ELECTRICAL&ELECTRONICS ENGINEERING DEPARTMENT

EEM 214 ELECTRONICS

EXPERIMENT- 2

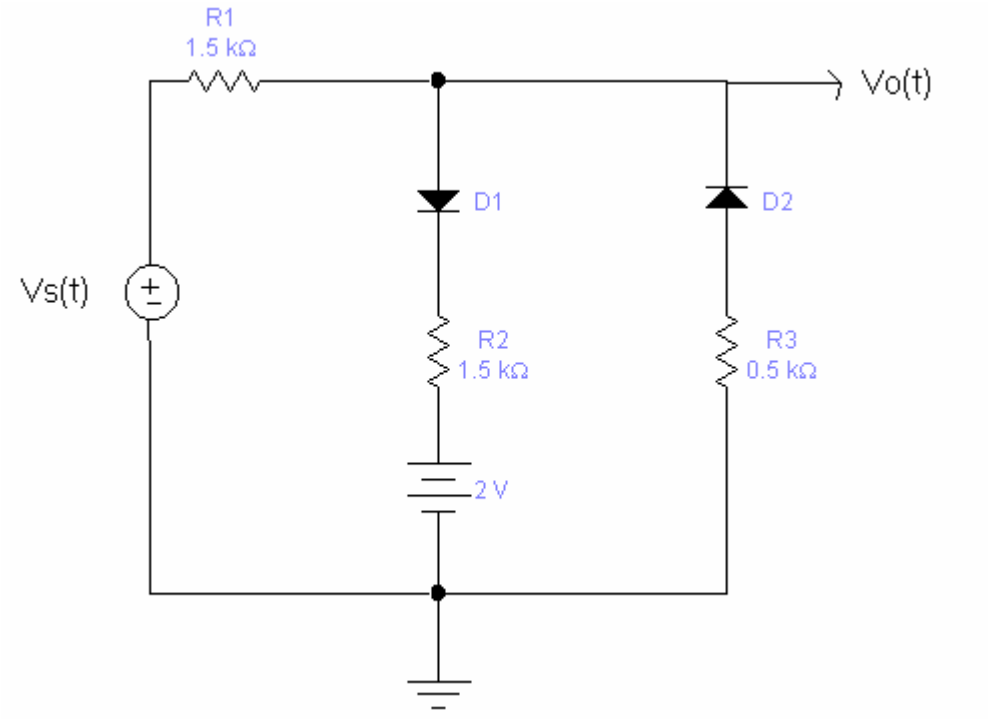
LIGHT EMITTING AND ZENER DIODES

Objective

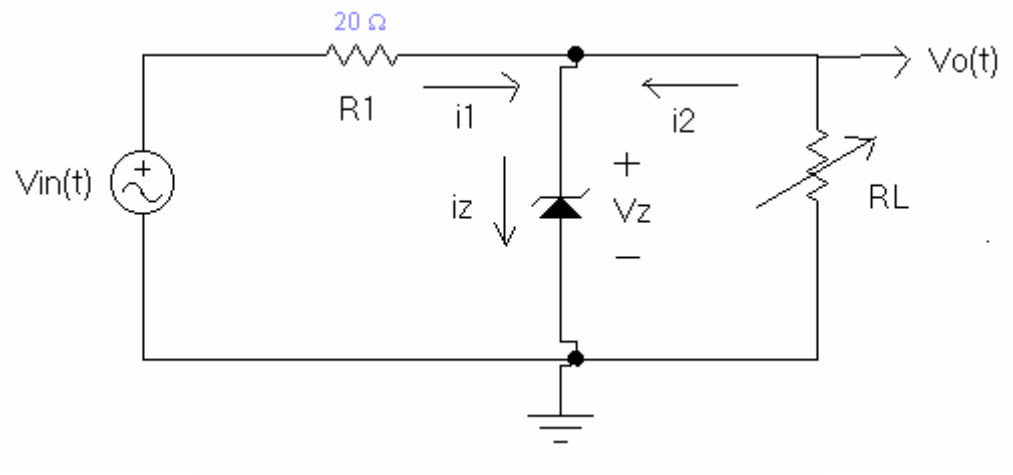
To become familiar with the characteristics and use of a light-emitting diode (LED) and Zener diode.

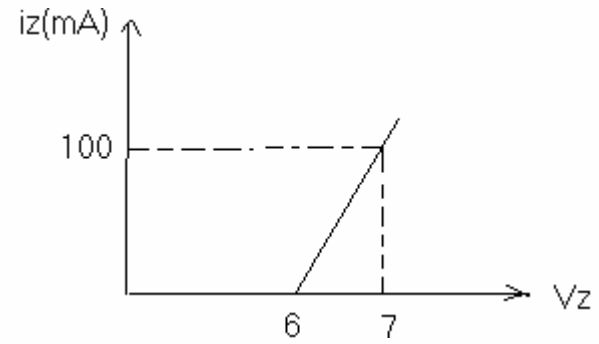
PRELIMINARY WORK

1) Find and plot V_O - V_S transfer characteristic.



2)





a-) Vin(t) = 8 V, Find and plot the load line for RL=0.1K and 1K and calculate the Q point (iz, Vz)

b-) Let Vin(t)= 8 + Vr .cos(wt)

I_{Zmax} = 100 mA

Determine the max. value of Vr for proper operation for all possible values of RL between 0.1K and 1K.

EXPERIMENTAL WORK

PROCEDURE

Part-1 LED Characteristics

a. Construct the circuit of Fig.-1. Initially, set the supply to 0 V and record the measured value of the resistor R.

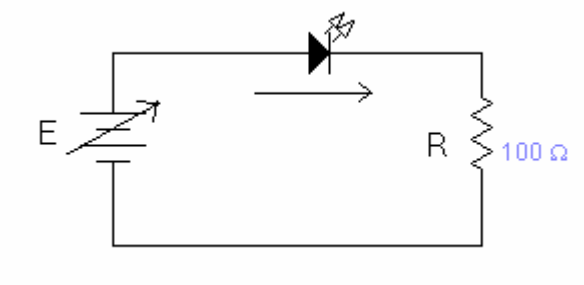


Figure-1

b. Increase the supply voltage E until "first light" is noticed.Record the value of V_D and V_R using the DMM (Digital MultiMeter). Calculate the corresponding level of I_D using $I_D = V_R/R$ and the measured resistance value R_{meas}

(measured) V_D = ----------
(measured) V_R = ----------
(calculated) I_D = ----------

c. Continue to increase the supply voltage E until " good brightness " is first established. Don't overload (too much current) the circuit and possibly damage the LED by continuing to raise the voltage beyond this level. Record the values of V_D and V_R and calculate the corresponding level of I_D using $I_D = V_R/R$ and the measured resistance value.

(measured) V_D = ----------
(measured) V_R = ----------
(calculated) I_D = ----------

d. Set the DC supply to the levels appearing in Table -1 and measure both V_D and V_R. Record the values of V_D and V_R in Table-1 and calculate the corresponding level of I_D using $I_D = V_R/R$ and the measured resistance value.

Table-1

E (V)	0	1	2	3	4	5	6
V_D (V)							
V_R (V)							
$I_D = V_R/R_{meas}$ (mA)							

e. Using the data of Table-1 sketch the curve of I_D vs. V_D Choose an appropriate scale for both I_D and V_D.

f. Draw a light dashed horizontal line across the graph at the current I_D required for "good brightness." In addition, draw a light dashed vertical line at the point of intersection between the curve and the light dashed horizontal line. The intersection of the vertical line with the horizontal axis should result in a level of V_D close to that measured in Part 1(c).

Shade in the region below the I_D line and the left of the V_D line and label the region as the region to be avoided if " good brightness" is to be obtained. Label the remaining unshaded region of the graph as the region for "good brightness."

Part-2 Zener Diode Characteristics

a. Construct the circuit of Fig.2. Initially, set the DC supply to 0 V and record the measured value of R.

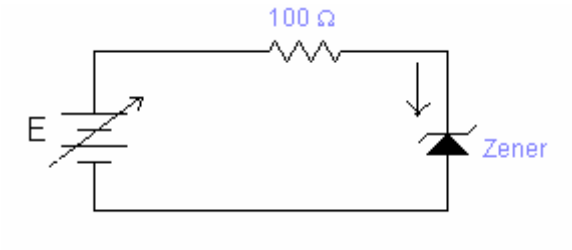


Figure-2

b. Set the DC supply (E) to the values appearing in Table-2 and measure both V_Z and V_R. You may have to use the millivolt range of your DMM for low values of V_Z and V_R

Table-2

E (V)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
V_Z (V)																
V_R (V)																
$I_Z = V_R / R_{meas}$ (mA)																

c. Calculate the Zener current I_Z in mA at each level of E using Ohm's law as indicated in the last row of Table-2 and complete the table.

d. This step will develop the characteristic curve for the Zener diode.Since the Zener region is in the third quadrant of a complete diode characteristic curve, place a (-) sign in front of each level of I_Z and V_Z for each data point.With this convention in mind plot the data of Table-2 on a graph. Choose an appropriate scale for I_Z and V_Z as determined by the range of values for each parameter.

e. For the range of measurable current I_Z in the linear (straight line) region that drops from the
V_Z axis, what is the average value of V_Z? In other words, for all practical purposes, what is V_Z for this Zener diode?

(approximated) V_Z = ----------

f. For the range of measurable current I_Z in the linear region that drops from the axis, estimate
the average resistance Rz of the Zener diode.

g. Using the result of steps **e** and **f**, establish the Zener diode equivalent circuit for the “on” linear region.