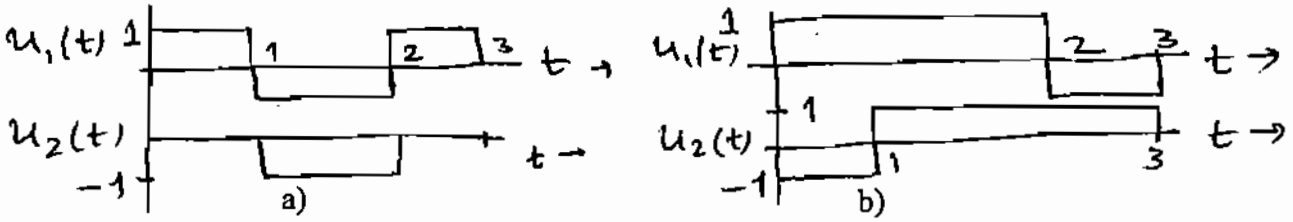
EEL 714 DIGITAL COMMUNICATION & INFORMATION SYSTEMS
MAJOR EXAM

Max Marks 60
Time 3.30-5.30 PM
Dec. 2,2006

Q1 The following two sets of signals are used for binary data transmission. Find out which set will give us the minimum data transmission error based on the Gram Schmidt procedure.

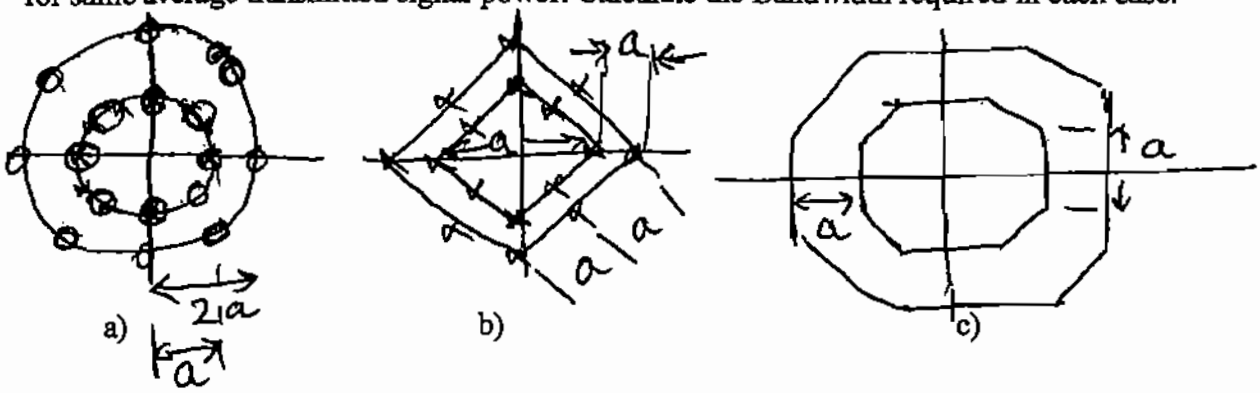


Q2 A PCM system uses a μ law compander for transmission of a signal over the rangc of –10 V to + 10 V. The value of μ= 100 is used in the compander. Give the expression for the compander characteristics. Determine the number of levels for binary PCM if the minimum SNR required is 40 dB. Model the compander characteristics with four piecewise linear approximation. Compare this SNR with that obtained by the piecewise linear approximation. etc. and compare them in tabular fashion. Compare two realizations logarithmic and piecewise linear for implementation.

Q3 The data stream d(t) =110011 is to be transmitted using DEPSK digital modulation scheme.

a) Find the coded bit stream b(t).
b) Draw the waveform of the modulated signal if it is given that symbol rate fs = fb/4.
c) If the 3rd bit of b(t) is in error, find the bit(s) in error in the recovered data stream after decoding.
d) What is the advantage of the encoded signal over BPSK.

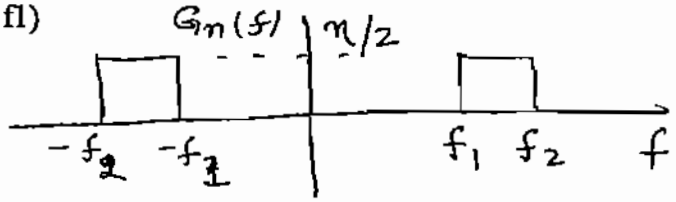
Q4 Find which of the following constellations are better from the noise performance point of view for same average transmitted signal power. Calculate the Bandwidth required in each case.



Q5 Is it possible to implement a MSK transmitter using filters? If possible, give block diagram and label the voltages at various points starting from the data stream d(t). Given data stream as 1001, sketch the MSK waveform with reference to the transmitter design. Assume value of m = 7.

Q6 The two sided power spectral density of noise n(t) is shown below.

a) Plot the power spectral density of the product n(t) Cos 2 Π fl t
b) Calculate the normalized power of the product in the frequency range –(f2 – F1) to (f2 – fl)



Q7 The following polynomials are proposed to used for CRC code generation for a codeword length n < 7. Choose the correct polynomial giving the reasons for your choice. If not suggest a polynomial.

a) $X^5 + X^3 + 1$
b) $X^4 + X^3 + X + 1$
a) $X^3 + X^2 + 1$
d) $X^3 + 1$

Show implementation for the CRC code decoder for this polynomial for data 1100110. Is it a valid codeword?

Q8 Consider the Generator Matrix as given below for a (5,2) Block code. There is one error in the matrix which is for a Hamming Code. Correct the error and compute the error correcting capability of the code.

$$G = \begin{matrix} 1\,0\,1\,0\,1 \\ 0\,1\,0\,1\,1 \end{matrix}$$

Q9 A communication channel uses BFSK modulation and has an error probability $P_e = 10^{-3}$. It is proposed to use the Block Code with two error correcting capability to improve the BER on the channel by using its error correction capability as possible. Find out the BER that can be achieved on the channel and what increase in Bandwidth is required for this purpose. If instead of BFSK, we wish to use MPSK what will be the change in SNR required over the channel to achieve the same BER performance. What is the difference in performance in quantitative terms if a single error correcting code is used.

Q10 Design a Matched Filter which will differentiate best between the code ++--+- - and the code +++--+- using shift registers. Using the shift register implementation find the peak to side lobe ratio for the output of the matched filter.