Registration No. : | | | | | | | | | | |

Total number of printed pages – 3

B. Tech

PCEC 4305

Sixth Semester Regular Examination – 2014

DIGITAL COMMUNICATION TECHNIQUES

BRANCH(S) : EC, ETC

QUESTION CODE : F 234

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

(a) Write down the advantages of Huffman coding.

(b) What is the mutual information provided about $X = x_i$ by the occurrence of the event $Y = y$?

(c) Sketch the power spectrum of a typical BPSK modulated signal.

(d) Find the minimum bandwidth required to transmit 1 Mbps of data if it is to be transmitted using 8-PSK.

(e) Draw the signal space diagram for 8-QAM.

(f) Can you opt for a non coherent demodulation for a BFSK signal ? Justify.

(g) What is an AWGN channel model ?

(h) Does a digital receiver need equalization always ? Justify.

(i) What are the disadvantages of a DSSS system ?

(j) What is the relation between information content measured in nats and in bits ?

P.T.O.

2. (a) Design a Huffman code for a DMS having source symbols $\{x_1, x_2, x_3, x_4, x_5, x_6, x_7\}$ with probabilities of $\{0.35, 0.3, 0.2, 0.1, 0.04, 0.005, 0.0005\}$ respectively. 5

(b) Prove that $\ln x \leq x - 1$ and also demonstrate the validity of this inequality by plotting $\ln x$ and $x - 1$. 5

3. (a) For which input probability distribution is the value $I(X; Y)$ is a maximum ? Prove your statement mathematically. X is the input and Y is the output. 1+5

(b) How do you achieve channel capacity through the use of orthogonal signals ? Discuss. 4

4. (a) In a communication system, the transmitted pulse is $x(t)$ having a duration of T with unit energy and the received pulse is $h(t) = x(t) + \alpha x(t - T)$. Find out the equivalent discrete time equivalent white noise filter model. 5

(b) Find out the Fourier transform of a sequence given as $x_n = \sqrt{1 - \alpha^2 \alpha^n}$, $\alpha = 0, 1, \ldots$. Sketch the same. 5

5. (a) Derive the average energy per symbol in an M-ary PAM system. 5

(b) Find out a set of orthonormal functions to represent the following waveforms : 5

$$x_1(t) = \begin{cases} 1, & 0 \leq t \leq 2 \\ 0, & \text{elsewhere} \end{cases}, \quad x_2(t) = \begin{cases} 1, & 0 \leq t \leq 2 \\ -1, & 2 < t \leq 3 \\ 0, & \text{elsewhere} \end{cases} \text{ and}$$

$$x_3(t) = \begin{cases} 1, & 0 \leq t \leq 1 \\ -1, & 1 < t \leq 2 \\ 0, & \text{elsewhere} \end{cases}.$$

6. (a) Suggest a suitable transmitter for DSSS that uses QPSK. 5

(b) How do you take care of a narrowband interference in an SS system ? You may derive suitable mathematical expressions if required. 5

7. (a) Evaluate the cross correlation coefficient between adjacent signal points for signal waveforms constructed from binary codes. 5

(b) Evaluate the phase of the carrier in a given time interval corresponding to an MSK signal that uses a rectangular pulse of duration T. 5

8. Write short notes on any **two** : 5×2

(a) Linear equalization

(b) CDMA

(c) Correlator receiver

(d) Frequency hopping.