Question 1 (35 pts)

Set the sampling rate as 1 kHz.

1) Generate the message signal whose spectrum is shown in Figure 1.

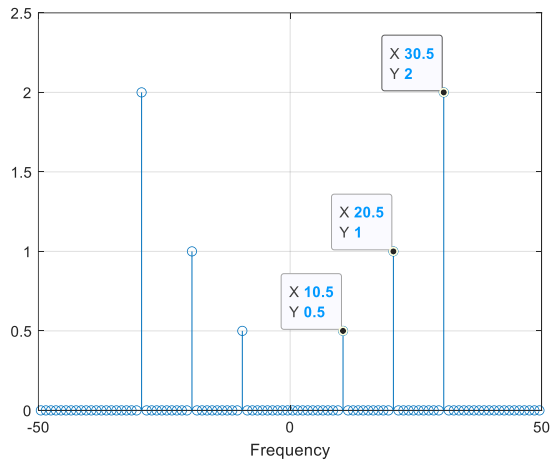

Figure 1

2) Then, generate an DSB-SC at carrier frequency 100 Hz. Then, generate USB and LSB modulated signals and show their spectrum as in Figure 2.

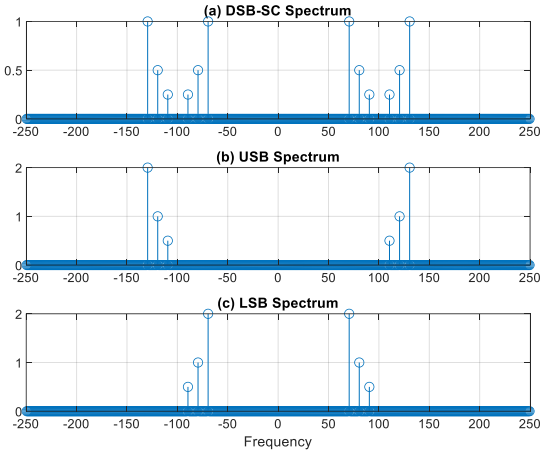

Figure 2

3) Propose a LPF to recover the message signal. Compare the original message spectrum in 1) with the output of the low pass filter for USB and LSB cases respectively as in Figure 3 and Figure 4.

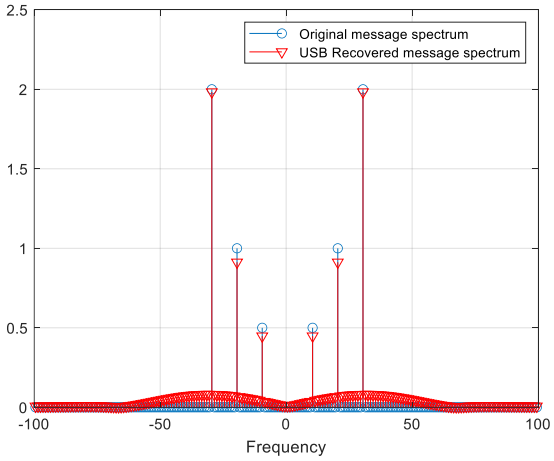

Figure 3

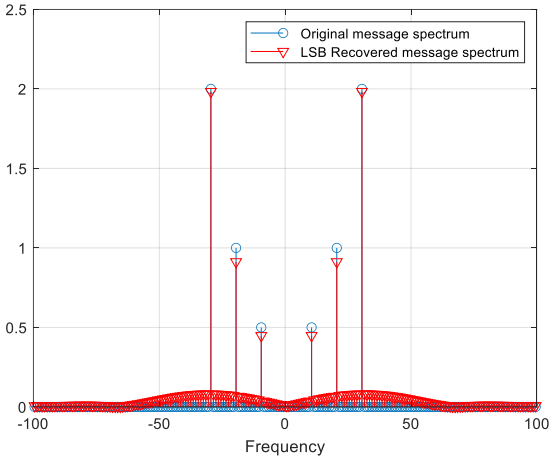

Figure 4

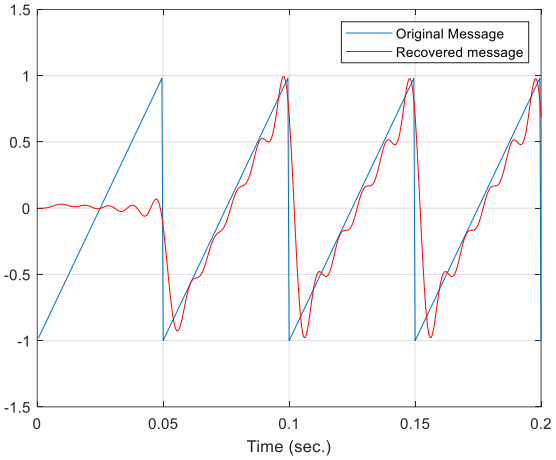

Figure 6

Question 2 (35 pts)

Set the sampling rate as 2 kHz.

Generate a sawtooth message signal with fundamental frequency as 20 Hz as $m_1(t)$. Then generate a square message signal with fundamental frequency 20 Hz as $m_2(t)$. Implement QAM modulator and demodulator with carrier frequency 500 Hz and show the original and recovered messages on top of each other as represented in Figure 5 and Figure 6 respectively.

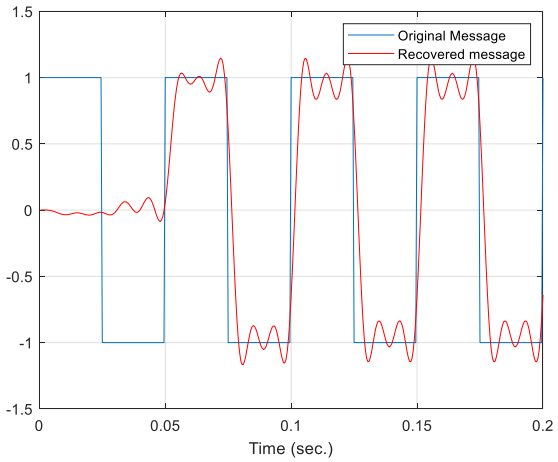

Figure 5