Registration no: | | | | | | | | | | |

Total Number of Pages: 2

M.TECH
ETPC102

1st Semester Back Examination – 2016-17
INFORMATION CODING & CRYPTOGRAPHY
BRANCH(S): ETC, ECE, COMMUNICATION SYSTEMS, COMMUNICATION ENGINEERING
Time: 3 Hours
Max marks: 70
Q Code:Y917
Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: (2 x 10)

a) Define syndrome polynomial? Give the properties of syndrome polynomial.

b) Relate the amount of information provided and probability of occurrence of events.

c) Find the entropy of a discrete memory-less source with source alphabet Z={A, B, C, D, E} with probability

$P(A) = P_0 = \frac{1}{4}$, $P(B) = P_1 = \frac{1}{16}$, $P(C) = P_2 = \frac{1}{16}$,

$P(D) = P_3 = \frac{1}{8}$ $P(E) = P_4 = \frac{1}{2}$

d) What is source coding? Define code length & code efficiency. Give the relation between them.

e) What is conditional entropy? When the entropy function will have its maximum value?

f) Define mutual information I (X ; Y) and show that I (X ; Y) ≥ 0.

g) Briefly explain the Shannon first theorem.

h) Differentiate trellis code and tree code.

i) Explain hamming distance.

j) Define zero memory sources.

Q2 a) Derive the expression for conditional entropy, joint entropy. (5)

b) Explain RSA algorithm, with suitable diagram/ flow chart. (5)

Q3 Design an (n, k) = (5, 2) linear block code. (10)

i. Choose the code words to be in systematic form, and choose them with the goal of maximizing d_{min} .
ii. Find the generator matrix for the codeword set.
iii. Calculate the parity-check matrix.
iv. Enter all of the n-tuples into a standard array.
v. What are the error-correcting and error-detecting capabilities of the code?

Make a syndrome table for the correctable error patterns.

Q4 a) A discrete memory less source emits five symbols with probabilities {0.4, 0.1, 0.2, 0.1, 0.2}. Find Huffman code and its length by placing the combined symbol as high as possible. (5)

b) Describe the operation of JPEG decoding stage with a block diagram (5)

Q5 a) A voice- Grade channel of network has a band width of 2.4 kHz. Calculate (5)

i. Information capacity of the telephone channel for SNR of 20dB.
ii. The minimum SNR required to support information through the telephone channel

at the rate of 9.6 kb/s.

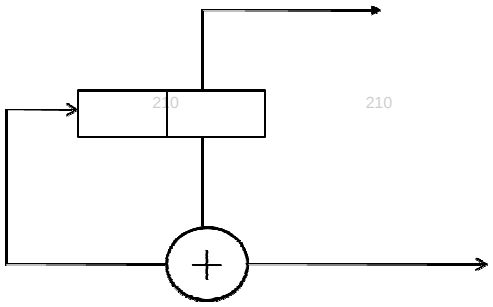
b) Explain Shannon-Hartley theorem with example (5)

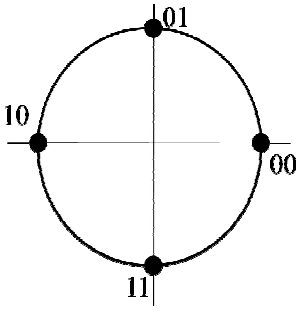
Q6 a) Consider the TCM scheme as shown below consisting of a rate ½ convolutional encoder coupled with a mapper. (6)

i. Draw the trellis diagram for this encoder

ii. What is the minimum hamming distance (d_{free}^{H}) of this code

iii. How many paths are there with this d_{free}^{H} ?





b) Explain the Ungerboeck Partitioning scheme and the trellis structure in TCM code formation. (4)

Q7 a) Construct (15, 11) linear block code for the given message block. The parity check matrix is as shown below. (10)

$$H_{4x15} = \begin{bmatrix} 1111 & 1110 & 0001 & 000 \\ 1111 & 0001 & 0100 & 100 \\ 1100 & 1101 & 1010 & 010 \\ 1010 & 1011 & 1110 & 001 \end{bmatrix} \text{ and } \quad m = (0010 \quad 1100 \quad 111)$$

Q8 Write Short Notes (Any Two) (5 x 2)

a) Asymmetric-key cryptography.

b) State diagram for convolution codes

c) JPEG standards in image compression.

d) Data encryption standard (DES).