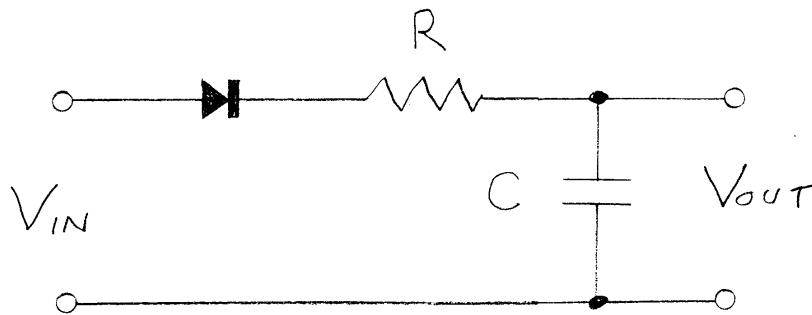


Physics 334, Winter Quarter 2013

Homework Assignment 2

Due Tuesday January 22 in class or in my mail box before the end of class.

1. Diode/power circuits. Consider the half-wave rectifier below. Assume the input voltage is sinusoidal with frequency 60 Hz. Further assume the output load (not shown) draws current over a range 0 to 100 mA. (a) Suppose you'd like the output voltage to "droop" by 1 V or less over the allowed load-current range. What's a reasonable value of R ? (b) Suppose you'd like the output "ripple" to be 0.1 V or less. What's a reasonable value of C ?



2. Estimation. A $1 \mu\text{F}$ capacitor is charged to 200 V, then discharged through a 2-inch length of 30 AWG (American Wire Gauge) copper wire. Do you expect the wire to melt? Why or why not? To attack this problem, you'll need certain physical constants of copper; include in your answer a table of the physical constants you used.

3. Zener power circuits. Below is the measured I-V curve of one particular 30 V zener diode. (a) Estimate the dynamic resistance of this diode when operating in the “zener region” at “reasonable” currents; explicitly state what current and voltage you used in this estimation. (b) Suppose you want a well-regulated 30 ± 0.5 V voltage from a poorly-regulated $50. V \pm 5. V$ power supply in the manner of the circuit in text figure 1.14. Find a reasonable value of the series resistor R; specify the resulting zener current and output voltage “ripple”.

