**1. Mention is the properties of cyclic codes**

**Linearity property**

The sum of any two code word is also a valid code word

**Cyclic property**

Every cyclic shift of a valid code vector produces another valid code vector.

**2. Define hamming distance.**

The hamming distance between two code vectors is equal to the number of elements in which they differ. For example, let the two code words be,

X = (101) and Y= (110) These two code words differ in second and third bits. Therefore the hamming distance between X and Y is two.

**3. What is meant by transparency with respect to line codes**

The line code is said to be transparent if the synchronization between the transmitter and receiver is maintained for any type of input data sequence.

**4. Define hamming distance and calculate its value for two code words 11100 and 11011**

The hamming distance between two code vectors is equal to the number of elements in which they differ. For example, let the two code words be,

X = (11100) and Y= (11011)

D= 2 These two code words differ in second and third bits. Therefore the hamming distance between X and Y is two.

**5.** **What is convolution code? How is it different from block codes?**

Fixed number of input bits is stored in the shift register & they are combined with the help of mod 2 adders. This operation is equivalent to binary convolution coding.

**6.** **State any four desirable properties of line code**

              The PAM signal should have adequate timing content,

              The PAM signal should immune to channel noise and interference

              The PAM signal should allow error detection and error correction

              The PAM signal should be transparent to digital data being transmitted

**7.** **Find the hamming distance 101010 and 010101.If the minimum hamming distance of a (n,k) linear block code is 3, what is its minimum hamming weight?**

d(x1,x2)=x1 exor x2 =111111

d(x1,x2)=6

Dmin=3 then Wmin=dmin=3

**8. What is meant by syndrome of linear block code?**

The non zero output of the produce YHT is called syndrome & it is used to detect errors in y. Syndrome is denoted by S & given as,

S=YHT

**9. What is convolutional code? Explain the fundamental difference between block codes and convolutional codes.**

Block codes takes‟k‟ number of bits simultaneously form „n‟-bit code vector. This code vector is also called block. Convolutional code takes one message bits at a time and generates two or more encoded bits. Thus convolutional codes generate a string of encoded bits for input message string.

**10. What is hamming distance?**

The hamming .distance .between .two code vectors .is equal to the number .of elements in which they differ. For example, let the two code words be,

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These .two code words differ in second and third bits.Therefore .the .hamming distance between X and Y is two.

**11. Define code efficiency.**

The code efficiency is the ratio of message bits in a block to the transmitted bits for that block by the encoder i.e.

Code efficiency= (k/n)

k=message bits

n=transmitted bits.

**12.**      **What are the error detection and correction capabilities of hamming codes ?**

The minimum distance (dmin) of hamming codes is „3‟. .Hence it can be used to detect double errors or correct single errors. Hamming codes are basically linear block codes with dmin =3.

**13.**      **What is meant by linear code?**

A code is linear if modulo-2 sum of any two code vectors produces another code vector. This means any code vector can be expressed as linear combination of other code vectors.

**14. What is meant by cyclic codes?**

Cyclic codes are the subclasses of linear block codes. They have the property that a cyclic shift of one codeword produces another code word.

**15. How syndrome is calculated in Hamming codes and cyclic codes?**

In hamming codes the syndrome is calculated as,

S=YHT

Here Y is the received and H.is the transpose of parity check matrix

**16. What is difference between block codes and convolutional codes?**

 Block codes takes‟k‟ number of bits simultaneously form „n‟-bit .code vector. This code vector is also called block. Convolutional code takes one message bits at a time and generates two or more encoded bits. Thus convolutional codes generate a string of encoded bits for input message string.

**17.** What is meant by constraint length and code rate of a convolution code?

**Constrain Length**: For an (n,k,L) convolution code, the quantity n(L+1) is referred as constrain length. It represents the number of successive encoded bits influenced by each message bit.

**Code Rate**: For an (n,k,L) convolution code, Code rate is given by

r= k/n(k+L)

**18. Describe the BCH Code.**

Common binary BCH codes known as primitive BCH codes are characterized by

Block length n=2m-1

No. of message bits k<= n-mt where m>=3 and t<(2m-1)/2

Min distance dmin>=2t+1

**19. Define Hamming code.**

It is an (n, k) linear block code that has the following parameters and it is a single bit error

Correction code.

Block length n=2m-1

No. of message bits k=2m-1-m

No. of parity bits=(n,k)

**20. Define Code Rate and Channel data rate.**

**Code rate** of an (n,k) block code is the ratio of number of message bits to number of bits in a code word is

Code rate=k/n=r and 0<r<1

**Channel data rate:** if the source rate is Rs and an(n,k) block code encoder supplies data to the channel,

the channel data rate =(n/k)Rs