PART A
UNIT I

1. What is information?

   Information can be defined as the inverse of probability of occurrence

   $$= - \log p_k$$

2. Give two properties of information.
   - Information must be Non-negative (i.e.) $I(s_k) \geq 0$
   - If probability is less then information is more and if probability is more then Information is less

     If $(I(s_k) > I(s_i))$ then $p(s_k) < p(s_i)$

3. What is entropy?

   Entropy can be defined as the average amount of information per source symbol.

   $$H(\Im) = - \sum_{k=0}^{K-1} p_k \log p_k$$

4. Give two properties of entropy.
   - $H(\Im) = 0$ if and only if $p_k = 1$ and the remaining probabilities in the set is equal to 0.The lower bound on entropy corresponds to no uncertainty.
   - $H(\Im) = \log_2 K$ if and only if $p_k = 1/K$ then all the probabilities in the set is equiprobable. The upper bound on entropy corresponds to maximum uncertainty.

5. What is extremal property?

   $$H(\Im) \leq \log_2 K$$

6. What is extension property?

   The entropy of the extended source is 'n' times that of the primary source.

   $$H(\Im^n) = n * H(\Im)$$

7. What is discrete source?

   If a source emits symbols $\Psi = \{s_0, s_1, s_2, \ldots s_{k-1}\}$ from a fixed finite alphabet then the source is said to be discrete source.

8. State Shannon's first theorem (or) source coding theorem

   A distortion less coding occurs when $\bar{L} * \log_2 r \geq H(\Im)$ where $\bar{L}$ represents the average codeword length and $H(\Im)$ represents entropy.

9. What is data compaction?

Data compaction is used to remove redundant information so that the decoder reconstructs the original data with no loss of information.

10. What is decision tree? Where it is used?

The decision tree is a tree that has an initial state and terminal states corresponding to source symbols $s_0, s_1, s_2, \ldots s_{k-1}$. Once each terminal state emits its symbol, the decoder is reset to its initial state.

Decision tree is used for decoding operation of prefix codes.

11. How will you check the condition for validity in ternary Huffman coding?

$\bar{L} * \log_2 3 \geq H(\mathfrak{I})$

12. What is instantaneous code?

If a codeword is not a prefix of any other code word then it is said to be instantaneous code.

(e.g)

0
10
110
1110

13. What is uniquely decipherable code?

If a codeword is not a combination of any other code word then it is said to be uniquely decipherable code.

(e.g)

0
11
101
1001

14. How an encoding operation is taken place in Lempel-ziv coding using binary sequence?

Encoding operation can be taken place by parsing the source data stream into segments that are the shortest subsequences not encountered previously.

15. What is discrete channel?

The channel is said to be discrete when both the alphabets $\mathfrak{X}$ and $\mathfrak{Y}$ have finite sizes.

16. What is memory less channel?

The channel is said to be memory less when the current output symbol depends only on the current input symbol and not any of the previous choices.

17. What is the important property while using the joint probability (x_j, y_k)?

The sum of all the elements in a matrix is equal to 1.

18. What is the important property while using the conditional probability (x_j / y_k)?

The sum of all the elements along the column side should be equal to 1.

19. What is the important property while using the conditional probability (y_k / x_j)?

The sum of all the elements along the row side should be equal to 1.

20. Define mutual information?

Mutual information of the channel is the average amount of information gained by the transmitter when the state of the receiver is known.

$$I(\mathcal{X} ; \mathcal{Y}) = H(\mathcal{X}) - H(\mathcal{X} / \mathcal{Y})$$

21. Give two properties of mutual information?

- Mutual information is always non-negative (i.e.) $I(\mathcal{X} ; \mathcal{Y}) \geq 0$
- The mutual information of the channel is symmetric

$$I(\mathcal{X} ; \mathcal{Y}) = I(\mathcal{Y} ; \mathcal{X})$$

22. Define channel capacity?

Channel capacity of a discrete memory less channel can be defined as the maximum value of the mutual information $I(\mathcal{X} ; \mathcal{Y})$, Where the maximization is carried out for all input probabilities $\{p(x_j)\}$ when the symbols whose input probabilities $\{p(x_j)\}$ are equiprobable.

$$C = \max_{\{p(x_j)\}} I(\mathcal{X} ; \mathcal{Y})$$

23. State Shannon's second theorem (or) channel coding theorem

$$\frac{H(\mathfrak{I})}{T_s} \leq \frac{C}{T_c}$$

There exists a coding scheme for which the source output can be transmitted over the channel and be reconstructed with an arbitrarily small probability of error.

Conversely if

$$\frac{H(\mathfrak{I})}{T_s} > \frac{C}{T_c}$$

It is not possible to transmit information over the channel and be reconstructed with an arbitrarily small probability of error.

24. State Shannon's third theorem (or) Information capacity theorem

The information capacity of a continuous channel of bandwidth B hertz perturbed by additive white Gaussian noise of power spectral density $N_o/2$ and limited in bandwidth to B is given by

$$C = B \log_2 \left(1 + \frac{P}{N_o B}\right) \text{ bits per second}$$

25. What are the two important points while considering a code word?

- The code words produced by the source encoder are in binary form.
- The source code is uniquely decodable.

UNIT II

26. What is quantization?

The process of converting the original signal m (t) into a new signal (or) quantized signal m_q (t) which is an approximation of m (t) is known as quantization.

27. What is quantization error?

The difference between the original signal m (t) and the quantized signal m_q (t) is called quantization error.

28. Define uniform quantization?

If the step size 's' is fixed then it is said to be uniform quantization. This is also known as non-linear quantization.

29. Define uniform quantization?

If the step size 's' is not fixed then it is said to be non-uniform quantization. This is also known as non-linear quantization. Non-linear quantization is used to reduce the probability of quantization error.

30. Define Mid tread quantization?

If the origin lies in the middle of a tread of the stair case graph, then it is said to be mid thread quantization.

31. Define Mid rise quantization?

If the origin lies in the middle of a rising part of the stair case graph, then it is said to be mid rise quantization.

32. What is PCM?

A signal, which is to be quantized prior to transmission, is usually sampled. We may represent each quantized level by a code number and transmit the code numbers rather than sample value itself. This system of transmission is termed as PCM.

33. Specify the 3 elements of regenerative repeater

- Equalizer
- Timing circuit
- Decision making device

34. What is DPCM?

In DPCM, it transmits the difference between the current sample value m (k) at sampling time k and the immediately preceding sample value m (k-1) at time k-1. Now these differences are added in the receiver to generate a waveform, which is identical to the message signal m (t).

35. How DPCM works?

DPCM works on the principle of prediction.

36. How a speech signal is coded at low bit rates?

- To remove redundancies from the speech signal as far as possible.
- Assign the available bits to code the non-redundant parts of the speech signal in an efficient manner.

By means of these 2 conditions 64 bit sample is reduced into 32 bits, 16 bits, 8 bits and 4 bits.

37. What is ADPCM?

A digital coding scheme that uses both adaptive quantization and adaptive prediction is called ADPCM.

The use of ADPCM is used for reducing the number of bits per sample from 8 into 4.

38. What is AQF?

Adaptive quantization with forward estimation.

Here unquantized samples of the input signal are used to derive forward estimates of σ_M (nT_s).

39. What is AQB?

Adaptive quantization with backward estimation.

Here samples of the quantizer output are used to derive backward estimates of σ_M (nT_s).

40. What is APF?

Adaptive prediction with forward estimation.

Here unquantized samples of the input signal are used to derive forward estimates of the predictor coefficients.

41. What is APB?

Adaptive prediction with backward estimation.

Here samples of the quantizer output and the prediction error, are used to derive backward estimates of the predictor coefficients.

42. What is ASBC?

Adaptive sub band coding. ASBC is a frequency coder (i.e.) the speech signal is processed in frequency domain in which in which the step size varies with respect to frequency.

43. Give the main difference between PCM and ASBC?

The ASBC is capable of digitizing speech at a rate of 16 KBPS where as PCM is capable of digitizing speech at a rate of 64 KBPS.

44. What is noise-masking phenomenon?

Noise can be measured in terms of decibels. If the noise is below 15 db of the signal level in the band, the human ear does not perceive noise. This is known as noise masking phenomenon.

45. How much delay that is taken place in ASBC?

25 ms, because a large number of arithmetic operations are involved in designing the adaptive sub band coder whereas in PCM delay is not encountered.

46. What is delta modulation?

Delta modulation is a DPCM scheme in which the difference signal Δ (t) is encoded into a single bit 0 (or) 1. This single bit is used to increase (or) decrease the estimate $\hat{m}(t)$.

47. What is the maximum slope of a signal x(t)?

$$\frac{\delta}{T_s} \geq \max\left|\frac{d\,x(t)}{dt}\right|$$

48. What are the drawbacks in delta modulation?

- Granular noise (or) hunting
- Slope overloading

49. What is hunting?

In hunting, there is a large discrepancy (or) difference between m (t) and $\hat{m}$ (t) and stepwise approach of $\hat{m}$ (t) to m (t). When $\hat{m}$ (t) caught m (t) and if m (t) remains unvarying $\hat{m}$ (t) hunts swinging up (or) down, above and below m (t). This process is known as hunting.

50. What is slope overloading?

We have a signal m (t), which over an extended time exhibits a slope, which is so large that $\hat{m}$ (t) cannot keep up with it. The excessive disparity (or) difference between m (t) and $\hat{m}$ (t) is described as slope overloading.

51. How Hunting and slope overloading problems can be solved?

These two problems can be solved by Adaptive delta modulation by varying the step size in an adaptive fashion.

UNIT III

52. What is the use of error control coding?

The main use of error control coding is to reduce the overall probability of error, which is also known as channel coding.

53. What is the difference between systematic code and non-systematic code?

- If the parity bits are followed by message bits then it is said to be systematic codes.
- If the message bits and parity check bits are randomly arranged then it is said to be non-systematic codes.

54. What is a Repetition code?

A single message bit is encoded in to a block of 'n' identical bits producing a (n, 1) block code. There are only two code words in the code.

- all-zero code word
- all-one code word

55. What is forward acting error correction method?

The method of controlling errors at the receiver through attempts to correct noise-induced errors is called forward acting error correction method.

56. What is error detection?

The decoder accepts the received sequence and checks whether it matches a valid message sequence. If not, the decoder discards the received sequence and notifies the transmitter (over the reverse channel from the receiver to the transmitter) that errors have occurred and the received message must be retransmitted. This method of error control is called error detection.

57. Define linear block code?

If each of the 2^k code words can be expressed as linear combination of 'k' linearly independent code vectors then the code is called linear block code.

58. Give the properties of syndrome in linear block code.

- The syndrome depends only on the error patterns and not on the transmitted code word.
- All error patterns that differ by a code word have the same syndrome.

59. What is Hamming code?

This is a family of (n, k) linear block code.

Block length: $n = 2^m - 1$

Number of message bits: $k = 2^m - m - 1$

Number of parity bits: $n - k = m$

Where $m \geq 3$ and m should be any positive integer.

60. When a code is said to be cyclic?

- Linearity property

  The sum of any two code words in the code is also a code word.
- Cyclic property

  Any cyclic shift of a code word in the code is also a code word.

61. Give the difference between linear block code and cyclic code.

- Linear block code can be simply represented in matrix form
- Cyclic code can be represented by polynomial form

62. What is generator polynomial?

Generator polynomial g (x) is a polynomial of degree n-k that is a factor of $X^n + 1$, where g (x) is the polynomial of least degree in the code. g(x) may be expanded as

$$g(x) = 1 + \sum_{i=1}^{n-k-1} g^i X_i + X^{n-k}$$

Where the coefficient g_i is equal to 0 (or) 1. According to this expansion the polynomial g (x) has two terms with coefficient 1 separated by n-k-1 terms.

63. What is parity check polynomial?

Parity check polynomial h (x) is a polynomial of degree 'k' that is a factor of $X^n + 1$, where h (x) is the polynomial of least degree in the code. h(x) may be expanded as

$$h(x) = 1 + \sum_{i=1}^{k-1} h^i X_i + X^k$$

Where the coefficient h_i is equal to 0 (or) 1. According to this expansion the polynomial h (x) has two terms with coefficient 1 separated by k-1 terms.

64. How will you convert a generator polynomial into a generator matrix?

$g(x), xg(x), x^2g(x), \ldots\ldots\ldots\ldots\ldots, x^{k-1} g(x)$

65. How will you convert parity check polynomial into a parity check matrix?

$X^k h(x^{-1})$

.

66. How a syndrome polynomial can be calculated?

The syndrome polynomial is a remainder that results from dividing r(x) by the generator polynomial g(x).

$R(x) = q(x)\, b(x) + S(x)$

67. Give two properties of syndrome in cyclic code.

- The syndrome of a received word polynomial is also the syndrome of the corresponding error polynomial.
- The syndrome polynomial S(x) is identical to the error polynomial e(x).

68. Define Hamming distance (HD)?

The number of bit position in which two adjacent code vectors differs is known as Hamming distance.

(e.g) if c_1 = 1 0 0 1 0 1 1 0 and c_2 = 1 1 0 0 1 1 0 1

then HD = 5

69. Define Weight of a code vector?

The number of non-zero components in a code vector is known as weight of a code vector.

(e.g) if c_1 = 1 0 0 1 0 1 1 0

then W(c1) = 4

70. Define minimum distance?

The minimum distance of a linear block code is the smallest hamming distance between any pairs of code words in a code.

(e.g)

if c_1 = 0 0 1 1 1 0

c_2 = 0 1 1 0 1 1

c_3 = 1 1 0 1 1 0

$d_{min} = 3$

71. What is coset leader?

A Coset leader is an error pattern with 2^{n-k} possible cosets.

72. What is convolutional code?

A convolutional code in which parity bits are continuously interleaved by information (or) message bits.

73. Define constraint length?

The constraint length (K) of a convolutional code is defined as the number of shifts a single message bit to enter the shift register and finally comes out of the encoder output.

$$K = M + 1$$

74. What is meant by tail of a message?

The number of zero's that is appended to the last input of the message sequence (i.e.) K-1 zero's is called the tail of the message.

75. What is state diagram?

The state diagram is simply a graph with possible states of the encoder and possible transitions from one state to another.

76. What is trellis diagram?

A trellis is a tree like structure with remerging branches. While drawing the trellis diagram we use the convention that a solid line denotes the output generated by the input bit 0 and the dotted line denotes the output generated by the input bit 1.

UNIT IV

77. How compression is taken place in text and audio?

In text the large volume of information is reduced, where as in audio the bandwidth is reduced.

78. Specify the various compression principles?

- Source encoders and destination decoders
- Loss less and lossy compression
- Entropy encoding
- Source encoding

79. What is the function of source encoder and destination decoder?

The compression algorithm is the main function carried out by source encoder and the destination decoder carries out the decompression algorithm.

80. What is lossy and loss less compression?

The Compressed information from the source side is decompressed in the destination side and if there is loss of information then it is said to be lossy compression.

The Compressed information from the source side is decompressed in the destination side and if there is no loss of information then it is said to be loss less compression. Loss less compression is also known as reversible.

81. Define run-length encoding?

This can be used for long sub strings of the same character or binary digits.

(e.g) 00000001111111110000011……..

This can be represented in run-length as:

0,7,1,10,0,5,1,2…….

82. Define statistical encoding?

Statistical encoding is used for a set of variable length code words, in which shortest code words are represented for frequently occurring symbols (or) characters.

83. Define Differential encoding?

Differential encoding is used to represent the difference in amplitude between the current value/signal being encoded and the immediately preceding value/signal.

84. Define transform coding?

This is used to transform the source information from spatial time domain representation into frequency domain representation.

85. Define spatial frequency?

The rate of change in magnitude while traversing the matrix is known as spatial frequency.

86. What is a horizontal and vertical frequency component?

If we scan the matrix in horizontal direction then it is said to be horizontal frequency components.

If we scan the matrix in Vertical direction then it is said to be vertical frequency components.

87. Define static and dynamic coding?

After finding the code words these code words are substituted in a particular type of text is known as static coding.

If the code words may vary from one transfer to another then it is said to be dynamic coding.

88. Define Huffman tree?

A Huffman tree is a binary tree with branches assigned the value 0 (or) 1. The base of the tree is known as root node and the point at which the branch divides

is known as branch node. The termination of the branch is known as leaf node to which the symbols being encoded are assigned.

89. Let us consider the codeword for A is 1, the codeword for B is 01,the codeword for c is 001 and the codeword for D is 000. How many bits needed for transmitting the text AAAABBCD.

    4 * 1 + 2 * 2 + 1 * 3 + 1 * 3 = 14 bits

90. Give two differences between Arithmetic coding and Huffman coding.
    - The code words produced by arithmetic coding always achieve Shannon value
    - The code words produced by Huffman coding gives an optimum value.
    - In arithmetic coding a single code word is used for each encoded string of characters.
    - In Huffman coding a separate codeword is used for each character.

91. Define GIF?

    Graphics interchange format. It is used extensively with the Internet for the representation and compression of graphical images. Color images can be represented by means of 24-bit pixels. Each 8-bit corresponds to R, G and B.

92. What is global and local color table?

    If the whole image is related to the table of colors then it is said to be global color table.

    If the portion of the image is related to the table of colors then it is said to be local color table.

93. Define TIFF?

    Tagged image file format. Color images can be represented by means of 48 bits. Each 16-bits corresponds to R, G and B.TIFF is used for transferring both images and digitized documents. Code numbers 2,3,4,5 were used.

94. Define termination code and Make-up code table?

    Code words in the termination-code table are for white (or) black run lengths of from 0 to 63 pels in steps of one pel.

    Code words in the Make up-code table are for white (or) black run lengths that are multiples of 64 pels.

95. Define Over scanning?

    Over scanning means all lines start with a minimum of one white pel. Therefore the receiver knows the first codeword always relates to white pels and then alternates between black and white.

96. What is modified Huffman code?

    If the coding scheme uses two sets of code words (termination and make up). They are known as Modified Huffman codes.

97. What is one-dimensional coding?

If the scan line is encoded independently then it is said to be One-dimensional coding.

98. What is two-dimensional coding?

Two-dimensional coding is also known as Modified Modified Read (MMR) coding. MMR identifies black and White run lengths by comparing adjacent scan lines.

99. Define pass mode?

If the run lengths in the reference line (b_1b_2) is to the left of the next run-length in the coding line (a_1a_2) (i.e.) b_2 is to the left of a_1, then it is said to be pass mode.

100. Define Vertical mode?

If the run lengths in the reference line (b_1b_2) overlap the next run-length in the coding line (a_1a_2) by a maximum of plus or minus 3 pels, then it is said to be vertical mode.

100. Define Horizontal mode?

If the run lengths in the reference line (b_1b_2) overlap the next run-length in the coding line (a_1a_2) by more than plus or minus 3 pels, then it is said to be horizontal mode.

UNIT V

101. What is LPC?

Linear predictive coding

The Audio waveform is analyzed to determine a selection of the perceptual features it contains. These are then quantized and sent and the destination used them, together with a sound synthesizer, to regenerate a sound that is perceptually comparable with the source audio Signal. This is the basis of linear predictive coding.

102. What are Vocal tract excitation parameters?

The origin, pitch, period and loudness are known as vocal tract excitation parameters

103. Give the classification of vocal tract excitation parameters

- Voiced sounds
- unvoiced sounds

104. What is CELP?

CELP – code excited Linear Prediction

In this model, instead of treating each digitized segment independently for

encoding purpose, just a limited set of segments is used, each known as waveform template.

105. What are the international standards used in code excited LPC?

ITU-T Recommendations

G.728
G. 729
G. 7.29(A) and
G. 723.1

106. What is processing delay?

All coders have a delay associated with them which is incurred while each block of digitizer samples is analyzed by the encoder and the speech is reconstructed at the decoder. The combined delay value is known as the code's processing delay.

107. What is perceptual coding?

Perceptual encoders are designed for the compression of general audio such as that associated with a digital television broadcast. This process is called perceptual coding.

108. What is algorithmic delay?

Before the speech samples can be analyzed, it necessary to store the block of samples in memory (i.e.) in buffer. The time taken to accumulate the block of samples in memory is known as algorithmic delay.

109. What is called frequency masking?

When multiple signals are present as in the case with general audio a strong signal may reduce the level of sensitivity of the ear to other signals, which are near to it in frequency. This effect is known as frequency masking.

110. What is temporal masking?

After the ear hears a loud sound, it takes a further short time before it can hear a quieter sound. This is known as temporal masking.

111. What is called critical bandwidth?

The width of each curve at a particular signal level is known as the critical bandwidth. For that frequency and experiments have shown that for frequencies less than 500 HZ, the critical bandwidth remains constant at about 100 HZ.

112. Define dynamic range of a signal?

Dynamic range of a signal is defined as the ratio of the maximum amplitude of the signal to the minimum amplitude and is measured in decibels (db)

113. What is MPEG?

MPEG-Motion Pictures Expert Group (MPEG)

MPEG was formed by the ISO to formulate a set of standards relating to a range of multimedia applications that involves the use of video with sound

114. What is DFT?

DFT-Discrete Fourier transforms

DFT is a mathematical technique by which the 12 sets of 32 PCM samples are first transformed into an equivalent set of frequency components.

115. What are SMRs?

SMRs – Signal to Mask Ratios

SMRs indicate those frequency components whose amplitude is below the related audible threshold

116. What is meant by AC in Dolby AC-1?

AC Acoustic coder. It was designed for use in satellites to relay FM radio programs and the sound associated with television programs.

117. What is meant by the backward adaptive bit allocation mode?

The operation mode in which, instead of each frame containing bit allocation information in addition to the set of quantized samples it contains the encoded frequency coefficients that are present in the sampled waveform segment. This is known as the encoded spectral envelope and this mode of operation is the backward adaptive bit allocation mode

118. List out the various video features used in multimedia applications.

a. Interpersonal - Video telephony and video conference
b. Interactive – Access to stored video in various forms
c. Entertainment – Digital television and movie/video – on demand

119. What does the digitization format define?

The digitization format defines the sampling rate that is used for the luminance y and two chrominance C_b and C_r, signals and their relative position in each frame

120. What is SQCIF?

SQCIF – Sub Quarter Common Intermediate Format.

It is used for video telephony, with 162 Mbps for the 4:2:0 format as used for digital television broadcasts.

121. What is motion estimation and motion compensation?

The technique that is used to exploit the high correlation between successive frames it to predict the content of many of the frames. The accuracy of the prediction operation is determined by how well any movement between successive frames is estimated. This operation is known as motion estimation

If the motion estimation process is not exact, so additional information

must also be sent to indicate any small differences between the predicted and actual positions of the moving segments involved. This is known as motion compensation.

122.What are intracoded frames?

Frames that encoded independently are called intracoded frames or I-frames

123. Define GOP?

GOP- group of pictures.

The number of frames/pictures between successive I- frames is known as a group of pictures.

124. What is a macro block?

The digitized contents of the Y matrix associated with each frame are first divided into a two dimension matrix of 16 x 16 pixels known as a macro block.

125. What is H.261?

H.261 video compression standard has been defined by the ITU-T for the provision of video telephony and video conferencing over an ISDN.

126.What is GOB?

GOB- Group of blocks

Although the encoding operation is carried out on individual macro blocks, a large data structure known as a group of block is also defined.

127. What is error tracking?

In the error tracking scheme, the encoder retains what is known as error predication information for all the GOBs in each of the most recently transmitted frames, that is, the likely spatial and temporal effects on the macro blocks in the flowing frames that will result of a specific GOB in a frame is corrupted.

128.What are AVOs and VOPs?

AVOs- Audio Visual Objects

VOPs- Video Objects Planes

129. What is the difference between MPEG and other standard.

Difference between MPEG-4 and other standard is that MPEG-4 has a number of content based functionalities.

130.What are blocking artifacts?

The high quantization threshold leads to blocking artifacts which are cause by the macro block encoded using high thresholds differing from those quantized using lower thresholds.

PART B

UNIT I

21. Problems using Huffman coding.

There are three phases

- Generation of Huffman code
  - Arrange the given source symbols in descending order with respect to its probability
  - If it is a binary Huffman Huffman coding add the last source values into a single unit and plac a new column with other values.
  - Once again arrange the source values n decreasing order as obtained in step 2.
  - Continue the process until only 2 source symbols are left.
  - Start assigning codes (0,1) in the backward direction towards the initial stage.
    - Determination of $H(\mathfrak{I})$ and $\bar{L}$
    - Check the condition for validity by using source coding theorem. If the condition satis calculate coding efficiency and code redundancy.

22. Problems using Shanno-Fano coding.

- There are three phases
  - Generation of Shanno-Fano code
    - (i) List the source symbols in descending order with respect to its probability
    - (ii) Partition the symbol (or) sample (or) ensemble into almost equi-probable groups.
    - (iii) Assign '0' to one group and '1' to the other group.
    - (iv) Repeat steps (ii) and (iii) on each of the subgroups until only one source sy is left
    - (v) Determination of $H(\mathfrak{I})$ and $\bar{L}$
    - (vi) Check the condition for validity by using source coding theorem. If the condition satisfies calculate coding efficiency and code redundancy.

23. Problems using extension property.

- Calculate the entropy of the source.

  If it is a second order extension then $H(\mathfrak{I}^2) = 2 * H(\mathfrak{I})$

  If it is a third order extension then $H(\mathfrak{I}^3) = 3 * H(\mathfrak{I})$

24. Problems for calculating all entropies.

- Calculate source entropy $H(\mathfrak{X})$
- Calculate destination entropy $H(\mathfrak{Y})$
- Calculate Joint entropy $H(\mathfrak{X}, \mathfrak{Y})$
- Calculate Conditional entropy $H(\mathfrak{X} / \mathfrak{Y})$
- Calculate Conditional entropy $H(\mathfrak{Y} / \mathfrak{X})$

Check by entropy in-equalities

- $0 \le H(\mathcal{X} / \mathcal{Y}) \le H(\mathcal{X})$
- $0 \le H(\mathcal{Y} / \mathcal{X}) \le H(\mathcal{Y})$
- $H(\mathcal{X}, \mathcal{Y}) \le H(\mathcal{X}) + H(\mathcal{Y})$
-

25. Write the properties of mutual information?

- Mutual information of a channel is symmetric

$$I(\mathcal{X}; \mathcal{Y}) = I(\mathcal{Y}; \mathcal{X})$$

- Mutual information is always non-negative

$$I(\mathcal{X}; \mathcal{Y}) \ge 0$$

- Mutual information is related to joint entropy

$$I(\mathcal{X}; \mathcal{Y}) = H(\mathcal{X}) + H(\mathcal{Y}) - H(\mathcal{X}, \mathcal{Y})$$

UNIT II

26. Explain in detail about Quantization?

- Quantization
- Quantization error
- Uniform Quantization
- Non-uniform Quantization
- Mid rise Quantization
- Mid tread Quantization

27. Explain in detail about PCM and DPCM?

PCM

- Block diagram for transmitter and receiver
  - On – Off Signaling
  - Return to zero signaling
  - Non Return to Zero signaling
- Transmission path (Regenerated Repeaters)
  - Equalization
  - Timing circuit
  - Decision making device

DPCM

- Block diagram for transmitter and receiver
- Working principle by prediction

28. Explain in detail about delta modulation and Adaptive delta modulation?

- Block diagram for transmitter and receiver
- Delta modulator response
- Hunting
- Slope overloading
- Block diagram for Adaptive delta modulation

29. Explain how 8 bits per samples is reduced into 4 bit per samples?
    - Block diagram for Adaptive quantization with forward estimation
    - Block diagram for Adaptive quantization with backward estimation
    - Block diagram for Adaptive prediction with forward estimation
    - Block diagram for Adaptive prediction with backward estimation

30. Explain Adaptive sub band coding?
    - Block diagram of ASBC encoder
    - Block diagram of ASBC decoder

UNIT III

31. Explain Linear Block Code?
    - Derivation of linear block code
    - Generator Matrix
    - Parity check matrix
    - Syndrome decoding
        - Properties of syndrome

32. Explain cyclic code?
    - Derivation of Cyclic codes
    - Generator polynomial
    - Parity check polynomial
    - Syndrome polynomial
        - Properties of syndrome

33. Explain Convolutional codes?
    - Design the convolutional encoder with the following concepts
        - M-stage shift register
        - n modulo-2 adders
        - Constraint length
        - Code rate
        - Generator polynomial

34. Write the procedures for designing an Encoder circuit?
    - Multiplication of the message polynomial m (x) by x^{n-k}
    - Division of x^{n-k} m (x) by the generator polynomial g (x) to obtain the remainder b (x) and
    - Addition of b (x) to x^{n-k} m (x) to form the desired code polynomial.

    To implement all such procedures we need the following requirements

    Flip- flops
    Modulo – 2 adders
    Gate

Switch

With the gate turned on and the switch is in position 1, the information digits are shifted into the register and simultaneously into the communication channel. As soon as the 'k' information digits have been shifted into the register the register contains the parity check bits.

With the gate turned off and the switch is in position 2 the contents of the shift register are shifted into the channel.

35. Write the procedures for designing a syndrome calculator circuit?

To implement all such procedures we need the following requirements

Flip- flops
Modulo – 2 adders
Gate
Switch

This is identical to the encoder circuit except that the received bits are fed into the (n-k) stages of the feed back shift register from the left with gate 2 open and gate 1 is closed. As soon as all the received bits have been shifted into the shift register the contents of the shift register defines the syndrome s.

UNIT IV

36. . Explain various compression principles?

- Source encoders and destination decoders
- Loss less and lossy compression
- Entropy encoding
  - Run-length encoding
  - Statistical encoding
- Source encoding
- Differential encoding
- Transform encoding
-

37. Explain Static and Dynamic Huffman coding?

Static Huffman coding
- Root node, Branch node and Leaf node
- Figure for tree creation

Dynamic Huffman coding
- Both transmitter and receiver has a single empty leaf node
- Read the first character
- Since the tree is initially empty ASCII representation of the first character is sent.
- Immediately the character is assigned in the tree

- Check whether the tree is optimum (or) not
- If it is not optimum, the nodes are rearranged to satisfy the optimum condition
-For each subsequent character the encoder checks whether the character is already present in the tree or not.
- If it is present, the corresponding code word is send
-If it is not present, the encoder sends the current code word for the empty leaf
- This is taken place in the decoder side also.

38. Explain digitized documents?
- Termination code table
- Make up code table
- Modified Huffman table
- Over scanning
- One-dimensional coding
- Two-dimensional coding
- Types of modes
  - Pass mode
  - Vertical mode
  - Horizontal mode

39. Explain the various stages of JPEG?
- Image / Block preparation
- Forward DCT
- Quantization
- Entropy Encoding
  - Vectoring
  - Differential encoding
  - Run-length encoding
  - Huffman encoding
- Frame building
- JPEG decoding

40. Write short notes on GIF and TIFF

GIF

- Graphics interchange format
- Color images can be represented by 24-bit pixels
- Global color table
- Local color table
- Extending the table by using Lempel-Ziv coding algorithm
- Interlaced mode

TIFF

- Tagged Image File Format

- Used in images and digitized documents
- Represented by 48-bit pixels
    - Code numbers are used

UNIT V

41. Explain linear predictive coding and Code excited linear predictive coding?

LPC

- Perceptual features
    - Pitch
    - Period
    - Loudness
    - Origin
- Vocal tract excitation parameters
    - Voiced sounds
    - Unvoiced sounds
- Diagram for LPC encoder and decoder

CELP

- Enhanced excitation model
- Used in Limited bandwidth
- Waveform template
- Template codebook
- ITU - T Recommendation standards
- Processing delay
- Algorithmic delay
- Look ahead

42. Explain Video compression principles?

- Frame types
    - I Frames
    - P frames
    - B frames
    - PB frames
    - D frames
- Motion estimation
- Motion compensation

43. Explain MPEG audio coders and DOLBY audio coders?

MPEG audio coders

- Diagram for encoding operation
- Diagram for decoding operation

DOLBY audio coders

- Forward adaptive bit allocation
- Fixed bit allocation
- Backward adaptive bit allocation
- Hybrid backward/forward adaptive bit allocation

44. Write short notes on H.261?

- Macro block format
- Frame/picture format
- GOB structure

45. Explain in detail about MPEG?

MPEG - 1

- MPEG – 1 frame sequence
- MPEG – 1 Video bit stream structure

MPEG – 2

- HDTV
- MP@ML

MPEG – 4

- Content based functionalities
- AVO's
- VOP's