

## **Module I**

### **Digital Representation of Analog Signal:**

Sampling Theorem, Signal Reconstruction from uniform samples, Quantization of Signals, Quantization error, PCM, Electrical representation of binary digits, PCM System, Companding

1. Draw a simple circuit that can do sampling?
2. What is the need of quantization of signals? Can you transmit a PCM signal without it?
3. What is the need of an anti-aliasing filter/Pre-Alias Filter?
4. What is the effect of multiplying a sequence of impulses with low pass signal? Explain mathematically.
5. A signal to be sampled consists of frequency components 20Hz, 1 KHz, 3 KHz AND 5KHz.what is the minimum frequency at which the signal should be sampled?
6. Why pulse code modulation is used in modern communication?
7. The speech signal is band limited to 3.5 kHz. What should be the desirable sampling rate?
8. Write Short notes on Companding.
9. State and Prove Sampling Theorem.
10. Differentiate PAM, PPM and PWM modulation schemes. Considering a Suitable waveform show the three waveforms.

## **Module II**

Issues in Digital transmission: Line coding, Scrambling, T1 Digital System, Multiplexing T1 lines – The T2, T3, T4, E1 lines, Differential PCM: Linear predicted design, Delta Modulation, Adaptive Delta Modulation

1. What is Line Coding? State the properties of Line Coding.
2. Explain the Process of Scrambling and Descrambling/Unscrambling with a example?
3. What is TDM (Time Division Multiplexing)
4. Explain T1 Carrier System.
5. What is T2, T3, T4 line?
6. Explain DPCM (differential pulse code modulation) with neat diagram.
7. Give the circuit for realizing DM. Explain its working?
8. Using suitable diagram analyze the working of a delta modulator. List the merits and demerits of the modulator and how these are removed by ADM.?
9. What is Granular Noise and Slope overload distortion? How to avoid it

### Module III

#### Digital Modulation Technique:

Generation, Transmission, Reception, Spectrum and Geometrical Representation in the Signal Space of BPSK, DPSK, QPSK, QASK, M-ary PSK, BFSK, M-ary FSK, and Minimum Shifting Keying (MSK)

1. Differentiate BFSK and BPSK signals.
2. Draw the signal representation of 8-ary PSK signal.
3. How does the phase of the carrier vary for message  $m(n)=[1,0,1,1,0,1,\dots]$  in (a)BPSK (b)DPSK (C) DEPSK system.
4. Show the decoded output of the 10110100 message in (a) DPSK (B) DEPSK.
5. Can BPSK be considered a kind of DSB-SC signal?
6. Why DPSK is preferred to BPSK? A bit stream  $d(t) = 1011000110$  is input to DPSK transmitter. Draw the transmitted bit stream  $b(t)$ .
7. What is the importance of OFFSET in QPSK
8. Write down two advantages of MSK?
9. Give the signal space representation/constellation diagram/ of BFSK. What is the advantage of BFSK looking at the signal space diagram?
10. Explain the process of generation and demodulation of BPSK.
11. With suitable diagram analyze the process of generation of DPSK signal. Show the DPSK transmitted signal waveform if the input bit stream is 11001001101001.
12. Why is it necessary to locally generate the carrier in QPSK receiver? Show the process of carrier recovery in QPSK receiver.
13. Draw the signal space representation of a QPSK signal and compare with BPSK signal. With suitable figure show the signal space representation of QPSK and compare with DPSK.
14. What is the difference between QPSK and  $\pi/4$  SHIFTED QPSK .compare the signal space diagram?
15. A bit stream 0110110100 is to be transmitted by QPSK using a sinusoidal carrier. Draw the odd sequence and even sequence and the resultant carrier waveform transmitted. If instead of QPSK the bit stream transmitted by  $\pi/4$  QPSK what advantages would have been achieved.
16. Write short notes on MSK?

## **Module IV**

**Noise in PCM and DM:** Calculation of Quantization Noise, Output Signal Power, and the Thermal Noise, Output SNR in PCM, Quantization noise in Delta Modulation, output signal power, output SNR, Comparison with PCM and DM

1. A video signal band limited to 5 MHz is encoded with PCM&DM. The signal power is mostly concentrated at the top of the frequency spectrum. Compare the signal to quantization noise ratio for both the techniques. Which of the systems is better for this condition? Justify
2. Compare SNR of PCM & DM

## **Module V**

### **Principle of Digital Data Transmission:**

Digital Communication Systems – Source, Line coder, Multiplexer, Regenerative repeater; Line Coding: PSD of various line codes, polar signaling, constructing a DC Null in PSD by pulse shaping, On Off signaling, Bipolar signaling; Pulse shaping – ISI and effect, Nyquist first criterion for zero ISI; Scrambling, Digital receiver and regenerative repeaters; Equalizers, Timing extraction, Detection error, Eye Diagram

1. Write Short notes on
  - a. Regenerative Repeater
  - b. Signalling Schemes/Line Coding Schemes ( ex: Unipolar NRZ, Bipolar RZ, AMI, etc)
  - c. Timing Extraction
  - d. Eye Diagram
  - e. ISI

## **Module VI**

A base band signal Receiver, Peak signal to RMS noise output voltage ratio, probability of error, optimum threshold, optimum receiver for both base band and pass band: calculation of optimum filter transfer function, optimum filter realization using Matched filter, MAP&ML decoding.

1. What is a Matched Filter?
2. What is optimum filter?
3. Derive the transfer function of optimum filter?

4. What is baseband transmission? Explain a baseband signal receiver by explaining each block. Give an example of baseband transmission.?
5. Derive an expression for output signal to noise ratio  $(S_o/N_o)_{\text{PSK}}$  for a PCM-BPSK system.
6. Derive the expression for the average probability of bit error for a BPSK signal transmitted through an AWGN channel. State clearly the assumptions you have made to derive this result?
7. The probability of bit error is same for BPSK and QPSK. Justify.

## **Module VII**

### **Discrete Messages and information content:**

Information theory: entropy, mutual information and channel capacity theorem. Fundamentals of error correction, hamming codes.

1. What is information, mutual information, Entropy and Information Rate
2. State Shannon's theorem.
3. Derive Shannon's channel capacity theorem. What assumptions are made in deriving this expression? What is the significance of this result?
4. Shannon-Fano/Huffman/Lempel-ziv coding related problem
5. Write short notes on Hamming Code.