

TEC-604

57

Printed Pages : 5

Roll No. to be filled in your Answer Book

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B. Tech. (EC) (6TH Semester)
Examination, 2015
Digital Communication

Time: 3.00 Hrs]

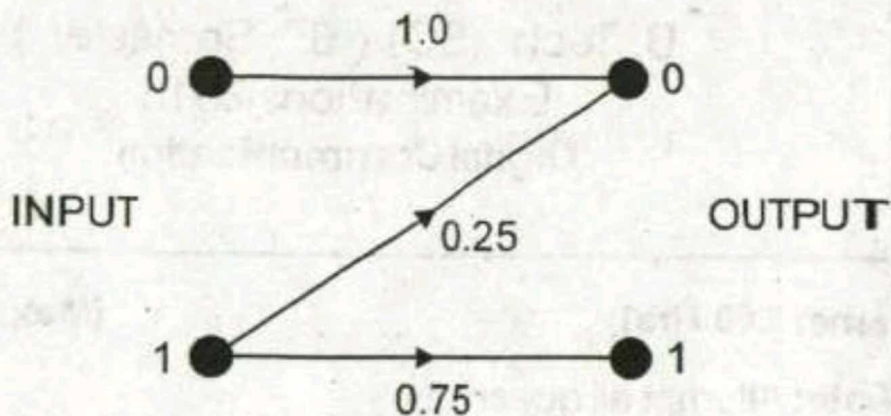
[Max. Marks: 100

Note: Attempt all questions.

Q1: Attempt any four questions of the following: (4×5 = 20)

- Draw the block diagram of Digital communication and discuss briefly each part of the block diagram.
- What is Entropy? Consider a binary memory-less source X with two symbols x_1 and x_2 . Show that $H(X)$ is Maximum when both x_1 and x_2 are equiprobable.
- Discuss the transmitter part of DPCM.
- Let $g(t) = e^{\pi t^2}$ and $h(t)$ is a filter matched to $g(t)$. If $g(t)$ is applied as input to matched filter, then determine the output of matched filter $y(t)$.
- Write the mathematical expression for MSK and GMSK modulation schemes and write one application for GMSK modulation scheme.

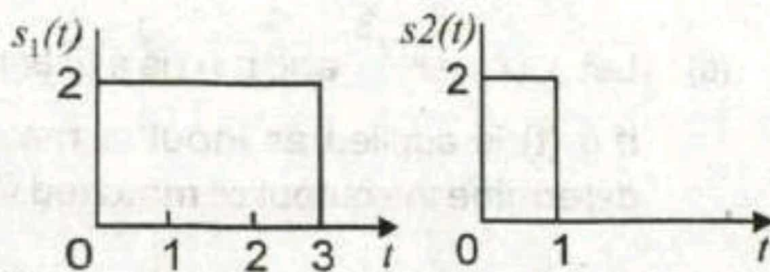
- (f) Consider the Z-channel given in the figure. The input is 0 or 1 with equal probability.



If the output is '0', by using Baye's theorem determine the probability that the input is also '0'

- Q2. Attempt any four questions of the following: (4×5 = 20)

- What do you mean by line coding? And discuss the properties of line coding.
- Determine the set of orthonormal signals using Gram-Schmidt procedure for the following two signals $s_1(t)$ and $s_2(t)$.



- A bipolar binary signal $s_i(t)$ is a $(1, -b)$ volt or $(-1, -b)$ volt pulse during the interval $(0, T)$. Additive

white Gaussian noise with power spectral density

$$\frac{N_0}{2} = 10^{-5} \text{ W/Hz}$$

is added to the signal. Determine the maximum bit rate that can be sent with a bit error probability of $p_e \leq 10^{-4}$. [Note $Q(3.71) = 10^{-4}$].

- (d) Draw the constellation diagram or signal space diagram for 8-QAM and 16-QAM with proper Gray coding mapping Scheme.
- (e) What do you mean by ISI? Discuss Nyquist criterion for zero ISI by pulse shaping.
- (f) Draw the waveforms of BASK, BPSK and BFSK for bit stream [0 1 1 0 0 1 1 1].

Q3. Attempt any two parts of the following: (2×10= 20)

(a) A signal $m(t) = \cos(20000\pi t)$ is sampled at Nyquist rate and transmitted through a channel using 3-bit PCM,

(i) Calculate step size, maximum quantization error, Nyquist interval and bit rate. (5)

(ii) If the sampled values are 3.9, 2.5, 0.2, -0.9, -2.8, -3.1, -4, determine the quantizer output, encoder output, quantization error for each sample and sketch transfer characteristics of quantizer. (5)

(b) Derive the expression of Power Spectral Density (PSD) for bipolar (AMI) line encoding scheme.

(c) A DMS X has six symbols with probabilities 0.3, 0.25, 0.20, 0.12, 0.08 and 0.05.

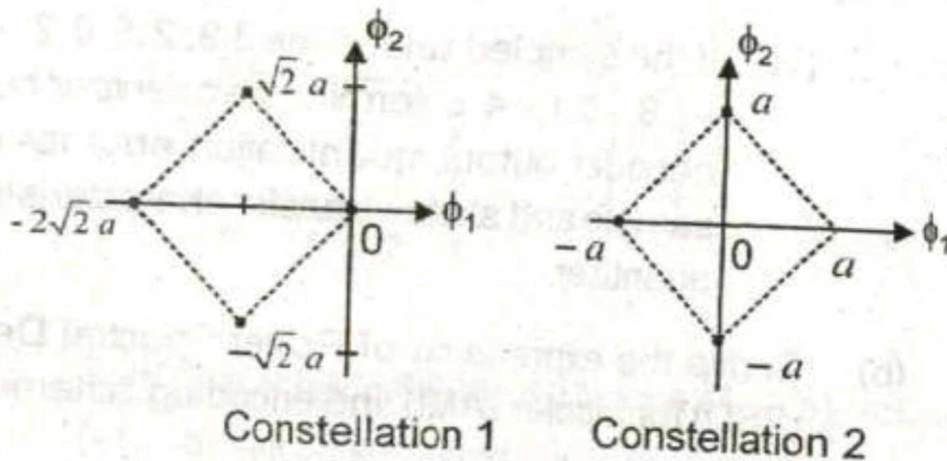
(i) Construct a Huffman Code for X and calculate the code efficiency. (5)

(ii) Construct a Shannon-Fano code for X and calculate average code length and efficiency. (5)

Q4. Attempt any two parts of the following: (2×10=20)

(a) Write the mathematical expression for B-ASK and calculate the bandwidth of B-ASK? Discuss any one method of generation and any one non-coherent detection method of B-ASK.

(b) Two 4-ary constellations are shown below. It is given that ϕ_1 and ϕ_2 are the orthonormal basis functions for the two constellations. Assume that the four symbols in both the constellations are equiprobable. Let $N/2$ denote the PSD of white Gaussian noise. Derive the relation between the average energy of constellation 1 to average energy of constellation 2.



- (c) Derive the optimum probability of bit error for B-FSK Modulation scheme.

Q5. Attempt any two parts of the following: (2×10 = 20)

- (a) A PCM system uses a uniform quantizer followed by v bit encoder. show that rms signal to noise ratio is approximately given by $(1.8 + 6v)$ dB. (Input to the PCM system is sinusoidal signal)
- (b) What do you mean by block code? Discuss any one encoding and decoding method for linear block code (LBC).
- (c) Discuss the short note on the following:
- (i) Direct sequence spread spectrum
 - (ii) Viterbi decoding Algorithm

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