USN | | | | | | | | | | |

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 qudrature 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 $f_s = 500$Hz. If the sampled signal is passed through an ideal low pass filter with cut off frequency $f_s = 400$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 $[S/N]_{dB}$ 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 60×10^6 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)**

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) :

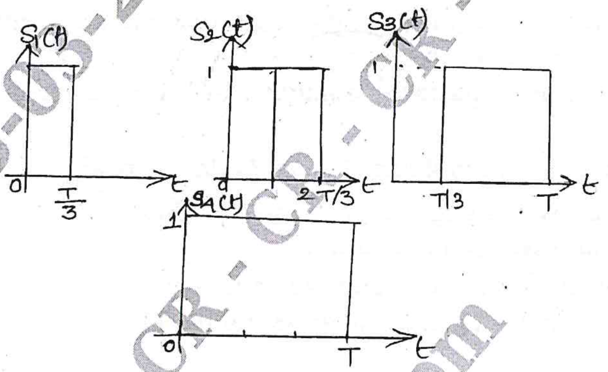

Fig.Q6(a)

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 $\frac{No}{2} = 10^{-15}$ 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 resister 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)**

* * * * *