



## DAY-25

### #100DAYSOFRTL

**Aim:-** Implementation of 16 BIT ALU with 16 Operations.

#### RTL CODE:-

```
1 //DATE:-25/01/2024
2 //Implementation of ALU with 16 operations of 16 bit numbers
3 module ALU(input [15:0] A,B,
4   input en, input [3:0] opcode, output reg [31:0] result);
5 always @(A or B or opcode or en ) begin
6   if (en==1)
7     case(opcode)
8       4'b0000: result=A+B;///ADDITION
9       4'b0001: result=A-B;///Subtraction
10      4'b0010: result=A*B;///Multiplication
11      4'b0011: result=A+1;///Increment
12      4'b0100: result=A-1;///Decrement
13      4'b0101: result=A;///Buffer
14      4'b0110: result=~(A);///not gate
15      4'b0111: result=A&B;///AND GATE
16      4'b1000: result=A|B;///OR GATE
17      4'b1001: result=A^B;///XOR GATE
18      4'b1010: result=~(A^B);///XNOR GATE
19      4'b1011: result=~(A&B);///NAND GATE
20      4'b1100: result=~(A|B);///NOR GATE
21      4'b1101: result=A<<1;///LEFT SHIFT
22      4'b1110: result=A>>1;///RIGHT SHIFT
23      4'b1111: result=A/B;///DIVISION
24      default : result=16'hxxxx;
25    endcase
26  else
27    result=16'hzzzz;
28  end
29 endmodule
```

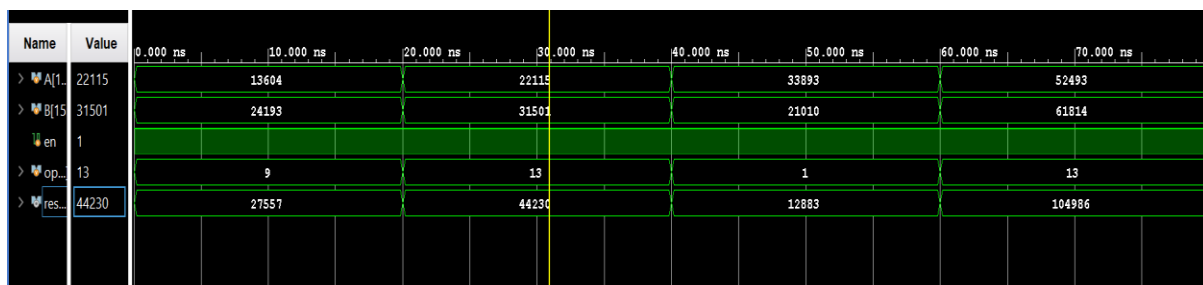
## TESTBENCH:-

```
1 module ALU_tb();
2   reg [15:0] A,B;
3   reg en;
4   reg [3:0] opcode;
5   wire [31:0] result;
6   ALU uut(A,B,en,opcode,result);
7   initial begin
8     for(integer i=0; i<20; i=i+1) begin
9       A=$random();
10      B=$random();
11      en=1;
12      opcode=$random();
13      #10;
14      $display("A=%d,B=%d,en=%d,opcode=%b,result=%d",A,B,en,opcode,result);
15      #10;
16    end
17  end
18  initial begin
19    #400;
20    $finish();
21  end
22 endmodule
```

## OUTPUT:-

```
A=13604,B=24193,en=1,opcode=1001,result= 27557
A=22115,B=31501,en=1,opcode=1101,result= 44230
A=33893,B=21010,en=1,opcode=0001,result= 12883
A=52493,B=61814,en=1,opcode=1101,result= 104986
A=22509,B=63372,en=1,opcode=1001,result= 41057
A= 9414,B=33989,en=1,opcode=1010,result=4294926332
A=63461,B=29303,en=1,opcode=0010,result=1859597683
A=56207,B=27122,en=1,opcode=1110,result= 28103
A=31464,B=20165,en=1,opcode=1100,result=4294934802
```

## WAVEFORMS:-



# SCHEMATIC:-

