6E6054

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B.Tech. (Sem. VI) (Main & Back) Examination, April-May 2018
Electronics & Communication Engg.
6EC4A Digital Communication

Time : 3 Hours] **[Maximum Marks : 80**
[Min. Passing Marks : 24

Attempt any five questions, selecting one question from each unit. All Questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. Nil 2. Nil

UNIT - I

1 (a) What are the various steps included in PCM ? Explain the significance of quantization in PCM. How can quantization error be reduced ? **8**

(b) Explain in detail the transmitter and receiver of DPCM along with suitable diagrams. **8**

OR

1 (a) The bandwidth of an input signal to the PCM is restricted to 4 kHz. The input signal varies in amplitude from –3.8V to +3.8V and has the average power of 30 mW. The required signal to noise ratio is given as 20 dB, The PCM modulator produces binary output. Assuming uniform quantization,
(i) Find the number of bits required per sample. **6**

(ii) Outputs of 25 such PCM coders are time multiplexed. What would be the minimum required transmission bandwidth for this multiplexed signal ?

2

(b) What is Delta modulation ? Explain the advantages of ADM over DM.

8

UNIT - II

2 (a) Sketch the transmitted sequence of pulses for data stream 10110011101 for the following codes :

(i) Unipolar NRZ

(ii) Bipolar NRZ

(iii) Polar RZ

(iv) Manchester Format

8

(b) Calculate the Power Spectral Density of NRZ unipolar format.

8

OR

2 (a) Describe matched filter and explain any two properties of matched filter.

8

(b) Prove that the maximum SNR for the matched filter is found to be

$$\left(\frac{S}{N}\right)_{o,man} = \frac{2E}{No}$$

where, E is the energy of signal $x(t)$ No/2 is power spectral density of white noise.

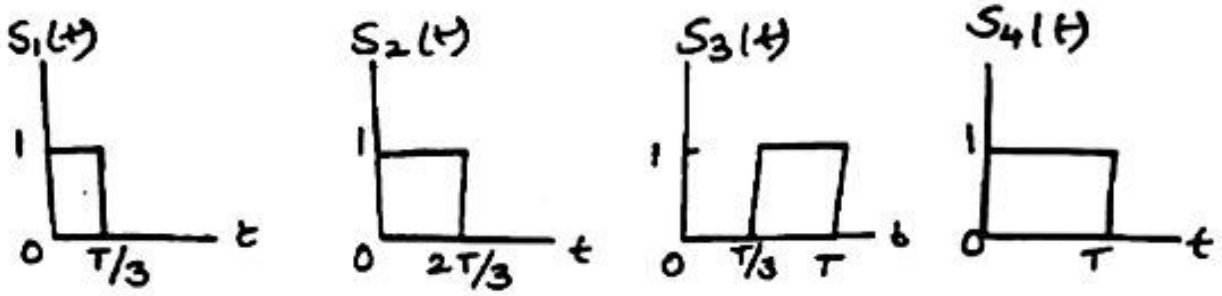
8

UNIT - III

3 (a) Explain generation and detection of Binary PSK. Also calculate probability of error of BPSK.

8

(b) Consider the signals S_1 (t), S_2 (t), S_3 (t) and S_4 (t) shown in fig. below. 8



Use the Gram-Schmidt orthogonalization procedure to find an ortho-normal basis for the given set of signals.

OR

3 (a) Explain the signal space diagram of MSK and what is the difference between signal space diagram of MSK and QPSK. Also explain the working of MSK receiver. 8

(b) Draw the BFSK and QPSK waveform for the data stream 10101011101. 8

UNIT - IV

4 (a) An analog signal band limited to 10 kHz is quantized in 8 levels of a PCM system with probabilities of 1/4, 1/5, 1/5, 1/10, 1/10, 1/20, 1/20 and 1/20 respectively. Find the entropy and the rate of information. 8

(b) Prove that for a source generating M messages, entropy is $O \le H \le \log_2 M$ 8

OR

4 (a) Consider a noiseless channel with m input symbols and n output symbols. Show that H(x) = H(y) and H (Y/X)=0. 8

(b) Prove that the channel capacity of an ideal AWGN channel with infinite bandwidth is given by $C_\infty = 1.44\frac{S}{\eta} b/s$ where S is the average signal power and $\eta/2$ is the power spectral density of white gaussian noise. 8

UNIT - V

5 (a) Apply the Shannon fano coding procedure for the given message.

$[x] = [x_1\ x_2\ x_3\ x_4\ x_5\ x_6\ x_7]$

$[P] = [0.4\ 0.2\ 0.12\ 0.08\ 0.08\ 0.08\ 0.04]$

Assume M = 3

8

(b) A cyclic (7,3) code has the generator polynomial

$g(x) = x^4 + x^2 + x + 1$

Find the generator matrix for this code, further find the minimum distance for the code.

8

OR

5 (a) The parity check bits of a (8,4) block code are generated by

$C_5 = d_1 \oplus d_2 \oplus d_4$

$C_6 = d_1 \oplus d_2 \oplus d_3$

$C_7 = d_1 \oplus d_3 \oplus d_4$

$C_8 = d_2 \oplus d_3 \oplus d_4$

where d_1, d_2, d_3 and d_4 are message bits.

(i) Find the generator matrix and parity check matrix for this code.
(ii) Find minimum weight of this code.
(iii) Find the error detecting capabilities of this code.

3+3+3=9

(b) Design an encoder for (7, 4) binary cyclic code generated by $g(x) = 1 + x + x^3$ and verify its operation using message vector 0101.

7