**Name: -** Shahrukh Padaniya

**Student Id: -** C0769542

**1005**

Lab Activity-March 30, 2020 => 4-bit ADC

Deadline: Sunday April 5, 11:59 PM

Each student must submit individually the text editor, output editor, and the Schematics regarding VHDL Coding for one of the following digital circuit:

The Big Group ONE:

4-BIT ADC

The Big Group TWO:

4-BIT DAC

**Code: -**

library IEEE;

use IEEE.STD\_LOGIC\_1164.ALL;

-- Uncomment the following library declaration if using

-- arithmetic functions with Signed or Unsigned values

use IEEE.NUMERIC\_STD.ALL;

-- Uncomment the following library declaration if instantiating

-- any Xilinx primitives in this code.

--library UNISIM;

--use UNISIM.VComponents.all;

entity adc is

port( analog : in real := -2.931;

de : in std\_logic;

bpi : in std\_logic;

dr: in std\_logic;

cnvrt: in std\_logic;

digital\_out : out std\_logic\_vector(3 downto 0)

);

end adc;

architecture Behavioral of adc is

signal analog\_in : real range -5.000 to 10.000;

begin

process(analog,analog\_in,de,bpi,cnvrt,dr)

begin

analog\_in<= analog;

if (de = '0') then

if (bpi = '0') then

if (cnvrt = '1') then

if (dr = '0') then

if (analog\_in = 0.000 or (analog\_in > 0.000 and analog\_in < 0.625 )) then

digital\_out <= "0000";

elsif (analog\_in = 0.625 or (analog\_in > 0.625 and analog\_in < 1.250)) then

digital\_out <= "0001";

elsif (analog\_in = 1.250 or (analog\_in > 1.250 and analog\_in < 1.875)) then

digital\_out <= "0010";

elsif (analog\_in = 1.875 or (analog\_in > 1.875 and analog\_in < 2.500)) then

digital\_out <= "0011";

elsif (analog\_in = 2.500 or (analog\_in > 2.500 and analog\_in < 3.125)) then

digital\_out <= "0100";

elsif (analog\_in = 3.125 or (analog\_in > 3.125 and analog\_in < 3.750)) then

digital\_out <= "0101";

elsif (analog\_in =3.750 or (analog\_in > 3.750 and analog\_in < 4.375)) then

digital\_out <= "0110";

elsif (analog\_in = 4.375 or (analog\_in >4.375 and analog\_in < 5.000)) then

digital\_out <= "0111";

elsif (analog\_in = 5.000 or (analog\_in > 5.000 and analog\_in < 5.625)) then

digital\_out <= "1000";

elsif (analog\_in = 5.625 or (analog\_in > 5.625 and analog\_in < 6.250)) then

digital\_out <= "1001";

elsif (analog\_in = 6.250 or (analog\_in > 6.250 and analog\_in < 6.875)) then

digital\_out <= "1010";

elsif (analog\_in = 6.875 or (analog\_in > 6.875 and analog\_in < 7.500)) then

digital\_out <= "1011";

elsif (analog\_in = 7.500 or (analog\_in > 7.500 and analog\_in < 8.125)) then

digital\_out <= "1100";

elsif (analog\_in = 8.125 or (analog\_in > 8.125 and analog\_in < 8.750)) then

digital\_out <= "1101";

elsif (analog\_in = 8.750 or (analog\_in > 8.750 and analog\_in < 9.375)) then

digital\_out <= "1110";

elsif (analog\_in = 9.375 or (analog\_in > 9.375 and analog\_in < 10.000) or analog\_in=10.000) then

digital\_out <= "1111";

end if;

end if;

end if;

end if;

if (bpi = '1') then

if (cnvrt = '1') then

if (dr = '0') then

if (analog\_in = -5.000 or (analog\_in > -5.000 and analog\_in < -4.375)) then

digital\_out <= "0000";

elsif (analog\_in = -4.375 or (analog\_in > -4.375 and analog\_in < -3.750)) then

digital\_out <= "0001";

elsif (analog\_in = -3.750 or (analog\_in > -3.750 and analog\_in < -3.125)) then

digital\_out <= "0010";

elsif (analog\_in = -3.125 or (analog\_in > -3.125 and analog\_in < -2.500)) then

digital\_out <= "0011";

elsif (analog\_in = -2.500 or (analog\_in > -2.500 and analog\_in < -1.875)) then

digital\_out <= "0100";

elsif (analog\_in = -1.875 or (analog\_in > -1.875 and analog\_in < -1.250)) then

digital\_out <= "0101";

elsif (analog\_in = -1.250 or (analog\_in > -1.250 and analog\_in < -0.625)) then

digital\_out <= "0110";

elsif (analog\_in = -0.625 or (analog\_in > -0.625 and analog\_in < 0.000)) then

digital\_out <= "0111";

elsif (analog\_in = 0.000 or (analog\_in > 0.000 and analog\_in < 0.625)) then

digital\_out <= "1000";

elsif (analog\_in = 0.625 or (analog\_in > 0.625 and analog\_in < 1.250)) then

digital\_out <= "1001";

elsif (analog\_in = 1.250 or (analog\_in > 1.250 and analog\_in < 1.875)) then

digital\_out <= "1010";

elsif (analog\_in = 1.875 or (analog\_in > 1.875 and analog\_in < 2.500)) then

digital\_out <= "1011";

elsif (analog\_in = 2.500 or (analog\_in > 2.500 and analog\_in < 3.125)) then

digital\_out <= "1100";

elsif (analog\_in = 3.125 or (analog\_in > 3.125 and analog\_in < 3.750)) then

digital\_out <= "1101";

elsif (analog\_in = 3.750 or (analog\_in > 3.750 and analog\_in < 4.375)) then

digital\_out <= "1110";

elsif (analog\_in = 4.375 or (analog\_in > 4.375 and analog\_in < 5.000) or analog\_in=5.000) then

digital\_out <= "1111";

end if;

end if;

end if;

end if;

end if;

end process;

end Behavioral;

**Explanation: -** In the code above for ADC, we have 1 analog input and 16 digital output. When BPI is low only positive input will be considered in the range of 0.000 to 10.000. So, we have 16 codes to represent this range of 10v input. Thus, we divided range by codes, so that each code can represent a range. Also, when BPI is high, the voltage range changes to -5v to +5v and corresponding code for that input will be generated. Here we can initiate analog voltage in code and the corresponding code can be generated.

**Output: -** For analog input = -2.931 and bpi=1.

