DESIGN

1’s complement:

• 1’s complement is designed using only IC 7404 which is a NOT gate.

• Simple inversion of the given input will be the 1’s complement.

2's Complement:

• Addition of 0001 to the 1’s complement will give 2’s complement.

• Binary Adder which is IC7483, is used to add the 0001 to the 1’s Complement.
• Whenever the Carry input bit is provided to the Vcc, the addition is performed and hence the output of the binary adder will give the 2’s complement of the number.

• If Cin is 0,then the output will be the 1’s complement of the number.

9’s Complement:

• 9’s complement of a number is always subtracted from the decimal number 9.

• In Binary format, the 4-bit binary number is subtracted from the 1001.

• The 9’s complement of a BCD code of a number “x” can be expressed as:

$$9-x = (15-6)-x = (15-x)-6 = \bar{x}-6=(\bar{x}+10) \text{ or, } 9-x = [(15-x)+10]-16$$

• The first part (15-x) is the 1’s complement of x when x is a BCD number i.e. (15-x) produces $\bar{x}$.

• In the circuit implementation, with the IC-7483 adder circuit, this $\bar{x}$ can be generated by four single inverters, i.e., 4-bit inverted numbers are $\bar{x}3$, $\bar{x}2$, $\bar{x}1$, $\bar{x}0$.
• Now in the first case, $(\bar{x}-6) = (\bar{x}+10)$ can be done by the 2’s complement of the 6 which form gives 10. (6) → 0110 (1’s complement)→ 1001 (Add+1) → 1010 (2’s Complement) 17

• Next, the $(10)_{10}$ =(1010) can easily be added to the inverter’s output by using a 4-bit full. adder IC-7483.

• The subtraction of 16 from the sum output of the full adder can be done very easily by ignoring the (Cout).

• The (Cin) input should be grounded otherwise extra 1 will be added. So carefully grounded the (Cin) i.e., pin 13 for IC-7483 to 0.

10’s Complement:

• 10’s complement of a 4-bit number (BCD code) “x” is, 1010-x = 10-x; or simply we can add (+1) to the result out for the 9’s complement.

• The 10’s complement of a BCD code of a number “x” can be expressed as: 9-x+1 = (15-6)-x+1 = (15-x)-6+1 = $\bar{x}$-6+1=($\bar{x}$+10)+1 or, ($\bar{x}$+11)

• The first part is the 9’s complement of “x” when “x” is a BCD number i.e. (15-x) produces $\bar{x}$.

• And the (+1) is added to it when the Cin input of the full adder IC-7483 is connected to logic high i.e., 1 or +Vcc.

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FLOW CHART