Hall Ticket No | | | | | | | | | | | Question Paper Code: AEC009

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Four Year B.Tech V Semester End Examinations (Supplementary) - January, 2019

Regulation: IARE – R16

DIGITAL COMMUNICATIONS

Time: 3 Hours **(ECE)** **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) State and prove sampling theorem and explain various types of sampling techniques. **[7M]**
   (b) Determine the processing gain of a DPCM system with a first order predictor, if the message signal has a normalized auto-correlation function of 0.8 for a lag of one period, assuming that the predictor is designed to minimize the mean square value of the prediction error. **[7M]**

2. (a) Explain PCM modulation and demodulation system with neat sketches. Describe the quantization noise in PCM. **[7M]**
   (b) Find the maximum amplitude of a 1 KHz sinusoidal signal input to a delta modulator that will prevent slope overload, when the sampling rate is 10,000 samples/sec and the step size is $\Delta = 0.1$ **[7M]**

UNIT – II

3. (a) Explain binary PSK and QPSK with corresponding equations and constellation diagrams. **[7M]**
   (b) For the signals, the given bit rate is 10Kbps. Estimate the bandwidth for Amplitude Shift Keying and Frequency Shift Keying signals. **[7M]**

4. (a) Explain the Non-coherent detection of FSK modulation scheme. **[7M]**
   (b) The bit stream 11011100101 is to be transmitted using DPSK. Determine the encoded sequence and the transmitted phase sequence. **[7M]**

UNIT – III

5. (a) Describe the scrambling coding scheme HDB3 and Sketch the signal corresponding to the bit sequence "01100000000100001100" using rectangular pulses. **[7M]**
   (b) Define roll off factor and describe the Nyquist bandwidth requirement of raised cosine filter for distortion less transmission. **[7M]**

6. (a) What is pulse shaping? Why it is useful in baseband transmission? Explain in detail. **[7M]**
   (b) Draw and explain the block diagram of modified duo-binary signaling scheme consider the binary sequence b_k= "01001101" applied to the input of a precoded modified duo-binary sequence. Determine the sequence a_k at the pre-coder output. **[7M]**

UNIT – IV

7. (a) Calculate the Conditional entropy, mutual information and channel capacity using channel matrix for a noise free channel. **[7M]**

   (b) Illustrate the principle of Frequency hopped spread spectrum. What is the minimum number of bits in a PN sequence if we use FHSS with a channel bandwidth of B =4 KHz and Bss=100 KHz? **[7M]**

8. (a) Describe Code Division Multiple Access(CDMA) in detail. **[7M]**

   (b) Apply Shannon fano coding for the 5 messages with probabilities 0.4, 0.15, 0.15, 0.15, 0.15 and find the coding efficiency. **[7M]**

UNIT – V

9. (a) Define the following terms **[7M]**
   (i) Code word
   (ii) Block length
   (iii) Code rate
   (iv) Channel data rate
   (v) Code vector
   (vi) Hamming distance
   (vii) Minimum distance

   (b) Determine the generator polynomial g(X) for A (7, 4) cyclic code and find the code vector for the following data vector 1010, 1111 and 1000. **[7M]**

10. (a) Explain how generator and parity matrices are obtained for cyclic codes with an example. **[7M]**

    (b) Decode the given sequence 11 01 01 10 01 of a convolutional code with a code rate of r=1/2 and constraint length K=3, using viterbi decoding algorithm. **[7M]**

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INSTITUTE OF AERONAUTICAL ENGINEERING

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Four Year B.Tech V Semester End Examinations (Regular) - November, 2018

Regulation: IARE – R16

DIGITAL COMMUNICATIONS

Time: 3 Hours **(ECE)** **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Define Quantization. What is the need for Companding in PCM system and show that the mean square quantization error in PCM is $\Delta^2/12$. **[7M]**

   (b) Illustrate with waveforms, how PPM is generated using PWM. **[7M]**

2. (a) Explain the encoding scheme used in DPCM scheme with block diagram description and mathematical modeling. **[7M]**

   (b) What are the noise present in Delta Modulation. Explain the modulation scheme to avoid these noise effects **[7M]**

UNIT – II

3. (a) Explain the generation of QPSK modulation scheme using constellation diagram. **[7M]**

   (b) Determine the amount of probability of error in matched filter Receiver. **[7M]**

4. (a) How does the phase of the carrier vary for message m(n)={1,0,1,1,0,1…} in BPSK and DPSK. Draw the block diagram of QPSK receiver. **[7M]**

   (b) A binary data has to be transmitted over a telephone link that has a usable bandwidth of 3000Hz and a maximum achievable signal to noise power of 6dB at its output. **[7M]**

   (i) Determine the maximum signaling rate and probability of error if a coherent ASK is used for transmitting binary data through this channel

   (ii) if the data rate is maintained at 300 bits/sec. Find the error probability.

UNIT – III

5. (a) Write down the Unipolar, Polar and Bipolar Line Coding Schemes. **[7M]**

   (b) Explain Eye Diagram with neat diagram and how to draw eye diagram for ASK. **[7M]**

6. (a) What is pulse shaping? Why it is useful in baseband transmission? Explain in detail. **[7M]**

   (b) A line coding scheme uses Unipolar NRZ encoding with rectangular pulses. Sketch the signal corresponding to the bit sequence “101100”. Compute its Power spectral density. **[7M]**

UNIT – IV

7. (a) Define Mutual Information and Prove the relation I(X:Y) = H(X) + H(Y)-H(X,Y) . **[7M]**

   (b) A Guassian channel has 5MHz bandwidth. Calculate the channel capacity if the signal power to noise spectral density ratio is 10^6 Hz. Discuss the trade off between bandwidth and S/N ratio. **[7M]**

8. (a) Describe spread spectrum modulation techniques in detail. **[7M]**

   (b) A source emits letters from an alphabet A={a1,a2,a3,a4,a5,a6} with probabilities P(a1)==0.1, P(a2)=0.4, P(a3)=0.06, P(a4)=0.1, P(a5)=0.04 and P(a6)=0.3 **[7M]**

   (i) Find a Huffman code for this source.

   (ii) Find the average length of the code.

UNIT – V

9. (a) What is a convolutional code? How it is different from a block code? **[7M]**

   (b) Show that if ci and cj are two code vectors in an (n,k) linear block code, then their sum is also a code vector. **[7M]**

10. (a) Explain how generator and parity matrices are obtained for cyclic codes with an example. **[7M]**

    (b) Decode the Received code word [10 11 10] using viterbi algorithm and find the correct transmitted code word using the given convolutional encoder. **[7M]**

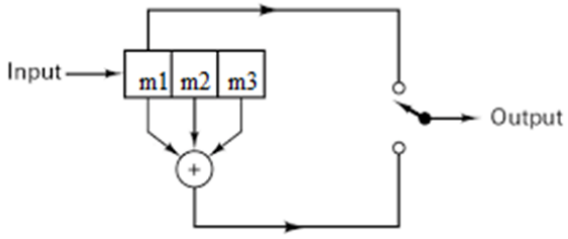

Figure 1