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10EC/TE61

**Sixth Semester B.E. Degree Examination, Jan./Feb. 2021**  
**Digital Communication**

Time: 3 hrs.

Max. Marks:100

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

**PART – A**

- 1
  - a. With neat block diagram, explain the operation of digital communication system. Explain the functioning of each block. (06 Marks)
  - b. Explain the term quadrature sampling of band pass signal with help of spectrum and block diagram. (08 Marks)
  - c. A signal  $x(t) = 2\cos 400\pi t + 6\cos 640\pi t$  is ideally sampled at  $f_s = 500\text{Hz}$ . If the sampled signal is passed through an ideal low pass filter with cut off frequency  $f_c = 400\text{Hz}$ . Find :
    - i)  $X(f)$  and sketch its spectrum
    - ii) Sampled signal  $X\delta(f)$  and sketch its spectrum
    - iii) The components that will appear at the filter output. (06 Marks)
  
- 2
  - a. Derive an expression for maximum signal to quantization noise ratio for PCM system that employs linear quantization techniques. What will be the  $[S/N]_{\text{dB}}$  if the destination power and signal amplitude are normalized. (08 Marks)
  - b. With a suitable block diagram, explain the functioning of a PCM system. (06 Marks)
  - c. A PCM system uses a uniform quantizer followed by a 7 bit encoder. The bit rate of the system is equal to  $60 \times 10^6$  bits/sec. i) What is the maximum message bandwidth for which the system operates satisfactorily. ii) Determine SNR when a full load sinusoidal wave is considered. (06 Marks)
  
- 3
  - a. Explain the principles of delta modulation, with relevant figures and mathematical expressions explain the functioning of DM transmitter and receiver. (08 Marks)
  - b. For a binary sequence 111000110110. Draw the waveforms for the following :
    - i) Digital formats
    - ii) RZ unipolar
    - iii) RZ polar
    - iv) NRZ bipolar
    - v) Manchester coding. (06 Marks)
  - c. Obtain an expression for the power spectral density of NRZ polar wave form. (06 Marks)
  
- 4
  - a. The binary data 001101001 are applied to the input of a duobinary system. Construct the duobinary coder output and corresponding receiver output assume the precoder is used. (04 Marks)
  - b. What is an eye pattern? Explain how it is helpful in understanding the ISI problem. (08 Marks)
  - c. What is ISI? Derive an expression for Nyquist pulse shaping criteria for distributionless base band binary transmission. (08 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.

## PART - B

- 5 a. Explain with neat block diagram the coherent QPSK transmitter and receiver. For a given binary sequence 01101000. Draw the signal space representation and relevant QPSK wave forms. (10 Marks)
- b. Explain M-ary modulation techniques. (06 Marks)
- c. Compare binary PSK and QPSK schemes. (04 Marks)
- 6 a. Consider the signal  $S_1(t)$ ,  $S_2(t)$ ,  $S_3(t)$  and  $S_A(t)$  as given below in Fig.Q6(a) :

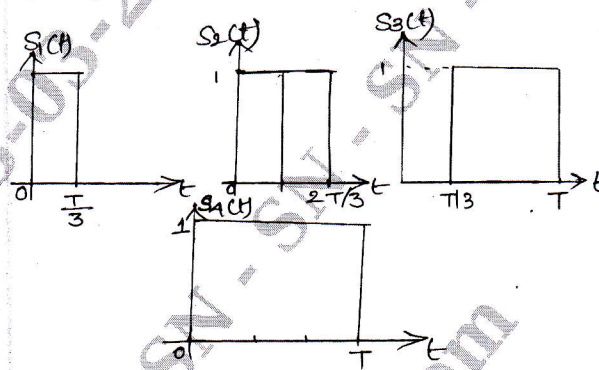


Fig.Q6(a)

- Find an orthonormal basis for these set of signal using Gram-Schmidt orthogonalization procedure. (10 Marks)
- b. With neat block diagram, explain the principle of detection and estimation. (05 Marks)
- c. With vector space representation of message symbols.  $M = 3$ , briefly explain geometric representation of message vectors. (05 Marks)
- 7 a. Derive an expression for probability of error in binary QPSK generation and coherent detection. (08 Marks)
- b. Briefly explain the properties of matched filter. (06 Marks)
- c. A binary data is transmitted using ASK over a AWGN channel at a rate of 2.4 Mbps. The carrier amplitude at the receiver is 2mv. The noise power spectral receiver is 1MV. The noise power spectral density  $\frac{N_0}{2} = 10^{-15}$  watts/Hz. Find the average probability of error if the detection is coherent. (take  $\text{erfc}(5) = 3 \times 10^{-6}$ ). (06 Marks)
- 8 a. Explain the principle of direct sequence spread spectrum communication system. (06 Marks)
- b. What is spread spectrum? What is the role of PN code in spread spectrum? (04 Marks)
- c. 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. (06 Marks)
- d. Distinguish between slow frequency hopping and fast frequency hopping. (04 Marks)

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