Concordia University
Department of Electrical and Computer Engineering
ELEC 6831: Digital Transmission Systems I
Final Exam, Fall 2001

Q1 (25%)

An (n,k) = (6,2) cyclic code is to be designed using shortest possible generator polynomial:

a) Determine the generator matrix G (in systematic form) and find all possible code words. Enter all the n-tupples into a standard array considering only single error patterns.
b) Evaluate all the syndromes for single error patterns and determine error correction, error detection & erasure correction capability of the code.

Q2 (25%)

Consider the rate 1/3, constraint length K=3, convolutional code given by $g_1(x) = 1 + x^2, g_2(x) = g_3(x) = 1 + x + x^2$.

a) Sketch the the state diagram of the encoder and specify the minimum free distance of the code by evaluating the transfer function T(D).
b) Sketch trellis diagram of the encoder and Give an example showing the steps of Viterbi decoding algorithm.

Q3 (25%)

One of 3 equally likely messages is to be communicated over an additive white gaussian noise channel with the spectral power density of $No/2$ and zero mean. The transmitter uses a signal set $\{s_i(t), i = 1,2,3\}$ where $s_i(t) = a_i \Psi(t)$, and $\Psi(t)$ is the base orthonormal function and a_i belongs to the set $\{-d, d, 5d\}$.

a) Draw the signal constellation diagram and optimum decision regions.
b) Determine the probability of symbol error.

Q4 (25%)

A stream of digital data with data rate of 10 Mb/s is to be encoded with a (255, 123) BCH code and then transmitted using a coherent 16-ary modulation scheme. The transmitter has excess bandwidth of 25%. The received signal power to noise power spectral density P_r / N_0 is 83 dB-Hz.

a) If a gray coded 16PSK system is used, find the probability of information bit error.
b) If orthogonal 16FSK system is used, find probability of information bit error. Discuss the results of part a and b.

Available Time: 3 Hours