**Note: For this assignment, your Handwritten, hard-copy solution is due on or before September 29th, 2012.**

**Question No. 1**

Given an analog signal:

sampled at a rate of 8,000 Hz,

1. sketch the spectrum of the original signal
2. sketch the spectrum of the sampled signal from 0 kHz to 20 kHz.

**Question No. 2**

Given an analog signal:

sampled at a rate of 8,000 Hz,

1. sketch the spectrum of the sampled signal up to 20 kHz;
2. sketch the recovered analog signal spectrum if an ideal lowpass filter with a cutoff frequency of 4 kHz is used to filter the sampled signal in order to recover the original signal.

**Question No. 3**

Given an analog signal:

sampled at a rate of 8,000 Hz,

1. sketch the spectrum of the sampled signal up to 20 kHz;
2. sketch the recovered analog signal spectrum if an ideal lowpass filter with a cutoff frequency of 4 kHz is used to filter the sampled signal in order to recover the original signal;
3. determine the frequency / frequencies of aliasing noise.

**Question No. 4**

Given an analog signal:

sampled at a rate of 8,000 Hz,

1. sketch the spectrum of the sampled signal up to 20 kHz;
2. sketch the recovered analog signal spectrum if an ideal lowpass filter with a cutoff frequency of 4 kHz is used to filter the sampled signal in order to recover the original signal;
3. determine the frequency / frequencies of aliasing noise.

**Question No. 5**

Consider the analog signal:

1. Determine the minimum sampling rate required to avoid aliasing.
2. Suppose that the signal is sampled at the rate of 200 Hz. What is the discrete-time signal obtained after sampling?
3. Suppose that the signal is sampled at the rate of . What is the discrete-time signal obtained after sampling?
4. What is the frequency of a sinusoid signal that yields samples identical to those obtained in part (c)?

**Question No. 6**

Given the analog signal:

What is the Nyquist rate for this signal?

**Question No. 7**

Consider the analog signal:

1. What is the Nyquist rate for this signal?
2. Assume now that we sample this signal using a sampling rate of 5000 samples/s. What is the discrete-time signal obtained after sampling?

**Question No. 9**

If the analog signal to be quantized is a sinusoidal waveform, that is,

and if the bipolar quantizer uses 6 bits, determine

1. number of quantization levels;
2. quantization step size or resolution,, assuming that the signal range is from to volts;
3. the signal power to quantization power ration.

**Question No. 10**

An digital communication link carries binary-coded words representing samples of an input signal

The link is operated at 10,000 bits/s and each input sample is quantized into 1024 different voltage levels.

1. What are the sampling frequency and the folding frequency?
2. What is the Nyquist rate for the signal ?
3. What are the frequencies in the resulting discrete-time signal ?
4. What is the resolution ?