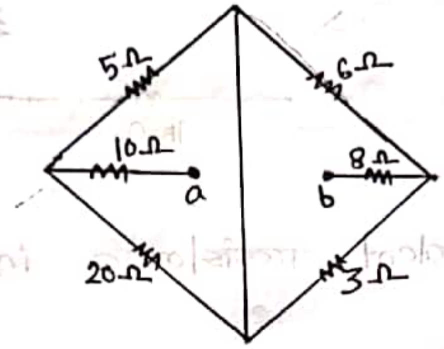
Name: Omor Faruk

Roll: 2019831055

Ans: to the que: NO -1



5Ω and 20Ω are in parallel and equivalent resistance,

$$R_1 = \left(\frac{1}{5} + \frac{1}{20}\right)^{-1} = 4\,\Omega$$

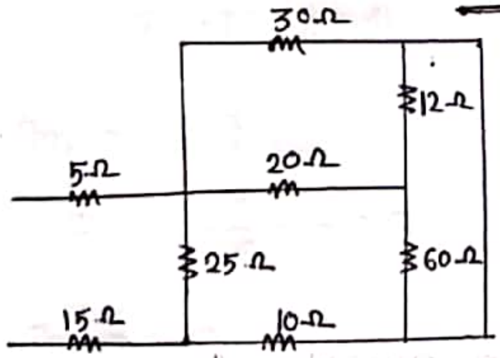
6Ω and 3Ω are in parallel and equavalent resistance,

$$R_2 = \left(\frac{1}{6} + \frac{1}{3}\right)^{-1} = 2\,\Omega$$

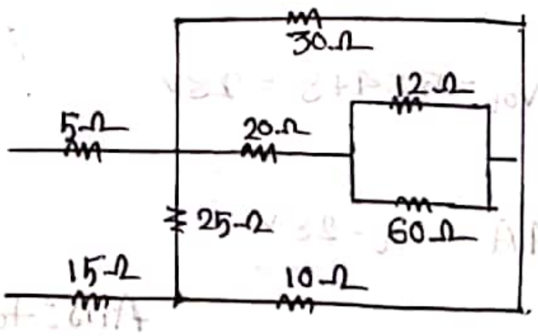
So, total resistance is,

$$R_T = 10 + R_1 + R_2 + 8 = (10+4+3+8)\,\Omega = 24\,\Omega$$

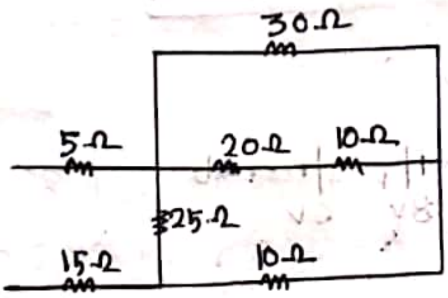
Ans: to the que: NO - 2



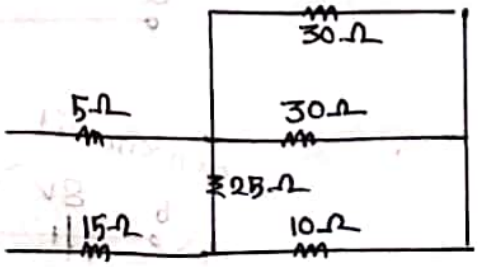
⇒

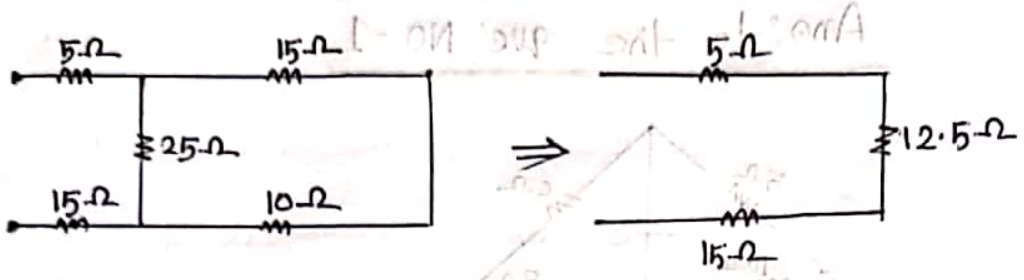


⇒



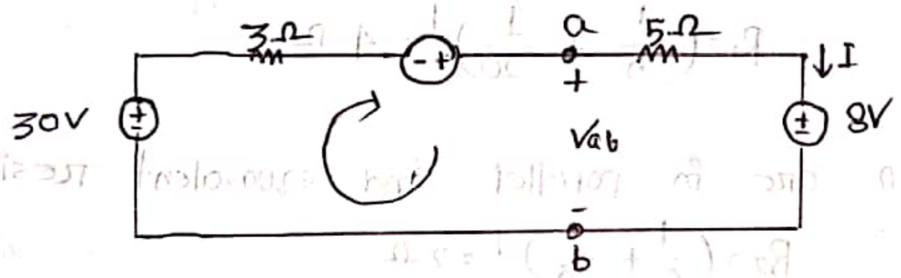
⇒





So, the total equivalent resistance is 32.5 Ω

Ans: to the que: NO-3



Applying KVL,

$-30 + 3I - 10 + 5I + 8 = 0$

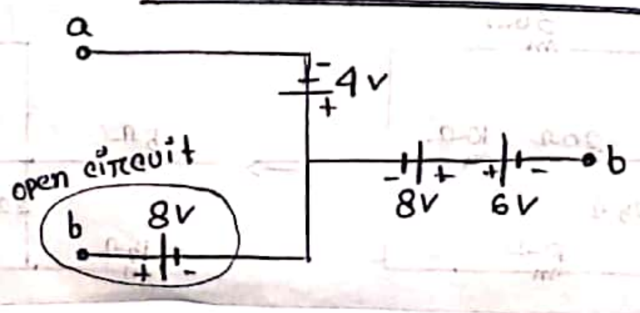
$\Rightarrow 8I - 32 = 0$

$\Rightarrow I = 4\,A$

So, $V_{ab} = 5 \times 4 + 8 = 28V$

$\therefore I = 4A,\ V_{ab} = 28V$

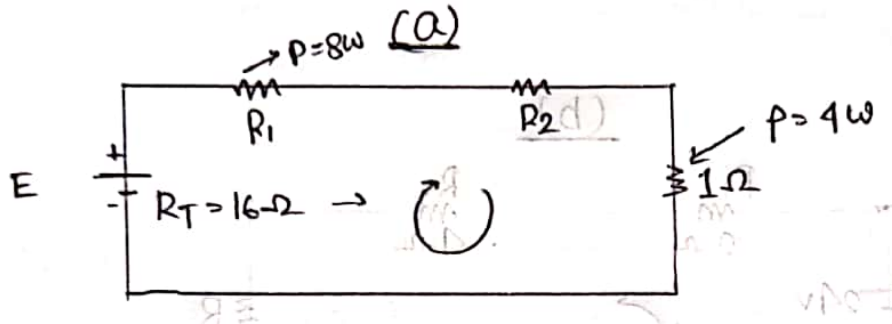
Ans: to the que: NO-4



so,
$V_{ab} = (-4-8+6)V = -6V$

Ans: to the que: NO - 5

(a)



Here,

$R_T = R_1 + R_2 + 1 \Rightarrow R_1 + R_2 = 16 - 1 \Rightarrow R_1 + R_2 = 15 \ldots (i)$

Applying KVL in the loop

$IR_1 + IR_2 + I - E = 0 \Rightarrow IR_1 + IR_2 + I = E \ldots (ii)$

and,

$P_1 = VI = I^2 R_1 = 8 \ldots (iii)$

also,

$P_2 = I^2 \times 1 = 4 \Rightarrow I = 2$

From (iii)

$R_1 = \frac{8}{4} = 2\Omega$

From (i),

$2 + R_2 = 15 \Rightarrow R_2 = 13\Omega$

From, (ii)

$IR_1 + IR_2 + 2 = E$

$\Rightarrow 2 \times 2 + 2 \times 13 + 2 = E$

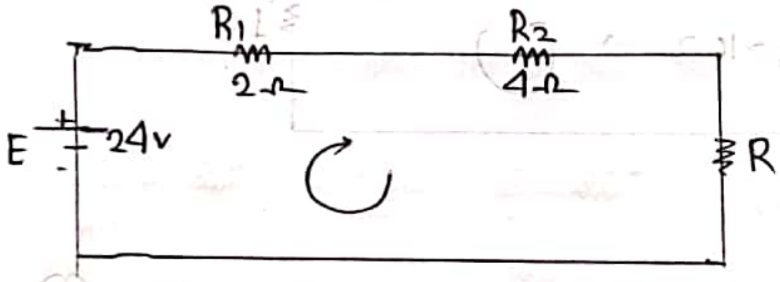
$E = 32V$

So, the unknown quantities are.

$I = 2A$ $\quad$ $R_2 = 13\Omega$

$R_1 = 2\Omega$ $\quad$ $E = 32V$

(b)



Applying KVL in the loop,

$IR_1 + IR_2 + IR = E$

$2I + 4I + IR = 24$

$\Rightarrow IR + 6I = 24 \cdots (i)$

and,

$P = I^2R \Rightarrow R = \frac{24}{I^2} \cdots (ii)$

From (i) and (ii)

$I \times \frac{24}{I^2} + 6I = 24$

$\Rightarrow \frac{24}{I} + 6I = 24 \Rightarrow 6I^2 + 24 = 24I$

$\Rightarrow 6I^2 - 24I + 24 = 0 \Rightarrow 6I^2 - 12I - 12I + 24 = 0$

$\Rightarrow 6I(I-2) - 12(I-2) = 0 \Rightarrow (I-2)(6I-12) = 0$

$\therefore I = 2$

From (ii)

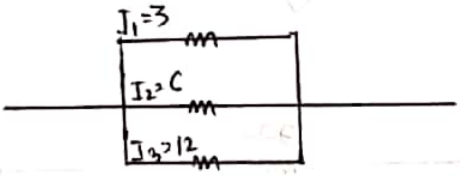
$2^2 \times R = 24$, $R = 6$

So, the unknown quantities are,

$I = 2A$, $R = 6\Omega$

Ans: to the que: NO-6

let, draw a parallel circuit -



we know,

the relation between current (I) and resistance (R) in.

$I \propto \frac{1}{R}$ [$\because$ V is const. in parallel circuit]

So,

$I_1 : I_2 : I_3 = \frac{1}{R_1} : \frac{1}{R_2} : \frac{1}{R_3}$

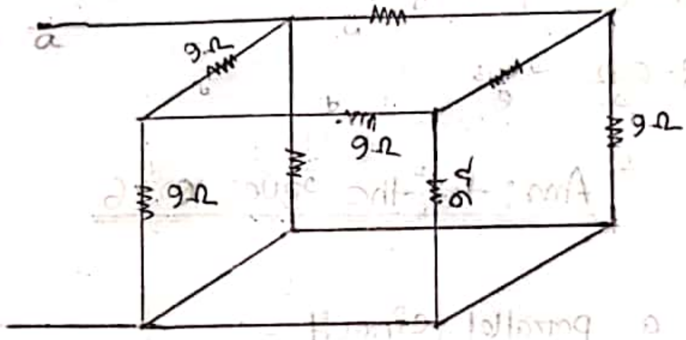
$\Rightarrow R_1 : R_2 : R_3 = \frac{1}{I_1} : \frac{1}{I_2} : \frac{1}{I_3}$

$= \frac{1}{3} : \frac{1}{6} : \frac{1}{12}$

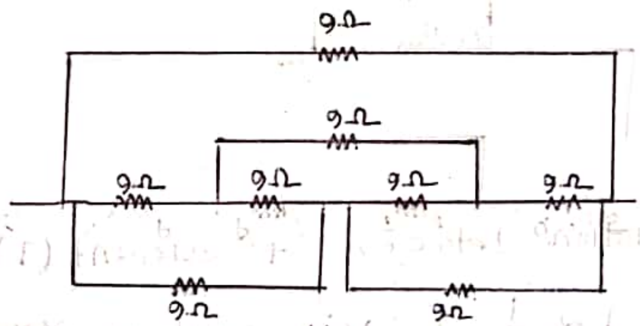
$= 4 : 2 : 1$

So, the ratio of resistance is 4:2:1

Ans: to the que: NO-7



⇓



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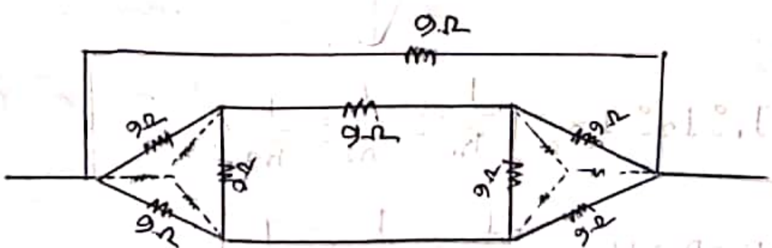
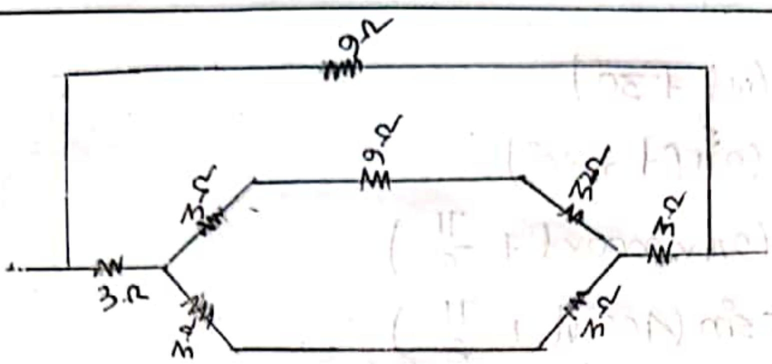


[wye-delta in the loop]

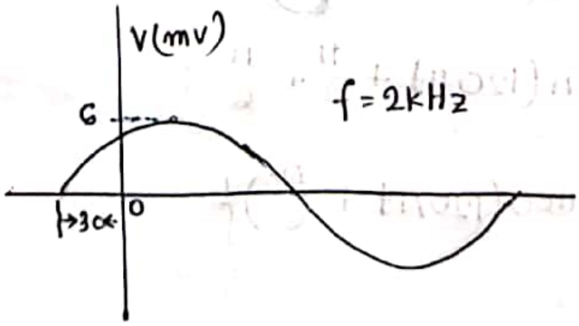


So, the total resistance is $R_T = \left(\frac{1}{6+\left(\frac{1}{15}+\frac{1}{6}\right)^{-1}} + \frac{1}{9}\right)^{-1} \Omega$

$= 4.2\ \Omega$

Ans to the que: NO - 8

(a)



We know that,

$V = V_m \sin(\omega t + \delta)$

$= = V_m \sin(\omega t + 30^\circ)$

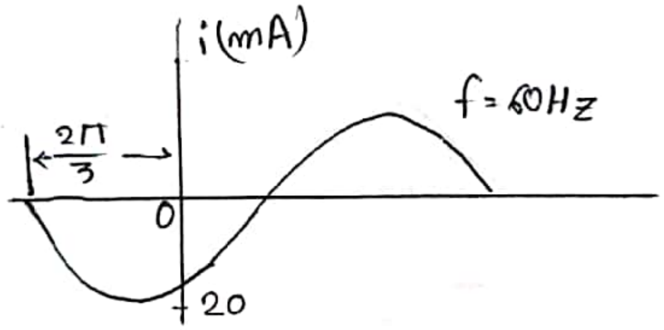
$= V_m \sin(2\pi f t + 30^\circ)$

$= V_m \sin\left(2\pi \times 2000 \times t + \frac{\pi}{6}\right)$

$= \cancel{V_m \sin}\ 6 \sin\left(4000\pi t + \frac{\pi}{6}\right)$

A

(b)



$i = -i_m \sin(\omega t + \delta)$

$= -20 \sin(2\pi f t + \delta)$

$= -20 \sin\left(120\pi t + \frac{2\pi}{3}\right)$

$= -20 \sin\left(120\pi t + \frac{\pi}{2} + \frac{\pi}{6}\right)$

$= \left\{-20 \cos\left(120\pi t + \frac{\pi}{6}\right)\right\}$

A

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Ans: to the que: NO - 9

(a)

given that,

$$V = 2\cos(\omega t - 30^\circ)$$
$$= 2\sin(90^\circ + \omega t - 30^\circ)$$
$$= 2\sin(\omega t + 60^\circ)$$

and, $i = 5\sin(\omega t + 60^\circ)$

So, the phase difference : $(60^\circ - 60^\circ) = 0^\circ$

(b)

Given that,

$$V = -4\cos(\omega t + 90^\circ)$$
$$= -4\sin(90^\circ + \omega t + 90^\circ)$$
$$= -4\sin(\omega t + 180^\circ)$$

and,

$$i = -2\sin(\omega t + 10^\circ)$$

So, the phase difference : $(180^\circ - 10) = 170^\circ$

Ans:- to the que: NO - 10

$$\text{average value} = \frac{|5\times 6| + |10\times 3| + |10\times -3|}{30}$$

$$= \frac{30+30+30}{30} \text{ volt}$$

$$= 3 \text{ volt}$$

$$Rms = \sqrt{\frac{5\times 6^2 + 10\times 3^2 + 10\times(-3)^2}{30}}$$

$$= \sqrt{\frac{180+90+90}{30}}$$

$$= 3.464$$

Ans:- to the que: NO - 9

(a)

given that,

$$V = 100\sin(\omega t + 40^\circ)$$

and, $i = 20\sin(\omega t + 70^\circ)$

Phase difference, $= 70^\circ - 40^\circ = 30^\circ$

Power, $P = E_{rms} \cdot I_{rms} \cdot \cos\phi$

$$= (100\times 0.707)\times(20\times 0.707)\cdot \cos 30^\circ$$

$$= 865.763 \text{ watt} \quad (\text{leading})$$

(b)

given that,

$v = 150 \sin(\omega t - 70^\circ)$

and $i = 3\sin(\omega t - 50^\circ)$

Phase difference, $\phi = -50 - (-70^\circ)$
$= 20^\circ$

power, $P = E_{rms} \cdot I_{rms} \cdot \cos\phi$
$= (150 \times 0.707) \times (3 \times 0.707) \cdot \cos 20^\circ$
$= 211.36$ watt (leading)

Ans: to the que: NO-10

Given that,

$F(w, x, y, z) = \sum(1, 3, 7, 11, 15)$

w	x	y	z	F
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0

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w	x	y	z	F
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

$$F = \bar{w}x\bar{y}z + \bar{w}x\bar{y}z + \bar{w}xyz + w\bar{x}yz + wxyz$$

Using k-map:

	$\bar{w}\bar{x}$	$\bar{w}x$	wx	$w\bar{x}$
$\bar{y}\bar{z}$	X	1	1	X
$\bar{y}z$		X	1	
yz			1	
$y\bar{z}$			1	

$\because$ F has don't care condition $d(w,x,y,z) = \Sigma(0,2,5)$

$$F = x\bar{y} + wx$$

Ans to the que: NO-11

let us consider the two binary numbers A and B are expanded in term of bits in desending order as,

$$A = A_4 A_3 A_2 A_1$$
$$B = B_4 B_3 B_2 B_1$$

Where each subscripted letters represents one of the digits in the numbers. It is observed from the bit contents of the two numbers ~~as~~ that A=B when -

$$A_4 = B_4, \; A_3 = B_3, \; A_2 = B_2, \; A_1 = B_1$$

A_i	B_i	X_i
0	0	1
0	1	0
1	0	0
1	1	1

So, the equility relation of each pair can be expressed logically by the equivalente function as,

$$X_i = A_i B_i + \bar{A}_i \bar{B}_i$$

$$X_i = (\overline{A_i \oplus B_i}) \text{ for } i = 1,2,3,4$$

To determine the relative magnitude of two numbers A and

B, the relative magnitudes of pairs of significant bits are inspected from the most significant position. If the two digits of the most significant position are equal, the next significant pair of digits are compared. The comparison process is continued until a pair of unequal digits is found. It may be concluded that A>B, if the corresponding digit of A is 1 and B is 0.

Therefore we can derive the logical expression of the function F(A>B) as

$$F(A>B) = A_4\bar{B_4} + X_4A_3\bar{B_3} + X_4X_3A_2\bar{B_2} + X_4X_3X_2A_1\bar{B_1}$$

For A>B

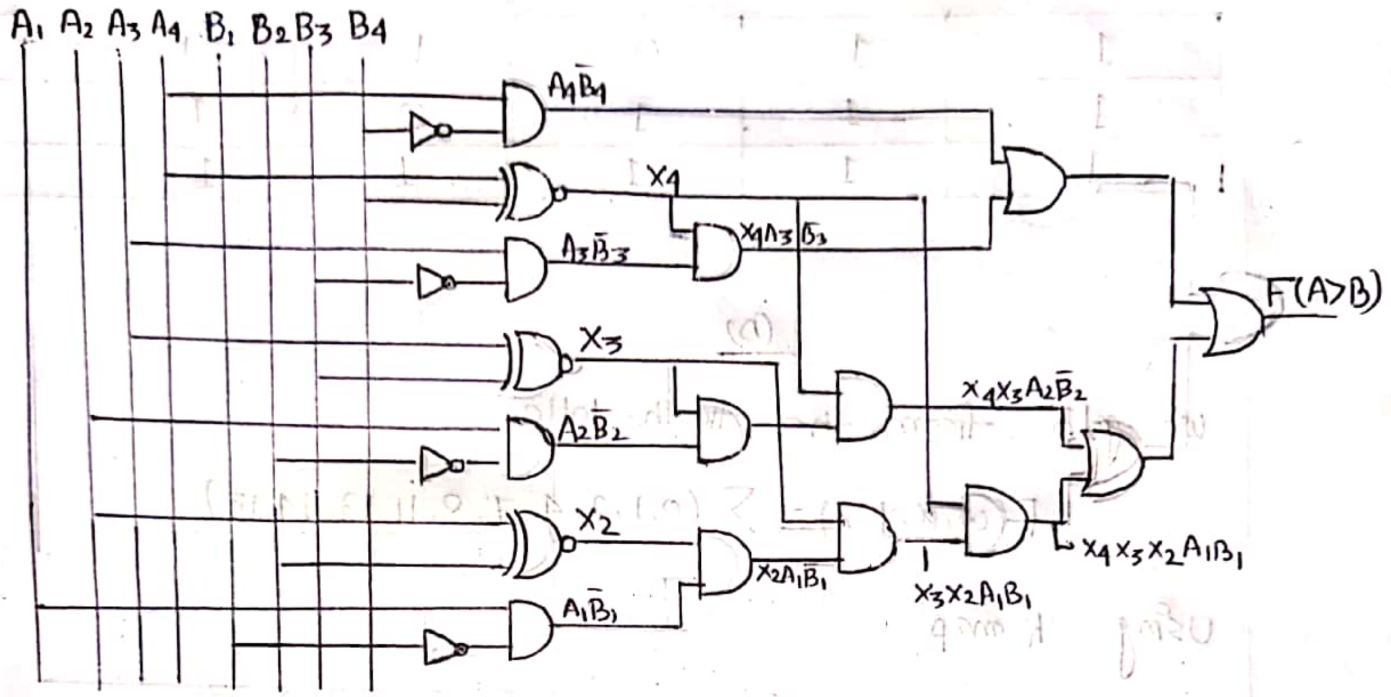
1) $A_4 > B_4$

2) $A_4 = B_4$ & $A_3 > B_3$

3) $A_3 = B_3$, $A_4 = B_4$ & $A_2 > B_2$

4) $A_2 = B_2$, $A_3 = B_3$, $A_4 = B_4$ & $A_1 > B_1$

The logic circuit that will turn on a LED only if 4 bit binary numbers B is less than a 4 bit binary number A is shown here:



Ans: to the que: NO - 12

(a)

	X	Y	Z	output
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0

1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

(b)

we gets from the truth-table

$$F(w,x,y,z) = \sum(0,1,2,4,7,8,11,13,14,15)$$

Using k-map:

	$\bar{y}\bar{z}$	$\bar{y}z$	yz	$y\bar{z}$
$\bar{w}\bar{x}$	1	1	0	1
$\bar{w}x$	1	0	1	0
wx	0	1	1	1
$w\bar{x}$	1	0	1	0

$$\therefore F = \bar{w}\bar{x}\bar{z} + \bar{w}\bar{x}\bar{y} + \bar{w}\bar{y}\bar{z} + \bar{x}\bar{y}\bar{z} + xyz + wxz + wyz + wxy$$

(C)

lets simplify the function using k-map.

	$\bar{y}\bar{z}$	$\bar{y}z$	yz	$y\bar{z}$
$\bar{w}\bar{x}$	1	1	0	1
$\bar{w}x$	1	0	1	0
wx	0	1	1	1
$w\bar{x}$	1	0	1	0

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$F = (w+x+\bar{y}+\bar{z})\cdot(w+\bar{x}+y+\bar{z})\cdot(w+\bar{x}+\bar{y}+z)\cdot(\bar{w}+x+y+\bar{z})\cdot(\bar{w}+x+\bar{y}+z)$

Ans: to the ques: No: 13

(a)

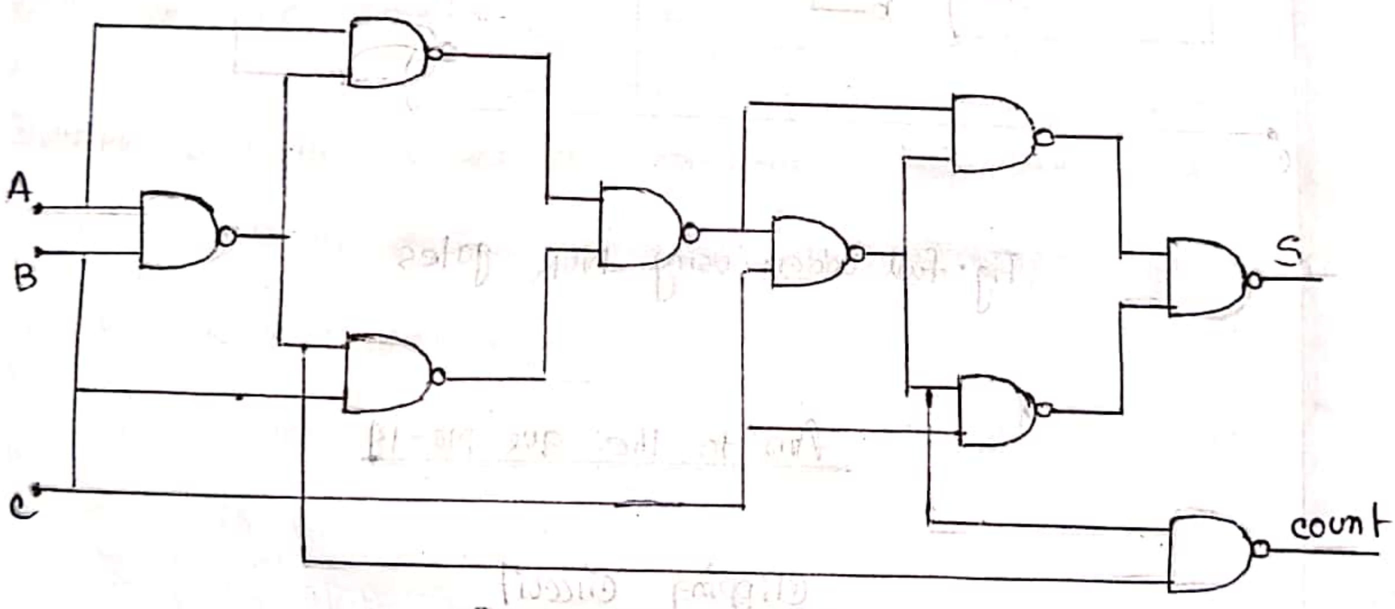


Fig: Full adder using NAND gates.

(b)

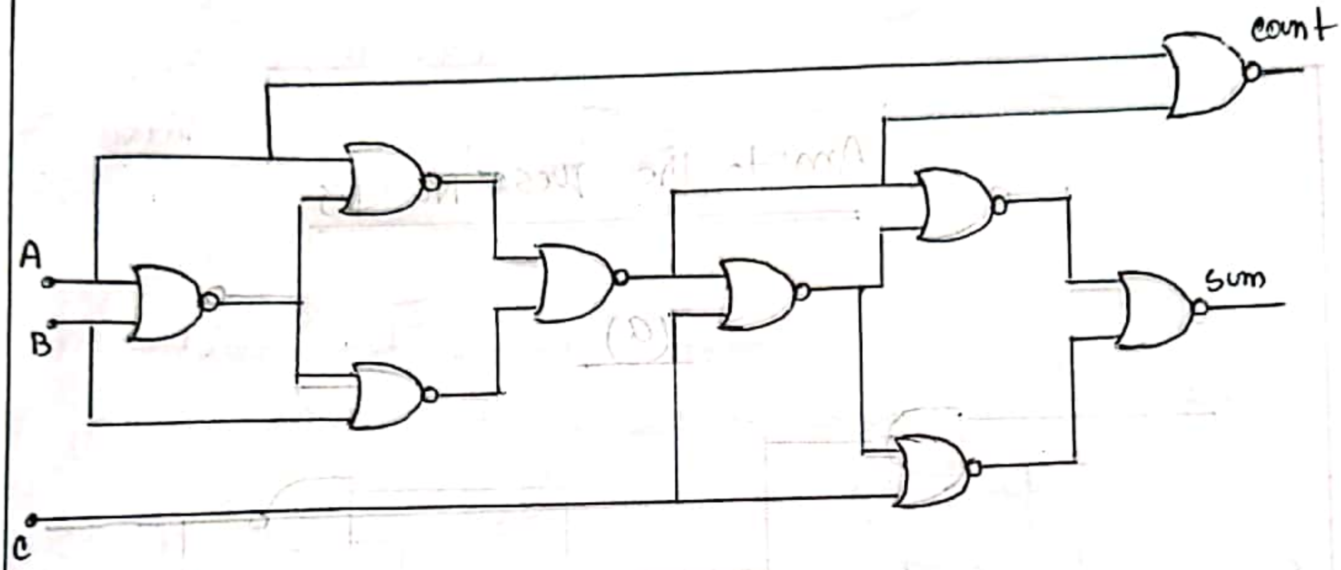


Fig: full adder using NOR gates

Ans: to the que: NO- 14

Clipping circuit

Clipping circuit is a wave-shaping circuit, and is used to either remove or clip a portion of the applied wave in order to control the shape of the output waveform.

One of the most basic clipping circuit is the half-wave rectification circuit. A half wave rectifier clips either the negative half cycle or the positive half cycle of an alternating wave form. and allows to pass only one half cycle.

Clapping circuits are also reffered to as voltage limiters, amplitude sectors or slices.

Clippers are used to eliminated amplitude noise or to fabricate new wave form from an existing signal.

Clipping circuits consist of non-linear and linear devices. The non-linear devices generally used for clipping are diodes and transistors.

According non-linear devices used, clippers may be classified as:

i) Diode clippers

ii) Transistor clippers

According ~~devices used~~, clippers ~~ma~~ classified as,

i) unbiased clippers

ii) Biased clippers

According to level of clipping, the clippers may be.

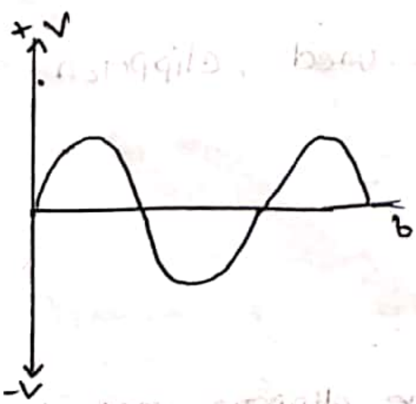
i) positive clippers
ii) Negative clippers
iii) Biased clippers
iv) combination clippers

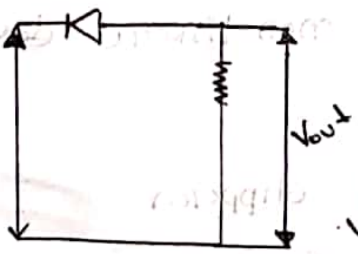
There are two categories of clippers.

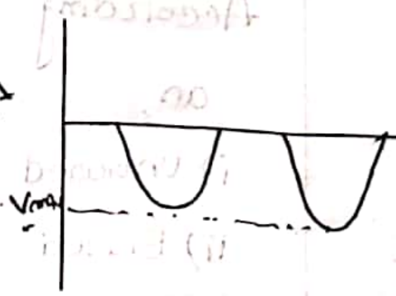
<u>Series and parallel:(or shunt)</u>

The series configuration is defined as one where diode is in series with the load. while the shunt clipper has the diode in a branch parallel to the load.

Depending on the features of the diode, the position or negative region of the input signal is "clipped" off and according the diode clippers may be positive or negative







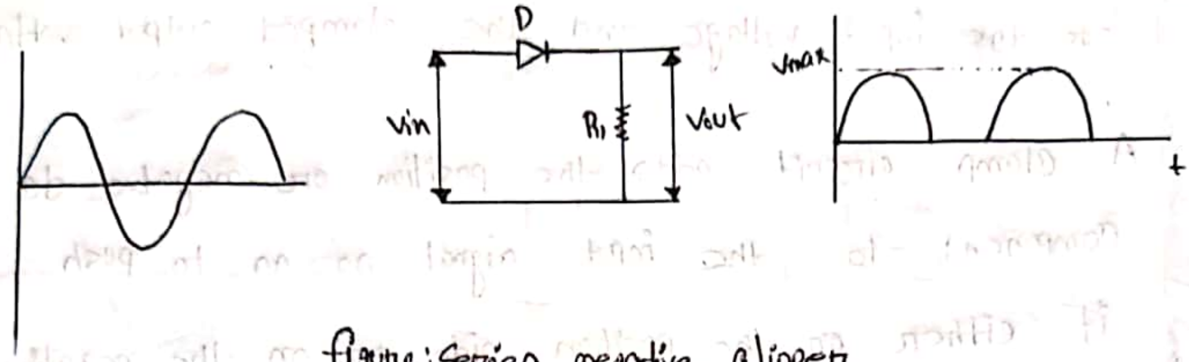


figure: Series negative clipper

Clamping circuit

A clamping circuit is used to place either the positive or negative peak of a signal at a desired level. The dc component is simply added or subtracted to/from the input signal. The clamper is also referred to as an IC restorer and ac signal level shifter.

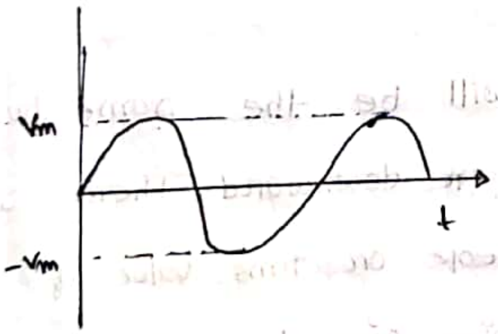
The shape of the waveform will be the same, but its level is shifted either upward or downward. There will be no change in the peak-to-peak or rms value of the wave-form due to the clamping circuit. Thus, the input waveform and output waveform will have the same peak-to-peak value that is $2V_{max}$. It must also be noted that same readings will be obtained in the ac voltmeter for the input voltage and the clamped output voltage.

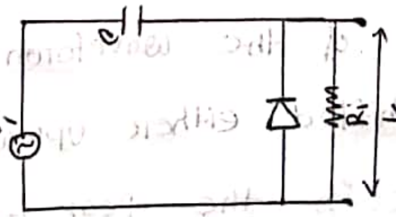
A clamp circuit adds the position or negative dc component to the input signal so as to push it either on the position side, or on the negative side.

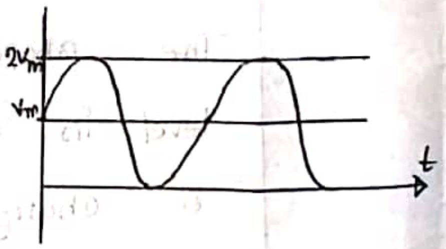
Generally there are two types of circuit.

i) positive clamper:

The circuit will be called Positive clamper, when the signal is pushed upword by the circuit, when the signal moves upword, the negative peak of the signal coincides with the zero level.







ii) Negative clamper:

The circuit will be called a negative clamper, when the signal is pushed downward by the circuit. When the signal is pushed on the negative side, as the positive peak of the input signal ~~can~~ coinciden with the zero level.

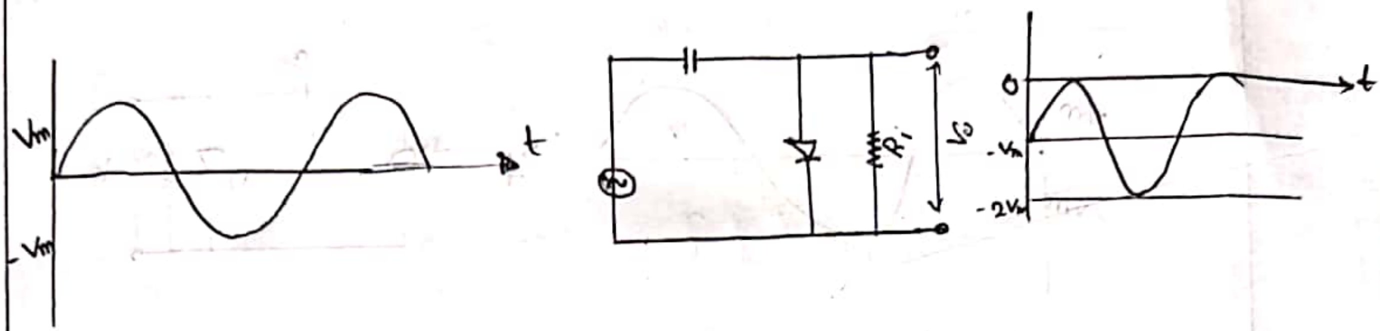


Figure: Negative ~~cha~~ clamper circuit

Part - II

Ans: to the q. No-1

Clipping Circuit

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one of the most basic clipping circuit is the half wave rectification circuit. A half wave ~~rectifier~~ clips

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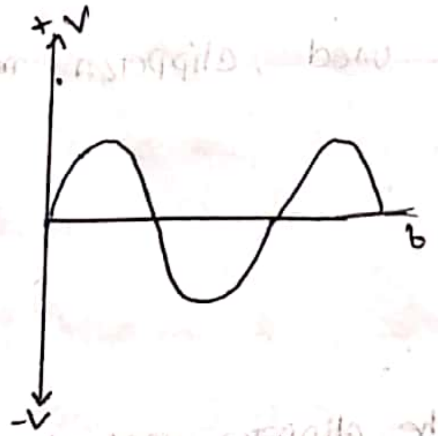

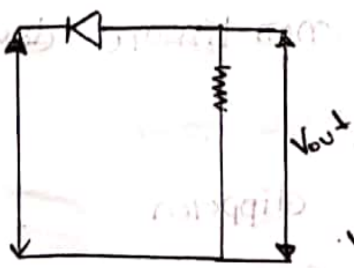

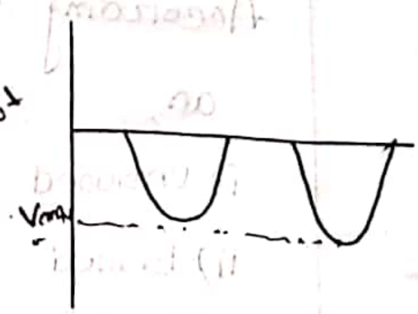

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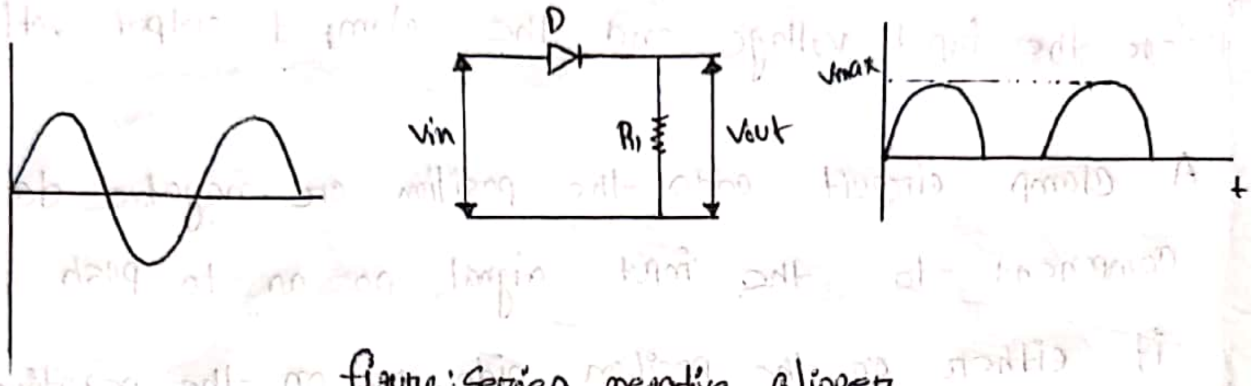


figure: Series negative clipper

Clamping circuit

A clamping circuit is used to place either the positive or negative peak of a signal at a desired level. The dc component is simply added or subtracted to/from the input signal. The clamper is also referred to as an IC restorer and ac signal level shifter.

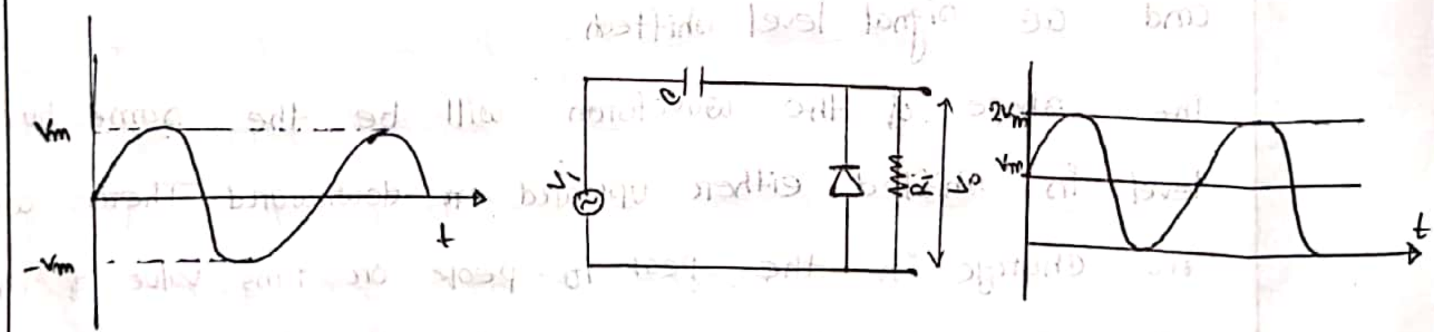
The shape of the waveform will be the same, but its level is shifted either upward or downward. There will be no change in the peak-to-peak or rms value of the wave-form due to the clamping circuit. Thus, the input waveform and output waveform will have the same peak-to-peak value that is $2V_{max}$. It must also be noted that same readings will be obtained in the ac voltmeter for the input voltage and the clamped output voltage.

A clamp circuit adds the position or negative dc component to the input signal so as to push it either on the position side, or on the negative side.

Generally there are two types of circuit.

i) positive clamper:

The circuit will be called positive clamper, when the signal is pushed upword by the circuit, when the signal moves upword, the negative peak of the signal coincides with the zero level.



ii) Negative clamper:

The circuit will be called a negative clamper, when the signal is pushed downward by the circuit. When the signal is pushed on the negative side, as the positive peak

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of the input signal coincides with the zero level.

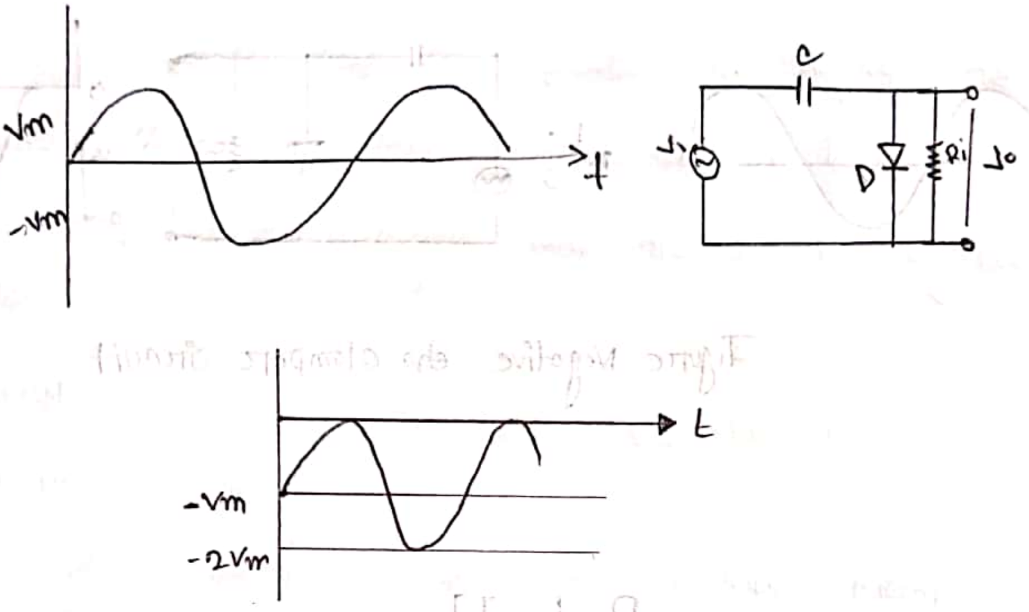


Figure: Negative clamper circuit.

Ans: to the que: NO - 2

We know there is a net transfer of power over a full cycle because power is delivered to the load at each instant of the applied voltage or current (except when either is crossing the axis) no matter what the direction is of the current or polarity of the voltage.

The power delivered at each instant of time –

$P = VI = V_{max} \sin\omega t \cdot I_{max} \sin(\omega t + \phi)$

we know,

$$W = \int_0^T P\,dt$$

$$= \int_0^T \frac{\mathcal{E}_0}{\sqrt{2}} \cdot \frac{I_0}{\sqrt{2}} \cdot 2 \cdot \sin\omega t \cdot \sin(\omega t + \phi)\,dt$$

$$= E_{rms} \cdot I_{rms} \int_0^T \{\cos\phi - \cos(2\omega t + \phi)\}\,dt$$

$$= E_{rms} \cdot I_{rms} \left[t\cos\phi - \frac{\sin(2\omega t + \phi)}{2\omega} \right]_0^T$$

$$= E_{rms} \cdot I_{rms} \cdot \left[T\cos\phi - \sin\left(\frac{\frac{2\pi}{T} \times 2 \times T + \phi}{2\omega}\right) + \sin\frac{\phi}{2\omega} \right]$$

$$W = E_{rms} \cdot I_{rms} \cdot T\cos\phi$$

$$\because P = \frac{W}{T}$$

$$\therefore P = E_{rms} \cdot I_{rms} \cos\phi$$

If the phase difference $\phi = 0°$, then,

$$P = E_{rms} \cdot I_{rms}$$

If resistor R is given,

Then, $I_{rms} = \frac{V_{rms}}{R}$

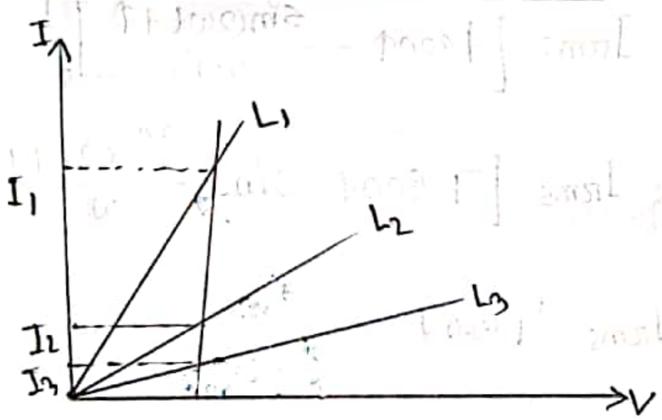
$$P = \frac{V_{rms}^2}{R} = I_{rms}^2 R$$

Here, we see power change with phase difference.

Power factor $= F_p = \cos\theta$

$$\therefore F_p = \cos\theta = \frac{P}{I_{rms} \cdot E_{rms}}.$$

Ans: to the que: No.-3



Let the three lines be L_1, L_2, L_3. We draw straight line parallel to the I-axis. This straight line intersects each of the three lines.

At the intersecting point, voltage for each line are equal.

we know,

$$R \propto \frac{1}{I} \text{ [when } v \text{ is constant]}$$

$$\Rightarrow \frac{1}{I_1} < \frac{1}{I_2} < \frac{1}{I_3}.$$

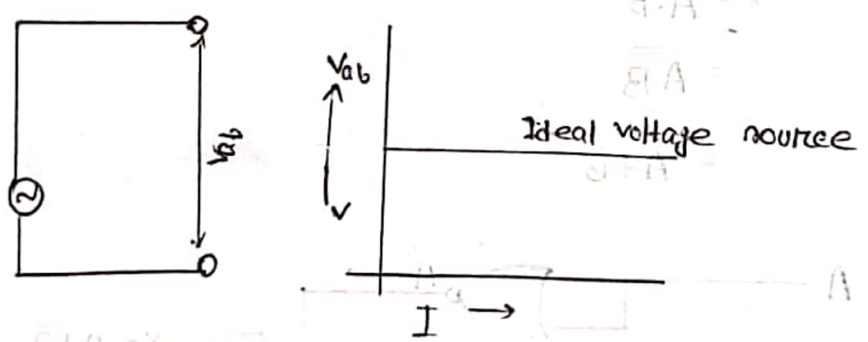
$$\Rightarrow R_1 < R_2 < R_3$$

So, the L_3 indicates the higher resistance.

Ans:-to the que: NO-4

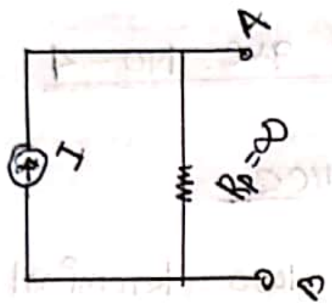
Ideal voltage Source

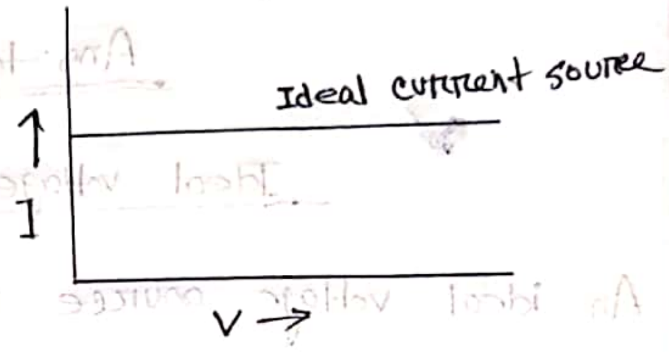
An ideal voltage source is a two-terminal element with the property that the voltage across the terminals is specified at every instant in time. This voltage doesn't depend on the current in any direction could possibly will be determined solely by the circuit elements connected to this source.



Ideal current Source

An ideal current source is a two-terminal circuit element which supplies the same current to any load resistance connected across the terminals. The current supplies by the voltage of source terminals. It has infinite resistance.



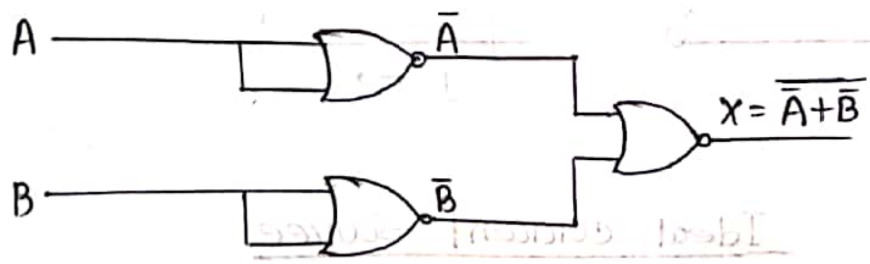


Ans: to the que: No-5

Converting an AND network for two inputs to an all NOR:

Let the two input are A & B, and output X.

$$X = A.B$$
$$= \overline{\overline{A.B}}$$
$$= \overline{\bar{A}+\bar{B}}$$



Converting an OR network for two inputs to an all NOR:

Let the input A, B and output Y.

$Y = A+B = \overline{\overline{A+B}}$