PRINCIPLES OF ELECTRONICS ENGINEERING

Tutorial –3

1. Simplify the following logic expressions using Boolean postulates and theorems. Realize these expressions using basic gates.

   (a) $Y = \overline{((\overline{A\bar{B}} + ABC)} + A(B + A\bar{B}))$

   (b) $Y = AB + \overline{(AC)} + ABC(AB + C)$

   (c) $Y = \bar{A}\bar{B}\bar{C} + \bar{A}B\bar{C} + A\bar{B}\bar{C} + \bar{A}\bar{B}C$

   (d) $Y = (A + \bar{B} + C) . (\bar{A} + \bar{B} + \bar{C}) . (\bar{A} + B)$

   (e) $Y = AB + \bar{A}C + \bar{B}C$

   (f) $Y = \overline{[\overline{((A + B). (CD))} + E + \bar{F})]}$

2. **Realize the X-OR function using:**
   (a). Only NAND gates
   (b).Only NOR gates

3. **Realize half adder using:**
   (a).Only NAND gates
   (b). Only NOR gates

4. A logic circuit has three inputs A, B and C and two outputs X and Y. The first output X is at logic 1, when two or more of the inputs are at logic 1. The second output Y is at logic 1, when only one of the inputs is at logic 1. Write the truth table, logic expressions for X and Y and realize the logic circuits using**NAND** gates only.

5. A logic circuit has four inputs A, B, C & D and three outputs X, Y and Z. The first output X is at logic 1 when any two inputs are at logic 1. The second output Y is at logic 1 when only one of the inputs is at logic 1. The third output is at logic 1 when three or more inputs are at logic 1. Write the truth table, logic expressions for X, Y and Z and realize the logic circuits using **NOR** gates only.

6. Simplify the given Boolean expression using k map.

a) $F(W,X,Y,Z)=\sum m(0,2,3,7,8,11,14,15)$

b) $F(A, B,C,D)= \sum m(0,2,5,6,7,8,10,13.15)$

****