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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).

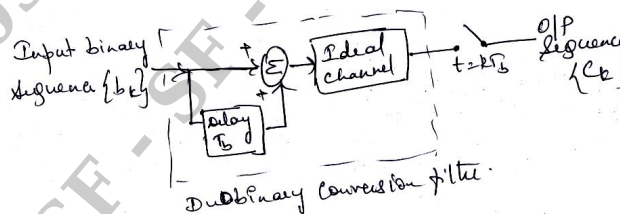


Fig. Q4 (b)

- (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)**

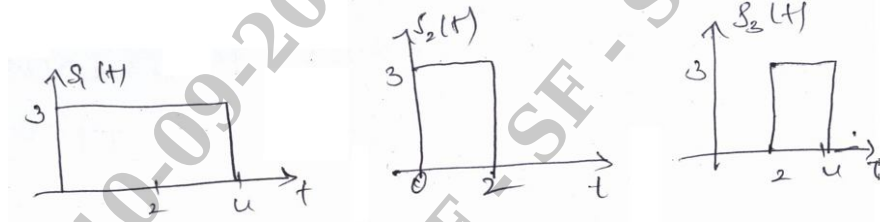


Fig. Q6 (a)

- 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)**
