Set the sampling rate as 1 kHz.

Question 1 (35 pts)

Define a 50 Hz sinusoidal signal with peak amplitude 1 V. Sample (down sample) the signal at 250 Hz using the following code piece.

```
xsig = cos(2*pi*fm*t);
Lsig = length(xsig);
% Now we define sampling.
fs = 250; % Sample the C.T. like signal at a rate fs Hz.
ts = 1/fs; % Desired Sampling Period
Nfactor = ts/td; % Nfactor should be an integer for downsampling/upsampling operations.
s_out = downsample(xsig,Nfactor);
xsig_sampled = upsample(s_out,Nfactor);
```

Observe the original and 250 Hz downsampled signal in both time and frequency domains as in Figure 1 and Figure 2. In Figure 2, by what factor the gains are reduced?

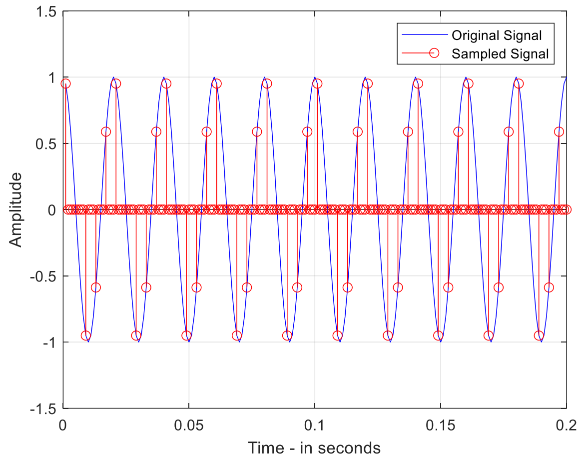

Figure 1 – Add Description Here.

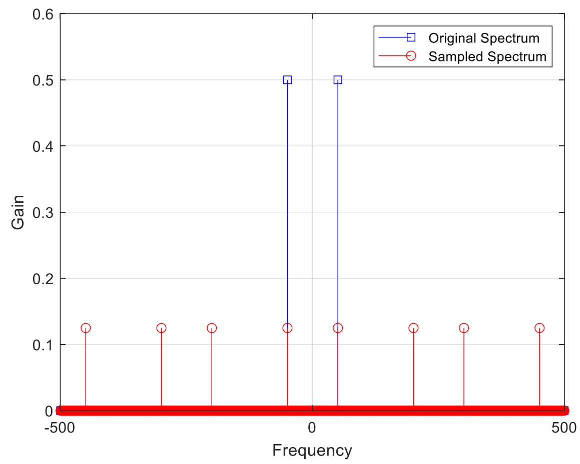

Figure 2– Add Description Here.

Now, define a suitable low pass filter to recover the original signal from the downsampled signal. You should obtain the original and recovered messages close to each other in both time and frequency domains as in Figure 4 and Figure 5.

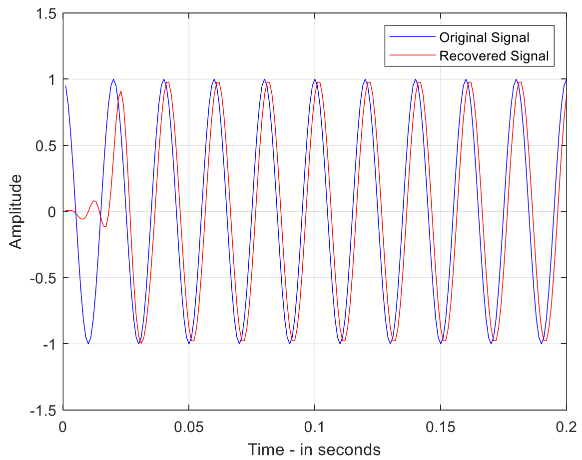

Figure 3 - Add Description Here

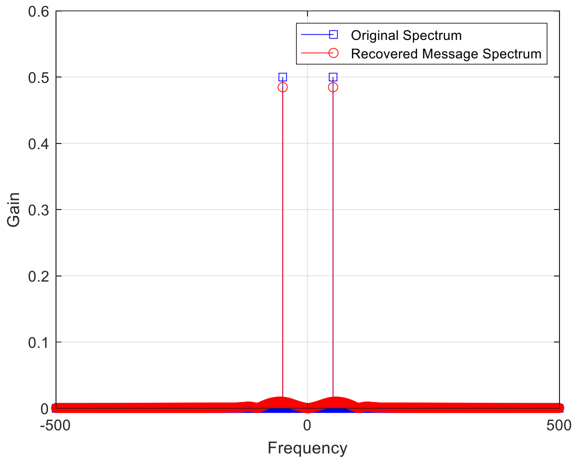

Figure 4- Add Description Here

Question 2 (35 pts)

Repeat Question 1, for a periodic square signal whose fundamental frequency is 10 Hz. Down-sampled at a rate 200 Hz.

Observe the original and 200 Hz downsampled signal in both time and frequency domains.

Define a suitable low pass filter to recover the original signal from the downsampled signal. You should obtain the original and recovered messages close to each other in both time and frequency domains.