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10EC/TE61

Sixth Semester B.E. Degree Examination, June/July 2016

Digital Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain sampling theorem of low pass signals and derive the interpolation formula. **(08 Marks)**

b. A low pass signal x(t) has spectrum X(f) given by,

$$X(f)=\begin{cases}1-\frac{|f|}{200}; & |f|<200\\ 0 & \text{Elsewhere}\end{cases}$$

Sketch the spectrum $X_\delta(f)$ for $|f| < 200$ Hz if x(t) is ideally sampled at $f_s = 300$ Hz. **(06 Marks)**

c. A band pass signal g(t) with a spectrum shown in Fig.Q1(c) is ideally sampled. Sketch the spectrum of sampled signal at $f_s = 25$ Hz and $f_s = 45$ Hz. Indicate if and how the signal can be recovered.

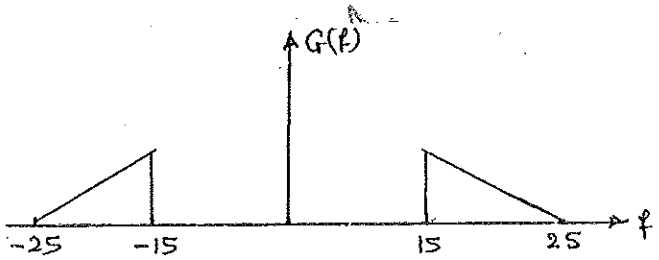

Fig.Q1(c) **(06 Marks)**

2 a. Derive the expression for signal to quantization noise ratio (SNR) and show that for uniform quantization, each bit in the codeword of a PCM contributes 6 dB to SNR. **(08 Marks)**

b. For a binary PCM signal, determine L if the compression parameter $\mu = 100$ and the minimum $[SNR]_0$ dB = 45 dB. Determine the $[SNR]_0$ dB with this value of L. **(06 Marks)**

c. With a neat block diagram and waveform, explain time division multiplexing. **(06 Marks)**

3 a. Explain the principles of delta modulator. With relevant figure and mathematical expressions, explain the functioning of DM transmitter and receiver. **(08 Marks)**

b. For a binary sequence 111000110101 draw the digital format waveforms corresponding to: i) Bipolar NRZ waveform and ii) 8-ary signaling waveform. **(06 Marks)**

c. Derive an expression for power spectral density of bipolar NRZ format and plot the same with respect to frequency. **(06 Marks)**

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

b. The binary data 011100101 are applied to the input of a modified duo binary system:
   i) Construct the modified duo binary coder output and corresponding receiver output without a precoder.
   ii) Suppose that due to error in transmission, the level produced by the third digit is reduced to zero. Construct a new receiver output. **(07 Marks)**

c. With a neat block diagram, explain the concept of adaptive equalization. **(05 Marks)**

PART – B

5 a. With neat block diagram, explain DPSK transmitter and receiver. Illustrate the generation of differentially encoded sequence for the binary input sequence 00100110011110. **(12 Marks)**

b. A binary data is transmitted over an AWGN channel using binary phase shift keying at the rate of 1 Mbps. It is desired to have average probability of error $P_e \leq 10^{-4}$. Noise power spectral density is $N_{0/2} = 10^{-12}$ W/Hz. Determine the average carrier power required at the receiver input, if the detector is of coherent type. Take erfc(3.5) = 0.00025. **(08 Marks)**

6 a. Write a note on Gram-Schmidt orthogonalization procedure. **(08 Marks)**

b. Consider the signal $s_1(t)$, $s_2(t)$, $s_3(t)$ and $s_4(t)$ as given below in Fig.Q6(b).

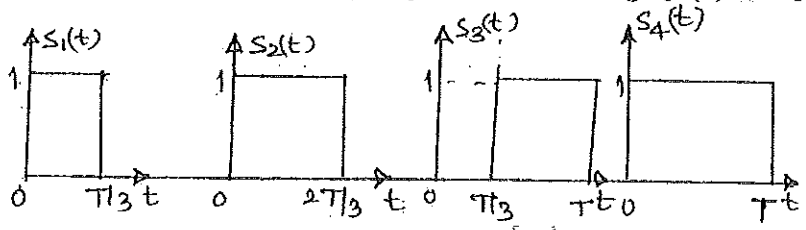

Fig.Q6(b)

Find an orthonormal basis for these set of signals using Gram-Schmidt orthogonalization procedure. **(12 Marks)**

7 a. Draw and explain the block diagram of correlation receiver. **(08 Marks)**

b. Show that the probability of bit error of a matched filter receiver is given by $P_e = \frac{1}{2}\text{erfc}\sqrt{\frac{E_b}{N_o}}$. **(12 Marks)**

8 a. What is spread spectrum technique? How are they classified? **(08 Marks)**

b. Explain properties of PN sequence. **(06 Marks)**

c. A slow FH/MFSK system has the following parameters:
The number of bits/MFSK symbol = 4
The number of MFSK symbols per hop = 6
Calculate processing gain of the system. **(06 Marks)**

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