Set the sampling rate as 1 kHz.

Question 1 (40 pts)

1) Generate a message signal as a sinusoidals with frequency 30Hz and peak amplitude 1 V respectively. Plot the message signal in frequency domain as in Figure 1.

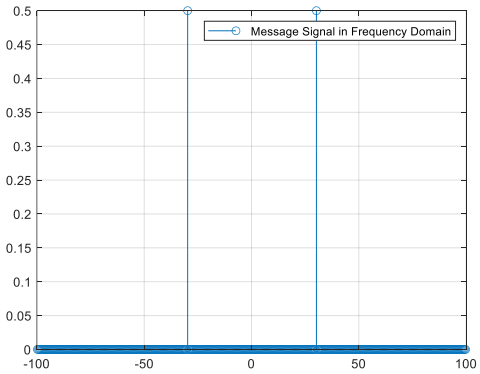

Figure 1

2) Then, generate an AM signal with modulation index 1 and carrier frequency 200 Hz as in Figure 2. Plot the AM signal in both time and frequency domain. Then shift the carrier frequency to 150 Hz and comment on your results.

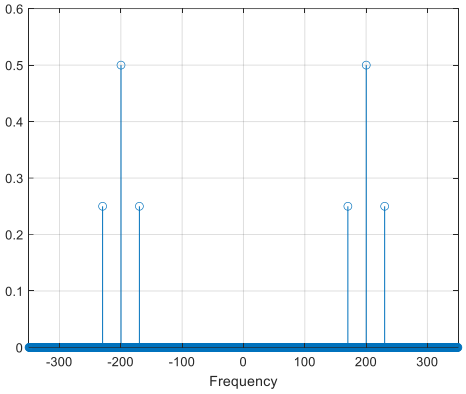

Figure 2

3) Show AM signal and envelope recovery output as in Figure 3. (Use envelope command in Matlab)

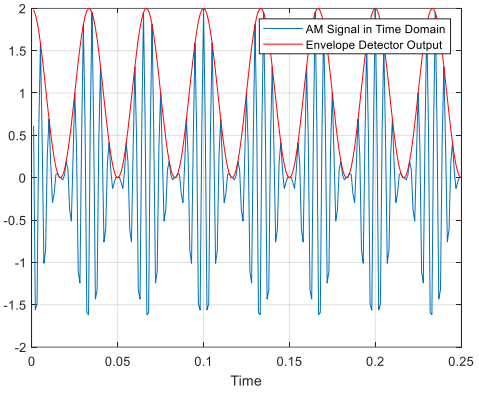

Figure 3

4) Then plot the original and recovered message signals as in Figure 4.

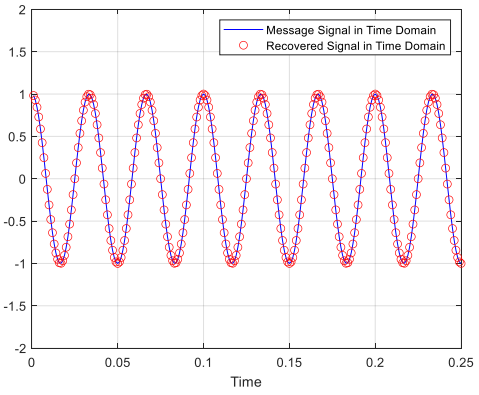

Figure 4

5) Then, repeat the above steps with modulation index 0.5 and 1.5. Comment on your results.

Question 2 (30 pts)

1) For the message signal and the carrier given in Question 1) generate a DSB-SC AM signal. Plot the DSB-SC AM signal in both time and frequency domains. Compare the DSB-SC AM spectrum with AM spectrum obtained in Question 1 part 2).

2) During the demodulation process, plot the signal in frequency domain as in Figure 5 before the Low pass filter (LPF) and comment on your results.

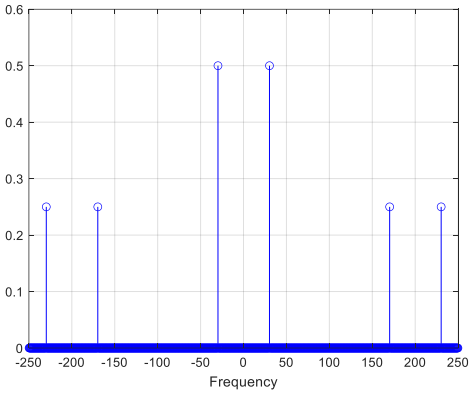

Figure 5

3) Propose a LPF to recover the message signal. Compare the original message in 1) with the output of the low pass filter.