EE303 - Problem Set

<u>Problem 1</u>

For the circuit shown in Figure P.4.3 using ideal diodes find the values of the labeled voltages and currents.



Problem 2

Consider the circuit shown in Fig. 4.15. A string of three diodes is used to provide a constant voltage of about 2.1 V. We want to calculate the percentage change in this regulated voltage caused by (a) a $\pm 10\%$ change in the power-supply voltage and (b) connection of a 1-k Ω load resistance.



<u>Problem 3</u>

The 6.8-V zener diode in the circuit of Fig. 4.19(a) is specified to have V_Z =6.8 V at I_Z =5 mA, r_z =20 Ω , and I_{ZK} =0.2 mA. The supply voltage V⁺ is nominally 10 V but can vary by ± 1V.

(a) Find V_0 with no load and with V+ at its nominal value.

(b) Find the change in V₀ resulting from the \pm 1-V change in V+. Note that, $\Delta Vo/\Delta V^+$ is usually expressed in mV/V, is known as line regulation .

(c) Find the change in V₀ resulting from connecting a load resistance R_L that draws a current $I_L = 1$ mA, and hence find the load regulation ($\Delta Vo/\Delta I_L$) in mV/mA.

(d) Find the change in V_0 when $R_L = 2 k\Omega$.

(e) Find the value of V_0 when $R_L = 0.5 \text{ k}\Omega$.

(f) What is the minimum value of R_L or which the diode still operates in the breakdown region?



Figure 4.19 (a) Circuit for Problem. (b) Circuit with zener diode replaced with its equivalent circuit model.

<u>Problem 4</u>

Consider a peak rectifier fed by a 60-Hz sinusoid having a peak value Vp = 100 V. Let the load resistance $R = 10 k\Omega$. Find the value of the capacitance C that will result in a peak-to-peak ripple of 2 V.

Also, calculate the fraction of the cycle during which the diode is conducting and the average and peak values of the diode current.



Problem 5

Assuming the diodes to be ideal, describe the transfer characteristic of the circuit shown in Fig. E4.26.



<u>Problem 6</u>

The circuit shown in Fig P4.5 is a model for a battery charger. Here v_I is a 10-V peak sine wave, D1 and D2 are ideal diodes, I is a 60-mA current source, and B is a 3-V battery. Sketch and label the waveform of the battery current i_B . What is its peak value? What is its average value? If the peak value of vI is reduced by 10%, what do the peak and average values of i_B become?

