

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION- Oct 2017

B.Tech 5th Semester

COURSE CODE: 10B11EC511

MAX. MARKS:15

COURSE NAME: Digital Communications

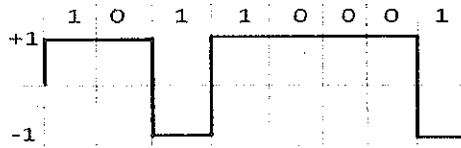
COURSE CREDITS: 4

MAX. TIME: One Hr

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.

1. [5 marks] Consider a baseband discrete PAM system. Assume $\{a_n\}$ is an Independent Identically Distributed random binary sequence where a_n takes value 0 and 1 equally likely with bit duration T_b . Also, $\{b_n\}$ is the output of a binary pre-coder with input $\{a_n\}$, and $h_T(t)$ is a rectangular pulse shape defined as: $h_T(t) = \begin{cases} A & \text{for } t \in [0, T] \\ 0 & \text{otherwise} \end{cases}$
- Where T is symbol duration. Let $y(t)$ be the output discrete PAM signal with PSD $S_y(f)$. Determine $S_y(f)$, for NRZ polar quaternary signaling.

2. [3 marks] Determine PSD of a PAM signal known as NRZI and illustrated by the following figure.



3. For a band-limited channel, the sampling value at the receiver for the k^{th} symbol is given by $y(kT) = \sum_{n=-\infty}^{\infty} \mu b_n p(kT - nT) + n_0(kT)$ where $\{b_n\}$ is the output of the pre-coder and $p(t)$ is the convolution of three filters, $h_T(t)$, the pulse shaping filter, $h_c(t)$, the channel filter, and $h_d(t)$, the receiving filter which is normalized as $p(0)=1$, and μ is the scalar factor.
- [1 marks] What is the ISI component for detecting symbol b_5 ?
 - [2 marks] State the Nyquist criterion for zero ISI and give an example of a filter $p(t)$ which satisfies this criterion (you must specify the definition of the spectrum of $p(t)$).
4. [4 marks] Assuming PCM system consisting of a sampler, a uniform quantizer with L levels, and a basic binary encoder. An original audio signal $s(t)$ with highest frequency component 20 KHz is required to be converted in digital format for Compact Disc (CD) application where signal $s(t)$ is considered with high-fidelity (100% exactness). If a guard band of 4.1 KHz, and $L=65,536$ is used. Find Nyquist sampling rate, actual sampling rate, data rate of the output of PCM, and minimum transmission bandwidth for zero ISI.

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