LNMIIT
The LNM Institute of Information Technology

Digital Communication

Quiz 1

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

Roll No.: 16UCC04

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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.

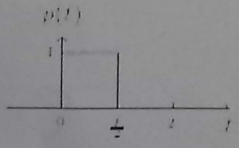
   a) Determine a set of orthonormal functions for the signals by using Gram-Schmidt Orthogonalization starting with $S_1(t)$ and going in sequence. [4]

   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]