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College of Science & Technology
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EPE 2165—Analog Electronics

HOMEWORK #2—Signals and amplifiers

Question:	1	2	3	4	5	Total
Points:	20	10	10	20	40	100
Score:						

Issued on: *June 23, 2022*
Due on: June 30, 2022

1. Figure 1 represents a portion of battery-charger circuit for a battery with a voltage V_B. The sine-wave input $v_S = 12\,\text{V}(rms)$, while the battery voltage varies from 12 V to 14 V from the discharged to fully charged states. The charging-source resistance $R_S = 10\,\Omega$. Assuming that D is an ideal diode, and $R_C = 50\,\Omega$ is a current-controlling resistor established by the designer:

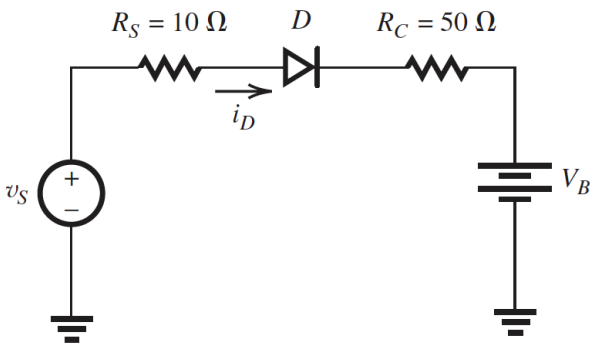

FIGURE 1. Battery-charger circuit

   (a) (10 points) Sketch and label the voltage waveforms of the voltage accros the diode and the current through the diode for $V_B = 12\,\text{V}$.

   (b) (10 points) What is the peak diode current?

2. (10 points) For the circuits shown in Figure 2, using ideal diodes, find the values the output voltage V_O and the currents I_{D1} and I_{D2}.

3. (10 points) The diode in the circuit shown in Figure 3 has a reverse-saturation current of $I_s = 5 \times 10^{-11} A$. Determine the diode voltage $V_D$and current I_D.

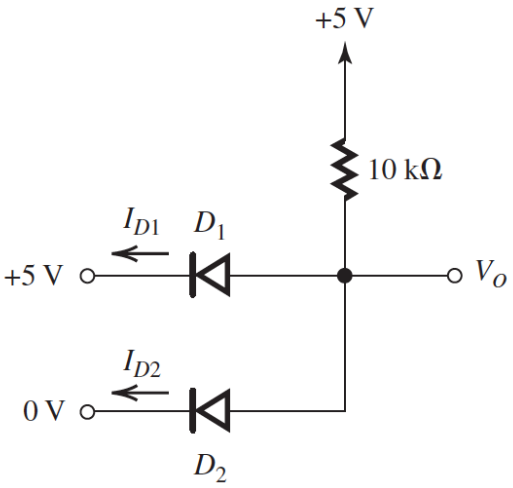

FIGURE 2

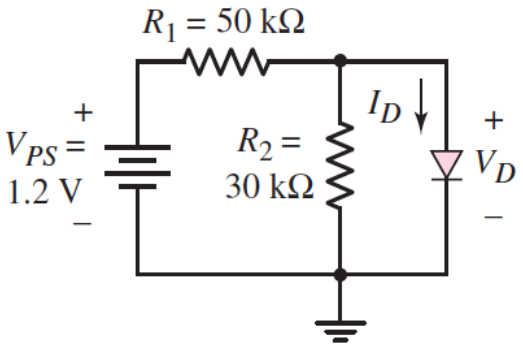

FIGURE 3

4. (20 points) Figure 4 shows a 4 diode circuit. The 4 diodes are identical and each diode exhibits a voltage drop of $V_D = 0.7V$ at a 1 mA current. For small input signals (e.g., 10-mV peak), find the small-signal equivalent circuit and use it to determine values of the small-signal transmission vo/vi for a current $I = 1\,\mu A$

5. Consider a half-wave rectifier circuit shown in Figure 5.

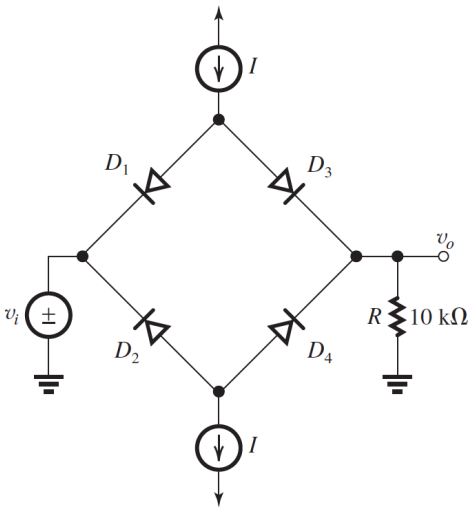

FIGURE 4

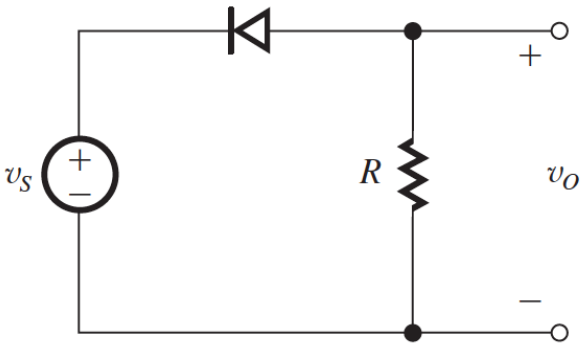

FIGURE 5

Let v_s be a sinusoid with 10V peak amplitude, and let $R = 1k$. Use the constant-voltage-drop diode model with $V_D = 0.7V$.

(a) (10 points) Sketch the transfer characteristic.

(b) (10 points) Sketch the waveform of v_O.

(c) (10 points) Find the peak current in the diode.

(d) (10 points) Find the PIV of the diode