Department of Electrical Engineering
Final Assignment Summer 2020
Subject: Communication Systems

Max Marks: 50

Question 1 (10)

A signal x(t) band limited by 250 Hz is sampled by an impulse train with angular frequency of f_s

a. Determine the Nyquist rate required for perfect reconstruction of signal.
b. Considering x(t) and impulse train in figure below, construct all the signals involved in sampling.
c. Determine the cut off frequency of reconstruction filter H(f) to be used for the signal given in question.
d. If the frequency of sampler is $f_s = 800Hz$, draw the resulting sampled signal s(f)

Question 2 (10)

a. Let $x(t)$ be a signal with Nyquist rate f_s determine the Nyquist rate for following
   i. $x(t) + x(t-1)$
   ii. $dx(t)/dt$
b. Let $m(t) = 10\sin 400\pi t$ is sampled at 300Hz and reconstructed using an ideal low pass filter with a cut off frequency of 150Hz. What are the frequency/frequencies present in the reconstructed signal $y(t)$

Question 3 (15)

Consider the bit sequence (0 1 1 0 1 1 0 0 0 1 1) and draw the PCM waveform for following modulation schemes

a. NRZ-S
b. Polar-RZ
c. Split Phase Manchester
d. Bi-ϕ-L
e. Dicode - NRZ

Question 4 (15)

a. A carrier wave is represented by the equation $e_c(t) = 7.5\sin 20\times10^3\pi t$. If the modulation index of wave is 0.5, draw the waveform of AM modulated waveform.

b. A sinusoidal carrier $10\cos 50\times10^5 t$ is amplitude modulated by the sinusoidal voltage of $5\cos 628\times10^3 t$ over a load resistance of 50Ω

   a. Find the depth of modulation and calculate the transmission efficiency
   b. Plot the AM wave in time domain as well as its frequency domain spectrum
   c. Calculate the total power in spectrum
   d. Calculate the percentage power in USB