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Time: 90 Minutes **PST-2018: Mock Paper** Maximum Marks: 50

**Read the following instructions carefully**

- (1) This question paper contains MCQ and numerical type questions divided into two sections:
  - (i) Section I – Question number 01 to 10 (10 Questions) will carry one mark each.
  - (ii) Section II – Question number 11 to 30 (20 Questions) will carry two mark each.
- (2) Answer all the questions.
- (3) Question must be answered on special machine gradable Objective Response Sheet (ORS) by darkening the appropriate bubble (marked A, B, C, D) using black ink ball pen against the question number on the ORS. Each question has only one correct answer.
- (4) Wrong answer carries negative marks. For one mark, there is one-third negative mark. For, two mark two-third negative mark. No negative marking for numerical type questions.
- (5) More than one answer bubbled against the question will be deemed as an incorrect response.
- (6) Write your registration number and other details at the specified locations on the ORS.
- (7) Calculator is allowed in the examination hall but the programmable calculator is not permitted.
- (8) Charts, graph sheets or tables are not allowed.
- (9) Choose the closest numerical answer among the choice given.
- (10) Use the blank pages given at the end of the question paper for rough use.
- (11) Cellphones, mobile phones are prohibited in the examination hall.
- (12) This question paper contains 12 printed pages including pages for rough work.
- (13) Please check all pages and report if there is any discrepancy.

**Candidate Name:** \_\_\_\_\_

**Registration Number:** \_\_\_\_\_

**Branch:** **ECE, EE, IN**

**Paper Code: 101**

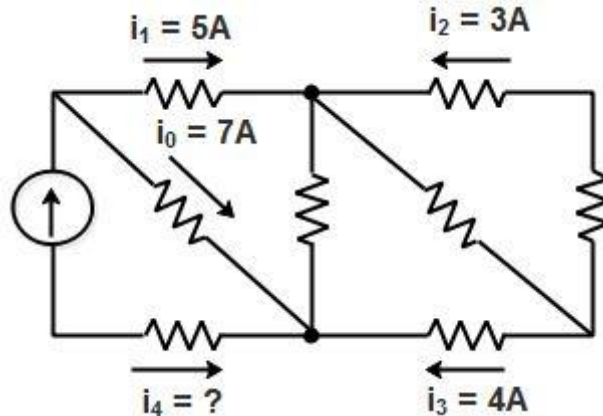
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## SECTION-A

[Q-1] The current  $i_4$  in the circuit of figure is equal to .....(A)

[GATE-1997]

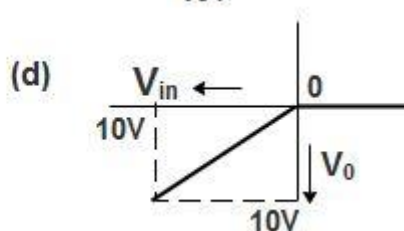
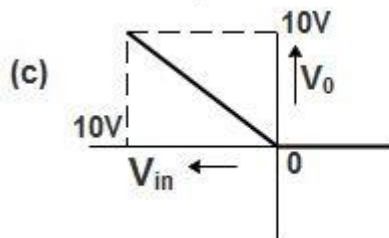
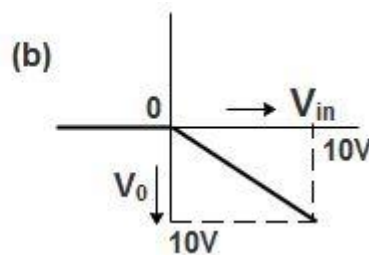
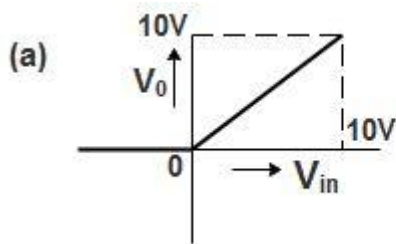
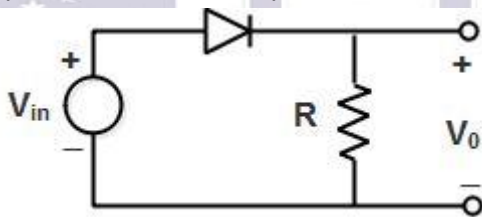


[Q-2] The logical expression  $y = A + \bar{A}B$  is equivalent to.....

[GATE-1999]

- (a)  $y = AB$  (b)  $y = \bar{A}B$  (c)  $y = \bar{A} + B$  (d)  $y = A + B$

[Q-3] Sketch the transfer characteristics, if the input voltage ( $v_{in}$ ) is ranging from  $-10V$  to  $+10V$  (Diode to be ideal)



[Q-4] The order and degree of the differential equation  $\frac{d^3y}{dx^3} + 4\sqrt{\left(\frac{dy}{dx}\right)^3 + y^2} = 0$  are respectively?

- (a) 3 and 2 (b) 2 and 3 (c) 3 and 3 (d) 3 and 1

[GATE-2010]

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[Q-5] Cost of 3 cricket balls = cost of 2 pairs of leg pads.

Cost of 3 pairs of leg pads = cost of 2 pairs of gloves.

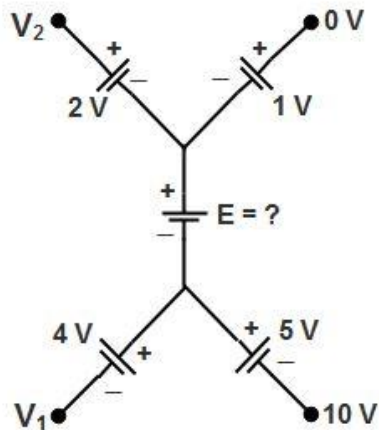
Cost of 3 pairs of gloves = cost of 2 cricket bats.

If a cricket bat costs Rs. 54, what is the cost of a cricket ball?

(a) Rs. 12 (b) Rs. 14 (c) Rs. 16 (d) Rs. 18

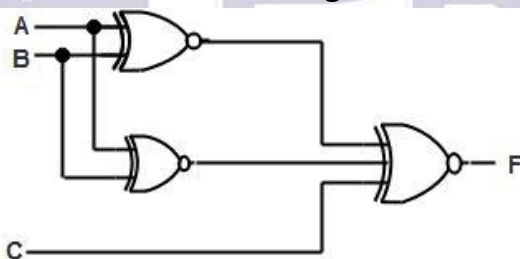
[Q-6] In the circuit of the figure, the value of the voltage source E is.....

[GATE-2000]



(a)  $-16\text{ V}$  (b)  $4\text{ V}$  (c)  $-6\text{ V}$  (d)  $16\text{ V}$

[Q-7] For the circuit F to 1 is the logic circuit shown the input combination should be...



(a)  $A = 1, B = 1, C = 0$  (b)  $A = 1, B = 0, C = 0$   
 (c)  $A = 0, B = 1, C = 0$  (d)  $A = 0, B = 0, C = 1$

[Q-8] Match List-I with List-II and select the correct answer using the codes given below the lists:

List-I

- A. Singular matrix
- B. Non-square matrix
- C. Real symmetric
- D. Orthogonal matrix

List-II

- 1. Determinant is not defined
- 2. Determinant is always one
- 3. Determinant is zero
- 4. Eigen value are always real
- 5. Eigen value are not defined

**Codes:**

	A	B	C	D
(a)	3	1	4	2
(b)	2	3	4	1
(c)	3	2	5	4
(d)	3	4	2	1

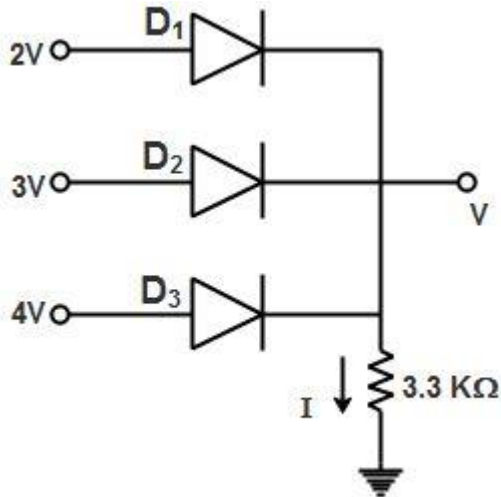
[GATE-2006]

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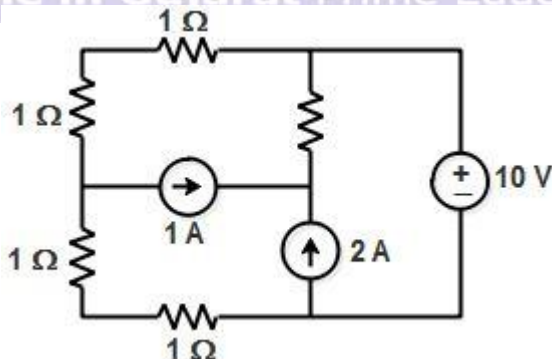
- [Q-9] A can do a piece of work in 10 days and B can do the same work in 20 days. With the help of C, they finish the work in 5 days. How long will it take for C alone to finish the work?  
 (a) 20 days (b) 10 days (c) 35 days (d) 15 days

[Q-10] Given  $V_{D(ON)} = 0.7\text{ V}$ , find  $V$ ?



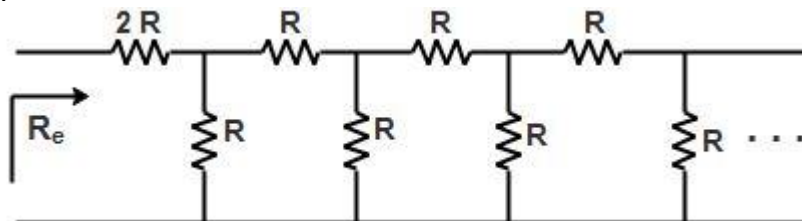
## SECTION-B

[Q-11] In the circuit shown, the power supplied by the voltage source is..... [GATE-2010]



- (a) 0 W (b) 5 W (c) 10 W (d) 100 W

[Q-12] The equivalent resistance in the infinite ladder network shown in the figure, is  $R_e$



The value  $R_e/R$  is.....

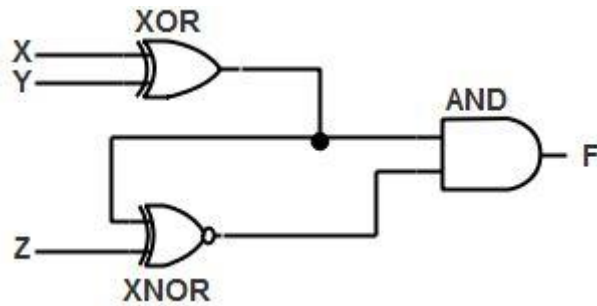
[GATE-2014]

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[Q-13] The output F in the digital logic circuit shown in the figure is....

[GATE-2014]



- (a)  $F = \bar{X}YZ + X\bar{Y}Z$       (b)  $F = \bar{X}Y\bar{Z} + XY\bar{Z}$   
 (c)  $F = \bar{X}\bar{Y}Z + XYZ$       (d)  $F = \bar{X}\bar{Y}\bar{Z} + XYZ$

[Q-14] The rank of the matrix  $\begin{bmatrix} 6 & 0 & 4 & 4 \\ -2 & 14 & 8 & 18 \\ 14 & -14 & 0 & -10 \end{bmatrix}$  is.....

[GATE-2014]

[Q-15] 5 skilled workers can build a wall in 20 days; 8 semiskilled workers can build a wall in 25 days; 10 unskilled workers can build a wall in 30 days. If a team has 2 skilled, 6 semiskilled and 5 unskilled workers, how long will it take to build the wall?

- (a) 20 days    (b) 18 days    (c) 16 days    (d) 15 days

[GATE-2010]

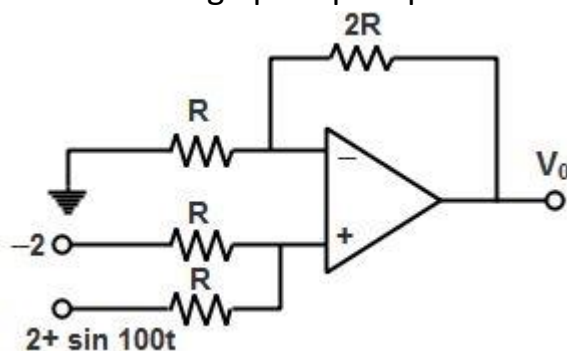
[Q-16] The Boolean expression  $Y = \bar{A}\bar{B}\bar{C}D + \bar{A}BC\bar{D} + A\bar{B}\bar{C}D + ABC\bar{D}$  can be minimized to.....

- (a)  $Y = \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}\bar{C} + A\bar{C}D$     (b)  $Y = \bar{A}\bar{B}\bar{C}D + BC\bar{D} + A\bar{B}\bar{C}D$

- (c)  $Y = \bar{A}BC\bar{D} + \bar{B}\bar{C}D + A\bar{B}\bar{C}D$     (d)  $Y = \bar{A}BC\bar{D} + \bar{B}\bar{C}D + AB\bar{C}\bar{D}$

[GATE-2007]

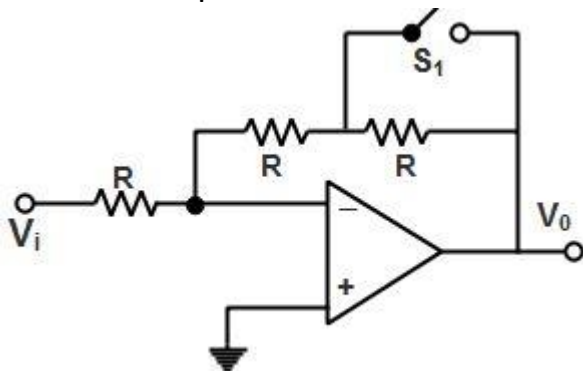
[Q-17] A non-inverting op-amp amplifier is shown in figure. The output voltage is.....



- (a)  $\frac{3}{2} \sin 100t$     (b)  $3 \sin 100t$     (c)  $2 \sin 100t$     (d) None of these

[GATE-1996]

[Q-18] Let the magnitude of the gain in the inverting op-amp amplifier circuit shown be  $X$  with switch  $S_1$  open. When the switch  $S_1$  is closed, the magnitude of gain becomes



- (a)  $X/2$  (b)  $-X$  (c)  $2X$  (d)  $-2X$

[GATE-1996]

[Q-19] The  $\lim_{x \rightarrow 0} \frac{\sin\left[\frac{2}{3}x\right]}{x}$  is.....

- (a)  $2/3$  (b)  $1$  (c)  $3/2$  (d)  $\infty$

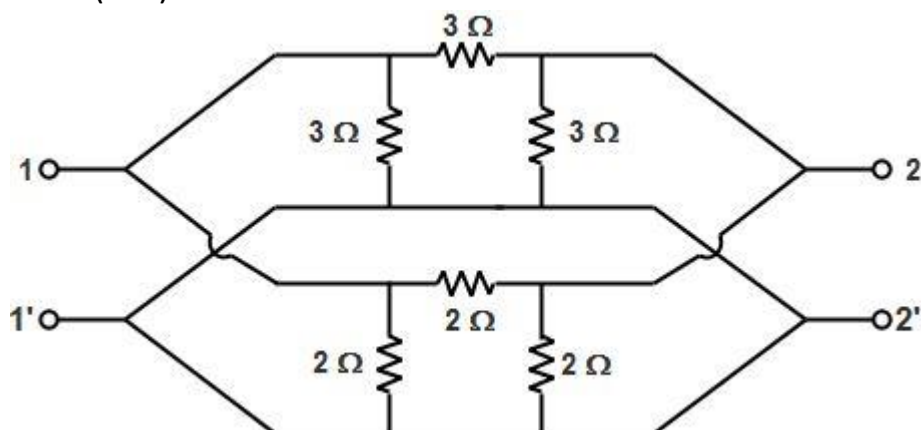
[GATE-2010]

[Q-20] A container originally contains 10 litres of pure spirit. From this container 1 litre of spirit is replaced with 1 litre of water. Subsequently, 1 litre of the mixture is again replaced with 1 litre of water and this process is repeated one more time. How much spirit is now left in the container? [GATE-2011]

- (a) 7.58 litres (b) 7.84 litres (c) 7 litres (d) 7.29 litres

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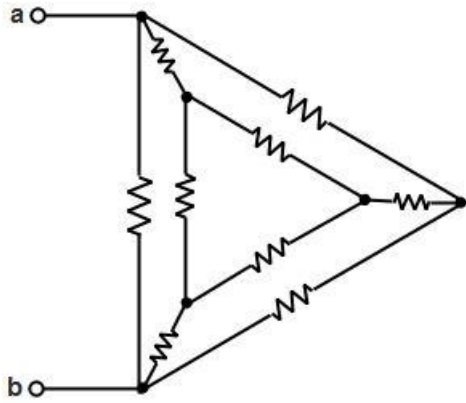
[Q-21] In the h-parameter model of the 2-port network given in the figure shown, the value of  $h_{22}$  (in S) is... [GATE-2014]



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[Q-22] In the given circuit, each resistor has a value equal to  $1 \Omega$ .



What is the equivalent resistance across the terminals a and b?

[GATE-2016]

- (a)  $1/6 \Omega$  (b)  $1/3 \Omega$  (c)  $9/20 \Omega$  (d)  $8/15 \Omega$

[Q-23] With initial condition  $x(1) = 0.5$ , the solution of the differential equation.  $t \frac{dx}{dt} + x = t$  is

- (a)  $x = t - \frac{1}{2}$  (b)  $x = t^2 - \frac{1}{2}$  (c)  $x = \frac{t^2}{2}$  (d)  $x = \frac{t}{2}$

[GATE-2012]

[Q-24] The salaries of A and B together amount to Rs. 2000. A spends 95% of his salary and B, 85% of his salary. If now, their savings are same, what is A's salary?

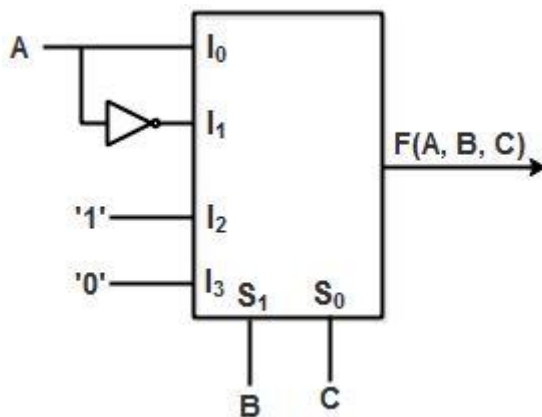
- (a) Rs. 1500 (b) Rs. 1250 (c) Rs. 750 (d) Rs. 1600

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[Q-25] A 4 x 1 MUX is used to implement a 3- input Boolean function as shown in figure.

The Boolean function  $F(A, B, C)$  implemented is.....

[GATE-2006]

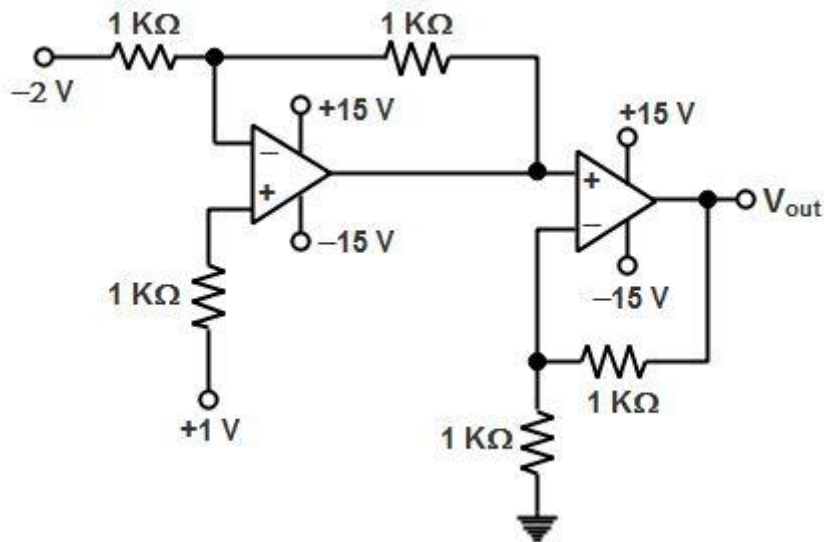


- (a)  $F(A, B, C) = \sum(1, 2, 4, 6)$  (b)  $F(A, B, C) = \sum(1, 2, 6)$   
 (c)  $F(A, B, C) = \sum(2, 4, 5, 6)$  (d)  $F(A, B, C) = \sum(1, 5, 6)$

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[Q-26] In the circuit shown below the op-amps are ideal. Then  $V_{out}$  in Volts is.....



[GATE-2013]

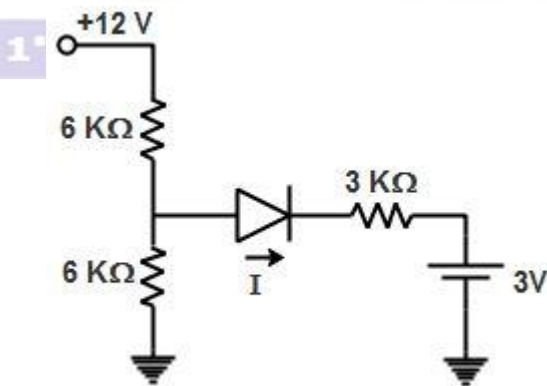
- (a) 4 (b) 6 (c) 8 (d) 10

[Q-27] A firm is selling its product at Rs. 60/unit. The total cost of production is Rs. 100 and the firm is earning a total profit of Rs. 500. Later the total cost increased by 30%. By what percentage should the price be increased to maintain the same profit level...

- (a) 5 (b) 15 (c) 10 (d) 30

[GATE-2013]

[Q-28] Find the current  $I$ , in the circuit shown in below (Diode is ideal).....(mA).



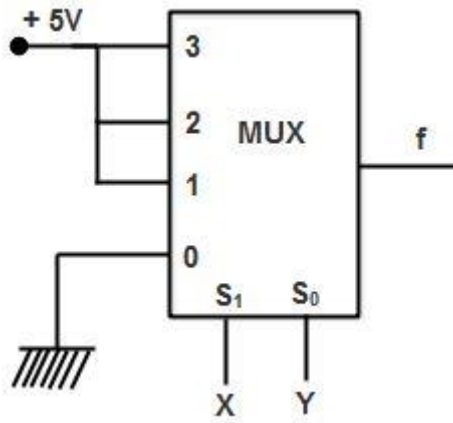
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[Q-29] A mixture contains alcohol and water in the ratio of 12 : 5. On adding 14 litres of water, the ratio of alcohol to water becomes 4 : 3. The quantity of alcohol in the mixture is....(liters)



[Q-30] The output  $f$  of the 4-to-1 MUX shown in figure is

[GATE-2001]



- (a)  $\overline{XY} + X$     (b)  $X + Y$     (c)  $\overline{X} + \overline{Y}$     (d)  $XY + \overline{X}$



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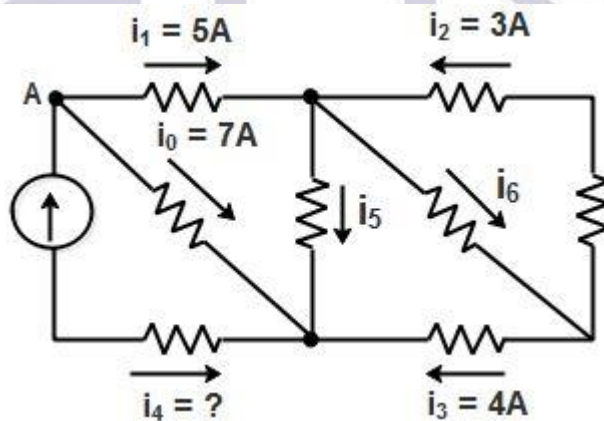
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## ANSWER KEY

Q.	ANS	Q.	ANS	Q.	ANS	Q.	ANS
Q-1	12 A	Q-9	[A]	Q-17	[A]	Q-25	[A]
Q-2	[D]	Q-10	3.3 V	Q-18	[A]	Q-26	[C]
Q-3	[A]	Q-11	[A]	Q-19	[A]	Q-27	[A]
Q-4	[A]	Q-12	2.62	Q-20	[D]	Q-28	0.5 mA
Q-5	[C]	Q-13	[A]	Q-21	1.25	Q-29	42 L
Q-6	[A]	Q-14	2	Q-22	[D]	Q-30	[B]
Q-7	[D]	Q-15	[D]	Q-23	[D]	-	-
Q-8	[A]	Q-16	[D]	Q-24	[A]	-	-

## SOLUTION

[Q-1]



Apply KCL at node A

$$i_0 + i_1 + i_4 = 0$$

$$7 + 5 + i_4 = 0$$

$$i_4 = -12 \text{ A}$$

$$[Q-2] y = A + \bar{A}B = (A + \bar{A})(A + B) = A + B$$

[Q-4]  $\frac{d^3y}{dx^3} + 4\sqrt{\left(\frac{dy}{dx}\right)^3 + y^2} = 0$  Removing radicals we get  $\left(\frac{d^3y}{dx^3}\right)^2 = 16\left[\left(\frac{dy}{dx}\right)^3 + y^2\right]$

The order is 3 since highest differential is  $\frac{d^3y}{dx^3}$

The degree is 2 since power of highest differential is 2.

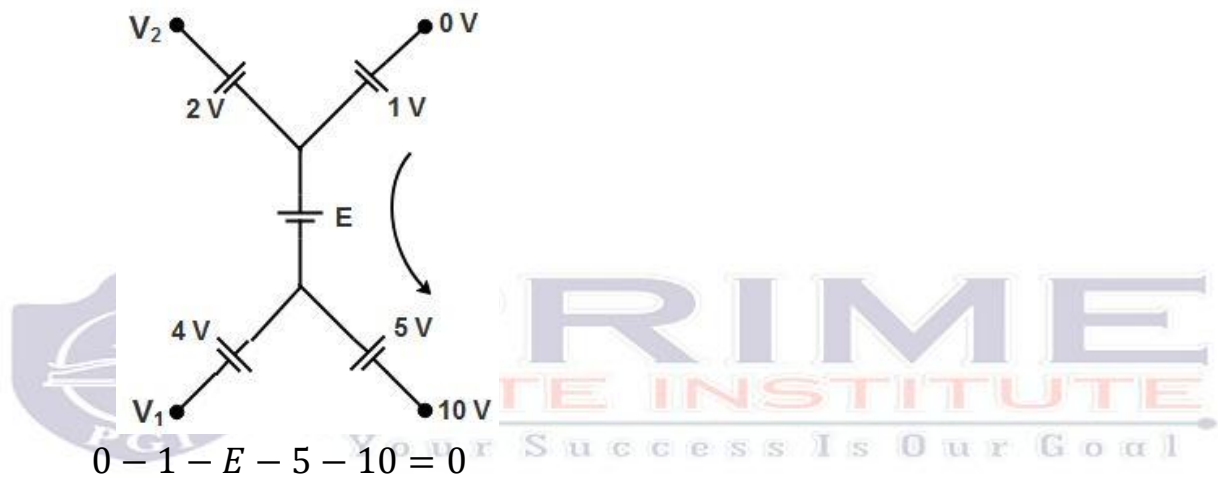
[Q-5]  $3G = 54 \times 2 = 108 \Rightarrow G = 36$

$3P = 36 \times 2 = 72 \Rightarrow P = 24$

$3C = 24 \times 2 = 48 \Rightarrow C = 16$

Cost of a cricket ball = Rs. 16

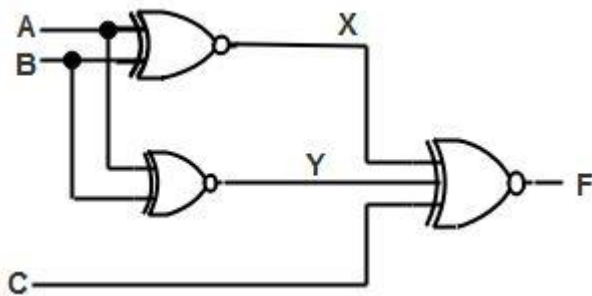
[Q-6]



$E = -16V$

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[Q-7]



If  $A = 0, B = 0$  then

$X = \bar{A}B + \bar{B}A = 0$

$Y = AB + \bar{A}\bar{B} = 1$

F will be '1' if even number of inputs to XNOR gate is '1'; hence option (d) is the correct answer.

[Q-9]  $\frac{1}{5} - \frac{1}{10} - \frac{1}{20} = \frac{1}{20}$

This is C's one day work so 20 days are required for C alone to finish task

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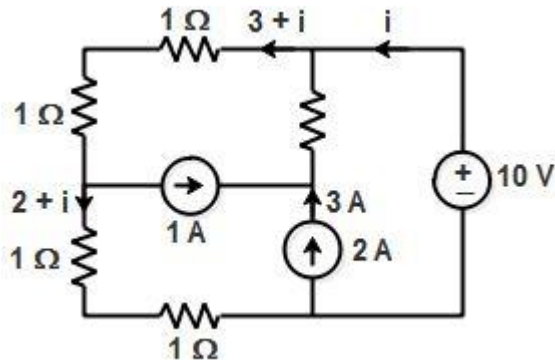
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[Q-10] Diode  $D_3$  FB,  $D_1$  RB,  $D_2$  RB

$$V_0 = 3.3V, I = 1mA (\because V_D = 0.7V)$$

[Q-11]



Applying KVL in outer loop,

$$(3 + i)2 + (2 + i)2 = 10$$

$$\Rightarrow 6 + 2i + 4 + 2i = 10$$

$$\Rightarrow 4i = 0$$

$$\Rightarrow i = 0$$

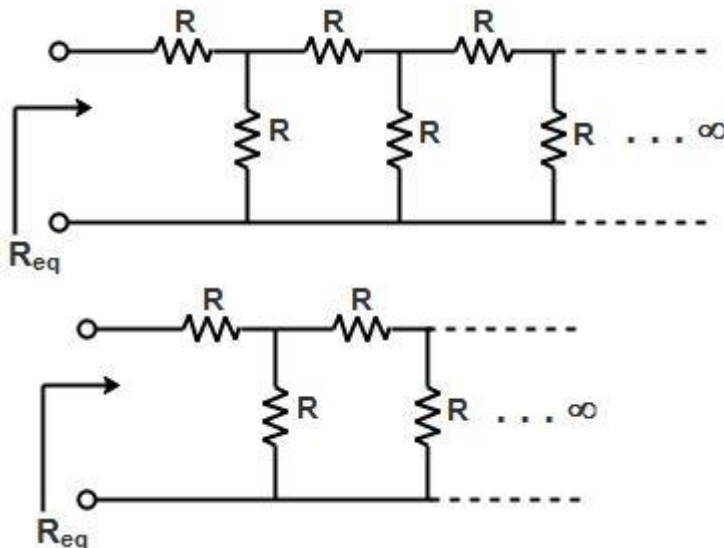
Power supplied by the voltage source,

$$P = V i$$

$$= 10 \times 0 = 0W$$

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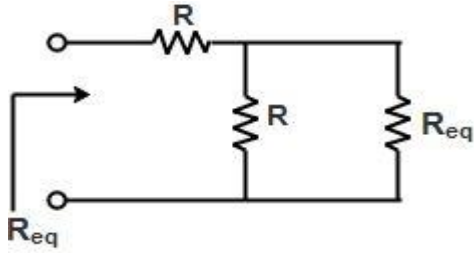
[Q-12] For an infinite ladder network, if all the resistance are comprises of same value  $R$ , then



Or,

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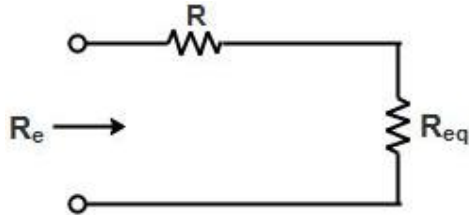
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$$\therefore R_{eq} = R + \frac{R \cdot R_{eq}}{R + R_{eq}} \quad \dots\dots(i)$$

$$\text{After solving equation (i) we get, } R_{eq} = \left(\frac{1+\sqrt{5}}{2}\right) R \quad \dots\dots(ii)$$

From the given question the circuit can be redraw as



$$\therefore R_e = R + R_{eq} \quad \dots\dots(iii)$$

From equation (ii) and (iii) we get,

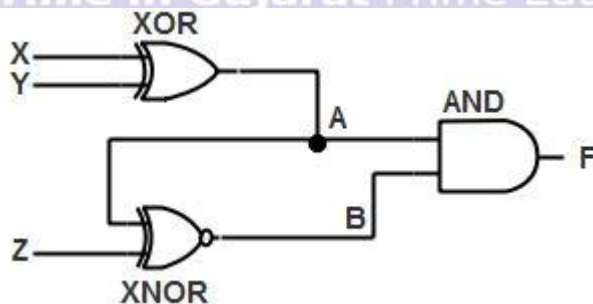
$$R_e = R + \left(\frac{1+\sqrt{5}}{2}\right) R = 2.618 R \quad \dots\dots(iv)$$

$$\text{Or } \frac{R_e}{R} = 2.618 = 2.62$$



[Q-13]

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$$A = X \oplus Y$$

$$B = A \odot Z = A \cdot Z + \bar{A}\bar{Z}$$

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

$$F = AB$$

$$= (X \oplus Y)[Z(X \oplus Y) + \bar{Z} \overline{(X \oplus Y)}]$$

$$= Z[(X \oplus Y)(X \oplus Y) + \bar{A} \overline{(X \oplus Y)}(X \oplus Y)]$$

As we know  $A \cdot A = A$

$$A \cdot A = 0$$

$$= Z[(X \oplus Y) + 0]$$

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

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[Q-14] 
$$\begin{bmatrix} 6 & 0 & 4 & 4 \\ -2 & 14 & 8 & 18 \\ 14 & -14 & 0 & -10 \end{bmatrix}$$

$$R_3 \rightarrow R_3 - 2R_1 + R_2$$

$$\begin{bmatrix} 6 & 0 & 4 & 4 \\ -2 & 14 & 8 & 18 \\ 14 - 2(6) + (-2) & -14 - 2(0) + (14) & 0 - 2(4) + 8 & -10 - 2(4) + (18) \end{bmatrix}$$

$$\begin{bmatrix} 6 & 0 & 4 & 4 \\ -2 & 14 & 8 & 18 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Determinant of matrix  $\begin{bmatrix} 6 & 0 \\ -2 & 14 \end{bmatrix}$  is not zero

So, Rank is 2

[Q-15] Per day work or rate of 5 skilled workers =  $\frac{1}{20}$

Per day work or rate of one skill worker =  $\frac{1}{5 \times 20} = \frac{1}{100}$

Similarly per day work or rate 8 semiskilled workers =  $\frac{1}{25}$

Per day work or rate of one semi-skill worker =  $\frac{1}{8 \times 25} = \frac{1}{200}$

And per day work or rate of 10 unskilled workers =  $\frac{1}{30}$

Per day work or rate of one un-skill worker =  $\frac{1}{10 \times 30} = \frac{1}{300}$

Thus total per day work of 2 skilled, 6 semiskilled and 5 unskilled workers

$$= \frac{2}{100} + \frac{6}{200} + \frac{5}{300} = \frac{12+18+10}{600} = \frac{40}{600} = \frac{1}{15}$$

Thus time to complete the work is 15 days.

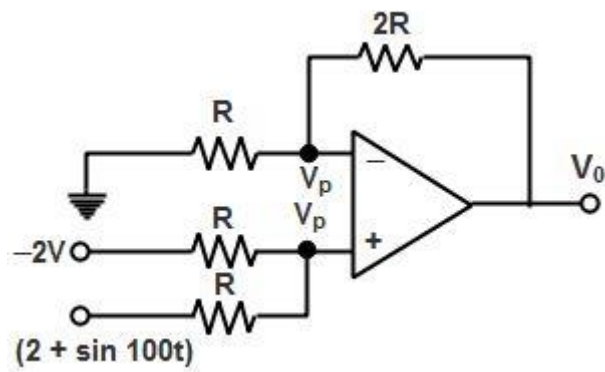
[Q-16] K-map corresponding to given Boolean expression

	CD	00	01	11	10
AB	00		1		
	01				1
	11	1			
	10		1		

Simplified expression from the K-map

$$Y = \bar{A}BC\bar{D} + AB\bar{C}\bar{D} + \bar{B}\bar{C}D$$

[Q-17]



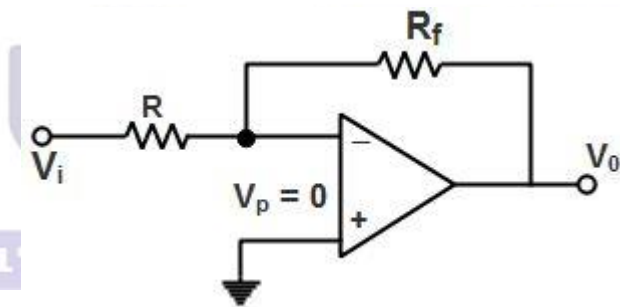
$$\frac{V_p + 2}{R} + \frac{V_p - (2 + \sin 100t)}{R} = 0$$

$$\Rightarrow V_p = \frac{1}{2} \sin 100t$$

$$\frac{V_p}{R} + \frac{V_p - V_0}{2R} = 0$$

$$\therefore V_0 = 3V_p = \frac{3}{2} \sin 100t$$

[Q-18]



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$$\frac{V_i - 0}{R} = \frac{0 - V_0}{R_f}$$

$$\Rightarrow \frac{V_0}{V_i} = -\frac{R_f}{R}$$

When switch  $S_1$  is open;  $R_f = 2R$

$$\frac{V_0}{V_i} = -\frac{2R}{R} = -2 = X$$

When switch  $S_1$  is closed;  $R_f = R$

$$\frac{V_0}{V_i} = -\frac{R}{R} = -1 = \frac{X}{2}$$

[Q-19]  $\lim_{x \rightarrow 0} \frac{\sin\left[\frac{2}{3}x\right]}{x} = \lim_{\frac{2}{3}x \rightarrow 0} \frac{\sin\left(\frac{2}{3}x\right)}{\frac{2}{3}x} \cdot \frac{2}{3}$

$$= (1) \left(\frac{2}{3}\right) = \frac{2}{3}$$

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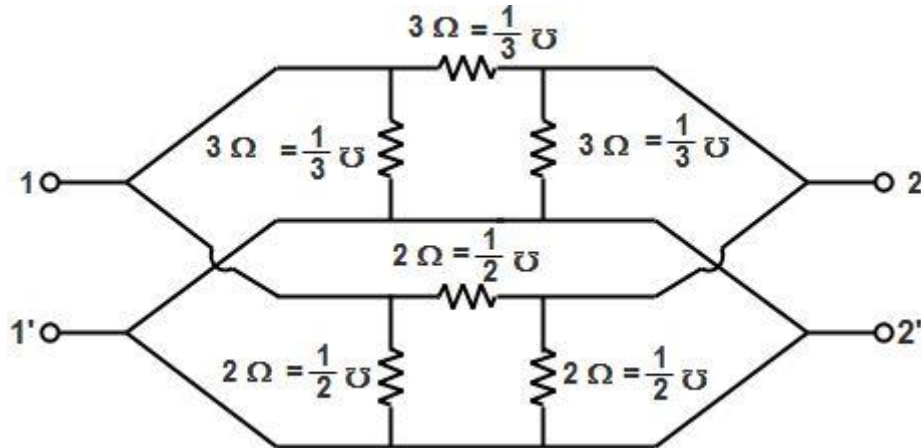
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**[Q-20]** Every time if we take 1 litre of mixture out and replaced with water, content of pure spirit will keep on reducing by 10 %.

So, final quantity of spirit after 3 such operations are

$$10 \times 0.9 \times 0.9 \times 0.9 = 7.29 \text{ litres}$$

**[Q-21]** When two, two port network are connected in parallel then individual Y-parameter are added therefore from the given network



For network (1) Y-parameter is

$$Y_1 = \begin{bmatrix} \frac{1}{3} + \frac{1}{3} & -\frac{1}{3} \\ -\frac{1}{3} & \frac{1}{3} + \frac{1}{3} \end{bmatrix}$$

Similarly for network (2),

$$Y_2 = \begin{bmatrix} 1 & -\frac{1}{2} \\ -\frac{1}{2} & 1 \end{bmatrix}$$

$$\text{Thus, } Y = Y_1 + Y_2 = \begin{bmatrix} \frac{5}{3} & -\frac{5}{6} \\ -\frac{5}{6} & \frac{5}{3} \end{bmatrix}$$

$$\therefore I_1 = Y_{11} V_1 + Y_{12} V_2 \\ = \frac{5}{3} V_1 - \frac{5}{6} V_2 \quad \dots\dots\dots(i)$$

$$I_2 = Y_{21} V_1 + Y_{22} V_2 \\ = -\frac{5}{6} V_1 + \frac{5}{3} V_2 \quad \dots\dots\dots(ii)$$

$$\text{Also } h_{22} = \left. \frac{I_2}{V_2} \right|_{I_1=0}$$

From equation (i) we get

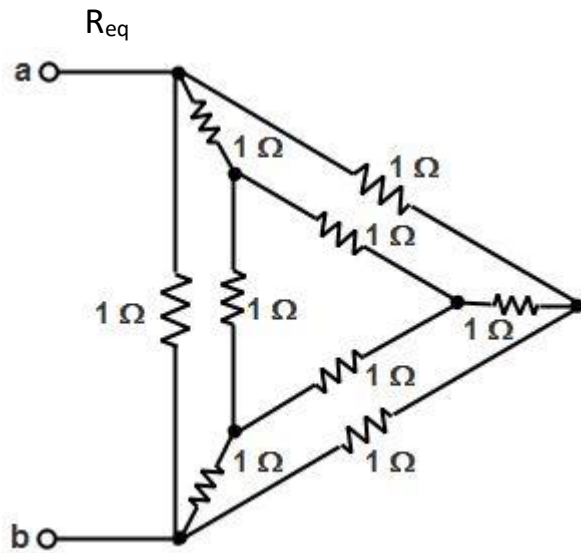
$$V_1 = \frac{1}{2} V_2 \quad \dots\dots\dots(iii)$$

And from equation (ii) and (iii) we get

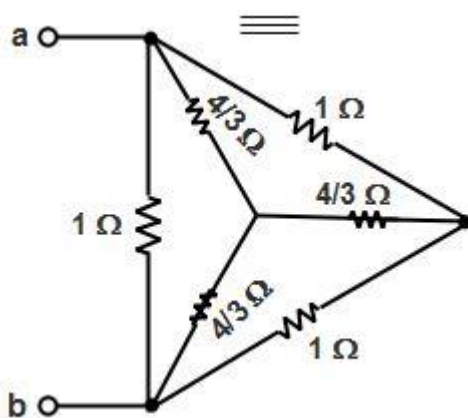
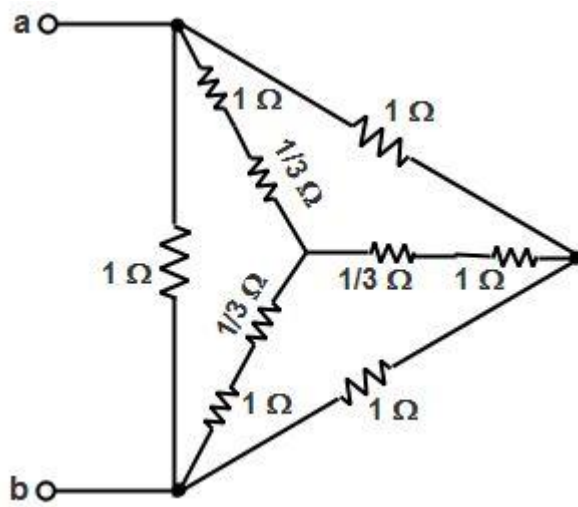
$$h_{22} = \frac{I_2}{V_2} = \frac{15}{12} = 1.25$$



[Q-22]



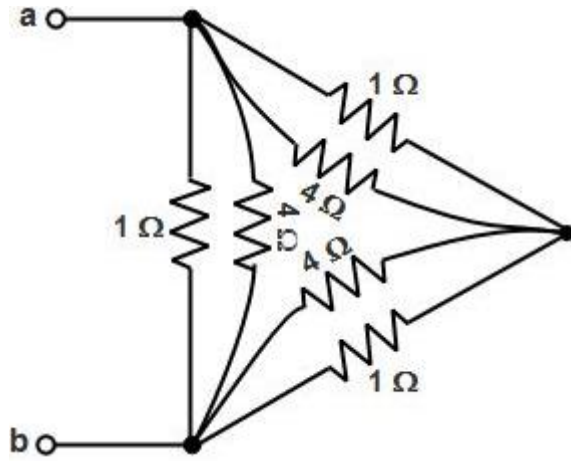
By using delta to star conversion



Again by star to delta conversion

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$$R_{ab} = \{(4||1) + (4||1)\} || \{(1||4)\}$$

$$= \left(\frac{4}{5} + \frac{4}{5}\right) || \frac{4}{5} = \frac{8}{15} \Omega$$

**[Q-23]** The given differential equation is  $t \frac{dx}{dt} + x = t$  with initial condition  $x(1) = \frac{1}{2}$  which

is same as  $\frac{dx}{dt} + \frac{x}{t} = 1$

Which is a linear differential equation

$$\frac{dx}{dt} + Px = Q \text{ where } P = \frac{1}{t} \text{ and } Q = 1$$

Integrating factor

$$= e^{\int P dt} = e^{\int \frac{1}{t} dt}$$

$$= e^{\log t} = t$$

Solution is  $x \cdot (IF) = \int Q \cdot (IF) dt + C$

$$x \cdot t = \int 1 \cdot t \cdot dt + C$$

$$xt = \frac{t^2}{2} + C$$

$$x = \frac{t}{2} + \frac{C}{t}$$

$$\text{Put } x(1) = \frac{1}{2}$$

$$\Rightarrow \frac{1}{2} + \frac{C}{1} = \frac{1}{2}$$

$$\Rightarrow C = 0$$

So,  $x = \frac{t}{2}$  is the solution

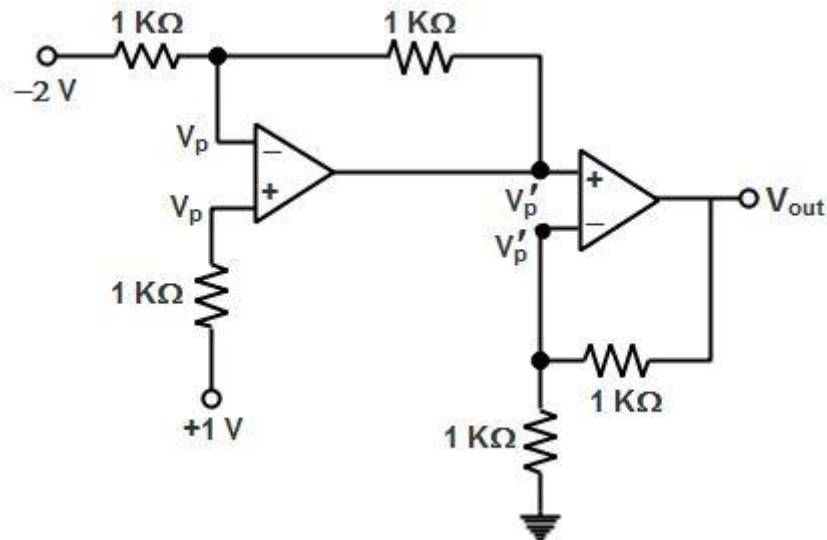
**[Q-24]** Let A's salary = x, then B's = (2000 - x)

5% of A = 15% of B, i.e.

$$\frac{5}{100}x = \frac{15}{100}(2000 - x) \text{ or } x = 1500$$

$$\begin{aligned}
 \text{[Q-25]} \quad F(A, B, C) &= \bar{S}_0 \bar{S}_1 l_0 + \bar{S}_1 S_0 l_1 + \bar{S}_0 S_1 l_2 + S_0 S_1 l_3 \\
 &= \bar{A} \bar{B} \bar{C} + \bar{A} \bar{B} C + \bar{A} B \bar{C} + A B \bar{C} \\
 &= \bar{A} \bar{B} \bar{C} + \bar{A} \bar{B} C + (A + \bar{A})(B \bar{C}) \\
 &= \bar{A} \bar{B} \bar{C} + \bar{A} \bar{B} C + A B \bar{C} + \bar{A} B \bar{C} \\
 F(A, B, C) &= \Sigma(4, 1, 6, 2) = \Sigma(1, 2, 4, 6)
 \end{aligned}$$

[Q-26]



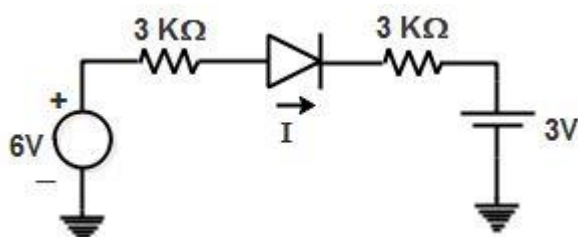
$$V_p = 1V$$

$$\frac{-2 - V_p}{1} = \frac{V_p - V'_p}{1}$$

$$\Rightarrow V'_p = 4V$$

$$V_{out} = 2 \times V'_p = 8V$$

[Q-28]



$$I = \frac{6-3}{6K} = 0.5 \text{ mA}$$

[Q-29] Ratio of alcohol and water 12 : 5

Let their qualities be  $12x$  and  $5x$  respectively.

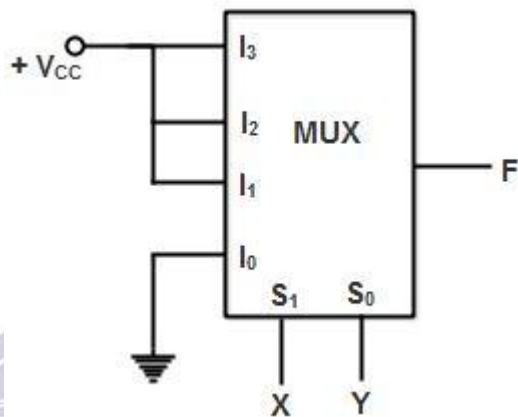
After adding the litres of water ratio becomes 4 : 3

$$\frac{12x}{5x+14} = \frac{4}{3}$$

$$x = \frac{7}{2}$$

Quantity of alcohol =  $12 \times \frac{7}{2} = 42$  litres.

[Q-30]



$$f = \bar{X}\bar{Y} \cdot 0 + X\bar{Y} \cdot 1 + \bar{X}Y \cdot 1 + XY \cdot 1$$

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

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

$$= X + Y$$

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