PEE GrA-4

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A016

Q2. Use Boolean Algebra and De-Morgan's Theorem To Solve the Following.

a. $XY + XY'$

$\Rightarrow X[Y+Y']$

$\Rightarrow X$

b. $(X+Y)(X+\bar{Y})$

$\Rightarrow XX + X\bar{Y} + XY + Y\bar{Y}$

$\Rightarrow X + X\bar{Y} + XY$

$\Rightarrow X + X(Y+\bar{Y})$

$\Rightarrow X + X \Rightarrow X$

c. $XYZ + \bar{X}Y + XY\bar{Z}$

$\Rightarrow XY[Z+\bar{Z}] + \bar{X}Y$

$\Rightarrow XY + \bar{X}Y \Rightarrow Y[X+\bar{X}] \Rightarrow Y$

d. $\overline{(A+B)}\,\overline{(\bar{A}+\bar{B})}$

$\Rightarrow \bar{A}\cdot\bar{B}\cdot(\bar{\bar{A}}\cdot\bar{\bar{B}})$

$= \bar{A}\cdot\bar{B}\cdot A\cdot B$

$\Rightarrow 0$

e. $(a+b+\bar{c})(\bar{a}+\bar{b}+c)$

$\Rightarrow a\bar{a} + a\bar{b} + ac + \bar{a}b + b\bar{b} + bc + \bar{a}\bar{c} + \bar{b}\bar{c} + c\bar{c}$

$\Rightarrow a\bar{b} + ac + \bar{a}b + bc + \bar{a}\bar{c} + \bar{b}\bar{c}$

$\Rightarrow$

f. $(a+b+\bar{c})(\bar{a}\bar{b}+c)$

$\Rightarrow a\bar{a}\bar{b} + ac + \bar{a}\bar{b}b + bc + \bar{a}\bar{b}\bar{c} + c\bar{c}$

$\Rightarrow ac + bc + \bar{a}\bar{b}\bar{c}$

g. $\bar{a}bc + ab\bar{c} + abc + \bar{a}b\bar{c}$

$\Rightarrow \bar{a}b(c+\bar{c}) + ab(c+\bar{c})$

$\Rightarrow \bar{a}b + ab$

$\Rightarrow b(a+\bar{a})$

$\Rightarrow b$

a. $ABC + \bar{A}B + AB\bar{C}$

$\Rightarrow AB(C+\bar{C}) + \bar{A}B$

$\Rightarrow AB + \bar{A}B$

$\Rightarrow B(A+\bar{A})$

$\Rightarrow B$

b. $\bar{X}YZ + XZ$

$\Rightarrow \bar{X}YZ + XZ(Y+\bar{Y})$

$\Rightarrow \bar{X}YZ + XYZ + X\bar{Y}Z$

$\Rightarrow \bar{X}YZ + XYZ + XYZ + X\bar{Y}Z$

$\Rightarrow YZ(X+\bar{X}) + XZ(Y+\bar{Y}) \Rightarrow YZ + XZ$

c. $\overline{(X+Y)}(\bar{X}+\bar{Y})$

$\Rightarrow (\bar{X}\cdot\bar{Y})(\bar{X}+\bar{Y})$

$\Rightarrow \bar{X}\bar{X}\bar{Y} + \bar{Y}\bar{Y}\bar{X}$

$\Rightarrow \bar{X}\bar{Y} + \bar{Y}\bar{X}$

$\Rightarrow 1$

d. $XY + X(WZ + W\bar{Z})$

$\Rightarrow XY(W+\bar{W})(Z+\bar{Z}) + X(WZ + W\bar{Z})(Y+\bar{Y})$

$\Rightarrow XY(WZ + W\bar{Z} + \bar{W}Z + \bar{W}\bar{Z}) + (XY + X\bar{Y})(WZ + W\bar{Z})$

$\Rightarrow XYWZ + WXY\bar{Z} + \bar{W}XYZ + \bar{W}XY\bar{Z} + WXYZ + WXY\bar{Z} + WX\bar{Y}Z + WX\bar{Y}\bar{Z}$

$\Rightarrow WXYZ + WXY\bar{Z} + \bar{W}XYZ + \bar{W}XY\bar{Z} + WX\bar{Y}Z + WX\bar{Y}\bar{Z}$

$\Rightarrow WXY(Z+\bar{Z}) + \bar{W}XY(Z+\bar{Z}) + WX\bar{Y}(Z+\bar{Z})$

$\Rightarrow WXY + \bar{W}XY + WX\bar{Y}$

$\Rightarrow XY(W+\bar{W}) + WX\bar{Y}$

$\Rightarrow XY + WX\bar{Y}$

e. $(B\bar{C} + \bar{A}D)(A\bar{B} + C\bar{D})$

$\Rightarrow A\bar{B}B\bar{C} + BC\bar{C}\bar{D} + A\bar{A}D\bar{B} + \bar{A}C\bar{D}\bar{D}$

$\Rightarrow 0$

f. $(a\bar{A} + \bar{C})(A + \bar{B} + \bar{C})$

$\Rightarrow A\bar{A} + \bar{A}\bar{B} + \bar{A}\bar{C} + A\bar{C} + B\bar{C} + \bar{C}\bar{C}$

$\Rightarrow \bar{A}\bar{B} + \bar{A}\bar{C} + A\bar{C} + B\bar{C}$

$\Rightarrow \bar{A}\bar{B} + \bar{C}(A + \bar{A}) + B\bar{C}$

$\Rightarrow \bar{A}\bar{B} + \bar{C} + B\bar{C}$

a. $\bar{A}\bar{C} + ABC + A\bar{C}$

$\Rightarrow \bar{C}(A + \bar{A}) + ABC$

$\Rightarrow \bar{C} + ABC$

b. $\overline{(\bar{X}\bar{Y} + Z)} + Z + XY + WZ$

$\Rightarrow \overline{\bar{X}\bar{Y}} \cdot \bar{Z} + Z + XY + WZ$

$\Rightarrow (X + Y)\bar{Z} + Z + XY + WZ$

$\Rightarrow X\bar{Z} + Y\bar{Z} + Z + XY + WZ$

$\Rightarrow X\bar{Z}(X + \bar{Y})(W + \bar{W}) + Y\bar{Z}(X + \bar{X})(W + \bar{W}) +$

$\Rightarrow X + Y + Z + XY + WZ \quad [\because b'a + b = a + b]$

$\Rightarrow X(1 + Y) + Y(1 + X) + Z(1 + W)$

$\Rightarrow X + Y + Z$

c $\bar{A}B(\bar{D}+\bar{C}D)+B(A+\bar{A}CD)$

$\Rightarrow \bar{A}B\bar{D}+\bar{A}B\bar{C}D+AB+\bar{A}BCD$

$\Rightarrow \bar{A}B+B+AB+\bar{A}BD(C+\bar{C})+B(A+\bar{A})$

$\Rightarrow 0+\bar{A}BD+B$

$\Rightarrow B(\bar{A}D+\bar{A}\bar{C}D+A+\bar{A}CD)$

$\Rightarrow B(\bar{A}\bar{A}+\bar{A}A+\bar{A}(\bar{D}+\bar{C}D+CD))$

$\Rightarrow B(A+\bar{A}(\bar{D}+D))$

$= B(A+\bar{A})$

$\Rightarrow B$

e $ABCD+\bar{A}BD+AB\bar{C}D$

$\Rightarrow BD(AC+\bar{A}+A\bar{C})$

$\Rightarrow BD(AC(1+\bar{C})+\bar{A})$

$\Rightarrow BD(A+\bar{A})$

$\Rightarrow BD$

d $(\bar{A}+\bar{C})(\bar{A}+\bar{C})(A+B+\bar{C}D)$

$\Rightarrow(\bar{A}\bar{A}+\bar{A}\bar{C}+\bar{A}\bar{C}+\bar{C}\bar{C})(A+B+\bar{C}D)$

$\Rightarrow(\bar{A}\ \bar{C})(A+B+\bar{C}D)$

$\Rightarrow \bar{A}A\bar{C}+\bar{A}B\bar{C}+\bar{A}\bar{C}\bar{C}D+$ ~~$A\bar{C}D$~~

$\Rightarrow \bar{A}B\bar{C}$ ~~D~~

Q3. Convert Each of the following to other canonical form:-

a. $F(x, y, z) = \Sigma(1,3,5)$
$= \pi(0,2,4,6,7)$

b. $F(A,B,C,D) = \pi(3,5,8,11)$
$= \Sigma(0,1,2,4,6,7,9,10,12,13,14,15)$

Convert Each of following in SOP and POS:-

a. $(U+XW)(X+\bar{U}V)$
$\Rightarrow XU + U\bar{U}V + XXW + XW\bar{U}V$
$\Rightarrow XU + XW + XW\bar{U}V$
$\Rightarrow XW(1+\bar{U}V) + XU$
$\Rightarrow XW + XU \in SOP$
$\Rightarrow X(W+U) \in POS$

b. $\bar{X} + X(X+\bar{Y})(Y+\bar{Z})$
$\Rightarrow \bar{X} + X(XY + X\bar{Z} + Y\bar{Y} + \bar{Y}\bar{Z})$
$\Rightarrow \bar{X} + X(XY + X\bar{Z} + \bar{Y}\bar{Z})$
$\Rightarrow \bar{X} + XXY + XX\bar{Z} + X\bar{Y}\bar{Z}$
$\Rightarrow \bar{X} + XY + X\bar{Z} + X\bar{Y}\bar{Z}$
$\Rightarrow \bar{X}(1+Y+Z) + XY(1+\bar{Z})$
$\Rightarrow \bar{X} + XY$
$\Rightarrow \bar{X} + XXY + XX\bar{Z} + X\bar{Y}\bar{Z}$
$\Rightarrow \bar{X} + XY + X\bar{Z} + X\bar{Y}\bar{Z}$
$\Rightarrow \bar{X} + XY$

$\bar{X} + (X+\bar{Y})(Y+\bar{Z})$
$(\bar{X}+X+\bar{Y})(\bar{X}+Y+\bar{Z})$
$(\bar{X}+Y+\bar{Z}) \in POS$ & SOP

Q4. Write the Boolean Expression & draw the logic diagram of the circuit whose output is defined by the following Truth table.

X	Y	Z	F_1	F_2
0	0	0	1	1
0	0	1	0	1
0	1	0	1	0
0	1	1	1	1
1	0	0	1	0
1	0	1	0	1
1	1	0	1	0

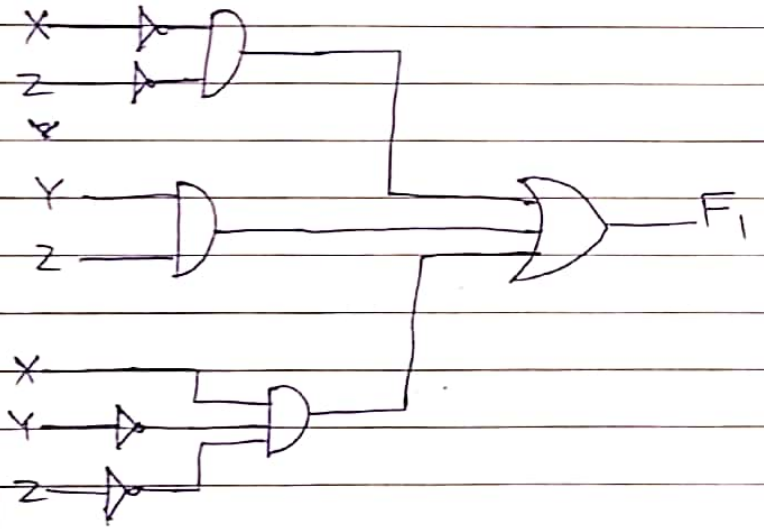
F_1 & F_2 = O/P

X, Y, Z = I/P

F_1 Exp: $= \bar{X}\bar{Y}\bar{Z} + \bar{X}Y\bar{Z} + \bar{X}YZ + X\bar{Y}\bar{Z} + XYZ$

$= \bar{X}\bar{Z}(Y+\bar{Y}) + XYZ(X+\bar{X}) + X\bar{Y}\bar{Z}$

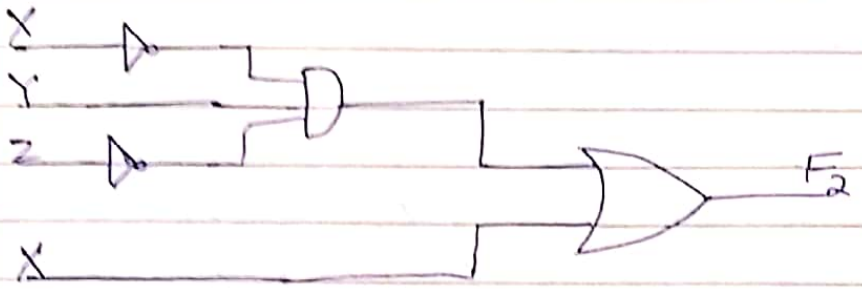
$= \bar{X}\bar{Z} + YZ + X\bar{Y}\bar{Z}$



F_2 Exp: $\bar{X}Y\bar{Z} + X\bar{Y}\bar{Z}$ XYZ

$\Rightarrow \bar{X}Y\bar{Z} + X(\bar{Y}\bar{Z} + YZ)$

$\Rightarrow \bar{X}Y\bar{Z} + X$



Q1.

Oscillator

- Tuned
  - RC
    - Weign Bridge
    - RC Phase Shift
  - LC
    - Harley
    - Colpitt
    - Clap
  - Other
    - Crystal
    - Negative Resistance
- Un-Tuned
  - Relaxation
  - Ring

An oscillator is a circuit which produces a continuous, repeated, alternating waveform without any input. Oscillators basically convert unidirectional current flow from a DC source into an alternating waveform of desired frequency.

RC Phase Shift Oscillator

In this oscillator, the RC network is used in the feedback to generate the stable sine wave. This oscillator is the harmonic oscillator.

RC phase shift oscillator is used for low frequency generation. Typically it is used for the audio frequencies.

In RC phase shift oscillator, the transistor or op-amp is inverting mode is used for amplification. So, it provides the 180° of phase shift. And the remaining 180° of phase shift is provided by the RC feedback network.

By tuning the gain of the RC network and the amplifier it is possible to achieve the unity loop gain.

In the feedback loop, more than 2 RC stages are cascaded to achieve the stable phase shift.

If 3 stages are used for then the attenuation provided by the feedback circuit $\beta = 1/29$.

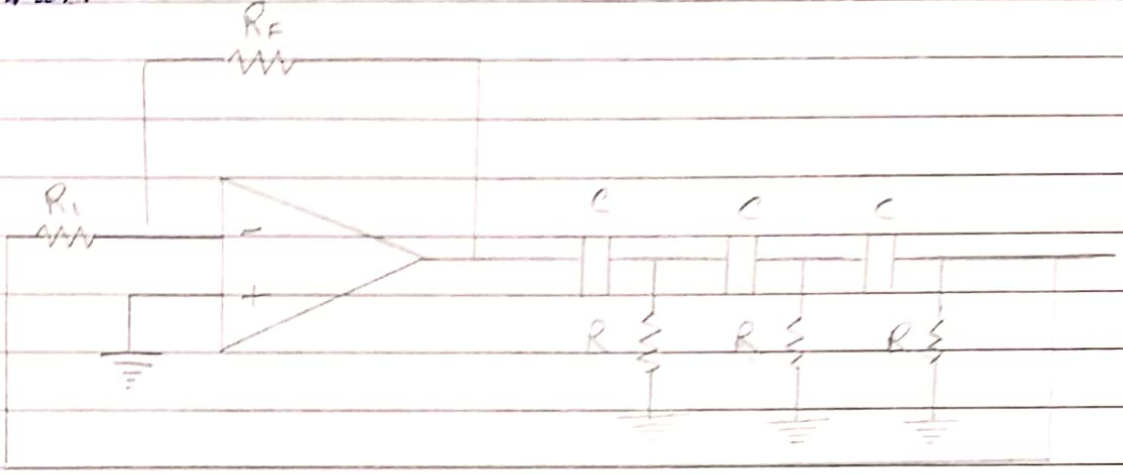
And the frequency of the oscillation

$$f = \frac{1}{2\pi RC\sqrt{6}}$$

In general of N stages of the RC circuits are cascaded then

$$f = \frac{1}{2\pi RC\sqrt{2N}}$$

In the RC phase shift oscillator, usually the R is kept fixed and C is changed to tune the oscillator. And for proper tuning, all capacitors are ganged together.



Q3. Convert into POS & SOP

b. $\bar{X} + X(X+\bar{Y})(Y+\bar{Z})$

$\Rightarrow \bar{X} + (\bar{X}+X)(\bar{X}+(X+\bar{Y})(Y+\bar{Z}))$

$\Rightarrow \bar{X} + X\bar{X} + \bar{Y}\bar{Z} +$

$\Rightarrow \bar{X} + (X+\bar{Y})(Y+\bar{Z})$

$\Rightarrow (\bar{X}+X+\bar{Y})(\bar{X}+Y+\bar{Z})$

$\Rightarrow (\bar{X}+Y+\bar{Z}) \in$ POS & SOP