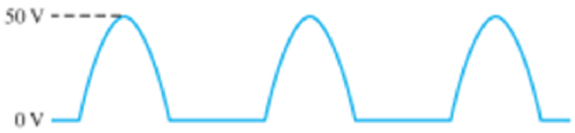
Electronic Engineering

Shee2: Diodes

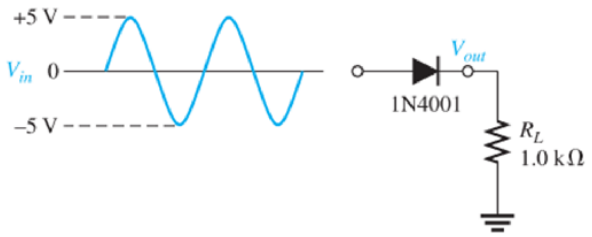
1- What is the average value of the half-wave rectified voltage in the below Figure?



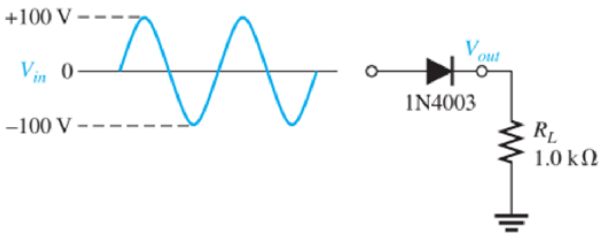
$$V_{AVG} = \frac{V_p}{\pi} = \frac{50\text{ V}}{\pi} = \mathbf{15.9\text{ V}}$$

Notice that V_{AVG} is 31.8% of V_p.

2- Draw the output voltages of each rectifier for the indicated input voltages, as shown in the below Figure.



(a)



(b)

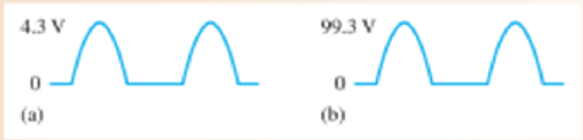
The peak output voltage for circuit (a) is

$$V_{p(out)} = V_{p(in)} - 0.7\text{ V} = 5\text{ V} - 0.7\text{ V} = \mathbf{4.30\text{ V}}$$

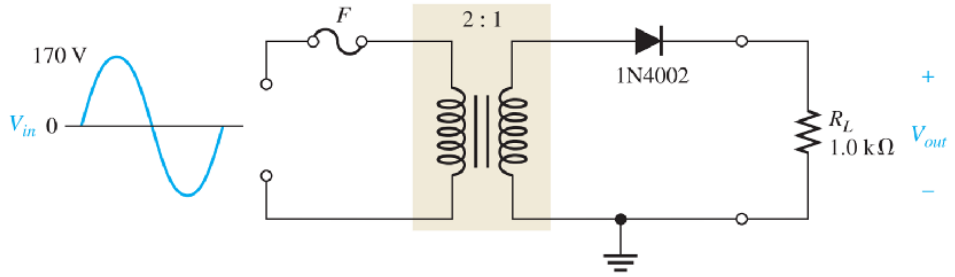
The peak output voltage for circuit (b) is

$$V_{p(out)} = V_{p(in)} - 0.7\text{ V} = 100\text{ V} - 0.7\text{ V} = \mathbf{99.3\text{ V}}$$

The output voltage waveforms are shown in Figure 2–25. Note that the barrier potential could have been neglected in circuit (b) with very little error (0.7 percent); but, if it is neglected in circuit (a), a significant error results (14 percent).



3- Determine the peak value of the output voltage for the below Figure if the turns ratio is 0.5.



$$V_{p(pri)} = V_{p(in)} = 170\text{ V}$$

The peak secondary voltage is

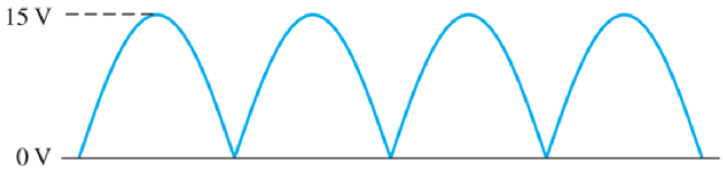
$$V_{p(sec)} = nV_{p(pri)} = 0.5(170\text{ V}) = 85\text{ V}$$

The rectified peak output voltage is

$$V_{p(out)} = V_{p(sec)} - 0.7\text{ V} = 85\text{ V} - 0.7\text{ V} = \mathbf{84.3\text{ V}}$$

where $V_{p(sec)}$ is the input to the rectifier.

4- Find the average value of the full-wave rectified voltage in the below Figure.

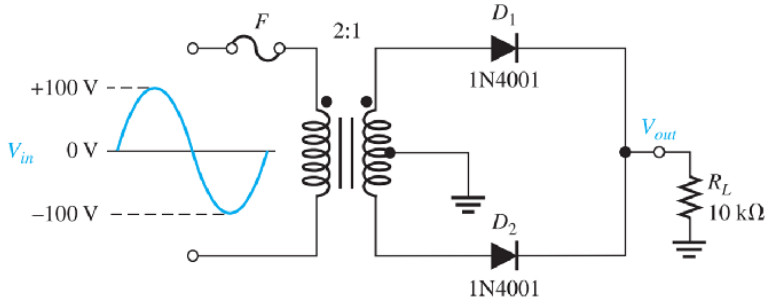


$$V_{AVG} = \frac{2V_p}{\pi} = \frac{2(15\text{ V})}{\pi} = \mathbf{9.55\text{ V}}$$

V_{AVG} is 63.7% of V_p.

5- (a) Show the voltage waveforms across each half of the secondary winding and across RL when a 100 V peak sine wave is applied to the primary winding in the below Figure.

(b) What minimum PIV rating must the diodes have?



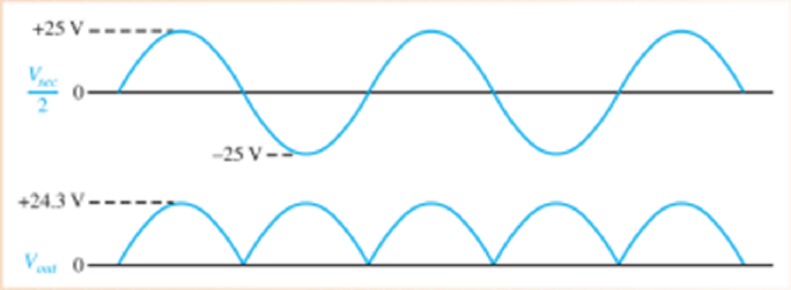
(a) The transformer turns ratio $n = 0.5$. The total peak secondary voltage is

$$V_{p(sec)} = nV_{p(pri)} = 0.5(100\text{ V}) = 50\text{ V}$$

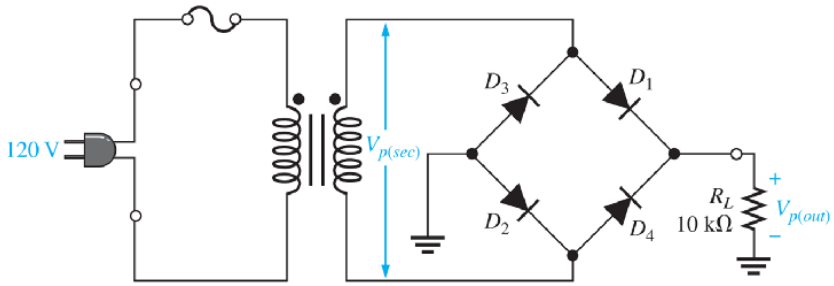
There is a 25 V peak across each half of the secondary with respect to ground. The output load voltage has a peak value of 25 V, less the 0.7 V drop across the diode. The waveforms are shown in Figure 2–37.

(b) Each diode must have a minimum PIV rating of

$$\text{PIV} = 2V_{p(out)} + 0.7\text{ V} = 2(24.3\text{ V}) + 0.7\text{ V} = \mathbf{49.3\text{ V}}$$



6- Determine the peak output voltage for the bridge rectifier in the below Figure. Assuming the practical model, what PIV rating is required for the diodes? The transformer is specified to have a 12 V rms secondary voltage for the standard 120 V across the primary.



The peak output voltage (taking into account the two diode drops) is

$$V_{p(sec)} = 1.414V_{rms} = 1.414(12\text{ V}) \cong 17\text{ V}$$
$$V_{p(out)} = V_{p(sec)} - 1.4\text{ V} = 17\text{ V} - 1.4\text{ V} = \mathbf{15.6\text{ V}}$$

The PIV rating for each diode is

$$\text{PIV} = V_{p(out)} + 0.7\text{ V} = 15.6\text{ V} + 0.7\text{ V} = \mathbf{16.3\text{ V}}$$