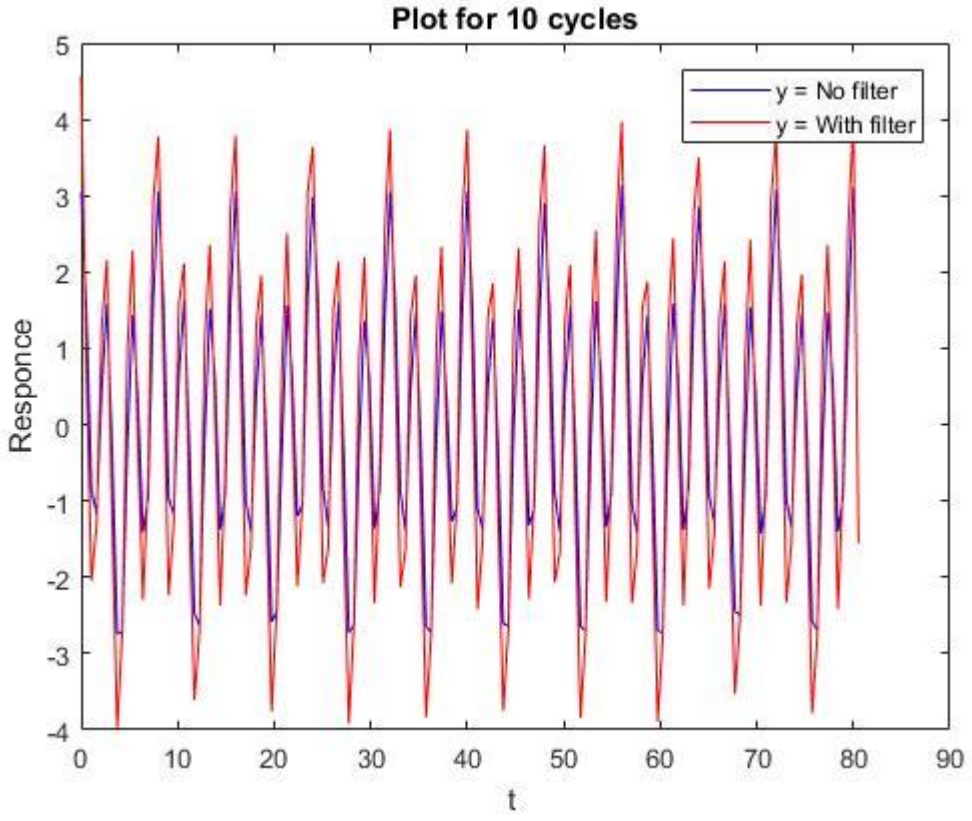
In the triangular filter the M=6 case also has multiple frequencies as compared to the M=5 case in the rectangular filter.

The decrease in amplitude with increase in M is not so much as the rectangular filter. The triangular filter only amplifies a small band of frequencies as compared to the rectangular filter.

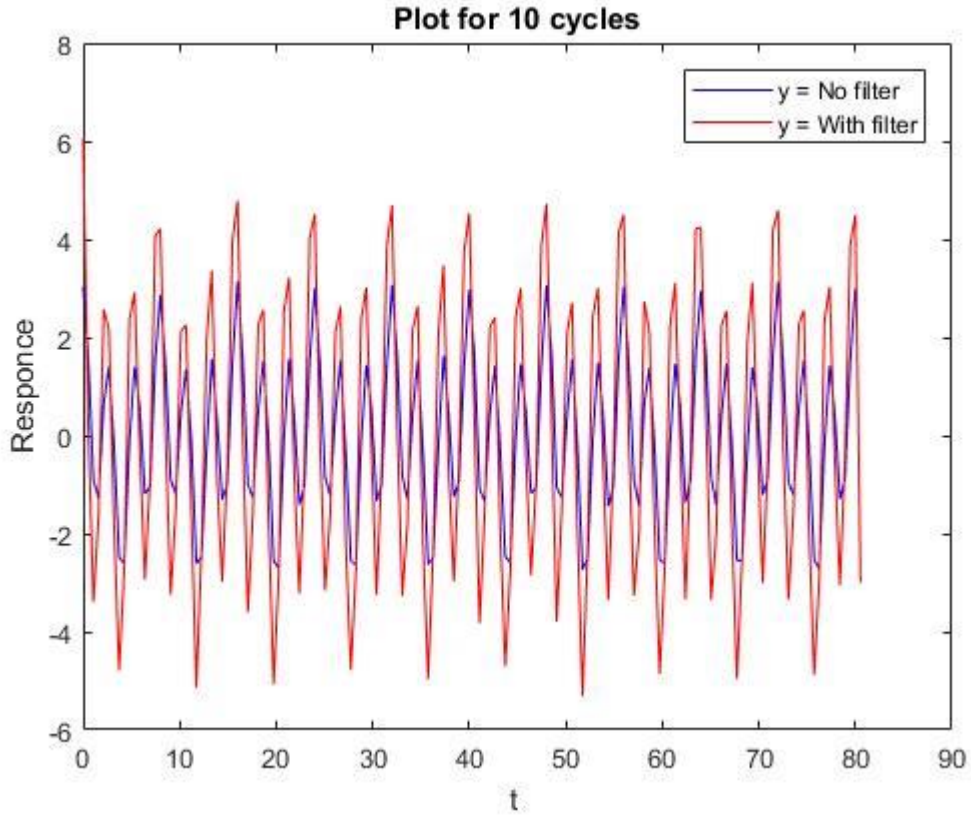
Sometimes these filters are used as matching filters to improve the SNR.

Q4d)

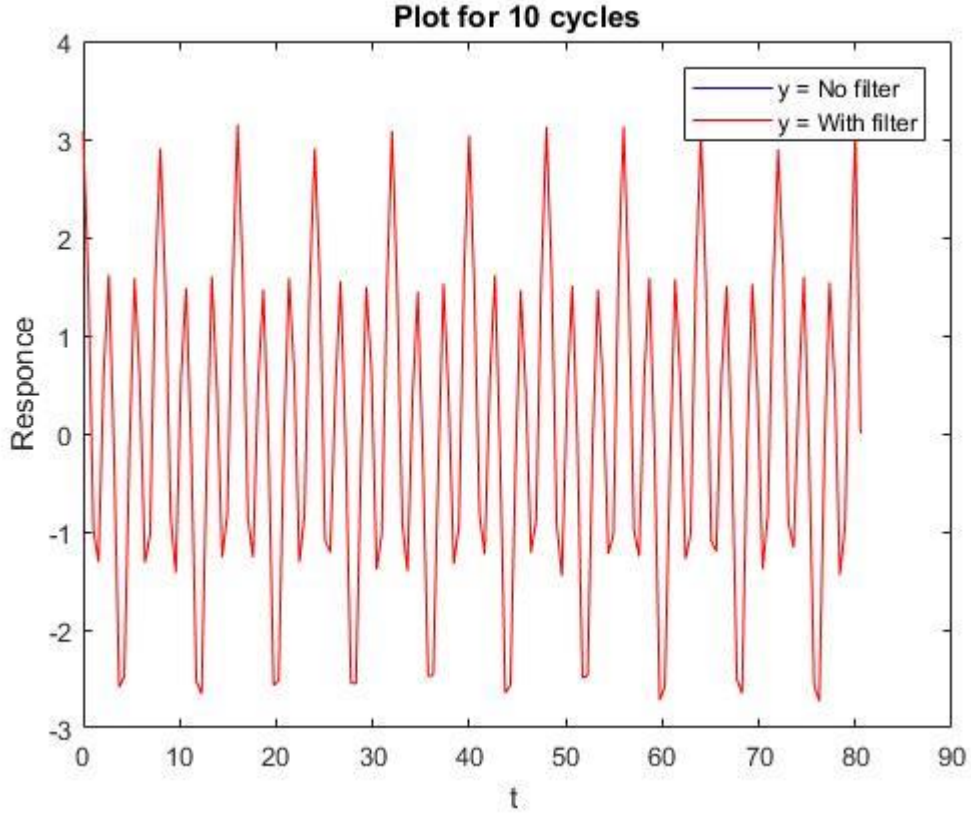
P=0.5



P=1


Plot for 10 cycles
y = No filter
y = With filter
Responce
t
8
6
4
2
0
-2
-4
-6
0
10
20
30
40
50
60
70
80
90

P=0


Plot for 10 cycles
y = No filter
y = With filter
Responce
t
4
3
2
1
0
-1
-2
-3
0
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70
80
90

OBSERVATIONS AND INFERENCES FOR Q4d)

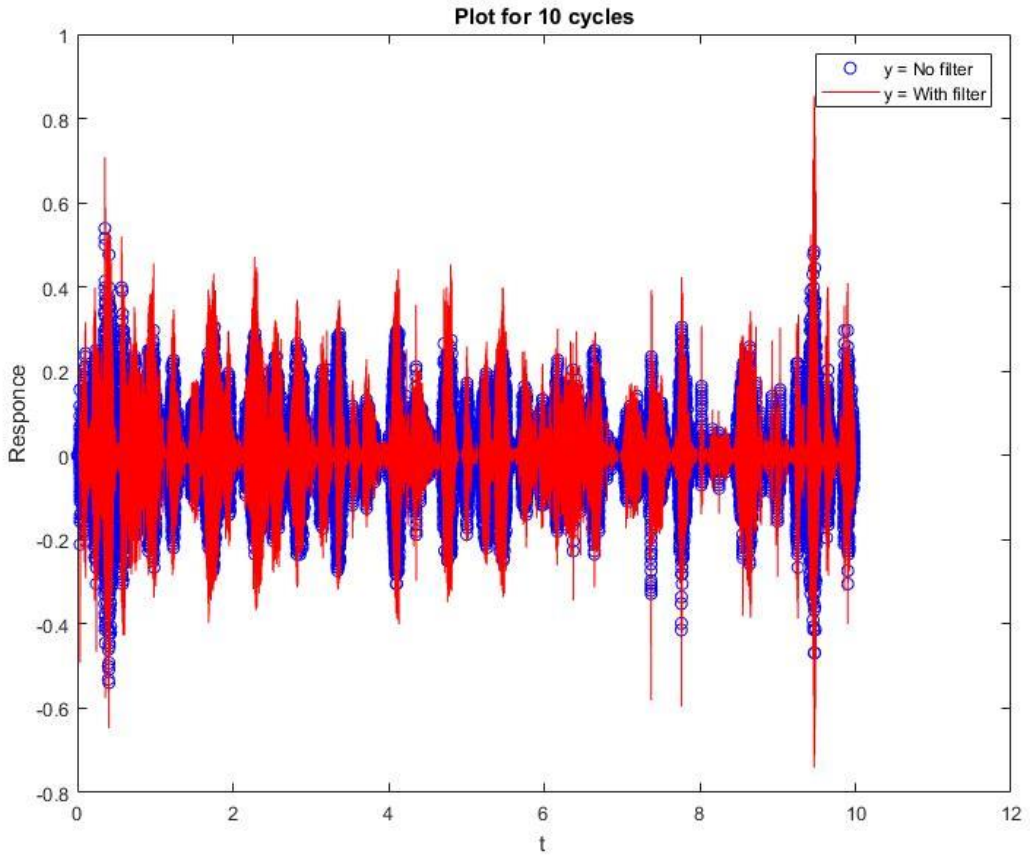
When the value of P is increased for the delta filter the amplitude of the filtered signal increases.The delta filter is basically just sampling the signal and the present time and using some sort of a backward difference (derivative) sampling. This difference of value between the present and previous time is proportional to p .Hence as P increases this difference increases and thus the net sampling amplitude increases.

As the value of p increases there is also a slight phase delay as compared to the present signal with no filter. This is from the difference at previous time instants.

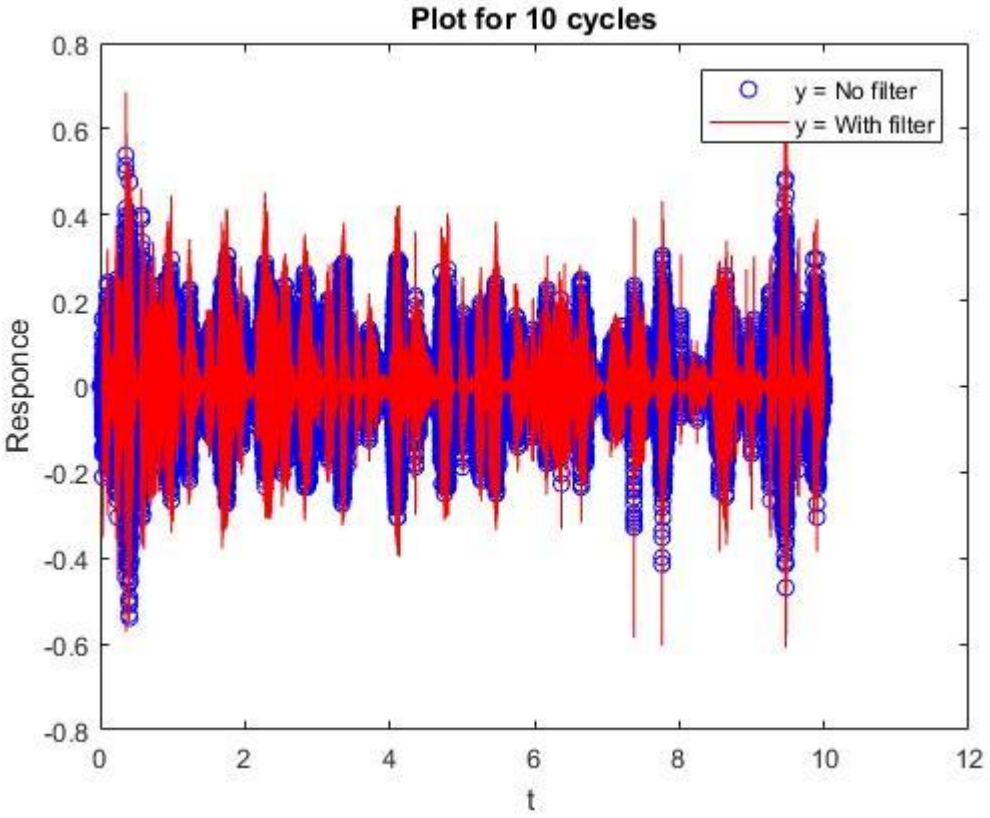
When p is 0 the signal is just sampled exactly

Q5)

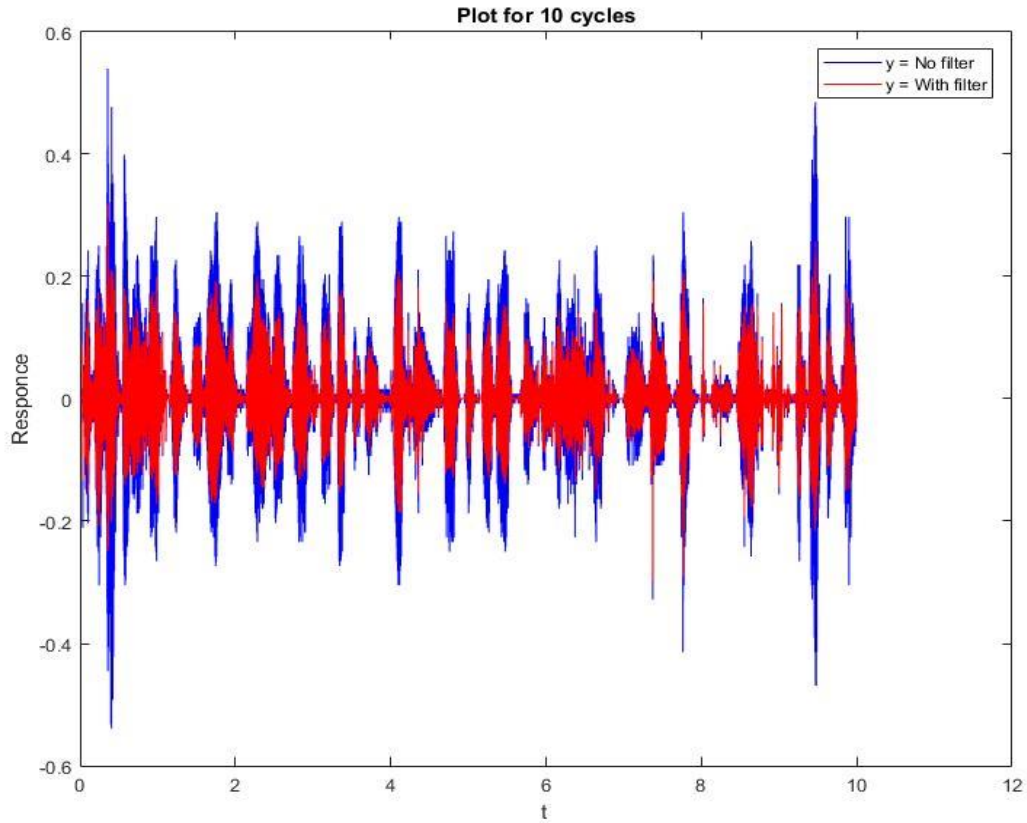
Real sound with delta filter



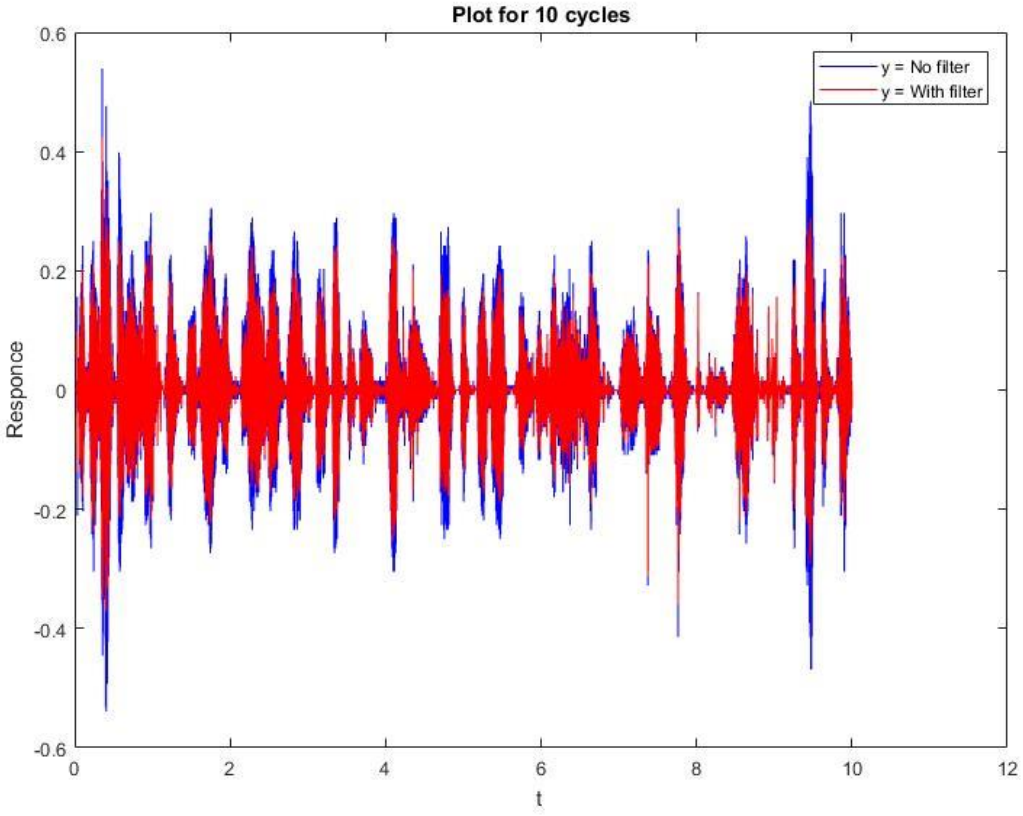
Real sound with delta filter



Real sound with rectangular filter M=10



Real sound with triangular filter M= 10



OBSERVATIONS AND INFERENCES FOR Q5)

The effect of the filters is easily seen in the graphs. The delta filter just samples the signal. There is some extra noise at certain points when the delta filter is used.The rectangular and triangular filters work better.

When listening to the sound keenly a slight feeling of lesser noise,distortions in the case with the triangular and rectangular filter is observed.