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

III B.Tech. I Semester Regular Examinations, November/December - 2012
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) With a neat sketch explain the basic elements of a digital communication system.
   (b) List the advantages and disadvantages of PCM.

2. (a) Discuss in brief about Delta modulator and its characteristics.
   (b) Compare the overall output S/N ratio for 8-bit PCM and DM systems used for transmitting a baseband signal whose spectrum is confined from 300 to 3000 Hz. Assume that both systems operate at a bit rate of 64 Kbits/sec and use a PSK signaling scheme with $(S_{av}/\eta f_x) = 20$ dB.

3. With a neat sketch explain the QPSK transmitter and receiver

4. (a) Calculate the error probability for QPSK.
   (b) Discuss in brief about matched filter.

5. (a) Explain Entropy and its properties.
   (b) Messages Q_1,……Q_M have probabilities p_1,…….p_M of occurring. Write an expression for H
   If M=3, write H in terms of p_1 and p_2, by using the result that $p_1+p_2+p_3=1$.
   Find p_1 and p_2, for $H=H_{max}$ by setting $\delta H/\delta p_1=0$ and $\delta H/\delta p_2=0$

6. (a) Explain the capacity of a Gaussian channel.
   (b) Calculate the capacity of the discrete channel shown in Fig.1. Assume r_s =1 symbol/sec

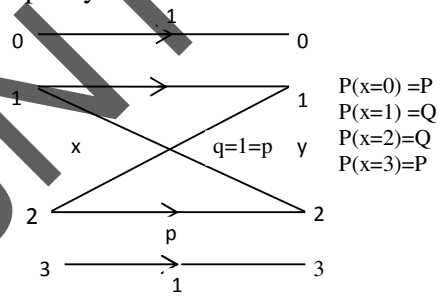

Fig -1

7. (a) Explain matrix description of linear block codes
   (b) The parity check bits of a (8,4) block code are generated by
   $c_5= d_1+d_2+d_4$
   $c_6=d_1+d_2+d_3$
   $c_7=d_1+d_3+d_4$
   $c_8=d_2+d_3+d_4$
   where d_1, d_2, d_3 and d_4 are the message digits.
   (i) Find the generator matrix and parity check matrix for this code
   (ii)Find the minimum weight of this code
   (iii)Find the error detecting capabilities of this code.

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8. (a) Explain the transform domain approach to analysis of a convolutional encoder with an example.
   (b) Discuss the performance of convolutional codes

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

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1. (a) List the advantages of digital communication system
(b) Discuss in brief about quantization in PCM.

2. (a) Draw and explain the functional block diagram of a Delta modulation system.
(b) A DM system is designed to operate at three times the nyquist rate for a signal with 3 KHz bandwidth. The quantizing step size is 250 mV
(i) Determine the maximum amplitude of a 1 KHz input sinusoid for which the delta modulator does not show slope overload
(ii) Determine the post filtered output SNR for the signal of part (i)

3. (a) Explain the means of generating a DPSK signal.
(b) Briefly explain about M-ary FSK.

4. (a) Draw and explain the coherent system of signal reception.
(b) Calculate the error probability for BFSK and BPSK.

5. (a) Explain the mutual information and its properties.
(b) A code is composed of dots and dashes. Assume that the dash is three times as long as the dot and has one-third the probability of occurrence.
(i) Calculate the information in a dot and that in a dash
(ii) Calculate the average information in the dot-dash code.
(iii) Assume that a dot lasts for 10 ms and that this same time interval is allowed between symbols. Calculate the average rate of information transmission.

6. (a) State and explain Shannon's theorem.
(b) Plot channel capacity C versus B, with S/η=constant for the gaussian channel.
(c) If the channel bandwidth B=5 KHz and a message is being transmitted with $R=10^6$ bits/sec, find S/η for R≤C.

7. (a) Consider a (7,4) linear code whose generator matrix is

$$G = \left[\begin{array}{cccc:ccc} 1 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 \end{array}\right]$$

(i) Fin all the code vectors of this code
(ii) Find the parity check matrix for this code
(iii) Find the minimum weight of this code
(b) Explain the algebraic structure of cyclic codes

8. (a) Explain the time domain approach to analysis of a convolutional encoder with an example.
(b) What are the advantages and disadvantages of convolutional codes?

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

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

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1. (a) Explain the companding in PCM
   (b) A television (TV) signal with a bandwidth of 4.2 MHz is transmitted using binary PCM. The number of representation levels is 512. Calculate the following parameters.
   (i) The code word length
   (ii) The final bit rate
   (ii) The transmission bandwidth, assume that k=2.

2. (a) List the advantages and disadvantages of delta modulation.
   (b) Explain about the noise in delta modulation system.

3. (a) Write a brief note on DEPSK.
   (b) Describe binary ASK, PSK and FSK schemes.

4. (a) Discuss the probability of error of the matched filter.
   (b) Explain the non-coherent detection of FSK.

5. (a) Explain the concept of amount of information.
   (b) An analog signal is bandlimited to B Hz, sampled at the nyquist rate, and the samples are quantized into 4 levels. The quantization levels Q_1, Q_2, Q_3 and Q_4 (messages) are assumed independent and occur with probabilities $p_1= p_4=1/8$ and $p_2= p_3=3/8$. Find the information rate of the source.

6. (a) Consider five messages given by the probabilities 1/2,1/4, 1/8, 1/16, 1/16.
   (i) Calculate H
   (ii) Use Shannon-Fano algorithm to develop an efficient code and for that code, calculate the average number of bits/message. Compare with H
   (b) Explain about Bandwidth-S/N trade off.

7. (a) Briefly explain error detection and error correction capabilities of linear block codes.
   (b) The generator polynomial for a (15,7) cyclic code is.
   $g(x) = 1+x^4+x^6+x^7+x^8$
   (i) Find the code vector (in systematic form) for the message polynomial
   $D(x) = x^2+x^3+x^4$
   Assume that the first and last bits of the code vector V(x) for $D(x) = x^2+x^3+x^4$ suffer Transmission errors. Find the syndrome of V(x)

8. (a) Explain the viterbi algorithm for the decoding of convolutional codes.
   (b) Write a brief note on encoder for convolutional codes.

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

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

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1. (a) With a neat sketch explain the representation of the basic principle of differential PCM.
   (b) State the sampling theorem for band-limited signals of finite energy.
   (c) Write a brief note on Aliasing effect.

2. (a) Compare the performance of PCM and DM systems in terms of overall signal quality and equipment complexity.
   (b) Briefly explain about Adaptive delta modulation.

3. (a) Explain the generation and reception of BPSK signal.
   (b) The bit stream d(t) is to be transmitted using DPSK. If d(t) is 001010011010, determine b(t). Show that b(t) b(t-T_b) yields the original data.

4. (a) Calculate the transfer function of the Optimum filter.
   (b) Draw and explain the receiver for a binary coded signal.

5. (a) Discuss in brief about Discrete messages.
   (b) One of five possible messages Q_1 to Q_5 having probabilities 1/2, 1/4, 1/8, 1/16, 1/16, respectively, is transmitted. Calculate the average information.

6. (a) A Gaussian channel has a 1-MHz bandwidth. If the signal-power-to-noise power spectral density $S/\eta=10^5$ Hz, calculate the channel capacity C and the maximum information transfer rate R
   (b) Explain about Huffman coding.

7. (a) Briefly explain about BCH codes.
   (b) Design an encoder for the (7,4) binary cyclic code generated by $g(x) = 1+x+x^3$ and verify its operation using the message vector (0 1 0 1).

8. Draw the state diagram, tree diagram, and trellis diagram for k=3, rate 1/3 code generated by $g_1(x) = 1+x^2$, $g_2(x) = 1+x$ and $g_3(x) = 1+x+x^2$

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