JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- MAY 2017

M.Tech II[nd] Semester (ECE)

Dr Neeru

COURSE CODE: 10M11EC213 MAX. MARKS: 35

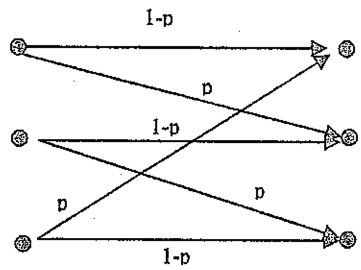
COURSE NAME: INFORMATION AND CODING THEORY

COURSE CREDITS: 3 MAX. TIME: 2 Hrs

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means. Use of calculator is permitted.

Q1(a) A source emits one of four symbols s_0, s_1, s_2, and s_3 with probabilities 1/3, 1/6, 1/4 and 1/4 respectively. The successive symbols emitted by the source are statistically independent. Calculate the entropy of the source. [2 Marks]

(b) Determine the channel capacity of the channel shown below:



[3 Marks]

(c) For GF(2^5) find the factors of D^4-1. [2 Marks]

Q2(a) Consider the following generator matrix over GF(2)

$$G=\begin{bmatrix}1 & 0 & 1 & 0 & 0\\ 1 & 0 & 0 & 1 & 1\\ 0 & 1 & 0 & 1 & 0\end{bmatrix}$$

[5 Marks]

(i) Generate all possible codewords using the matrix.
(ii) Find the parity check matrix H.
(iii) Find the generator matrix of an equivalent systematic code.
(iv) What is the minimum distance of this code?
(v) How many errors can this code detect?

(b) State and explain Shannon's channel capacity theorem. [2 Marks]

Q3(a) Find the cyclic binary codes of block length 5. Find the minimum distance of each code. [3 Marks]

(b) Let the polynomial $g(x)=x^{10}+x^8+x^5+x^4+x^2+x+1$ be the generator polynomial of a cyclic code over GF(2) with block length 15. [4 Marks]

(i) Find the generator polynomial G
(ii) Find the parity check matrix H.

Q4(a) Let the primitive code have blocklength n=31 with q=2 and m=5. Determine the generator polynomial for a single error correcting BCH code. [3 Marks]

(b) Write the steps involved in decoding BCH codes in detail. Can a binary (9,2) cyclic code have the generator polynomial $g(x)=x^7+x^6+x^4+x^3+x+1$? [4 Marks]

Q5(a) With the help of block diagram explain convolution coding. Are the following two codes equivalent?

$$G_1(D)=\begin{bmatrix}1 & 0 & \frac{D}{1+D^3}\\ 0 & 1 & \frac{D^2}{1+D^3}\end{bmatrix} \quad G_2(D)=\begin{bmatrix}1 & D^2 & D\\ D & 1 & 0\end{bmatrix}$$

[4 Marks]

(b) Explain Viterbi decoding for convolution codes. [3 Marks]