Code: 13A04502

SS

B.Tech III Year II Semester (R13) Regular & Supplementary Examinations May/June 2017

DIGITAL COMMUNICATION SYSTEMS

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Compare amplifier and regenerative repeater.
(b) List the drawbacks of DM.
(c) Find matched filter for a rectangular pulse g(t) of amplitude A and duration T.
(d) Define Duo binary signaling. What are the disadvantages of it?
(e) What is Schwarz inequality?
(f) Draw the block diagram of correlation receiver.
(g) Define bandwidth efficiency.
(h) Draw signal space diagram of QPSK.
(i) Verify that the given code C = {0 0 0, 1 1 1} is linear code or not.
(j) Show that the code C= {0 0 0, 1 0 0, 0 1 1, 1 1 1} is not cyclic.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) State and prove sampling theorem.
(b) Compare PCM, DPCM & DM.

OR

3 (a) Draw and explain the block diagram of TDM.
(b) Explain operation of ADPCM system.

UNIT – II

4 (a) Explain inter symbol interference with required equations.
(b) What are the practical difficulties encountered with the ideal Nyquist channel and how to overcome them?

OR

5 (a) What are properties of matched filter?
(b) Explain how an eye pattern provides a great deal of useful information about the performance of a data transmission system.

UNIT – III

6 (a) Explain Gram-Schmidt orthogonalization procedure.
(b) Explain correlation receiver with neat block diagram briefly.

OR

7 Explain conversion of AWGN channel into vector channel.

UNIT – IV

8 Explain coherent generation and detection of BPSK signals and derive the expression for probability of error.

OR

9 (a) Explain non-coherent binary frequency shift keying.
(b) Explain generation and detection of DPSK signals.

Contd. in page 2

UNIT – V

10 (a) For a (6,3) systematic linear block code, the three parity check bits c_4, c_5 and c_6 are formed from the following equations: $c_4 = d_1 \oplus d_3$

$c_5 = d_1 \oplus d_2 \oplus d_3$

$c_6 = d_1 \oplus d_2$

(i) Write down the generator matrix G.

(ii) Construct all possible code words.

(iii) Suppose that the received word is 010111. Decode this received word by finding the location of the error and the transmitted data bits.

(b) Consider a (7, 4) cyclic code with $g(x) = 1 + x + x^3$.

(i) Let data word d = (1 0 1 0). Find the corresponding code word.

(ii) Let the code word c = (11 0 0 1 0 1). Find the corresponding data word.

OR

11 Write a short notes on:

(a) Error correction and detection codes.

(b) Automatic Retransmission Query (ARQ) Systems.

(c) Linear block codes.

(d) Convolutional codes.

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Code: 9A04601 **R09**

B.Tech III Year II Semester (R09) Supplementary Examinations May/June 2017

DIGITAL COMMUNICATIONS

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 What is companding? Explain the process in digital communications.

2 (a) What is delta modulation technique? Comment on the motivation for this technique.

(b) In a single integration DM system, the voice signal is sampled at a rate of 128 kHz, similar to PCM. The maximum signal amplitude is normalized as $A_{max} = 1$.
(i) Determine the minimum value of the step size to avoid slope overload.
(ii) Determine the granular noise power N_o if the voice signal bandwidth is 15.0 kHz.
(iii) Assuming that the voice signal is sinusoidal, determine S_o and the SNR.

3 (a) Distinguish between pass band and base band transmission.

(b) Derive the power spectral density of NRZ unipolar format.

4 (a) What are optimal filters? Derive the transfer function of optimum filter.

(b) What is the difference between base band transmission and band pass transmission? Distinguish both features.

5 (a) Explain encoding using an (n-k) bit shift register.

(b) Explain Syndrome calculation and BCH codes.

6 (a) Explain the Shannon-Hartley theorem and its implications.

(b) Calculate the capacity of low pass channel with a usable bandwidth of 3000 Hz and S/N = 10^3 at the channel output. Assume the channel noise to be Gaussian and White.

7 (a) Derive an expression for probability of bit error of a binary coherent FSK receiver.

(b) Derive an expression for probability of bit error of a binary non-coherent ASK.

8 Explain the operation of 16-QAM system with neat block diagram in detail and also give the constellation diagram.

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Code: 9A04601

III B. Tech II Semester (R09) Regular Examinations, April/May 2012

DIGITAL COMMUNICATIONS

(Electronics & Communication Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions
All questions carry equal marks
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1 (a) What is Sampling theorem and prove it for band pass signals?

(b) A waveform $x(t) = 10\cos(1000t + \frac{\pi}{3}) + 20\cos(2000t + \frac{\pi}{6})$ is to be uniformly sampled for digital transmission. (i) What is the maximum allowable time interval between sample values that will ensure perfect signal reproduction?
ii) If we want to reproduce 1 hour of this wave form, how many sample values need to be sorted?

2 (a) Explain Hierarchy levels used in multiplexing.

(b) Explain about North American Hierarchy. (or) Explain about AT&T Hierarchy and table it bit rates and capacities.

3 (a) State and prove properties of matched filter.

(b) Show that the probability of bit error of a matched filter receiver is given by

$$P_e = \frac{1}{2} erfc \sqrt{\frac{E_b}{N_0}}$$

4 (a) Discuss base band transmission of M-ary data.

(b) An audio signal of bandwidth 4 kHz is sampled at a rate 25% above the Nyquist rate and quantized. The quantization error is not to exceed 0.1% of the signal peak amplitude. The resulting quantized samples are now coded and transmitted by 4 - ary pulses.
(i) Determine the minimum number of 4-ary pulses required to encode each sample.
(ii)Determine the minimum transmission bandwidth required to transmit this data with zero ISI.
(iii) If 4-ary pulses satisfying Nyquist's criterion with 25% roll-off are used to transmit this data. Determine the transmission bandwidth.

5 Explain about forward error correction systems with comparison.

6 Find the efficiency of transmission using Shannon-Fano coding and Huffman coding for the following message sequence [X] = [A B C D E F G H] with probabilities
[P] = [0.50, 0.15, 0.15, 0.08, 0.08, 0.02, 0.01, 0.01]

7 Derive a transfer function of the optimum filter and give the block diagram of correlation receiver with detailed explanation.

8 Compare digital modulation schemes with their space/constellation diagrams.
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2

Code: 9A04601

III B. Tech II Semester (R09) Regular Examinations, April/May 2012
DIGITAL COMMUNICATIONS
(Electronics & Communication Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions
All questions carry equal marks
*****

1 (a) Derive an expression for output signal to quantization noise ratio in a commercial PCM system.
(b) A certain 8 bit uniform quantization PCM system can accommodate a signal ranging from -1V to +1V. The RMS value of the signal is 0.5V. Calculate the signal to quantization noise ratio and expresses it in dB.

2 (a) Draw the block diagram of delta modulation system and explain its working.
(b) Derive an expression for quantization noise in delta modulation.

3 (a) What are the essential aspects when designing transmit and receive filters?
(b) What is a raised-cosine pulse? Describe with the help of diagram.

4 (a) What is matched filter? Derive an expression for matched filter.
(b) Give the properties of matched filter.
(c) Show that the probability of bit error of a matched filter receiver is given by

$$P_e = \frac{1}{2} erfc \frac{E_b}{N_0}$$

5 Write the [H] matrix for the (15, 11) cyclic code using $g(X) = 1+X+X^2+X^3+X^4$. Calculate the code polynomial for $m(X) = 1+X^3+X^7+X^{10}$. Construct the decoder for the code.

6 (a) Derive the condition for encoding the stationary source.
(b) Calculate the coding efficiency of the following codes and construct the decision tree.

Symbol	Probability	Code1	Code2
X_1	1/2	0	00
X_2	1/4	10	01
X_3	1/8	110	10
X_4	1/8	111	11

7 (a) Explain about The Gram-Schmidt process in band pass digital transmission.
(b) Explain in detail about Band pass binary data transmission system.

8 Draw the block diagram of QPSK modulator and demodulator and explain each block in detail.

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Code: 9A04601

III B. Tech II Semester (R09) Regular Examinations, April/May 2012

DIGITAL COMMUNICATIONS

(Electronics & Communication Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions
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*****

1 How will you differentiate binary FSK and MFSK, explain with block diagrams?

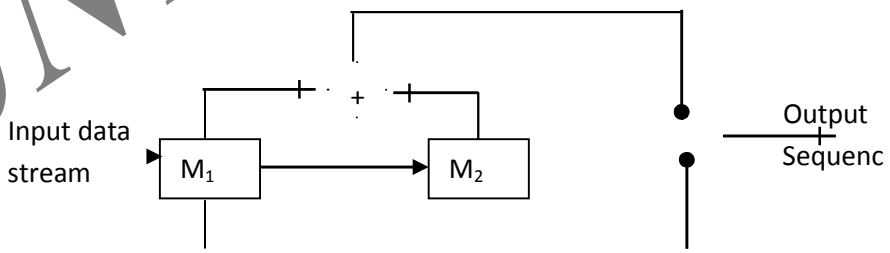
2 (a) Briefly explain the noise present in PCM systems.
(b) A modulating signal is given by x (t) = A Sin (β t). Find the Maximum value of A for no slope over distortion. Assume step size δ=2 mV and a sampling rate of f_s = 10 KHz.

3 (a) Explain the generation and reception of DPSK signals with a neat block diagram.
(b) Derive an expression for method filter with neat block diagram.

4 (a) Draw the block diagram of delta modulation system and explain its working.
(b) A decimal number N was transmitted using seven bit even parity Hamming code. After transmission, it was received as 1101101. Is there any error introduced during transmission. What is the value of N?

5 (a) Derive an expression for coding efficiency.
(b) Derive an expression for channel capacity in terms of signal power, noise power and band width of the channel.

6 Construct state diagram, Trellis Code tree for the Convolution encode shown in figure below, find the coded sequence for the input sequence 1 1 0 0. If the received sequence has an error in the 4th bit. How Vitterbe algorithm is used to correct the errors.



7 (a) With the help of a block diagram explain baseband binary data transmission system?
(b) Binary data is transmitted at the rate of 112kbps using a baseband binary PAM system designed to have a raised cosine spectrum. What is the transmission bandwidth required if the roll off factor ρ = 0.2, 0.45?

8 (a) What is correlative coding? Explain it in detail.
(b) For input binary data 1011101 obtain the output of duo binary encoder and also the output of decoder.

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Code: 9A04601

4

III B. Tech II Semester (R09) Regular Examinations, April/May 2012

DIGITAL COMMUNICATIONS

(Electronics & Communication Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions
All questions carry equal marks
*****

1 (a) What are optimal filters? Derive the transfer function of optimum filter.
(b) What is the difference between base band transmission and band pass transmission? Distinguish both features.

2 (a) Distinguish between delta modulation and adaptive delta modulation.
(b) In a single integration DM system, the voice signal is sampled at a rate of 32 kHz, similar to PCM. The maximum signal amplitude is normalized as A_{max}=1.
(i) Determine the minimum value of the step size to avoid slope overload.
(ii) Determine the granular noise power N_o if the voice signal bandwidth is 1.7 kHz.
(iii) Assuming that the voice signal is sinusoidal, determine S_o and the SNR.

3 (a) The term matched filter is often used synonymously with correlator. Describe how that is possible when their mathematical operations are different.
(b) A binary PAM wave is to be transmitted over a baseband channel with an absolute maximum bandwidth of 75 kHz. The bit duration is 10 μs. Find the raised cosine spectrums that satisfy these requirements.

4 (a) What is meant by quantization error? How to reduce it?
(b) What is the disadvantage of uniform quantization over the non-uniform quantization?

5 Design a syndrome calculator for a (7, 4) cyclic Hamming code generated by the polynomial g (x) = x^3+x+1. Calculate the syndrome for the received code vector 100101.

6 (a) Three BSC's each with error probability p_e=0.1 are cascaded as shown below and p (0) =1/4, p (1) = 3/4. Calculate H(Y), H (U), I(X, Z) and I (X, U).
(b) A BSC has the error probability p=0.2 and the input to the channel consists of 4 quiprobable messages x_1 =000, x_2 =001, x_3 =011, x_4 =111, calculate:
(i) p (0) and p (1) at the input (ii) Efficiency of code (iii) Channel capacity.

7 (a) What is matched filter? Give its properties.
(b) A binary data is transmitted over a microwave link at the rate of 10^6 bits/sec. and the psd of the noise at the receiver input is 10^{-10} watts/Hz. Find the average carrier power required to maintain an average probability of error $p_e \leq 110^{-4}$ for coherent binary PSK.

8 (a) Give the comparison of M-ary digital modulation techniques.
(b) Derive an expression for probability of error for an M-ary PAM system (M=4).

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