**Digital Signal Processing ENGR 4333/5333**

**Sample Test 1**

**Date:**   **Time:** 75 minutes **Name:**



**Q1)** Find the energy of the signal *x*[*n*] shown in Fig. 1

**Q2**) Answer the following

1. Plot the signal *x*[3 - *n*] where *x*[*n*] is shown in Fig. 1.
2. Plot the signal *y*[*n*] = *n* (*u*[*n*] – *u*[*n*-5])
3. The signal *x*(*t*) = cos(50π*t*) is sampled at a sampling rate of 200 samples/second. Find the discrete signal *x*[*n*].
4. What is the digital frequency and the fundamental period of the signal *x*[*n*]=cos(0.3πn)
5. Is the system *y*[*n*] = *nx*[*n −* 1] time invariant?

**Q3)** A TV signal has a bandwidth of 4 MHz. This signal is sampled, quantized, and binary coded.

1. Determine the sampling rate if the signal is to be sampled at a rate 25% above the Nyquist rate.
2. If the samples are quantized into 512 levels, determine the number of binary pulses required to encode each sample.
3. Determine the binary pulse rate (bits/s) of the binary coded signal.

**Q4)** A signal *x*(*t*) is converted to a binary signal. If the signal-to-quantization-noise ratio (SQNR) is required to be at least 60 dB, determine the minimum number of quantization levels *L* required, if the power of the signal *x*(*t*) is 5 watts. Determine the actual SQNR obtained with this minimum *L*.

**Q5)** Find a difference equation, including initial conditions, that approximates the behavior of the second-order difference equation *d*2*y*(*t*)/*dt*2 + 3*y*(*t*) = *dx*(*t*)/*dt,* where *y*(0) = 0 and d*y*(0)/dt = 3. Take the sampling interval as *T* = 0*.*05.

**Q6)** Determine the zero-input response for the system specified by the difference equation below and initial conditions *y*[-1] = 1 and *y*[0] = 2

 *y*[*n*+2] - *y*[*n +* 1] + 0.16*y*[*n*] = 4*x*[*n*+2]

**Q7)** Determine a closed-form representation of the unit impulse response *h*[*n*] for the system specified by the difference equation

 *y*[*n*] - *y*[*n −* 1] + 0.25*y*[*n −* 2] = 4*x*[*n*]