LNMIIT
The LNM Institute of Information Technology

Digital Communication

Quiz 1

Date: 17th Sept, 2018 Time: 45 Minutes Max Marks:15

Roll No.:_____

Name:_____

1. Consider the four waveforms defined as:
$S_1(t) = u(t) - u(t-1) + u(t-2) - u(t-3)$,
$S_2(t) = u(t-1) - u(t-2) + u(t-3) - u(t-4)$,
$S_3(t) = u(t-1) - u(t-3)$,
$S_4(t) = u(t-1) - u(t-2) - u(t-3) + u(t-4)$,
where u(·) is the unit step function.

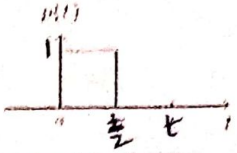
   a) Determine a set of orthonormal functions for the signals by using Gram-Schmidt Orthogonalization starting with $S_1(t)$ and going in sequence. [4]

   b) Determine the dimensionality of the signals. [1]

2. The information sequence $\{a_n\}_{n=-\infty}^{\infty}$ is a sequence of independent and identically distributed (iid) random variables, each taking values +1 and −1 with equal probability. This sequence is to be transmitted at baseband by a line coding scheme, described by

$$X(t) = \sum_{n=-\infty}^{\infty} a_n p(t - nT - \Delta)$$

   where Δ is a random variable that is independent of the value of a_n and uniformly distributed over $0 \leq \Delta < T$ and p(t) is shown in Fig. below [5]



   a) Identify the line coding scheme.
   b) Derive the autocorrelation function of X(t).
   c) Derive the power spectral density $S_X(f)$ of X(t).
   d) Roughly sketch this $S_X(f)$.
   e) Determine the first null bandwidth (FNB) of the signal X(t).

3. Perform the detailed Bit Error Rate (BER) analysis of BPSK modulation scheme. [5]

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Quiz 2

Date: 23rd Nov., 2018 | Time: 45 Minutes | Max Marks: 20

Roll No.: [redacted] | Name: [redacted]

Q1. Draw the block diagram of a phase locked loop (PLL). What is the role of loop filter and loop gain in the design of PLL? Show relevant calculation and indicate the condition to lock both incoming frequency and phase. [5]

Q2. What are the methods you know for Carrier Recovery? Draw the block diagram of any of the methods and indicate the advantages and disadvantages of the method. [5]

Q3. i) Define - Code Rate. ii) Indicate Hamming Bound and how will you define a Perfect Code. iii) Confirm the possibility of a (18,7) binary code that can correct up to three errors. Can this code correct up to four errors? [1+2+2=5]

Q4. Use the Generator polynomial $g(x)=x^3+x+1$ to construct a systematic (7,4) cyclic code. If the received word is 1101100, determine the transmitted data word. [5]