**01. Your report should be written in English. The report should include the code (with comments or notes), the resulted figure (or print-screen), and a short discussion on the result if necessary.**

**2. Upload: .m file, .fig file and .doc report**

**3. Pack all the above files and send to 1315480535@qq.com**

**4. The format of pack name: LabX\_ID\_Name.zip, X is the experiment number.**

**5. Deadline: Thursday in Next week.**

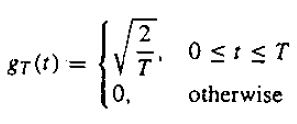
**Complete the following tasks:**

1. Consider 4ASK modulation. The signals are:



and



,

where *d*=1, *T*=1, fc=5Hz, the mapping rule from the bit pair to *m* is: 00->1, 01->2,11->3,10->4.

(1) If the message bits are 11 00 10 00 01, plot the corresponding 4ASK signal in both time and frequency domain, sampling frequency fs=1000Hz.

(2) Give the average signal energy per bit, i.e., Eb, for 4ASK.

(3) Denote SNR as Eb/N0, plot the theoretical SER (symbol error rate) and simulated SER, for SNR=0:2:8 dB.

Hint: refer to the slides and codes related to 4PAM baseband signal in Ch5 ppt.

2. Consider the 4PSK modulation. The signals are:



where **the average signal energy** **Es=1**, T=1, fc=5Hz, and the constellation diagram is:

(1) If the message bits are 11 00 10 00 01, **plot** the corresponding 4PSK signal in both **time and frequency domain**, sampling frequency fs=1000Hz.

(2) Plot the **constellation diagram** of the 4PSK experiencing the AWGN channel with **N0=0.5**. (You can generate a **large number** of 4PSK signals and noise samples.)

(3) Give the **BER and SER** for N0=0.5, from theoretical calculation and numerical simulation, respectively.