POSTAL
BOOK PACKAGE
2024

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1
CHAPTER

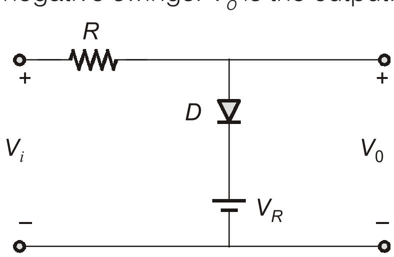
Diode Circuit and Power Supply

MCQ and NAT Questions

Q.1 The voltage across diode at temperature T_1 is 0.76 V. If temperature is increased by 20°C at constant current the new voltage across diode is
(a) 0.65 V (b) 0.81 V
(c) 0.71 V (d) 0.7 V

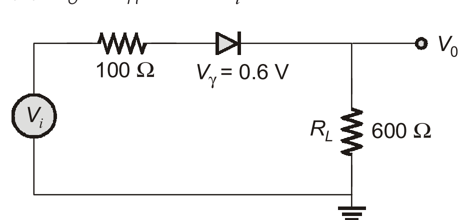
Q.2 A diode whose terminal characteristics are related as $i_D = I_s e^{V/V_T}$, where I_s is the reverse saturation current and V_T is thermal voltage (V_T = 25 mV), is biased at I_D = 4 mA. Its dynamic resistance is
(a) 12.5 Ω (b) 50 Ω
(c) 6.25 Ω (d) 25 Ω

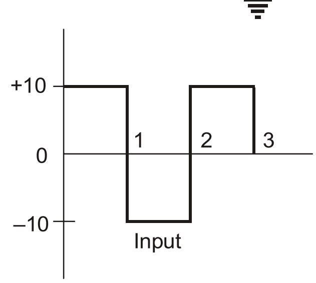
Q.3 In the circuit shown below the input V_i has positive and negative swings. V_o is the output.



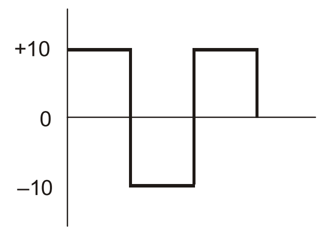
(a) V_o = 0 for negative V_i
(b) $V_o = V_R$ for positive V_i
(c) $V_o = V_R$ for $V_i > V_R$
(d) $V_o = V_R$ for all V_i

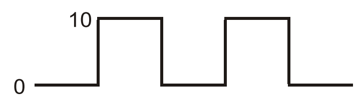
Q.4

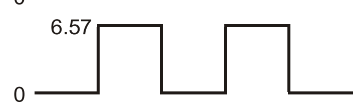


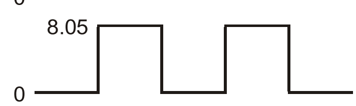


The output waveform is

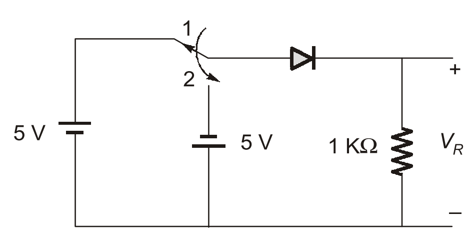
(a)


(b)


(c)


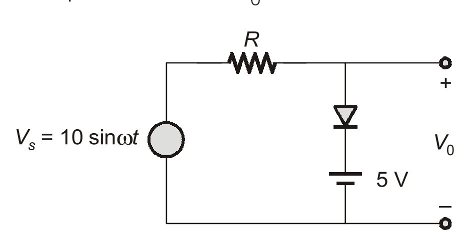
(d)


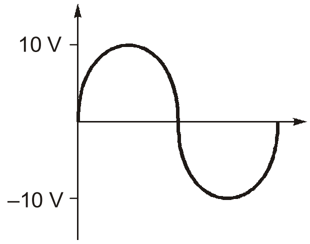
Q.5 In the circuit shown below, the switch was connected to position 1 at $t < 0$ and at $t = 0$, it is changed to position 2. Assume that the diode has zero voltage drop and a storage time t_s. For $0 < t \le t_s$, V_R is given by (all in Volts)

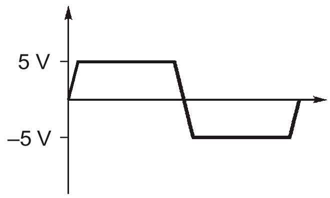


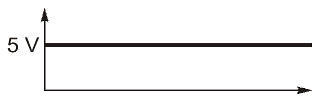
(a) $V_R = -5$ (b) $V_R = 0$
(c) $0 \le V_R < 5$ (d) $-5 < V_R < 0$

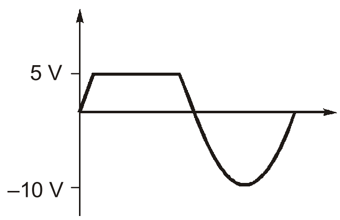
Q.6 For the circuit shown below assuming ideal diode, the output waveform V_0 is



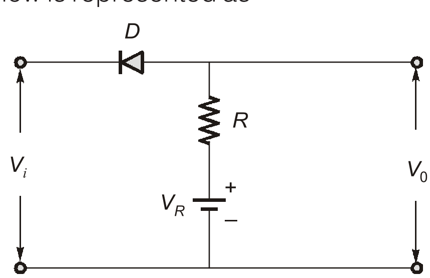
(a)


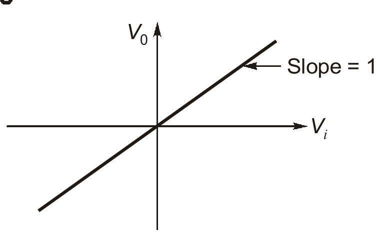
(b)


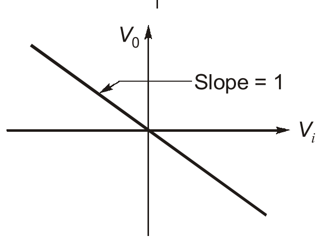
(c)


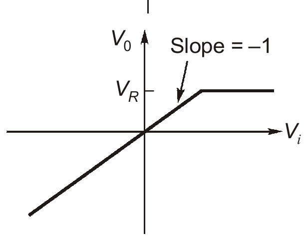
(d)


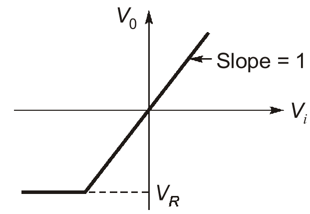
Q.7 The transfer characteristic of the network shown below is represented as



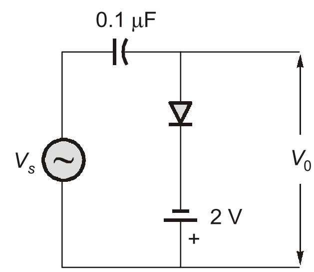
(a)


(b)


(c)


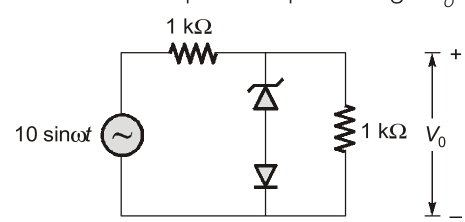
(d)


Q.8 For an input of V_s = 5 sinωt, (assuming ideal diode), circuit shown below will behave as a



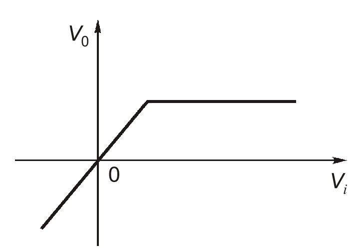
(a) clipper, sine wave clipped at –2 V
(b) clamper, sine wave clamped at –2 V
(c) clamper, sine wave clamped at zero volt
(d) clipper, sine wave clipped at 2 V

Q.9 The cut-in voltage of both Zener diode D_z and D shown in figure is 0.65 V, while breakdown voltage of the Zener is 3 V. Diode is considered to be ideal. The value of peak output voltage V_o.



(a) 3 V in the positive half cycle and 0.65 V in the negative half cycle.
(b) 3.65 V in the positive half cycle and –5 V in the negative half cycle.
(c) 3 V in positive half cycle and –5 V in the negative half cycle
(d) –3.65 V in positive half cycle and 5 V in the negative half cycle

Q.10 The voltage transfer characteristic as shown in the figure will relate to a

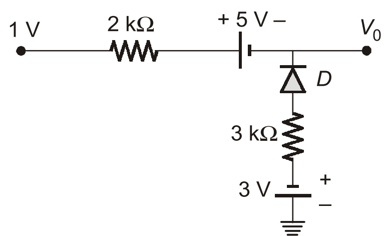


1. voltage regulator
2. half-wave rectifier
3. full-wave rectifier

Which of the above is/are correct?

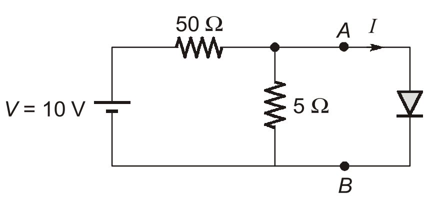
(a) 1 only (b) 2 only
(c) 1 and 2 (d) 1 and 3

Q.11 What is the output voltage V_0 for the circuit shown below assuming an ideal diode?



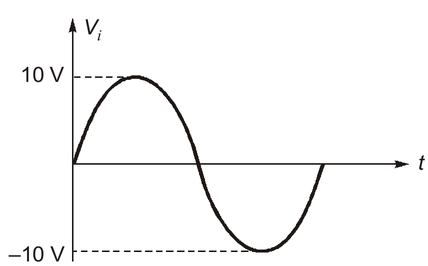
(a) $-\frac{18}{5}$ V (b) $\frac{18}{5}$ V
(c) $-\frac{13}{5}$ V (d) $\frac{13}{5}$ V

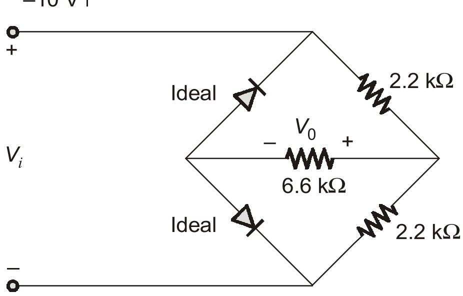
Q.12 What is the value of current I through the ideal diode in the circuit?

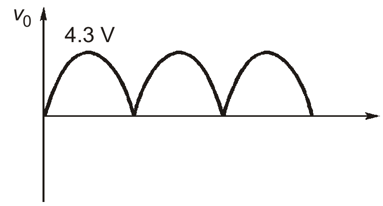


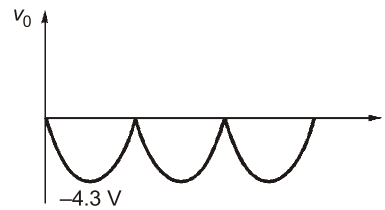
(a) 100 mA (b) 150 mA
(c) 200 mA (d) 250 mA

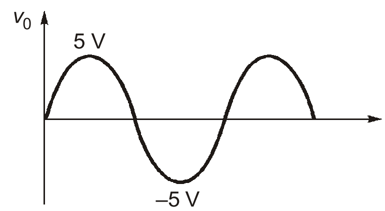
Q.13 The correct waveform for output (V_0) for below network is

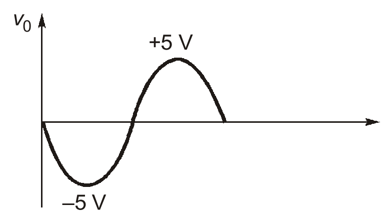




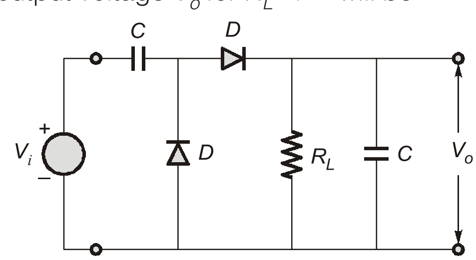
(a)


(b)


(c)


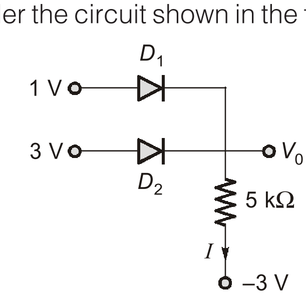
(d)


Q.14 Consider the below circuit, for $V_i = V_m \sin \omega t$, the output voltage V_o for $R_L \to \infty$ will be



(a) Zero (b) V_m
(c) $2\,V_m$ (d) $-V_m$

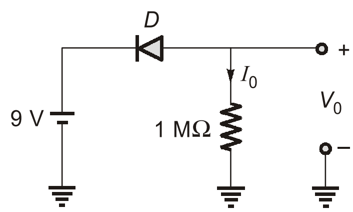
Q.15 Consider the circuit shown in the figure below



If diode D_1 and D_2 are made up of same material with the cut-in voltage $V_\gamma = 0.7$ V, then the value of current I is equal to

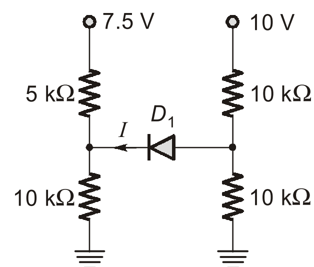
(a) 0.46 mA (b) 0.99 mA
(c) 0.59 mA (d) 1.06 mA

Q.16 Consider the diode circuit shown in the figure below:



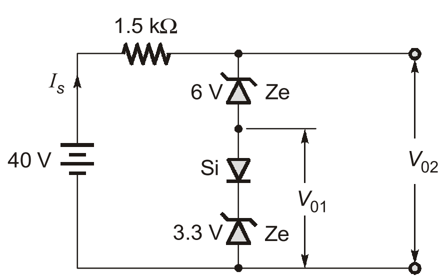
The diode in the circuit is a large high-current silicon device whose reverse leakage current is reasonably independent of voltage appearing on the diode. If V_0 = 1 V at 20° C, then the value of output voltage at 40°C is equal to _________ V.

Q.17 Consider the circuit shown in the figure below



If the cut-in voltage of the diode D_1 is equal to 0.7 V, then the value of current flowing through the diode is equal to ________ mA.

Q.18 A 40 V dc supply is connected across the network comprising of Zener and Silicon diodes as shown. The regulated voltages V_{01}, V_{02} and source current I_s are

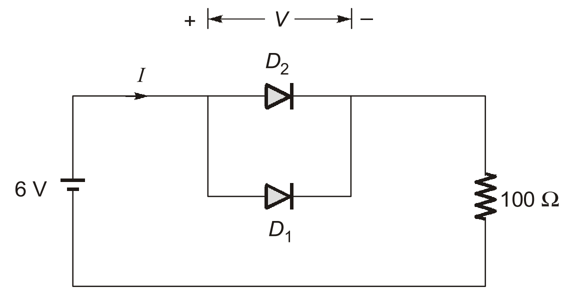


(a) 2.4 V, 5.1 V and 21.7 mA
(b) 3 V, 6 V and 22.7 mA
(c) 3.3 V, 9.3 V and 20.5 mA
(d) 4 V, 10 V and 20 mA

Q.19 A 700 mW maximum power dissipation diode at 25°C has 5 mW/°C de-rating factor. If the forward voltage drop remains constant at 0.7 V, the maximum forward current at 65°C is

(a) 700 mA (b) 714 mA
(c) 1 A (d) 1 mA

Q.20 In the given circuit, D_1 is an ideal germanium diode and D_2 is a silicon diode having its cut-in voltage as 0.7 V, forward resistance as 20 Ω and reverse saturation current (I_s) as 10 nA. What are the values of I and V for this circuit, respectively?



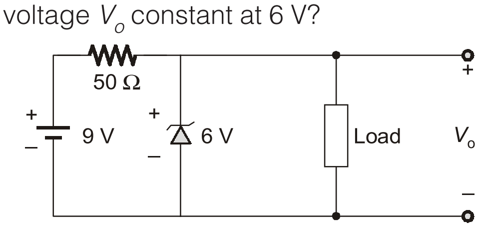
(a) 60 mA and 0 V (b) 50 mA and 0 V
(c) 53 mA and 0.7 V (d) 44 mA and 1.58 V

Q.21 Consider the following statements :
A clamper circuit
1. adds/subtracts a dc voltage to/from a waveform.
2. does not change the shape of the waveform.
3. amplifies the waveform.

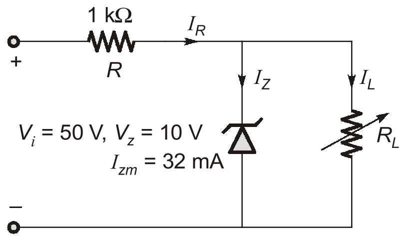
Of these statements
(a) 1 & 2 are correct (b) 1 & 3 are correct
(c) 2 & 3 are correct (d) 1, 2 & 3 are correct

Q.22 In order to rectify sinusoidal signals of millivolt range (< 0.6 V)
(a) bridge rectifier using diodes can be employed
(b) full-wave diode rectifier can be used
(c) a diode is to be inserted in the feedback loop of an OP-AMP
(d) a diode is to be inserted in the input of an OP-AMP

Q.23 A Zener diode in the circuit shown below has a knee current of 5 mA, and a maximum allowed power dissipation of 300 mW. What are the minimum and maximum load currents that can be drawn safely from the circuit, keeping the output voltage V_o constant at 6 V?

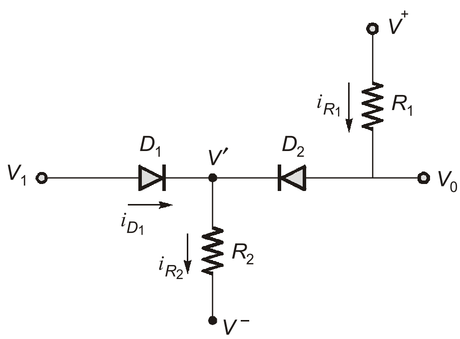


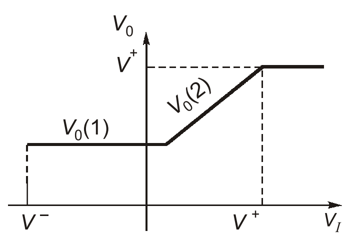
(a) 0 mA, 180 mA (b) 5 mA, 110 mA
(c) 10 mA, 55 mA (d) 60 mA, 180 mA



(a) $R_{L\,min} = 250\ \Omega$ (b) $I_{L\,min} = 8$ mA
(c) $R_{L\,max} = 1.25$ kΩ (d) $I_R = 40$ mA

Q.50 For the circuit shown below :

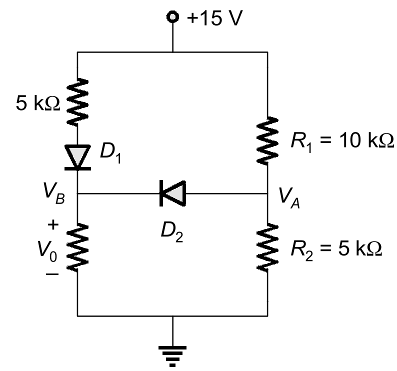




Assume the circuit parameters are R_1 = 5 kΩ, R_2 = 10 kΩ, V_γ = 0.7 V, V^+ = +5 V and V^- = – 5V

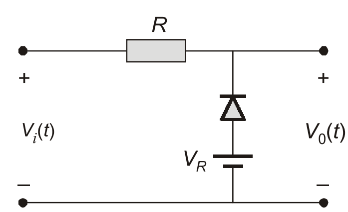
(a) For $V_1 = 0$, $i_{R1} = 0.62$ mA
(b) For $V_1 = 4$ V, $i_{R1} = 0.2$ mA
(c) For $V_1 = 4$ V, $i_{R2} = 0.83$ mA
(d) For $V_1 = 4$ V, $i_{D1} = 0.63$ mA

Q.51 For the circuit shown below :



Which of the following are correct?
(a) $V_A = 7.62$ V (b) $V_B = 6.92$ V
(c) $V_A = 5$ V (d) $V_B = 9.53$ V

Q.52 Assuming ideal diode characteristics, the input/output voltage relationship for the circuit shown in figure is



(a) When $V_i(t) \le V_R$; $V_0 = V_R$
(b) When $V_i(t) \le V_R$; $V_0 = V_i(t)$
(c) When $V_i(t) > V_R$; $V_0 = V_R$
(d) When $V_i(t) > V_R$; $V_0 = V_i(t)$

■■■■

Answers Diode Circuit and Power Supply

1. (c)	2. (c)	3. (c)	4. (d)	5. (a)	6. (d)	7. (c)
8. (b)	9. (b)	10. (a)	11. (a)	12. (c)	13. (a)	14. (c)
15. (d)	16. (4)	17. (0)	18. (d)	19. (b)	20. (a)	21. (a)
22. (c)	23. (c)	24. (a)	25. (c)	26. (b)	27. (d)	28. (c)
29. (b)	30. (b)	31. (a)	32. (d)	33. (c)	34. (a)	35. (c)
36. (c)	37. (d)	38. (c)	39. (d)	40. (b)	41. (c)	42. (b)
43. (d)	44. (b)	45. (d)	46. (c)	47. (c)	48. (c, d)	49. (a, b, c, d)
50. (a, b, c, d)	51. (c , d)	52. (a, d)				

Explanations **Diode Circuit and Power Supply**

1. (c)

$$\frac{dV_D}{dT} = -2.5 \text{ mV/°C}$$

$$\Delta V_D = 20 \times (-2.5 \text{ mV}) = -0.05 \text{ V}$$

$$\therefore \quad V_D + \Delta V_D = V_2 = 0.71 \text{ V}$$

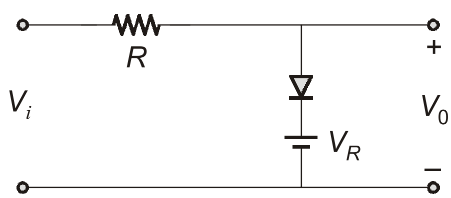
2. (c)

$$\frac{1}{r_d} = \frac{\partial I_D}{\partial V} = \frac{I_D}{V_T}$$

r_d : dynamic resistance.

$$\therefore \quad r_d = \frac{V_T}{I_D} = \frac{25}{4} = 6.25\ \Omega$$

3. (c)



Considering ideal diode :

for $V_i < V_R$, diode is OFF hence there is no current through R and $V_0 = V_i$.

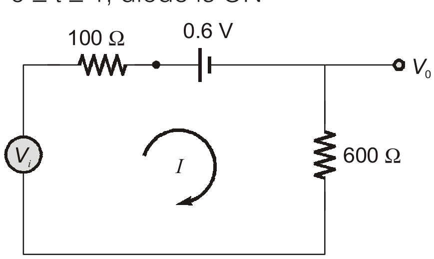
For $V_i > V_R$, diode is ON hence

$$V_0 = V_R$$

(as diode will act as short circuit)

4. (d)

For $0 \le t \le 1$, diode is ON



$$I = \frac{V_i - 0.6}{100 + 600} = \frac{10 - 0.6}{700}$$

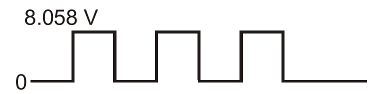
$$= 0.01343 \text{ A}$$

$$\therefore \quad V_0 = 600 \times 0.01343 = 8.058 \text{ V}$$

for $1 < t < 2$, diode is OFF, there will be no current in the circuit and hence

$$V_0 = 0 \text{ V}$$

Hence output waveform can be given as shown below:



5. (a)

For $0 < t < t_s$ diode will remain ON and hence

$$V_R + 5 = 0$$

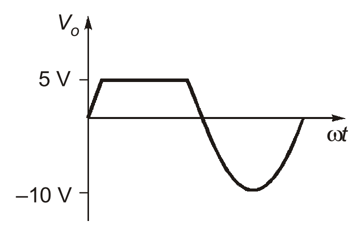
$$\therefore \quad V_R = -5 \text{ V}$$

6. (d)

For $0 \le V_i < V_R$ = diode is OFF $\Rightarrow V_0 = V_i$

For $V_R \le V_i \Rightarrow$ diode is ON $\Rightarrow V_0 = 5$ V

Hence output waveform can be as shown below

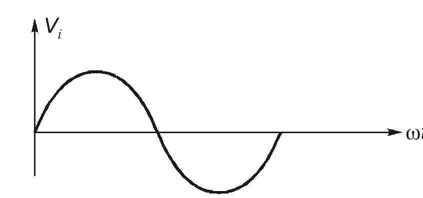


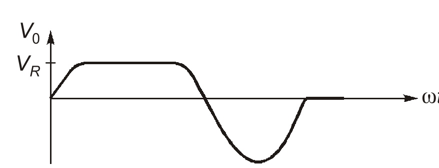
7. (c)

For $V_i < V_R$ = Diode is OFF $\Rightarrow V_0 = V_i$

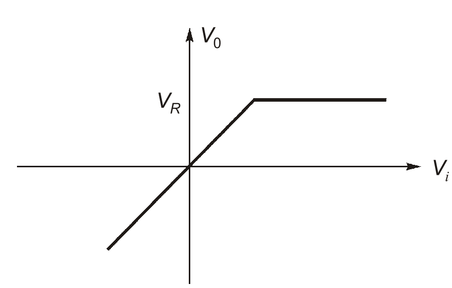
For $V_i > V_R$ = Diode is ON $\Rightarrow V_0 \simeq V_R$

Hence for a sinusoidal input, output can be shown as below

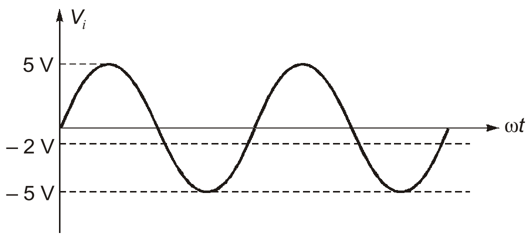




Hence characteristic can be as shown below



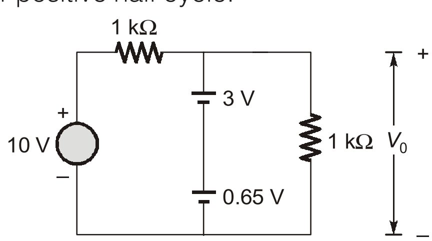
8. (b)



Hence given circuit acts as a clamper, sine wave clamped at – 2 V.

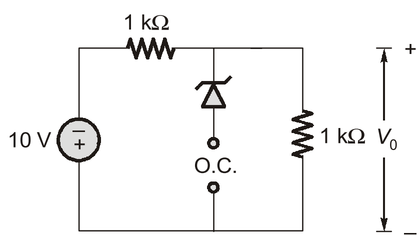
9. (b)

For positive half cycle:



So, $V_o = 3.65$ V

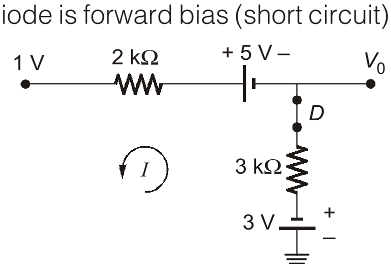
In negative half cycle:



So, $V_o = -5$ V

11. (a)

∵ Diode is forward bias (short circuit)



By applying KVL,

$3\text{ V} + 3\text{ k}\Omega I - 5\text{ V} + 2\text{ k}\Omega I + 1\text{ V} = 0$

$$I = \frac{1\text{V}}{5\text{k}\Omega} = \frac{1}{5}\text{ mA}$$

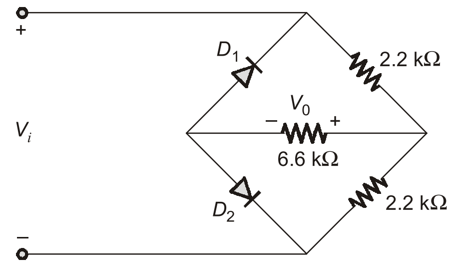
$$\therefore \quad V_o = -3 - 3\times\frac{1}{5} = -\frac{18}{5}\text{ V}$$

12. (c)

∵ Diode is in forward bias (short circuit)

$$I = \frac{10}{50} = 0.2\text{ A} = 200\text{ mA}$$

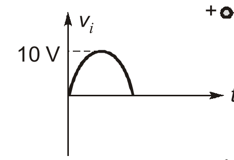
13. (a)

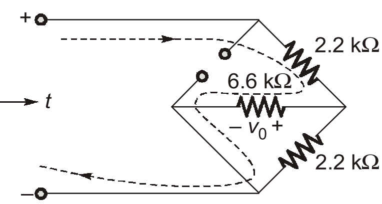


For positive half cycle of input voltage

$D_1 \rightarrow$ OFF

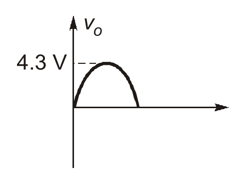
$D_2 \rightarrow$ ON



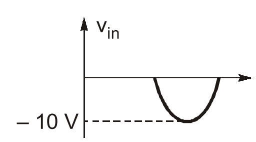


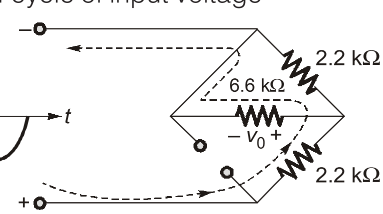
$$V_{0max} = \frac{[6.6\text{ k}\Omega \parallel 2.2\text{ k}\Omega]}{2.2\text{ k}\Omega + [6.6\text{ k}\Omega \parallel 2.2\text{ k}\Omega]} V_{i\,max}$$

$$= \frac{0.75}{1+0.75}\times 10\text{ V} = 4.3\text{ V}$$



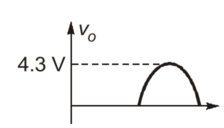
For negative half cycle of input voltage





$$V_{0max} = \frac{[6.6\text{ k}\Omega \parallel 2.2\text{ k}\Omega]}{2.2\text{ k}\Omega + [6.6\text{ k}\Omega \parallel 2.2\text{ k}\Omega]} V_{i\,max}$$

$$= \frac{0.75}{1+0.75}\times 10\text{ V} = 4.3\text{ V}$$



Still the polarity of output voltage is in the same direction. So, net output of the circuit will be a full rectified wave.