**INDRA GANESAN COLLEGE OF ENGINEERING**

**DEPARTEMENT OF INFORMATION TECHNOLOGY**

 **QUESTION BANK**

**Subject : Information Coding Technique**

**Subject Code : IT1301**

**Year/Sem : III / V**

**Staff Name : Tamilselvan K**

**UNIT – I**

**PART –A**

1. What is a Huffman Coding?
2. State Channel Coding Theorem.
3. What is entropy .State their properties
4. Find Entropy of the source emitting symbol with probability x, y, z with probability 1/5 , ½ & 1/3
5. A Source emitting 4 symbols with probability 0.4, 0.3, 0.2, and 0.1. Find the amount of information gained by observing the source
6. What is the code rate?
7. Find amount of information produced by each source with probability x,y,z with probability 1/5 , ½ & 1/3
8. Define Channel Coding Theorem
9. Explain channel capacity
10. State source coding Theorem
11. State Channel Capacity theorem?
12. What are the disadvantages of Channel Coding Theorem?
13. Find the Shannan coding for the symbols S0, S1, S2, S3, S4 with the probabilities 0.4, 0.2, 0.2, 0.1, 0.1
14. What is discrete memory less Source?
15. Define Discrete Memory less channel.
16. Define uncertainty?
17. Explain the concept of amount of information?
18. Give the functional requirement of the source encoder.
19. Write the properties of mutual information.
20. What is variable length code? Give example.
21. Calculate the amount of information if Pk =1/4?
22. What is average information?
23. Calculate the entropy when Pk =0 and Pk =1?
24. Draw the Channel diagram for the given channel matrix P(Y/X)= 1-P P 0 0 P 1-P
25. Define shenon feno code method?

**PART-B**

1. A discrete memory less source has an alphabet of five symbols with there are given by,
[X] = [X1, X2, X3, X4, X5]
[P] = [0.45, 0.15,0.15,0.10,0.15]
Compute Entropy & second order Extension for the Symbol. Find the amount of Information gained by observing the source.
2. State and prove the Upper bound & lower bound of Entropy.
3. A discrete memory less source has an alphabet of five symbols with there are given by,
[X] = [X1, X2, X3, X4, X5]
[P] = [0.45, 0.15,0.15,0.10,0.15] Compute Two different code for this.
4. What is coding? Explain the steps involved in Shannon Fano coding. What are
the disadvantages of fano coding.
5. Consider a sequence of letters of English alphabet with their probabilities of occurrence as given here
Letters = [a, b, c, d, E, f, g, h]
[P] = [0.1 0.1 0.2 0.1 0.1 0.2 0.1 0.1]
Compute two different Huffman codes for this source. For these two codes find
 a. Average code word Length
 b. Variance of average code word.
 c. Entropy
6. State & Explain Shannaon first theorem.
7. State and explain Shannon Second Theorem.
8. Write short notes on:
 (a) Binary Communication channel
 (b) Binary symmetric channel.
9. Determine the code efficiency for the two alternatives?
10 (a) State and prove any two properties of information and entropy.

1. Apply Shannon-Fano encoding procedure to the following message symbols x= {x1, x2, x3……x9};

P= {0.49, 0.14, 0.14, 0.07, 0.07, 0.04, 0.02, 0.02, 0.01}. Find the efficiency of coding.

1. (a) Define Mutual information and prove that the Mutual information of a channel is symmetric.

 (b) Apply Huffman coding algorithm for data compression. For a DMS ‘X’ with nine symbols

x1, x2, x3… x9, Find a compact code for every symbol if the probability distribution is as follows

 P= {0.49, 0.14, 0.14, 0.07, 0.07, 0.04, 0.02, 0.02, 0.01}

Calculate: i) Entropy of the source ii) Average length of the code

 iii) Code Efficiency and iv) Redundancy of the code v) Code variance

1. (a) Explain in detail the basic properties of codes.

 (b) Explain arithmetic coding with an example.

1. State and explain Shannon’s Channel Capacity theorem.
2. Write short notes on Mutual Information and Self Information.
3. Write short notes on code efficiency and redundancy.
4. Explain coding theory. Explain Shannon Fano Coding and Huffman coding in detail with examples. Calculate code efficiency and redundancy
5. Explain entropy. Describe the properties of information and entropy.

**UNIT – II**

**PART- A**

1. What are the advantages of coding speech signal at low bit rates
2. What is sub-band coding?
3. Draw the block diagram for pulse code modulator?
4. Give the differences between delta modulation and DPCM?
5. What is adaptive DPCM?
6. What is adaptive Prediction?
7. Explain the Processes that are done at transmitter.
8. What is adaptive Quantization?
9. Differentiate AFQ and ABQ.
10. What are errors occurred during Delta Modulation.
11. Define DPCM.
12. What is Modulation?
13. Can we code the speech signal using standard PCM? Justify
14. What you mean by adaptive sub band coding?
15. Write short notes on Delta Modulation?
16. Define sampling and quantization?
17. What is Adaptive delta modulation?
18. What is differential pulse code modulation?
19. Explain the sub band coding for speech signal
20. What are the advantages of coding speech at low bit rates?
21. Draw the block diagram of DPCM.
22. Give the draw backs of delta modulation.
23. Define Nyquist rate?
24. What is meant by aliasing effect?
25. State Sampling theorem?

**PART –B**

1. Explain delta-modulation?
2. Explain adaptive quantization and prediction with ADPCM?
3. Explain PCM.
4. Explain coding of speech signal at low bit rates?
5. Explain adaptive delta modulation?
6. Explain about ADPCM
7. (i) With the help of neat diagrams, explain the transmitter and receiver of Pulse code modulation? (6)
   (ii) How ADPCM codes speech at low bit rates? (6)
8. (i) Explain the transmitter and receiver of Adaptive delta modulation Technique? (6)
    (ii) Explain the advantages and disadvantages of Delta modulation? (6)
9. (i) what is slope overhead distortion and granular noise in delta modulation and how is it removed in ADM?. (6)
    (ii) Consider a sine wave of frequency fm and amplitude Am applied to a delta modulator of step size d, show that the      slope over head distortion will occur  if Am = d/ 2p fmTs where Ts is the sampling period? (6)
10. Explain in detail about Adaptive subband coding of coding at low bit rate.

1. Write short notes on the following:
2. Vocoders (b) Adaptive Delta Modulation (c) Linear Predictive Coding.
3. Write short notes on:
4. ZIV-Lempel coding (b) Run-Length coding (c) Subband Coding.
5. Explain Lossless Predictive coding in detail.
6. Explain about Adaptive sub-band coding with its advantages and disadvantages.
7. Explain the different types of modulation techniques involved in the conversion of analog signals into digital data. (PCM, DPCM, Delta Modulation, Adaptive Delta Modulation)

**UNIT – III**

 **PART A**

1. What is a Linear Block code?
2. How you decode the Linear Block code?
3. What is syndrome?
4. Define Hamming Distance.
5. What is CRC?
6. Explain about Hamming code.
7. What is convolution code?
8. What are the properties of Syndrome
9. Define Hamming Weight and Minimum Destination
10. Define Hadamard and extended block codes?
11. What is a Generator polynomial? Give some standard generator polynomials.
12. How to find the parity check matrix
13. Write the syndrome decoding algorithm.
14. What is sequential Decoding?
15. What is a cyclic code?
16. What is Hamming bound?
17. What is error control coding?
18. Differentiate systematic codes and un systematic codes?
19. What is the use of syndromes?
20. What are the error detection and correction capabilities of hamming code?
21. Define code efficiency?
22. What are the error detection and correction capabilities of hamming code?
23. What are Hamming codes?
24. Differentiate convolutional code and block codes?
25. What is constraint length for convolutional encoders?

**PART B**

1) The parity check matrix of a particular (7,4) linear block code is given by,
 1 1 1 0: 1 0 0
H =
 0 1 1 1: 0 1 0

 1 1 0 1: 0 0 1
 (i) Find the generator matrix (G)
 (ii) List all the code vectors
 (iii) What is the minimum distance between ode vectors?
 (iv) how many errors can be detected?
 (v) how many errors can be corrected?
2) (i) The parity check matrix of a (7,4) hamming code is given as follows:
 1 1 1 0: 1 0 0
H =  0 1 1 1: 0 1 0
 1 1 0 1: 0 0 1
Calculate the syndrome vector for single bit errors? (8)
    (ii) Define dual code and repeated code? (4)

3) (i) The generator polynomial of (7,4)cyclic code is ,G(P)=P3+P+1, Find all code vectors for all the code in non systematic form? (6)
   (ii) Explain the operation of encoders for cyclic codes? (6)

4) (i) Explain the concatenated block codes? (6)
    (ii) Explain the operation of Convolutional coding with an example? (6)
5) (i) For the Convolutional encoder of figure determine the following :
 (a) Dimension of the code
 (b) Code rate
 (c) Constraint length
 (d) Generating sequences
 (e) Find output sequence for message sequence of  M=[ 1 0 0 1 1 ] (8)

1 Message  (M) M1 M2 2 O/P
(ii) Compare hard decision decoding and soft decision decoding? (4)

6. Explain the procedure for Decoding Linear Block Codes with an Example.
7. Explain about Hamming Codes.
8. How do you calculate Minimum distance for Block code? Explain with Example.
9. Explain about Cyclic Redundancy check.
10. i) Define cyclic code.
     ii) How to find the Generated Polynamial?
     iii) Give the syndrome decoding algorithm.

1. (a) The generation matrix for a (6, 3) block code is given below. Find all code vectors of this code.



G=

1. Prove that the minimum distance of a linear block code is equal to the minimum weight of any nonzero word in the code.
2. (a) Explain in detail the method for generating cyclic codes with an example.
3. Write short notes on BCH code.
4. Construct a convolutional encoder with the following specifications:
5. Constraint length is 3
6. Code rate is ½
7. Generator sequences are g1=(1,1,1) and g2=(1,0,1)
8. The input sequence is 10011

Also draw the code tree for the above specifications.

1. Explain about Trellis Coded Modulation in detail.
2. Write short notes on:
3. Trellis Tree diagram
4. Code Tree and
5. State diagram
6. Show that C= (0000, 1100, 0011, 1111) is linear code. What is its minimum distance?
7. Explain Linear Block Codes for error Correction with an example.
8. Explain Cyclic Codes for error Correction with an example.
9. Explain in detail about Convolution codes with an example.

**UNIT – IV**

**PART- A**

1. What are the advantages and disadvantages of compression?.
2. Compare lossless and lossy compression?
3. Explain the principle of data compression and give the types of data compression?
4. What are the methods used for Text compression?
5. What is TIFF?
6. What are the types of JPEG algorithms and explain it ?.
7. What is spatial frequency?
8. Explain Run-length coding?
9. Draw the block diagram of JPEG decoder?
10. What is Arithmetic coding?
11. Draw the block diagram of data compression/decompression principle.
12. Define dynamic Huffman coding.
13. State the main application of Graphical interchange format (GIF).
14. What is source encoding? Give example.
15. What is text compression?
16. What is run-length encoding
17. Define: Arithmetic Encoding.
18. Differentiate Static and Dynamic Huffman Coding
19. Write Short notes on JPEG.
20. What is TIFF?
21. Define: Image Compression.
22. Define GIF.
23. What is a Lossless Compression?
24. Define Entropy Encoding
25. What is Compression? Why we need compression?

**PART- B**

1 (i) Explain the principle and types of data compression? (6)
  (ii) Compare static coding and Dynamic coding? (6)
2 (i) With the following symbols and their probabilities of Occurrence , encode the message “went#” using
       Arithmetic coding algorithm? (6)
 Symbols e n T w #
 Probabilities 0.3 0.3 0.2 0.1 0.1
   (ii) Compare Huffman coding and Arithmetic coding? (6)
3 (i) Explain various methods used for Text Compression? (6)
  (ii) Explain LZ coding? (6)
4 (i) What is image compression? Explain the different types of Formats used for image compression? (6)
  (ii) Explained Digitized documents? (6)
5 (i) With the help of block diagrams , explain the working of JPEG Encoder and decoder? (6)
  (ii) Explain Dynamic Huffman coding? (6)
6. Explain the basic principles of Compression
7. Explain Static and dynamic Huffman Coding
8. Explain Arithmetic Coding
9. Why we need Image Formats? Explain JPEG format encoding.
10.Explain about TIFF and GIFF.

11 (a) Explain about JPEG standards in detail with neat diagrams.

 (b) Explain about Quantization Methods.

1. Explain any two MPEG standards in detail with neat diagrams.
2. Explain the following MPEG standards:
3. MPEG 1 (b) MPEG 2 and (c) MPEG 4
4. Explain about i-frames, p-frames and b-frames.
5. What is JPEG? Explain the JPEG standards for lossy and lossless compression.
6. Draw the block diagram of Baseline JPEG and explain the five main stages associated with it.

**UNIT – V**

**PART- A**

1. What is meant by pitch and loudness?
2. Draw the block diagram for LPC encoder?
3. What is meant by code excited LPC (CELP)?
4. What are the different types of CELP standards?
5. What is meant by frequency masking and temporal masking?
6. Draw the frame format for MPEG audio encoder?
7. What are MACRO blocks?
8. Define I, P, B frames?
9. Compare MPEG-2 & MPEG-4?
10. What is the need of MIDI standard?
11. What is Dolby AC-1?
12. Define the term “GOP” and “Prediction Span” with reference to video compression.
13. What is the significance of D-frames in video coding?
14. What is perceptual coding?
15. Define Video compressions
16. Differentiate Static and Dynamic Huffman Coding
17. Write Short notes on JPEG.
18. What is MPEG?
19. Define: Image Compression.
20. Define JPEG
21. What is MPEG -7
22. Define H.263?
23. What is divx compression?
24. List out compression standards?
25. What is the effectiveness of M-peg audio?

**PART –B**

1. (i) With the help of block diagrams explain speech coding  Using LPC?
   (ii) Compare the CELP standards?
2. (i) Explain the concepts of frequency masking and temporal masking?How they are used in perceptual coding?
   (ii) What is MPEG? Explain MPEG video standards?
3. (i) With the help of block diagrams of Encoder /Decoder ,explain MPEG audio perceptual coding?
   (ii) Give the advantages and disadvantages of Dolby AC-1?
4. (i) Draw the block diagrams and explain DOLBY AC-1 and DOLBY AC-2 audio coders. Compare them?
   (ii) What are the principles of video compression?
5. (i) with the help of block diagram, explain the MPEG algorithm For video coding?
6. Explain the basic principles of Compression
7. Explain Static and dynamic Huffman Coding
8. Explain about JPEG and MPEG
9. Explain about H2.61
10. Explain the various standards available in MPEG

1. (a) Explain the most widely used conventional encryption algorithm – DES in detail.
2. Write short notes on IDEA.
3. (a) Sketch out the RSA algorithm and illustrate with example.
4. Discuss about Pretty Good Privacy with a neat block diagram.
5. Explain Cryptography. Explain some of the basic cryptographic techniques.
6. Explain briefly about one-way Hashing.
7. (a) What is the need for security? List some of the objectives.
8. Explain the concept and overall framework for public key cryptography.

15 (a) Explain about Symmetric Key cryptography with neat diagram.

(b) Explain how the key is generated in RSA algorithm.

1. Describe any three substitution technique for encryption.
2. Explain in detail about Public Key Cryptography with Signature authentication.