

Experiment No 3.

Gray to Binary Converter

1. Theory:-

The **reflected binary code (RBC)**, also known just as **reflected binary (RB)** or **Gray code** is an ordering of the binary numeral system such that two successive values differ in only one bit (binary digit). The reflected binary code was originally designed to prevent spurious output from electromechanical switches. Today Gray codes are widely used to facilitate error correction in digital communications such as digital terrestrial television and some cable TV systems.

Gray Code Input				Binary Code Output			
G3	G2	G1	G0	B3	B2	B1	B0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	1	0	0	1	0
0	0	1	0	0	0	1	1
0	1	1	0	0	1	0	0
0	1	1	1	0	1	0	1
0	1	0	1	0	1	1	0
0	1	0	0	0	1	1	1
1	1	0	0	1	0	0	0
1	1	0	1	1	0	0	1
1	1	1	1	1	0	1	0
1	1	1	0	1	0	1	1
1	0	1	0	1	1	0	0
1	0	1	1	1	1	0	1
1	0	0	1	1	1	1	0
1	0	0	0	1	1	1	1

Table1

Figure 1. Truth Table for Gray to Binary code converter

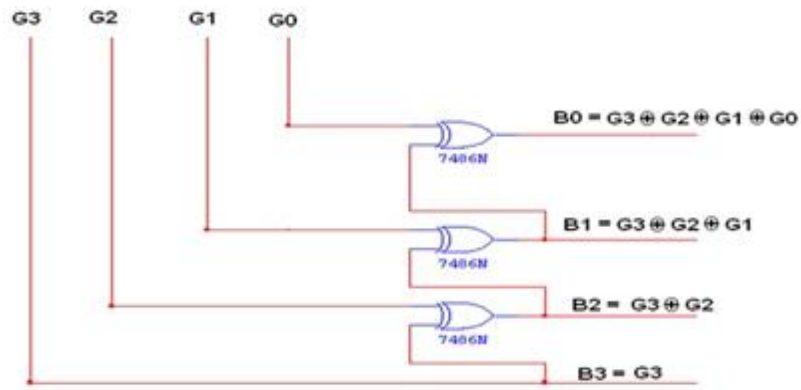


Figure 2. 4- bit Gray to Binary code Converter.

The K – map for various binary outputs and the corresponding simplified expression are given below:

For output B₃

G3G2 \ G1G0	G1G0			
	00	01	11	10
00	0	0	0	0
01	0	0	0	0
11	1	1	1	1
10	1	1	1	1

Kmap for B₃ :- $B3 = G3$

For output B₂

G3G2 \ G1G0	G1G0			
	00	01	11	10
00	0	0	0	0
01	1	1	1	1
11	0	0	0	0
10	1	1	1	1

Kmap for B₂:- $B2 = G(3) \oplus G(2)$

For output B_1

		G1G0			
		00	01	11	10
G3G2	00	0	0	1	1
	01	1	1	0	0
	11	0	0	1	1
	10	1	1	0	0

$B1 = G3 \oplus G2 \oplus G1$

K-map for $B1 = G1 \oplus G2 \oplus G3$

For output B_0

		G1G0			
		00	01	11	10
G3G2	00	0	1	0	1
	01	1	0	1	0
	11	0	1	0	1
	10	1	0	1	0

K-map for $B0 = G2 \oplus G3 \oplus G1 \oplus G0$

2. Schematic Diagram:-

The schematic diagram of Gray to Binary Converter circuit in eSim is as follows,

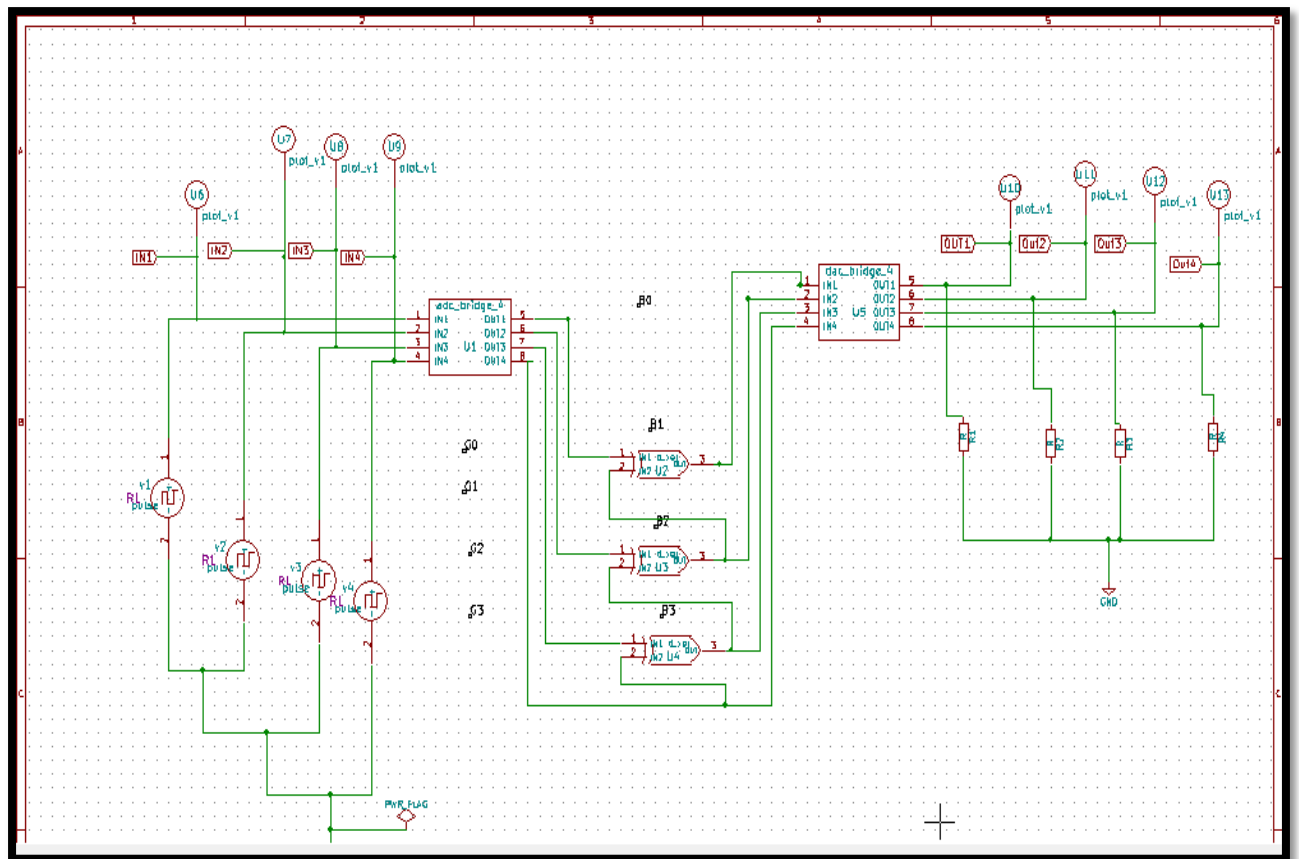


Figure 3:- Schematic of Gray to Binary Converter

3. Simulation Results:

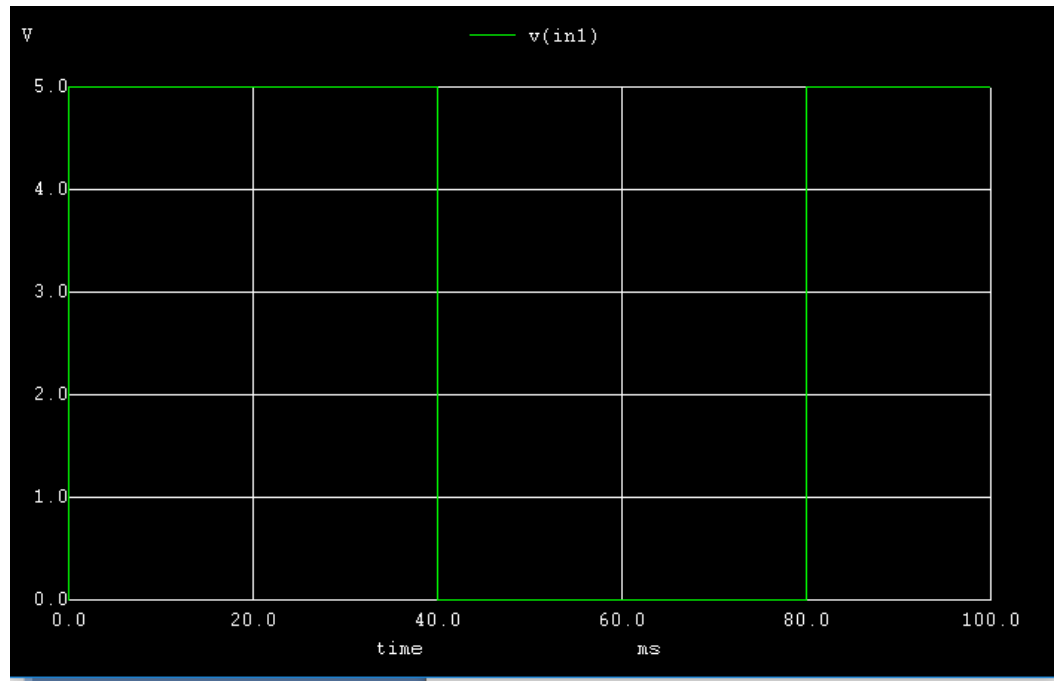


Figure 4 :-Ngspice input plot 1

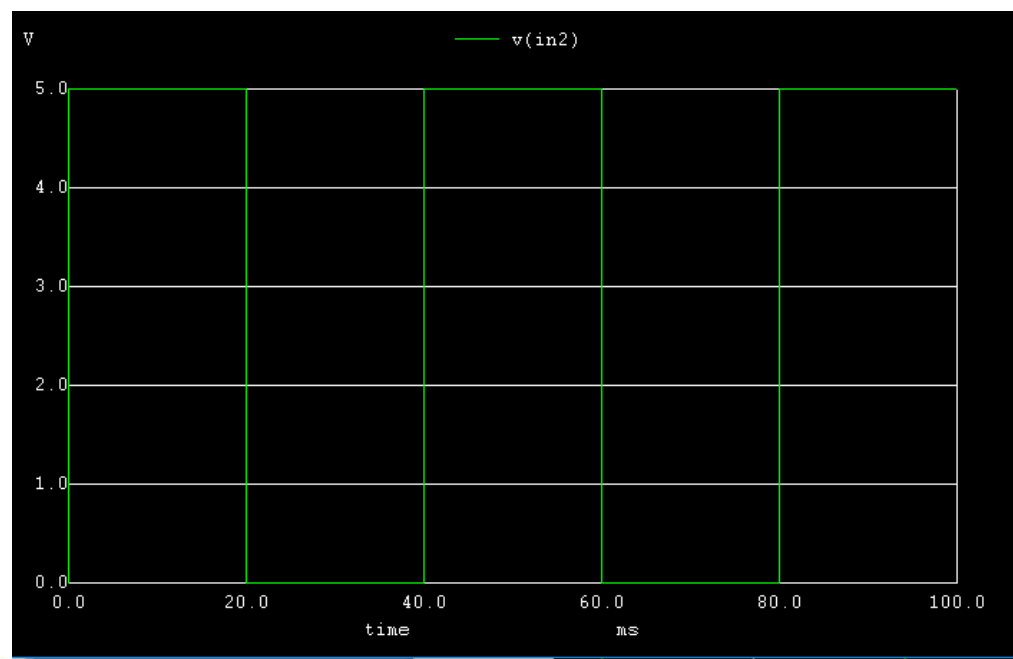
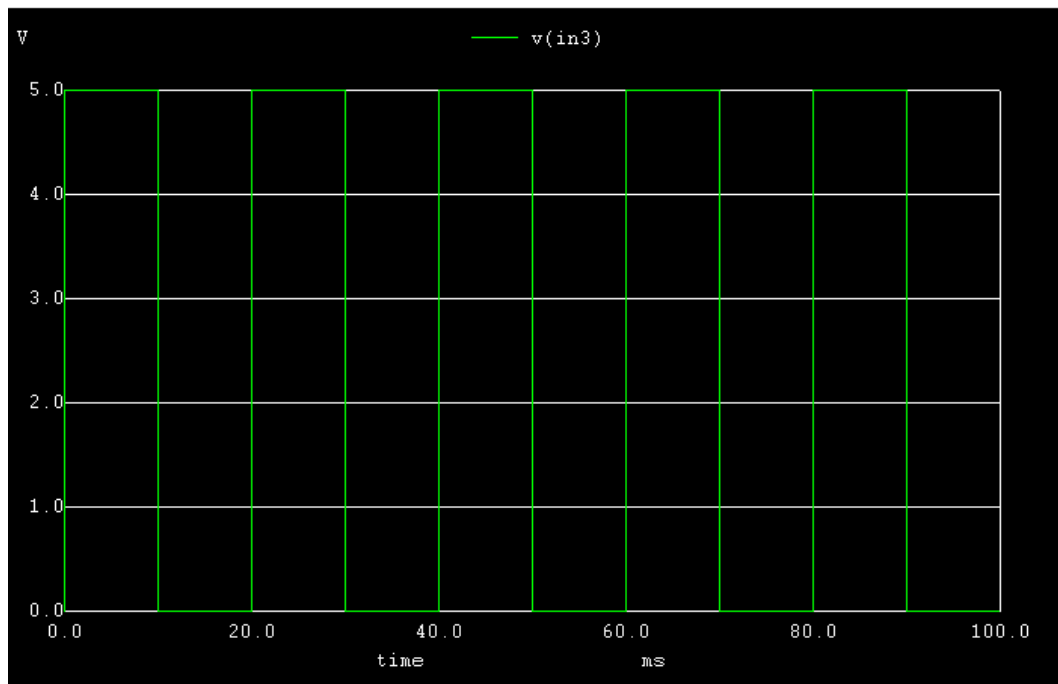
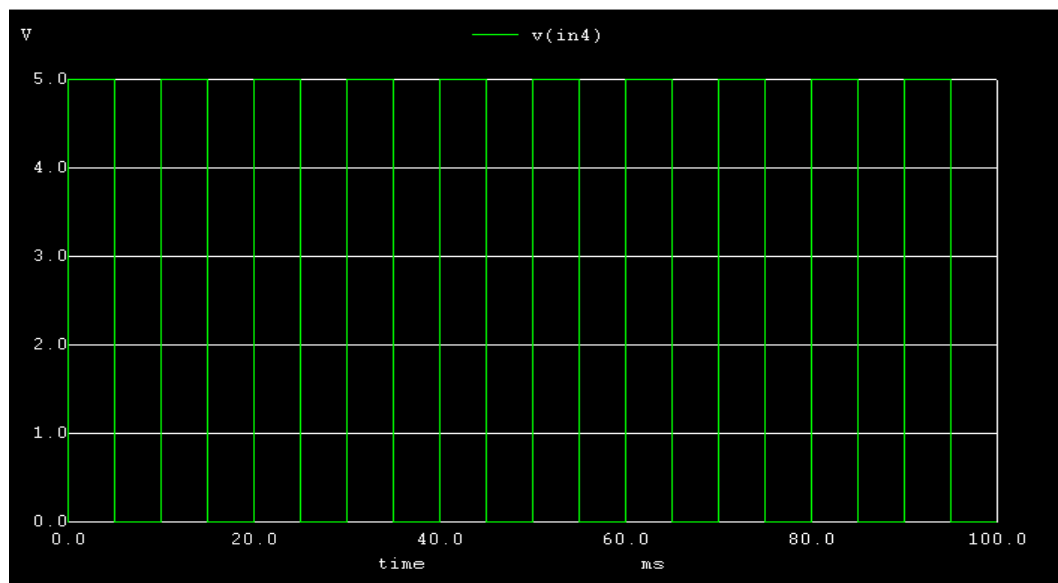
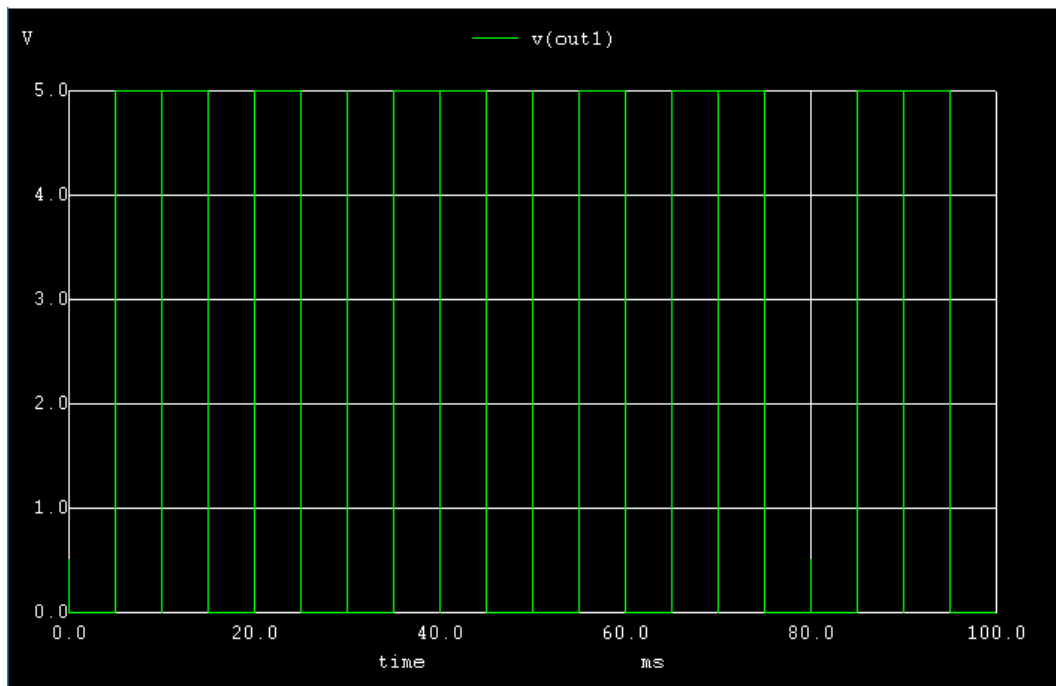
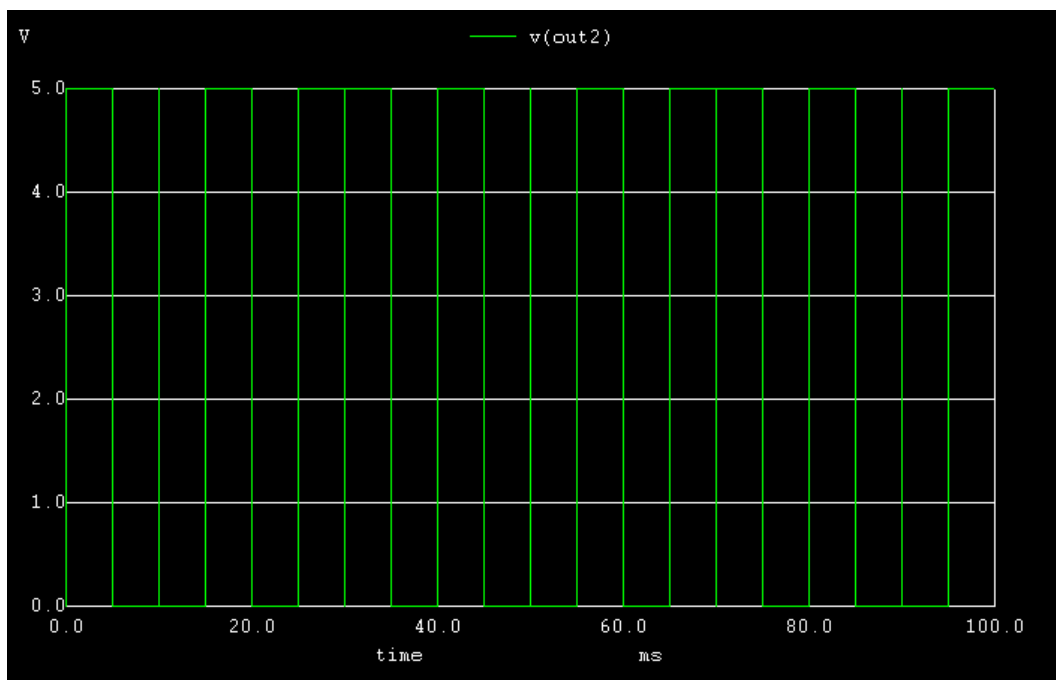


Figure 5:-Ngspice input plot 2

**Figure 6:-Ngspice input plot 3****Figure 7:-Ngspice input plot 4**

**Figure 8:-**Ngspice output plot 1**Figure 9: -**Ngspice output plot 2

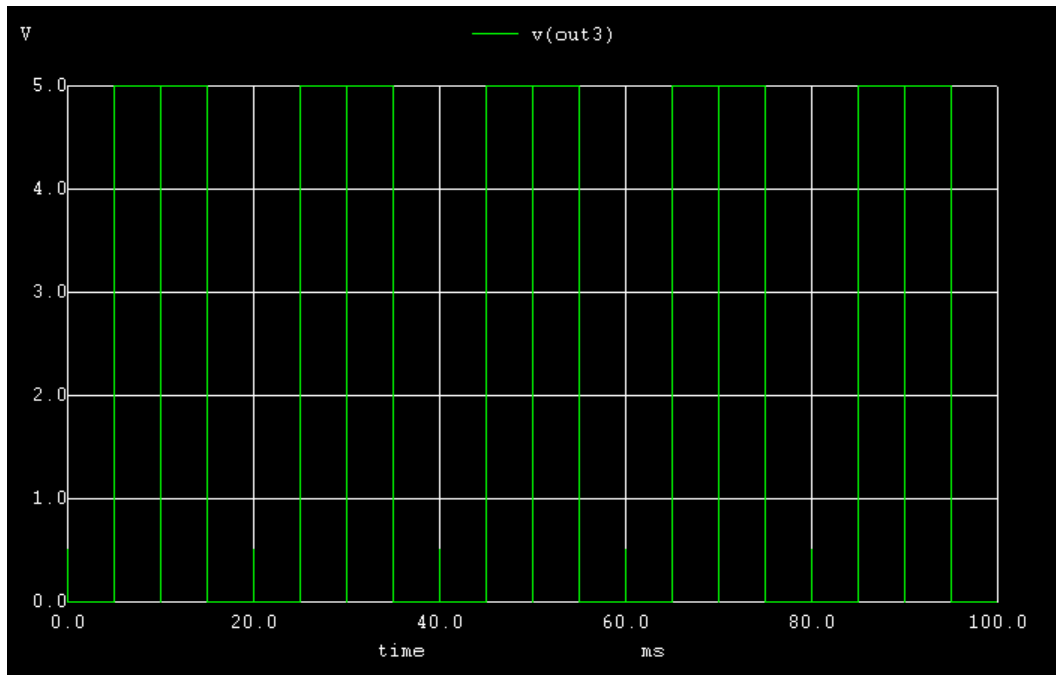


Figure 10:-Ngspice output plot 3

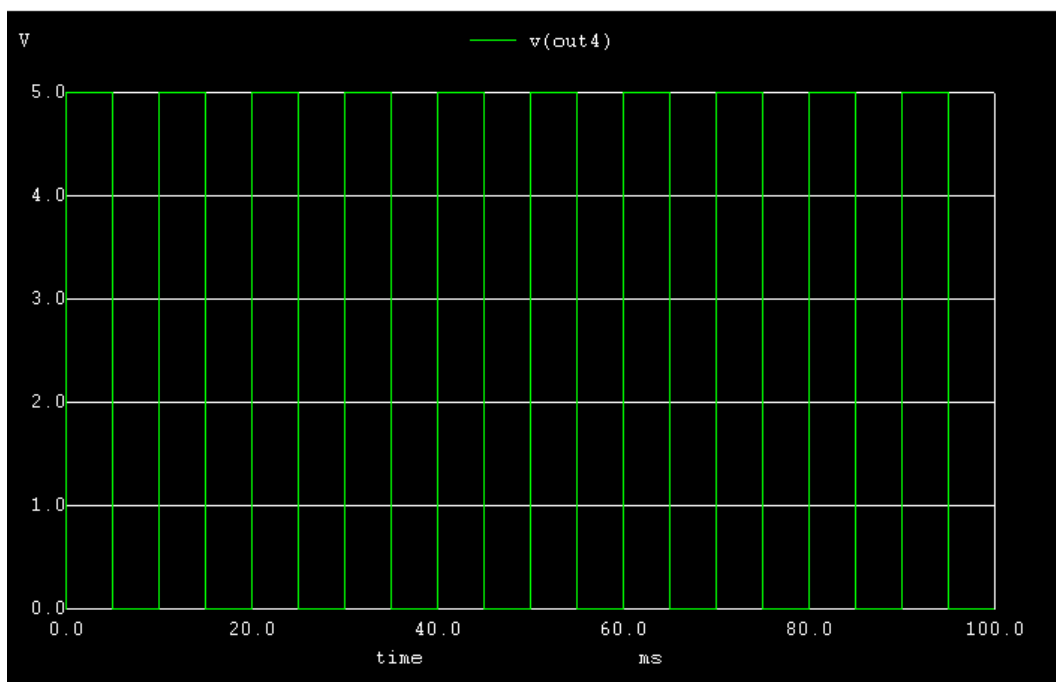
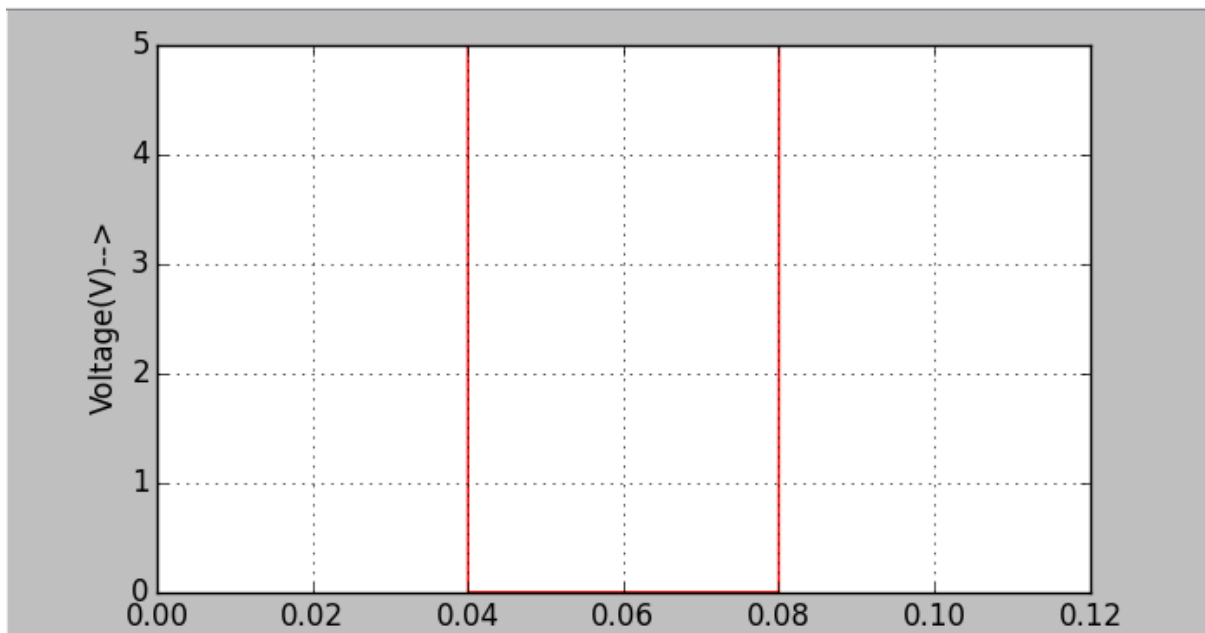
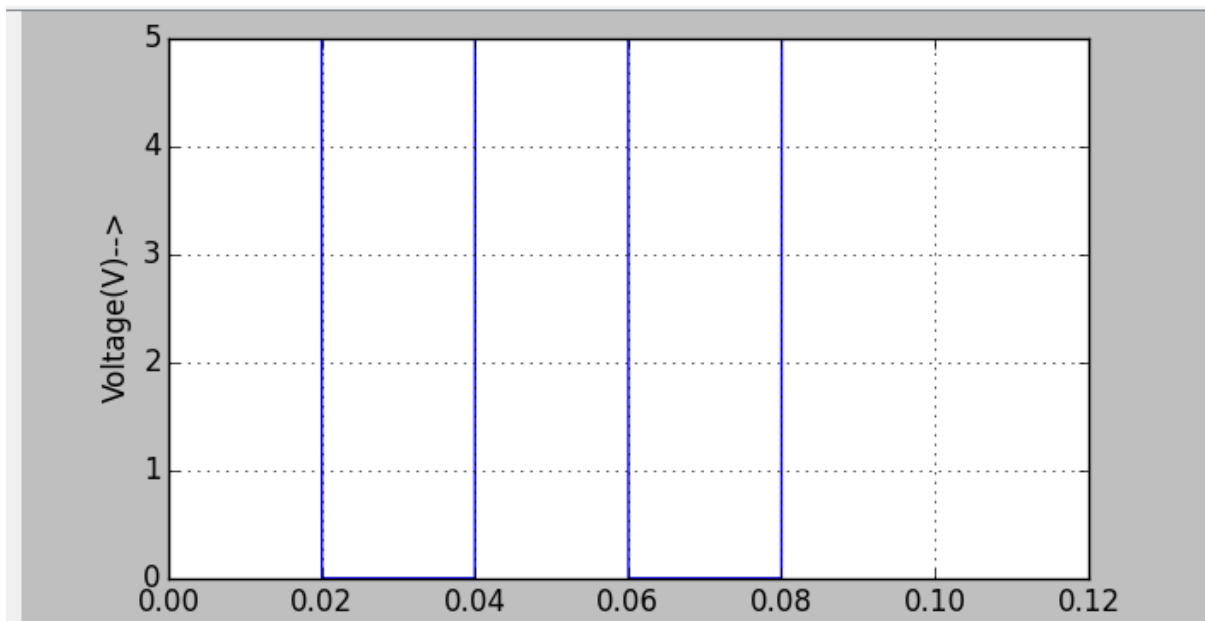
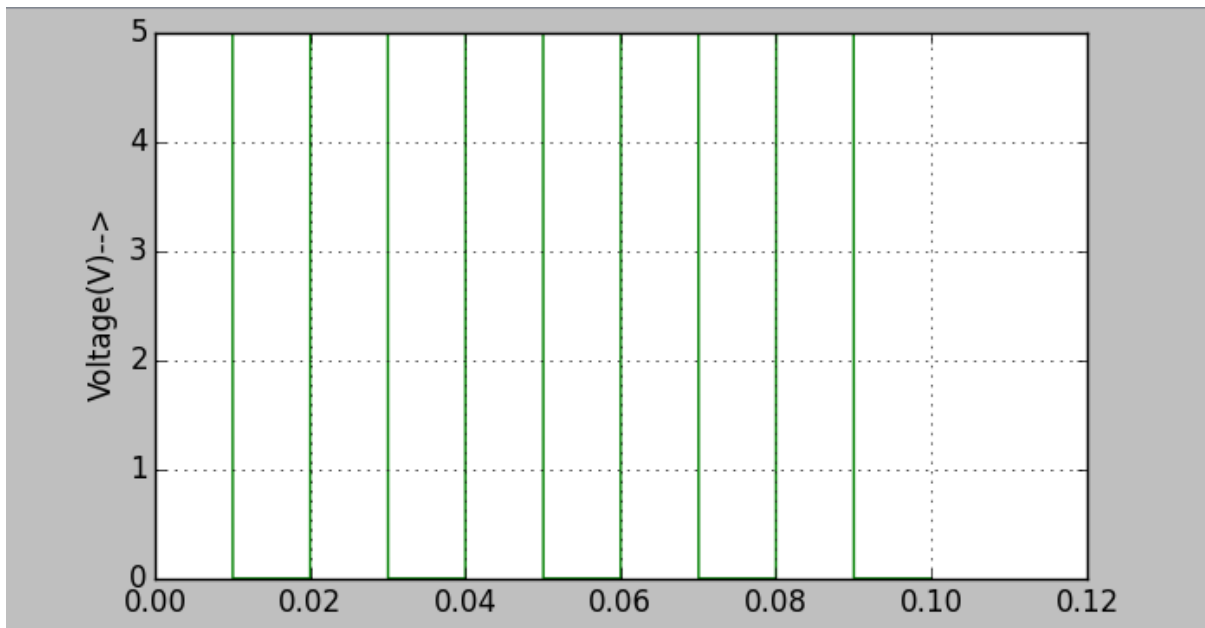
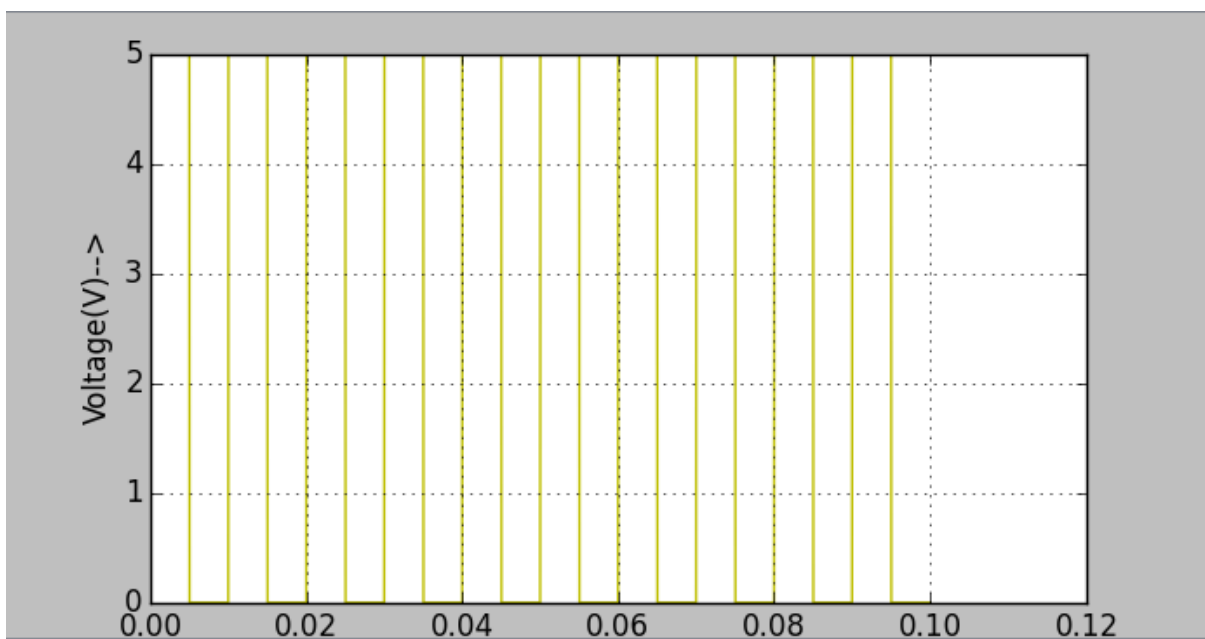
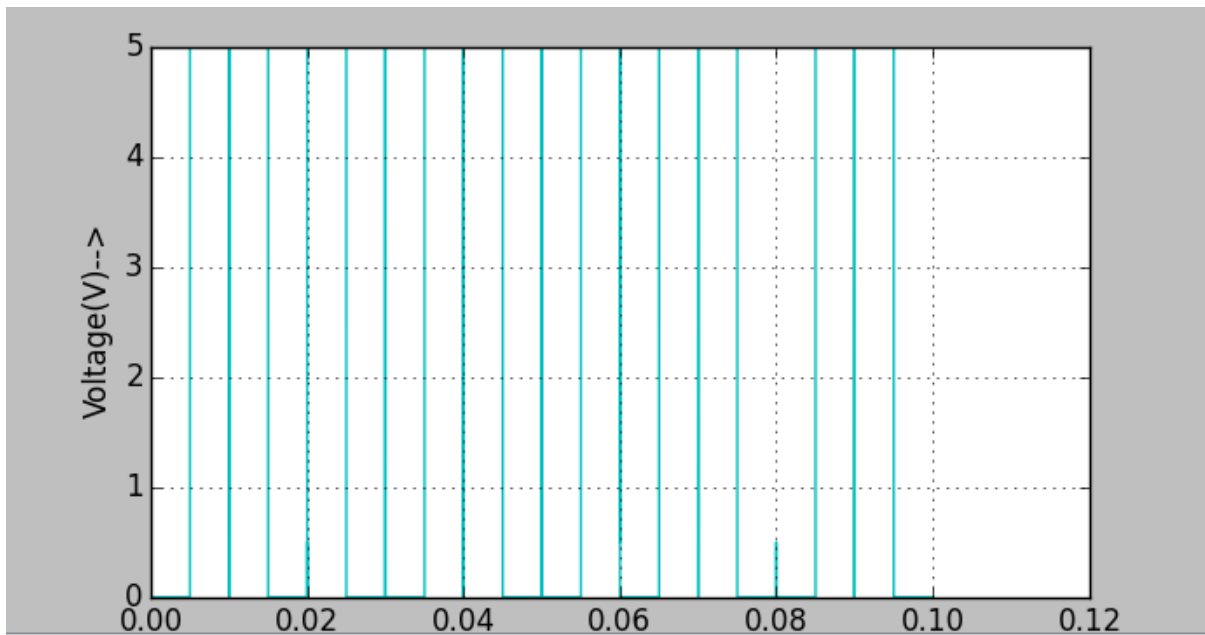
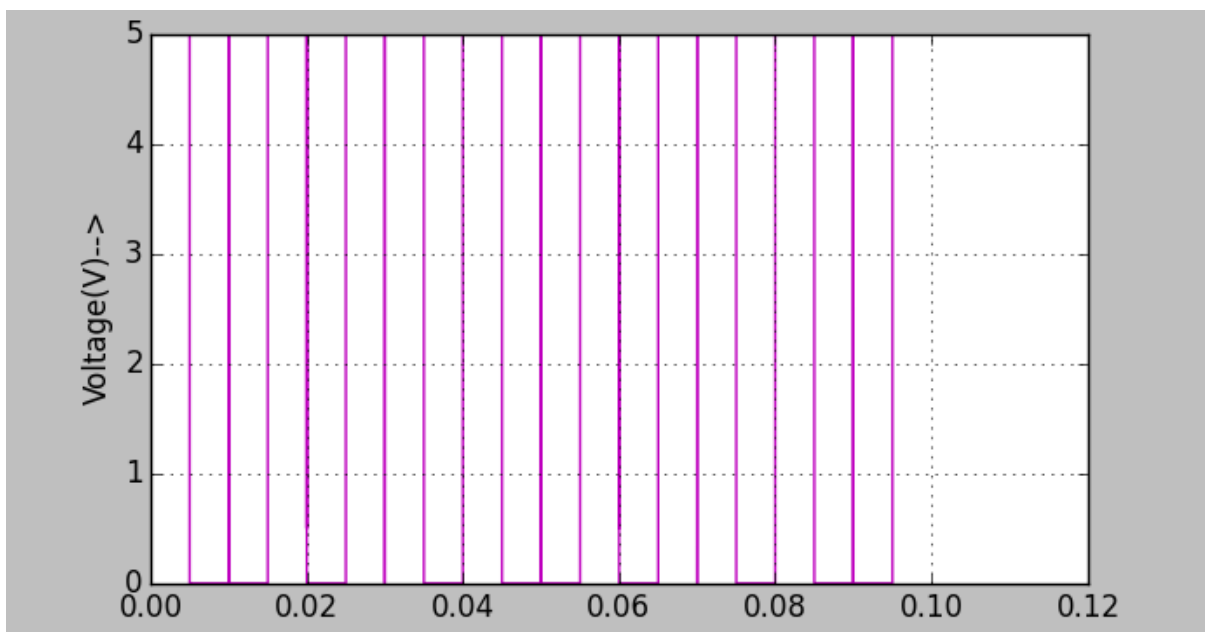
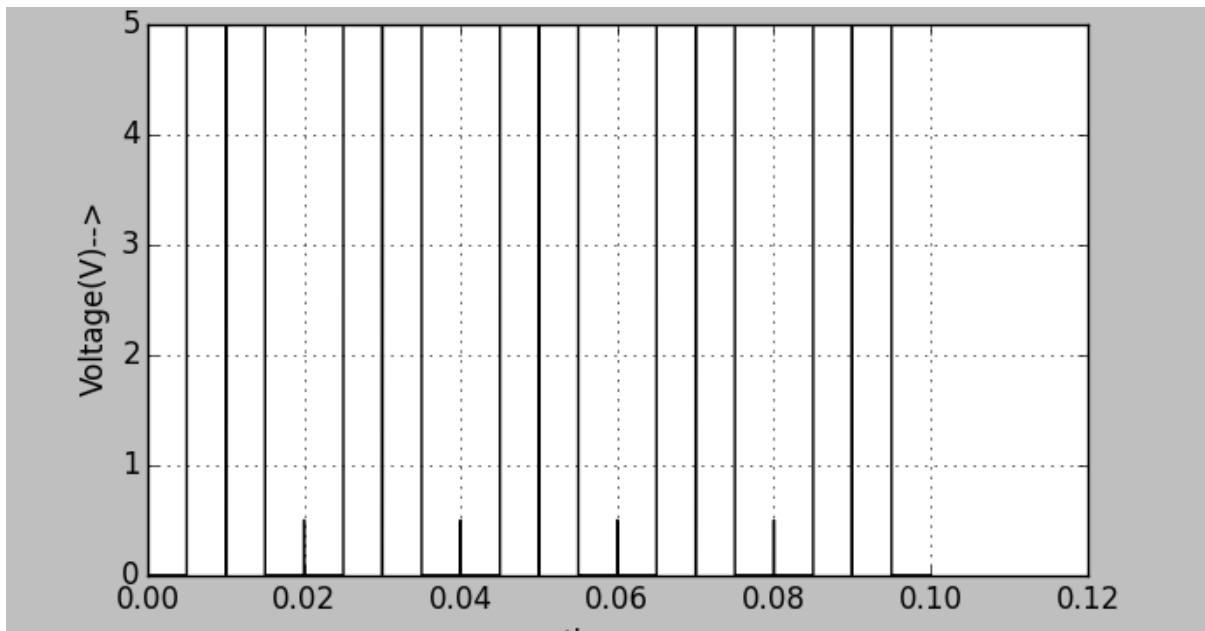
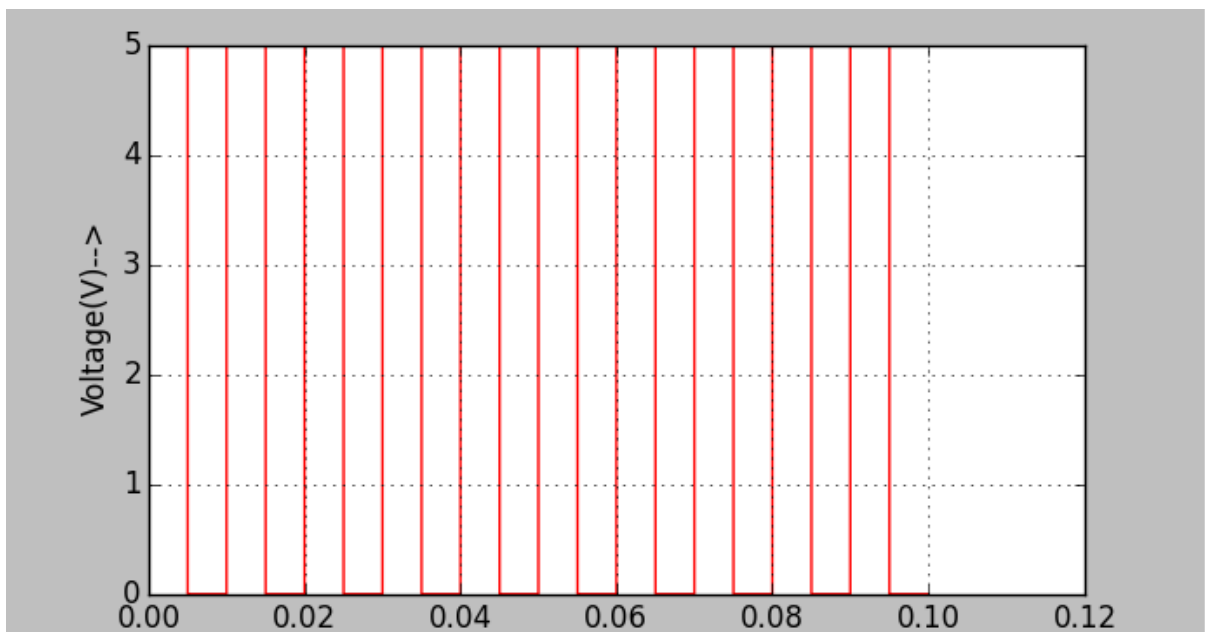


Figure 11:-Ngspice output plot 4

**Figure 12:-** Python input plot 1**Figure 13:-**Python input plot 2

**Figure 14:-Python input plot 3****Figure 15:-Python input plot 4**

**Figure 16:-Python output plot 1****Figure 17:-Python output plot 2**

**Figure 18:-**Python output plot 3**Figure 19:-**Python output plot 4

4. Conclusion :- Thus we have simulated Gray to binary converter circuit using eSim and output wave form is observed.

5. Reference:-

<http://www.ques10.com/p/17086/design-a-4-bit-grey-to-binary-code-converter/>

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1. **Conclusion :-** Thus we have studied Gray to Binary Converter circuit using eSim and got the appropriate wave forms.

2. **Reference:-**

<http://www.care4you.in/Tutorials/DE%20Lab/experiment-4.html>.

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