

Reg. No. :

--	--	--	--	--	--	--	--	--	--

Q 2214

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Sixth Semester

Electronics and Communication Engineering

EC 341 — DIGITAL COMMUNICATION

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. A delta modulator of step size 1 volt accepts samples of a signal of frequency 3 KHz and amplitude 2 volts at a rate of 40 K Samples/sec. Calculate the bit rate at the output of the delta modulator and check if there is slope overload distortion?
2. Justify the application of non-uniform quantization for speech signals.
3. Draw an eye pattern and specify the ways in which it is used to evaluate the performance of a baseband pulse transmission system.
4. Give the application of Raised cosine pulses.
5. Give the special features of matched filters.
6. Compare BPSK and QPSK in terms of their bandwidths and their error performance.
7. Define Hamming distance and based on that give the error correction and error detection capacity of a linear block code.
8. A communication system requires a minimum of 20 watts of transmitter power of achieve a BER of 10^{-7} in the absence of Channel Coding. If a channel coding scheme with a gain of 3 dB is incorporated into the system, calculate the minimum transmitter power required (assuming all other sub systems like modulator, channel et. remain the same).
9. How does frequency hop spread spectrum help in the mitigation of multipath effect?
10. Give the mechanism by which a direct sequence spread spectrum tackles the problem of jamming.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Represent the spectrum of a low pass signal of your choice. Draw the spectra of the sampled version of the signal for the two different cases viz. when the sampling frequency is higher than twice the highest message frequency and the sampling frequency being lower than twice the highest message frequency. Based on the spectra, state the condition for the minimum sampling rate of a low pass signal. (4)
- (ii) Briefly explain the condition for Band pass sampling. (3)
- (iii) Derive the expression for mean squared error in quantization for a uniform Quantizer of quantile interval width δ . (4)
- (iv) Obtain the expression for $(SNR)_q$, the signal to (quantization) noise ratio of a Uniform Quantizer if the input to the quantizer is (full load) sinusoid of amplitude A_m . (3)
- (v) Assume that a message signal has a maximum frequency of 4 KHz is fed to a PCM encoder consisting of a sampler operating at the minimum permissible sampling frequency and a (uniform) quantizer with 128 quantile intervals. Calculate the bit rate of the system. (2)

Or

- (b) (i) Draw the block diagrams of a DPCM encoder and a DPCM decoder and explain the principles behind their operation. (12)
- (ii) Obtain the expression for the processing gain of a DPCM. (4)
12. (a) (i) Obtain the expression for the overall frequency response of a duobinary signaling scheme. (8)
- (ii) What is the need for a precoder in duobinary coding? (3)
- (iii) Encode the data 01001101 using Duobinary coding. (3)
- without a precoder.
 - with a precoder.
- (iv) Calculate the bandwidth of Duobinary signaling for a binary data operating with a bit rate of 64 kbps. (2)

Or

- (b) (i) Define ISI and give the reason behind the manifestation of ISI? (3)
- (ii) Obtain the condition for Nyquist criterion for zero ISI. (5)
- (iii) Explain the MMSE equalizer in detail. (8)
13. (a) (i) Draw the block diagram of a BPSK transmitter and receiver and give a detailed explanation of the same. (8)
- (ii) Derive the expression for the error probability of a BPSK scheme. (8)

Or

- (b) (i) Discuss maximum likelihood detection as applied to a signal received through an AWGN channel. (10)
- (ii) Draw the ML partitioning space for BFSK. (2)
- (iii) Compare the performance of BPSK and BFSK. (4)
14. (a) (i) Give the properties of Linear Block codes. (2)
- (ii) Obtain all the code words generated using the generator matrix of a Linear block code (7, 4) given below and obtain the error correction and detection capability of the code. (7)

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

- (iii) If the received code word is (0110011), obtain the transmitted message vector. (5)
- (iv) Compare the bandwidth requirement of the coded with that of the uncoded system for the above code. (2)

Or

- (b) (i) Draw a convolutional encoder of rate $\frac{1}{2}$ with a constraint length of 3 and obtain the trellis and state diagram of the encoder. (8)
- (ii) Demonstrate Viterbi decoding algorithm with a received (8 bit) sequence. (8)

15. (a) Discuss the method of generation and properties of pseudo noise sequences in detail. (16)

Or

- (b) Draw the block diagram of a direct sequence spread spectrum transmitter and receiver and explain its function in detail. (16)
-