(b) A binary data stream 0010010011 are to be transmitted using DPSK. Show the encoding and decoding sequences.

(c) Explain the operation of non-coherent detection of BFSK with suitable diagram. Determine the bandwidth for an FSK signal with two frequency offsets placed at 48 kHz & 32 kHz. Input bit rate is specified as 4 kbps.

2 + 5 + (3 + 2) = 12

DIGITAL COMMUNICATION
(ECEN 3105)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

   (i) The technique that may be used to reduce the side band power is
   (a) MSK   (b) BPSK
   (c) Gaussian minimum shift keying   (d) BFSK.

   (ii) Use of non uniform quantization leads to
   (a) reduction in transmission bandwidth
   (b) increase in maximum SNR
   (c) increase in SNR for low level signals
   (d) simplification in quantization process.

   (iii) The data rate of QPSK is _____ of BPSK.
   (a) thrice   (b) four times   (c) twice   (d) same

   (iv) Zero forced equalizers are used for
   (a) reducing ISI to zero   (b) sampling
   (c) quantization   (d) none of the above.

   (v) If the number of bits/per sample is increased from n to n+1, the increase in signal to quantization noise ratio will be
   (a) 3 dB   (b) 6 dB   (c) 2n dB   (d) n dB.

   (vi) In a PCM system, numbers of quantization levels are 64 and the maximum signal frequency is 4 kHz, the minimum BW of the required transmission channel is
   (a) 128 kbps   (b) 256 kbps   (c) 48 kbps   (d) none of these.

   (vii) Pulse shaping is done
   (a) to control inter symbol interference
   (b) by limiting the bandwidth of transmission
   (c) after line coding and modulation of signal
   (d) all of the above.

(viii) Which of the following digital modulation techniques is used for CDMA mobile system?
(a) PSK   (b) O-QPSK   (c) MSK   (d) GMSK.

(ix) Matched filters are used
(a) for maximizing signal to noise ratio   (b) for signal detection
(c) in radar   (d) all of the above.

(x) Which of the following gives minimum probability of error?
(a) ASK   (b) PSK   (c) FSK   (d) All are same.

Group – B

2. (a) State sampling theorem.

(b) What is companding? Why is companding needed?
The amplitude of a sinusoid signal is 8 V. The signal is transmitted using PCM and the minimum SNR_q required in uniform quantization of the signal is 43.5 dB. Find the number of bits require to code the signal and estimate the step size.

(c) 24 channels, band limited to 4 kHz, is to be time division multiplexed by using PCM. Calculate the bit rate of the PCM system for 128 quantization levels, when sampled at twice the Nyquist rate.

2 + (2 + 1 + 4) + 3 = 12

3. (a) Draw the block diagram and explain the principle of operation of linear predictive coder.

(b) What is ADM? How it helps to overcome the limitations of DM?

(c) A television signal having a bandwidth of 10.2 MHZ is transmitted using binary PCM system. Given that the number of quantization level is 512. Determine (i) code word length (ii) transmission BW (iii) final bit rate (iv) output signal to quantization noise ratio.

(1 + 3) + (1 + 3) + 4 = 12

Group – C

4. (a) What are the four observations obtained from eye pattern?

(b) Justify the statement –"ISI can't be avoided".

(c) How pulse shaping reduces inter symbol interference?

(d) A communication channel of bandwidth 75 kHz is required to transmit binary data at a rate of 0.1 Mbps. Determine the roll off factor.

4 + 2 + 3 + 3 = 12

5. (a) To transmit a bit sequence of 10101111010111, draw the resulting waveform using (i) Unipolar NRZ and RZ (ii) Polar-NRZ and RZ (iii) Bipolar NRZ or AMI (iv) Manchester Coding.

(b) Derive the expression of the PSD for polar NRZ line code.

(c) Plot the variation of PSD with frequency.

6 + 4 + 2 = 12

Group – D

6. (a) What is the significance of the term 'Matched' in matched-filter?

(b) Show that maximum SNR of a matched filter is independent of signal shape but depends only on the signal energy.

(c) For the given signals shown in Fig.1, sketch the impulse responses of the filter matched to these signals.
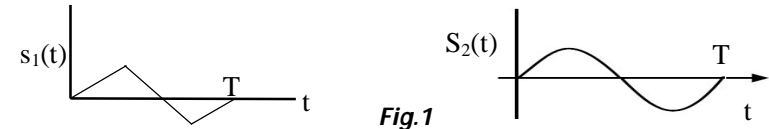
Fig.1

(d) Describe the operation of an integrate and dump filter.

2 + 5 + 2 + 3 = 12

7. (a) What do you mean by an optimum filter? When it is called a matched filter?

(b) Estimate the probability of error in a matched filter for unipolar binary signaling corrupted with Gaussian noise.

(2 + 2) + 8 = 12

Group – E

8. (a) The bit rate for the digital system is 36 Mbps. For 16-PSK modulation scheme, what is the baud rate?

(b) For a bit sequence of 110110, draw the resulting waveform for QPSK modulation scheme.

(c) With suitable diagram, explain the working principle of coherent detection of QPSK. Draw its signal space diagram.

(d) What are the advantages of OQPSK over QPSK?

1 + 2 + (5 + 1) + 3 = 12

9. (a) Why the non-coherent detection of PSK is not possible?