BITS, PILANI-DUBAI CAMPUS
KNOWLEDGE VILLAGE, DUBAI
COMPREHENSIVE EXAMINATION

Course No.: EEE UC416 **Course Name:** DIGITAL COMMUNICATION

Date: 27-05-2007 **Duration**: 3 hours **Marks:** 80 **Weightage:** 40 %

Note:- *Answer all questions.*

1. Describe briefly the three mathematical models used to characterize a majority of physical channels encountered in practice. (8)
2. a) Under what conditions can two disjoint events A and B be independent?

   b) The noise voltage in an electric circuit can be modeled as a Gaussian random variable with mean equal to zero and variance equal to 10^{-8}. What is the probability that the value of the noise exceeds 4×10^{-4}? You may express the answer in terms of the Q-function. (4+4)
3. Obtain the expression for the signal-to-quantization noise power ratio for PCM. Assume single-tone modulating signal and full-load quantization. (8)
4. Show that antipodal signals yield the same performance (same error probability) as orthogonal signals by using one-half of the transmitted energy of orthogonal signals. (12)
5. Consider a random binary sequence where bits are statistically independent and equally likely. Derive the power spectrum for the NRZ unipolar format representation of the sequence. (8)
6. a) Define the terms: Hamming distance and Hamming weight. b) State the channel coding theorem for a discrete memoryless channel. c) What is the main advantage of trellis coded modulation? (2+3+2)

BITS, PILANI-DUBAI CAMPUS
Knowledge Village, Dubai
Test II (Open Book)

Course No.: **EEE UC 416** Course Title: **Digital Communication**
Date: May 06, 2007 Time: 50 minutes Max. Marks: 40 Weightage: 20%
Note: *Answer all questions.*

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1. A matched filter has the frequency response $H(f)=\frac{1-e^{-j2\pi fT}}{j2\pi f}$.

   Determine the impulse response $h(t)$ corresponding to $H(f)$. Also, determine the signal waveform to which the filter characteristic is matched. (15 marks)

2. Suppose that two signal waveforms $s_1(t)$ and $s_2(t)$ are orthogonal over the interval $(0,T)$. A sample function $n(t)$ of a zero-mean, white noise process is crosscorrelated with $s_1(t)$ and $s_2(t)$ to yield $n_1 = \int_0^T s_1(t)n(t)dt$ and $n_2 = \int_0^T s_2(t)n(t)dt$. Assuming that $E[n^2(t)]=\sigma_n^2$, find $E(n_1 n_2)$. (10 marks)

3. Derive the expression for probability of error for signal detection of 4-level PAM in additive white Gaussian noise. Extend the result to the general M-level case and comment on the result. (15 marks)

BITS, Pilani-Dubai campus
Knowledge Village, Dubai
EEE IV Year, II Semester
Test-I (Closed Book)

Course No.: EEE UC416 Course Title: Digital Communication
Date: 01 April 2007 Time: 50 minutes Max. Marks: 40 Weightage: 20 %
Note: *Answer all questions.*

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1. Assume that $x(t)$ is a Gaussian random process such that the probability density function of a sample of $x(t)$ is $N(1,4)$. That is the mean of $x(t)$ is 1 and variance is 4. What is the probability that a sample of $x(t)$ is within the range of -1 to 1? Express your answer in terms of the Q function. (8 marks)
2. Define a matched filter. Show that the output SNR of a matched filter depends only on the ratio of the signal energy to the power spectral density of the white noise at the filter input. (12 marks)
3. Obtain the mean and variance of a random variable X uniformly distributed over [1,4]. (6 marks)
4. Use the Gram-Schmidt orthogonalization procedure to find an orthonormal basis for the set of four signals shown below: (14 marks)