Printed Pages : 4

EEC601

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 131601

Roll No.

B. Tech.

(SEM. VI) THEORY EXAMINATION, 2014-15

DIGITAL COMMUNICATION

Time : **3** Hours] [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 :

(i) Differential phase shift keying (DPSK)

(ii) Quadrature phase shift keying (QPSK).

(c) How FSK modulation and demodulation is done? Explain using block diagrams of modulator and demodulator.

2 Attempt **any two** questions **2×10=20**

(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) $Var(CX) = C^2 Var(X)$

(iii) $Var\ (X-Y) = Var\ (X) + Var\ (Y)$

(c) The probability density function is given as $f_x(x) = a e^{-b|x|}$ where X is a random variable.

Find :

(i) relationship between a and b

(ii) CDF

(iii) the probability that outcome lies between 1 and 2.

3 Attempt **any two** questions **2×10=20**

(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 Attempt **any four** questions **4×5=20**

(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.

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

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

Find :

(i) Generator matrix

(ii) code vector for message 1011

(iii) 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

(i) No error in received code vector

(ii) Error in third bit of received code vector.

(f) A rate 1 /3 convolution encoder has generating vectors as

$g^1 = (110)$, $g^2 = (110)$ and $g^3 = (101)$

(i) Sketch the encoder configuration

(ii) Draw the trellis diagram

(iii) If input message sequence is 11010; determine the output sequence of the encoder?