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06EC61

Sixth Semester B.E. Degree Examination, June/July 2013
Digital Communication

Time: 3 hrs. Max. Marks:100

Note: *1. Answer FIVE full questions, selecting atleast TWO questions from each part.*
2. Missing data, if any, may be suitable assumed.

PART – A

1 a. With a neat block diagram, explain the various elements of a digital communication system. **(07 Marks)**

b. Prove that the mean square error of reconstructed message process is zero for wide sense stationary message process whose power spectral density is strictly bandlimited. **(08 Marks)**

c. The signals $g_1(t) = 10 \cos 100 \pi t$ and $g_2(t) = 10 \cos 50 \pi t$ are both sampled with $f_s = 75$ hz. Show that the two sequences so obtained are identical. **(05 Marks)**

2 a. Six independent message sources of band widths w, w, 2w, 2w, 3w and 3w are to be transmitted on a time division multiplexing basis using common channel. Set up a scheme for accomplishing this with each message being sampled at its Nyquist rate. Determine the minimum transmission bandwidth of the channel. **(05 Marks)**

b. Derive on expression for the probability of error to estimate the performance of PCM system transmitted along the channel associated with AWGN. **(08 Marks)**

c. Explain the need for non-uniform quantization also explain μ - law and A – law compounding. **(07 Marks)**

3 a. Explain the working of DPCM transmitter and receiver. **(08 Marks)**

b. For the given binary sequence 111000110101, draw the digital format waveforms corresponding to,
i) Polar Manchester coding ii) Bipolar NRZ iii) 8 – ary signalling iv) Polar RZ. **(05 Marks)**

c. For the sinusoidal modulating signal $x(t) = A_0 \cos (2 \pi f_0 t)$, show that the output signal to quantizing noise ratio in a delta modulated system under the assumption of no slope overload is given by,

$$[SNR]_0 = \frac{3f_s^3}{8\pi^2 f_0^2 f_m}$$

where, f_s = sampling frequency ; f_m = cutoff frequency of LPF in receiver. **(07 Marks)**

4 a. What is correlative coding? Explain duobinary coding with and without precoding. **(08 Marks)**

b. Derive the Nyquist criterion for distortionless baseband binary transmission and mention its practical limitation and solution for it. **(07 Marks)**

c. Write a note on adaptive equalization for data transmission. **(05 Marks)**

PART – B

5 a. Driver an expression for probability of error in binary ASK generation and coherent detection. **(08 Marks)**

b. A binary sequence 101101 is transmitted over a communication channel using DPSK transmitter shown in Fig. Q5(b)(i) the channel introduces a phase reversal of 180°
   i) Sketch the transmitted DPSK waveform assuming an initial bit of 1. What is the effect of changing initial bit to 0?
   ii) Assuming the cannel is noise free, show that the DPSK detector in receiver shown in Fig. 5(b)(ii) produces the original binary sequence, despite the 180° phase reversal in the channel. Take DPSK waveform with $d_{k-1} = 1$. **(08 Marks)**

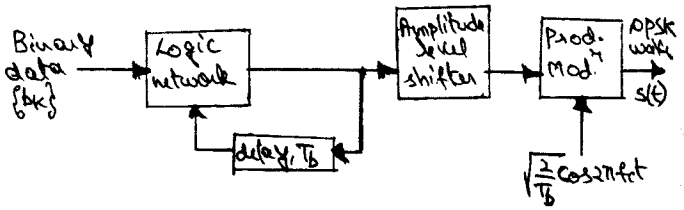

Fig. Q5(b)(i)

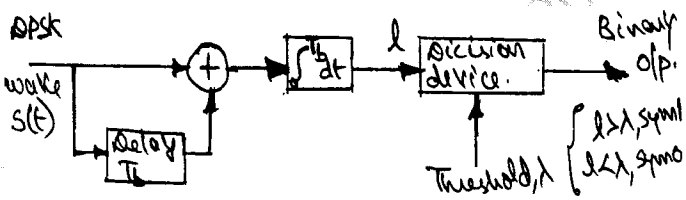

Fig. Q5(b)(ii)

c. With the help of sketches, explain generation and detection of binary FSK signals. **(04 Marks)**

6 a. Two signals $S_1(t)$ and $S_2(t)$ are given in Fig. 6(a). The interval is $0 \le t \le T$ secs. Using Gram – Schmidt procedure, express these functions in terms of orthogonal basis functions. Also sketch $\phi_1(t)$ and $\phi_2(t)$. **(06 Marks)**

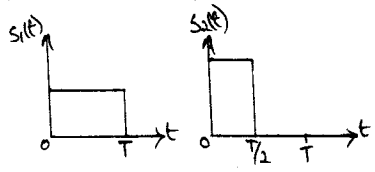

Fig. Q6(a)

b. Explain important properties of matched filter. **(08 Marks)**

c. 3 signals $S_1(t)$, $S_2(t)$ and $S_3(t)$ are to be transmitted over AWGN channel with noise power spectral density $\frac{No}{2}$. The signals are,

$$S_1(t) = \begin{cases} 1, & 0 \le t \le T \\ 0, & \text{otherwise} \end{cases} \qquad S_2(t) = \begin{cases} 1, & 0 \le t \le T/2 \\ 0, & \text{otherwise} \\ -1, & \frac{T}{2} \le t \le T \end{cases}.$$

   i) Determine the dimensionality of signal space
   ii) Determine appropriate basis functions for the signal space
   iii) Draw the constellation diagram and sketch optimum decision regions Z_1, Z_2, Z_3. **(06 Marks)**

7 a. Explain the properties of maximum length sequences. **(05 Marks)**

b. With the help of a block diagram, explain direct sequence spread spectrum system with binary PSK. **(08 Marks)**

c. With the help of a block diagram, explain the working of a frequency hopped transmitter and receiver. **(07 Marks)**

8 Write short notes on : a. Flat top sampling b. Speech coding at low bit rates
c. Digital modulation formats d. Eye pattern. **(20 Marks)**

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