Registration Number:

B.E. DEGREE (PART TIME) ARREAR EXAMINATION – APRIL 2014
ELECTRONICS AND COMMUNICATION ENGINEERING BRANCH
FOURTH SEMESTER – (REGULATIONS R 2009)
PTEC 9301 – DIGITAL COMMUNICATION TECHNIQUES

Duration : 3 Hours Max. Marks = 100

Answer **ALL** the questions.

PART- A (10 x 2 = 20 marks)

1. Given a bit duration of 10 μs to be transmitted over a baseband channel, calculate the transmission bandwidth required for Raised Cosine pulse shaping with roll-off factor $\alpha = 0.5$.
2. Draw the power spectral density graph for a rectangular pulse of unit amplitude and duration T sec.
3. What is the advantage of doing a carrier phase recovery and synchronization.
4. Highlight the merits and demerits of Zero-Forcing algorithm for adaptive equalization.
5. What is the difference between data compaction and data compression.
6. Define bandwidth efficiency and what would be the impact of error control coding on the bandwidth efficiency.
7. What is the significance of Constraint length with reference to convolutional codes.
8. What is the impact of code rate on the Coding gain achieved by Error control codes.
9. Explain the difference between Euclidean distance and Hamming distance with an example.
10. What do you understand by soft decision decoding.

PART – B (5 x 16 = 80 marks)

11. (i) Demonstrate the Ungerboeck set partitioning for an 8-PSK signal set. Show a possible 4-state trellis mapping for the same.
(ii) List out the advantages of LDPC Coding and the reasoning behind them. Draw the tanner graph for the given H matrix.

$$H = \begin{matrix} 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 \end{matrix}$$

(8 + 8)

12b. Why does Inter-Symbol Interference (ISI) occur in a communication channel. Discuss the Nyquist's criterion for pulse shaping to reduce ISI. Compare the merits and demerits of the Ideal Sinc pulse shaping and the Raised cosine pulse shaping solutions.

'OR'

12b. Draw the block diagrams for duo-binary and modified duo-binary coding systems. Derive their transfer functions and make your comparison. What is the rule used for decoding in both cases.

13a. What are the sources of carrier phase offset in digital communication systems. Justify the need for estimating the delay and the carrier phase as two different entitites. Suppose the real signal s(t) represents a modulated signal given by $s(t) = A \cos(2 \pi f_c t)$, occurring every T secs, where A is binary with uniform distribution. Derive the Log Likelihood Function and the ML estimate for the carrier phase ϕ.

'OR'

13b. Explain the necessity for an adaptive equalizer in practical systems with suitable examples. What is the need for training in an adaptive equalizer. Explain the usage of LMS algorithm for the same.

14a. Derive the Shannon's Information Capacity theorem for a continuous Gaussian channel subject to bandwidth and power constraints. Given a bandwidth of 3.4 KHz and a SNR of 20 dB, calculate the capacity. If source transmits 128 possible symbols with equal probabilities what is the maximum symbol rate for error-free transmission.

'OR'

14b. A discrete memoryless source has an alphabet of seven symbols with probabilities for its output, as described below:

Symbol	S_0	S_1	S_2	S_3	S_4	S_5
Probability	0.125	0.35	0.125	0.1	0.2	0.1

Obtain the Shannon-Fano and the Huffman code for this source. Calculate and compare the efficiencies for the coding schemes.

15a. The generator polynomial of a (7,4) Hamming code is defined by,

$$g(X) = 1 + X^2 + X^3$$

Obtain the Generator matrix for systematic encoding. Draw the encoder circuit for systematic coding. Trace the message sequence (1 1 0 1) through the encoder circuit and obtain the systematic codeword for the same. Verify the obtained codeword using the polynomial division method.

'OR'

15b. Consider a rate – ½, non-systematic Convolutional Code with $g^{(1)} = \{ 1,0,1 \}$ and $g^{(2)} = \{ 1,1,1 \}$. Draw the encoder structure and obtain the trellis diagram corresponding to this encoder. Determine the free distance and the error correction capability of the code.

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