Free Study Material from All Lab Experiments

All Lab Experiments

Electronics for NET/Gate Physical Sciences

Flip-Flops # Rectifiers

~~* fil~~

* Flip-Flop Conversion :-

Steps -

(i) Identify the flip-flop which is required.

(ii) Draw the characteristic table.

(iii) Develop the exitation table for the ~~required~~ given flip-flop. Minimise by K-map.

(iv) Impliment by logic gates.

(i) Convert JK to T-flip-flop :-

T	Q_n	Q_{n+1}	J	K
0	0	0	0	X
0	1	1	X	0
1	0	1	1	X
1	1	0	X	1

Q_n	Q_{n+1}	S	R
0	0	0	X
0	1	1	0
1	0	0	1
1	1	X	0

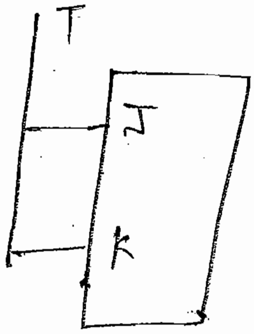
J	K
0	X
1	X
X	1
X	0

T \ Q_n	0	1
0	0	X
1	1	X

$\boxed{J = T}$

T \ Q_n	0	1
0	X	0
1	X	1

$\boxed{K = T}$



T - flip-flop

* Convert JK to D flip-flop :-

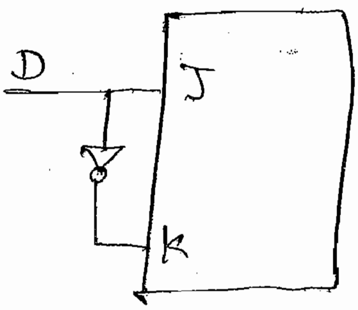
D	Q_n	Q_{n+1}	J K
0	0	0	0 X
0	1	0	X 1
1	0	1	1 X
1	1	1	X 0

D \ Q_n	0	1
0	0	X
1	1	X

$\boxed{J = D}$

D \ Q_n	0	1
0	X	1
1	X	0

$\boxed{K = \bar{D}}$



* Convert D to T flip-flop :

T	Q_n	Q_{n+1}	D $(= Q_{n+1})$
0	0	0	0
0	1	1	1
1	0	1	1
1	1	0	0

T \ Q_n	0	1
0	0	1
1	1	0

$$D = \bar{T} Q_n + T \bar{Q}_n$$

$$\boxed{D = T \oplus Q_n}$$

So $\boxed{T = D \oplus Q_n}$

* Point To be remember :-

$JK \longrightarrow T$

$J = T$
$K = T$

$JK \longrightarrow D$

$J = D$
$K = \overline{D}$

$SR \longrightarrow D$

$S = D$
$R = \overline{D}$

$D \longrightarrow T$

$D = T \oplus Q_n$

$T \longrightarrow D$

$T = D \oplus Q_n$

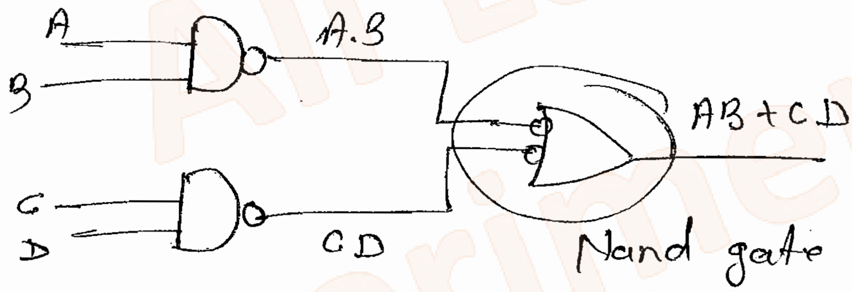
* Steps for identification

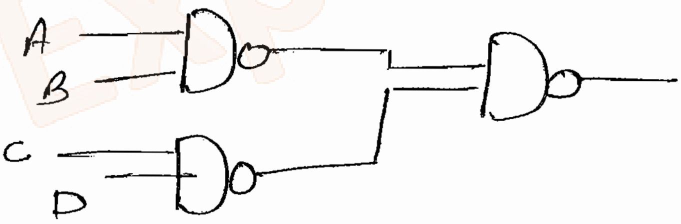
(I) Draw the circuit diagram by using ordinary gate

(II) Substitude bubble infront of AND Gate and input of OR Gate so that bubble is balanced.

(III) Replace every gate by Nand gate. it gives minm no. of nand gate.

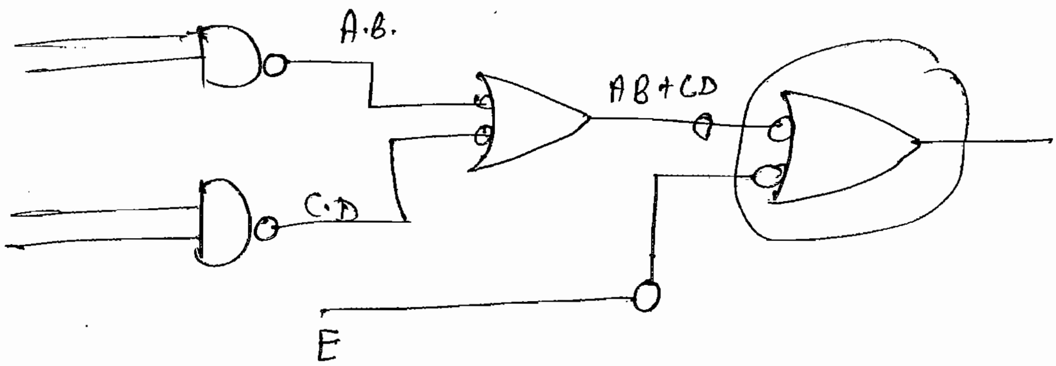
Ex –

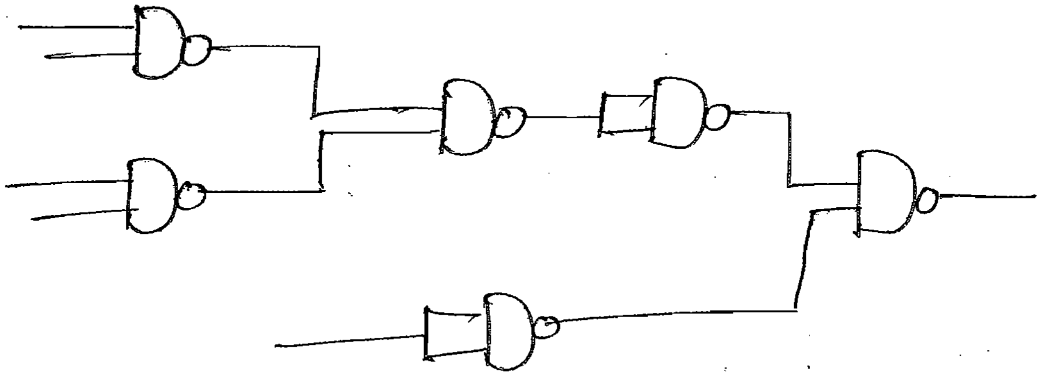




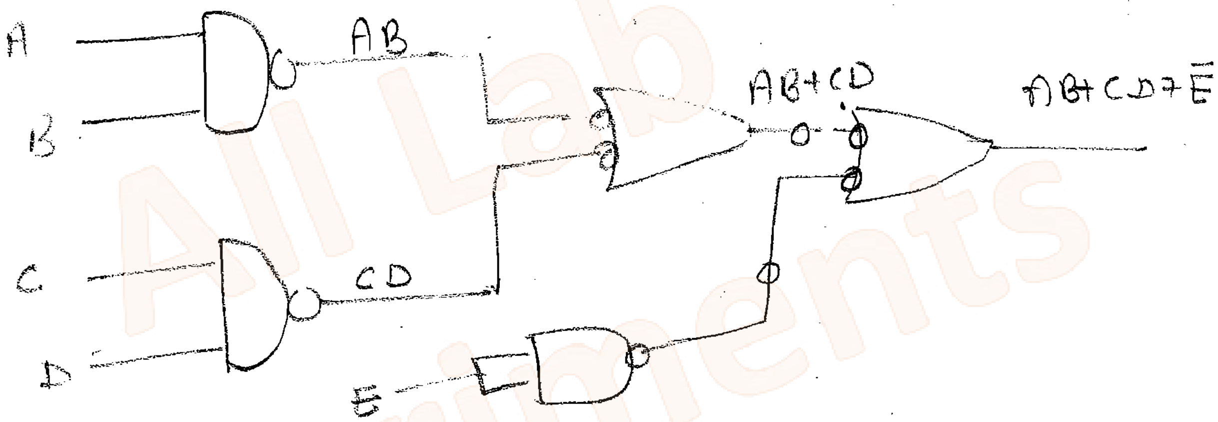
= (3)

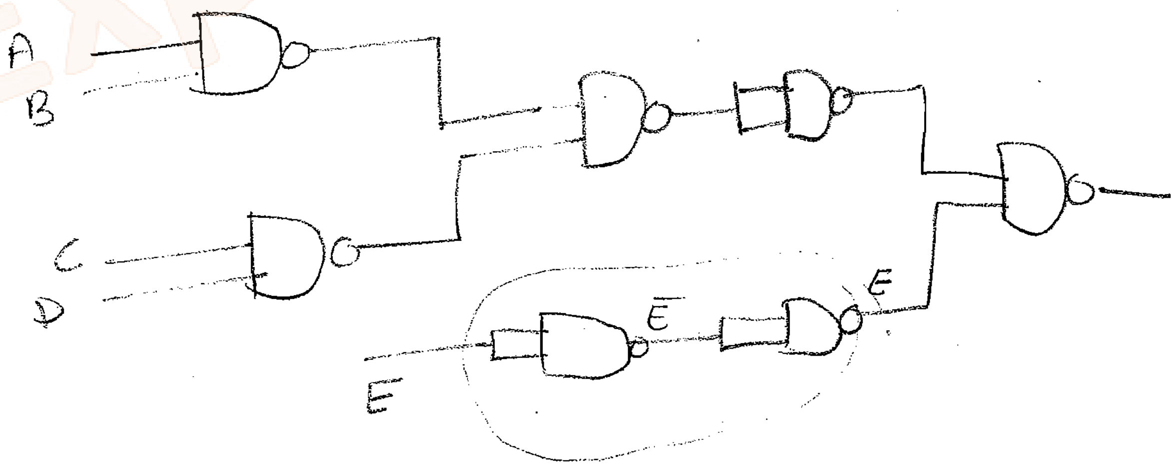
Q. $y = AB + CD + E$

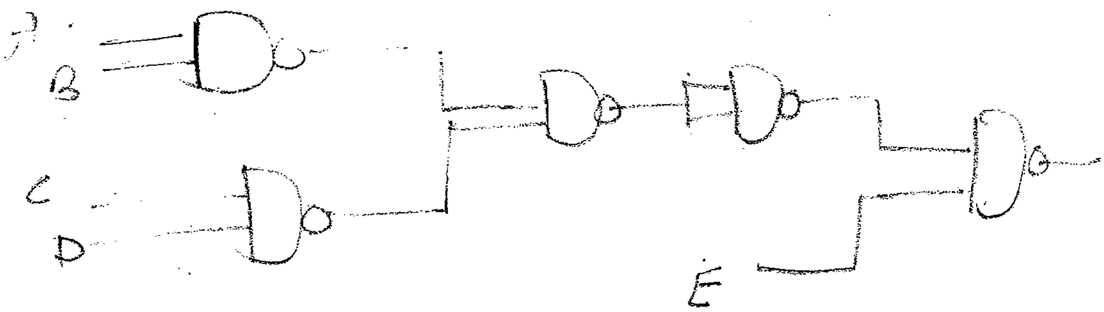




Q. $Y = AB + CD + \bar{E}$







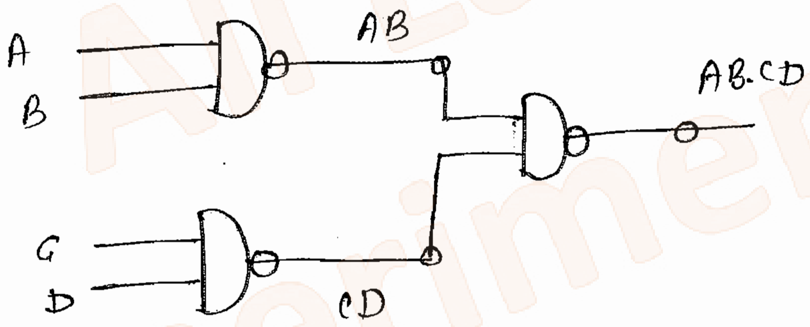
* Steps for identification minimum no. of Nor gate. ⇒

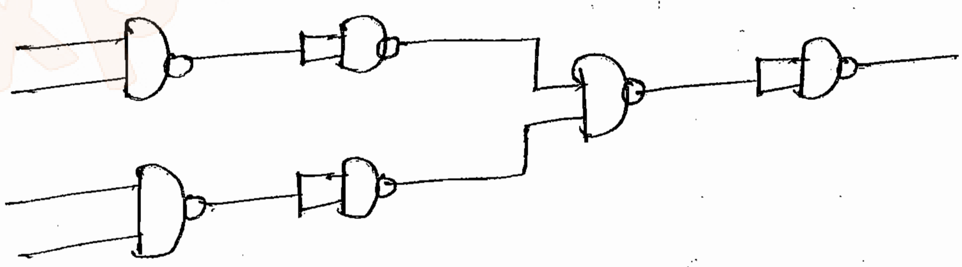
(I) Draw the circuit diagram by using ordinary gates.

(II) Substitude bubble at the infront of OR-ga[te] and at the input of AND-gate.

(III) Replace every gate by NOR-gate it will give minimum no. of nor gate.

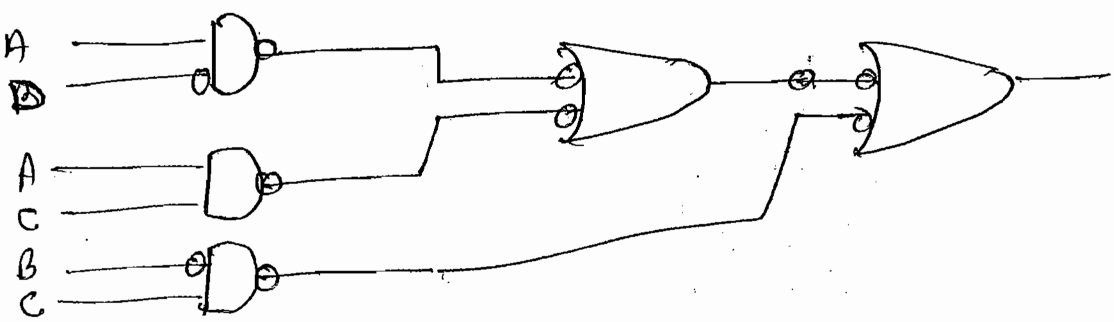
Q. I





= (6) Ans

Q. II



12

F F F F

1111 1111 1111 1111

-ve

0000 0000 0000 0000 1's

+1 2's

1

13

6 0000

36 → 5 0001 → Ans

35 4 0010

35 3 0011

34 2 0100

33 1 0101

32 16 → 0 0110

15 0111

14 1000

13 1001

12 1010

11 1011

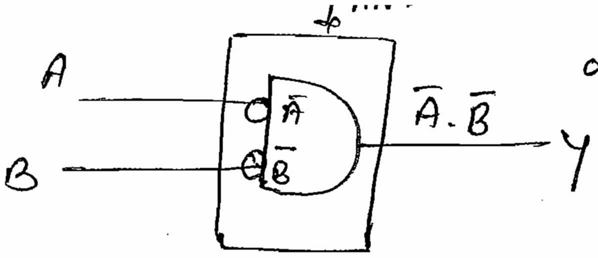
10 1100

9 1101

8 1110

7 1111

(14)



duality -

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

↑

OR

-ve logic

for +ve logic

$$\boxed{Y = \bar{A} + \bar{B}} \leftarrow \text{OR-Gate}$$

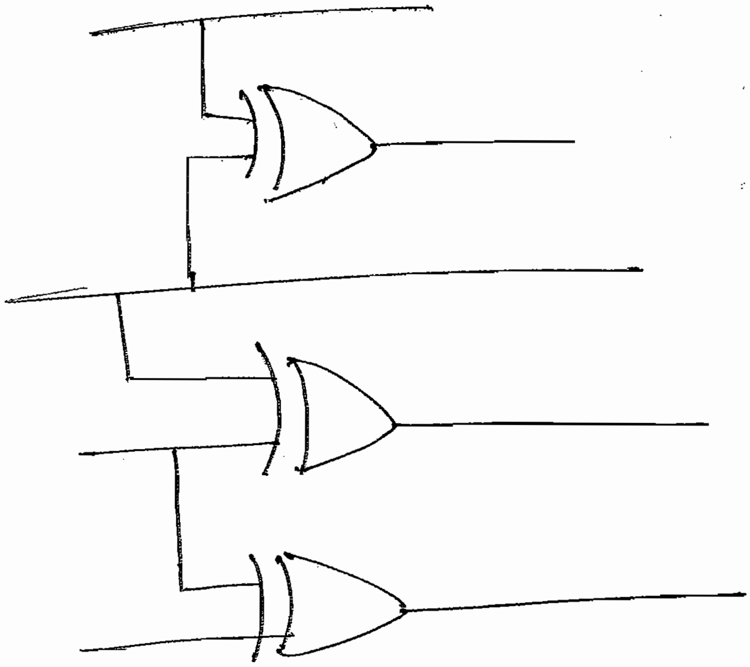
(15)

$$f(A, B, C, D, E) = C + \bar{D}E$$

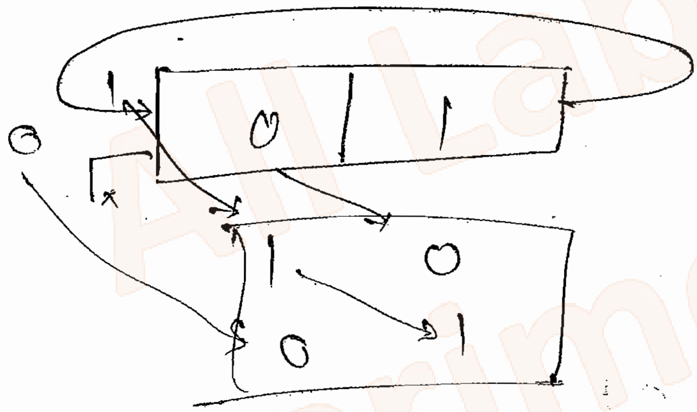
A	B	C	D	E
0	0	0	0	0
	0	0	0	1
	0	0	1	0
	0	0	1	1
	0	1	0	0
	0	1	0	1
	0	1	1	0
	0	1	1	1
	1	0	0	0
	1	0	0	1
	1	0	1	0
	1	0	1	1
	1	1	0	0
	1	1	0	1
	1	1	1	0
	1	1	1	1
0				

= (4).

(18)



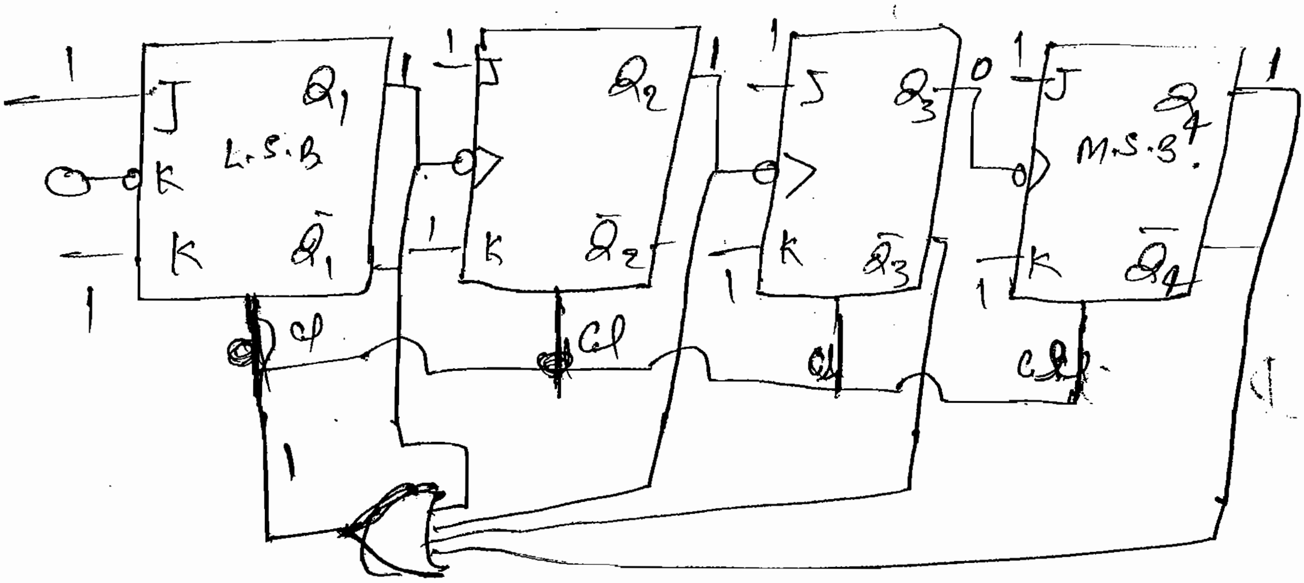
(23)



mod 2 Counter

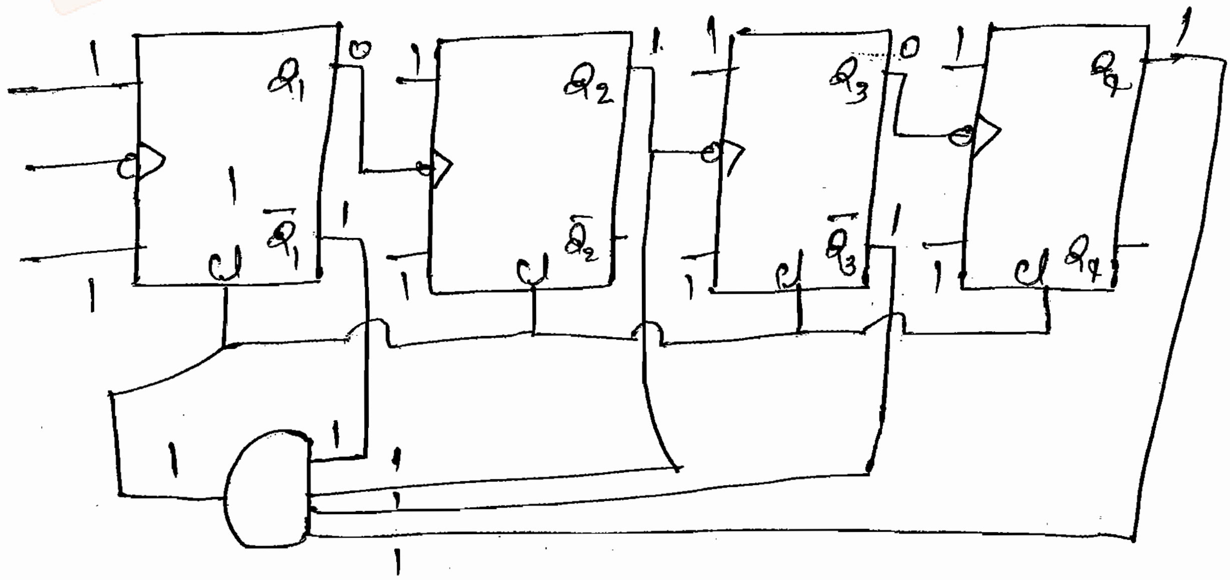
(22)

$4 = 2^4 = 16$



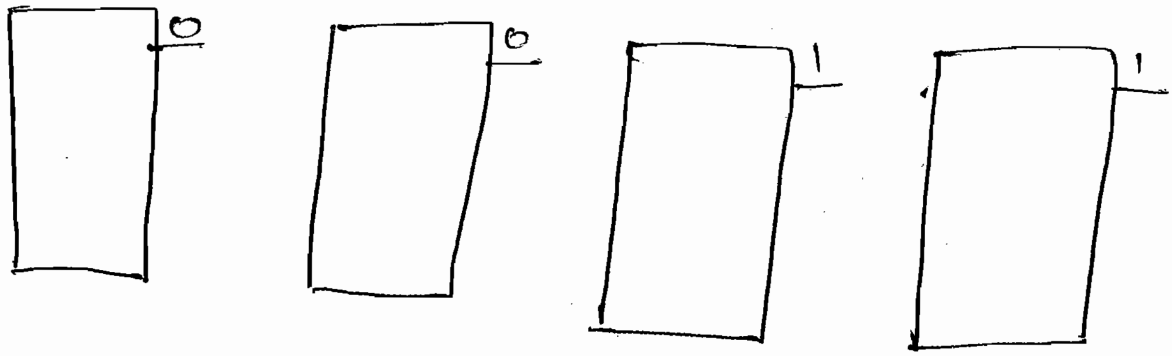
Q_4	Q_3	Q_2	Q_1
0	0	0	0
0	0	0	1
0	0	1	0
0	0	1	1
0	1	0	0
0	1	0	1
0	1	1	0
0	1	1	1
1	0	0	0
1	0	0	1
1	0	1	0
1	0	1	1
1	1	0	0
1	1	0	1
1	1	1	0
1	1	1	1

Q: For the given circuit diagram Identify the ~~gate~~ mod.

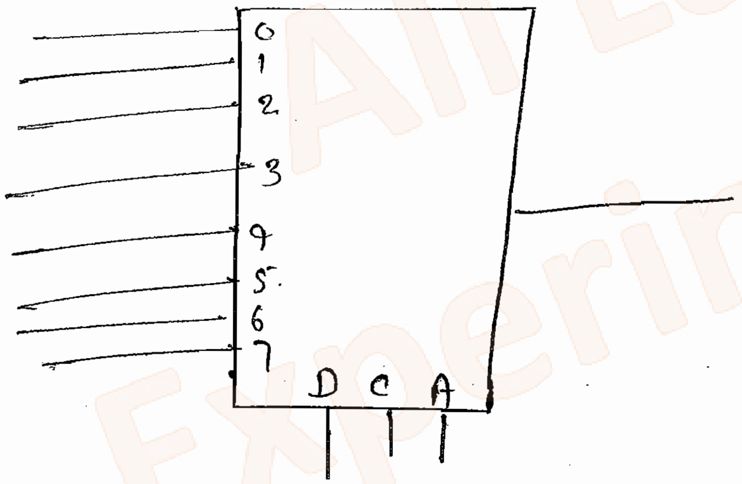


mod 10 –

Q. Draw the circuit diagram for mod - 12 up Counter by using all zero inputs.



Q.16



D	C	A
0	0	0
0	0	1
0	1	0
0	1	1
1	0	0
1	0	1
1	1	0
1	1	1

A	B	C	D	
0	0	0	0	
0	0	0	1	0
0	0	1	0	
0	0	1	1	
0	1	0	0	
0	1	0	1	0
0	1	1	0	
0	1	1	1	
1	0	0	0	
1	0	0	1	
1	0	1	0	$\rightarrow$ 1
1	0	1	1	$\rightarrow$ 1
1	1	0	0	
1	1	0	1	$\rightarrow$ 1
1	1	1	0	$\rightarrow$ 1
1	1	1	1	$\rightarrow$ 1

$$f(A, B, C, D) = AC + ABD + ACD$$

	I_0	I_1	I_2	I_3	I_4	I_5
$\bar{B}$				1	0	0
B				1	0	1
				1	0	B

Ans

(26)

F A

1111   1010

0000   0101   1's

+1   2s

0000 0110

= 6 Ans

(30)

1011   0110

100   1's   No Compliment

+1   2's

− 101   + 6

−5

$6 + (-5) = +1$

So (a) 0001

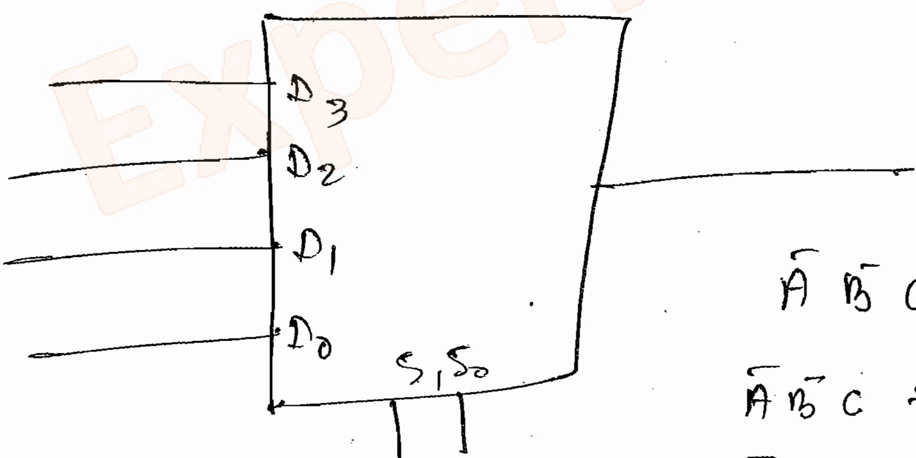
27

$(7E)_H$ & $(5F)_H$

$$
\begin{array}{r}
0111\ 1110 \\
+\ 0101\ 1111 \\
\hline
\underbrace{0010}_{2}\ \underbrace{0001}_{1} \\
\hline
0001\ 0000 \\
\hline
0000\ 0000 \\
0000\ 000X \\
0000\ 00XX \\
0000\ 000X \\
0010\ 0001\ X \\
\hline
001\ 0000\ 1\ 0000 \\
\hline
\end{array}
$$

EXOR

(4)



A	B
0	0
0	1
1	0
1	1

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

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

$\bar{A}[B + \bar{B}C] + A[\bar{B} + B]$

$\bar{A}[B + C] + A$

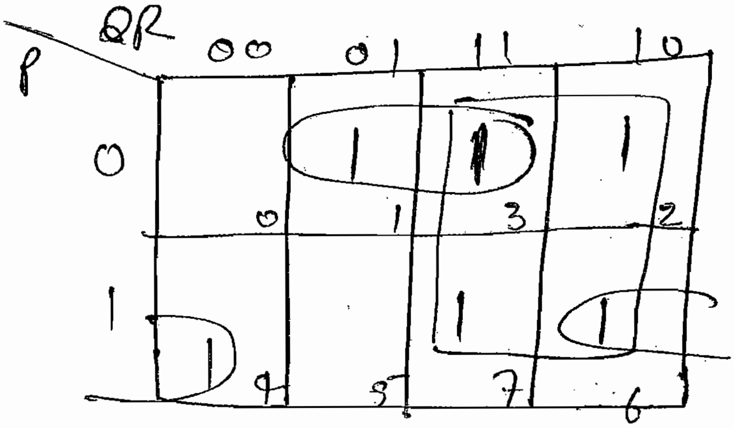
$\bar{A}B + \bar{A}C + A$

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

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

$A + B + C$

Q. 35



$= \bar{P}R + P\bar{R} + Q$

$= P \oplus R + Q$

one exor and 1 OR

(38) 15-bit (d)

(39)

10011

1100 1's

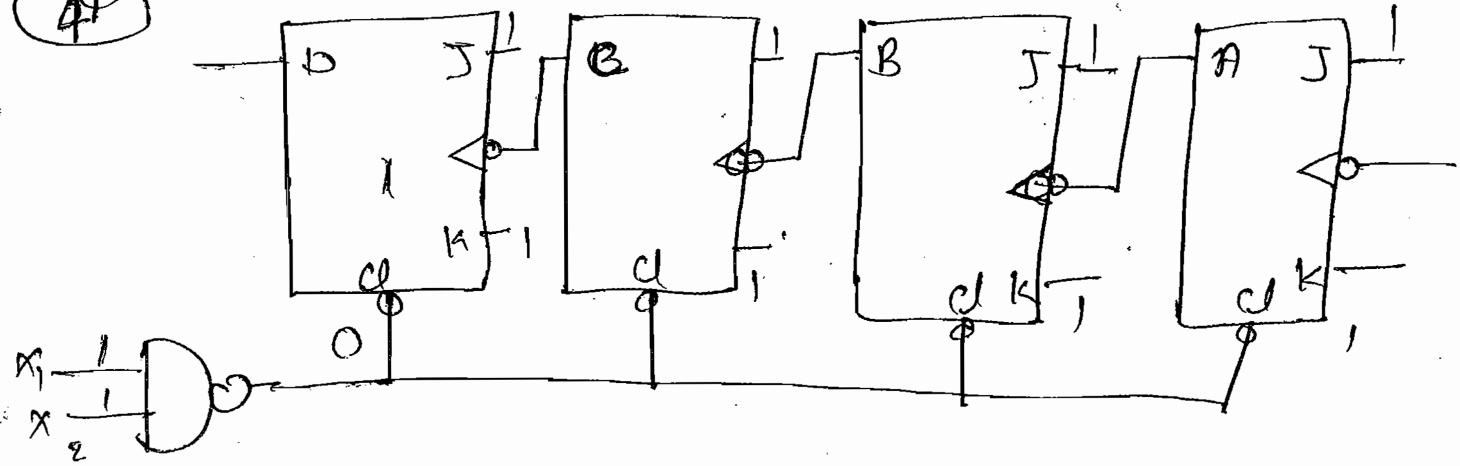
~~11~~ ~~0~~1 2's

$-ve$

1101

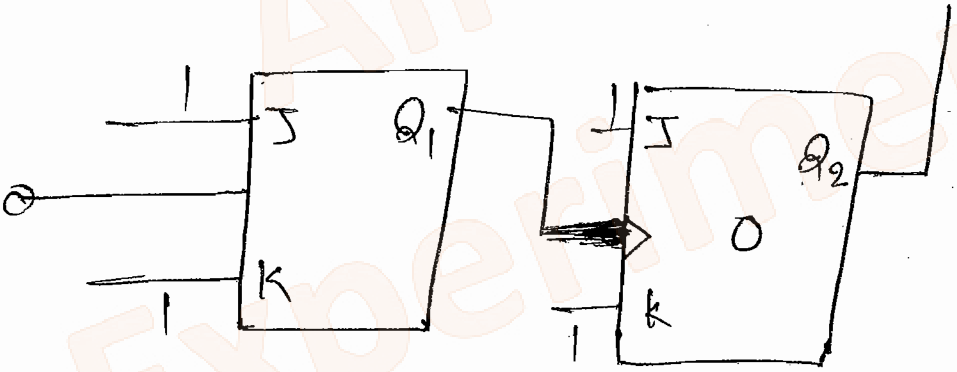
-13 Ans

(40)



DCBA
0000
0001
0010
0011
0100
0101
0110
0111
1000
1001
1010
1011
1100
1101
1110
1111

(46)

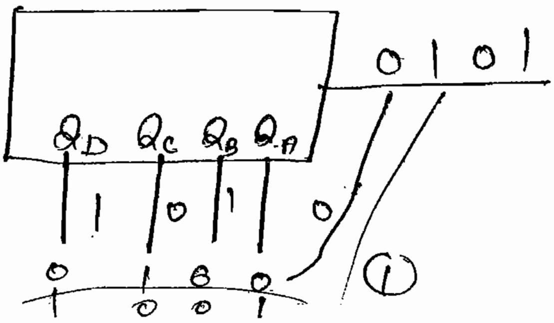


	Q_2 MSB	Q_1 LSB
1	0	0
~~0~~	0	1
3	1	0
2	1	1

4

Ans → 1 1

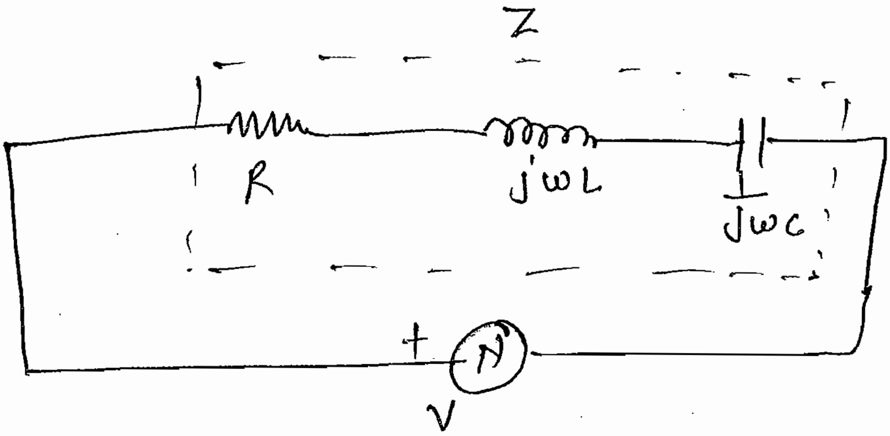
(47)



1001 M

* Resonance :-

Series RLC Network :-



$$Z = R + j\omega L + \frac{1}{j\omega C}$$

$$= R + j\omega L - \frac{1}{\omega C}$$

$$= R + j\left(\omega L - \frac{1}{\omega C}\right)$$

$$|Z| = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$$

At resonance ~~Series~~

$$\omega L = \frac{1}{\omega C}$$

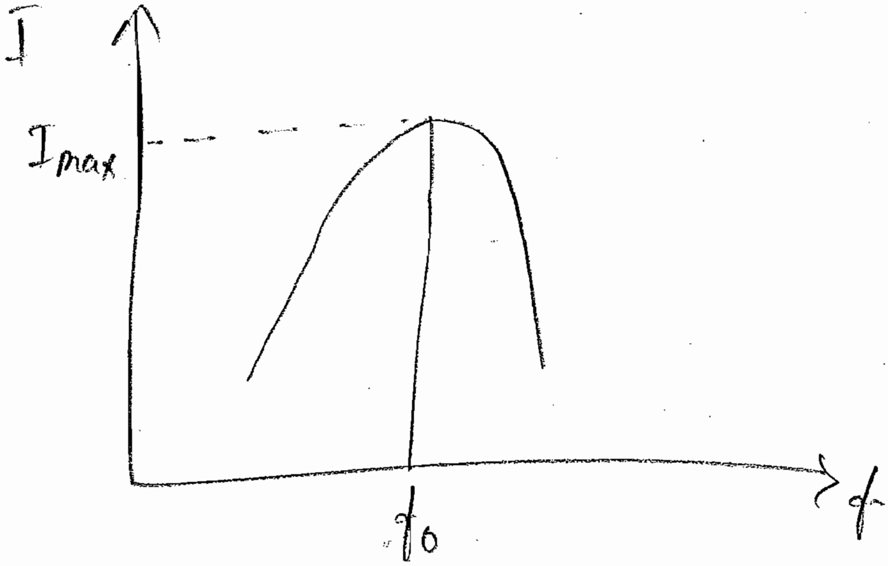
$$Z = \sqrt{R^2}$$

$$\boxed{Z_{min} = R_{min}}$$

$$I = \frac{V}{Z}$$

$$\boxed{I = \frac{V}{R_{min}}} \leftarrow \text{maximum}$$

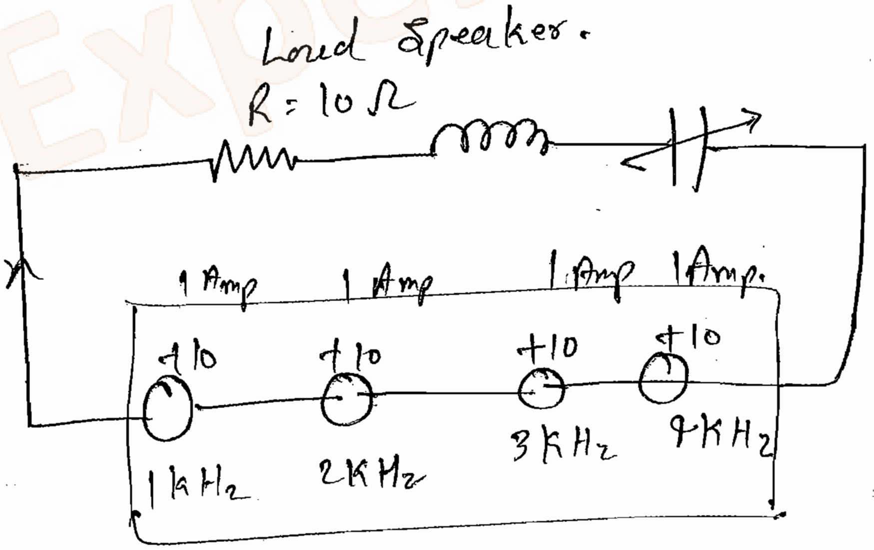
I_{max} at Resonance freq.



$$\boxed{Z = \sqrt{R^2 + \left(\omega_L - \frac{1}{\omega_C}\right)^2}}$$

Use of Resonance :-

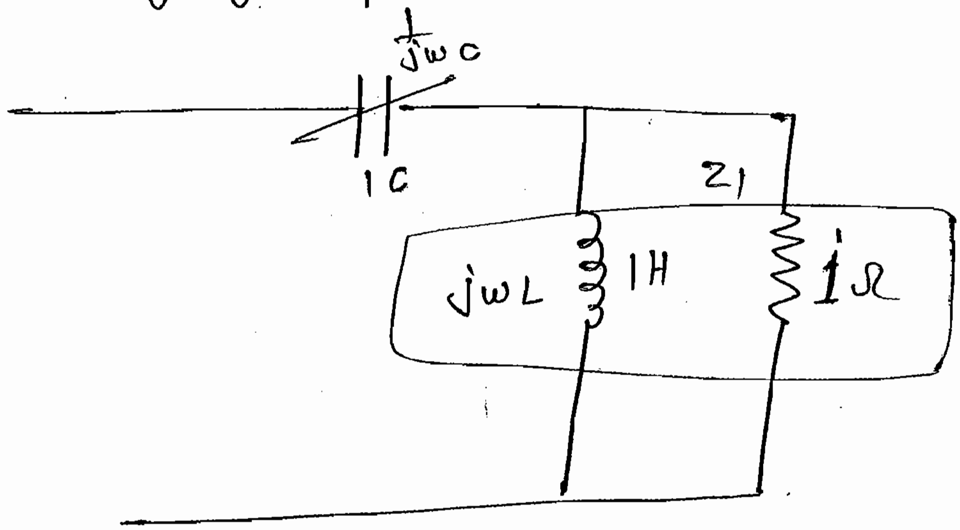
It is used to select only a single frequency by neglecting all other frequencies.



To calculate the resonance freq. of any circuit equate imaginary Component of expression to zero.

Q. For the given circuit diagram determine the resonance frequency.

Soln



$$Z_1 = \frac{1 \times j\omega}{1+j\omega}$$

So $$Z = Z_1 + \frac{1}{j\omega c}$$

$$= \frac{j\omega}{1+j\omega} + \frac{1}{j\omega} = \frac{(j\omega)^2 + 1 + j\omega}{j\omega(1+j\omega)}$$

$$= \frac{1 + j\omega - \omega^2}{j\omega(1+j\omega)}$$

$$= \frac{-j(1-\omega^2) + j\omega}{\omega(1+j\omega)}$$

$$= \frac{-j(1-\omega^2) + j\omega}{\omega(1+j\omega)} \frac{(1-j\omega)}{(1-j\omega)}$$

$$= \frac{-j\left[(1-\omega^2) + j\omega - j\omega(1-\omega^2) + \omega^2\right]}{\omega(1+\omega^2)}$$

$$= \frac{-j(1-\omega^2) + \omega - \omega(1-\omega^2) - j\omega^2}{\omega(1+\omega^2)}$$

$$= \frac{\omega - \omega(1-\omega^2) - j[1 \cancel{-\omega^2} \cancel{+\omega^2}]}{\omega(1+\omega^2)}$$

$$= \frac{\omega - \omega(1-\omega^2) - j}{\omega(1+\omega^2)}$$

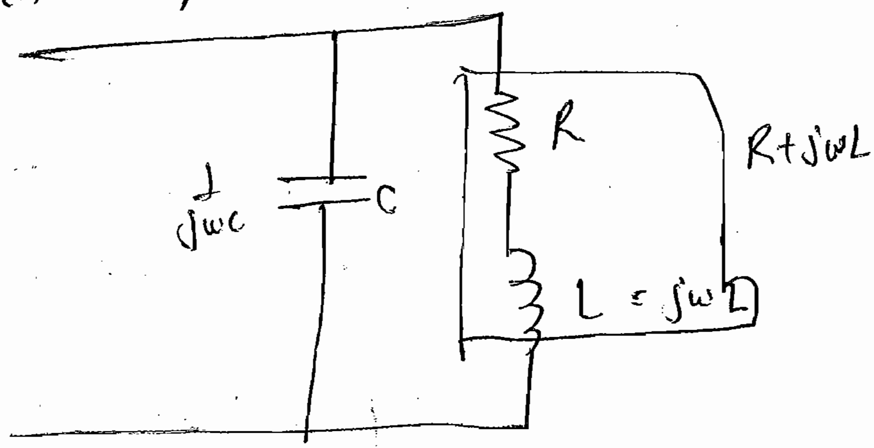
$$= \frac{\omega - \omega(1-\omega^2)}{\omega(1+\omega^2)} - j\frac{1}{\omega(1+\omega^2)}$$

So $\frac{-1}{\omega(1+\omega^2)} = 0$

$-1 \neq 0$ not possible

So Resonant freq. does not exist.

Q. For the given circuit diagram calculate given frequency. (Resonance).



for simplicity

Conductance (Y) $= j\omega C + \frac{1}{R+j\omega L}$

$$= \frac{\{j\omega C[R+j\omega L] + 1\}(R-j\omega L)}{(R+j\omega L)(R-j\omega L)}$$

$$= \frac{[j\omega C[R+j\omega L]+1][R-j\omega L]}{R^2+\omega^2L^2}$$

$$= \frac{j\omega RC[R+j\omega] + R + \omega^2LC(1+j\omega L) - j\omega}{(R^2+\omega^2L^2)}$$

$$= \frac{j\omega R^2C - \omega^2RC + R + \omega^2RLC + j\omega^2L^2C - j\omega}{R^2+(\omega L)^2}$$

equating imaginary part to zero.

$$\frac{j[\omega R^2C + \omega^2L^2C - \omega L]}{R^2+(\omega L)^2} = 0$$

$$\frac{R^2C + \omega^2L^2C - L}{R^2+(\omega L)^2} = 0$$

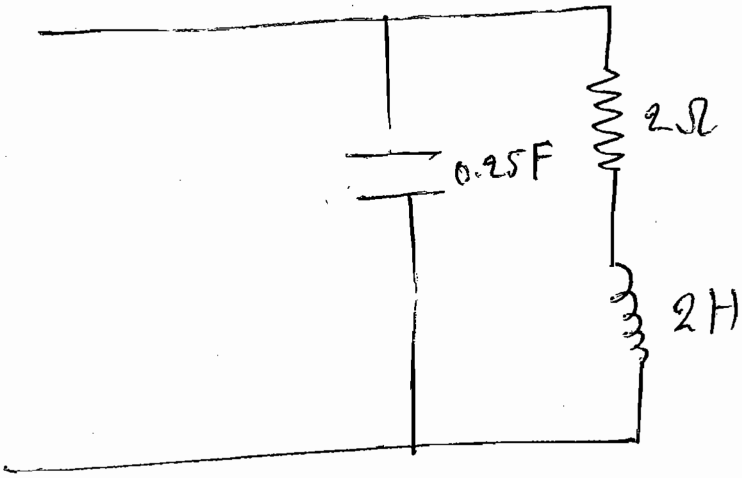
$$R^2C + \omega^2L^2C - L = 0$$

$$\omega^2L^2C = L - R^2C$$

$$\omega^2 = \frac{\cancel{L}}{\cancel{L}^2C} - \frac{R^2\cancel{C}}{L^2\cancel{C}}$$

$$\boxed{\omega = \sqrt{\frac{1}{LC} - \frac{R^2}{L^2}}}$$ Ans

Q. Calculate the resonance freq.



(a) 1.41
(b) 1
(c) 2
(d) 1.73

Soln

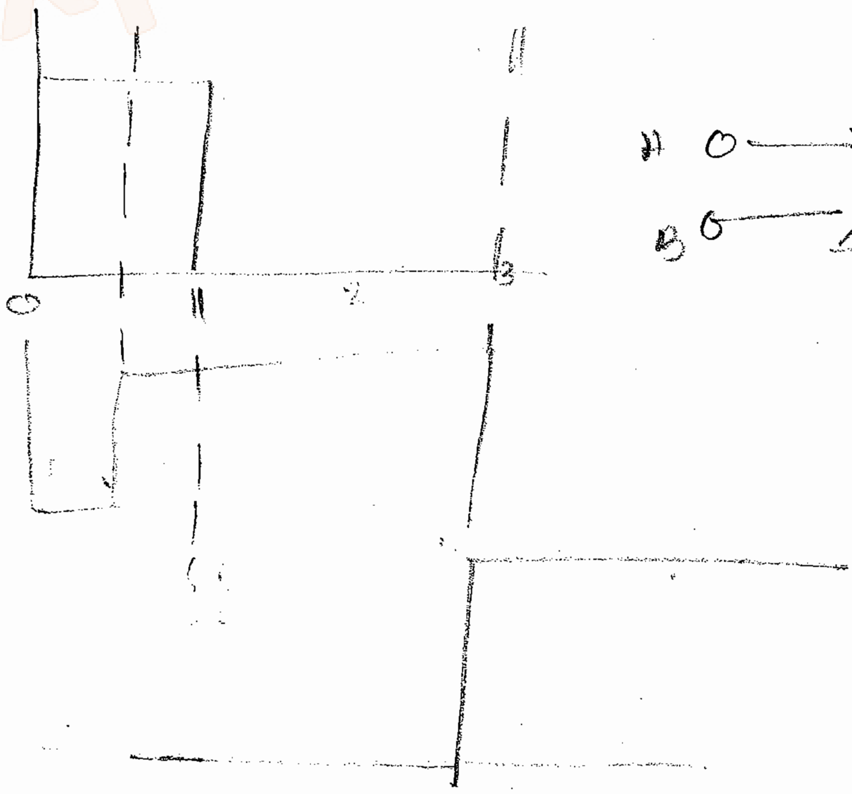
Normal $\omega = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{2\times 0.25}} = 1.41$

But it is not right

$$\omega = \sqrt{\frac{1}{LC} - \frac{R^2}{c^2}} = 1$$

Digital

68

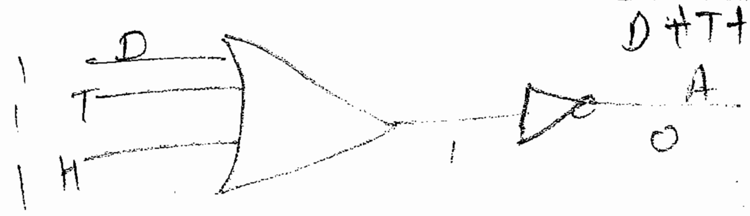


91?

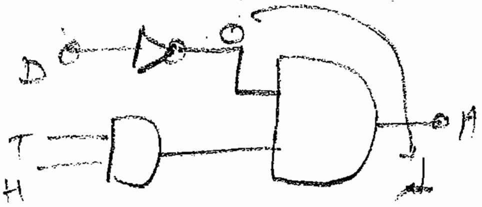
Q1

(a)

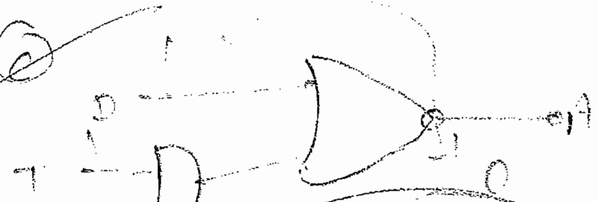
D+T+H



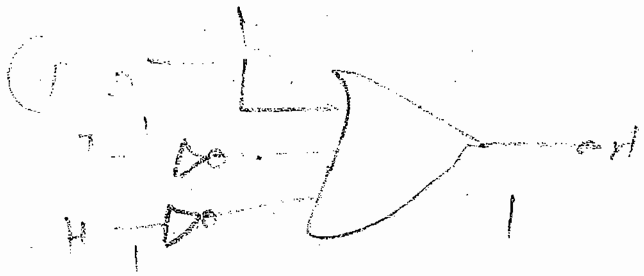
(b)



(c)



D+T.H



T → 1 , < a

A = 0

H → 7 , < a

D → 1 ← on the dear

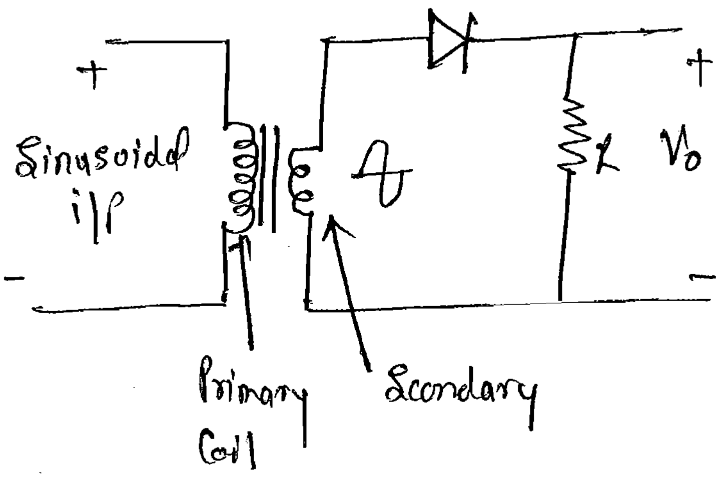
D or T and humidity

1 1 1 → A = 0

D + T.H

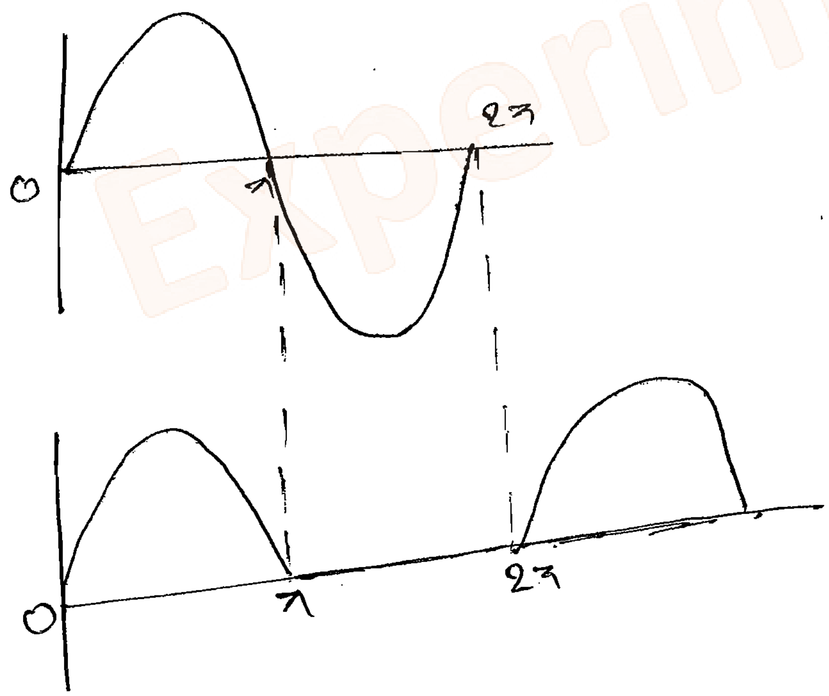
Q2 (a)

* Half - Wave Rectifier :-



Step-up- transformer increases the amplitude of applied i/p and reproduces at secondary of the transformer.

If the applied i/p whose amplitude is decrease, it called as step down transformer



* D.C. Value or Average value :-

$$= \frac{1}{2\pi} \int_0^{2\pi} f(x)\, dx$$

$$= \frac{1}{2\pi} \int_0^{2\pi} V_m \sin\theta\, d\theta.$$