Tutorial

Q1: Determine whether each diode in Figure 1 is forward-biased or reverse-biased

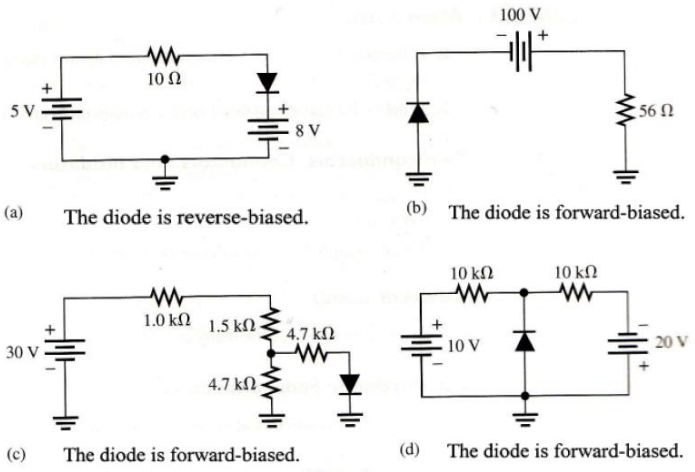


Figure 1

Q2: Draw the output voltage waveform for the circuit in Figure 2 and include the voltage values. Calculate the peak forward current through the diode.

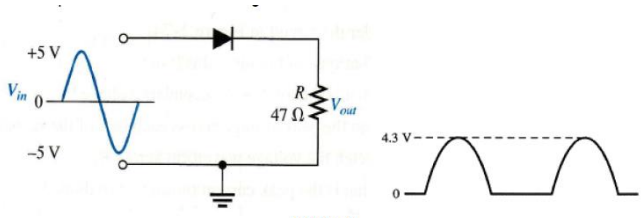


Figure 2

$$I_F = \frac{V_{(p)in} - 0.7\text{ V}}{R} = \frac{5\text{ V} - 0.7\text{ V}}{47\ \Omega} = \frac{4.3\text{ V}}{47\ \Omega} = \mathbf{91.5\ mA}$$

Q3: Determine the peak and average power delivered to RL in Figure 3.

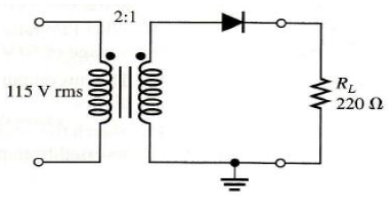


Figure 3

$$V_{sec} = nV_{pri} = (0.5)115\text{ V} = 57.5\text{ V rms}$$

$$V_{p(sec)} = 1.414(57.5\text{ V}) = 81.3\text{ V}$$

$$V_{avg(sec)} = \frac{V_{p(sec)}}{\pi} = \frac{81.3\text{ V}}{\pi} = 25.9\text{ V}$$

$$P_{L(p)} = \frac{(V_{p(sec)} - 0.7\text{ V})^2}{R_L} = \frac{(80.6\text{ V})^2}{220\ \Omega} = \mathbf{29.5\ W}$$

$$P_{L(avg)} = \frac{(V_{avg(sec)})^2}{R_L} = \frac{(25.9\text{ V})^2}{220\ \Omega} = \mathbf{3.05\ W}$$

Q4: Consider the circuit in Figure 4.

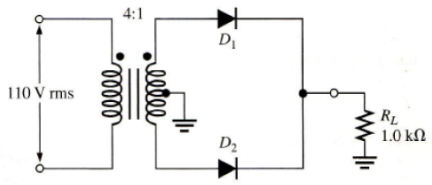


Figure 4

a) What type if circuit is this? **Center-tapped full-wave rectifier**

b) What is the total peak secondary voltage? $V_{p(sec)} = (0.25)(1.414)110\text{ V} = \mathbf{38.9\text{ V}}$

c) Find the peak voltage across each half of the secondary.

$$\frac{V_{p(sec)}}{2} = \frac{38.9\text{ V}}{2} = \mathbf{19.4\text{ V}}$$

d) Sketch the voltage waveform across R_L.

$V_{RL} = 19.4\text{ V} - 0.7\text{ V} = 18.7\text{ V}$

Q5: Sketch the output voltage of the bridge rectifier in Figure 5.

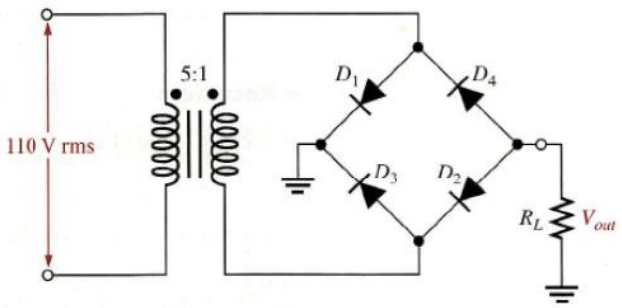


Figure 5

Q6: Determine the output voltage waveform for each circuit in Figure 6.

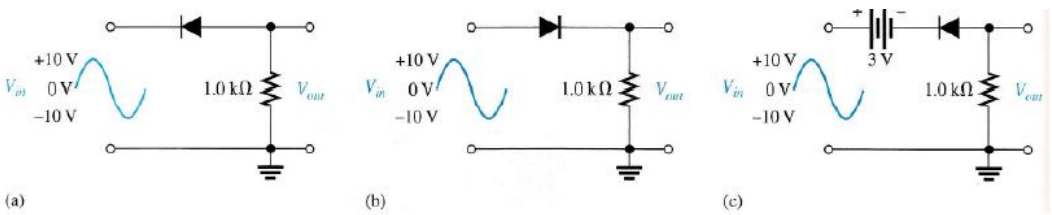
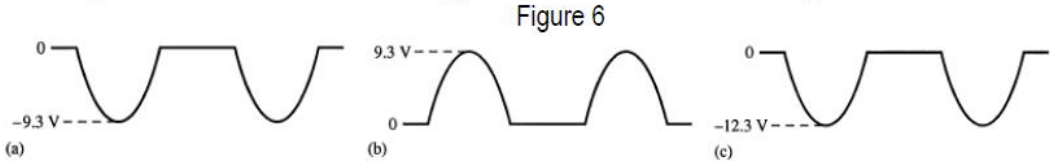


Figure 6



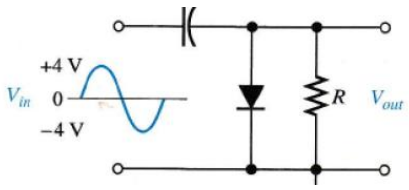
Q7: A full-wave rectifier produces an 80 V peak rectified voltage from a 60 Hz ac source. If a 10 μF filter capacitor is used, determine the ripple factor for a load resistance of 100 kΩ.

$$V_{r(pp)} = \frac{V_{p(in)}}{fR_LC} = \frac{80\text{ V}}{(120\text{ Hz})(100\text{k}\Omega)(10\ \mu\text{F})} = 0.67\text{ V}$$

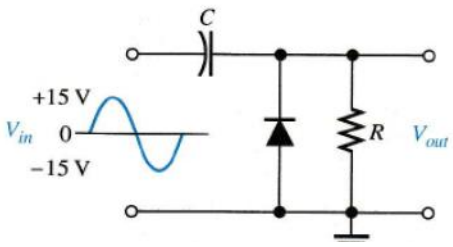
$$V_{DC} = \left(1 - \frac{1}{2fR_LC}\right)V_{p(in)} = \left(1 - \frac{1}{(240\text{ Hz})(100\text{k}\Omega)(10\ \mu\text{F})}\right)80\text{ V} = 79.67\text{ V}$$

$$r = \frac{V_{r(pp)}}{V_{DC}} = \frac{0.67\text{ V}}{79.67\text{ V}} = 8.41\text{x}10^{-3}$$

Q8: Describe the output waveform of each circuit in Figure 8, Assume the RC time constant is much greater than the period of the input.



A sine wave with a positive peak at 0.7 V, a negative peak at –7.3 V, and a dc value of –3.3 V.



A sine wave with a positive peak at 29.3 V, a negative peak at –0.7 V, and a dc value of +14.3 V.