**205NET**

**Assignment # 6**

**1st semester 1439 /1440**

Q1) What is the Nyquist sampling rate for each of the following signals?

1. A low-pass signal with bandwidth of 200 KHz?

Low-pass signal fl=0 Hz fh = fl + BW = 0+ 150kHz = 150KHz

Nyquist Sampling rate = 2 x 150k= 300, 000 sample per second

1. A band-pass signal with bandwidth of 200 KHz if the lowest frequency is 100 KHz?

Band-pass signal fh = fl + BW = 100K + 200K = 300kHz

Nyquist Sampling rate = 2 x 300k = 600, 000 sample per second

Q2) We have sampled a low-pass signal with a bandwidth of 200 KHz using 1024 levels of quantization.

1. Calculate the bit rate of the digitized signal.

*Bit rate = sampling rate × number of bits per sample*

? ?

Low pass signal: frequency between 0 – 200 KHz BW = 200 KHz   
Sampling rate >= 2 x fhighest = 2 x 200 KHz >= 400,000 samples /s

nb= log2  1024 = 10 bits/sample;

Bit rate = 400,000 x 10 = 4 Mbps

1. Calculate the SNRdB for this signal.

*SNRdB = 6.02 nb + 1.76 = 6.02 x 10 + 1.76 = 61.96 dB*

1. . Calculate the PCM bandwidth of this signal

Bmin = nb x Banalog = 10x 200 = 2000 Hz

Q3) a message signal has Vmin= -2V and Vmax=+30V , we want to quantize it to 8 quantization levels after it has been sampled.

1. What is the Zone width?

Δ = 30 – (-2) / 8 = 4

1. Find zones?

-2 🡪 2, 2🡪6, 6 🡪10, 10 🡪14, 14🡪 18 , 18 🡪22, 22 🡪 26, 26 🡪30

1. What are the midpoints?

0 , 4 , 8, 12, 16, 20, 24, 28

1. What are the bits codes of each zone?

nb = log2 8 = 3

000, 0001, 010, 011, 100, 101, 110, 111

Q4) Draw the staircase approximation signal and find the binary bits that will be sent after applying the Delta modulation for the following signal

