REVISION TO HOMEWORK SET 12

Homework set 12 is due December 6, 2004.

The following two problems are added:

PROBLEM 6.

Do Problem 9.20 on 510 of textbook.

PROBLEM 7.

Do Problem 9.24 on page 510 of text.

where at $T = 300$ K

$$I_o = 2.030 \times 10^{-15} \text{ A} \qquad V_T = \frac{kT}{q} \approx 26 \text{ mV}$$

$$v_S = 5.3 \text{ V} + 7\cos(\omega t) \quad \text{mV}$$

$$\omega = 377 \text{ rad/s} \qquad R = 4.6 \text{ k}\Omega$$

Determine, using superposition and the offset (or threshold) voltage model for the diode, the DC or Q point current through the diode.

9.20 If the diode in the circuit shown in Figure P9.18 is fabricated from silicon and

$$i_D = I_o(e^{v_D/V_T} - 1)$$

where at $T = 300$ K

$$I_o = 250 \times 10^{-12} \text{ A} \qquad V_T = \frac{kT}{q} \approx 26 \text{ mV}$$

$$v_S = 4.2 \text{ V} + 110\cos(\omega t) \quad \text{mV}$$

$$\omega = 377 \text{ rad/s} \qquad R = 7 \text{ k}\Omega$$

and the DC operating point or quiescent point (Q point) is

$$I_{DQ} = 0.5458 \text{ mA} \qquad V_{DQ} = 379.5 \text{ mV}$$

determine the equivalent small-signal AC resistance of the diode at room temperature at the Q point given.

9.21 If the diode in the circuit shown in Figure P9.18 is fabricated from silicon and

$$i_D = I_o(e^{v_D/V_T} - 1)$$

where at $T = 300$ K

$$I_o = 2.030 \times 10^{-15} \text{ A} \qquad V_T = \frac{kT}{q} \approx 26 \text{ mV}$$

$$v_S = 5.3 \text{ V} + 70\cos(\omega t) \quad \text{mV}$$

$$\omega = 377 \text{ rad/s} \qquad R = 4.6 \text{ k}\Omega$$

and the DC operating point or quiescent point (Q point) is

$$I_{DQ} = 1.000 \text{ mA} \qquad V_{DQ} = 0.700 \text{ V}$$

determine the equivalent small-signal AC resistance of the diode at room temperature at the Q point given.

9.22 A diode with the i-v characteristic shown in Figure 9.8 in the text is connected in series with a 5-V voltage source (in the forward bias direction) and a load resistance of 200 Ω. Determine

a. The load current and voltage.

b. The power dissipated by the diode.

c. The load current and voltage if the load is changed to 100 Ω and 500 Ω.

9.23 A diode with the i-v characteristic shown in Figure 9.32 in the text is connected in series with a 2-V voltage source (in the forward bias direction) and a load resistance of 200 Ω. Determine

a. The load current and voltage.

b. The power dissipated by the diode.

c. The load current and voltage if the load is changed to 100 Ω and 300 Ω.

9.24 The diode in the circuit shown in Figure P9.18 is fabricated from silicon and

$$i_D = I_o(e^{v_D/V_T} - 1)$$

where at $T = 300$ K

$$I_o = 250 \times 10^{-12} \text{ A} \qquad V_T = \frac{kT}{q} \approx 26 \text{ mV}$$

$$v_S = V_S + v_s = 4.2 \text{ V} + 110\cos(\omega t) \quad \text{mV}$$

$$\omega = 377 \text{ rad/s} \qquad R = 7 \text{ k}\Omega$$

The DC operating point or quiescent point (Q point) and the AC small-signal equivalent resistance at this Q point are

$$I_{DQ} = 0.548 \text{ mA} \qquad V_{DQ} = 0.365 \text{ V} \qquad r_d = 47.45 \text{ Ω}$$

Determine, using superposition, the AC voltage across the diode and the AC current through it.

9.25 The diode in the circuit shown in Figure P9.25 is fabricated from silicon and

$$R = 2.2 \text{ k}\Omega \qquad V_{S2} = 3 \text{ V}$$

Determine the minimum value of V_{S1} at and above which the diode will conduct with a significant current.

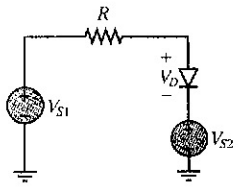

Figure P9.25

Section 9.4: Rectifier Circuits

9.26 Find the average value of the output voltage for the circuit of Figure P9.26 if the input voltage is sinusoidal with an amplitude of 5 V. Let $V_\gamma = 0.7$ V.

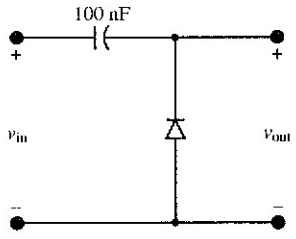

Figure P9.26