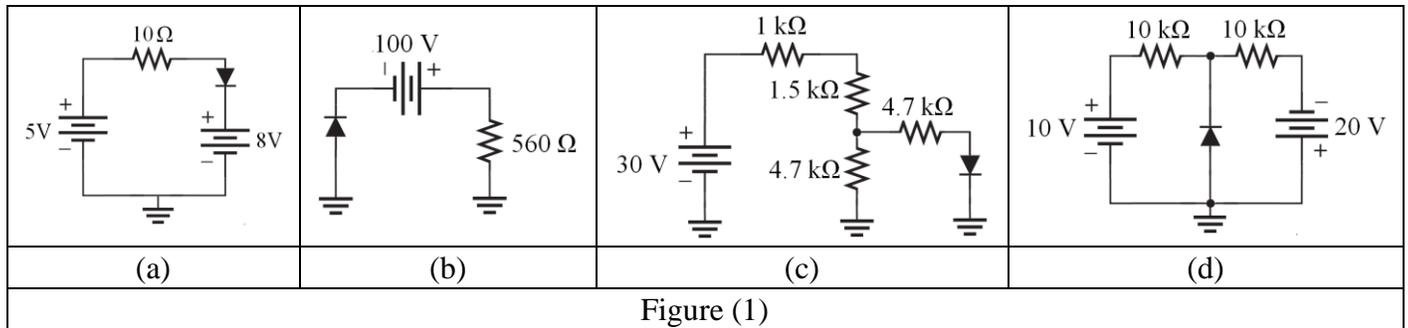




- Determine whether each silicon diode in Figure (1) is forward-biased or reverse-biased.
- Determine the voltage across each diode in Figure (1), assuming the practical model.
- Determine the voltage across each diode in Figure (1), assuming an ideal diode.
- Determine the voltage across each diode in Figure (1), using the complete diode model with  $r'_d = 10 \Omega$  and  $r'_R = 100 \text{ M}\Omega$ .



- Find the value of  $V_T$  at  $20^\circ\text{C}$ . [Ans. 25:27mV]
- Consider a silicon diode of  $n=1$ , find the change in the diode voltage if the current changes from 0.1 mA to 10 mA. [Ans. 115.1 mV]
- A silicon junction diode has  $v_D = 0.7\text{V}$  at  $i_D = 1\text{mA}$ . Find the voltage drop at  $i_D = 0.1\text{mA}$  and  $i_D = 10\text{mA}$  [Ans. 0.64 V; 0.76 V]
- Using the fact that a silicon diode has  $I_s = 10^{-14}\text{A}$  at  $25^\circ\text{C}$  and that it increases by 15% per  $1^\circ\text{C}$  rise in temperature, find the value of  $I_s$  at  $125^\circ\text{C}$ . [Ans.  $1.17 \times 10^{-8} \text{ A}$ ]
- Consider the half-wave rectifier circuit of Figure (2) with the diode reversed. Let  $v_i$  be a sinusoidal with 12V peak amplitude, and let  $R = 1.5\text{k}\Omega$ . Use the constant-voltage drop diode model with  $V_D = 0.7\text{V}$ .
  - Sketch the waveform of  $v_o$ .
  - Find the average value of  $V_o$ .
  - Find the peak current in the diode.
  - Find the PIV of the diode.
  - Sketch the transfer characteristics of the circuit.

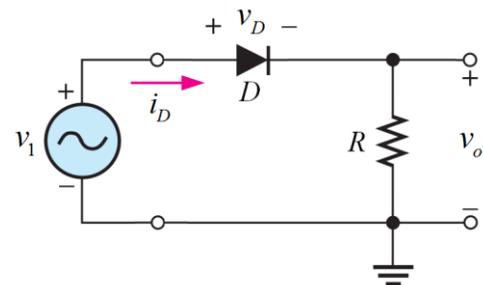


Figure (2)



10. A diode circuit that can generate an OR logic function is shown in Figure (3). A positive logic convention denotes logic 0 for 0V and logic 1 for a positive voltage, typically 5V. Show the truth table that illustrates the logic output.

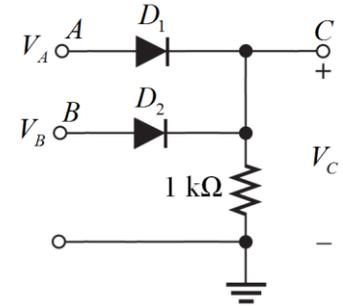


Figure (3)

11. A diode circuit that can generate an AND logic function is shown in Figure (4). A positive logic convention denotes logic 0 for 0V and logic 1 for a positive voltage, typically 5V. Show the truth table that illustrates the logic output.

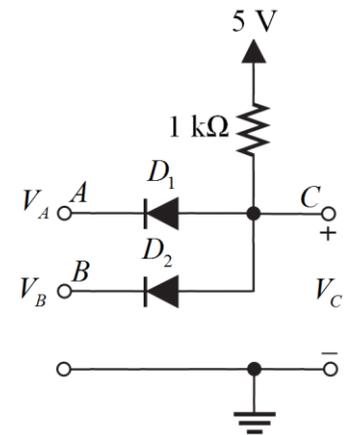


Figure (4)

12. Find voltage  $v_L$  in the circuit of Figure (5) where D is an ideal diode.

**Hint:** the analysis is simplified if a Thevenin equivalent is found for the circuit to the left of terminals a & b]

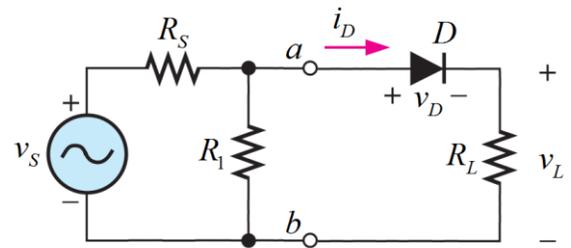


Figure (5)

13. Determine the average value of the waveforms shown in Figure (6) if its peak amplitude,  $V_p$ , is 155V.

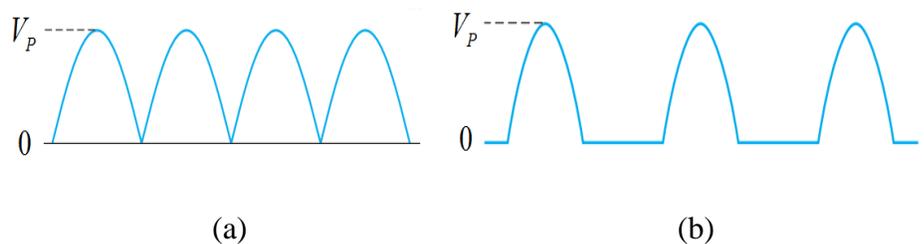


Figure (6)



14. Consider a half-wave rectifier circuit of Figure (7) with a  $1\text{k}\Omega$  load operates from a  $220\text{V}$  (rms)  $50\text{Hz}$  supply through a  $10:1$  step-down transformer. It uses a silicon diode that can be modeled to have a  $0.7\text{V}$  drop for any current. What is the peak voltage of the rectified output? What is the average output voltage? What is the average current in the load? What is the PIV of the diode?

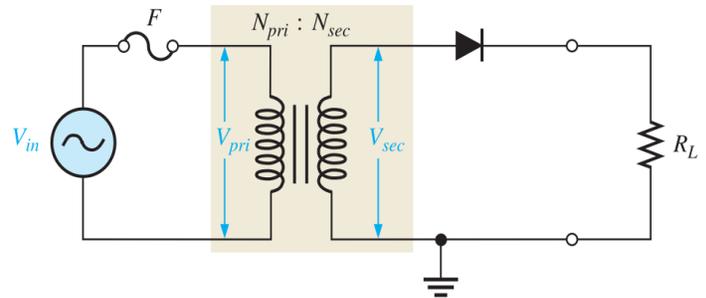


Figure (7)

15. Consider a full-wave rectifier circuit of Figure (8) with a  $1\text{k}\Omega$  load operates from a  $220\text{V}$  (rms)  $50\text{Hz}$  supply through a  $5:1$  transformer having a center-tapped secondary winding. It uses two silicon diodes that can be modeled to have a  $0.7\text{V}$  drop for all currents. What is the peak voltage of the rectified output? What is the average output voltage? What is the average current in the load? What is the PIV of the diode 2?

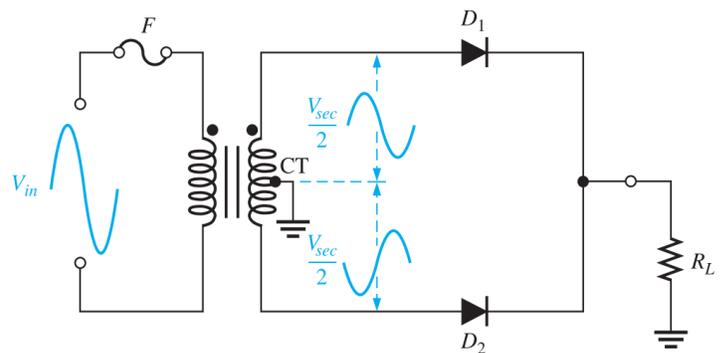


Figure (8)

16. Consider a full-wave bridge rectifier circuit of Figure (9) with a  $10\text{k}\Omega$  load operates from a  $220\text{V}$  (rms)  $50\text{Hz}$  supply through a  $10:1$  step-down transformer having a single secondary winding. It uses four diodes, each of which can be modeled to have a  $0.7\text{V}$  drop for any current. What is the peak value of the rectified voltage across the load? What is the average voltage across the load? What is the average current through the load? What is the PIV of each diode?

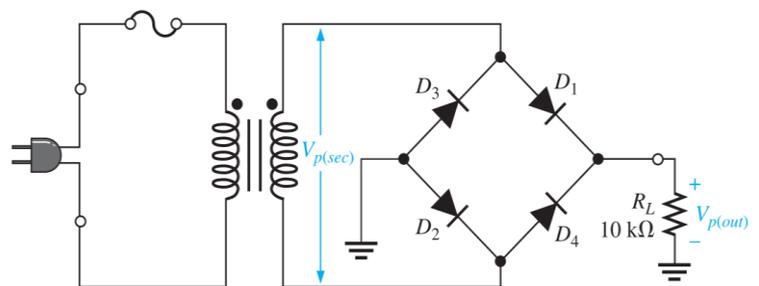


Figure (9)



### **Design Problems**

17. It is required to design a half-wave rectifier circuit using the circuit of Figure (7) to provide an average output voltage of 100V. Find the required turns ratio of the transformer. Assume that a conducting diode has a voltage drop of 0.7V. The ac line voltage is 120V rms.
18. Repeat problem 17 for Figure (8).