

Test 2

EE315 Spring 2017—Dr. B

NAME SOLUTION Key

**DO ALL YOUR WORK ON THIS EXAM.
USE THE BACK SIDES of EXAM PAPER IF
NECESSARY BUT POINT ME WHERE YOU
DID THAT.**

- ***Your Equation sheet must be turned in with the Exam.***
- ***NO Cell PHONE Calculators allowed. Other calculators ok.***
- ***Closed books/closed lecture notes.***
- ***Each Problem worth 18 points.***

A good engineer is someone who is good with math without having the personality of an accountant.

EE315 SPRING TERM 2017

TEST 2- 22 MARCH 2017

NAME

SOLUTION KEY

CIRCLE TRUE OR FALSE (1 point each)

Thermal voltage for a semiconductor diode depends on temperature (in Kelvin degrees), Boltzmann's Constant, and charge on the electron.

An intrinsic semiconductor does not have any doping to change the conductivity of the material.

A semiconductor diode has only two states; either forward biased or electrically biased.

At room temperature, thermal voltage for silicon is about 26 volts.

A depletion region in a semiconductor diode is a region free of charge carriers.

A semiconductor diode is formed by a p-n junction.

A Zener diode must be forward biased to perform and operate as a Zener diode.

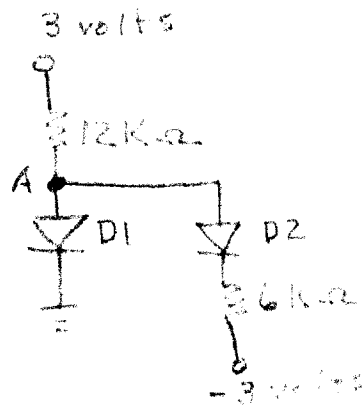
A "hole" is the empty space where an electron was but the space still has an effective mass and electrical charge.

A forward biased semiconductor diode is, ideally, an open circuit.

A "p region" in a semiconductor diode is a region where an excess of positive charges are available for conduction.

2. A newly hired EE recently graduated from Loachapoka University School of Engineering tells you that both diodes in circuit below are forward biased. Is the EE correct? YES or NO?

Show your work!! NO CREDIT FOR GUESSING



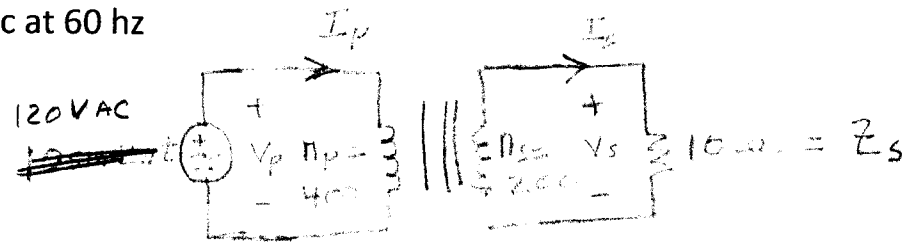
3. A step down transformer has the following data:

$V_p = 120$ volts ac at 60 hz

$N_p = 400$

$N_s = 200$

$Z_s = 10$ ohm



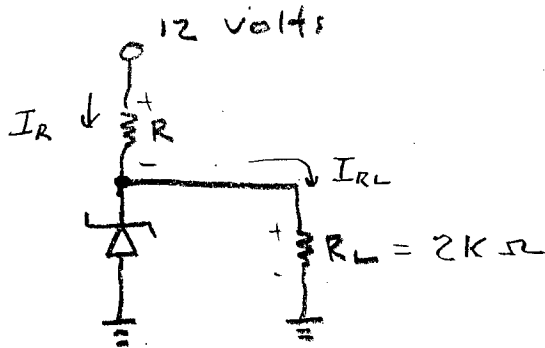
FIND V_s , I_s , and I_p

4. A diode operating in forward bias has a voltage drop of 0.7 volts at 1.0 milliamp. The diode is then operated at 0.5 milliamp. What is the new value of diode voltage? Assume: $V_T = 25$ millivolts.

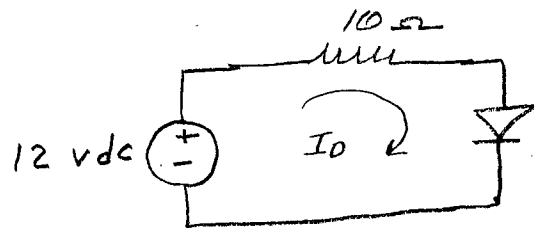
5. A Zener shunt regulator is shown below. Datasheet for the Zener shows:

$V_z = 6.0$ volts at $I_z = 5$ milliamp and $r_z = 10$ ohm.

- (a) Find Z_{zo} for the Zener diode
- (b) Find the current through R_L at that Zener voltage
- (c) Find the current through R
- (d) Find value for R



6. Using the Constant Voltage Drop Model for a Semiconductor Diode in the circuit below:



(a) Compute I_D

(b) If the 12 VDC source is replaced by a 12 V peak sinusoid waveform, sketch I_D resulting waveform.

Recall section 4.3.5, page 193