Roll No. | | | | | | | | | | | **NEC 031**

B.TECH
(SEM VII) THEORY EXAMINATION 2017-18
INFORMATION THEORY & CODING

Time: 3Hrs **Total Marks: 100**

Note: 1. Attempt all sections. If require any missing data; then choose suitably.
2. Any special paper specific instruction.

SECTION A

Q1) **Attempt ALL questions in brief** **(2*10=20 Marks)**

a) Describe probability Mass function.
b) Explain what is conditional entropy.
c) What is Kraft Inequality for instantaneous code.
d) Give properties of channel capacity
e) Explain what is DMC
f) Calculate error Syndrome s if no error occur in the required word v=(0111010).
g) What do you understand by soft decision decoding
h) Define minimum free distance of a convolution code
i) What is Channel Coding theorem?
j) What are impact of Concave & Convex Function

SECTION B

Q2) **Attempt any three parts of the following** **(10*3=30 Marks)**

a) Let the random variable X have three possible outcomes (a,b,c).Consider two distribution on this random variable

Symbol	P(x)	Q(x)
a	0.5	0.33
b	0.25	0.33
c	0.25	0.33

Calculate H(p),H(q),$D(p \| q)$,$D(q \| p)$

b) Consider the random Variable

$X = (x_1=0.49,\ x_2=0.26,\ x_3=0.12,\ x_4=0.04,\ x_5=0.04,\ x_6=0.03,\ x_7=0.02)$

i) Find the binary Huffman Code for X
ii) Find the Codeword Length
iii) Find the Ternary Huffman Code
c) State and prove joint AEP theorem depending on channel capacity
d) Write Short note on automatic repeat request scheme(ARQ)
e) A rate 1/3 convolution encoder has a generating vector as $g^1=(110)$, $g^2=(110)$, $g^3=(101)$
   i) Sketch the encoder configuration
   ii) Draw the trellis diagram

SECTION C

Q 3) Attempt any two parts of the following: **(5*2=10 Marks)**

a) For the Following Joint Probability calculate H(X),H(Y),H(X,Y),H(X/Y)

X \ Y	0	1
0	1/3	1/3
1	0	1/3

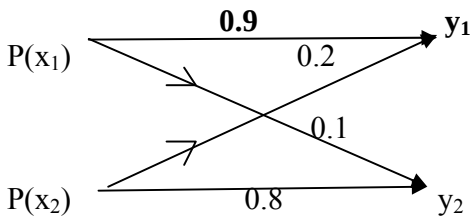
b) Relate Mutual Information & Entropy? Draw the Venn Diagram in Support of Your Answer
c) State Jensen's inequality and relate its consequences

Q4) Attempt any two parts of the following: **(5*2=10 Marks)**

a) Classify the various types of codes used in data compression technique
b) A DMS X has four symbols x_1,x_2,x_3,x_4 with $P(x_1)=1/2,P(x_2)=1/4,P(x_3)=P(x_4)=1/8$.Construct a Shannon Fano code for X; show that this code has the optimum property that $n_i=I(x_i)$ and code efficiency is100%
c) Show that the expected length L of any instantaneous D-ary code for a random variable X is greater than or equal to the entropy $H_D(X)$ that is $L>=H_D(X)$ with equality if and only if $D^{-li}=p_i$

Q5) Attempt any one parts of the following: **(10*1=10 Marks)**

a) The Information i For the Given Binary Channel?
   a. Find the Channel Matrix
   b. Find P(y1) and P(y2) when P(x1)=P(x2)=0.5



b) Explain channel capacity of a continuous memory less channel

Q6) Attempt any one parts of the following: **(10*1=10 Marks)**

a) For Consider a random Variable which takes on four values with probabilities (1/3,1/3,1/4,1/12)
i) Construct The Shannon Elias Code for this random Variable
ii) Construct the Huffman Code
iii) Show that there Exist two different sets of optimal lengths for the codeword, show that Codeword length (1,2,3,3) and (2,2,2,2) are both optimal
b) What is Hamming Distance ? Give relation between minimum distance and error detecting and correcting capability? Explain with an example

Q7) Attempt one parts of the following: **(10*1=10 Marks)**

a) Consider a(7,4) block code generated by

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

Explain how the errors syndrome S helps in correcting a single error

b) Define encoder for an (n,k,m) convolutional code