

waveform for transmitting binary information over base band channel for the following modulation schemes : 4

ASK, PSK, FSK and DPSK

(c) Draw and explain the block diagram of DPCM system. Compare the performance of DPCM with a PCM system. 5

4. (a) The parity-check matrix for a linear block code is given as

$$H = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$$

(i) Determine generator matrix.

(ii) Find C that begins 101...

(iii) If received word is 110110, decode it. 6

(b) For a (6, 3) systematic linear block code, the three parity-check digits C_4 , C_5 and C_6 are

$$C_4 = d_1 + d_2 + d_3$$

$$C_5 = d_1 + d_2$$

$$C_6 = d_1 + d_3$$

(i) Construct the appropriate generator matrix for this code.

- (iv) if the sampled signal is passed through an ideal low-pass filter of bandwidth 5 Hz, sketch the spectrum of the output signal. 5
- (b) Draw and explain the block diagram of transmitter and receiver of DPCM. How much SNR improvement is achieved in comparison to PCM? Prove that in PCM, the mean square quantization error $N_q = S^2 / 12$, where S is the step size. 4
- (c) What is inter-symbol interference (ISI)? Explain. A binary PAM wave is to be transmitted over a base band channel with an absolute maximum bandwidth of 75 kHz. The bit duration is 10 μ s. Find a raised-cosine spectrum that satisfies these requirements. 5
3. (a) What is a matched filter receiver? Derive its impulse response and the peak pulse signal-to-noise ratio. 5
- (b) What should be the desirable features of a digital modulation technique? For a bit stream 101101 represented in split-phase line code, draw the modulation

- (e) Explain the block diagram of a frequency hopping spread spectrum (FHSS) technique.
- (f) Name one technique that is used for measuring intersymbol interference.
- (g) What is the capacity of a band limited AWGN channel? Also find channel capacity with infinite bandwidth.
2. (a) What are the practical issues in signal sampling and reconstruction? What measures would be adopted to eliminate it?
- A signal $g(t) = \sin c^2(5\pi t)$ is sampled (using uniformly sampled impulses) at a rate of (1) 5 Hz, (2) 10 Hz and (3) 20 Hz. For each of the three cases—
- (i) sketch the sampled signal;
- (ii) sketch the spectrum of sampled signal;
- (iii) explain whether you can recover the signal $g(t)$ from the sampled signal;

B.Tech 7th Semester Exam., 2018

**DIGITAL COMMUNICATION AND
TELECOMMUNICATION MANAGEMENT**

Time : 3 hours

Full Marks : 70

Instructions:

- (i) The marks are indicated in the right-hand margin.*
- (ii) There are **EIGHT** questions in this paper.*
- (iii) Attempt **FIVE** questions in all.*
- (iv) Question No. 1 is compulsory.*

1. Answer the following questions : 2×7=14

- (a) Draw the block-schematic diagram of a digital communication system and explain.*
- (b) Explain hamming bound.*
- (c) State and prove sampling theorem. What is Nyquist criterion?*
- (d) Derive an expression for calculating PSD of Manchester Line Coding Scheme.*

(ii) Construct the code generated by this matrix.

(iii) Determine the error correction capabilities of this code.

(iv) Prepare a suitable decoding table.

(v) Decode the following received words :

101100, 000110, 101010 8

5. (a) A DMS emits six messages with probabilities 0.3, 0.25, 0.15, 0.12, 0.1 and 0.08. Find quaternary Shannon-Fano code. Determine its average word length, efficiency and redundancy. 6

(b) In a PAM scheme with $M = 16$ —

(i) determine the minimum transmission bandwidth required to transmit data at a rate of 12000 bit/sec with zero ISI;

(ii) determine the transmission bandwidth, if the Nyquist criterion pulses with a roll-off factor $r = 0.2$ are used to transmit data. 8

6. (a) Define the principle of frequency hopping spread spectrum (FHSS). Draw and explain FHSS system model comprising of transmitter and receiver. 6

(b) Consider an AWGN channel with noise level $N = 10^{-11}$. A user signal is a binary FSK modulation of a data rate 16 kbit/sec that occupies a bandwidth of 20 kHz. The received signal power is -20 dBm. An enemy has a jamming source that can jam either a narrow band or a broadband signal. The jamming power is finite such that the total received jamming signal power is at most -26 dBm. Use a spreading factor $L = 20$ to determine the approximate improvement of signal-to-noise ratio for the FHSS system under jamming. 8

7. (a) Explain ethernet protocol. Differentiate between the four generations of ethernet. 8

(b) A slotted ALOHA network is working with maximum throughput.

(i) What is the probability that a slot is empty?

(ii) How many slots, n , on average, should pass before getting an empty slot? 6

(7)

8. (a) What is switching? Explain. Differentiate among circuit switching, packet switching and hybrid switching. 8
- (b) Explain the taxonomy of attacks with relation to security goals. What are the techniques used for security? Explain any one. 6

AK9—680/210

Code : 041777