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06EC61

Sixth Semester B.E. Degree Examination, December 2012
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. A low pass signal g(t) and its spectrum is given by

$$G(f) = \begin{cases} 1 - \dfrac{|f|}{200} & |f| < 200\,\text{Hz} \\ 0 & \text{Elsewhere} \end{cases}$$

i) Assume that g(t) is ideally sampled at f_s = 300 Hz. Sketch the spectrum of the sampled signal.

ii) Repeat part (i) for f_s = 400 Hz. **(06 Marks)**

b. State and prove sampling theorem for band pass signals. **(10 Marks)**

c. Highlight the advantages and disadvantages of digital communication over analog communication. **(04 Marks)**

2 a. Twenty-four voice signals are sampled uniformly and then time-division multiplexed. The sampling operation uses flat-top samples with 1 microseconds duration. The multiplexing operation includes provision for synchronization by adding an extra pulse of sufficient amplitude and also 1 microsecond duration. The highest frequency component of each voice signal is 3.4 kHz.

i) Assuming a sampling rate of 8 kHz, calculate the spacing between successive pulse of the multiplexed signal.

ii) Repeat your calculation assuming the use of Nyquist rate sampling. **(06 Marks)**

b. Determine the probability of symbols error for binary encoded PCM wave and is given by

$$P_e = \frac{1}{2}\text{erfc}\left(\frac{A}{2\sqrt{2}\,\sigma}\right)$$ **(10 Marks)**

c. Write a note on robust quantization. **(04 Marks)**

3 a. For the sinusoidal modulating signal $x(t) = A_0 \cos 2\pi f_0 t$. Show that the output signal-to-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 and f_M = cut-off frequency of the low pass filter in the receiver. **(08 Marks)**

b. Give the binary sequence 011010110, construct the polar octal format of the NRZ type using i) natural code ii) Gray code **(06 Marks)**

c. Explain the inter symbol interference with the help of spectral analysis. How it will be eliminated? **(06 Marks)**

4 a. Explain duobinary signalling scheme. **(10 Marks)**

b. A binary wave using polar signalling is generated by representing symbol 1 by a pulse of amplitude +1 volt and symbol 0 by a pulse of amplitude –1 volt; in both cases the pulse duration equals the bit duration. This signal is applied to a low-pass RC filter with transfer function

$$H(f) = \frac{1}{1 + j^{f/f_0}}$$

Construct the eye pattern for the filter output for the following sequences:
i) Alternating 1s and 0s.
ii) A long sequence of 1s followed by a long sequence of 0s. **(06 Marks)**

c. Highlight the significance of raised cosine technique. **(04 Marks)**

PART – B

5 a. Explain the generation and detection of binary phase shift keying. **(10 Marks)**

b. Find the average probability of symbol error for a coherent QPSK system. **(10 Marks)**

6 a. For the signals $s_1(t)$, $s_2(t)$, $s_3(t)$ and $s_4(t)$ shown in the Fig.Q6(a), find the orthonormal basis functions using Gram-Schmidt orthogonalisation procedure. **(10 Marks)**

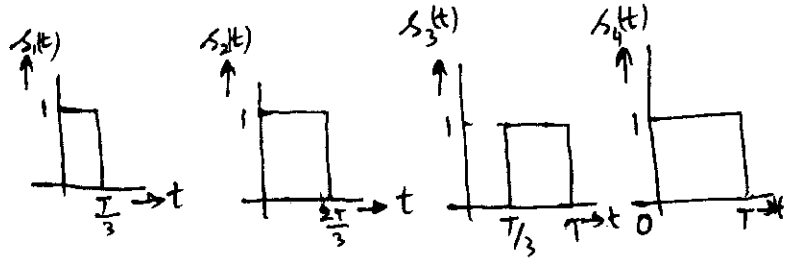

Fig.Q6(a)

b. In an FSK system the following data are observed;
Transmitted binary data rate = 2.5×10^6 bits/sec
PSd of zero mean AWGN = 10^{-20} Watts/Hz.
Amplitude of received signal in the absence of noise = 1 μVolt.
Find the probability of error assuming coherent detection. Given erfc($\sqrt{5}$) =1.7. **(05 Marks)**

c. Explain correlative receiver. **(05 Marks)**

7 a. State and prove properties of matched filter receiver. **(10 Marks)**

b. Explain adaptive equalizer with respect to a suitable block diagram. **(10 Marks)**

8 a. Explain the properties of maximum length sequence generated from 3 stage shift register with linear feedback. Verify these properties and determine the period of the given PN sequence 01011100101110. **(08 Marks)**

b. Explain with a block diagram the model of direct sequence spread binary PSK system. **(08 Marks)**

c. Highlight the applications of spread spectrum techniques. **(04 Marks)**

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