Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

SEVENTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION
NOV 2017
SUBJECT: INFORMATION THEORY AND CODING (ECE - 4009)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates
- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. Derive the relation between the entropy of a DMS and its nth extension and verify the relation for a DMS source S with symbol probabilities P={0.25, 0.5, 0.25} taking n=2.

1B. In a class of 70 students there are 60% of students have insufficient background of probability theory, 50% have adequate knowledge of ITC, and 80% are in either one or both of the two categories. What is the percentage of students who know ITC among those who have a sufficient background of probability theory?

1C. A box contains two red and 3 green balls. What is the amount of uncertainty involved in picking 4 balls at random in sequence that leads to alternate colour selection?

(5+3+2)

2A. Consider a third order Markov source with the binary source alphabet S={0,1}. Given that all the conditional symbol probabilities are equal to 0.5 except for given below

$p(0/000) = p(1/111) = 0.7$ and $p(1/000) = p(0/111) = 0.3$

State probabilities are $p(000)$ & p (111) is 5/22 & p (all other states) is 1/11.

(i) Draw the state diagram for the given source.
(ii) Find the source entropy
(iii) Obtain the first order state - transition probabilities from the third order conditional probabilities given and hence compute the entropy of this first order source.
(iv) Compute adjoint of S, S^3

2B. A zero memory DMS has probability of symbol occurrence $P(S_i) = p(1-p)^{i-1}$ for all i respectively. Compute the entropy of this source in terms of p. If p=0.5, what is the entropy?

2C. For a given source, S, define and prove the bounds on average length of any acceptable code.

(5+3+2)

3A. A source S consists of symbols as 26 English alphabets. Using adaptive Huffman coding, Generate a NYT list. Encode the word "INSTANT"

3B. Generate a ternary (r=3) compact code for the source S with probabilities as {1/3, ¼, 1/8, 1/8, 1/12, 1/12}. Find the efficiency

3C. Define uniquely decodable codes. Give examples of instantaneous and Non-instantaneous codes.

(5+3+2)

4A. Compute the channel capacity for the channels shown in Figure Q4A. Also compute the capacity if the two channels are cascaded.

4B. A message source produces two symbols A and B with probabilities 0.6 and 0.4 respectively. If the symbols are received through BSC with on an average 4 of 100 symbols in error. Find the capacity of the channel.

4C. Each message symbol (0 or 1) is repeated 5 times. Determine the probability of error in repeated code if the bit error probability is 0.01.

(5+3+2)

5A. Find the CRC and the transmitted code if the message bit stream is {11011011|} using the generating polynomial $g(x) = 1 + x + x^4$.

5B. A linear block code has a generator matrix entries as { (100011), (010101), 001110)}, Compute (i) G & H matrix (ii) Code rate, (iii)Hamming distance (iv) error detection and correction capability.

5C. Draw the encoder circuit for the generator matrix entries as {(100011), (010101), 001110)}

(5+3+2)

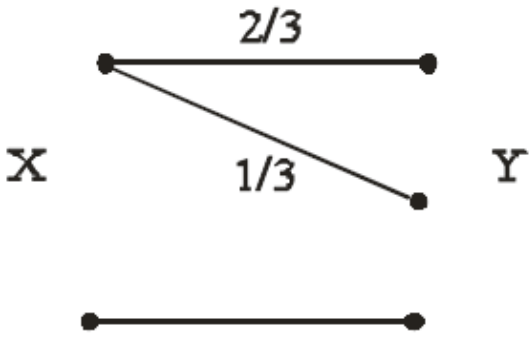

Figure Q4A (i)

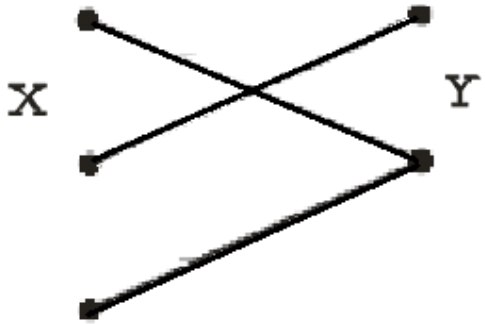

Figure Q4A (ii)