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

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 the sampling theorem for low pass signals and derive the interpolation formula. **(09 Marks)**

b. With a neat block diagram, explain the scheme for signal reconstruction for practical sampling. **(06 Marks)**

c. Let E denote the energy of a strictly band limited signal g(t). Show that E may be expressed interms of the sample values of g(t), taken at the Nyquist rate as, $E = \frac{1}{2w}\sum_{n=-\infty}^{\infty}\left|g\left(\frac{n}{2w}\right)\right|^2$ where w is the highest frequency component of g(t). **(05 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. Six independent message sources of bandwidths w, w, 2w, 2w, 3w and 3w hertz are to be transmitted on TDM. Set up a scheme to accomplish this requirement, with each message signal sampled at its Nyquist rate. **(05 Marks)**

c. The signal m(t) = 6 sin ($2\pi t$) Volts, is transmitted using 4-bit binary PCM system. The quantizer is of midriser type with a step size of 1 Volt. The sampling frequency is 4 Hz with samples taken at $t = \pm\frac{1}{8}, \pm\frac{3}{8}, \pm\frac{5}{8}, \ldots$ sec. Sketch the PCM wave for one complete cycle of the input. **(07 Marks)**

3 a. With a neat block diagram, explain the delta modulation system and illustrate its quantization error. **(08 Marks)**

b. Derive the expression for power spectral density of NRZ bipolar format. **(07 Marks)**

c. Explain T_1 carrier system with its compounding characteristics. **(05 Marks)**

4 a. Explain the Nyquist criterion for distortionless baseband binary transmission and obtain the ideal solution for zero ISI. **(08 Marks)**

b. For a binary sequence 10110001, construct (i) RZ polar format, (ii) Manchester format. **(04 Marks)**

c. The binary data 011100101 is applied to the input of a modified duobinary system.

i) Construct the modified duobinary coder output and receiver output with a precoder.

ii) Due to transmission error, the level produced by the third digit is zero, construct the new receiver output. **(08 Marks)**

PART – B

5 a. Obtain the expression for probability of symbol error of coherent binary FSK. **(09 Marks)**

b. Compare the probability of symbol errors for basic digital modulation formats and explain how the probability of error depends on the distance between the message points in signal space diagram. **(04 Marks)**

c. With a neat block diagram, explain the differential phase shift keying. Illustrate the generation of differentially encoded sequence for the binary data 1100100010. **(07 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

6 a. With the conceptualized model of a digital communication system, explain the Gram-Schmidt orthogonalization procedure. **(10 Marks)**

b. Using the Gram-Schmidt orthogonalization procedure, find a set of orthonormal basis functions to represent the three signals $s_1(t)$, $s_2(t)$ and $s_3(t)$ shown in Fig.Q6(b). Express each of these signals in terms of the set of basis functions. **(10 Marks)**

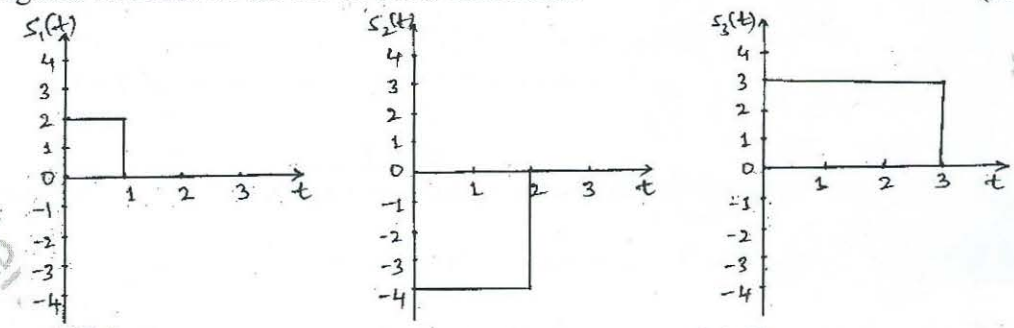


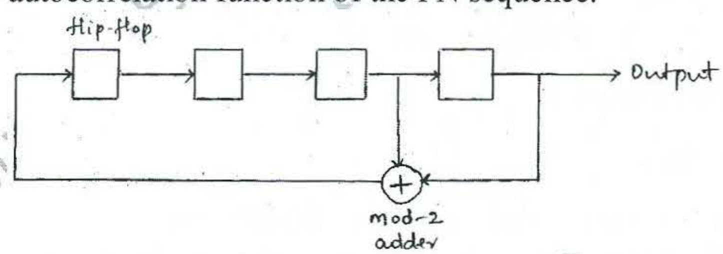
Fig.Q6(b)

7 a. Explain the maximum likelihood detection process and obtain the decision rule. **(10 Marks)**

b. Derive the impulse response of a matched filter receiver and explain any two properties of matched filter. **(10 Marks)**

8 a. Explain frequency hoop spread m-ary frequency shift keying with a neat block diagram and illustrate the slow frequency hopping. **(08 Marks)**

b. Find the output sequence of the shift register shown in Fig.Q8(b). The initial state of the register is 1000. Demonstrate the balance property and run property of a PN sequence. Calculate and plot the autocorrelation function of the PN sequence. **(07 Marks)**



c. In a DS/BPSK system, the feedback shift register used to generate the PN sequence has length $m = 19$. The system is required to have a probability of error due to externally generated interfering signals that doesn't excess 10^{-5}. Calculate the processing gain and antijam margin in decibels. Use erf(3) = 0.99998. **(05 Marks)**

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