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- demodulator.
- (c) Explain using block diagrams of modulator and demodulator.
- (d) How FSK modulation and demodulation is done?
- (e) Quadrature phase shift keying (QPSK).
- (f) Differential phase shift keying (DPSK).
- (g) Write short note on following digital modulation techniques :
- (h) Explain its operation with suitable example.
- (i) diagram of an unscrambler using shift registers and digital communication system. Draw the block diagram of a scrambler and unscrambler in digital communication system.
- (j) Explain the use of scrambler and unscrambler in digital communication system.
- (k) Attempt any two questions : 2×10=20

Note: Attempt all questions.

[Total Marks : 100

Time : 3 Hours]

DIGITAL COMMUNICATION

(SEM. VI) THEORY EXAMINATION, 2014-15

B. Tech.

Roll No.									
PAPER ID : 131601									
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EEEC601



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the vectors for

derived code vector

it of received code vector.

on encoder has generating

0) and $g^3 = (101)$

der configuration

diagram

age sequence is 11010;

output sequence of the

x

message 1011

er diagram?

ix of a (7, 4) hamming code

ix of a (7, 4) hamming code

2×10=20

2 Attempt any two questions

(a) Write short note on following :

- (i) CDF (ii) PDF (iii) random process.
(b) Define mean, variance and standard deviation for random variables.

Also prove the following theorem on variance

$$(i) \sigma^2 = E(X^2) - \mu^2$$

$$(ii) \text{Var}(CX) = C^2 \text{Var}(X)$$

$$(iii) \text{Var}(X-Y) = \text{Var}(X) + \text{Var}(Y)$$

- (c) The probability density function is given as

$$f_x(x) = a e^{-bx} \text{ where } X \text{ is a random variable.}$$

Find :

- (i) relationship between a and b
(ii) CDF
(iii) the probability that outcome lies between 1 and 2.

2×10=20

3 Attempt any two questions

- (a) What do you understand by matched filter and what are the properties of matched filter ?
(b) Derive an expression for the probability of error of the binary phase shift keying (BPSK) signal.
(c) Derive an expression for error probability of a matched filter.

4×5=20

4 Attempt any four questions

- (a) What is PN sequence? Draw suitable PN sequence generator and prove the properties of PN sequence and sketch its autocorrelation function.

- (b) With the help of block diagram and suitable expressions explain the generation and reception of direct sequence spread spectrum (DS-SS) signal using BPSK modulation.
(c) Explain the following terms for spread spectrum system.

- (i) Processing gain (P G)
(ii) Probability of error of DS/BPSK system
(iii) Jamming margin.
(d) Explain the operation of frequency hop spread spectrum (FH-SS) with the help of block diagram and waveforms.
(e) Explain how spread spectrum communication can be used for providing multipoint connectivity using CDMA techniques?

5 Attempt any five questions 5×4=20

- (a) An event has six possible outcomes with the probabilities $p_1=1/2, p_2=1/4, p_3=1/8, p_4=1/16, p_5=1/32, p_6=1/32$. Find the entropy of the system. Also find the information rate if there are 32 outcomes per second.
(b) Consider a sequence of symbols emitted by a source with their probabilities as given below:

Symbol	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8
Probability	0.1	0.25	0.15	0.05	0.15	0.1	0.05	0.15

Compute the Huffman code for the above source symbols. Also find the average codeword length and efficiency.

- (c) The generator polynomial of a (7, 4) cyclic code is $G(p) = p^3 + p + 1$ find the code vectors for messages 0111 & 1110. If code is in systematic form.

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- (d) The parity check matrix of a (7, 4) hamming code is given

$$[H] = \begin{bmatrix} 1110100 \\ 1101010 \\ 1011001 \end{bmatrix}$$

Find :

- Generator matrix
 - code vector for message 1011
 - draw the encoder diagram?
- (e) The parity check matrix of a (7, 4) hamming code is given.

$$[H] = \begin{bmatrix} 1110100 \\ 1101010 \\ 1011001 \end{bmatrix}$$

Calculate the syndrome vectors for

- No error in received code vector
- Error in third bit of received code vector.
- A rate 1/3 convolution encoder has generating vectors as

$$g^1 = (110), g^2 = (110) \text{ and } g^3 = (101)$$

- Sketch the encoder configuration
- Draw the trellis diagram
- If input message sequence is 11010; determine the output sequence of the encoder?

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[Total Marks : 100

Note: Attempt all questions.

1 Attempt any two questions :

2×10=20

- (a) Explain the use of scrambler and unscrambler in digital communication system. Draw the block diagram of an unscrambler using shift registers and explain its operation with suitable example.

- (b) Write short note on following digital modulation techniques :

- Differential phase shift keying (DPSK)
 - Quadrature phase shift keying (QPSK).
- (c) How FSK modulation and demodulation is done? Explain using block diagrams of modulator and demodulator.