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B.E DEGREE EXAMINATIONS: NOV/DEC 2014

(Regulation 2009)

Fifth Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

ECE126**:** Information Theory and Coding

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1.   The set of codewords given by C = {0, 10, 110} is :

   a)   Instantaneous   b)   Huffman code

   c)   Shannon Fano code   d)   not instantaneous

2.   If optimized, for a given rate the distortion is :

   a)   maximized   b)   minimized

   c)   optimized   d)   reduced

3.   The minimum distance of a linear block code is upper bounded by :

   a)   n-k+1   b)   n+k-1

   c)   n-k   d)   n+k

4.   The encoder of a turbo code is constructed using :

   a)   shift registers   b)   systematic convolutional encoders

   c)   convolutional encoders   d)   recursive systematic convolutional encoders

5.   In adaptive Huffman coding, the maximum number of nodes in the tree for an alphabet size of 48 is :

   a)   95   b)   48

   c)   96   d)   47

6.   In LZ77 encoder, the size of the search buffer is 7, size of the look ahead buffer is 7, The maximum length of the pattern that can be encoded is :

   a)   7   b)   13

   c)   14   d)   6

7.   In a delta modulation system, if the following sequence is output. It means the system is

producing ----------- errors.

Sequence : +1, -1, +1, -1, +1, -1, +1, -1, +1, -1

a) Minimum	b) Mean squared
c) Granular	d) Slope overload

8. In LPC-10 coder, pitch is estimated using :

a) Voiced speech	b) AMDF
c) Unvoiced speech	d) Speech segments

9. The compression algorithm used in TIF is :

a) Huffman	b) RLE
c) LZW	d) DPCM

10. Quality scalability is achieved in :

a) JPEG	b) MPEG
c) H.261	d) JPEG2000

PART B (10 x 2 = 20 Marks)

11. State the condition for which entropy of a source is maximum.

12. What is the mutual information transmitted if the input and output of the channel are independent?

13. Indicate the parameter of BCH codes.

14. Summarize the advantages of Trellis coded modulation.

15. State the sibling property in adaptive Huffman coding.

16. Compare static and adaptive dictionary.

17. Explain how temporal masking can be used for compression.

18. What are the two types of codebooks used in CELP?

19. Distinguish between spatial and temporal redundancy in video signal.

20. Examine the use of macroblocks in video compression.

PART C (5 x 14 = 70 Marks)

21. a) (i) An independent source transmits messages $\{x_1, x_2, x_3\}$ with probabilities $\{0.3,$ (7) $0.35, 0.35\}$. The joint probability matrix for the transmitted and received pairs is given below:

$$\begin{array}{c c c c} & y_1 & y_2 & y_3 \\ x_1 & \begin{bmatrix} 0.20 & 0.05 & 0.05 \\ x_2 & 0.05 & 0.25 & 0.05 \\ x_3 & 0.05 & 0.05 & 0.25 \end{bmatrix} \end{array}$$

The messages are transmitted over a noisy channel. Find the channel matrix.

(ii) Find the entropies H(X), and H(Y/X) for the above problem. (7)

(OR)

b) A source transmits nine characters {a, b, c, d, e, f, g, h, i} with equal probabilities. Construct the Huffman code for the source alphabets.

22. a) Generate (7, 4) systematic cyclic codes for any 8 messages with the generator polynomial $g(p) = p^3 + p + 1$.

(OR)

b) The parameters of a rate 2/3 convolutional encoder are given by :
K = 2, g_1 = [1011], g_2 = [1101], g_3 = [1010]. Construct the encoder and the corresponding trellis diagram.

23. a) For the probability model given, decode a sequence of length 10 with the tag 0.63215699.

Letter	Probability
a_1	0.2
a_2	0.3
a_3	0.5

(OR)

b) A sequence is encoded using LZ77 algorithm. Given c(a) = 1, c(b) = 2, c(r) = 3, c(t) = 4, decode the following sequence of triples :
<0,0,3> <0,0,1> <0,0,4> <2,8,2> <3,1,2> <0,0,3> <6,4,4> <9,5,4>.
Assume the size of the window is 20 and the size of the look ahead buffer is 10.

24. a) (i) Develop the equations for estimating the filter coefficients in LPC-10 coder. (10)
    (ii) Examine how CELP gives better quality than LPC. (4)

b) (i) Develop a subband coding system (with a minimum of 4 sub bands) to encode audio signal with a bandwidth of 15kHz at bit rates less than 100 kbits / sec.

25. a) (i) Explain how motion vector is generated and used in motion compensation for video compression. (7)

   (ii) Compare JPEG and JPEG2000 standards. (7)

(OR)

b) (i) Illustrate MMR coding procedure with flowchart and appropriate diagrams. (7)

   (ii) Compare H.261 and MPEG-1 standards. (7)

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