EC6501-DIGITAL COMMUNICATION

TWO MARK QUESTION WITH ANSWER

UNIT I SAMPLING & QUANTIZATION

1. Define Nyquist rate.

Let the signal be bandlimited to „W‟ Hz. Then Nyquist rate is given as,

Nyquist rate = 2W samples/sec

Aliasing will not take place if sampling rate is greater than Nyquist rate

2. What is meant by aliasing effect?

Aliasing .effect .takes .place .when .sampling .frequency .is .less .than .Nyquist .rate. Under .such .condition, .the .spectrum .of .the .sampled .signal .overlaps .with .itself. Hence higher frequencies take the form of lower frequencies. This interference of the frequency components is called as aliasing effect.

3. Define PWM.

PWM is basically pulse width modulation. Width of the pulse changes according to amplitude of the modulating signal. It also referred as pulse duration modulation or PDM.

4. State Sampling theorem.

A bandlimited signal of finite energy, which has no frequency components higher than W Hz, may be completely recovered from the knowledge of its samples taken at the rate of 2W samples per second.

5. How the message can be recovered from PAM?

The .message .can .be .recovered .from .PAM .by .passing .the .PAM .signal .through reconstruction filter integrates amplitude of PAM pulses. Amplitude reconstruction signal is done to remove amplitude discontinuities due to pulses.

6. Write an expression for bandwidth of binary PCM with N messages each with a maximum frequency of *fm* Hz.

If „v‟ number of bits are used to code each input sample, then bandwidth of PCM is given as,

$BT \geq N.v.fm$

Here v. *fm* is the bandwidth required by one message.

8. How is PDM wave converted into PPM message?

The .PDM .is .signal .is .clock .signal .to .monostable .multivibrator. The .multivibraor triggers on falling edge. Hence a PPM pulse of fixed width is produced after falling

edge of PDM pulse. PDM represents the input signal amplitude in the form of width of the pulse. A PPM pulse is produced after the width of PDM pulse. In other words,

the position of the PPM pulse depends upon input signal amplitude.

9. Mention the use of adaptive quantizer in adaptive digital waveform co d ing schemes.

Adaptive quantizer changes its .step .size .according variance of .the .input signal.

Hence quantization error is significantly reduced due to the adaptive quantization. ADPCM uses adaptive quantization. The bit rate of such schemes is reduced due to

adaptive quantization.

10. What do u understand from adaptive coding?

In adaptive coding, the quantization step size and prediction filter coefficients are changed as per properties of input signal. This reduces the quantization error and number of bits to represent the sample value. Adaptive coding is used for speech coding at low bits rates.

11. What is meant by quantization?

While converting the signal value from analog to digital, quantization is performed.

The .analog value is assigned to nearest digital value. This is called quantization.

The . quantized .value .is .then .converted .into .equivalent .binary .value. .The quantization levels are fixed depending upon the number of bits. Quantization is

performed in every Analog to Digital Conversion.

12. The signal to quantization noise ratio in a PCM system depends on what criteria?

The signal to quantisation noise ratio in PCM is given as, $(S/N)db \leq (4.8+6v)$dB

Here v is the number of bits used to represent samples in PCM. Hence signal to quantization noise ratio in PCM depends upon the number of bits or quantization levels

UNIT II WAVEFORM CODING

1. Mention the merits of DPCM.

1 .Bandwidth requirement of DPCM is less compared to PCM.

2. .Quantization error is reduced because of prediction filter

3. .Numbers .of bits used to represent .one sample .value are also reduced compared to PCM.

2. What is the main difference in DPCM and DM?

DM encodes the input sample by one bit. It sends the information about + δ or -δ, ie step rise or fall. DPCM can have more than one bit of encoding the sample. It sends the information .about difference .between .actual sample value and the predicted sample value.

3. What is meant by adaptive delta modulation?

In adaptive delta modulation, the step size is adjusted as per the slope of the input signal. Step size is made high if slope of the input signal is high. This avoids slope overload distortion.

4. What is the advantage of delta modulation over pulse modulation schemes?

Delta modulation encodes one bit per samples. Hence signaling rate is reduced in DM

5. What should be the minimum bandwidth required to transmit a PCM Channel?

The minimum transmission bandwidth in PCM is given as,

$B_T = vW$

Here v is the number of bits used to represent one pulse.

W is the maximum signal frequency.

6. What is the advantage of delta modulation over PCM?

Delta .modulation .uses .one .bit .to .encode .on sample. .Hence .bit .rate .of .delta modulation is low compared to PCM.

7. What are the two limitations of delta modulation?

1 Slope of overload distortion.

2. Granular noise.

8. How does Granular noise occurs?

It occurs due to large step size and very small amplitude variation in the input signal.

9. What are the advantages of the Delta modulation?

1 Delta modulation transmits only one bit for one sample. Thus the signalling rate and transmission channel bandwidth is quite small for delta modulation.

2. .The .transmitter .and .receiver .implementation .is .very .much .simple .for .delta modulation. There is no analog to digital converter involved in delta modulation.

UNIT III BASEBAND TRANSMISSION

1. What is intersymbol interference in baseband binary PAM systems?

In .baseband .binary .PAM, .symbols .are .transmitted .one .after .another. .These symbols are separated by sufficient time durations. The transmitter, channel and receiver .acts .as .a .filter .to .this .baseband .data. .Because .of .the .filtering characteristics, transmitted PAM pulses are spread in time.

2. What is correlative coding?

Correlative level coding is used to transmit a baseband signal with the signalling rate of 2Bo over the channel of bandwidth Bo. This is made physically possible by allowing ISI in the transmitted in controlled manner. This ISI is known to receiver. .The .correlative .coding .is .implemented .by .duobinary .signalling .and modified duobinary signalling.

3. **Define Duobinary baseband PAM systemK**

Duobinary encoding reduces the maximum frequency of the baseband signal.

The word „duo" means to double the transmission capacity of the binary system.

Let the PAM signal ak represents kth bit. Then the encoder the new waveform as

C*k* =a*k* + ak-1

Thus two successive bits are added to get encoded value of the kth bit. Hence Ck becomes a correlated signal even though a*k* is not correlated. This introduces intersymbol interference in the controlled manner to reduce the bandwidth.

4. What are eye pattern?

Eye pattern is used to study the effect of ISI in baseband transmission.

1) Width of .eye .opening defines the .interval over .which the .received wave can be sampled without error from ISI.

2.) The sensitivity of the system to timing error is determined by the rate of closure of the eye as the sampling time is varied.

3.) Height of the eye opening at sampling time is called margin over noise

5. How is eye pattern obtained on the CRO?

Eye pattern can be obtained on CRO by applying the signal to one of the input channels and given an external trigger of 1/T*b* Hz. This makes one sweep of beam equal to T*b*seconds.

6. Why do you need adaptive equalization in a switched telephone network.

In switched telephone network the distortion depends upon

1) Transmission characteristics of individual links.

2) Number of links in connection.

Hence fixed pair of transmit and receive filters will not serve the equalization

problem. The transmission characteristics keep on changing. Therefore adaptive equalization is used.

7 .What are the necessity of adaptive equalization?

Ans. Most of the channels are made up of individual links in switched telephone

network,the distortion induced depends upon

1) transmission characteristics of individual links

2) number of links in connection

8. Define the principle of adaptive equalization?

Ans. The filters adapt themselves to the dispersive effects of the channel that

is .the .cofficients .of .the .filters .are .changed .contineously according to .the

received .data. .The .filter .cofficients .are .changed .in .such .a .way .that .the distortion in the data is reduced

9. Define duobinary encoding?

Ans. Duobinary encoding reduces the maximum frequency of the base band

signal the “word duo” means to the double transmission capacity of the binary system

10. Write a note on correlative level coding?

Correlative level coding .allows the signal scaling rate of 2Bo in the channel of bandwidth Bo this is made physically possible by allowing ISI in the

transmitted signal in controlled manner this ISI IS KNOWN TO THE RECEIVER

11. Define the term ISI?

Ans. The presence of outputs due to other bits interference with the output of

required bit . this effect is called inter symbol interference (ISI)

12. Write the performance of data transmission system using eye pa ttern technique?

Ans. The width of the eye opening defines .the interval over which the received wave can can be .sampled without error from inter symbol interference .

The sensitivity of the system to timing error is determined by the rate of closure of the eye as the sampling time is varied

13. What is the necessity of equalization?

Ans. When the signal is passed through the channel distortion is introduced in terms of 1) amplitude 2) delay this distortion creates problem of ISI. The

detection of the signal also become difficult this distraction can be compensated with the help of equalizer.

14. What is raised cosine spectrum?

In the raised cosine spectrum, the frequency response P(f) decreases towards zero gradually That is there is no abrupt transition).

15. What is nyquist Bandwidth?

The B.i0s called nyquist bandwidth. .The nyquist bandwidth is the minimum transmission bandwidth for zero ISI.

16. Mention the need of optimum transmitting and receiving filter in baseband data transmission.

When binary data is transmitted over the baseband channel, noise interfaces

with it. Because .of this noise interference, .errors .are introduced .in signal detection. .Optimum .filter performs .two functions .while receiving .the noisy

signal:

1) Optimum filter integrates the signal during the bit interval and checks the

output at the .time instant where signal to noise ratio is maximum

2) Transfer function of the optimum filter is selected so as to maximise signal to noise ratio.

3) Optimum filter minimizes the probability of error

UNIT IV DIGITAL MODULATION SCHEME

1. Define ASK.

In .ASK, carrier .is .switched on .when binary .1 .is .to .be .transmitted and .it .is

switched off when binary D is to be transmitted ASK is also called on-off keying.

2. What is meant by DPSK?

In DPSK, the input sequence is modified. Let input sequence be d(t) and output

sequence be b(t). Sequence b(t) changes level at the beginning of each interval

in which d(t)=1 and it does not changes level when d(t)=0.

When b(t) changes level, phase of the carrier is changed. And as stated above, b(t) changes t=its level only

when d(t) =1. This means phase of the carrier is changed only if d(t)=1. Hence the technique is called Differential PSK.

3. Explain coherent detection?

In coherent detection, the local carrier generated at the receiver is phase locked with the carrier at the transmitter. The detection is done by correlating received noisy .signal .and .locally .generated .carrier. .The .coherent .detection .is .a synchronous detection.

4. What is the difference between PSK and FSK?

In PSK, phase of the carrier is switched according to input bit sequence. In FSK frequency of the carrier is switched according to input bit sequence. FSK needs double of the bandwidth of PSK.

5. What is meant by coherent ASK?

In coherent .ASK, correlation .receiver .is used to detect .the signal. .Locally generated carrier is correlated with incoming ASK signal. The locally generated carrier is in exact phase with the transmitted carrier. Coherent ASK is also called as synchronous ASK.

6 . What is the major advantage of coherent PSK over coherent ASK?

ASK .is .on-off .signalling, .where .as .the .modulated .carrier .is .continuously transmitted in PSK. Hence peak power requirement is more ASK, whereas it is reduced in case of PSK

7. Explain the model of bandpass digital data transmission system?

The bandpass digital data transmission system consists of source, encoder and modulator in the transmitter. Similarly receiver, decoder and destination form the transmitter.

8. What is baseband signal receiver?

A baseband signal receiver increases the signal to noise ratio at the instant of sampling. This reduces the probability of error. The baseband signal receiver is also called optimum receiver.

9. What is matched filter?

The matched filter is a baseband signal receiver, which works in presence of white Gaussian noise. The impulse response of .the matched response of .the matched filter is matched to the shape pf the input signal.

10. What is the value of maximum signal to noise ratio of the matched filter? When it becomes maximum?

Maximum signal to noise ratio is the ratio of energy to psd of white noise. i.e.,

$\rho max = E/ (N0/2)$

This maximum value occurs at the end of bit duration i.e. Tb

11. What is correlator ?

Correlator is the coherent receiver. It correlates the received noisy signal .f(t) with .the .locally .generated .replica .of .the .unknown .signal .x(t). .It‟ s output .is denoted as r(t).

12. On what factor, the error probability of matched filter depends.

Error probability is given as

Pe = 1/2erfc√E/N. o

This equation shows that error probability depends only on energy but not on shape of the signal.

13. Bring out the difference between coherent & non coherent binary modulation scheme.

a. Coherent detection:

In this method the local carrier generated at the receiver is phase locked with the carrier at the transmitter. Hence it is called synchronous detection

b. Non coherent detection:

In this method, the receiver carrier need not be phase locked with transmitter carrier. Hence it is called envelope detection.

14. Write the expression for bit error rate for coherent binary FSK. Bit error rate for coherent binary FSK is given as,

Pe = 1/2erfc√0.6E/N. o

15. Highlight the major difference between a QPSK & MSK signal.

MSK signal have continuous phase in all the cases, where as QPSK has phase shift of π/2 or π.

16. What is the error probability of MSK & DPSK?

Error probability of MSK: Pe = 1/2erfc√E/N. o

Error probability of DPSK: Pe = 1/2e -Eb/No

17. In minimum shift keying what is the relation between the signal frequencies & bit rate.

Let the bit rate be f b and the frequency of carrier be f. The h0igher and lower MSK signal frequencies are given as,

fH.= f.+0f./4 b fL.= f.-0f./4b

18. List the advantages of Passband transmission

a. Long distance.

b. Analog channels can be used for transmission.

c. Multiplexing techniques can be used for bandwidth conservation. d. Transmission can be done by using wireless channel also.

19. List the requirements of Passband transmission.

a. Maximum data transmission rate.

b. Minimum probability of symbol error.

c. Minimum transmitted power.

UNIT V ERROR CONTROL CODING

1.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,

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.

2. 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.

3. What is meant by systematic and non-systematic codes?

In a Systematic block code, message bits appear first and then check bits. In the non-systematic .code, .message .and .check .bits .cannot .be .identified .in .the .code vector.

4. 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.

5. What are the error detection and correction capabilities of hamming co d es ?

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.

6. 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.

7 . How syndrome is calculated in Hamming codes and cyclic codes?

In hamming codes the syndrome is calculated as, S=YH.T

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

8. What is BCH code?

BCH .codes .are .most .extensive .and .powerful .error .correcting .cyclic .codes. .The decoding of BCH codes is comparatively simpler. For any positive integer „m‟ and „t‟ (where t<2 m-1)there exists a BCH code with following parameters:

Block length: n= 2 m-1

Number of parity check bits : n-k<=mt

Minimum distance: d min>=2t+1

9. What is RS code?

These are non binary BCH codes. The encoder for RS code operates on multiple bits simultaneously. The (n, k) RS code takes the groups of m- bit symbols of incoming binary data stream. It takes such „k‟ number of symbols in one block. Then the encoder acts (n – k) redundant symbols to form the code word of „n‟ symbols

RS code has:

Block Length : n=2.-1msymbols

Message size: K symbols

Parity check size: n-k= 2t symbols

Minimum distance: dmin=2t+a symbols

10. 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.

11. Define constraint length in convolutional code?

Constraint length is the number of shift over which the single message bit can influence the encoder output. It is expressed in terms of message bits.

12. Define free distance and coding gain.

Free distance is the minimum distance between code vectors. It is also equal to minimum weight of the code vectors.

Coding gain is used as a basis of comparison for different coding methods. To achieve the same bit error rate the coding gain is defined as,

A= (E.b/N.)oencoded (E.b/N.)ocoded

For convolutional coding, the coding gain is given as,

A = rd./f2

Here „r‟ is the code rate

And „df is the free distance.

13. What is convolution code?

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.

14. What is meant by syndrome of linear block code?

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

S=YH T

15. What are the advantages of convolutional codes?

Advantages:

1 .The decoding delay is small in convolutional codes since they operate o smaller blocks of data.

2. .The storage hardware required by convolutional decoder is less since the block sizes are smaller.

Disadvantages:

1 .Convolutional codes are difficult to analyze since their analysis is complex.

2. .Convolutional codes are not developed much as compared to block codes.

16. Define sates of encoder?

The constraint length of the given convolutional encoder is K=2. Its rate is

½ means for single message bit .input, two bits .x1 and x2 .are encoded at the output. .„S 1‟ represents the input message bit and S.stores the2 previous message bit. .Since only one previous message bit is stored, .this encoder can have states depending upon this stored message bit. .Let‟ s represent,

S.2= 0

and S.2= 1 state „b‟

state „a‟

Sr. No.	*Code tree*	Trellis diagram
1	Code tree indicates flow of the coded signal along the nodes of the tree	Trellis diagram indicates transitions from current to next states
2	Code tree is lengthy way of representing coding process	Code trellis diagram is shorter or compact way of representing coding process

17. Compare between code tree and trellis diagram?

18. Write the futures of BCH Codes?

BCH codes are most extensive and powerful error correcting cyclic codes. The

decoding of BCH codes is comparatively simpler.

Th e decoding schemes of BCH codes can be implemented on digital

co mputer. Because of software implementation of decoding schemes they a re quite flexible

compared to hardware implementation of other schemes.

19. What is Golay codes?

Golay code is the (23,12) cyclic code whose generating polynomial is, G(p) = p.+1p1.+p.9+p.+7p.+6p+1

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This code has minimum distance of d min= 7. This code can correct upto 3 errors. But Golay code cannot be generalized to other combinations of n and k.

20. Define constraint length in convolutional codes?

Constraint length is the number of shifts over which the single message bit can influence the encoder output. .This expressed in terms of message bits.

16 MARKS

1. Derive the power spectral Density of a Synchronous Data pulse stream generated by a Binary, Zero mean, Wide Sense Stationary Sequence.

i. Define mean. Auto correlation and wide sense stationary

ii. Derive the expression of (Sa) f

iii. Derive the expression of (Sp) f

iv. Combine the values of (Sa) f and (Sp) f

v. Make the necessary approximations.

2. Derive the power spectral Density of a Synchronous Data pulse stream generated by a Binary, Zero mean, Cyclostationary Sequence.

i. Define mean. Auto correlation and Cyclostationary

ii. Derive the expression of (Sa) f

iii. Derive the expression of (Sp) f

iv. Combine the values of (Sa) f and (Sp) f

v. Make the necessary approximations.

3. Derive the power spectral Density of a Generalized M-ary Markov Source

i. Define mean. Auto correlation and Markov source

ii. Derive the expression of (Sa) f

iii. Derive the expression of (Sp) f

iv. Combine the values of (Sa) f and (Sp) f

v. Make the necessary approximations.

4. Explain in detail about scalar communication and obtain the probability of Mary Scalar Receiver starting from the implementation of M-ary Scalar Receiver.

i. Draw the Block Diagram of M-ary Scalar Receiver.

ii. Do the implementation of M-ary Scalar Receiver.

iii. Find the probability of Error of M-ary Scalar Receiver.

iv. Draw the signal space diagram

5. Explain in detail about vector communication and obtain the probability of Binary Vector Receiver starting from the implementation of Binary Vector Receiver.

i. Draw the Block Diagram of Binary Vector Receiver.

ii. Do the implementation of Binary Vector Receiver.

iii. Find the probability of Error of Binary Vector Receiver.

iv. Draw the signal space diagram

6. Explain the construction of Block Code and explain how error syndrome is calculated

i. Representation of Block Code.

ii. Generator Matrix.

iii. Generation of Codewords.

iv. Generation of Parity Check Matrix.

v. Calculation OF Error Syndrome.

7. Explain in detail about Orthogonal Codes, Biorthogonal Codes and Transorthogonal Codes

i. Definitions of codes,

ii. Formation of orthogonal codes.

iii. Formation of Biorthogonal Codes.

iv. Formation of Transorthogonal Codes.

8. Explain in detail about Shannon Coding Theorem.

i. Statement of Theorem.

ii. Discussion of theory.

iii. Derivation of the Theorem.

9. What is Spread Spectrum Techniques Explain in detail about Direct Sequence Spread Spectrum Techniques with necessary diagrams?

i. Concept of Spread Spectrum Techniques

ii. Block Diagram Representation.

iii. Waveform at all stages of the system.

iv. Derivation of processing Gain.

10. What is Frequency Hopping? Explain the different types of frequency hopping with necessary diagrams.

i. Concept of frequency hopping.

ii. Explanation of slow frequency hopping

iii. Explanation of Fast frequency hopping

iv. Block Diagrams and waveform

11. Explain in detail about Golay Codes, Reed Solomon Codes and BCH Codes.

i. Definition of Golay Codes, Reed Solomon Codes and BCH Codes.

ii. Explanation of Golay Codes

iii Explanation of Reed Solomon Codes

iv Explanation of BCH Codes.

12. Explain in detail about Binary Phase Shift Keying and obtain an expression for its probability of error.

i. Block Diagram of Transmitter and Receiver.

ii. Explanation of Transmitter and receiver.

iii. Signal Space Diagram

iv. Calculation of Probability of Error

13. Explain in detail about Quadrature Phase Shift Keying and obtain an expression for its probability of error.

i. Block Diagram of Transmitter and Receiver.

ii. Explanation of Transmitter and receiver.

iii. Signal Space Diagram

iv. Calculation of Probability of Error

14. Explain in detail about Minimum Shift Keying and obtain an expression for its probability of error.

i. Block Diagram of Transmitter and Receiver.

ii. Explanation of Transmitter and receiver.

iii. Signal Space Diagram0

iv. Calculation of Probability of Error

15. Explain in detail about the optimum demodulation of Digital signals in the presence if ISI and AWGN. Also, explain about the various equalization techniques.

i. Concept of ISI and AWGN

ii. Derivation of ISI.

iii. Ideal Solution and Practical Solution.

iv. Types of Equalization.

16. Explain in detail about the operation of Non Coherent Receivers in the presence of Random Phase Channel and implement the receiver.

i. Concept of Non Coherent Receivers.

ii. Derivation of probability of Error.

iii. Implementation of the Receiver.

iv. Waveforms

17. Explain in detail about the operation of Non Coherent Receivers in the presence of Random amplitude and phase Channel and implement the receiver.

a. Concept of Non Coherent Receivers.

b. Derivation of probability of Error.

c. Implementation of the Receiver.

d. Waveforms

18. Explain in detail about the operation of Optimum Receivers in Rayleigh Channel and implement the receiver.

a. Concept of Raleigh Receivers.

b. Derivation of probability of Error.

c. Implementation of the Receiver.

d. Waveforms

19. Explain in detail about the operation of Optimum Receivers in Rician Channel and implement the receiver.

a. Concept of Rician Receivers.

b. Derivation of probability of Error.

c. Implementation of the Receiver.

d. Waveforms

20. Explain in detail about the operation of Partially Coherent Receivers in the presence of Random Phase Channel and implement the receiver.

a. Concept of Partially Coherent Receivers.

b. Derivation of probability of Error.

c. Implementation of the Receiver.

d. Waveforms

21. a. Explain in detail about In phase and Quadrature Modulation systems.

b. With necessary diagrams explain the operation of Quadrature Amplitude Modulation systems.

a. In phase and Quadrature Modulation systems.

- Block Diagram
- Derivation
- Explanation

b. Quadrature Amplitude Modulation systems.

- Draw the Block Diagram

- Derivation
- Explanation

22. Draw the code tree of a Convolutional code of code rate r=1/2 and Constraint length of K=3 starting from the state table and state diagram for an encoder which is commonly used.

a. Draw the state Diagram.

b. Draw the state Table.

c. Draw the code Tree

23. Draw the trellis diagram of a Convolutional code of code rate r=1/2 and Constraint length of K=3 starting from the state table and state diagram for an encoder which is commonly used.

a. Draw the state Diagram.

b. Draw the state Table.

c. Draw the trellis diagram

24. Decode the given sequence 11 01 01 10 01 of a convolutional code with a code rate of r=1/2 and constraint length K=3, using viterbi decoding algorithm.

a. Draw the state Diagram.

b. Draw the state Table.

c. Draw the code Tree

d. Decode the given sequence using trellis diagram

25. Explain in detail about Continuous Phase Frequency Shift Keying and obtain an expression for its probability of error.

a. Block Diagram of Transmitter and Receiver.

b. Explanation of Transmitter and receiver.

c. Signal Space Diagram

d. Calculation of Probability of Error

26. Derive the power spectral Density of a Synchronous Data pulse stream generated by a Binary, non-zero mean, Cyclostationary Sequence.

a. Define mean. Auto correlation and wide sense stationary

b. Derive the expression of (Sa) f

c. Derive the expression of (Sp) f

d. Combine the values of (Sa) f and (Sp) f

e. Make the necessary approximations.

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