**ST. ANNE’S**

**COLLEGE OF ENGINEERING AND TECHNOLOGY**

(Approved by AICTE, New Delhi. Affiliated to Anna University, Chennai)

(An ISO 9001: 2015 Certified Institution)

ANGUCHETTYPALAYAM, PANRUTI – 607 106.

**QUESTION BANK**

**PERIOD:** JULY - NOV 2018 **BATCH**: 2016 – 2020

**BRANCH:** ECE **YEAR/SEM:** III/V

**SUB CODE/NAME:** EC6501 – DIGITAL COMMUNICATION

**UNIT I SAMPLING AND QUANTIZATION**

**PART – A**

* + - 1. State sampling theorem for band limited signals and the filter to avoid aliasing.[D] [**Nov/Dec 2015]**
      2. Write two fold effects of quantization process. [D] [**Nov/Dec2015]**
      3. Define band pass sampling? [D]  **[Apr/May-2018]**
      4. In a PCM system,the output of the transmitting quantizer is digital. then why is it further encoded?[ID] **[Apr/May-2018]**
      5. What is aliasing ? [D] [**May/June-2016]**
      6. What is companding ? Sketch the input-output characteristics of a compressor and an Expander. [D] [**May/June-2016]**
      7. A certain lowpass bandlimited signal x(t) is sampled and the spectrum of the sampled version has the first guard band from 1500 Hz to 1900 Hz. What is the sampling frequency? What is the maximum frequency of the signal? [ID] [**April/May 2017]**
      8. What is companding?.Sketch the characteristics of a compander. [D] [**April/May 2017]**
      9. Define companding. [D] [**Nov/Dec 2016]**
      10. What is meant by aliasing? [D] [**Nov/Dec 2016]**
      11. Define Nyquist rate, Nyquist interval, Dirac comb and crest factor. [D]
      12. What is meant by Quantization noise power and quantization error? [D]
      13. What is meant by PCM and what are the noises present in PCM system what is the SNR of PCM system if the number of quantization level is28? [ID]
      14. What you meant by non- uniform quantization? [D]
      15. What is the disadvantage of uniform quantization over the non-uniform quantization? [D]
      16. What are the advantages and disadvantages of Digital over analog Communication system? [D] **[April/May-2011]**
      17. What are the advantages and disadvantages of PCM System? [D]
      18. What is TDM? Write its advantages and disadvantages. [D]
      19. How the message can be recovered from PAM? [D]
      20. The signal to quantization noise ratio in a PCM system depends on what criteria? [D]
      21. Write an expression for bandwidth of binary PCM with N messages each with a maximum frequency of fm Hz. [D]
      22. What is meant by quantization? [D]
      23. State any two nonuniform quantization rules. [D]
      24. Write two fold effects of quantization process. [D]
      25. What is meant natural sampling? [D]
      26. Compare uniform and non uniform quantization. [D]
      27. Define quantization noisr power. [D]
      28. Why is prefiltering done before sampling?
      29. It is required to transmit speech over PCM channel with 8-BIT accuracy .assume the speech in base band limited to 3.6KHZ.determine the bit rate.
      30. Give advantages and disadvantages of digital communication.

**PART – B**

**[First Half]**

**[Low Pass Sampling]**

1. Describe the process of sampling and how the message signal is reconstructed from its samples. also illustrate the effect of aliasing with neat sketch. **8 [ID] [Nov/Dec-2015]**
2. State the low pass sampling theorem and explain reconstruction of the signals from it samples. **10 [D] –[May/June -2016]**
3. Write a detailed note on aliasing and signal Reconstruction? **7 [D] [Apr/May-2018]**
4. Write short notes on aperture effect distortion? **4 [D] [Apr/May-2018]**
5. The signal x(t)=4cos400πt +12 cos360 πt is ideally sampled at a frequency of 300 samples per second.the sampled signal is passed through a unit gain low pass filter with a cut off frequency **of** 220HZ.List the frequency components present at the output of the low pass filter. **8 [D] [May/June -2016]**
6. A bandlimited signal with fmax=4KHZ is sampled at fs=7KHZ.calcilate aliasing component and draw the spectrum of sampled wave. **6 [D]**

**[Quantization]**

1. Illustrate and describe the types of quantizer? Describe the mid tread and mid rise type characteristics of uniform quantizer with a suitable diagram? . **10 [ID] [Nov/Dec-16]**
2. What is meant by quantization? Derive the expression for S/N ratio in PCM system? **10 [D] [APR/MAY-18]**
3. Show that the signal to noise power ratio of a uniform quantizer is PCM system increases significantly with increase in number of bits per sample. also determine the signal to quantization noise ratio of an audio signal S(t)=4sin(2π500t) which is quantized using a 10bit PCM. **10[D] [Apr/May-2018]**
4. Explain the non uniform quantization. Write the necessity of non uniform quantization for speech signal. **8 [D]**
5. Explain quantization noise and SNR briefly? **10[D]**

**[Second Half]**

**[PCM]**

1. Describe PCM waveform coder and decoder with neat sketch and list the merits compared with analog orders? **7 [ID] [Nov/Dec-2015]**
2. Explain PCM system with neat block diagram. **6 [D] [May/June -2016]**

**[TDM]**

1. What is TDM? Explain the TDM with its applications? **8[D] [Nov/Dec-16]**
2. Draw and explain the difference between analog TDM and digital TDM? **9 [D] [May/June-16]**
3. Explain TDM system for n-number of channels? **10 [ID] [Apr/May-2018]**
4. Write short notes on PCM/TDM system?

**[Logarithmic Companding]**

1. Plot the µ law compression characteristics for µ=255. **4 [D]**
2. Explain how companding improve the SNR of PCM system with respect to µ -law? **8 [ID]**
3. Write short notes on Logarithmic companding? **7 [D]**

**UNIT II WAVEFORM CODING**

**PART – A**

1. What are the advantages of delta modulator ? **[D]** [**May/June-2016]**
2. What is a linear predictor ? On what basis are the predictor coefficients determined ? **[ID]** [**May/June-2016]**
3. What is meant by granular noise in a delta modulation system? How can it be avoided? **[D]** [**April/May 2017]**
4. What is a linear predictor? On what basis are the predictor coefficients determined? **[D]** [**April/May 2017]**
5. What is the need of prediction filtering? **[D]** [**Nov/Dec 2016]**
6. How to overcome the slope overlap? **[D]** [**Nov/Dec 2016]**
7. Define APF and APB. **[D]** [**Nov/Dec 2015]**
8. Write the limitations of delta modulation. **[D]** [**Nov/Dec 2015]**
9. what is meant by delta modulation systems? **[D] [Apr/May-2018]**
10. Why delta modulation is superior to differential pulse code modulation? **[ID]** **[Apr/May-2018]**
11. Mention the merits of DPCM. **[D]**
12. What is the main difference in DPCM and DM? **[D]**
13. What is meant by adaptive delta modulation? **[D]**
14. What is the advantage of delta modulation over pulse modulation schemes? **[D]**
15. What should be the minimum bandwidth required to transmit a PCM

Channel? **[D]**

1. What is the advantage of delta modulation over PCM? **[D]**
2. What are the two limitations of delta modulation? **[D]**
3. How does Granular noise occurs? **[ID]**
4. What are the advantages of the Delta modulation? **[D]**
5. What is meant by forward and backward estimation? **[D]** [**NOV/DEC2015]**
6. What are the advantages of delta modulator? **[D]** **[MAY/JUNE2016]**
7. What is linear predictor? On what basis predictor coefficients are determined. **[ID]** [**MAY/JUNE2016]**
8. Mention the merits of DPCM. **[D]**
9. Define delta modulation and adaptive delta modulation. **[D]** [**NOV/DEC 2015]**
10. Define ADPCM. **[D]**
11. What is the main difference in DPCM and DM? **[D]**
12. What is meant by temporal waveform coding? **[D] [NOV 11, NOV14]**
13. Differentiate the properties of temporal waveform coding and model Based coding. **[D]** **[NOV12]**
14. Mention the use of adaptive quantized in adaptive digital waveform coding schemes. **[ID]**
15. Mention two merits of DPCM. **[D]**

**PART – B**

**[First Half]**

**[Prediction Filtering and DPCM]**

1. Elucidate a DPCM system .derive the expression for slope overload noise of a system? **7 [D] [Apr/May- 2018]**
2. Explain the DPCM system .derive the expression for slope overload noise. show that SNR of DPCM is better than that of PCM. **8 [D]**
3. Write short notes on prediction filtering? **(8) [D]**
4. Explain the working of differential PCM and derive the expression for SNR. **10[D]**

**[Delta Modulation]**

1. Describe and illustrate Delta modulation and it quantization error? **8 [D] [Nov/Dec-15]**
2. Compare PCM with delta modulation system? **8 [D] [May/June 16]**
3. Describe delta modulation system in detail with a neat diagram and illustrate the two forms of quantization error in delta modulation? **10 [D][Nov/Dec-16]**
4. Explain the advantage and disadvantage of delta modulation briefly. **8[D]**
5. Writ short notes on delta sigma modulation. 8[D]

**[Second Half]**

**[ADPCM and ADM Principles]**

1. Explain how Adaptive delta modulation performs better and gains more SNR and delta modulation.

**[ID] [Nov/Dec-15]**

1. Illustrate how adaptive time domain coder codes the speech at low bit rate and compare it with the frequency domain coder? **6 [ID] [Nov/Dec-15**]
2. Draw the block diagram of ADPCM system and explain it function? **8 [D] [May/June- 16]**
3. Draw the block diagram of an Adaptive delta modulator with continuously variable step size? **7 [D] [May/June-16]**
4. Describe ADM with neat diagram and compare it with delta modulation? **10 [D] [Nov/Dec-16]**
5. Explain the construction features and working of adaptive delta modulation? **10 [D] [Apr/May-2018]**
6. With a neat diagram explain the adaptive delta modulation and demodulation system? **[D] [April/May-17]**

**[Linear Predictive Coding]**

1. Explain speech synthesis using LPC. **8 [D]**
2. Explain speech model based encoding technique. **7 [D] [May/June-13]**
3. Explain the speech generation model. **6[D]**
4. Briefly explain LPC encoder and decoder with neat block diagram. **13[D]**

**UNIT III BASE BAND TRANSMISSION**

**PART – A**

1. What are line codes ? Name some popular line codes. **[D]** **[May/June-2016]**
2. What is IS1 and what are the causes of ISI ? **[D] [May/June-2016]**
3. State the desirable properties of line codes. [**April/May- 2017]**
4. What is an eye diagram? **[D]** [**April/May- 2017]**
5. Define correlative level coding. **[D] [Nov/Dec- 2016]**
6. For the binary data 01101001 draw the unipolar and RZ signal. **[D]** [**Nov/Dec- 2016]**
7. List the properties of syndrome. **[D] [Nov/Dec- 2015]**
8. Compare M-ary PSK and M-ary QAM. **[D] [Nov/Dec- 2015]**
9. what do the various autocorrelation coefficients represent in the power spectral density expression of a line code? Give the values of R10,R8,R50 and R200 and arrange them in the increasing order. **[ID] [Apr/May-2018]**
10. State nyquist second and third criteria to realize zero ISI. **[D] [Apr/May-2018]**
11. What are line codes? Name some popular line codes. **[D] [MAY/JUNE-2016]**
12. What is ISI? What are the causes of ISI? **[D] [MAY/JUNE-2016]**
13. List the properties of syndrome. **[D] [NOV/DEC-2015]**
14. Compare M-ary PSK and M-ary QAM. **[D] [NOV/DEC-2015]**
15. Define the followingterms **[D]**
    1. NRZ unipolar format
    2. NRZ polar format
    3. NRZ bipolar format
    4. Manchester format
16. State Nyquist criterion for ZeroISI. **[D]**
17. List the properties of linecodes . **[D] [April/May 2017]**
18. What is correlative coding? **[D] [Nov/Dec 2016]**
19. What is intersymbol interference in baseband binary PAM systems? **[ID]**
20. What is mean by base band transmission? **[D]**
21. Define Duobinary baseband PAM system K. **[ID]**
22. What are eye pattern? **[D]**
23. How is eye pattern obtained on the CRO? **[D]**
24. Why do you need adaptive equalization in a switched telephone network. **[ID]**
25. What are the necessity of adaptive equalization? **[D]**
26. Define the principle of adaptive equalization? **[D]**
27. Define duobinary encoding? **[D]**
28. Write a note on correlative level coding? **[D]**
29. Define the term ISI? **[D]**
30. Write the performance of data transmission system using eye pattern technique? **[ID]**

**PART – B**

**[First Half]**

**[Properties of line codes]**

1. Compare the various line coding techniques and list their merits and demerits. **(8) [D] [May/June 2016]**
2. what is need for line shaping of signals ?derive the PSD of a unipolar RZ and NRZ ,line code and compare their performance? **10 [ID] [Apr/May-2018]**

**[Power Spectral Density of UNIPOLAR/POLAR RZ and NRZ]**

1. Determine the power spectral density for NRZ bipolar and unipolar data formats. Assume that 1s and 0s in the input binary data occur with equal probability? **[ID] [Nov/Dec- 2015**.]
2. Derive the power spectral density of unipolar NRZ data format and list its properties ? **8 [D][May/June- 2017]**
3. Sketch the power spectra of (a) Polar NRZ and (b) bipolar RZ signals. **(8) [D] [May/June- 2016]ISI**
4. what is ISI and what are the various method to improve ISI in communication system .also state and prove nyquist first criterion for zero ISI. **13[D] [Apr/May-2018]**

**[Second Half]**

**[Nyquist's criteria]**

1. Describe the Nyquist's criteria for distortion less base band transmission. **8 [D] [May/June-2017]**
2. What is a "raised Cosine spectrum"? Discuss how does it help to avoid IST? **(6) [ID] [May/June- 2017]**
3. Explain how Nyquist's Criterion eliminates interference in the absence of noise for distortion -less baseband binary transmission. **(16) [ID] [Nov/Dec- 2016]**

**[Eye Pattern]**

1. Describe how eye pattern is helpful to obtain the performance of the system in detail with a neat sketch. **16 [D] Nov/Dec- 2016**
2. Describe how eye pattern illustrates the performances of a data transmission system with respect to inter symbol interference with neat sketch? 8**[ID][Nov/Dec- 2015].**
3. Illustrate the modes of operation of an adaptive equalizer with neat diagram? **8 [D][Nov/Dec- 2015].**

**[Equalization]**

1. Compare the various line coding techniques and list their merits and demerits. **(8) [D] [May/June- 2016]**
2. Draw the block diagram of duo binary signaling scheme without and with precoder and explain. **(9) [D] [May/June- 2016]**
3. Explain the adaptive equalization with block diagram. **(7) [D] [May/June-2016]**
4. Explain correlative coding to eliminate ISI.**(6) [D]**
5. Write short notes on tapped delay line filter, adaptive equalization.**7 [D]**
6. Why ISI cannot be avoided.justify the statement.**4[D]**
7. Explain duobinary encoding with neat block diagram**.** 6**[D]**

**UNIT IV DIGITAL MODULATION SCHEMES**

**PART – A**

1. Distinguish between coherent and non-coherent reception. **[D]** **[May/June-2016]**
2. What is QPSK ? Write the expression for the signal set of QPSK**. [D] [May/June-2016]**
3. What is QPSK? Write down an expression for the signal set. **[D]** **[April/May- 2017]**
4. What do you understand by non-coherent detection? **[ID]** **[April/May- 2017]**
5. Distinguish coherent vs non coherent digital modulation techniques. **[D]** **[Nov/Dec- 2016]**
6. Draw a block diagram of a coherent BFSK receiver. **[D] [Nov/Dec- 2016]**
7. Draw the block diagram of a coherent BFSK receiver. **[D]** **[Nov/Dec- 2015]**
8. Distinguish BPSK and QPSK techniques. **[D] [Nov/Dec- 2015]**
9. Draw the PSK and QPSK wave forms of a bit stream 11110011. **[ID] [Apr/May-2018]**
10. Define non coherent detection schemes. **[D] [Apr/May-2018]**
11. Define ASK. **[D]**
12. What is meant by DPSK? **[D]**
13. Explain coherent detection? **[D]**
14. What is the difference between PSK and FSK? **[D]**
15. What is meant by coherent ASK? **[D]**
16. What is the major advantage of coherent PSK over coherent ASK? **[ID]**
17. Explain the model of bandpass digital data transmission system? **[ID]**
18. What is baseband signal receiver? **[D]**
19. What is matched filter? **[D]**
20. What is the value of maximum signal to noise ratio of the matched filter? When it becomes maximum? **[ID]**
21. What is correlator ? **[D]**
22. Bring out the difference between coherent & non coherent binary modulation scheme. **[ID]**
23. What is the error probability of MSK & DPSK? **[D]**
24. List the advantages of Pass band transmission. **[D]**
25. List the requirements of Pass band transmission. **[D]**
26. What is QAM?
27. What is signal constellation diagram?
28. Write the disadvantage of BPSK.
29. Define BER?
30. Distinguish BPSK and QPSK techniques.

**PART – B**

**[First Half]**

**[BPSK]**

1. Explain in detail the detection and generation of BPSK system. Derive the expression for its bit error probability . **13 [ID] [April/May- 2017]**

**[QPSK]**

1. Describe the generation and detection of Coherent QPSK Signals. (12) **[D] [Nov/Dec- 2016]**
2. Illustrate the power spectra of QPSK signal. (4) **[D] [Nov/Dec- 2016]**
3. Derive the expression for bit error rate probability of a QPSK system? **7 [D] [Apr/May-2018]**
4. Draw and explain the quadrature receiver structure for coherent QPSK? **8[D] [Apr/May-2018]**
5. Draw the signal space diagram of a coherent QPSK modulation scheme and also find the Probability of error .if the carrier takes on one of four equally spaced values 0.,90’,180’ And 270’**. 8 [ID] [Apr/May-2018]**
6. Illustrate the transmitter receiver and signal space diagram of quadrature phase shift keying and describe how it reproduces the original sequence with the minimum probability of symbol error with neat sketch.**10 [ID] [Nov/Dec- 2015]**

**[Principle Of DPSK]**

1. Explain the principle of DPSK encoding. **8 [D] [April/May- 2017]**
2. Illustrate the transmitter receiver and the generation of the non coherent version of PSK with neat diagram. **7 [D] [Nov/Dec- 2015]**
3. Calculate the BER for a binary phase shift keying modulation from first principles. **6 [D] [Apr/May-2018]**

**[Second Half]**

**[PSD]**

1. Explain the principle of working of an "early late-bit synchronizer". **(8) [D] [April/May- 2017]**
2. Describe the generation and detection of Coherent binary PSK Signals. **8 [D] [Nov/Dec- 2016]**
3. Illustrate the power spectra of binary PSK signal. **6 [D] [Nov/Dec- 2016]**
4. Explain the generation and detection of a coherent binary PSK signal and derive the power spectral density of binary PSK signal and plot it. **16 [ID] [May/June- 2016]**

**[BFSK]**

1. Explain the non-coherent detection of FSK signal and derive the expression for probability of error. **16[D] [May/June- 2016]**
2. Explain the geometric representation of orthogonal BFSK? **6[D]**
3. Explain the spectrum and band width of BFSK .**7 [D]**
4. Explain the graphical representation and principle of BPSK signals? **8 [D]**
5. Explain the geometric representation of signals? **9 [D]**
6. Differentiate BFSK and QPSK ? **8 [D]**

**UNIT-5 ERROR CONTROL CODING**

**PART – A**

1. What is a linear code ? **[D]** [**May/June-2016]**
2. What is meant by constraint length of a convolutional encoder ? **[ID] [May/June-2016]**
3. What is the need of channel coding? **[D]** **[April/May- 2017]**
4. What are the different methods of describing the structure of a convolutional

code? **[ID]** **[April/May- 2017]**

1. Generate the cyclic code for (n, k) syndrome calculator. **[ID]** **[Nov/Dec- 2016]**
2. Define channel coding theorem. **[D]** **[Nov/Dec- 2016]**
3. State the channel coding theorem. **[D]** **[Nov/Dec- 2015]**
4. List the properties of cyclic codes . **[D]** **[Nov/Dec 2015]**
5. what is meant by syndrome of linear block code? **[D]** **[Apr/May-2018]**
6. Write the various techniques /algorithms used in encoding and decoding of convolutional code. **[ID]** **[Apr/May- 2018]**
7. What is hamming distance? **[D]**
8. Define code efficiency. **[D]**
9. What is meant by systematic and non-systematic codes? **[D]**
10. What is meant by linear code? **[D]**
11. What is meant by cyclic codes? **[D]**
12. How syndrome is calculated in Hamming codes and cyclic codes? **[ID]**
13. What is BCH code? **[D]**
14. What is RS code? **[D]**
15. What is difference between block codes and convolutional codes? **[D]**
16. Define constraint length in convolutional code? **[D]**
17. Define free distance and coding gain. **[D]**
18. What is convolution code? **[D]**
19. What is meant by syndrome of linear block code? **[D]**
20. What are the advantages of convolutional codes? **[D]**
21. Define constraint length in convolutional codes? **[D]**
22. What is Golay codes? **[D]**
23. Write the futures of BCH Codes? **[D]**
24. Write the fundamental properties of cyclic codes? **[D]**
25. Define minimum distance? **[D]**
26. Define viterbi decoder? **[D]**

**PART – B**

**[First Half** ].

**[Channel coding theorem]**

1. State and explain shannon’s theorem on channel capacity.**8 [D]**

**[Linear block codes]**

1. Explain the step involved in generation (n,k) linear block codes.
2. Explain the matrix representation of linear block codes.
3. Consider a linear block code with generator matrix. **13[D] [May/June-2016]**

G= 1101000

0110100

1110010

1010001

(i) Determine the parity check matrix.

(ii) Determine the error detecting and capability of the code.

(iii) Draw the encoder and syndrome calculation circuits.

(iii) Calculate the syndrome for the received vector r = [1 1 0 1 0 1 0].

1. For a systematic linear block code ,the three parity check digits p1,p2,p3 are given by

PKn-k = 1 0 1

1 1 1

1 1 0

0 1 1

* + 1. Construct generated matrix
    2. Construct code generated by the matrix
    3. Determine error correcting capacity
    4. Decode the received words with an example. **13 [D] [ Nov/Dec- 2015]**

**[Hamming Codes]**

1. Describe how the errors are corrected using Hamming code with an

example. **13 [D] [Nov/Dec- 2016]**

1. The code vector [1110010] is sent, the received vector is [1100010].
2. Calculate the syndrome.. **(4) [ID] [Nov/Dec- 2016]**

**[Second Half]**

**[Cyclic Codes]**

1. The generator polynomial of a (7, 4) cyclic code is 1 + X + X3. Develop encoder and syndrome calculator for this code. **10 [D] [May/June-2016]**
2. Explain the principle and design of binary cyclic codes.10[D]
3. The generator polynOmial of a (7,4) linear systematic cyclic block code is i + X + X3. Determine the correct code word transmitted, if the received word is (i 1011011 and ii) 1101111 **[D] [April/May-2017]**
4. find the (7,4) systematic and non systematic cyclic code words of the message word 1101 .assume the generator polynomial as 1+x2+x3. **13 [ID] [Apr/May-2018]**
5. Develop the code for an (n,k) linear cyclic code and explain its working**. 8[D]** **[Apr/May-2018]**
6. Describe the cyclic codes with the linear and cyclic property. Also

represent the cyclic property of a code word in polynomial notation**. 12** **[D] [Nov/Dec- 2016]**

1. List the different types of errors detected by CRC code. **(4) [D] [Nov/Dec- 2016]**

**[Convolutional codes]**

1. A rate 1/3 convolutional encoder with constraint length of 3 uses the **[ID] [April/May-2017]**

generator sequences: g1 = (100), g2 =(1 0 1) and g3 = (1 1 1).

* + 1. Sketch encoder diagram
    2. Draw the state diagram for the encoder
    3. Determine the dfree distance of the encoder

1. A convolution code is described by g1=[100]:g2=[101];g3=[111]. **[D] [Nov/Dec-2015]**
   * 1. draw the encoder corresponding to this code.
     2. draw the state transition diagram for this code .

(iii)draw the trellis diagram and find the transfer function.

**[Viterbi decoder]**

1. Explain viterbi algorithm with an appropriate coder and a received input word of length 12.assume a coder of constraint length 6 and rate efficiency ½. **10 [D] [Apr/May-2018]**
2. what is need of digital modulation in digital communication? explain any one modulation scheme? **8 [D]** **[Apr/May-2018]**

20.Explain Viterbi decoding algorithm for convolutional code. **(8) [D]**