

Physics 313 assignment 4, Fall 2018:

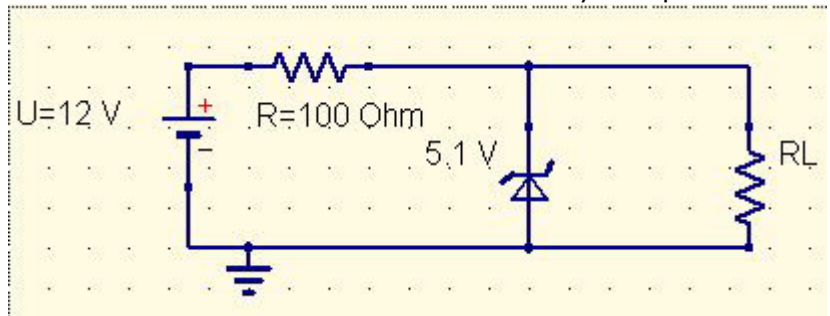
New topics: diodes; diode clippers and clamps; voltage regulation

Problems: (assume any diodes are silicon)

1) Plot the I vs. V data you took for the 1N914 diode on a semilog scale (that is, log of I vs. V —you could also use semi-log graph paper or most reasonable (gnuplot) plotting programs let you set a scale logarithmically). What conclusion about the mathematical relationship between I and V can you draw from your plot?

2) For the circuit below assume both the 100 ohm resistor and the Zener diode can safely dissipate $\frac{1}{4}$ watt.

- a) What would happen if the load resistor R_L were shorted?
 - b) What would happen if the load resistor were removed?
- Hint: think about the power ratings.



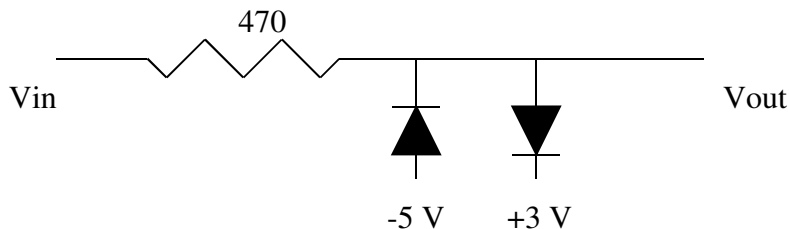
3) Design a full-wave bridge rectifier circuit that converts AC line voltage to 5 volts DC with less than 0.1 volt ripple into a $180\ \Omega$ resistive load. Sketch the circuit and give component values. Remember that transformer voltages are usually given as rms values. Ignore internal resistance of the transformer.

4) a) Consider the circuit below. For each of the following V_{in} values, find V_{out} . Explain each answer briefly.
 $V_{in} = +2V, +4V, +6V, -2V, -4V, -6V$

b) Now if the input is a 10 V amplitude triangle wave, sketch what the output looks like and explain briefly how you came up with your answer.

c) Indicate the path of the current in the circuit when $V_{in} = -8V$.

d) What would happen if the resistor weren't in the circuit? Explain your reasoning.



5) Reading/Conceptual questions:

a) What does the filter capacitor in a rectifier circuit do?

b) For voltages more negative than the breakdown voltage of a Zener diode, what is the relationship between the current through and the voltage across the diode?

c) Describe one possible application of a diode clipper circuit.