BITS, PILANI-DUBAI CAMPUS
Knowledge Village, Dubai
EEE IV Year, I Semester, 2006-2007
Test-I (Closed Book)

Course No.: **EEE UC416** Course Title: **Digital Communication**

Date: 29 Oct 2006 Time: 50 minutes Max. Marks: 40 Weightage: 20 %

Note: *Answer all questions.*

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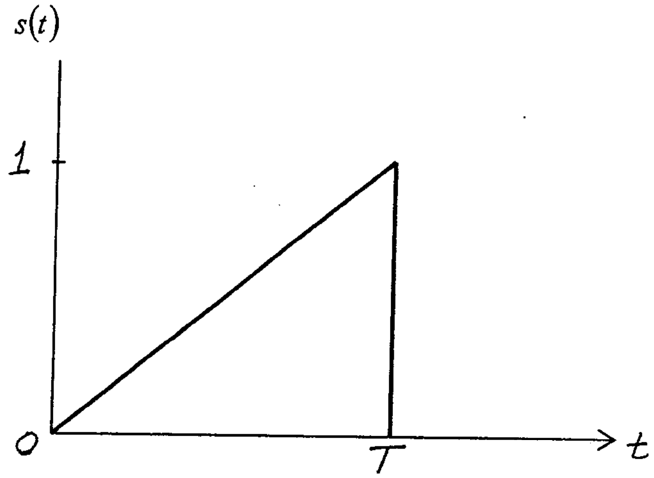
1. Consider a Gaussian signal pulse in the time domain with zero mean and variance σ^2. Find the relationship between the pulse width τ and standard deviation σ if τ is the width measured between the half power points in time. (6)
2. Distinguish between the terms *mutually exclusive* and *statististically independent* events. (4)
3. Give an appropriate mathematical model with sketch for the ionospheric radio channel. (6)
4. Write a brief note on the power spectrum of *thermal noise.* (4)
5. Consider a random process $X(t)$ defined by $X(t) = A + Bt$, where A and B are independent random variables each uniformly distributed on [-1, 1]. Find $m_X(t)$ and $R_X(t_1, t_2)$. (8)
6. Draw the appropriate M=8 signal-point constellation in two dimensions using two sets of biorthogonal signal waveforms with different energies. (4)
7. Obtain and sketch the output of the filter matched to the pulse shown below: (8)



BITS, PILANI-DUBAI CAMPUS
Knowledge Village, Dubai
IV YEAR EEE, I SEMESTER, 2006-2007
Comprehensive Examination (Closed Book)

Course No.: **EEE UC 416** Course Title: **Digital Communication**

Date: Dec 27, 2006 Time: 3 hours Max. Marks: 40 Weightage: 40%

Note: *Answer all questions.*

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1. (a) Let $X(t)$ be a WSS random process with autocorrelation $R_{XX}(\tau)$. Show that the following properties hold: (i) $R_{XX}(-\tau) = R_{XX}(\tau)$, (ii) $|R_{XX}(\tau)| \le R_{XX}(0)$.

   (b) State and explain the Wiener-Khinchine theorem. (2+2)

2. (a) Write a brief note on bandpass processes and their representation.

   (b) Explain the steps involved in the Gram-Schmidt orthogonalization procedure. (2+3)

3. 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. (5)

4. Explain the principle of the Quadrature Receiver that is used for the detection of a sinusoidal signal of arbitrary phase which is corrupted by an additive white Gaussian noise. (6)

5. Derive the formula for the average probability of error for non-coherent orthogonal modulation. Hence show that the average probability of error for non-coherent binary FSK is:

   $P_e = \frac{1}{2}\exp\left(-\frac{E_b}{2N_o}\right)$, where the symbols have their usual meanings.

(5+2)

6. (a) State the Source Coding theorem.

   (b) Name the sources of error in Delta Modulation and how they are overcome.

   (c) Define code rate of an (n, k) code. State the properties of a linear code.

   (d) What is the main advantage of Trellis Coded Modulation?

   (1+1.5+1.5+1)

7. (a) Write a brief note on the various channel models that you have come across.

   (b) Draw the model of a spread spectrum digital communication system. Explain the operation of a Direct-Sequence Spread Spectrum system. (3+5)

BITS, PILANI-DUBAI CAMPUS
Knowledge Village, Dubai
EEE IV Year, I Semester, 2005-2006
Quiz (Closed Book)

Course No.: **EEE UC416** Course Title: **Digital Communication**
Date: 10 Oct 2006 Time: 30 minutes Max. Marks: 20 Weightage: 10 %
Note: *Answer all questions. Show the working in the space provided.*

Name: ______________________ **ID No.:** ______________

VERSION A

1. Define the Q-function. (3)

2. Let X be a random variable uniformly distributed over $[a, b]$. Find the variance of X. (4)

3. Define the term random process. When is a random process called strict-sense stationary? (4)

4. Let $P(A) = 0.9$ and $P(B) = 0.8$. Show that $P(A \cap B) \geq 0.7$. (3)

5. Consider the three orthonormal waveforms $\phi_n(t)$, $n = 1,2,3$ shown. Express the waveform $x(t)$ as a weighted linear combination of $\phi_n(t)$, $n = 1,2,3$ if:

$$x(t) = \begin{cases} -1, & 0 \leq t \leq 1 \\ 1, & 1 \leq t \leq 3 \\ -1, & 3 \leq t \leq 4 \end{cases}$$

and find the weighting coefficients. Comment on the result. (6)