Q1. (a) For the Boolean expression given below

$F(A,B,C,D) = \Sigma\, m(3,4,5,8,11,15)$

$d(A,B,C,D) = \Sigma\, m(0,2,9)$

(i) Plot the k-Map

(ii) Identify the Prime Implicants. Express each PI as product form.

(iii) Identify the essential Prime Implicants. Express each EPI as product form.

(iv) How many different minimal SOPs are possible for F? Write down the expression for all the minimal SOP for F.

(v) Draw the gate level circuit diagram of the minimal SOP (any one) using required number of two input NAND gates.

(b) Express the following function as sum of minterms and product of maxterms.

$F(A,B,C,D) = B'D + A'D + BD$

Q2. Realize the following four variable function using minimum number of 2:1 MUXs only. NO other gates/components are available. Also only true forms of input variables are available.

$F = AB + B'CD + AC'$

Q3. **(a)** Implement the following Boolean function using minimum number of

(i) Transistors in CMOS logic

(ii) Transmission gates & NOT gates.

$F(A,B,C) = A'B' + (B+C)' + ABC$

Assume inputs available in true and compliment forms.

(b) Mention any two merits and demerits of TTL totem-pole over TTL Open collector logic family