Code No: R31046 **R10** **Set No: 1**

III B.Tech. I Semester Supplementary Examinations, May 2013

DIGITAL COMMUNICATIONS

(Electronics and Communication Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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1. (a) Explain the DPCM transmitter and receiver with the help of block diagram.
   (b)A PCM system uses a uniform quantizer followed by a 7-bit binary encoder. The bit rate of the system is equal to $50x10^6$ bits/sec.
   (i) What is the maximum message signal bandwidth for which the system operates satisfactorily?
   (ii) Calculate the output signal to quantization noise ratio when a full load sinusoidal modulating wave of frequency 1 MHz is applied to the input.

2. (a) Discuss the noise effects in Delta modulation.
   (b) Explain the operation of the Adaptive Delta modulation with the help of a block diagram.

3. (a) Explain the operation of the QPSK and draw the phasor diagram for it.
   (b) What is M-ary signaling technique? Explain the M-ary PSK transmitter.

4. (a) Find the probability of error for BPSK.
   (b) Obtain the transfer function of a optimum filter.

5. (a) Explain the terms: entropy and mutual information.
   (b) Consider the four messages of x_1,x_2,x_3,x_4 with the probabilities of 0.4, 0.3, 0.2,0.1 then find (i) entropy H(X) (ii) find the amount of information contained in the messages $x_1\ x_2\ x_1\ x_3$ and $x_4\ x_3\ x_3\ x_2$ and compare with H(X) obtained in part (i)

6. (a) Apply the Shannon fano coding for the message signals with the probabilities of 0.16,0.15, 0.4,0.19,0.1 and find the coding efficiency.
   (b) Explain the tradeoff between bandwidth and signal to noise ratio.

7. (a) Explain about the BCH codes in detail.
   (b) For the (7,4) hamming code , the parity check matrix H given by

$$H = \begin{bmatrix} 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$$

   (i)Construct the generator matrix.
   (ii) The code word that begins with 1010.
   (iii) If the received code word Y is 0111100, then the decode this received codeword.

8. Write a short notes on
   (a) Code tree for convolution encoder.
   (b) Exhaustive search method of convolution decoding.

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Code No: R31046 **R10** **Set No: 2**

III B.Tech. I Semester Supplementary Examinations, May 2013

DIGITAL COMMUNICATIONS

(Electronics and Communication Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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1. (a)what is quantization? Explain the types of the quantization.
   (b) Give the advantages and disadvantages of the PCM.

2. (a) Explain the operation of the delta modulation transmitter and receiver with the help of neat sketches.
   (b)A delta modulator system is designed to operate at five times the nyquist rate for a signal having a bandwidth is equal to 3 KHz. Calculate the maximum amplitude of 2KHz signal for which the delta modulator does not have a slope over load distortion. Given that the quantizing step size is 250mV. Also, derive the formula that you use.

3. (a) Explain the operation of the DPSK with the help of transmitter and receiver.
   (b) What is DEPSK? Compare it with DPSK.

4. (a) A band pass data transmission scheme uses a PSK signaling scheme with
   $S_2(t)= A \cos(\omega_c t)$, $0 \le t \le T_b$, $\omega_c = 10\pi / T_b$
   $S_1(t)= -A \cos(\omega_c t)$, $0 \le t \le T_b$, T_b=0.2 msec.
   the carrier amplitude at the receiver input if 1m volt and the psd of the additive white Gaussian noise at the input is 10 -11 watt/ Hz. Assume that an ideal correlation receiver is used. Calculate the average bit error rate of the receiver.
   (b) Find the probability of error for QPSK.

5. (a) Prove any two properties of the mutual information.
   (b)The probabilities of the five possible outcomes of an experiment are given as $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}$. Determine the entropy and information rate if there are 16 outcomes per second.

6. (a) Apply the Huffman coding for the messages with the probabilities of 0.05, 0.15, 0.2, 0.05, 0.15, 0.3, 0.1. Calculate the coding efficiency.
   (b) Explain about Shannon- Hartley Law? And find the channel capacity of a AWGN channel with 4 KHz bandwidth and noise power spectral Density $\eta/2 = 10^{-12}$ W/Hz. The signal power required at the receiver is 0.1 mW.

7. (a) What are Huffman codes? Explain the properties of the Huffman codes.
   (b) Given a (6,3)linear block code with the parity check matrix H given by

$$H = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$$

   (i)Construct the generator matrix. (ii) the code word that begins with 101

8. Write a short notes on
   (a) Time domain approach of encoding of convolution codes.
   (b) Trellis diagram for convolution decoder.

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Code No: R31046 **R10** **Set No: 3**

III B.Tech. I Semester Supplementary Examinations, May 2013
DIGITAL COMMUNICATIONS
(Electronics and Communication Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) What is companding in PCM system? Explain the methods of companding.
   (b) A television signal having a bandwidth of 4.2 MHz is transmitted using binary PCM system. Given that the number of quantization levels is 512. Determine (i) code work length (ii) transmission bandwidth (iii) Final bit rate (iv) output signal to quantization ratio

2. (a) What are the drawbacks of Delta modulation? Explain how these errors are eliminates in ADM.
   (b) Explain about the noises in PCM system.

3. (a) Explain the operation of non coherent detection of FSK.
   (b) What are the advantages and disadvantages of DPSK?

4. (a) What is a matched filter? Write the properties of the matched filter.
   (b) Derive the probability of error for BPSK.

5. (a) What is mutual information. And prove that for a loss less channel H(x|y)=0 and also prove that I(X;Y)= I(Y;X).
   (b) Given a telegraph source having two symbols, dot and dash. The dot duration is 0.2 s. the dash duration is 3 times the dot duration. The probability of the dot's occurring is twice that of the dash. And the time between symbols is 0.2 s. calculate the information rate of the telegraph source.

6. (a) Calculate the channel capacity for AWGN channel with bandwidth of 1 MHz and signal to noise ratio of -40 db.
   (b) Show that the channel capacity of an ideal AWGN channel with infinite bandwidth is given by $C_\infty = 1.44 \frac{S}{\eta}$ b/s.
   Where s is the average signal power and η/2 is the power spectral density of the Gaussian noise.

7. (a) design a syndrome calculator for (7,4) cyclic hamming code generated by polynomial $G(p)= p^3+p+1$. Evaluate the syndrome for Y=(1001101)
   (b) Write a short note on cyclic codes.

8. Write a short notes on
   (a) Convolution codes.
   (b) Trellis diagram decoding of convolutional codes.

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Code No: R31046 **R10** **Set No: 4**

III B.Tech. I Semester Supplementary Examinations, May 2013
DIGITAL COMMUNICATIONS
(Electronics and Communication Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Explain the elements of a PCM system with the help of the block diagram.
(b) A PCM system uses a uniform quantizer followed by a 'ν' bit encoder. Show that rms signal to quantization ratio is approximately 1.8+6 ν db.

2. (a) Compare the PCM with delta modulation.
(b) Explain the operation of the Adaptive Delta Modulation with the help of neat sketches.

3. (a) Explain the non coherent ASK with a block diagram.
(b) A binary data stream 0010010011 needs to be transmitted using DPSK Technique. Prove that the reconstruction of the DPSK signal is independent on the choice of the Extra bit.

4. (a) Derive the probability of error for coherent ASK.
(b) Binary data has to be transmitted over a telephone link that has a usable bandwidth of 3000Hz and maximum achievable signal to noise power ratio of 6 db at its output. (i) determine the maximum signaling rate and P_e if a coherent ASK scheme is used for transmission binary data through this channel.(ii) if the data rate is maintained at 300 bits/sec, calculate the error probability.

5. (a) verify the following expression $I(x_i,x_j)=I(x_i)+I(x_j)$, if x_i, x_j are independent.
(b) A discrete source emits one of the five symbols once every millisecond with the probabilities of ½, 1/4,1/8, 1/16 and 1/16 respectively. Determine the source entropy and information rate.

6. (a) Explain about Shannon- Hartley Law? And find the channel capacity of a AWGN channel with 4 KHz bandwidth and noise power spectral Density $\eta/2= 10^{-12}$ W/Hz. The signal power required at the receiver is 0.1 mW.
(b) Apply the shanon Fano coding for the messages with the probabilities of 0.05, 0.15, 0.2, 0.5, 0.1. Calculate the coding efficiency.

7. (a) Write a short note on "linear block codes".
(b) Explain about vertical redundancy check and parity coding techniques.

8. Write a short notes on
(a) Code tree for convolution code
(b) Trellis diagram

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