Department of Electrical Engineering
Indian Institute of Technology, Madras

EE 5140: Digital Modulation & Coding

August 2017 **Tutorial #1** KG/IITM

1. Find the compact ortho-normal basis set, and using it, make a clear labeled plot of the signal constellation for the signal set shown in Fig-1.

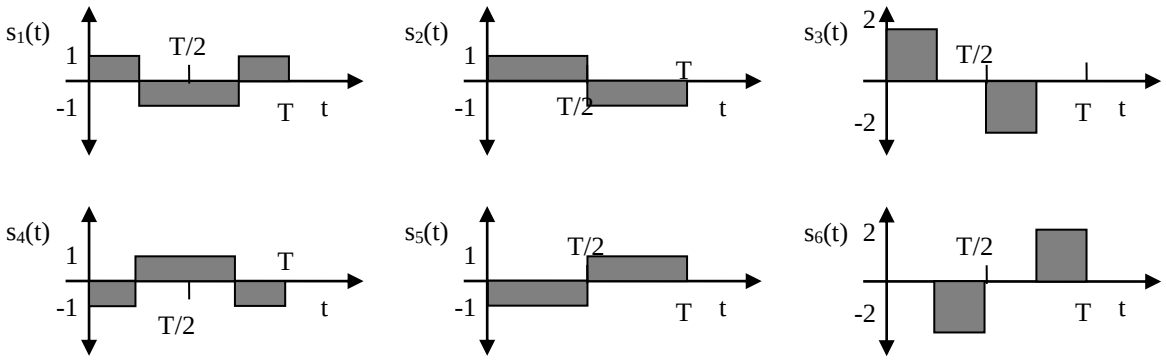

Fig-1

2. The signal g(t) is sent through a channel with impulse response h(t), where the two functions are shown in Fig-2. Make a labeled plot of the ideal matched filter's impulse response. *Hint:* Assume single-shot communication.

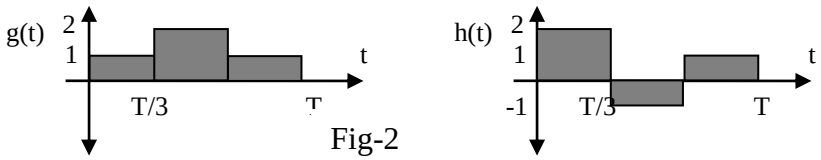

Fig-2

3. Find the autocorrelation function S(t) for the given signal g(t) in Fig3. Draw the signal S(t).

where

$$S(t) = \int_{-\infty}^{\infty} g(\tau)g(t-\tau)d\tau$$

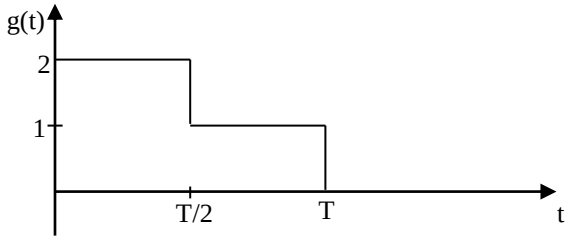

Fig-3

4. Find out the compact basis function for signals given in Fig-4.

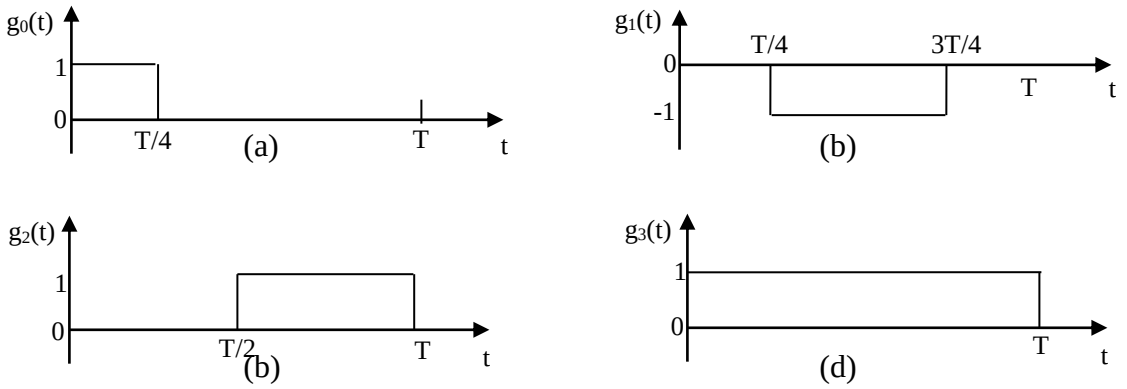

Fig-4

5. Consider the signal set shown in Fig-5 below.

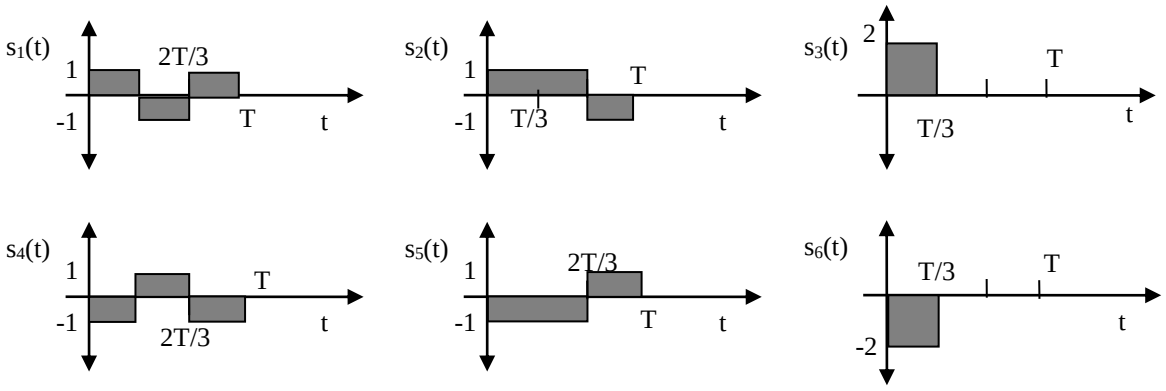

Fig-5

(a) Find a compact orthonormal basis set for this signal set. Sketch these functions.

(b) Using this, make a clear labeled plot of the corresponding signal constellation.

(c) In terms of the average energy E_a of the constellation, what is the minimum distance (i.e., 2d) of the signal set?

6. Find the minimum distance and multiplicity for given signals in Fig-6.

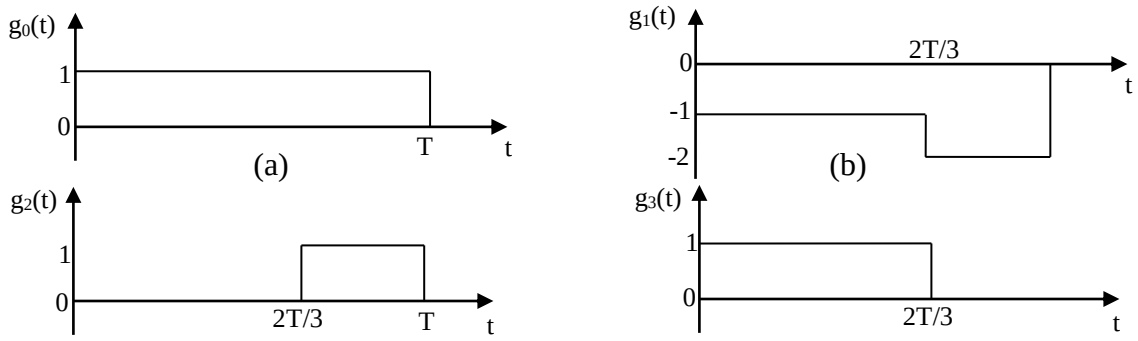

Fig-6

7. Do the following problems from the 7th chapter in the text-book (Proakis and Salehi), starting with page. 453 in the E-version.

➔ All problems from **7.1 to 7.9**. The possibly hard-one is perhaps are 7.8*.