SHRI SANT GADGE BABA COLLEGE OF ENGINEERING & TECHNOLOGY, BHUSAWAL

Department of Electronics & Communication Engineering

Subject: Information Theory & Coding Techniques (ITCT)

TE (E&C)-SEM-II

UNIVERSITY PAPER QUESTIONS BANK

UNIT-I

* April/May-2008 *

1. Apply Shannon-Fano Coding for following messages ensemble using 3 letters/characters {i.e. m = 3, -1, 0, 1}. Find out Coding Efficiency η, Entropy Al (x), Average length $\overline{L}$.

[p] = [0.3 0.12 0.12 0.12 0.12 0.8 0.07 0.07]

[x] = [x_1 x_2 x_3 x_4 x_5 x_6 x_7 x_8] **10**

2. Find capacity and mutual information of channel where channel matrix is given by

$$P(Y/X) = \begin{bmatrix} 0.8 & 0.2 \\ 0.3 & 0.7 \end{bmatrix}$$

Take p (x_1) = 0.6, p (x_2) = 0.4. Calculate Efficiency of channel? **10**

3. Enumerate interpretations of different entropies of two port communication system.

Prove that H (X, Y) = H (X / Y) + H (Y) **10**

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4. State and prove,

i) Kraft Inequality condition $\Sigma\, 2^{-Nk} \leq 1$

ii) Source coding theorem $H(x) \leq R \leq \overline{H}(x) + 1$ **10**

5. An analog signal having 4 KHz BW is sampled at 1.25 times the nyuist rate & each sample is quantized in to one of 256 equally likely levels. Assume that successive samples are statistically independent.

i) What is the information rate of this source.

ii) Can the O/P of this source be transmitted W/O error over an AWGN channel with & BW of 10 KHz & SNR of 10 dB.

iii) Find SNR required for AWGN channel for error free transmission for part ii).

iv) Find BW required for AWGN channel for error free transmission of the O/P of this source if SNR is 20 dB. **10**

6. Derive the expression for Information capacity of colored noise channel. **10**

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7. Apply Shannon-Fano Coding for following messages ensemble & find coding efficiency.

[X] = [X_1 X_2 X_3 X_4 X_5 X_6 X_7 X_8]

[p] = [1/4 1/8 1/16 1/16 1/16 1/4 1/16 1/8] **10**

8. ADMS has five sysmbols S_0 …… S_4 having probability distribution as 0.4, 0.2, 0.1 & 0.1. Evaluate two distinct variable length Huffman codes for the source to illustrate non-uniqueness of Huffman techniques. Calculate the variance σ^2 for ensemble. Comment on the result. **10**

9. Define mutual information, self information & conditional self information. Prove that mutual information is given by H (X : Y) = H (X) + H (Y) - H (X , Y) **10**

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10. An analog signal having bandwidth of 4 KHz is sampled at 1.25 times the Nyquist rate with each sample quantized into one of 256 equally likely levels.

i) What is information rate of this source?

ii) Can the output of this source be transmitted without error over an AWGN channel with bandwidth of 10 KHz and SNR of 20db.

iii) Find SNR required of error free transmission for above part.

iv) Find the bandwidth required for an AWGN channel for error free transmission this source if SNR happens to be 20 db. **10**

11. Applying Huffman coding procedure for the following messages with probabilities as shown.

P(x) = [0.4, 0.2, 0.12, 0.08, 0.08, 0.08, 0.04]. Find code efficiency and entropy of source. **10**

12. A channel with two inputs x_1 and x_2 three output y_1, y_2, & y_3 with noise matrix as shown bellow

$$P[y/x] = \begin{bmatrix} ¾ & ¼ & 0 \\ 0 & ½ & ½ \end{bmatrix}$$

Calculate I(X: Y) with $P(X_1) = P(X_2) = 0.5$. **10**

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13. Construct Shanon Fano code for the source having following outcomes with respective probability of occurrence. [X]=[X_1 X_2 X_3 X_4 X_5 X_6 X_7 X_8]

$$P[X] = \left[\frac{1}{2}, \frac{1}{8}, \frac{1}{8}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{32}, \frac{1}{32}\right]$$

Determine code efficiency, entropy and code redundancy of the source. **10**

14. Consider that two sources X and Y emit messages x_1, x_2, x_3 and y_1, y_2, y_3 with joint probability P(X;Y) as shown

$$P(XY) = \begin{pmatrix} \frac{3}{40} & \frac{1}{40} & \frac{1}{40} \\ \frac{1}{20} & \frac{3}{20} & \frac{1}{20} \\ \frac{1}{8} & \frac{1}{8} & \frac{1}{8} \end{pmatrix}$$

Calculate H[X], H[Y], H[X/Y], H[Y/X] and I[X ; Y]. **10**

15. Explain source coding theorem. How data compaction is used for source coding. **10**

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16. Derive the expression for information capacity of colored noise channel. **10**

17. State and prove source coding theorem,

$$H(X) \leq \bar{R} < H(X) + 1$$ **10**

18. Consider a DMS with source probabilities,

{0.20, 0.20, 0.15, 0.15, 0.10, 0.10, 0.05, 0.05}

i) Determine an efficient length code for the source.

ii) Determine Shannon fano code for this source.

iii) Determine efficiency for this source. **10**

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19. Apply Shannon-Fano Coding for following messages:

[x] = [x_1 x_2 x_3 x_4 x_5 x_6 x_7]

[p] = [0.45 0.15 0.1 0.1 0.08 0.08 0.04]

Calculate:

i) Average information in bits/message

ii) Codeword length in bits/message

iii) Coding efficiency in % **10**

20. The joint probability matrix representing transmitter & receiver is given as below. Find out all the entropies & the mutual information of the communication system. **10**

$$P(X, Y) = \begin{array}{c} \\ X1 \\ X2 \\ X3 \\ X4 \end{array} \begin{array}{c} \begin{array}{ccc} Y1 & Y2 & Y3 \end{array} \\ \begin{bmatrix} 0.3 & 0.05 & 0 \\ 0 & 0.25 & 0 \\ 0 & 0.15 & 0.05 \\ 0 & 0.05 & 0.15 \end{bmatrix} \end{array}$$

21. Write short notes on:

i) Kraft Inequality

ii) Source coding process. **10**

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22. Find all entropies & mutual information of channel where channel matrix is given by

$$P(Y/X) = \begin{bmatrix} 0.8 & 0.2 \\ 0.3 & 0.7 \end{bmatrix}$$

Take p (x_1) = 0.6, p (x_2) = 0.4. Calculate the Efficiency of channel? **10**

23. Apply Huffman Coding procedure for the following message coins their probabilities are

P [X] = {0.4, 0.2, 0.12, 0.08, 0.08, 0.08, 0.04} Find out

i) Entropy of the source

ii) Length

iii) Code efficiency **10**

24. 21. Write short notes on:

i) Kraft Inequality

ii) Source coding process. **10**

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25. For the given channel matrix, find out the mutual information. Given that P (x_1) = 0.6, P (x_2) = 0.3, P (x_3) = 0.1. Hence draw the channel structure. **10**

$$\begin{bmatrix} 1/2 & 1/2 & 0 \\ 1/2 & 0 & 1/2 \\ 0 & 1/2 & 1/2 \end{bmatrix}$$

26. Derive the equation for channel capacity for additive white Gaussian noise channel in terms of bandwidth & S/N ratio. **10**

27. Apply Shannon-Fano encoding procedure to the following messages ensemble.
P[x] = [0.49, 0.14, 0.14, 0.07, 0.07, 0.04, 0.02, 0.02, 0.01] Hence find code efficiency. **10**

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28. A discrete source transmits messages x_1, x_2, x_3 with probabilities p (x_1) = 0.3, p (x_2) = 0.25, p (x_3) = 0.45 to the destination capable of having output u_1, u_2, u_3. The source & destination are connected through a channel whose conditional probability matrix is

$$\begin{bmatrix} 0.9 & 0.1 & 0 \\ 0 & 0.8 & 0.2 \\ 0 & 0.3 & 0.7 \end{bmatrix}$$

Calculate all the entropies & mutual information with this channel & hence draw the channel model for the same. **10**

29. Apply Shannon-Fano algorithm for following messages ensemble & find coding efficiency having probabilities
P [x_i] = [0.49, 0.14, 0.14, 0.07, 0.07, 0.04, 0.02, 0.02, 0.01] **10**

30. An analog signal having 4 KHz BW is sampled at 1.25 times the Nyquist rate with each sample is quantized in to one of 256 equally likely levels. Assume that successive samples are statistically independent.
i) What is the information rate of this source.
ii) Can the O/P of this source be transmitted W/O error over an AWGN channel with & BW of

10 KHz & SNR of 10 dB.

iii) Find SNR required for AWGN channel for error free transmission for part ii).

iv) Find BW required for AWGN channel for error free transmission of the O/P of this source if SNR is 20 dB. **10**

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31. For a binary source having 8 possible outcomes having probabilities.

P[X] = {0.20, 0.18, 0.22, 0.15, 0.08, 0.02, 0.05, 0.10} apply Huffman coding procedure & find code efficiency & entropy of source. **10**

32. A transmitter having 4 possible outcomes & a receiver having 3 possible outcomes are connected by channel having joint probability matrix given by

$$\begin{bmatrix} 0.3 & 0.05 & 0 \\ 0 & 0.25 & 0 \\ 0 & 0.15 & 0.05 \\ 0 & 0.05 & 0.15 \end{bmatrix}$$

Calculate all the entropies & the mutual information across the channel. Also draw the channel Model. **10**

33. A 2 KHz channel has signal to noise ratio of 24 dB.

i) Calculate maximum capacity of this channel.

ii) Assuming constant transmitting power, calculate maximum capacity when channel bandwidth is halved & reduced to quarter of its original value. **10**

UNIT-II

* April/May-2008 *

1. For a systematic linear block code, the three parity check digits C_4, C_5, C_6 are given by

$C_4 = d_1 \oplus d_2 \oplus d_3$, $C_5 = d_1 \oplus d_2$, $C_6 = d_1 \oplus d_3$

i) Construct generator matrix.

ii) Construct code generated by this matrix.

iii) Determine detecting & correcting capabilities.

iv) Prepare a suitable decoding table.

v) Decode the received word '101100' and '000110'. **10**

2. Why are cyclic codes effective in detecting error bursts? The message 1001001010 is to be transmitted in a cyclic code with a generator polynomial g (x) $x^2 + 1$

i) How many check bits does the encode message contain?

ii) Obtain the transmitted code word.

iii) Draw encoding arrangement to obtain remainder bits.

iv) After received word is clocked into the decoder input, what should be the content of register stores? **10**

3. i) Explain the features of Golay code? **02**

ii) Explain method of generating systematic and non systematic code. **08**

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4. a) Consider the following generator matrix over GF (2)

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

i) Generate all possible code words.

ii) Find parity check matrix H.

iii) Find generator matrix of an equivalent systematic code.

iv) What is minimum distance of this code.

v) How many errors can this code detect & correct. **10**

5. Write a short note on.

i) CRC Codes.

ii) Golay codes. **10**

6. For a systematic cyclic code the generator polynomial is given as $g(X) = 1 + X + X^3$.

i) Find generator matrix for this cyclic code.

ii) Determine parity check matrix H.

iii) If received code word is 0110001, determine correct data word. **10**

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7. For (6, 3) systematic linear block codes the three parity digits are given by $C_4 = M_1 \oplus M_2$, $C_5 = M_1 \oplus M_2 \oplus M_3$, $C_6 = M_1 \oplus M_3$

i) Determine the generator matrix for the code.

ii) Convert the error detection & error correction capabilities of the code.

iii) If received sequence is 101101, determine the message word. **10**

8. For a systematic cyclic code the generator polynomial is given by $g(X) = 1 + X + X^3$.

i) Prepare generator matrix for the cyclic code in the form $G = [\, P_{k\times n-k}, I_{k\times k} \,]$

ii) Determine the parity check matrix 'H'.

iii) If the received code word is 0110001, determine the correct data word.

iv) Sketch the hardware configuration for cyclic code generator. **10**

9. What is generator polynomial? Why it should be factor of $X^n + 1$? Explain encoder & decoder of cyclic code. **10**

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10. Parity check matrix for (7, 3) codes is given below

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

Construct syndrome table for single bit error patterns.

Using syndrome, find error pattern and code words for each of the following received vectors
Y1 = 0011101, Y2 = 1101110, Y3 = 0111011
If information vector is (011), determine is corresponding code words. **10**

11. Explain in brief,
i) Meggit Decoder for cyclic codes.
ii) BCH Codes **10**

12. What is ARQ? With a neat sketch explain various types of ARQ. **10**

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13. The generator matrix for a (6,3) code is given below. Find parity check matrix, construct all code vectors. What is minimum distance of this code? How many errors this code can detect and correct? **10**

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

14. With appropriate sketches explain various ARQ techniques. Give advantages and disadvantages to elaborate the answer. **10**

15. i) What is meant by burst? How burst error corrections take place? Explain with suitable example.
ii) Explain syndrome decoding technique for error correction and detection. **10**

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16. Explain Cyclic Redundancy check codes in detail. Generate the CRC code for the data word of 110010101. The divisor is 10101. **10**

17. A message 101101 is to be transmitted in cyclic code with a generator polynomial $G(D) = D^4 + D^3 + 1$. Obtain transmitted codeword. How many check bits(parity bits) required to encode the message? Draw the encoder circuit for the transmitted code. **10**

18. For a (6, 3) code the generator matrix is given by

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

i) Realize an encoder circuit for this code.

ii) Verify that code is a single error correcting code.

iii) If received codeword is 100011, find the syndrome. **10**

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19. For a systematic Linear Block code. The three parity digits C_4, C_5, C_6 are given by the equations

$C_4 = d_1 \oplus d_2 \oplus d_3$,

$C_5 = d_1 \oplus d_2$,

$C_6 = d_1 \oplus d_3$

i) Construct generator matrix.

ii) Construct code generated by this matrix.

iii) Determine detecting & correcting capabilities.

iv) Design the decoding procedure for the code.

v) Find the corrected code words for the received code words

a) 101100

b) 001100. **10**

20. Suggest the suitable generator polynomial for (7, 4) systematic cyclic & find code vectors for the following data words.

i) 1010

ii) 1111

iii) 0001

iv) 1000

Construct the decoding procedure for all single bit error patterns & determine the data vectors transmitted for the following received vectors

i) 1101101

ii) 0101000. **10**

21. What is generator polynomial? Why it should be factor of $X^n + 1$? Explain encoder & decoder construction of cyclic code. **10**

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22. For (6, 3) linear block codes the three parity digits are

$C_4 = m_1 \oplus m_2$,

$C_5 = m_1 \oplus m_2 \oplus m_3$,

$C_6 = m_1 \oplus m_3$

i) Construct the generator matrix for the code.

ii) Construct the parity check matrix.

iii) Determine the error detecting & error correcting capability of the code.

iv) Check whether codeword 101101 is valid or not.

v) If receives sequence is 101101 determine the message word. **10**

23. For a systematic cyclic code the generator polynomial is given as $g(X) = 1 + X + X^3$.

i) Find generator matrix for this code.

ii) Determine parity check matrix.

iii) If received code word is 0110001, determine respective data word. **10**

24. A message 101101 is to be transmitted in cyclic code with a generator polynomial G (D) = D4 + D3 + 1. Obtain the transmitted codeword. **10**

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25. Consider a (7, 4) linear block code with parity check matrix is given by

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

i) Construct the code words for this code by generator matrix.

ii) Show that this code is a hamming code & hence find error detecting & correcting capabilities.

iii) If the received code word is 0101100, decode the word for errors if any.

26. For a systematic (7, 4) cyclic code having generator polynomial $G(x) = x^3 + x + 1$

i) Obtain generator matrix.

ii) Construct all code reactors using generator matrix.

iii) For a received code word 1101100 determine transmitted data word. **10**

27. With a neat diagram for generator & checker explain cyclic redundancy check code. **10**

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28. The generator matrix for the binary (7, 4) block code is given by

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

i) Find parity check matrix

ii) List all the code vectors

iii) What is the minimum distance between the code vectors

iv) How many errors can be corrected? How many errors can be detected? **10**

29. What is ARQ system? Explain with proper diagrammatic representation various ARQ systems. **10**

30. Sketch the encoder & syndrome calculator for the generator polynomial $g(x) = 1 + x^2 + x^3$ & obtain the syndrome for the received codeword 1001011. **10**

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31. With appropriate presentation describe various types of ARQ system. **10**

32. For a (8, 4) block code the parity check bits are given by

$$C_5 = d_1 + d_3$$

$$C_6 = d_1 + d_3 + d_4$$

$$C_7 = d_2 + d_3 + d_4$$

$$C_8 = d_1 + d_2 + d_3$$

Obtain generator matrix. Construct all code vectors to find error detecting & correcting capabilities of the code. Draw the encoder diagram for the same. Find out error if any in the received code vector 11001000. **10**

33. Sketch the encoder & syndrome calculator for generator polynomial $G(x) = 1 + x^2 + x^3$ & obtain the syndrome for the received code word 100111. **10**

UNIT-III

* April/May-2008 *

1. Explain TCM encoding and TCM decoding **10**

2. For the convolutional encoder shown in figure below. Sketch the state diagram and trellis diagram. Find the output data sequence for the input data sequence 10100. **10**

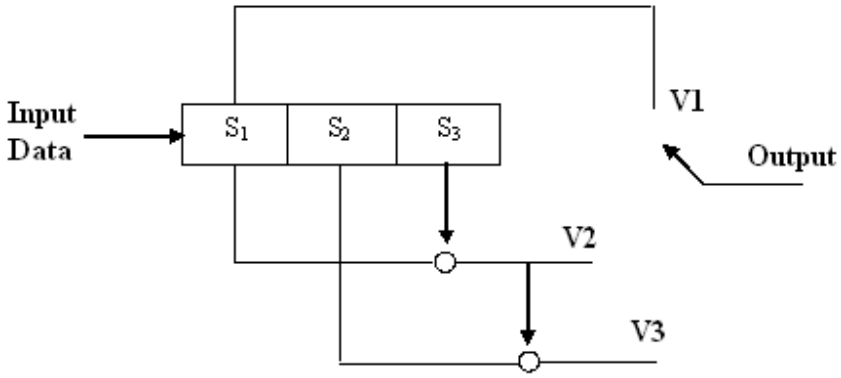

Figure:1

3. Explain the encoding of convolutional code through following terms

i) Code tree.

ii) State diagram.

iii) Code trellis. **10**

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4. Explain in detail Turbo codes. **10**

5. Explain in detail performance evolution for a TCM scheme design for an AWGN channel. **10**

6. Explain Veterbi decoding technique with suitable example. **10**

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7. Explain AWGN channel. Explain Turbo codes. **10**

8. Determine the code tree, state diagram for convolutional encoder shown in figure. Draw the trellis diagram through the first set of steady state transitions. On the second trellis diagram, show the termination of trellis to all zero state. **10**

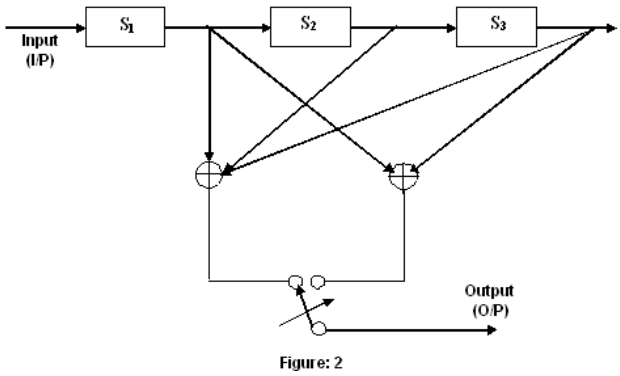

Figure: 2

9. Explain convolutional code in detail. **10**

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10. Define the following terms related to Convolutional codes.

i) Constraint length.

ii) Code rate.

iii) Generating function

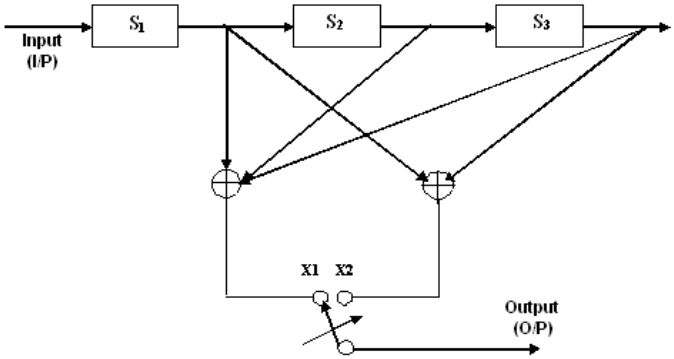
iv) Minimum Distance

v) Free length. **10**

11. i) Explain in brief about TCM decoding.

ii) What are turbo codes? What is the need of interleaver in a turbo code? **10**

12. Determine the state diagram for the Convolutional encoder shown in figure. Draw the trellis diagram through first set of steady state transitions. On the second Trellis diagram, shown the termination of the Trellis to all- zero state. **10**



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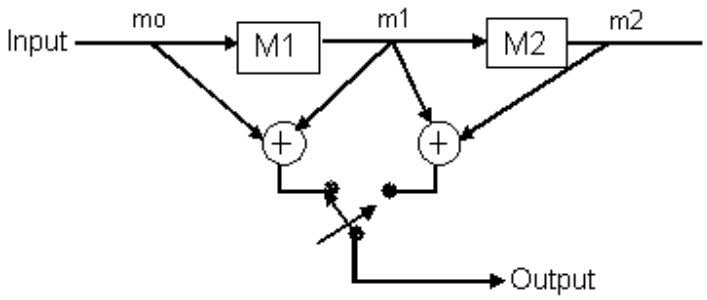
13. What are Ugerboeck's TCM design rules? Explain asymptotic coding gain. **10**

14. For a convolutional encoder shown in figure use viterbi Algorithm to decode the encoded sequence 10, 11, 11, 11, 01. **10**



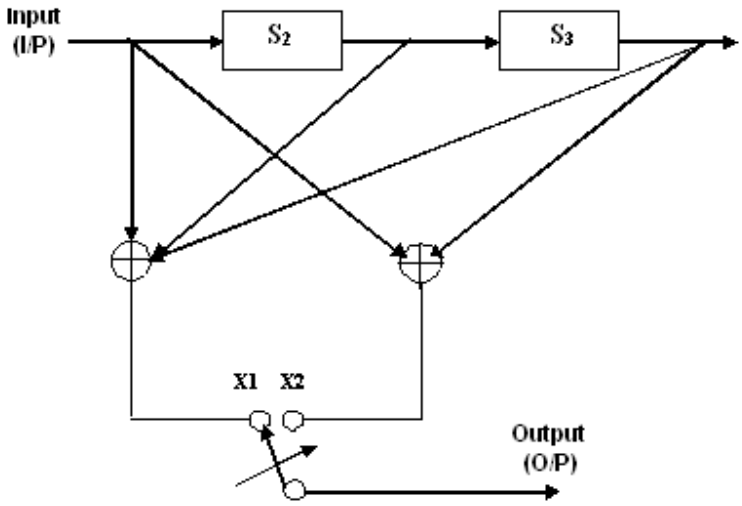
15. What are turbo codes? Explain their performance with encoded transmission in terms of error rate. **10**

* Nov/Dec-2010 *

16. Explain the general structure of TCM encoder and Ungerboeck's TCM design rules. **10**

17. Explain turbo encoder and decoding along with iterative decoding procedure. **10**

18. The encoder shown in figure generates all zero sequence which is sent over a binary symmetric channel. The received sequence is 010010000……. There are two errors in this sequence (at second and fifth position). Show that this double error detection is possible with correction by application of viterbi algorithm. **10**



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19. Determine the code tree, state diagram for convolutional encoder shown in figure. Draw the trellis diagram through the first set of steady state transitions on the second trellis diagram, show the termination of trellis to all zero state. **10**

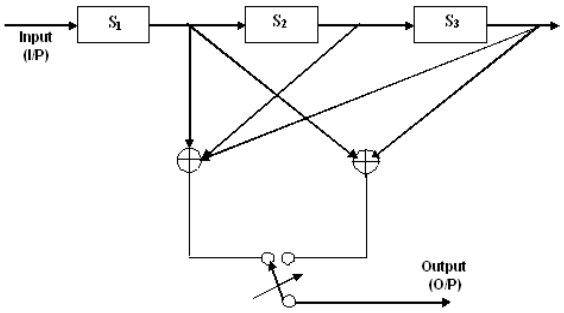

Figure: 2

20. Explain the following terms in connection with convolutional code.

i) State diagram.

ii) Code tree diagram.

iii) Code trellis diagram. **10**

21. What is turbo code? Explain coding & decoding procedure for turbo codes. **10**

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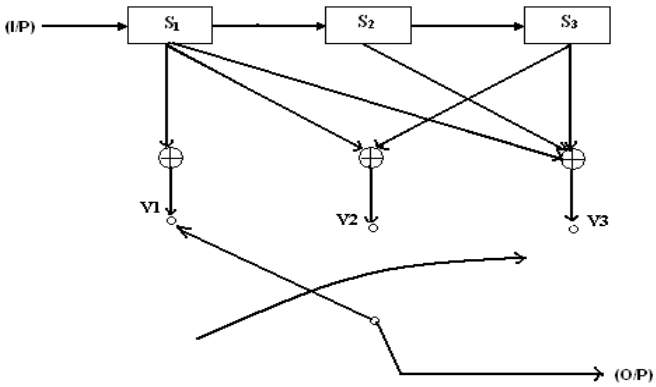
22. For the convolutional encoder shown in figure.



i) Specify the code

ii) Determine code rate

iii) Sketch state, trellies & code tree diagrams

iv) Find out output data sequence for the input data sequence 10100. **10**

23. Explain encoding & decoding scheme for TCM. **10**

24. Explain the following terms in connection with convolutional code.

i) Constraint length

ii) Code rate tree diagram.

iii) Generating function

iv) Look up table

v) State diagram. **10**

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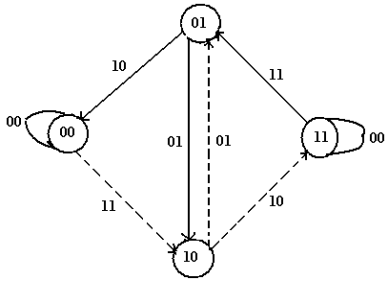
25. For the convolutional encoder arrangement shown in figure. Draw the state diagram & trellies diagram. Use Viterbi algorithm to decode the sequence 100110



26. Explain in brief

i) Turbo codes.

ii) Ungerboecks TCM design rules.

27. With reference to convolutional codes explain the following

i) Code tree.

ii) State diagram.

iii) Code trellies

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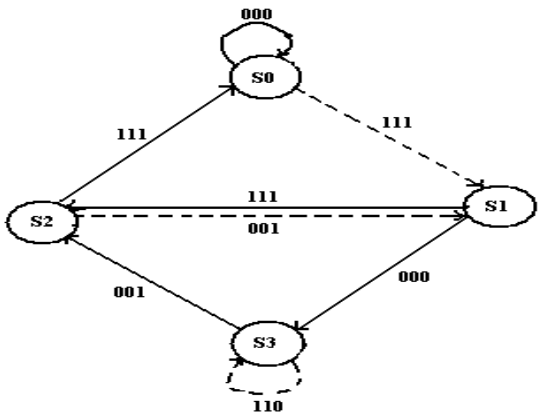
28. State diagram of a rate 1/3 convolutional encoder is shown bellow.



Draw the Trellis diagram, code tree & obtain the code word if input sequence is 101011. **10**

29. Draw & explain encoder for a tree code. Give the comparison between block code & Convolutional code. **10**

30. What are Ungerboecks TCM design rules? Explain Asymptotic coding gain. **10**

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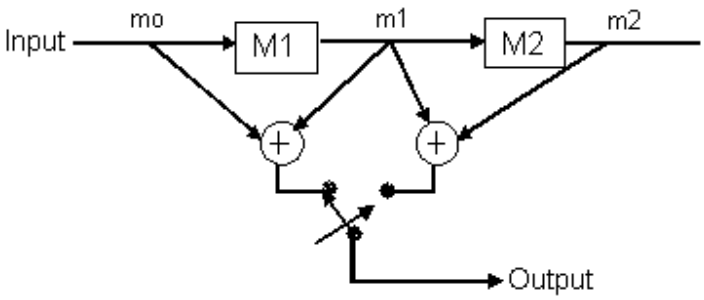
31. i) Give the comparison between block codes & convolutional codes.

ii) Describe code trellies & state diagram. **10**

32. The convolutional encoder as shown in figure is used to generate an all zero code sequence which is transmitted over a binary symmetric channel. The corresponding received code sequence is 01001000. Show that this double error detection is possible by the application of Viterbi decoding algorithm. **10**



33. Explain in brief:

i) Ungerboecks TCM design rules.

ii) TCM decoder. **10**

UNIT-IV

* April/May-2008 *

1. Explain the features of BCH code. Explain the features of Read soloman code. **10**

2. Explain data compression through following

i) Entropy Encoding & Statistical Encoding.

ii) Source Encoding. **10**

3. Explain the features of JPEG format. Explain Cryptography. **10**

* Nov/Dec-2008 *

4. What is data encryption? What are its standards? Explain key schedule calculation by flow chart. **10**

5. Compare performance of the following with optimum system.

i) AM, SSB, DSB.

ii) FM.

iii) PCM. **10**

6. Write a short note on.

i) BCH Codes.

ii) RS codes. **10**

* April/May-2009 *

7. Explain the implementation of Reed Solomon Encoders & Decoders. **10**

8. Explain the process of encryption & decryption? **10**

9. Explain various types of data compression algorithms in detail. **10**

* Nov/Dec-2009 *

10. Compare the performance of the following with optimum system.

i) Amplitude modulation (SSB, DSB)

ii) Frequency modulation.

iii) PCM. **10**

11. What is data encryption? What are its standards? Explain key schedule calculation by flow chart. **10**

12. Illustrate the decoding procedure for a (15, 5) BCH code which can correct 3 errors. Assume the generator polynomial of the code to be $G(x) = x^{10}+x^8+x^6+x^4+x^2+x+1$
Assume that the transmitted code word is an all zero word and the received codeword Polynomial is $Y(x) = x^5+x^3$. **10**

* April/May-2010 *

13. What is cryptography technique? Explain the DCT image compression schemes. **10**

14. Consider the (31, 15) Reed Soloman code.
i) How many bits are there in a symbol of the code?
ii) What is the block length in bits?
iii) What is the minimum distance of the code?
iv) How many symbols in error can the code correct? **10**

15. Illustrate the decoding procedure for (15, 5) BCH code which can correct 3 errors. Assume the generator polynomial of the code to be $G(X) = x^{10}+x^8+x^5+x^4+x^2+x+1$. Assume that the transmitted codeword is an all zero word but the received codeword polynomial is $Y(X) = x^5+x^3$ **10**

* Nov/Dec-2010 *

16. Draw and explain feedback communication system in detail. **10**

17. Derive the expression of signal to noise ratio for optimum modulation system. **10**

18. Construct the expression field GF(16) by assuming the primitive polynomial $P(X) = X^4 + X + 1$ over GF(2). Obtain the elements of GF(16) and minimal polynomials. **10**

* April/May-2011 *

19. Design a BCH code with block length n = 15 & error correcting capability tc = 1, 2, 3. **10**

20. Design a (7, 3) Reed-Soloman double error correcting code. Find the systematic code for the message α, α^3, α^5. If received symbols are as follows:
α^0 α^2 α^4 α^0 α^6 α^3 α^5. **10**

21. What is cryptography? Explain the features of JPEG format. **10**

* Nov/Dec-2011 *

22. Find the minimal polynomial of GF (23) whose transfield is GF (2) with primitive polynomial $X^3 + X + 1$. **10**

23. Design a (15, 11) Reed-Solomen code. Find the code whose message polynomial is given as (X + 1). **10**

24. Explain the implementation of Reed-Solomen encoder & decoder. **10**

* April/May-2012 *

25. What is data encryption? What are its standards? Explain key schedule calculation by flow chart. **10**

26. What is Reed-Solomon code? Explain in brief. **10**

Consider the (31, 15) Reed-Solomon code.

i) How many bits are there in a symbol of this code?

ii) What is the block length in bits?

iii) What is minimum distance of the code?

iv) How many symbols in error can code correct?

27. i) Give various objective of JPEG. **10**

ii) Give a note an cryptography components.

* Nov/Dec-2012 *

28. What is cryptography technique? With the help of neat sketch explain secret key cryptography technique in detail. **10**

29. Compute all the elements of GF (8) using the primitive polynomial $p(x) = x^3 + x + 1$ assuming that the primitive element of GF (8) is x = y. **10**

30. With a neat sketch explain various constituents of feedback communication system. Give the graphical representation for comparison of AM systems with ideal system. **10**

* April/May-2013 *

31. What is cryptography technique? With the help of appropriate diagram explain secret key cryptography technique in detail. **10**

32. What is JPEG standard? What are its objectives? Explain in detail. **10**

33. Compare the performance of the following with optimum system.

i) Amplitude modulation (SSB, DSB)

ii) Frequency modulation.

iii) PCM. **10**

UNIT-V

* April/May-2008 *

1. A typical receiver shown in figure bellow is used to receive the TV signal from geostationary satellite. If the above system works with satellite of EIRP of +36 dBW at 4 GHz downlink frequency. Determine the carrier to noise ratio at the demodulator input. Assume slant distance of 39500 km between the satellite and earth station. **10**

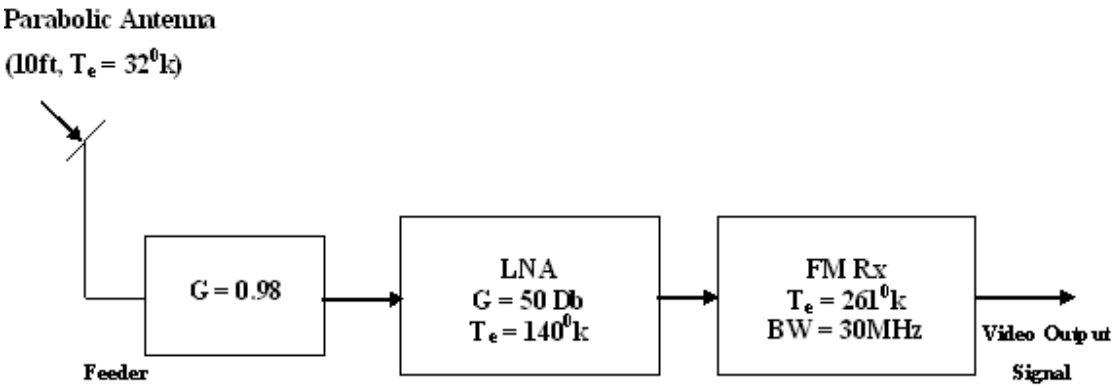


Figure: 2

2. Explain the following in terms of satellite communication **(Any Two)**

i) SPADE.

ii) IRIDIUM.

iii) Kepler's law. **10**

3. Explain the following in terms of mobile communication

i) Cell splitting, frequency reuse, Hand-off.

ii) CDMA services. **10**

* Nov/Dec-2008 *

4. What is diversity concept? Draw & explain the block diagram of space diversity technique. Give the type of diversity techniques. **10**

5. What is meant by satellite system power budget? With a neat sketch explain uplink power budget in detail. **10**

6. Compare TDMA, FDMA, CDMA, SDMA Multiplexing access techniques. **10**

* April/May-2009 *

7. Draw & explain the transmitter & receiver arrangements for typical digital satellite communication terminals. **10**

8. Explain TDMA & FDMA for satellite communication. **10**

9. Compare GSM & IS-95standards for mobile communication (2^{nd} Generation). **10**

* Nov/Dec-2009 *

10. What is diversity concept? Draw and explain the block diagram of space diversity technique. Give the types of diversity techniques. **10**

11. With an appropriate block schematic of satellite earth station explain working of each block in detail. Give brief about SPADE. **10**

12. What is meant by satellite system power budget with a neat sketch explain uplink power budget in details. **10**

* April/May-2010 *

13. Explain the following terms related to mobile communication.

i) Cells ii) Clusters iii) Frequency reuse iv) Cell splitting v) Hand Over **10**

14. A radio link uses a pair of 2m dish antenna with an efficiency of 60% each as transmitting and receiving antenna. Other specifications of the link are

Transmitted power = 1 dBW

Carrier frequency = 4 GHz

Distance of receiver from transmitter = 150m

Calculate:

i) Free space loss

ii) Power gain of each antenna

iii) Received power in dBW. **10**

15. What is meant by multiple accesses? Explain W-CDMA in detail. Give CDMA services. **10**

* Nov/Dec-2010 *

16. Explain the performance of various system over the Rayleigh fading and non fading channels. **10**

17. Explain all multiple access techniques in detail. **10**

18. A satellite receiver system consist of a LNA that has a gain of 47 dB and a noise temperature of 120^0K, a cable with loss of 6.5 dB and the main receiver with a noise factor of 7 dB. Calculate the equivalent noise temperature of the overall system referred to the input for following system correction:

i) LNA at the input followed by the cable connecting to the main receiver.

ii) The input direct to the cable which then connected to the LNA, which in turn connected to the main receiver. **10**

* April/May-2011 *

19. Explain typical satellite communication system. Write the advantages of satellite communication system. **10**

20. Explain following with reference to mobile communication.

i) CDMA services.

ii) Cell splitting & frequency reuse. **10**

21. Compare TDMA, FDMA, CDMA & SDMA techniques. **10**

* Nov/Dec-2011 *

22. Draw & explain the transmitter & receiver arrangement for typical digital satellite communication terminals. **10**

23. Compare multiple access techniques. **10**

24. Explain the following terms related to mobile communication.

i) Cell.

ii) Clusters.

iii) Frequency reuse.

iv) Cell splitting.

v) Hand over. **10**

* April/May-2012 *

25. Compare TDMA, FDMA, & CDMA techniques. **10**

26. What is diversity? Explain in brief various diversity techniques. **10**

27. With reference to satellite explain uplink frequency downlink frequency & satellite transponder with proper diagram. **10**

* Nov/Dec-2012 *

28. What is diversity? With reference to diversity concept explain various diversity techniques in detail. **10**

29. A radio link uses a pair of 2m dish antenna with an efficiency of 60% each as transmitting and receiving antenna. Other specifications of the link are

Transmitted power = 1 dBW

Carrier frequency = 4 GHz

Distance of receiver from transmitter = 150m

Calculate:

i) Free space loss

ii) Power gain of each antenna

iii) Received power in dBW. **10**

30. Explain the following terms related to mobile communication.

i) Cells.

ii) Cluster.

iii) Frequency Reuse.

iv) Cell splitting. **10**

* April/May-2013 *

31. With the help of neat sketch describe the satellite earth station. **10**

32. A radio link uses a pair of 2m dish antenna with an efficiency of 60% each as transmitting and receiving antenna. Other specifications of the link are

Transmitted power = 1 dBW

Carrier frequency = 4 GHz

Distance of receiver from transmitter = 150m

Calculate:

i) Free space loss

ii) Power gain of each antenna

iii) Received power in dBW. **10**

33. Draw the block diagram of basic cellular mobile system & explain the concept of

i) Frequency reuse.

ii) Cell splitting. **10**