Registration no:

Total Number of Pages: 2

B.Tech
PEEC5301

6th Semester Regular / Back Examination 2016-17
INFORMATION THEORY AND CODING
BRANCH: ECE.ETC
Time: 3 Hours
Max Marks: 70
Q.CODE: Z881

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 average mutual information $I(X;Y)$. What is the condition for $I(X;Y)=0$?

b) What is the source entropy for a DMS with source probabilities {0.30, 0.30, 0.20, 0.15, 0.5}? If the sources are encoded into fixed length code how many bits per message in needed?

c) What is bandwidth efficiency diagram? Represent capacity boundary in it.

d) With example explain antipodal and orthogonal signals.

e) How is parity check matrix generated from generator matrix? What is the role of parity check matrix in syndrome testing?

f) Using a generator polynomial $\mathbf{g}(x)=1+X^2+X^3$ for a (7, 4) cyclic code generate a systematic codeword for the message vector m=1 1 0 1.

g) What is catastrophic error propagation in Convolutional codes?

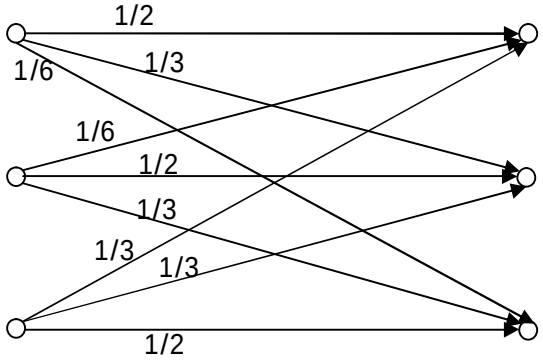
h) Why does an R-S code perform well in a bursty-noise environment?

i) What is Nyquist minimum bandwidth?

j) What is dithering and what is its application?

Q2 **a)** Write down the condition for Kraft inequality and prove them. **(5)**

b) Determine the channel capacity of the channel which is represented by the following: **(5)**



Q3 **a)** Show that $I(X;Y) = H(X) + H(Y) - H(XY)$ **(4)**

b) What is(are) the difference(s) between forward error correction and automatic repeat request? Explain the different types of ARQ techniques. **(6)**

Q4 For a (7,4) linear block code whose generator matrix is **(10)**

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

a) Find all the codewords of the code.
b) Find H, the parity-check matrix of the code.
c) Compute the syndrome for the received vector 1 1 0 1 1 0 1. Is this a valid code vector?
d) What is the error correcting capability of the code?
e) What is the error detecting capability of the code?

Q5 **a)** Draw the state diagram, tree diagram, and trellis diagram for K=3, rate 1/3 code generated by **(7)**

$$\mathbf{g}_1(X) = X + X^2, \mathbf{g}_2(X) = 1 + X, \mathbf{g}_3(X) = 1 + X + X^2$$

b) Explain the Circ encoding process. **(3)**

Q6 **a)** Design a feedback shift register encoder for an (8, 5) cyclic code with a generator $\mathbf{g}(X) = 1 = X + X^2 + X^3$. Use the encoder to find the codeword for the message 1 0 1 0 1 in systematic form. **(6)**

b) Represent the bandwidth-efficiency plane and write down its characteristics. **(4)**

Q7 **a)** Explain the Ungerboeck partitioning scheme for a 16-QAM signal set. **(6)**

b) Explain delta modulation and also explain the sigma-delta modulation using DPCM. **(4)**

Q8 **Write short answer on any TWO:** **(5 x 2)**

a) Syndrome decoding

b) Block interleaving

c) Differential pulse code modulation

d) Trellis coded modulation