

EXPERIMENT NUMBER : 8

EXPERIMENT NAME : EYE PATTERN GENERATION FOR BPSK

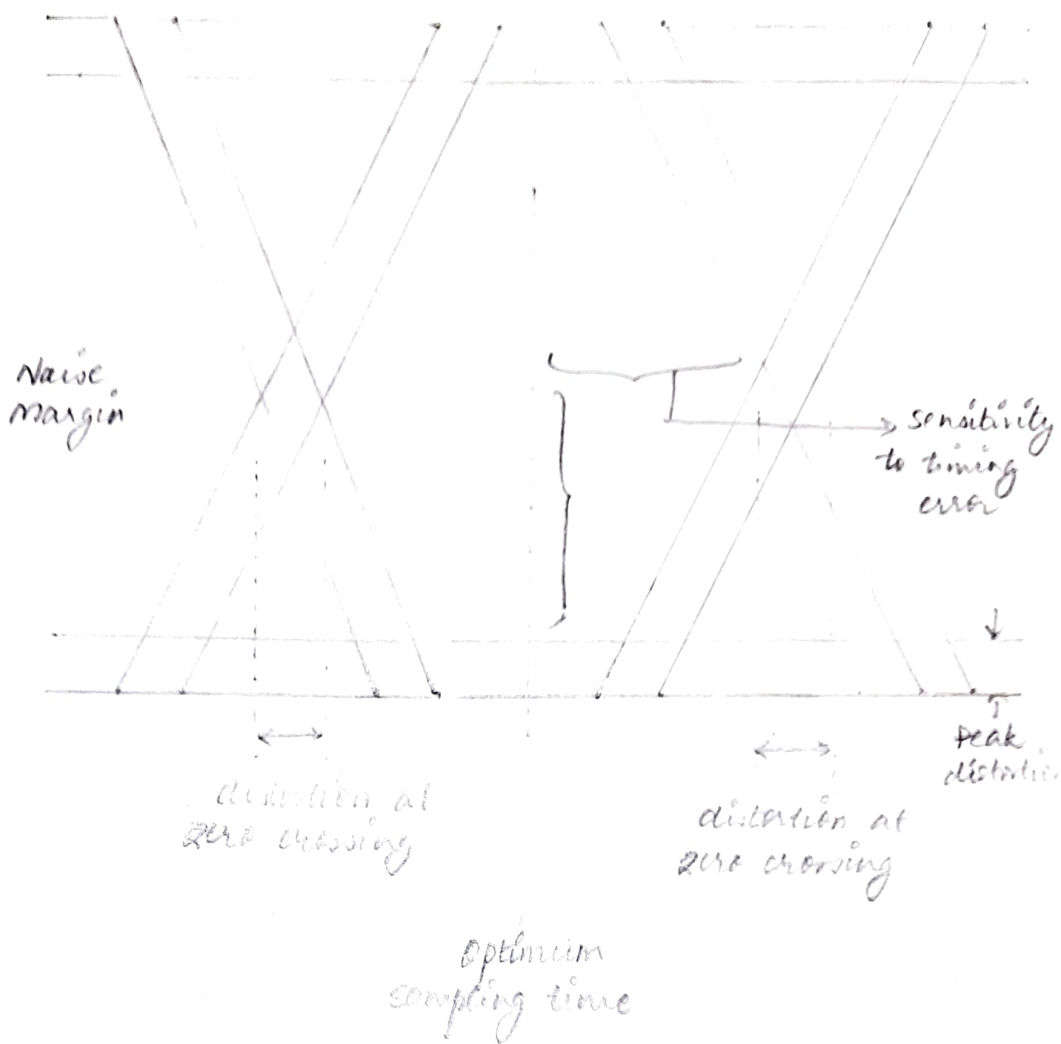
DATE : 12/12/2022, MONDAY

* AIM :

To generate eye-pattern for BPSK while transmitting over AWGN channel.

* THEORY :

- ① A eye diagram is used to visualize the effect of noise and signal distortion as a result of transmission over a channel. The eye diagram overlays a sequence of received pulses or symbols.
- ② The eye diagram plots the signal levels on vertical axis versus the normalized time on horizontal axis. For example, in BPSK system, there are four possible transmission -
 - (i) From -1 to $+1$.
 - (ii) From $+1$ to -1 .
 - (iii) From -1 to -1 .
 - (iv) From $+1$ to $+1$.These can be visualized in eye diagram.
- ③ All the symbols over a bit duration are overlapped to view interference of one over another. This is termed as Intersymbol Interference (ISI).
- ④ To counter this ISI, pulse shaping techniques is used. Hence, the interference is also reduced. Noise and distortions can also be analyzed with eye diagram by measuring few parameters.

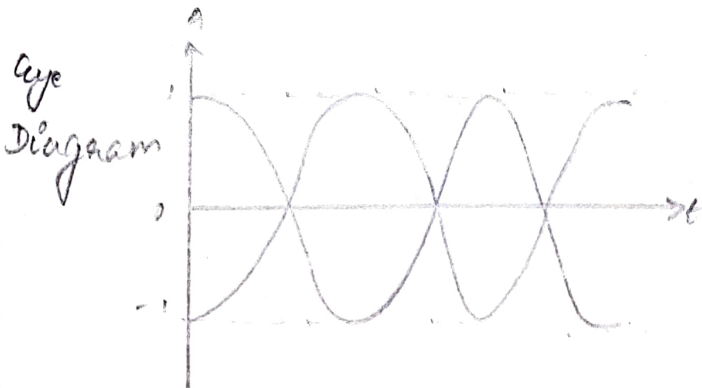
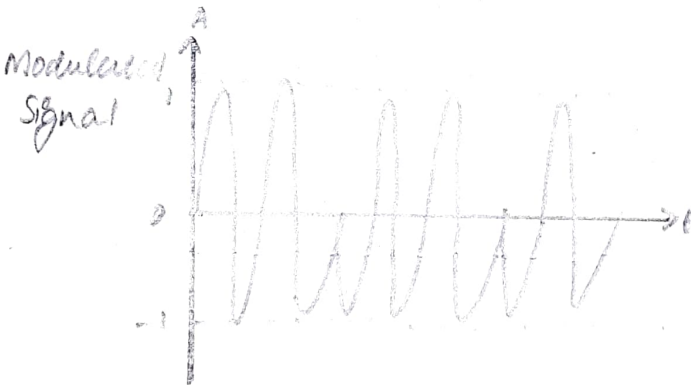
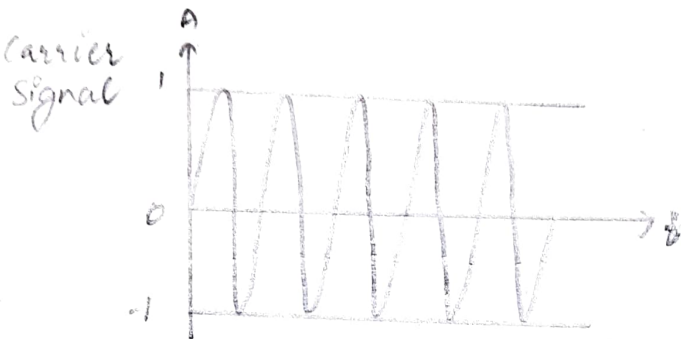
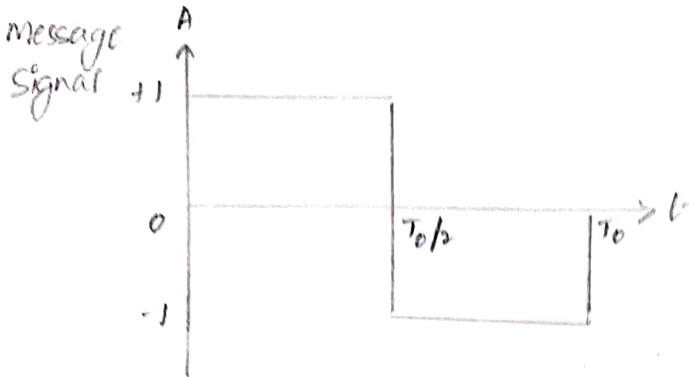


Interpretation of eye diagram

- ① The opening in the middle is called "eye opening", which measures the effect of additive noise on the signal. If there is more noise (or symbol interference), the opening will be narrower.
- ② The effect of ISI is to cause the eye to close, thereby reducing margin size for additive noise to cause errors.

\overrightarrow{PDD}

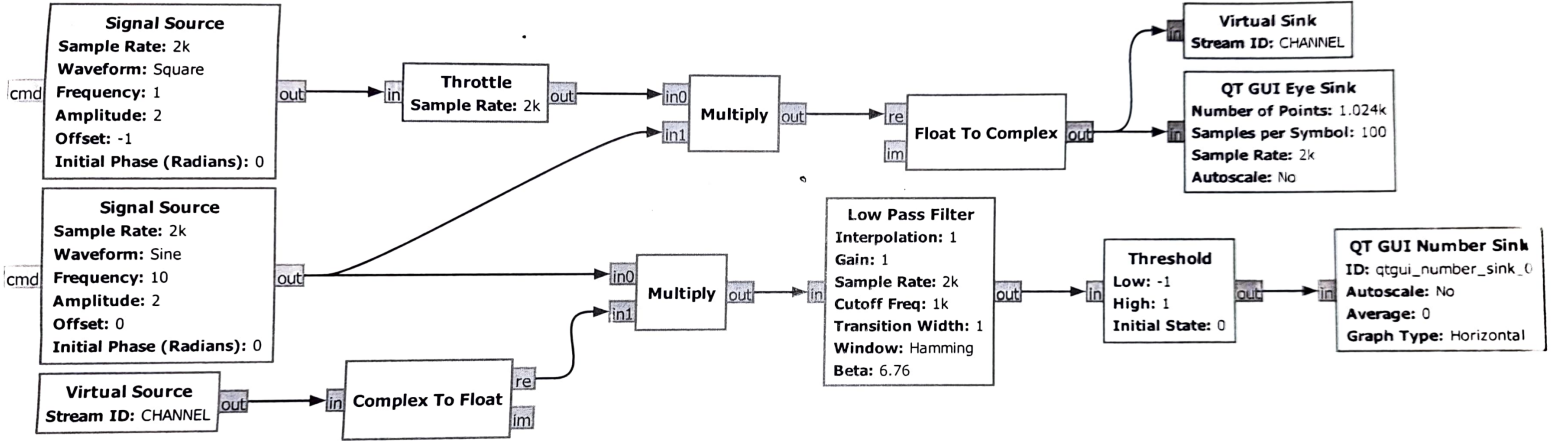
* BINARY PHASE SHIFT KEY (WITHOUT NOISE) :



PTO

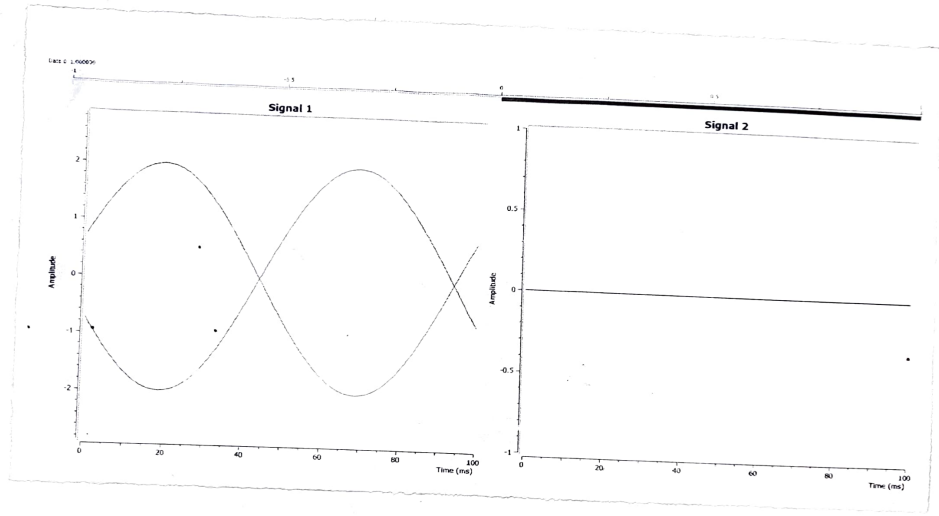
Options
Title: Eye_Without_Noise
Author: Santosh
Copyright: 2022
Output Language: Python
Generate Options: QT GUI

Variable
ID: samp_rate
Value: 2k

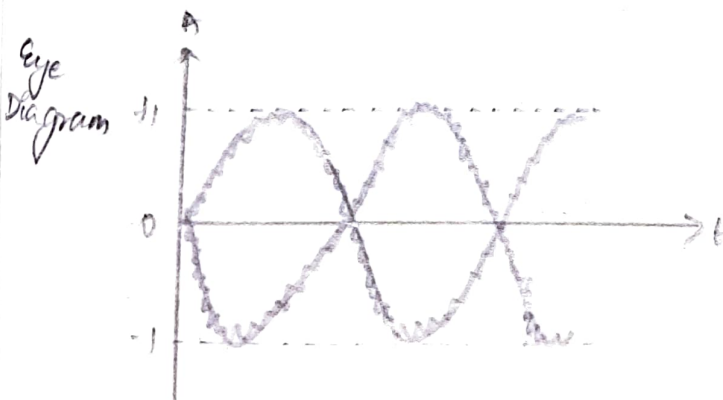
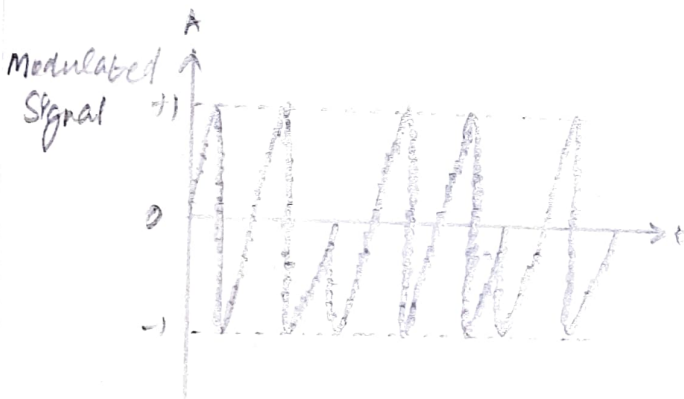
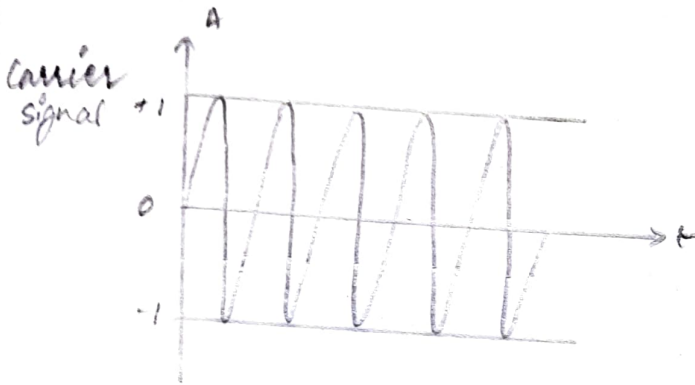
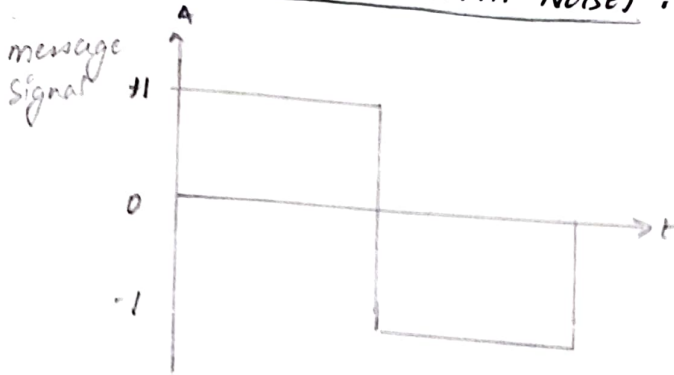


* Outputs:

a Binary Phase Shift Key (without Noise) -



* BINARY PHASE SHIFT KEY (WITH NOISE) :



Interfacing the noise amplitude, we see that the width of open eye closes causing noise error.

Options
Title: Eye_With_Noise
Author: Santosh
Copyright: 2022
Output Language: Python
Generate Options: QT GUI

Variable
ID: samp_rate
Value: 2k

Noise Source
Noise Type: Gaussian
Amplitude: 1
Seed: 0

Signal Source
Sample Rate: 2k
Waveform: Square
Frequency: 1
Amplitude: 6
Offset: -1
Initial Phase (Radians): 0

cmd

cmd

Signal Source
Sample Rate: 2k
Waveform: Sine
Frequency: 10
Amplitude: 6
Offset: 0
Initial Phase (Radians): 0

Virtual Source
Stream ID: CHANNEL

Complex To Float

Add

Multiply

Multiply

Float To Complex

QT GUI Eye Sink
Number of Points: 1.024k
Samples per Symbol: 100
Sample Rate: 2k
Autoscale: No

Low Pass Filter
Interpolation: 1
Gain: 1
Sample Rate: 2k
Cutoff Freq: 1k
Transition Width: 1
Window: Hamming
Beta: 6.76

Threshold
Low: -1
High: 1
Initial State: 0

QT GUI Number Sink
ID: qtgui_number_sink_0
Name: Demodulated Signal
Autoscale: No
Average: 0
Graph Type: Horizontal

Virtual Sink
Stream ID: CHANNEL

Delay
Delay: 1

Delay
Delay: 1

Delay
Delay: 1

Delay
Delay: 1

Delay
Delay: 1

Delay
Delay: 1

Delay
Delay: 1

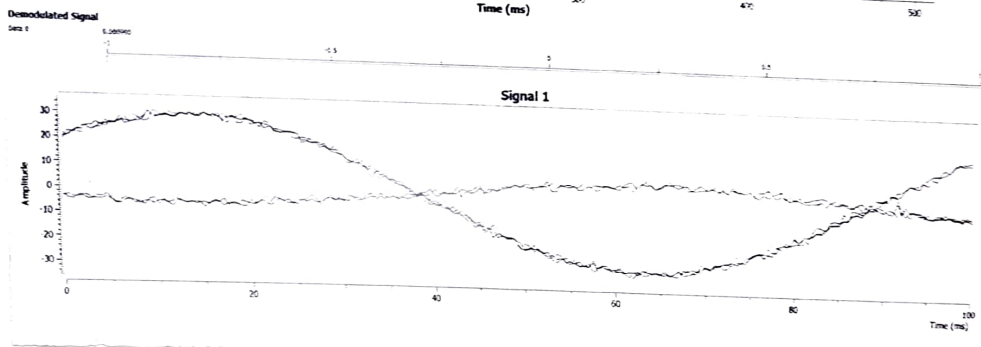
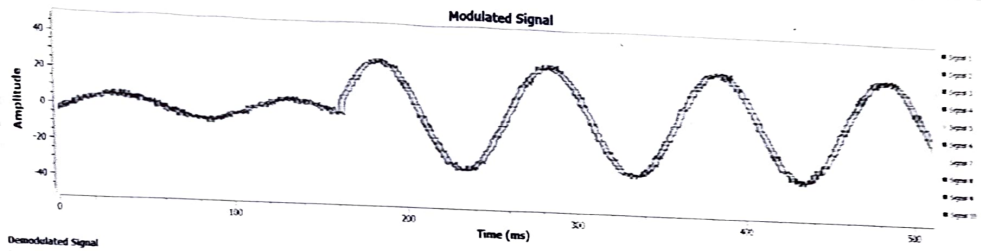
Delay
Delay: 1

Delay
Delay: 1

Delay
Delay: 1

QT GUI Time Sink
Name: Modulated Signal
Number of Points: 10.24k
Sample Rate: 2k
Autoscale: No

b. Binary Phase Shift Key (with Noise) -



* RESULT :

Thus, we have plotted the BPSK eye diagram with and without noise with added delay of symbols, increased noise amplitude and also, visualized the eye diagram with changes such as slope, distortion, etc. All the simulation results were verified successfully.