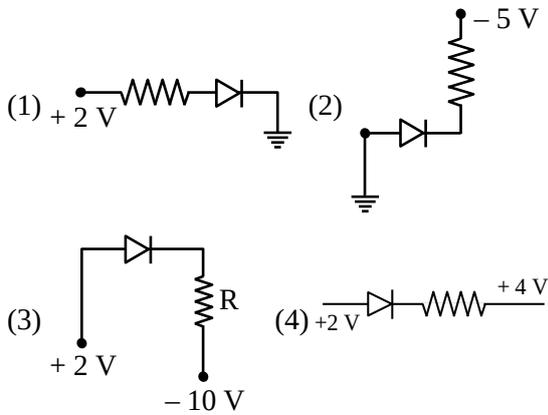
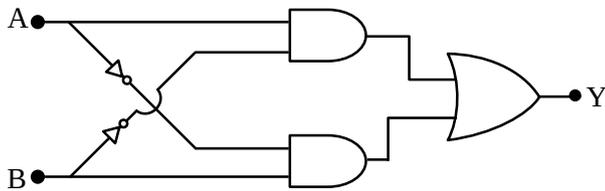


SEMICONDUCTOR

1. Which of the following circuits is reverse-biased ?

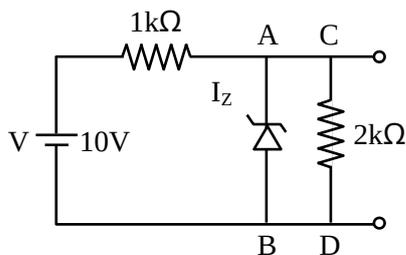


2. The truth table of the given circuit diagram is:



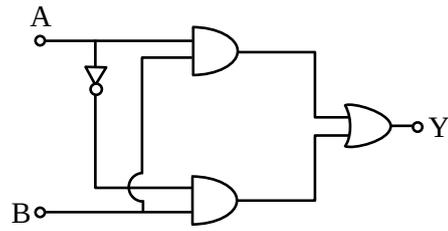
- | | |
|-----------|-----------|
| (1) A B Y | (2) A B Y |
| 0 0 1 | 0 0 0 |
| 0 1 0 | 0 1 1 |
| 1 0 0 | 1 0 1 |
| 1 1 1 | 1 1 0 |
- | | |
|-----------|-----------|
| (3) A B Y | (4) A B Y |
| 0 0 0 | 0 0 1 |
| 0 1 0 | 0 1 1 |
| 1 0 0 | 1 0 1 |
| 1 1 1 | 1 1 0 |

3. In the given circuit, the breakdown voltage of the Zener diode is 3.0 V. What is the value of I_Z ?



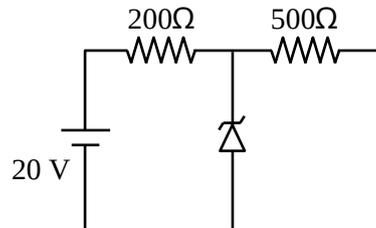
- | | |
|------------|------------|
| (1) 3.3 mA | (2) 5.5 mA |
| (3) 10 mA | (4) 7 mA |

4. The truth table for this given circuit is :



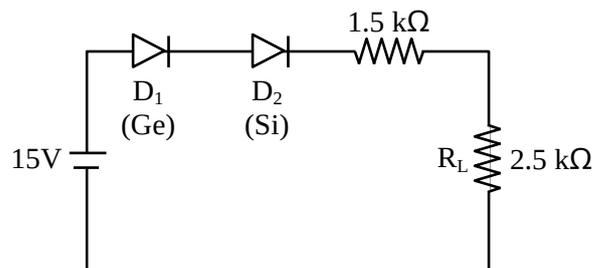
- | A | B | Y |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |
- | A | B | Y |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |
- | A | B | Y |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |
- | A | B | Y |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

5. A Zener diode of breakdown voltage 10V is used as a voltage regulator as shown in the figure. The current through the Zener diode is



- | | |
|-----------|-----------|
| (1) 50 mA | (2) 0 |
| (3) 30 mA | (4) 20 mA |

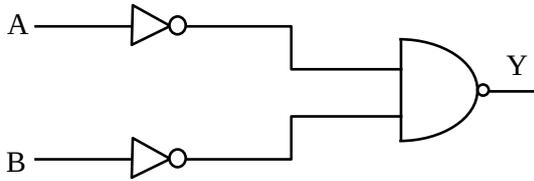
6. In the given circuit, the voltage across load resistance (R_L) is:



- | | |
|------------|-------------|
| (1) 8.75 V | (2) 9.00 V |
| (3) 8.50 V | (4) 14.00 V |

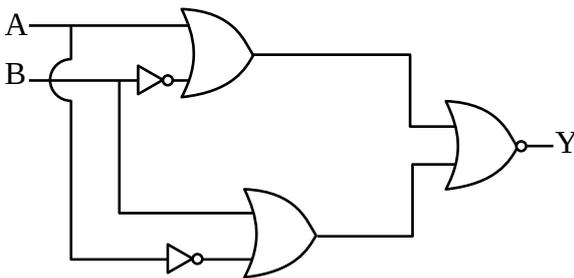
SEMICONDUCTOR

7. Identify the logic operation performed by the given circuit.



- (1) NAND (2) NOR
(3) OR (4) AND

8. The output of the given circuit diagram is



(1)

A	B	Y
0	0	0
1	0	0
0	1	0
1	1	1

(2)

A	B	Y
0	0	0
1	0	1
0	1	1
1	1	0

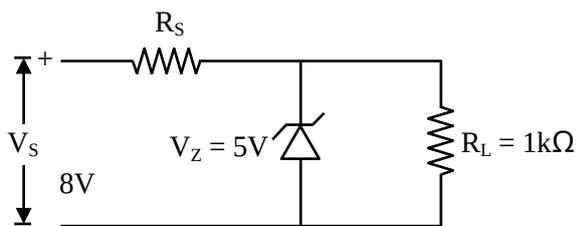
(3)

A	B	Y
0	0	0
1	0	0
0	1	0
1	1	0

(4)

A	B	Y
0	0	0
1	0	0
0	1	1
1	1	0

9. In the given circuit if the power rating of Zener diode is 10 mW, the value of series resistance R_s to regulate the input unregulated supply is :

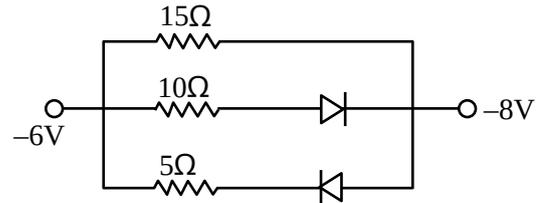


- (1) 5kΩ (2) 10Ω
(3) 1kΩ (4) 10kΩ

10. Conductivity of a photodiode starts changing only if the wavelength of incident light is less than 660 nm. The band gap of photodiode is found to be $\left(\frac{X}{8}\right) eV$. The value of X is :

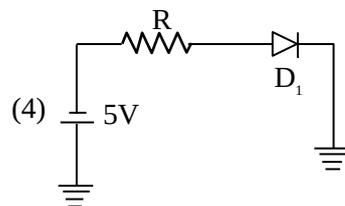
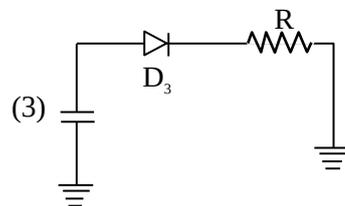
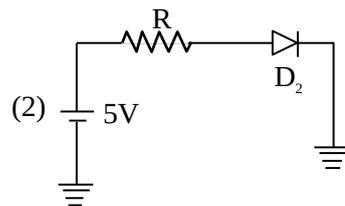
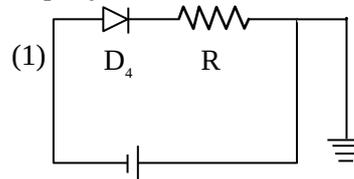
- (Given, $h = 6.6 \times 10^{-34} Js$, $e = 1.6 \times 10^{-19} C$)
(1) 15 (2) 11
(3) 13 (4) 21

11. The value of net resistance of the network as shown in the given figure is :

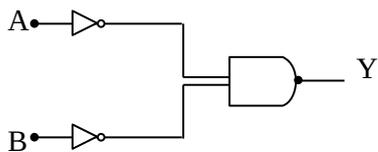


- (1) $\left(\frac{5}{2}\right) \Omega$ (2) $\left(\frac{15}{4}\right) \Omega$
(3) 6Ω (4) $\left(\frac{30}{11}\right) \Omega$

12. Which of the diode circuit shows correct biasing used for the measurement of dynamic resistance of p-n junction diode :

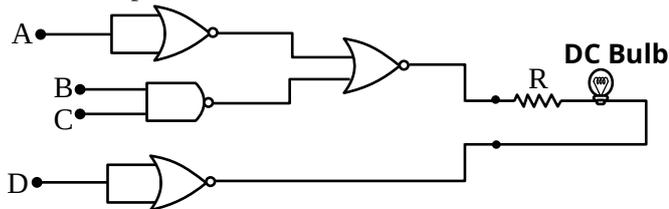


13. Identify the logic gate given in the circuit :



- (1) NAND - gate (2) OR - gate
(3) AND gate (4) NOR gate

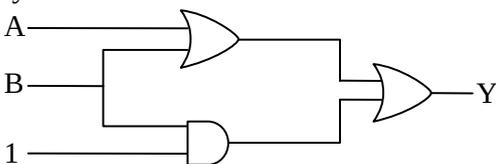
14. Following gates section is connected in a complete suitable circuit.



For which of the following combination, bulb will glow (ON):

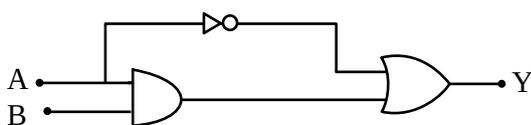
- (1) A = 0, B = 1, C = 1, D = 1
(2) A = 1, B = 0, C = 0, D = 0
(3) A = 0, B = 0, C = 0, D = 1
(4) A = 1, B = 1, C = 1, D = 0

15. The output (Y) of logic circuit given below is 0 only when :



- (1) A = 1, B = 0 (2) A = 0, B = 0
(3) A = 1, B = 1 (4) A = 0, B = 1

16. The correct truth table for the following logic circuit is :



Options :

(1)

A	B	Y
0	0	0
0	1	1
1	0	0
1	1	1

(2)

A	B	Y
0	0	1
0	1	1
1	0	0
1	1	1

(3)

A	B	Y
0	0	1
0	1	1
1	0	0
1	1	0

(4)

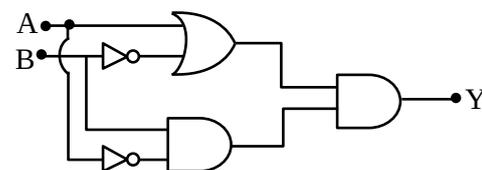
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

17. The acceptor level of a p-type semiconductor is 6eV. The maximum wavelength of light which can create a hole would be :

Given $hc = 1242 \text{ eV nm}$.

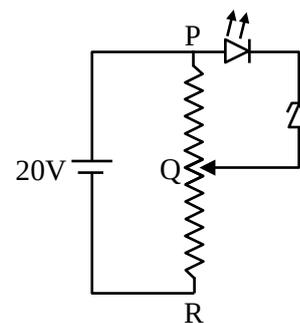
- (1) 407 nm
(2) 414 nm
(3) 207 nm
(4) 103.5 nm

18. The output Y of following circuit for given inputs is :



- (1) $A \cdot B(A + B)$ (2) $A \cdot B$
(3) 0 (4) $\bar{A}iB$

19. A potential divider circuit is connected with a dc source of 20 V, a light emitting diode of glow in voltage 1.8 V and a zener diode of breakdown voltage of 3.2 V. The length (PR) of the resistive wire is 20 cm. The minimum length of PQ to just glow the LED is cm.

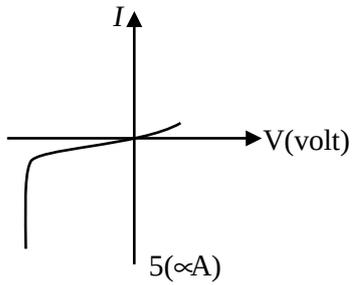


20. A light emitting diode (LED) is fabricated using GaAs semiconducting material whose band gap is 1.42 eV. The wavelength of light emitted from the LED is:

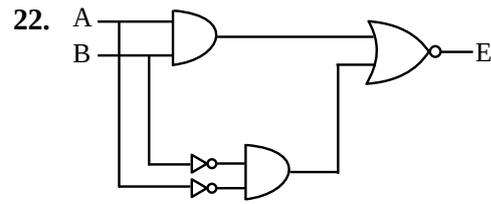
- (1) 650 nm
(2) 1243 nm
(3) 875 nm
(4) 1400 nm

SEMICONDUCTOR

21. The I-V characteristics of an electronic device shown in the figure. The device is :



- (1) a solar cell
- (2) a transistor which can be used as an amplifier
- (3) a zener diode which can be used as voltage regulator
- (4) a diode which can be used as a rectifier



A	B	E
0	0	0
0	1	X
1	0	Y
1	1	0

In the truth table of the above circuit the value of X and Y are :

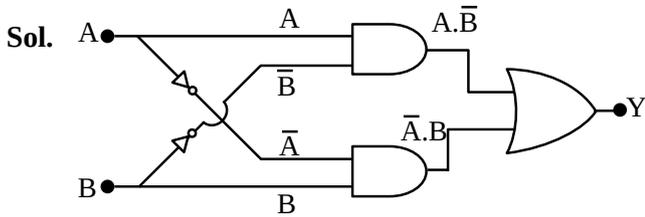
- (1) 1, 1
- (2) 1, 0
- (3) 0, 1
- (4) 0, 0

SOLUTIONS

1. **Ans. (4)**

Sol. P end should be at higher potential for forward biasing.

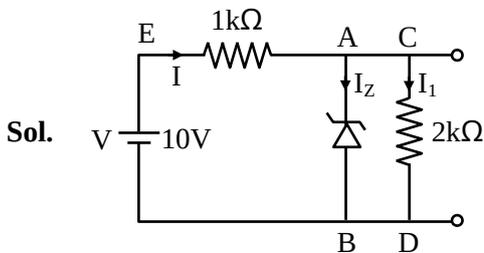
2. **Ans. (2)**



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

This is XOR GATE

3. **Ans. (2)**



$$V_z = 3V$$

Let potential at B = 0 V

Potential at E (V_E) = 10 V

$$V_C = V_A = 3 V$$

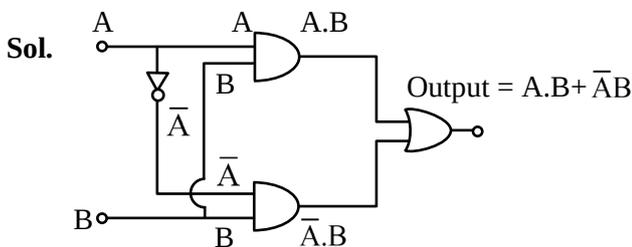
$$I_z + I_1 = I$$

$$I = \frac{10 - 3}{1000} = \frac{7}{1000} A$$

$$I_1 = \frac{3}{2000} A$$

$$\text{Therefore } I_z = \frac{7 - 1.5}{1000} = 5.5 \text{ mA}$$

4. **Ans. (2)**



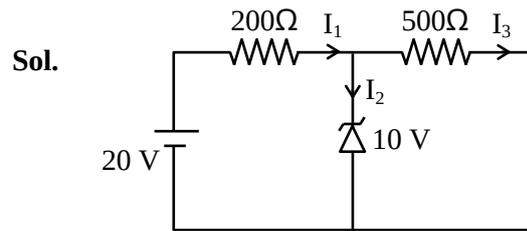
$$Y = A.B + \bar{A}.B$$

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

$$Y = 1.B$$

$$Y = B$$

5. **Ans. (3)**



Zener is in breakdown region.

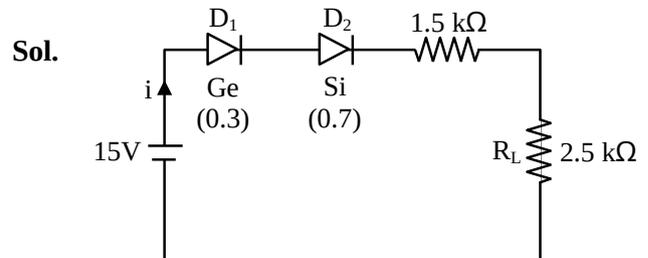
$$I_3 = \frac{10}{500} = \frac{1}{50}$$

$$I_1 = \frac{10}{200} = \frac{1}{20}$$

$$I_2 = I_1 - I_3$$

$$I_2 = \left(\frac{1}{20} - \frac{1}{50} \right) = \left(\frac{3}{100} \right) = 30 \text{ mA}$$

6. **Ans. (1)**



$$i = \frac{14}{4} = 3.5 \text{ mA}$$

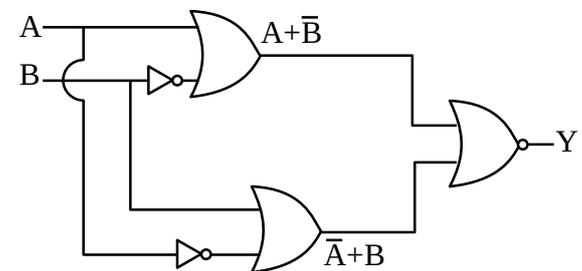
$$V_L = iR_L = 3.5 \cdot 2.5 \text{ volt} = 8.75 \text{ volt}$$

7. **Ans. (3)**

Sol. $Y = \overline{\bar{A} \bar{B}} = \bar{\bar{A}} + \bar{\bar{B}} = A + B$
(De-Morgan's law)

8. **Ans. (3)**

Sol.



$$\text{If } A = 0; \bar{A} \neq$$

$$A = 1; \bar{A} = 0$$

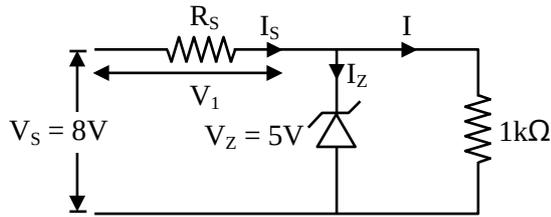
$$B = 0; \bar{B} \neq$$

$$B = 1; \bar{B} = 0$$

$$Y = \overline{(A + \bar{B})} + \overline{(\bar{A} + B)} = \overline{(1+1)} = 0$$

SEMICONDUCTOR

**9. Ans. NTA (3)
Allen (Bonus)**



Sol.

Pd across R_s

$$V_1 = 8 - 5 = 3V$$

Current through the load resistor

$$I = \frac{5}{1 \cdot 10^3} = 5mA$$

Maximum current through Zener diode

$$I_{z \max.} = \frac{10}{5} = 2mA$$

And minimum current through Zener diode

$$I_{z \min.} = 0$$

$$\therefore I_{s \max.} = 5 + 2 = 7mA$$

$$\text{And } R_{s \min} = \frac{V_1}{I_{s \max.}} = \frac{3}{7} k\Omega$$

Similarly

$$I_{s \min.} = 5mA$$

$$\text{And } R_{s \max.} = \frac{V_1}{I_{s \min.}} = \frac{3}{5} k\Omega$$

$$\therefore \frac{3}{7} k\Omega < R_s < \frac{3}{5} k\Omega$$

10. Ans. (1)

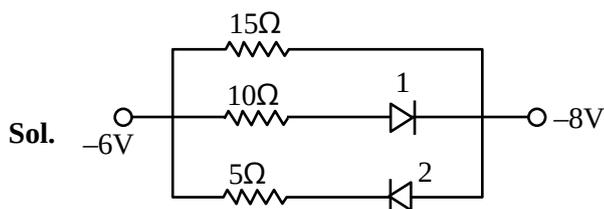
$$\text{Sol. } E_g = \frac{hc}{\lambda} = \frac{6.6 \cdot 10^{-34} \cdot 3 \cdot 10^8}{660 \cdot 10^{-9}} J$$

$$= \frac{6.6 \cdot 10^{-34} \cdot 3 \cdot 10^8}{660 \cdot 10^{-9} \cdot 1.6 \cdot 10^{-19}} eV$$

$$= \frac{15}{8} eV$$

So $x = 15$

11. Ans. (3)



Sol.

Diode 2 is in reverse bias

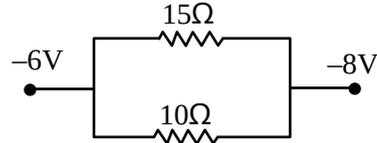
So current will not flow in branch of 2nd diode,

So we can assume it to be broken wire.

Diode 1 is in forward bias

So it will behave like conducting wire. So new

circuit will be



$$R_{eq} = \frac{15 \cdot 10}{15 + 10} = \frac{15 \cdot 10}{25} = 6\Omega$$

Correct answer (3)

12. Ans. (2)

Sol. Diode should be in forward biased to calculate dynamic resistance

Hence correct answer would be 2.

13. Ans. (2)

$$\text{Sol. } Y = \overline{\overline{A \cdot B}}$$

By De-Morgan Law

$$Y = A \cdot B$$

$$Y = A + B$$

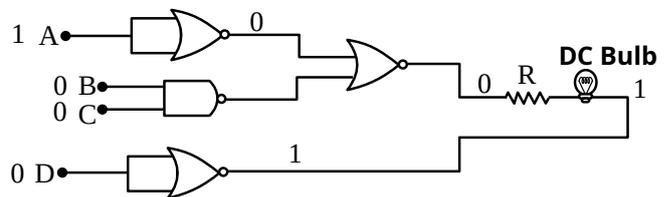
Hence OR gate

14. Ans. (2)

Sol. Bulb will glow if bulb have potential drop on it.

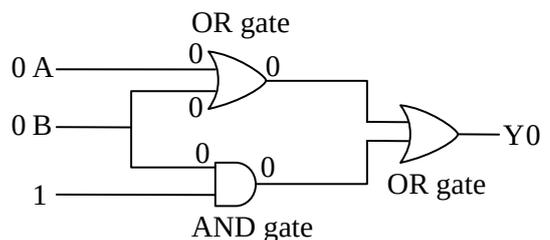
One end of bulb must be at high (1) and other must be at low (0).

Option (2) satisfy this condition

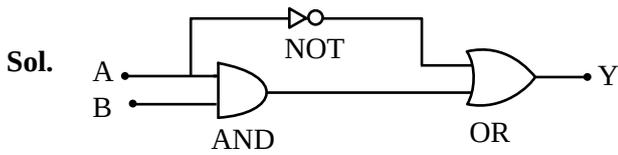


15. Ans. (2)

Sol.



16. Ans. (2)



17. Ans. (3)

Sol. Energy = $\frac{hc}{\lambda}$;

$$E = \frac{1240}{\lambda(\text{nm})} \text{eV}$$

$$6 = \frac{1240}{\lambda(\text{nm})}$$

$$\lambda = \frac{1240}{6} = 207 \text{nm}$$

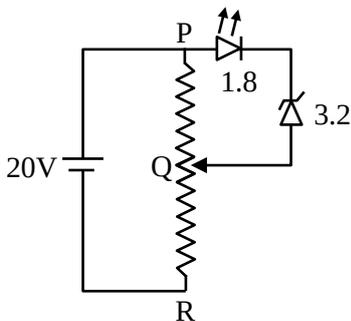
18. Ans. (3)

Sol. By truth table

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	0

19. Ans. (5)

Sol.



$$PR = 20 \text{ cm}$$

$$V_{PQ} = \frac{1}{4} \times R_{PR}$$

$$\min(PQ) = \frac{1}{4} \cdot 20 = 5 \text{ cm}$$

20. Ans. (3)

Sol. $\lambda = \frac{1240}{1.42} = 875 \text{ nm (Approx)}$

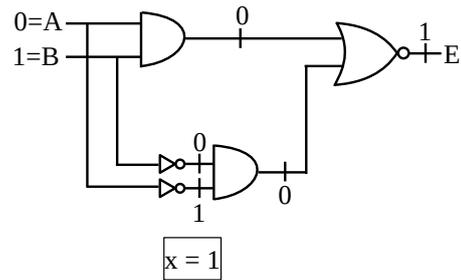
21. Ans. (3)

Sol. Theory

Zener diode used as voltage regulator

22. Ans. (1)

Sol. For x



For y

