



Govt. Women Engineering College, Ajmer

Department of Electronics and Communication Engineering

M. Tech (Digital Communication) 1st Semester 1st Mid Term Examination - October 2017
 Subject: Digital Communication Systems Subject Code: 1MDC2
 Time: 1 Hr. Max. Marks: 25
 Student College ID:.....Date of Examination: 03/10/2017

Note: The paper consists of three questions. Assume any missing data.

- Q. 1.** An orthogonal set of signals is characterized by the property that the inner product of any pair of signals in the set is zero. Fig. 1 shows a pair of signals $s_1(t)$ and $s_2(t)$ that satisfy this condition. Construct the signal constellation for $s_1(t)$ and $s_2(t)$. [7]

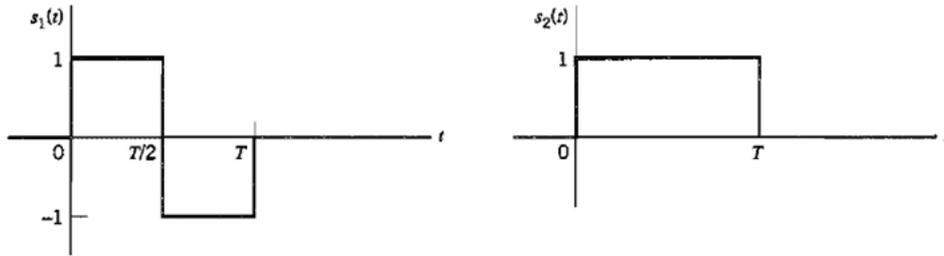


Fig. 1

- Q. 2.** Fig. 2 shows a pair of signals $s_1(t)$ and $s_2(t)$ that are orthogonal to each other over the observation interval $0 \leq t \leq 3T$. The received signal is defined as $x(t) = s_k(t) + w(t)$, $k = 1, 2$ where $w(t)$ is white Gaussian noise of zero mean and power spectral density $N_0/2$. Design a receiver that decides in favour of signals $s_1(t)$ and $s_2(t)$, assuming that these two signals are equiprobable. Also calculate the distance between two signal points $s_1(t)$ and $s_2(t)$. [9]

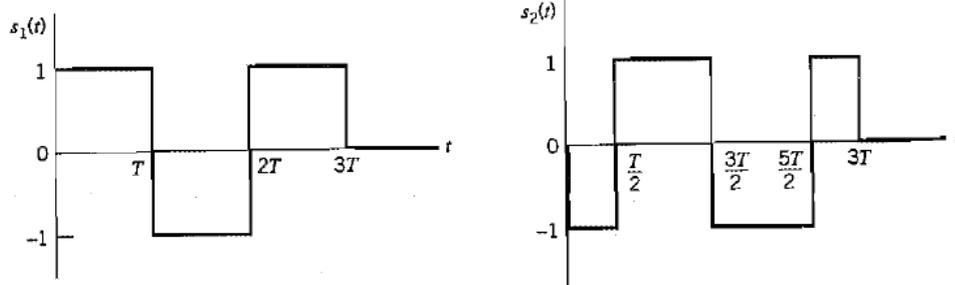


Fig. 2

- Q. 3.** (a) The two signal constellations shown in Fig. 3 exhibit the same average probability of symbol error. Justify the validity of this statement.
 (b) Which of these two constellations has minimum average energy? Justify your answer.
 You may assume that the symbols pertaining to the message points displayed in Fig. 3 are equally likely.

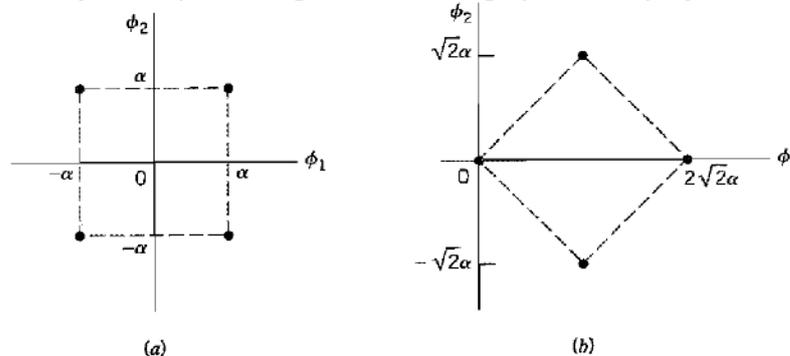


Fig. 3

[9]

OR

Consider the optimum detection of the sinusoidal signal

$$s(t) = \sin\left(\frac{8\pi t}{T}\right), \quad 0 \leq t \leq T$$

in additive white Gaussian noise.

- (a) Determine the correlator output assuming a noiseless input.
 (b) Determine the corresponding matched filter output, assuming that the filter includes a delay T to make it causal.
 (c) Hence show that these two outputs are the same only at time instant $t = T$. [9]

-----ALL THE BEST-----