Experiment #6- Part#3

Zener Diode Application

Procedure

1. Connect the zener diode test circuit shown in Fig.7. Increase the input voltage gradually in several steps from 0 to 15V, and record V_Z and I_Z according to Table 1.

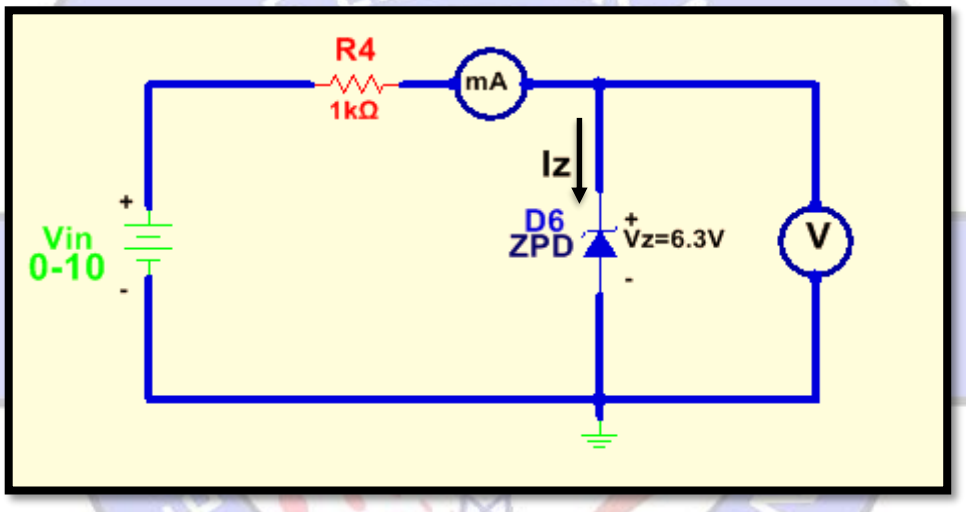

Figure 7: Practical Circuit Used to Obtain the Characteristics of the Zener Diode

Table 1: Recorded Data for the Circuit of Figure 7

$V_{in}(V)$	$V_Z(V)$	$I_Z(mA)$
0		
1		
2		
3		
4		
4.5		
5		
5.5		
6		
7		
8		
10		
12		
14		
15		

2. Connect the voltage regulator circuit shown in Fig.8, and vary the load resistor R_L in several steps as shown in Table 2. Record V_L, I_s, I_Z, and I_L where $I_L = I_s - I_Z$.
3. Connect the voltage regulator circuit shown in Fig.9, and vary the input voltage in several steps from 0 to 15V as shown in Table 3. Record V_L, I_s, I_Z, and I_L where $I_L = I_s - I_Z$.

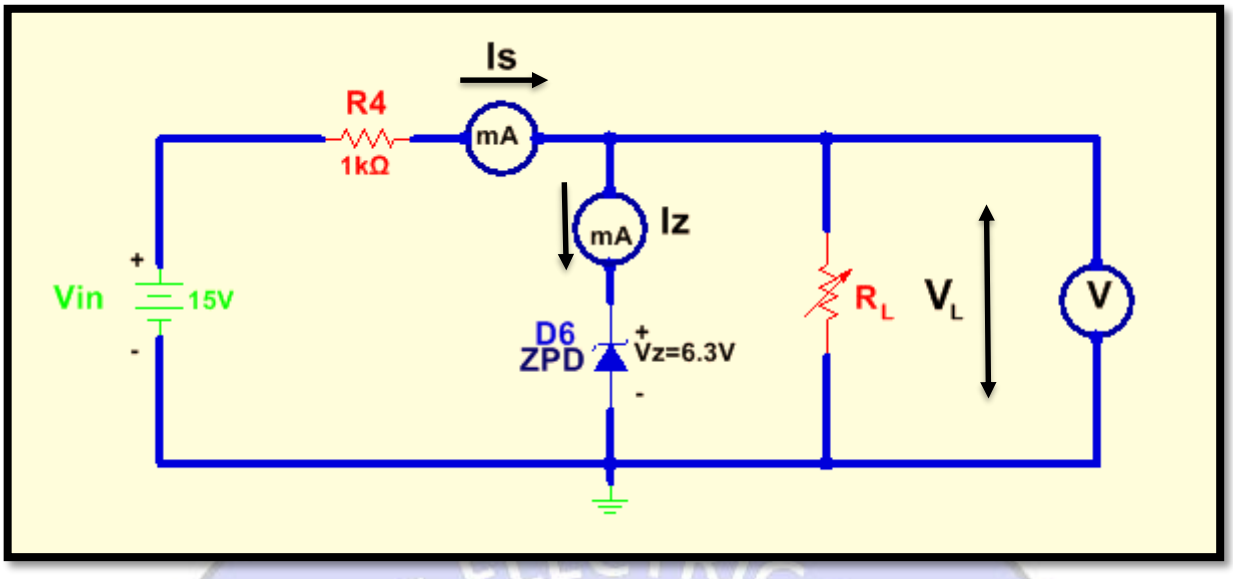

Figure 8: Practical Circuit for Zener Diode Voltage Regulator with Variable Load Resistor

Table 2: Recorded Data for the Voltage Regulator Circuit of Figure 8

$R_L(\Omega)$	$V_L(V)$	$I_S(mA)$	$I_Z(mA)$	$I_L(mA)$
50				
100				
150				
200				
300				
500				
800				
1.0K				
1.5K				
2.0K				
4.0K				
100K				

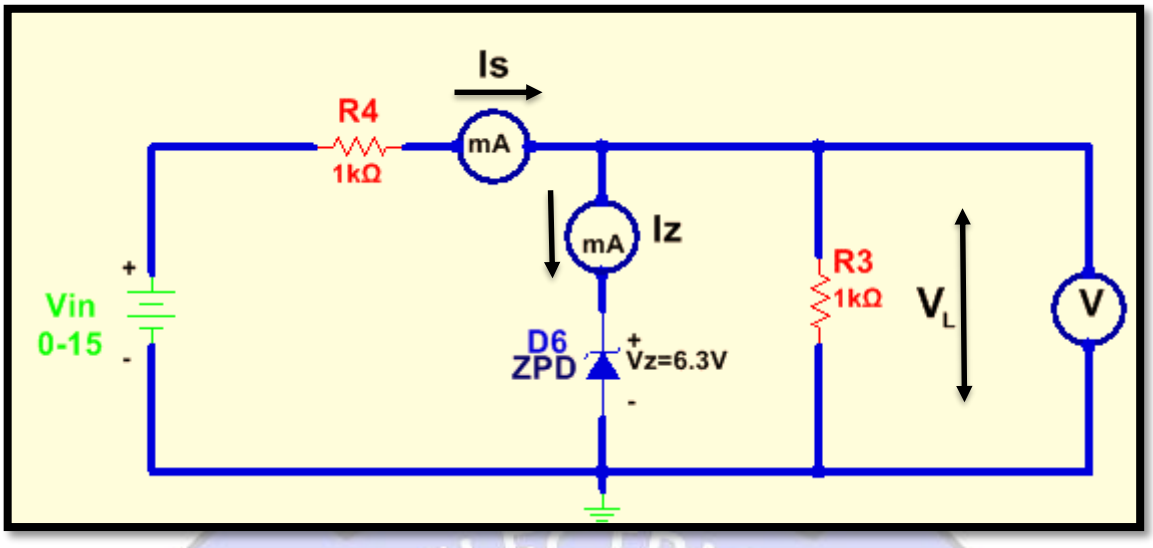

Figure 9: Practical Circuit for Zener Diode Voltage Regulator with Variable Input Voltage

Table 3: Recorded Data for the Voltage Regulator Circuit of Figure 9

$R_L(\Omega)$	$V_L(V)$	$I_S(mA)$	$I_Z(mA)$	$I_L(mA)$
0				
1				
2				
4				
5				
6				
6.5				
7				
10				
12				
14				
15				

Discussion

1. Plot the characteristic curve of the zener diode in the reverse-breakdown region from the results obtained in step 1 of the procedure.
2. Determine the internal resistance R_Z of the zener diode from your data. Do this calculation only on the straight-line breakdown region of the characteristic curve plotted in step 1 above.
3. Determine the power dissipation in the zener diode for the maximum zener current flowing through it from the obtained data of step1 in the procedure, and compare it with P_{ZM}.
4. For the zener diode voltage regulator circuit of Fig.8, sketch the relation between V_L and I_L (V_L versus I_L). Plot the relation between I_s and R_L. Sketch also the relation between I_Z and I_L . Comment on the resulting curves.
5. Calculate the theoretical minimum value of R_L required for putting the zener diode in the zener breakdown region for the regulator circuit of Fig.8. What value of load resistance results in the maximum zener current? Determine the maximum Zener current $I_{Z(\max)}$ in this case and compare it with I_{ZM}.
6. Plot the relation between V_L and V_{in} for the voltage regulator circuit in Fig.9, and comment on the resulting sketch. From this sketch, determine the minimum value of input voltage required to turn-on the zener diode.
7. Calculate the theoretical minimum value of V_{in} required to turn-on the zener diode in the voltage regulator circuit of Fig.9. Determine also the maximum permissible value of V_{in} knowing that the maximum DC power dissipation of the PZD zener diode is 0.5W.
8. Explain the difference between line regulation and load regulation.