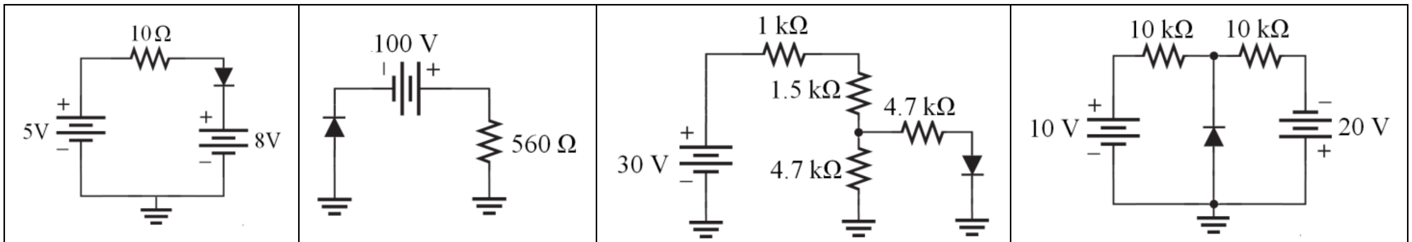
Benha university
Faculty of Engineering at Shoubra
Electrical Engineering Department
Electrical Power and Machines Section

Electronics (EPE 170)
1st Year,
Sheet 2, Diodes and Applications
Second Semester, 2016/2017

1. Determine whether each silicon diode in Figure (1) is forward-biased or reverse-biased.
2. Determine the voltage across each diode in Figure (1), assuming the practical model.
3. Determine the voltage across each diode in Figure (1), assuming an ideal diode.
4. Determine the voltage across each diode in Figure (1), using the complete diode model with r'_d =10 Ω and r'_R=100 MΩ.



(a)	(b)	(c)	(d)

Figure (1)

5. Find the value of V_T at 20ºC. **[Ans. 25:27mV]**

6. 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]**

7. A silicon junction diode has v_D = 0.7V at i_D = 1mA. Find the voltage drop at i_D = 0.1mA and i_D =10mA **[Ans. 0.64 V; 0.76 V]**

8. Using the fact that a silicon diode has I_s =10^{-14}A at 25ºC and that is increases by 15% per 1ºC rise in temperature, find the value of I_s at 125ºC. **[Ans. 1.17 ×10^{-8} A]**

9. 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 = 1.5kΩ. Use the constant-voltage drop diode model with VD = 0.7V.
   a. Sketch the waveform of v_O.
   b. Find the average value of V_O.
   c. Find the peak current in the diode.
   d. Find the PIV of the diode.
   e. Sketch the transfer characteristics of the circuit.

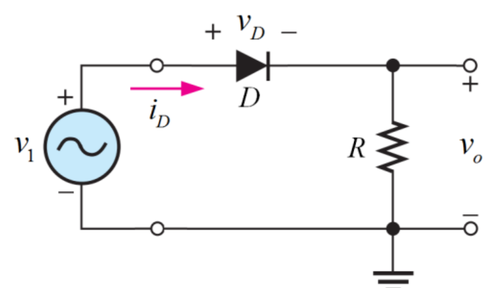


Figure (2)

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.

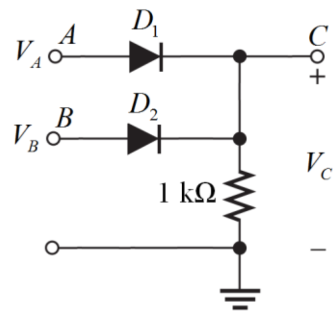


Figure (3)

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.

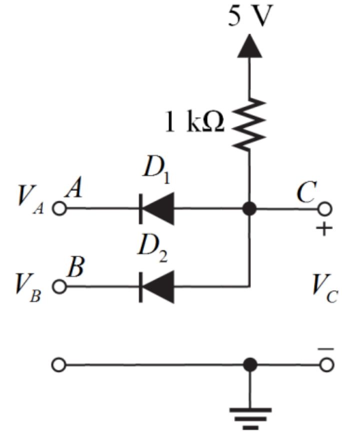


Figure (4)

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]

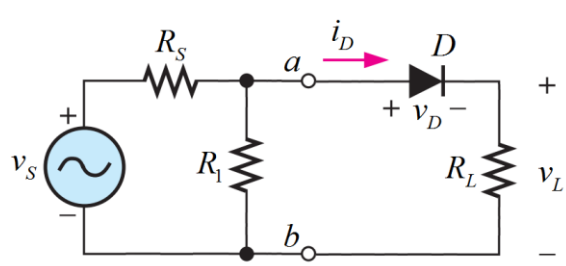
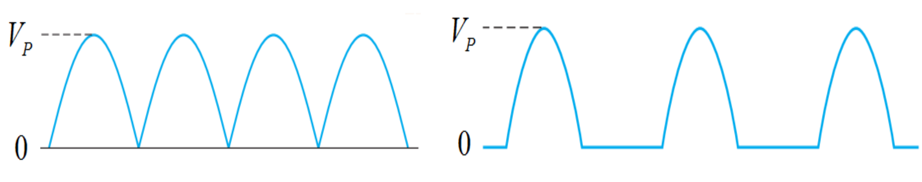


Figure (5)

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



(a) (b)

Figure (6)

14. Consider a half-wave rectifier circuit of Figure (7) with a 1kΩ load operates from a 220V (rms) 50Hz supply through a 10:1 step-down transformer. It uses a silicon diode that can be modeled to have a 0.7V 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?

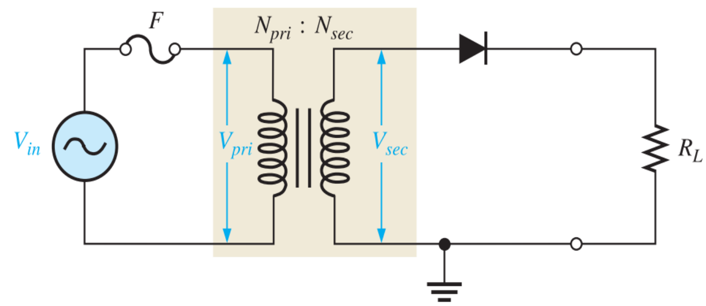


Figure (7)

15. Consider a full-wave rectifier circuit of Figure (8) with a 1kΩ load operates from a 220V (rms) 50Hz supply through a 5:1 transformer having a center-tapped secondary winding. It uses two silicon diodes that can be modeled to have a 0.7V 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?

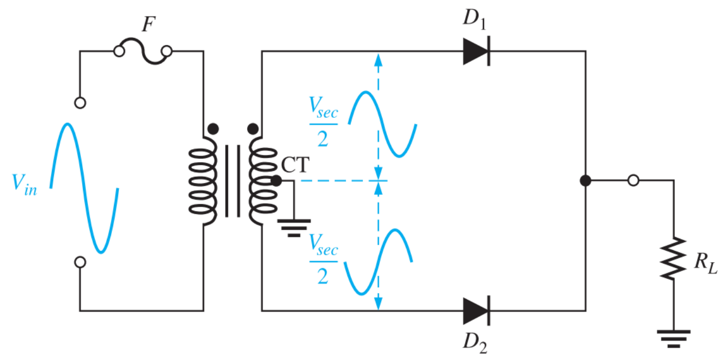


Figure (8)

16. Consider a full-wave bridge rectifier circuit of Figure (9) with a 10kΩ load operates from a 220V (rms) 50Hz 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 0.7V 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?

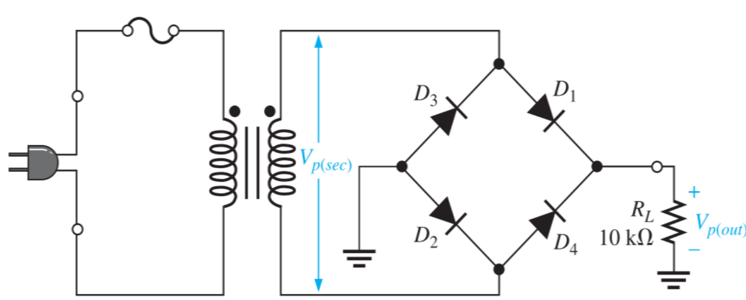


Figure (9)

Design Problems

17. It is required to design a fall-wave rectifier circuit using the circuit of Figure (8) 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 (9).