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10EC/TE61

Sixth Semester B.E. Degree Examination, Aug./Sept. 2020
Digital Communication

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. With the block diagram, explain basic signal processing operations in digital communication system and describe the functioning of each block. **(07 Marks)**

b. How practical sampling is different from ideal sampling? Obtain an expression for the flat top sampled signal. **(08 Marks)**

c. A signal $g(t) = 10\cos(20\pi t)\cos(200\pi t)$ is sampled at the rate of 250 samples/sec. Sketch the spectrum of the sampled signal and specify the cut-off for the ideal reconstruction filter so as to recover the original signal. **(05 Marks)**

2 a. With a neat block diagram, explain the working of TDM transmitter and receiver. **(07 Marks)**

b. A PCM system uses a uniform quantizer followed by a n-bit encoder. Show that RMS signal to quantization noise ratio is approximately given by $(6n + 1.8)$ db. **(08 Marks)**

c. A television signal having a B.W of 4.2 MHz is transmitted using binary PCM system. Given that the number of quantization levels are 512, determine
(i) Code word length (ii) Transmission B.W (iii) Output signal to quantization noise ratio. **(05 Marks)**

3 a. Explain the principle of delta modulator; with relevant figure and mathematical expressions, with neat block diagram of DM transmitter and DM Receiver. **(08 Marks)**

b. For a binary sequence 011011, draw the digital format waveforms corresponding to,
(i) Polar NRZ (ii) Bipolar NRZ (iii) Manchester NRZ (iv) Gray code NRZ. **(05 Marks)**

c. Derive an expression for power spectral density of polar NRZ format and plot the same with respect to frequency. **(07 Marks)**

4 a. Derive an expression for Nyquist pulse shaping criterion for distortion less baseband transmission. **(06 Marks)**

b. A binary sequences 001101001 is applied to a duobinary system shown in Fig. Q4 (b).

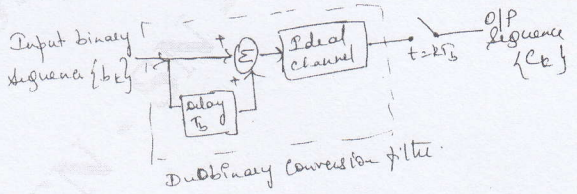

Fig. Q4 (b)

(i) Construct the duobinary coder output and corresponding receiver output, without a precoder.

(ii) Suppose that due to error during transmission, the level at the receiver input produced by the second digit is reduced to zero. Construct the new receiver output. **(08 Marks)**

c. What is the necessity of equalization in digital transmission? What is adaptive equalization? **(06 Marks)**

PART – B

5 a. Derive an expression for the average probability of symbol error for coherent binary FSK signal. (10 Marks)

b. With the block diagram of QPSK transmitter and receiver, explain the generation and demodulation of a QPSK wave. Also mention a relevant time domain expressions and draw the constellation diagram. (10 Marks)

6 a. Three signals $S_1(t)$, $S_2(t)$ and $S_3(t)$ are shown in Fig. Q6 (a). Apply Gram-Schmidt procedure to obtain an orthonormal basis for the signals. Express the signals $S_1(t)$, $S_2(t)$ and $S_3(t)$ in terms of orthonormal basis functions. Also give the signal constellation diagram. (10 Marks)

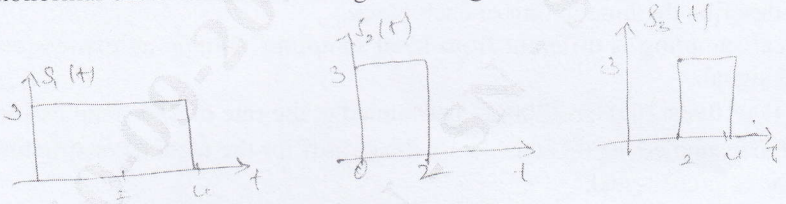

Fig. Q6 (a)

b. Explain the importance of geometric interpretation of signals. Illustrate the geometric representation of signals for the case of a 2-dimensional signal space with 3 signals. (10 Marks)

7 a. Explain in detail with necessary block diagram, the response of bank of correlators to noisy input. (10 Marks)

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

8 a. With a neat block diagram, explain direct sequence spread spectrum with coherent binary phase shift keying. (08 Marks)

b. A 3 stage shift register with a linear feedback generates the sequence: 01011100101110.

(i) Determine the period of given infinite sequence.

(ii) Verify the 3 properties of the PN sequence for the given sequence. (07 Marks)

c. Discuss briefly the applications of spread spectrum technique (i) CDMA (ii) Multipath suppression. (05 Marks)

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