Code No: 07A50405 **R07** **Set No. 2**

III B.Tech I Semester Examinations,May 2011
DIGITAL COMMUNICATIONS
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Write in detail about
   i. FSK
   ii. PSK with waveforms and equations
   (b) Assume that 3600 bits/sec data is sent over a band pass channel by FSK signalling scheme. Find the transmission Band width B_T such that the spectral envelope is down atleast 41 dB outside this band? [8+8]

2. A DMS has an alphabet of eight letters, xi ,i=1,2,3,,8, with probabilities 0.25, 0.2, 0.15, 0.12, 0.1, 0.08, 0.05, 0.05.
   (a) determine the average number of binary digits per source letter
   (b) determine the entropy of the source [16]

3. (a) 8 channels, each Band limited to 5 KHz, are to be time division multiplexed. Each sample is coded into 6-bit word. Find The output rate in bits/sec and required BW?
   (b) Explain the advantages and disadvantages of digital communciations over analog communications. [8+8]

4. A voice grade channel of the telephone network has a bandwidth of 3.4 kHz
   (a) Calculate the channel capacity of the telephone channel for a signal to noise ratio of 30dB.
   (b) Calculate the minimum signal to noise ratio required to support information transmission through the telephone channel at the rate of 4800bps [8+8]

5. (a) Explain the advantages of ADM over DM.
   (b) Compare DM with PCM technique. [8+8]

6. The polynomial $x^{15}+1$ when factored gives
   $x^{15}+1=(x^4+x^3+1)(x^4+x3+x^2+x+1)(x^4+x+1)(x^2+x+1)(x+1)$
   (a) Construct a systematic (15,2) code using the generator polynomial g(x)=(x4+x3+x2+x+1)(x4+x+1) (x4+x3+1)(x+1)
   (b) List all the code words. [8+8]

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7. A convolutional encoder has two shift registers two modulo-2 adders and an output multiplexer. The generator sequences of the encoder are as follows: $g^{(1)}$=(1,0,1); $g^{(2)}$=(1,1, 1). Assuming a 5bit message sequence is transmitted. Using the state diagram find the message sequence when the received sequence is (11,01,00,10,01,10,11,00,00,.....) [16]

8. A satisfically independent sequence of equiprobable binary digits is transmitted over a channel having finite Band width using rectangular signalling waveform is taken. The bit rate is 'r_b' and the channel noise has a PSD Gn(f) given by

   Gn(f) = $\mathrm{Go}\left[1+(f/f_1)^2\right]^{-1}$. Find the transfer function of the optimum receiver and calculate the P_e . [16]

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1. (a) Explain the need for non-uniform quantization in digital communications.
   (b) Explain μ-law and A-law. [8+8]
2. (a) A signal m(t) is to be encoded by using DM technique. The signal to quantization noise ratio is found as 40 dB. Find the BW required. [16]
   (b) Calculate the BW using PCM in case of DM.
   (c) Find the conclusion for the both. [7+7+2]
3. A convolutional encoer has 3 shift registers with two stages, two modulo-2 adders and an output multiplexer. The generator sequences of the encoder are as follows. $g^{(1)}$=(1, 1,1, 1) ; $g^{(2)}$=(1, 1, 0,1). Draw the block diagram of the encoder. Find the encoder output produced by the message sequence 1011101 using time domain approach based on convolution? [16]
4. In a single-parity-check code, a single parity bit is appended to a block of k message bits (m_1,m_2,m_3,,m_k). The single parity bit, b1 is chosen so that the code word satisfies the even parity rule: m_1 +m_2 ++mq + b1=0 mod-2. For k=3,set up the 2^k possible code words in the code defined by this rules. [16]
5. Explain coorelation receiver with a neat block diagram. Explain the function of each Block. Also explain why the coorelator receiver is called as integrated and dump filter? [16]
6. Explain PSK &DPSK. Compare both. [16]
7. Explain the Huffman coding algorithm using an example. [16]
8. Consider a telegraph source having two symbols, dot and dash. The dot duration is 0.2s.The dash duration is 3 times the dot duration. the probability of the dots occurring is twice that of the dash, and the time between symbols is 0.2s.Calculate the information rate of the telegraph source. [16]

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Code No: 07A50405 **R07** **Set No. 1**

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1. m(t) is a signal which is transmitted by binary PCM with out compression. The SNR required to be atleast 64 dB. Determine:
   (a) L_{min} taking m(t) to be sinusoidal
   (b) SNR for the 'L' obtained. Also derive the formula used. [16]
2. A memory less source has the alphabet {-5,-3,-1,0,1,3,5} with corresponding probabilities {0.05,0.1,0.1,0.15,0.05,0.25,0.3}.
   (a) Find the entropy of the source
   (b) design a Shannon Fano code that encodes a single level at a time and determine the average bit rate. [8+8]
3. What is the ideal solution for obtainings zero ISI and what is the disadvantage of this solution? [16]
4. Consider the (8,4) linear block code with G= $\begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \end{bmatrix}$
   (a) Construct all the possible code words
   (b) Construct all the single error patterns. [8+8]
5. A signal m(t) Band limited to 4 kHz is sampled at twice the Nyquist rate & its samples transmitting by PCM. An output SNR of 47 dB is required:
   (a) Find N and minimum value of Si/Ni of operation is to be above Threshold
   (b) Calculate minimum system Band width required and find signalling rate needed to achieve the given output SNR. [4+4+4+4]
6. A source emits one of four possible symbols during each signaling interval. The symbols occur with the probabilities. p1=0.4,p2= 0.3,p3= 0.2,p4=0.1.Find the information gained by observing the source emitting each of these symbols. [16]
7. Show the space representations of:
   (a) MSK
   (b) QPSK

(c) BPSK.

Also show their waveform. [16]

8. A convolutional encoder has 3 shift registers, two modulo-2 adders and an output multiplexer. The generator sequences of the encoder are as follows. $g^{(1)}$=(1, 0,0, 1); $g^{(2)}$=(1, 1, 1,1). Draw the block diagram of the encoder. Find the encoder output produced by the message sequence 1011101 using time domain approach based on convolution. [16]

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1. (a) Prove maximum output SNR of a matched filter is $(SNR)_0 = \frac{2E}{N_0}$.
   (b) Explain the need of matched filter. [10+6]
2. Define the following
   (a) information
   (b) entropy [8+8]
3. A system is having a bandwidth of 3KHZat a SNR of 29db.Find
   (a) the information carrying capacity
   (b) capacity of the channel if its bandwidth is doubled while the transmitted signal power remains constant? [8+8]
4. Assume that 4800 bits/sec random data are sent over band pass channal by using the following schemes:
   (a) BFSK
   (b) FSK

   Find the Transmission BW such that the spectral envelope is down atleast outside this band? Compare the result. [16]
5. A convolutional encoder has 3 shift registers with two stages, two modulo-2 adders and an output multiplexer. The generator sequences of the encoder are as follows. $g^{(1)}$=(1, 1,1, 1) ; $g^{(2)}$=(1, 1, 0,1),Draw the block diagram of the encoder. draw the code tree for this encoder. [16]
6. The probability density function of sampled values of an analog signal is shown in figure 1. Design:
   (a) A N-level uniform quantizer [N $\geq$ 4]
   (b) A N-level minimum squared error non-uniform quantizer[N $\geq$ 4]? [16]
7. For a DM system, signal sampled at 76 KHz and $A_{max} = 4$
   (a) Assuming that the signal is sinusoidal determine output signal power & SNR.
   (b) Determine the minimum transmission Band width? Derive the relations. [16]

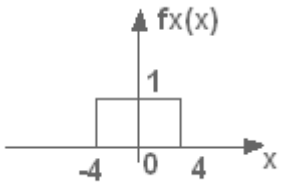

Figure 1:

8. Show that the syndrome S is the sum of those rows of matrix H^T corresponding to the error locations in the error pattern. [16]

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