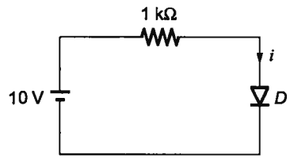
2 Diode Applications

Multiple Choice Questions

Q.1 The V-I characteristics of a pn-diode is shown below:

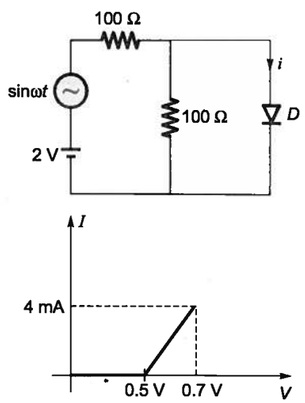


$$i = \begin{cases} \dfrac{V-0.7}{500} & V \geq 0.7 \\ 0 & V < 0.7 \end{cases}$$

Calculate the current i.

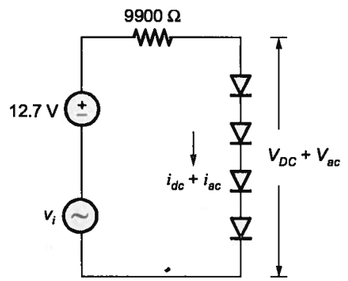
(a) 9.3 mA (b) 6.2 mA
(c) 10 mA (d) 5.2 mA

Q.2 Calculate the current i in the circuit shown below:



(a) $0.5\,(1 + \sin\omega t)$ mA
(b) $5\,(1 + \sin\omega t)$ mA
(c) $50\,(1 + \sin\omega t)$ mA
(d) $0.05\,(1 + \sin\omega t)$ mA

Q.3 In the circuit shown below, assume that the voltage drop across a forward biased diode is 0.7 V. The thermal voltage $V_T = kT/q = 25$ mV. The small signal input $V_i = V_p \cos \omega t$, where $V_p = 100$ mV



(i) The bias current I_{DC} through the diode is
(a) 1 mA (b) 1.28 mA
(c) 1.5 mA (d) 2 mA

(ii) The *ac* output voltage V_{ac} is
(a) 0.25 cos ωt mV (b) 1 cos ωt mV
(c) 2 cos ωt mV (d) 22 cos ωt mV

Q.4 In a half-wave rectifier, if an a.c. supply is 60 Hz, then what is the a.c. ripple frequency at output?

(a) 30 Hz (b) 60 Hz
(c) 120 Hz (d) 15 Hz

[ESE-2005]

Q.5 A half-wave rectifier having a resistance load of 1 kΩ rectifies an a.c. voltage of 325 V peak value and the diode has a forward resistance of 100 Ω. What is the RMS value of the current?

(a) 295.4 mA (b) 94.0 mA
(c) 147.7 mA (d) 208.0 mA

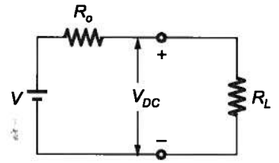
[ESE-2005]

Q.6 In a centre tap full wave rectifier, 100 V is the peak voltage between the centre tap and one end of the secondary. What is the maximum voltage across the reverse biased diode?

(a) 200 V (b) 141 V
(c) 100 V (d) 86 V

[ESE-2005 (EE)]

Q.7 The circuit shown below is the Thevenin's equivalent circuit of a centre-tapped full wave rectifier with diode forward resistance $R_f = 100$ Ω, transformer secondary coil resistance $R_S = 30$ Ω, peak input voltage $V_m = 10$ V.
What are the values of V and R_0, respectively?



(a) 10 V, 100 Ω (b) 6.36 V, 130 Ω
(c) 6.36 V, 115 Ω (d) 4.54 V, 130 Ω

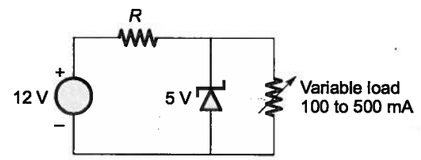
[ESE-2006 (EE)]

Q.8 If an input periodic signal with non-zero d.c. component is impressed upon a high-pass RC circuit, what will be the d.c. component in the output waveform?

(a) Zero
(b) It depends on the value of the capacitor
(c) It depends on the value of the resistor
(d) Same as that in input

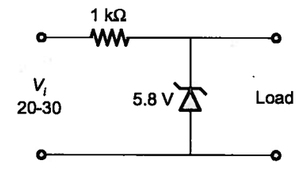
[ESE-2006 (EE)]

Q.9 In the voltage regulator shown in the figure. The load current can vary from 100 mA to 500 mA. Assuming that the Zener diode is ideal (i.e. the Zener knee current is negligibly small and Zener resistance is zero in the breakdown region). The value of R is



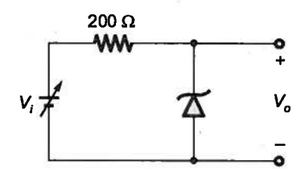
(a) 7 Ω (b) 70 Ω
(c) $\frac{70}{3}$ Ω (d) 14 Ω

Q.10 The Zener diode in the regulator circuit shown in figure has a Zener voltage of 5.8 V and a Zener knee current of 0.5 mA. The maximum load current drawn from this circuit ensuring proper functioning over the input voltage range between 20 and 30 V is



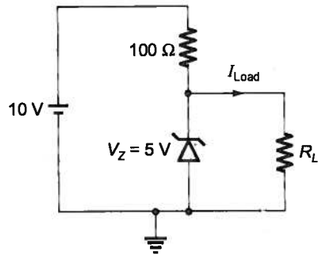
(a) 23.7 mA (b) 14.2 mA
(c) 13.7 mA (d) 24.2 mA

Q.11 For the Zener diode shown in the figure, the Zener voltage at knee is 7 V, the knee current is negligible and the Zener dynamic resistance is 10 Ω. If the input voltage V_i range from 10 V to 16 V, the output voltage V_o ranges from



(a) 7.00 to 7.29 V (b) 7.14 to 7.29 V
(c) 7.14 to 7.43 V (d) 7.29 to 7.43 V

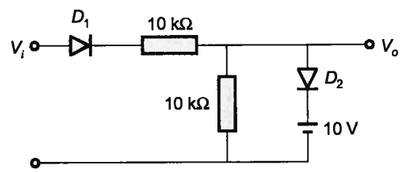
Q.12 In the circuit shown below, the knee current of the ideal Zener diode is 10 mA. To maintain 5 V across R_L, the minimum value of R_L in Ω and the minimum power rating of the Zener diode in mW respectively are



(a) 125 and 125 (b) 125 and 250
(c) 250 and 125 (d) 250 and 250

[GATE-2013]

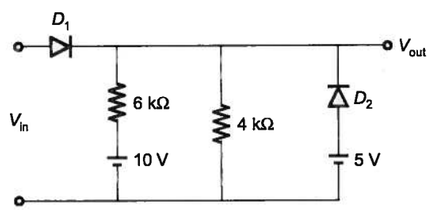
Q.13 Consider the following circuit



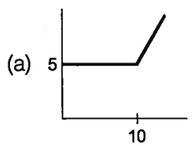
For the circuit shown above, which one of the following is correct statement?

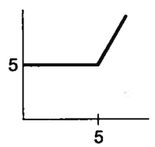
(a) D_2 does not conduct for any valve of V_i
(b) $V_o = 10$ V for all valves of $V_i > 10$ V
(c) $V_o = 0$ V for all valves of $V_i < 0$ V
(d) $V_o = 10$ V for all valves of $V_i > 0$ V

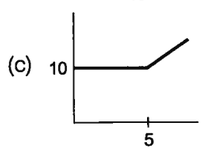
Q.14

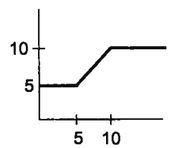


Which one of the following represents the transfer characteristics

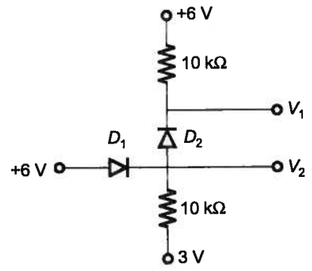
(a) 

(b) 

(c) 

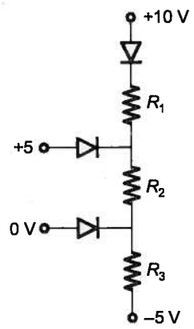
(d) 

Q.15 The voltage at V_1 and V_2 of the arrangement shown in figure will be respectively.



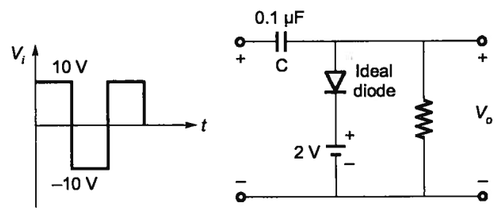
(a) 6 V and 5.4 V (b) 5.4 V and 6 V
(c) 3 V and 5.4 V (d) 6 V and 3 V

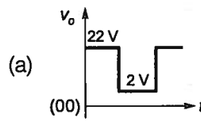
Q.16 The cut in voltage for each diode in figure is $V_r = 0.7$ V, each diode current is 0.5 mA. The valve of R_1, R_2 and R_3 will be

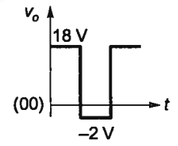


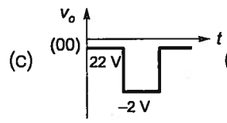
(a) 10 kΩ, 5 kΩ, 2.86 kΩ
(b) 6 kΩ, 3 kΩ, 3.43 kΩ
(c) 5 kΩ, 6 kΩ, 4.93 kΩ
(d) 6 kΩ, 8 kΩ, 6.43 kΩ

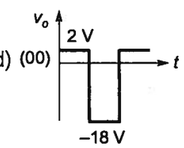
Q.17 Select the correct output (V_o) wave shape for a given input (V_i) in the clamping network given below:



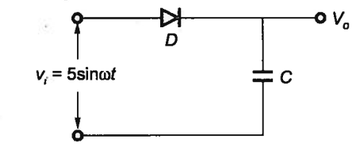
(a) 

(b) 

(c) 

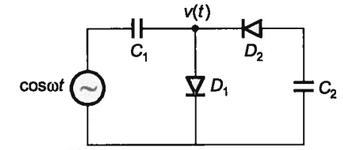
(d) 

Q.18 Find V_o in the circuit



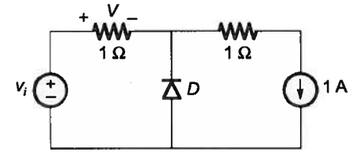
(a) 0 V (b) 5 V
(c) −5 V (d) 10 V

Q.19 The diodes and capacitors in the circuit shown are ideal. The voltage $v(t)$ across diode D_1 is



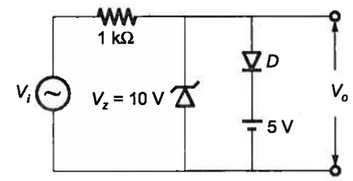
(a) $\cos\omega t - 1$ (b) $\sin\omega t$
(c) $1 - \cos\omega t$ (d) $1 - \sin\omega t$

Q.20 In the circuit below, the diode is ideal. The voltage V is given by

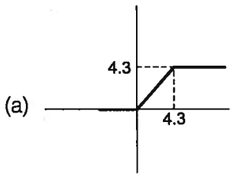


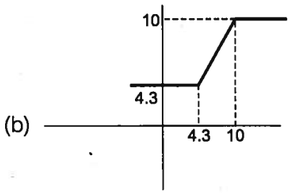
(a) min (v_i, 1) (b) max (v_i, 1)
(c) min ($-v_i$, 1) (d) max ($-v_i$, 1)

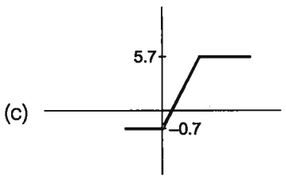
Q.21 A clipper circuit is shown below:

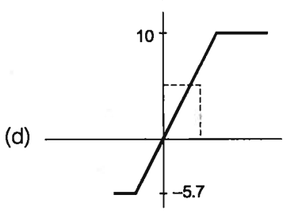


Assuming forward bias voltage drops of the diodes to be 0.7 V, the input-output transfer characteristics of the circuit is

(a) 

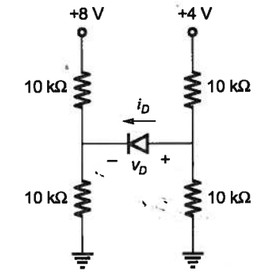
(b) 

(c) 

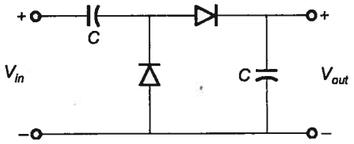
(d) 

80 Numerical Data Type Questions

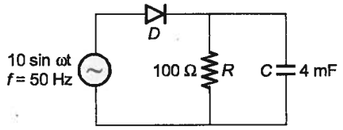
Q.22 For the circuit in the figure below. The value of v_D is _____ volts.



Q.23 If the input to the circuit given below is $10 \sin \omega_0 t$ then the output to the circuit will be _____ V.

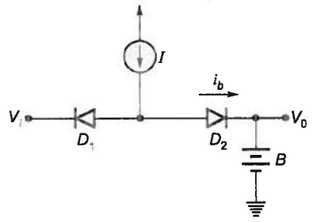


Q.24 The figure shows a half-wave rectifier. The diode D is ideal. The average steady-state current (in Amperes) through the diode is approximately _____.



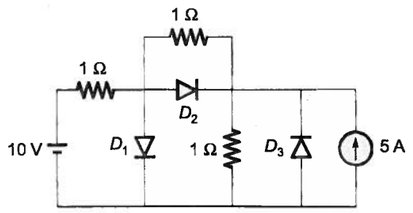
[GATE-2014]

Q.25 The circuit shown in the figure (given below) is a model for a battery charger. Here V_i is a 10 V peak sine wave, D_1 and D_2 are ideal diodes, I is a 100 mA current source, and B is a 4.5 V battery. The average value of i_b is _____ mA.



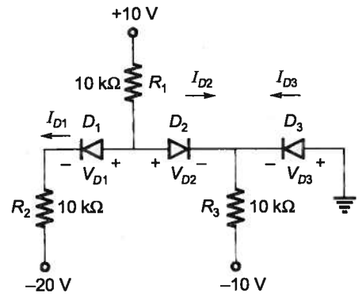
Try Yourself

T1. What are the states of the three ideal diodes of the circuit shown in figure?



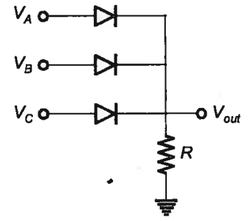
(a) D_1 ON, D_2 OFF, D_3 OFF
(b) D_1 OFF, D_2 ON, D_3 OFF
(c) D_1 ON, D_2 OFF, D_3 ON
(d) D_1 OFF, D_2 ON, D_3 ON

T2. Consider the given circuit and the cut in voltage of each diode is $V_\gamma = 0.6$ V.



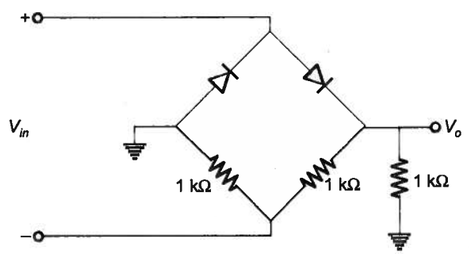
What is the value of I_{D1}, I_{D2}, I_{D3} respectively?
(a) 1.94, mA, –0.94 mA, 1.86 mA
(b) 1.47, mA, 0.94 mA, 0 mA
(c) 1.47, mA, 0 mA, 0.94 mA
(d) 1.94, mA, 0 mA, 0.94 mA

T3. In the figure shown below the diodes are ideal

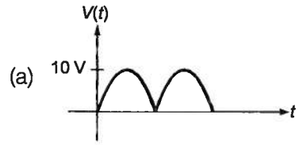


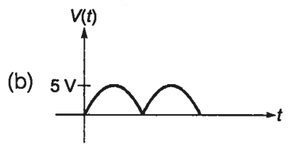
the output of the circuit when $V_A = 5$ V, $V_B = 3$ V, and $V_C = 1$ V will be
(a) 3 V (b) 0 V
(c) 5 V (d) 1 V

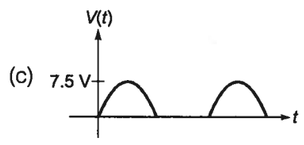
T4. Consider the circuit shown below,

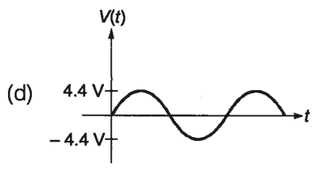


If the input of the signal is 10 sin $\omega_0 t$ then the output of the signal will be

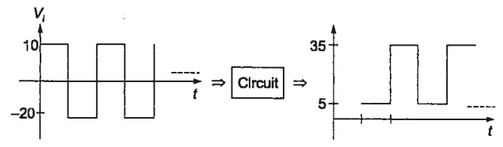
(a)


(b)


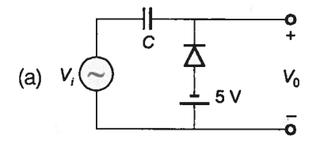
(c)


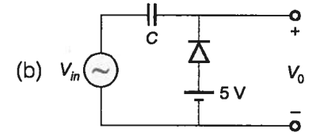
(d)


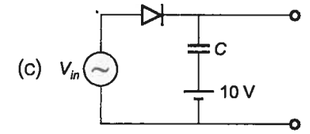
T5. In the figure shown below we know the input and output waveform of the circuit



the expected circuit that will replace the box given above will be.

(a)


(b)


(c)


(d)