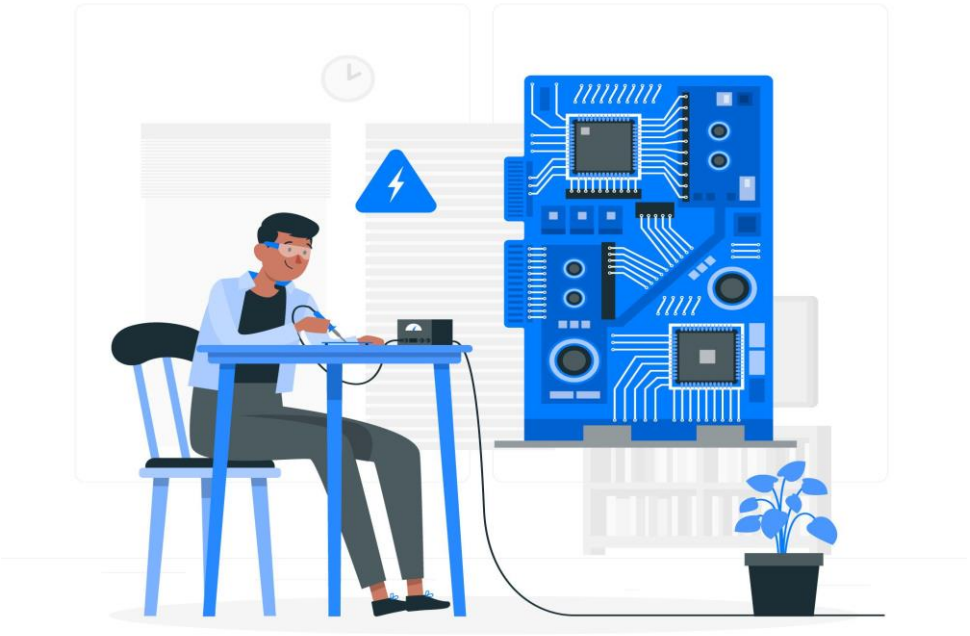


Lab 3:Pulse code modulation.

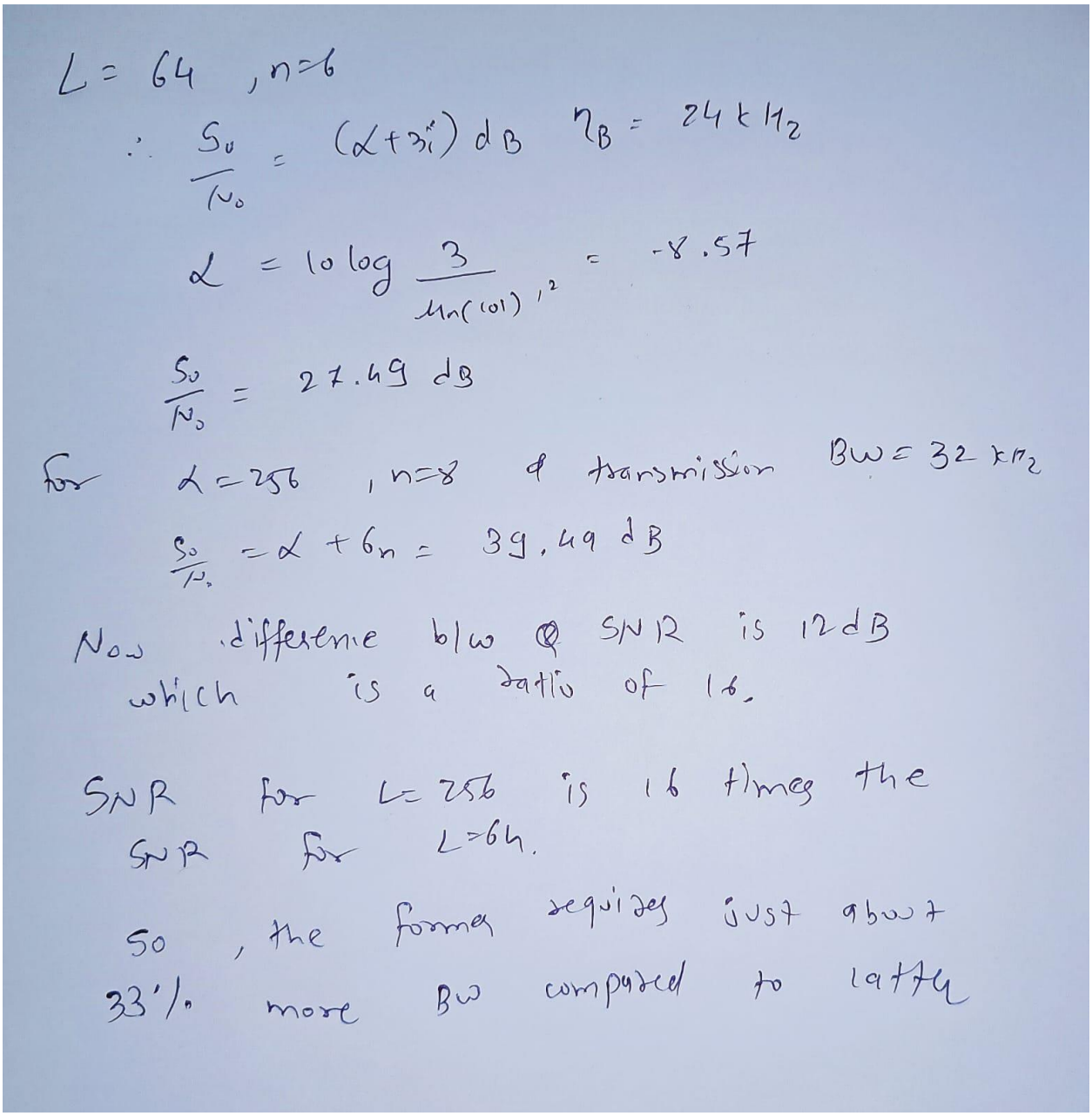
Akshar panchani- ID 202101522

CT303 Digital Communication

10/8/23

Lab 3: PCM and matlab code

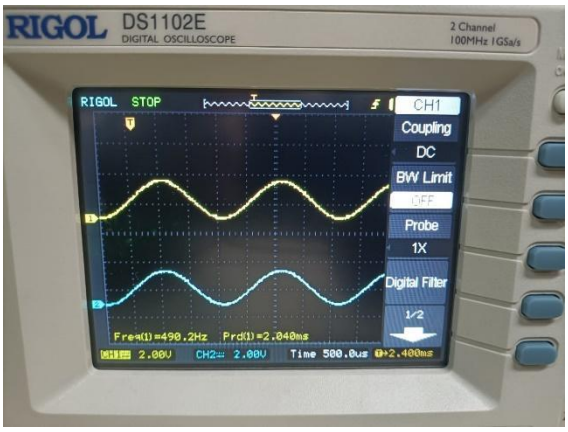
1.Tutorial question



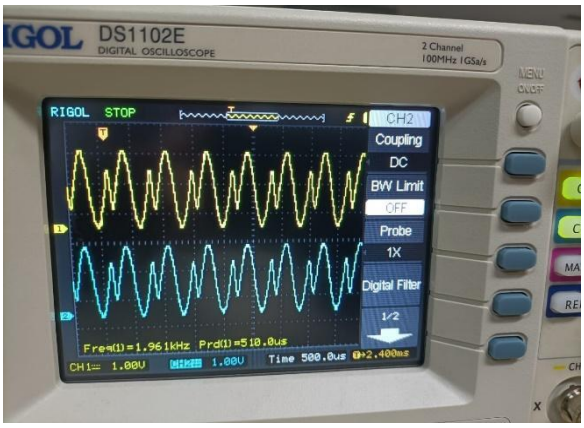
2.Hardware Experiment

Experiment 8:

Freq: 500Hz



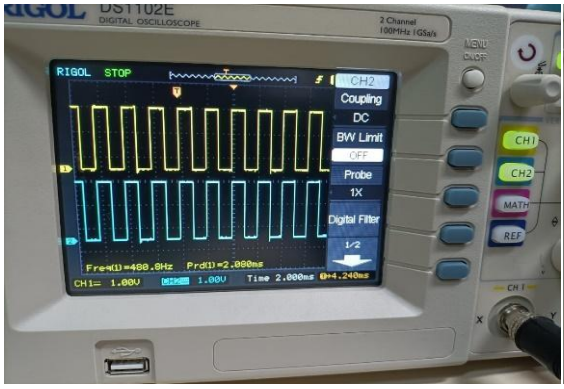
Freq: 1500Hz

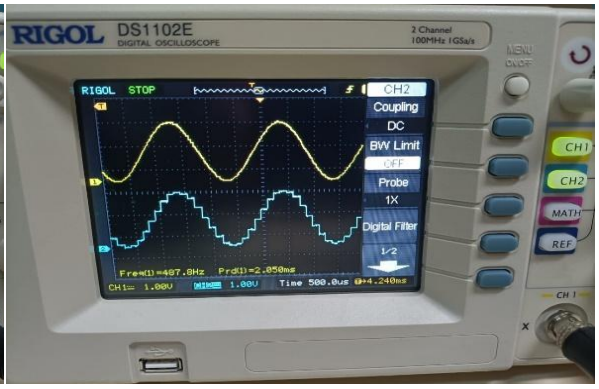


Freq: 500Hz

Freq: 500Hz

Sampling freq: 8KHz

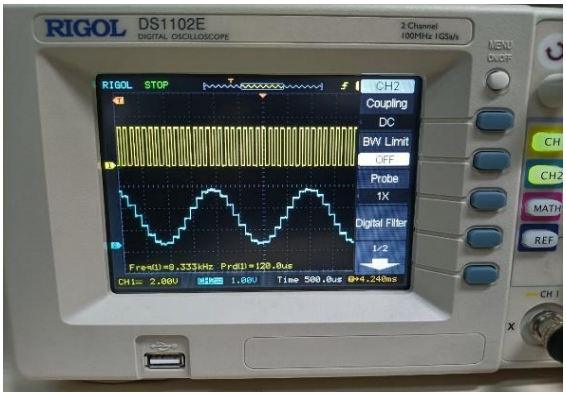


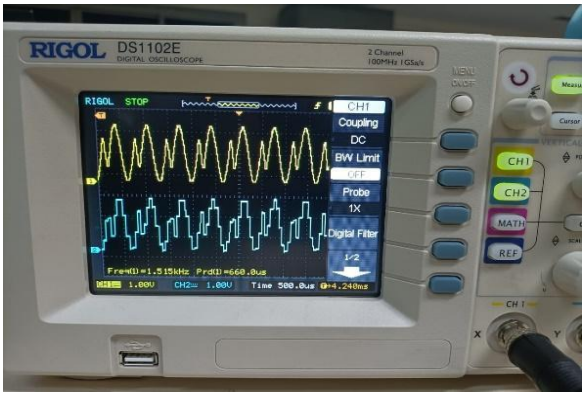


Freq: 500Hz

Freq: 1500Hz

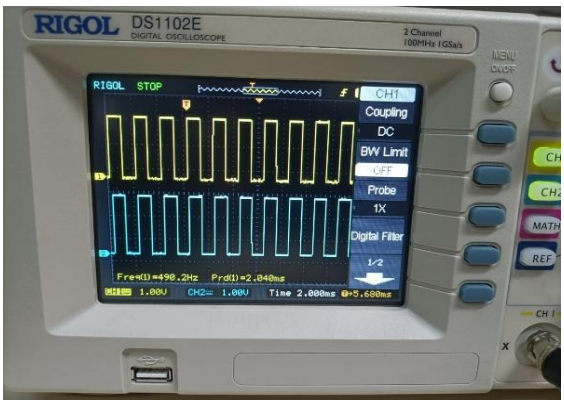
Sampling freq: 16 KHz

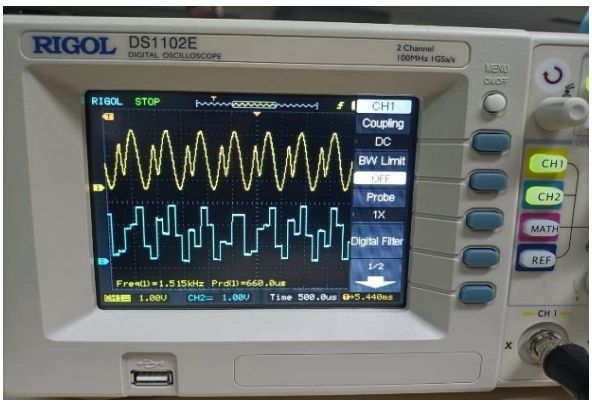




Freq: 500Hz **Freq: 1500Hz**

Sampling freq: 8 KHz

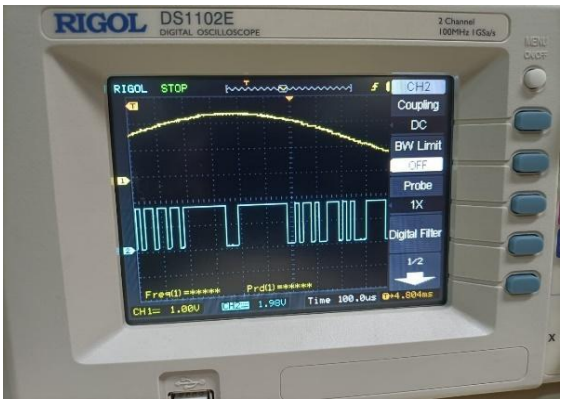


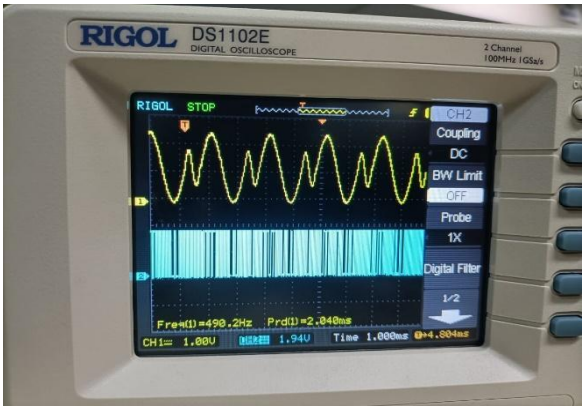


Experiment- 9:

Freq: 500Hz **Freq: 500Hz**

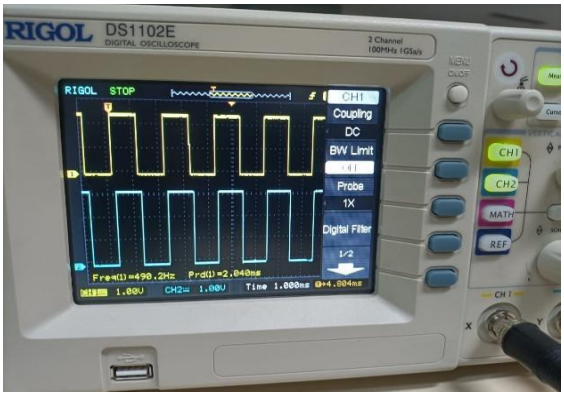
Sampling freq: 8KHz **Sampling freq: 8 KHz**





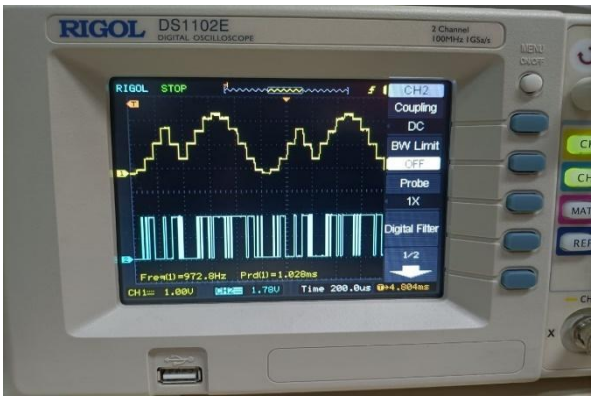
Freq: 500Hz

Sampling freq: 8KHz



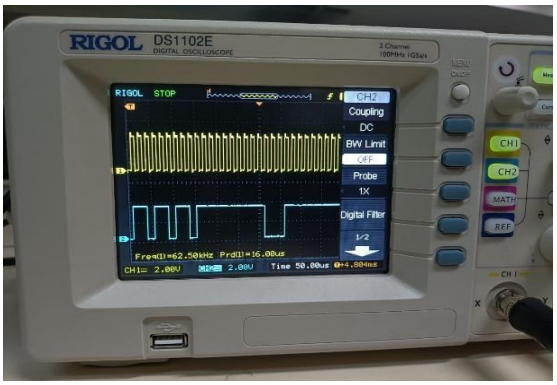
Freq: 1000Hz

Sampling freq: 16 KHz



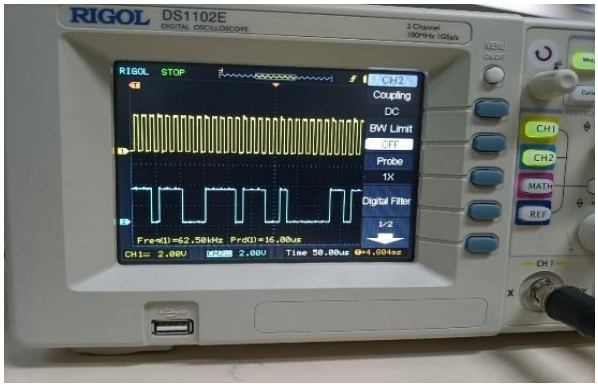
Freq: 500Hz

Sampling freq: 8KHz



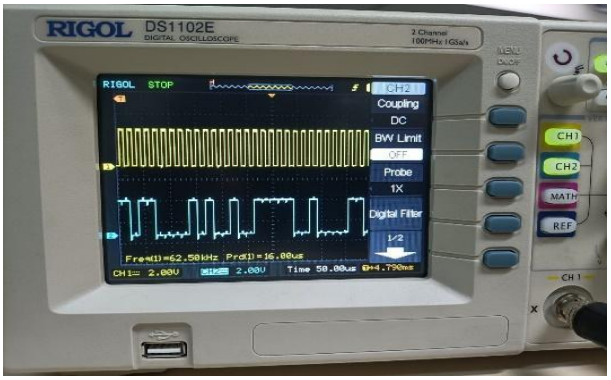
Freq: 1500Hz

Sampling freq: 8 KHz



Freq: 500Hz

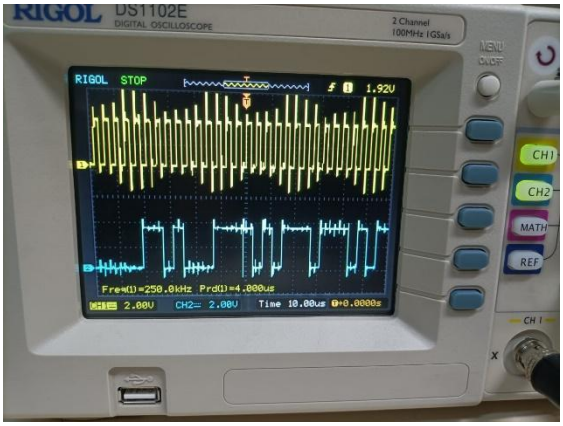
Sampling freq: 8KHz



Experiment 10:

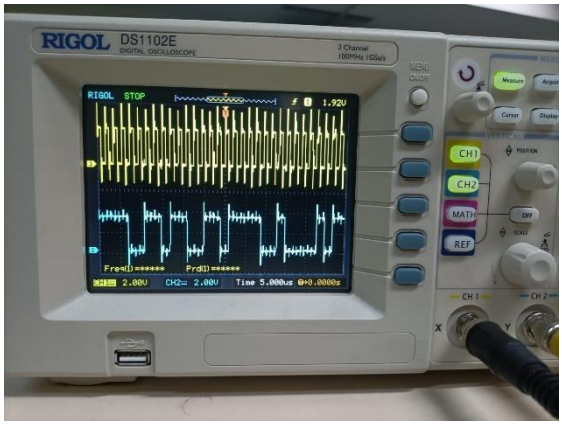
Freq: 500Hz

Sampling freq: 8KHz



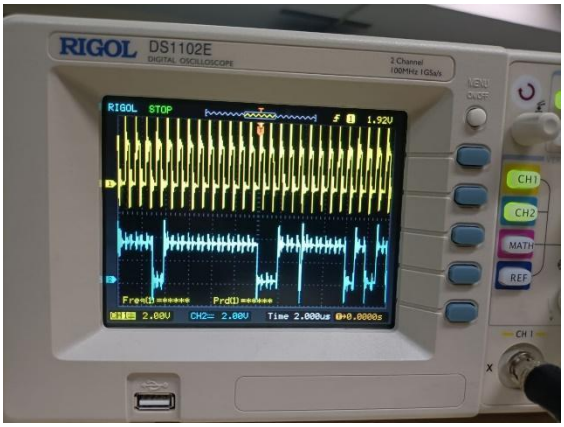
Freq: 500Hz

Sampling freq: 16 KHz



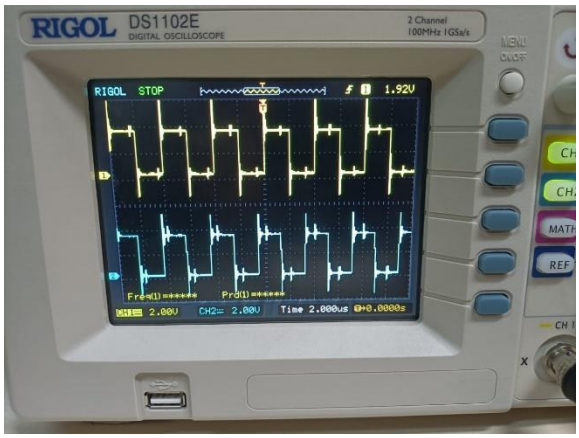
Freq: 500Hz

Sampling freq: 32KHz



Freq: 500Hz

Sampling freq: 8 KHz

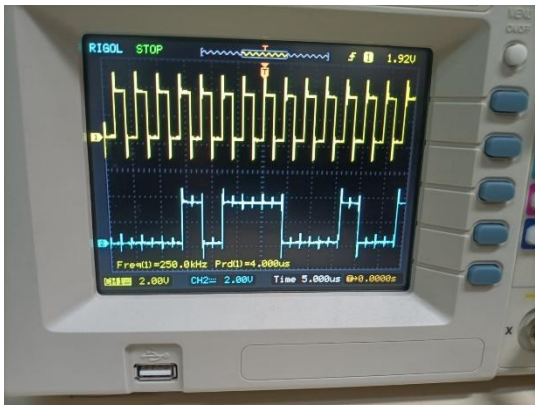


Experiment 11:

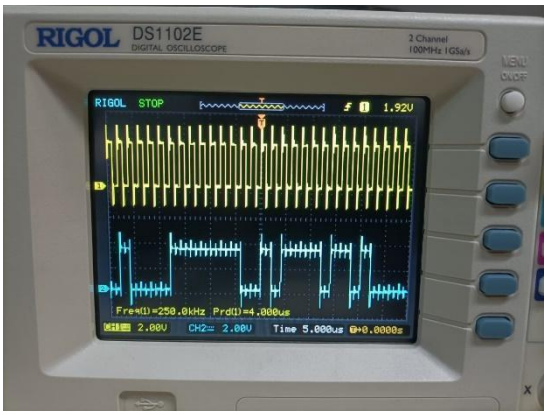
Freq: 500Hz

Freq: 500Hz

Sampling freq: 8KHz



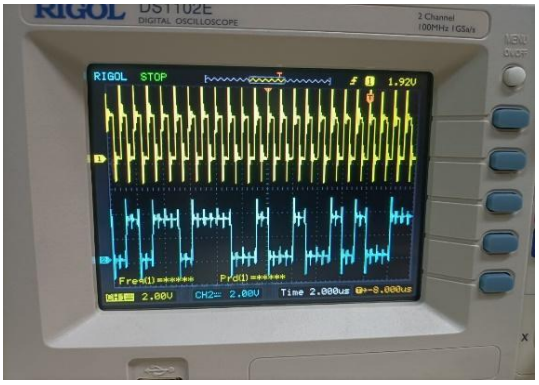
Sampling freq: 16 KHz



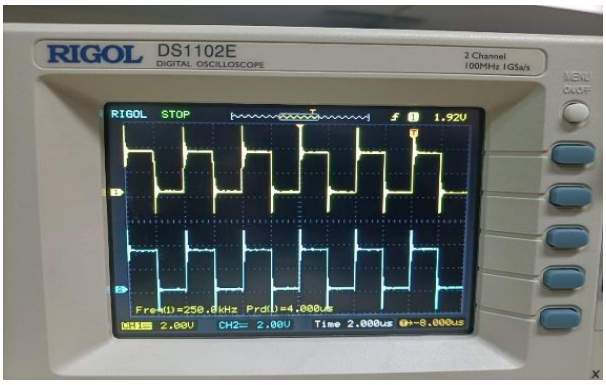
Freq: 500Hz

Freq: 500Hz

Sampling freq: 32 KHz

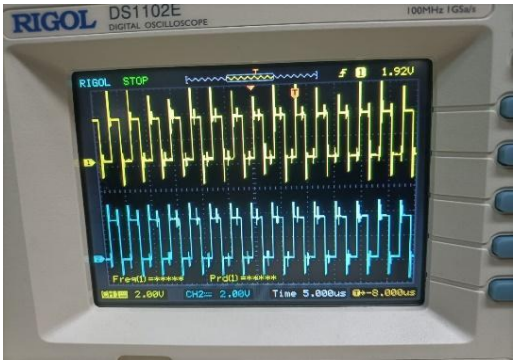


Sampling freq: 8 KHz



Freq: 500Hz

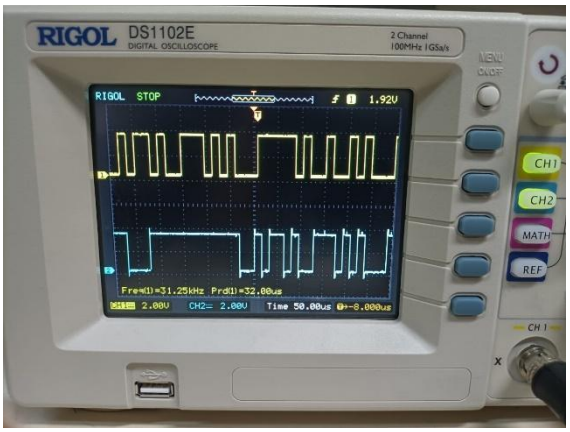
Sampling freq: 8 KHz



Experiment 12:

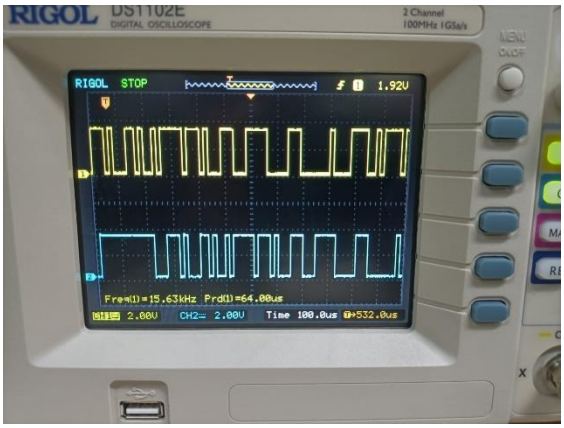
Freq: 500Hz

Sampling freq: 8 KHz



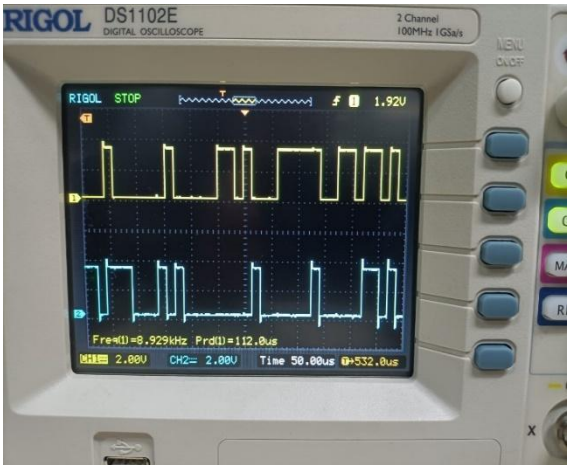
Freq: 500Hz

Sampling freq: 8 KHz



Freq: 500Hz

Sampling freq: 8 KHz



Experiment 13:

Freq: 500Hz

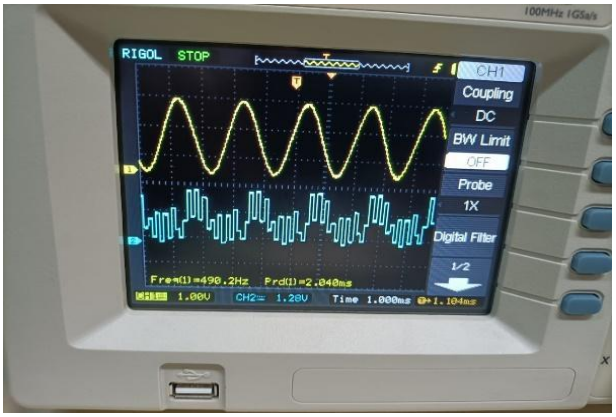
Sampling freq: 8 KHz

Freq: 500Hz

Sampling freq: 8 KHz

Freq: 500Hz

Sampling freq: 8 KHz

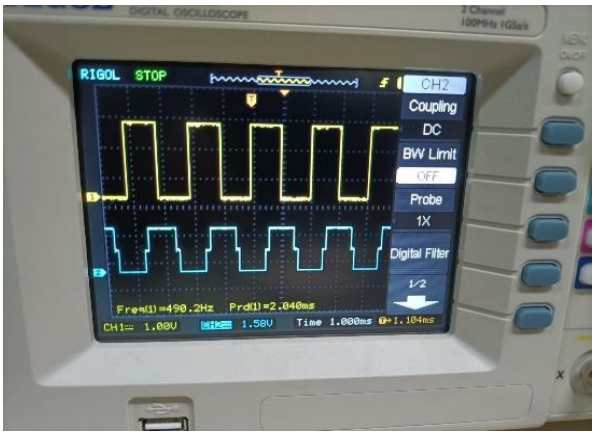


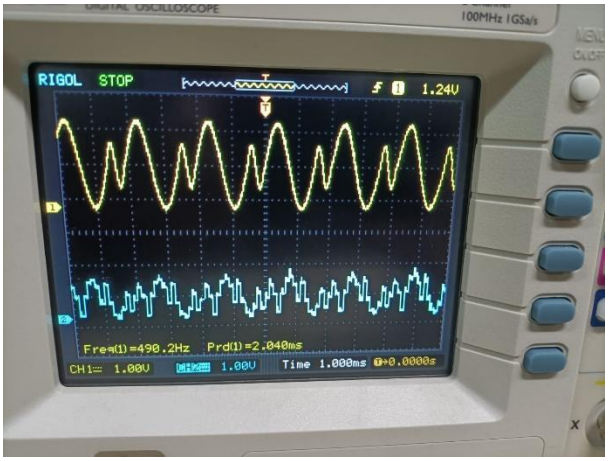
Freq: 500Hz

Sampling freq: 8 KHz

Freq: 500Hz

Sampling freq: 8 KHz





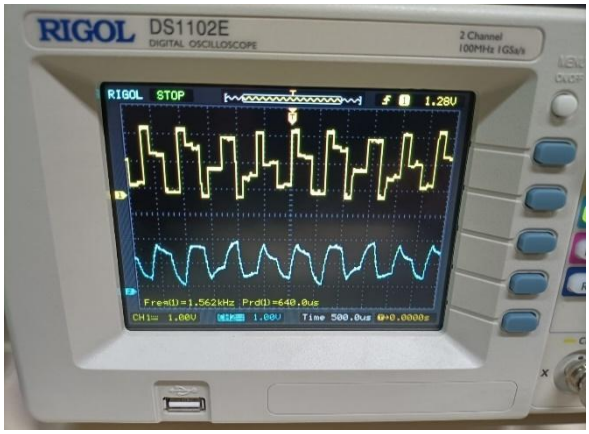
Experiment 14:

Freq: 500Hz

Sampling freq: 8 KHz

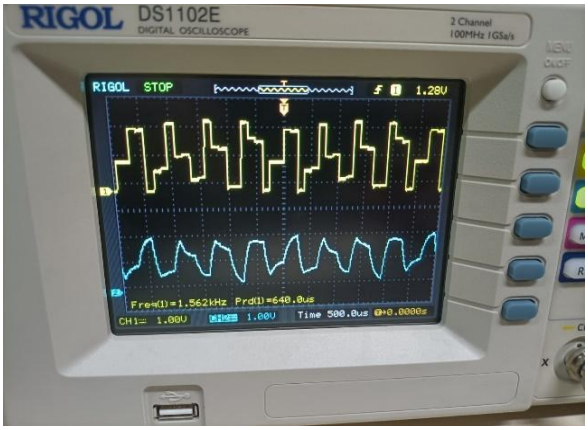
Freq: 1500Hz

Sampling freq: 8 KHz



Freq: 1500Hz

Sampling freq: 8 KHz



Freq: 1500Hz

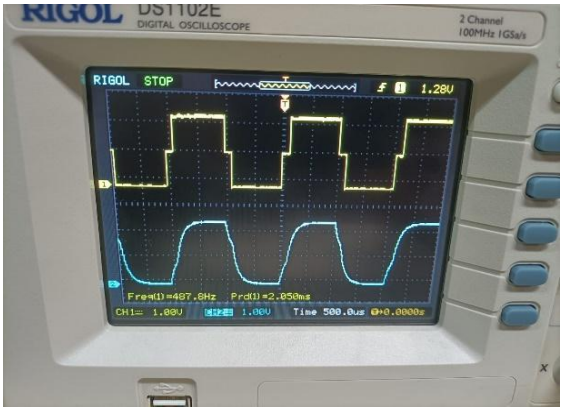
Sampling freq: 16 KHz

Freq: 500Hz

Sampling freq: 8 KHz

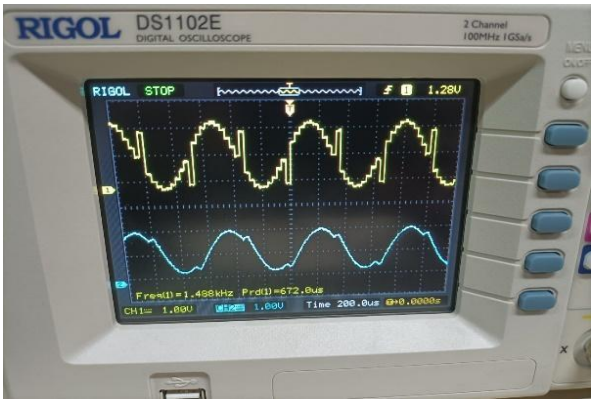
Freq: 1500Hz

Sampling freq: 8 KHz



Freq: 500Hz

Sampling freq: 8 KHz

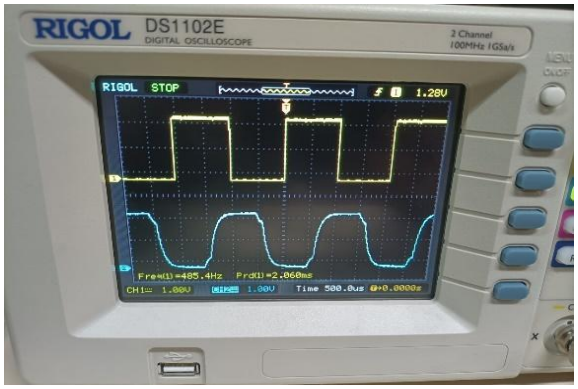


Freq: 500Hz

Sampling freq: 8 KHz

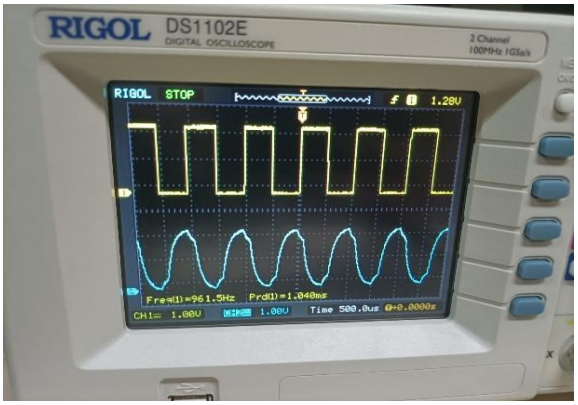
Freq: 1000Hz

Sampling freq: 8 KHz



Freq: 1500Hz

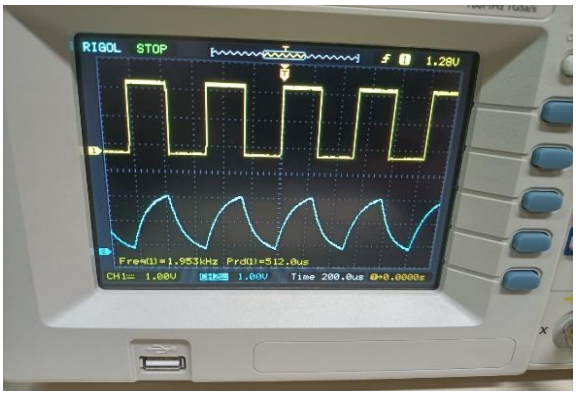
Sampling freq: 8 KHz



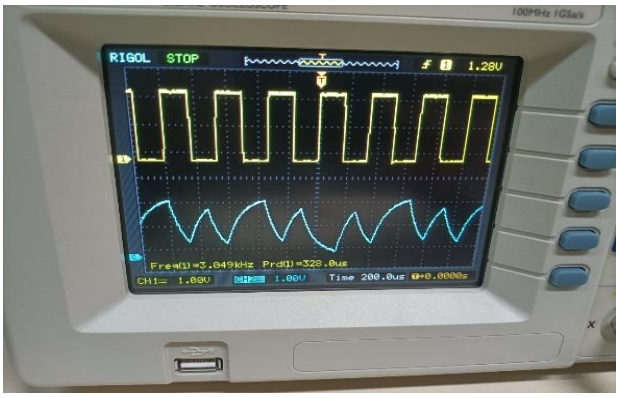
Freq: 2000Hz

Freq: 3000Hz

Sampling freq: 8 KHz



Sampling freq: 8 KHz



3.Matlab

```
% generating a rectangular pulse of width T/2
function pout=prz(T)
pout=[zeros(1,T/4) ones(1,T/2) zeros(1,T/4) ];
end
```

```
% generating a sinusoidal pulse of width T
function pout=psine(T)
pout=sin(pi*(0:T-1)/T) ;
end
```

```
function y=prcos(rollfac, length, T)
y=rcosdesign(rollfac, length, T,'normal' ) ;
end
```

```
clear;
```

```
data = sign ( randn(1, 400 ) );
Tau=64 ;
dataup=upsample ( data , Tau ) ;
yrz=conv ( dataup , prz ( Tau ) );
yrz =yrz (1: end-Tau+1 );
ynrz =conv( dataup , pnrz ( Tau ) );
ynrz =ynrz (1:end-Tau+ 1 ) ;

ysine=conv( dataup , psine ( Tau ) );
ysine = ysine (1: end-Tau+ 1 ) ;
Td=4 ;
yrcos=conv ( dataup , prcos (0.5,Td , Tau ) );
yrcos = yrcos (2*Td*Tau : end- 2 *Td*Tau+ 1 ) ;
eyel=eyediagram( yrz , 2 *Tau , Tau,Tau/ 2 ) ;
title ( ' RZ eye-diagram ' );
eye2=eyediagram( ynrz , 2 * Tau , Tau , Tau/2 ) ;
title ( ' NRZ eye-diagram ' );
eye3=eyediagram( ysine , 2*Tau , Tau , Tau/2 ) ;
title(' Half-sine eye-diagram ' );
eye4=eyediagram( yrcos , 2*Tau,Tau ) ;
title ( 'Raised-cosine eye-diagram' );
```

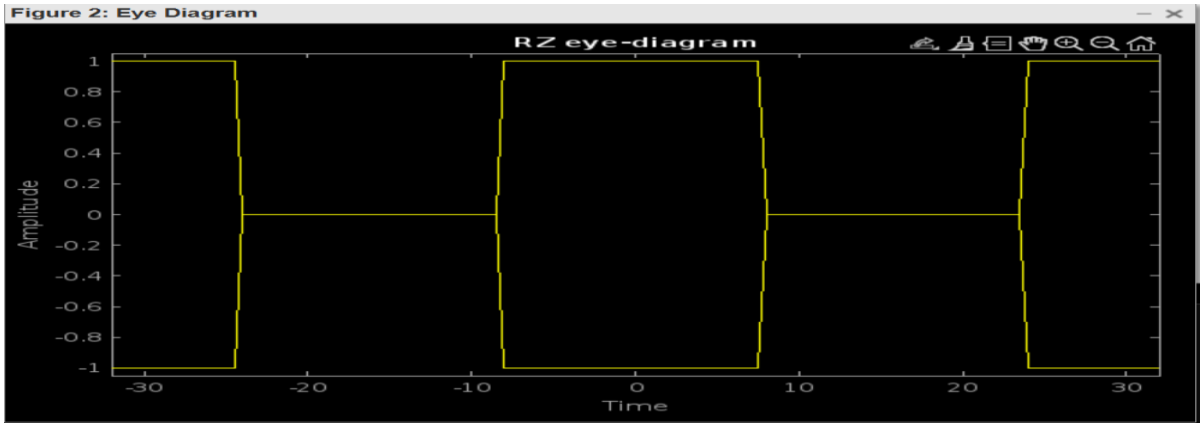


Figure 2: Eye Diagram
RZ eye-diagram
Amplitude
Time
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-30
-20
-10
0
10
20
30

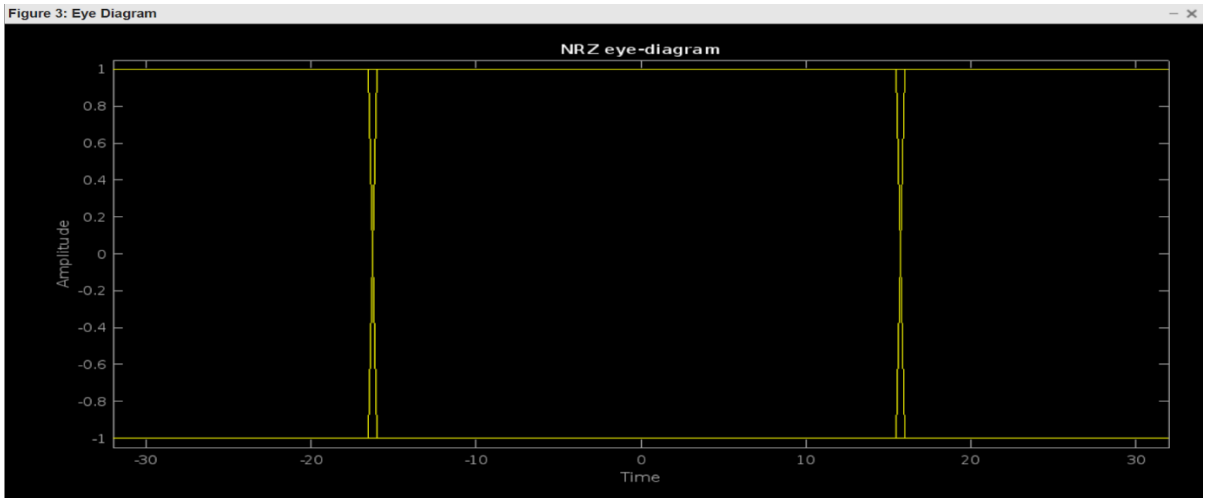


Figure 3: Eye Diagram
NRZ eye-diagram
Amplitude
Time
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-30
-20
-10
0
10
20
30

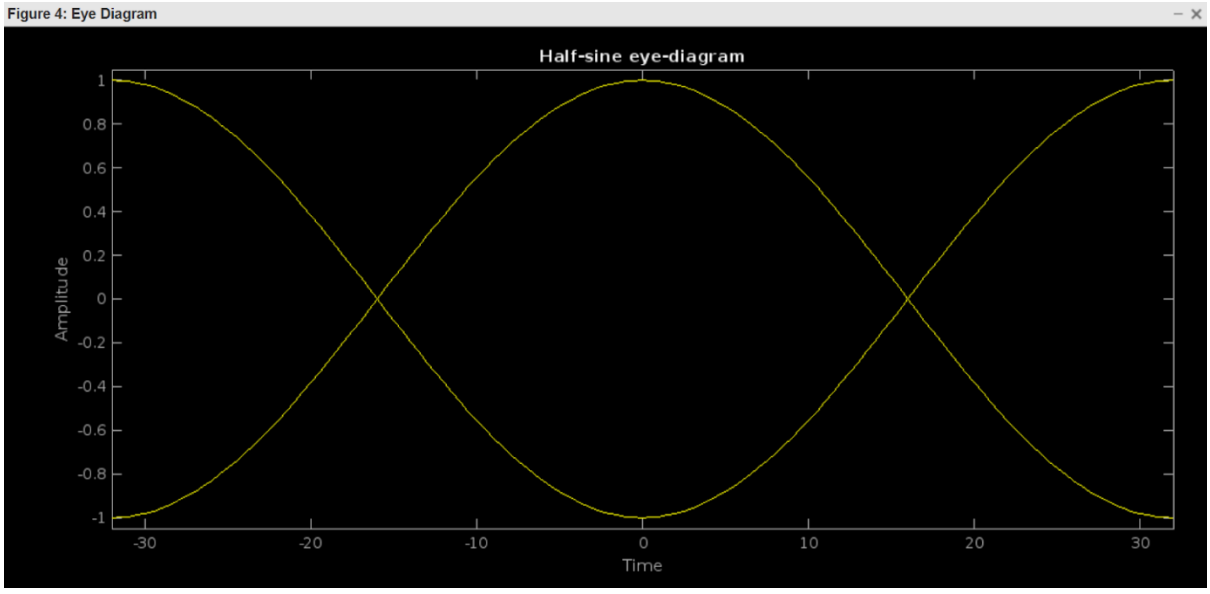
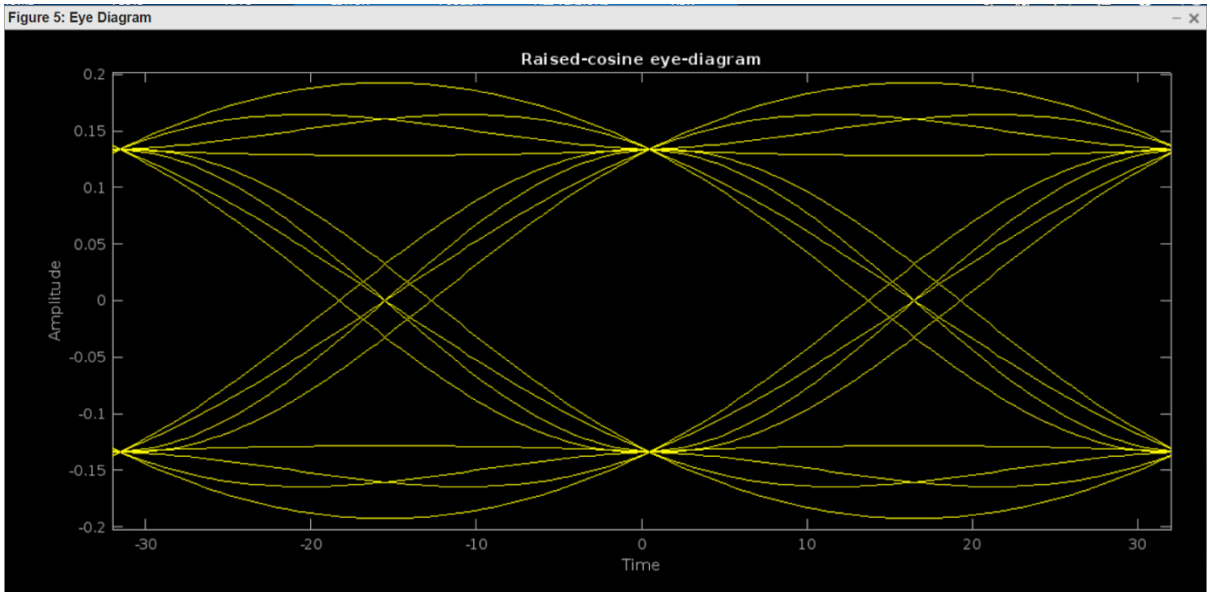
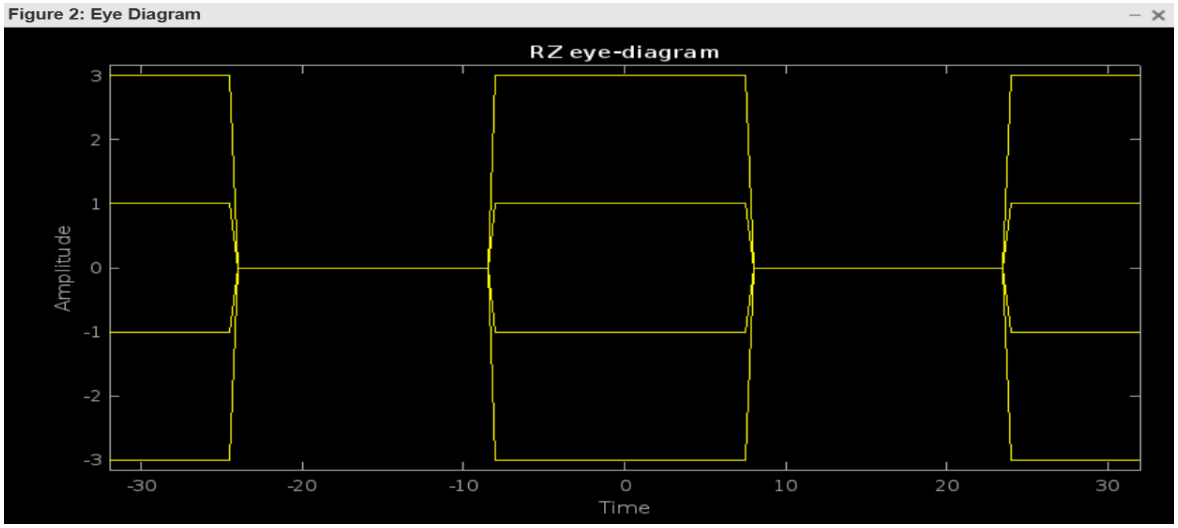


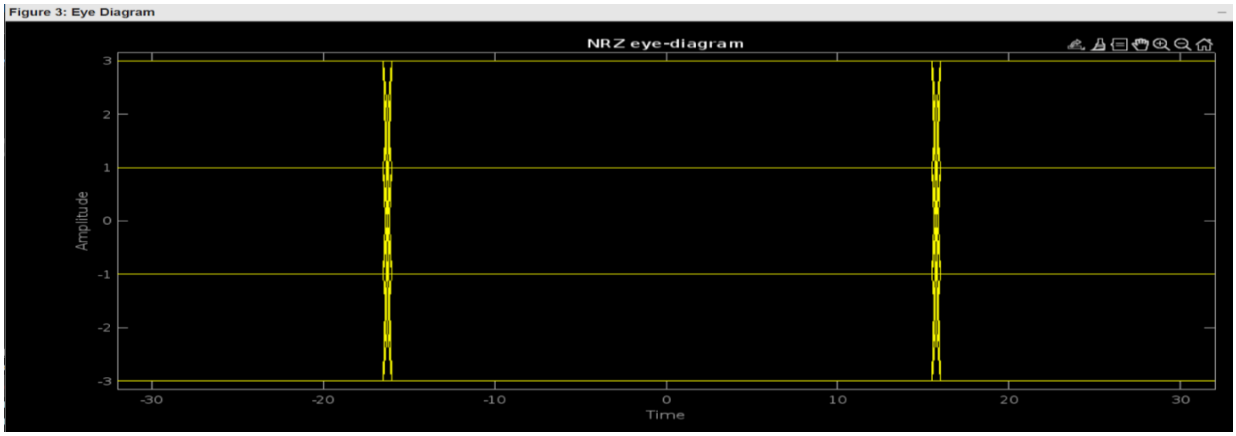
Figure 4: Eye Diagram
Half-sine eye-diagram
Amplitude
Time
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-30
-20
-10
0
10
20
30




```
Clear all
data = sign( randn(1,400) ) + 2* sign ( randn( 1,400) );
Tau=64 ;
dataup=upsample ( data , Tau ) ;
yrz =conv(dataup,prz ( Tau ) );
yrz =yrz (1: end-Tau+ 1 ) ;
ynrz =conv ( dataup , pnrz ( Tau ) );
ynrz =ynrz (1:end-Tau+ 1 ) ;
ysine=conv ( dataup , psine ( Tau) );
ysine=ysine ( 1 : end-Tau+1 ) ;
Td=4 ;
yrcos = conv ( dataup , prcos (0.5,Td , Tau ) );
yrcos = yrcos( 2 * Td*Tau : end- 2 *Td*Tau+ 1 ) ;
eyel = eyediagram(yrz , 2 *Tau , Tau , Tau/2 ) ;
title('RZ eye-diagram');
eye2 = eyediagram(ynrz , 2 * Tau , Tau , Tau/ 2 ) ;
title ( ' NRZ eye-diagram ' );
```

```
eye3 = eyediagram(ysine , 2 *Tau , Tau , Tau/2 ) ;
title ( ' Half-sine eye-diagram ' );
eye4=eyediagram ( yrcos , 2 * Tau,Tau );
title('Raised- cosine eye -diagram ' );
```





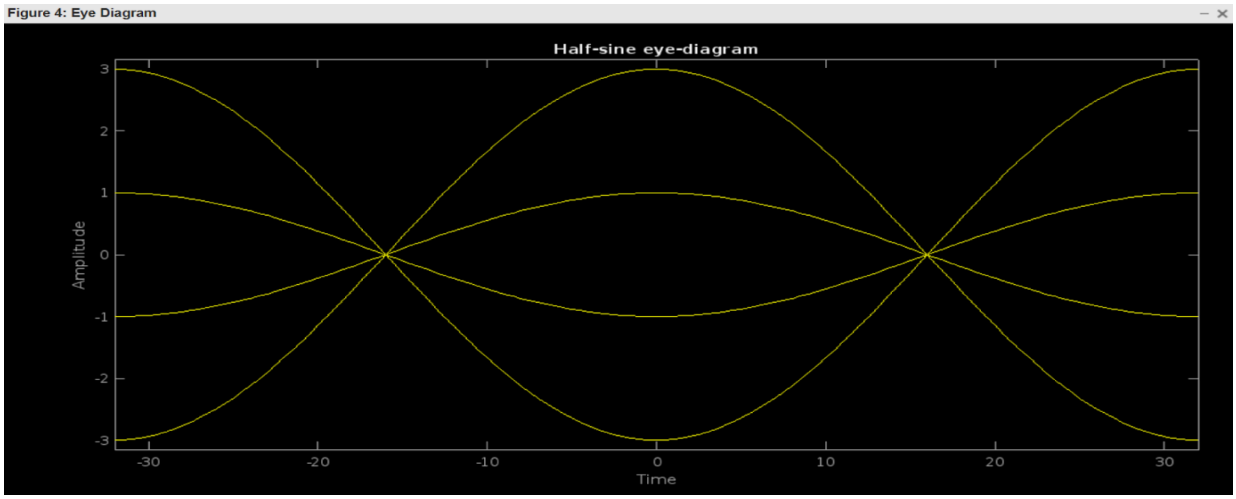


Figure 4: Eye Diagram
Half-sine eye-diagram
Amplitude
Time
3
2
1
0
-1
-2
-3
-30
-20
-10
0
10
20
30

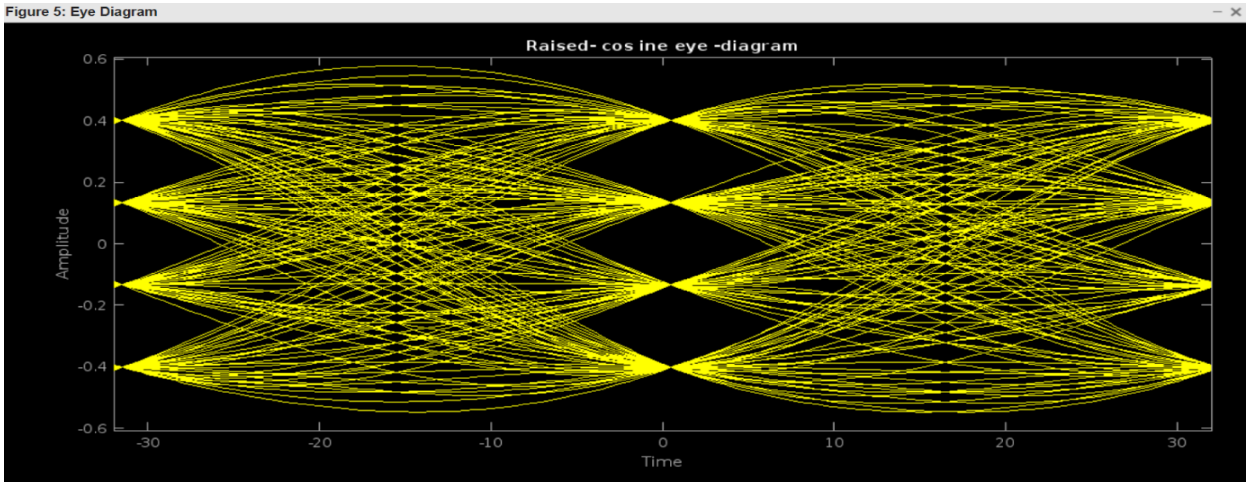


Figure 5: Eye Diagram
Raised- cos ine eye -diagram
Amplitude
Time
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-30
-20
-10
0
10
20
30