Experiment 6

Light Emitting and Zener Diode

Objective:

- To Become familiar with the characteristic and use of a light emitting diode (LED) and Zener diode

Light Emitting Diode (LED):

A light-emitting diode (LED) is a semiconductor device that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device

PROCEDURE:

PART-1 LED Characteristics

a) Construct the circuit of Fig. 7.1. Initially, set the supply to 0 V and record the measured value of the resistor R.

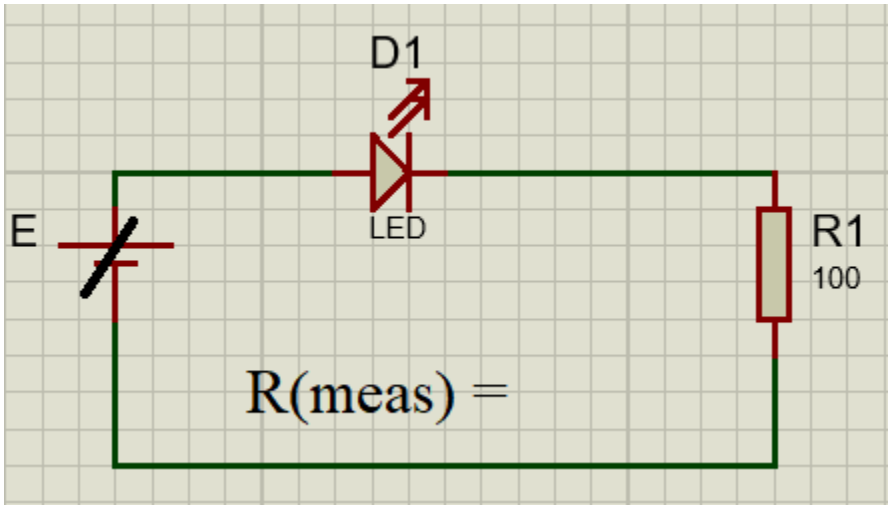


Figure 7.1

b) Increase the supply voltage E until "first light" is noticed. Record the value of V_D and V_R using the DMM. Calculate the corresponding level of I_D using $I_D = V_R/R$

(Measured)V_D =

(Measured)V_R =

(Measured)I_D =

c) Continue to increase the supply voltage E until "good Brightness" is obtained. Record the value of V_D and V_R using the DMM. Calculate the corresponding level of I_D using $I_D = V_R/R$

(Measured)V_D =

(Measured)V_R =

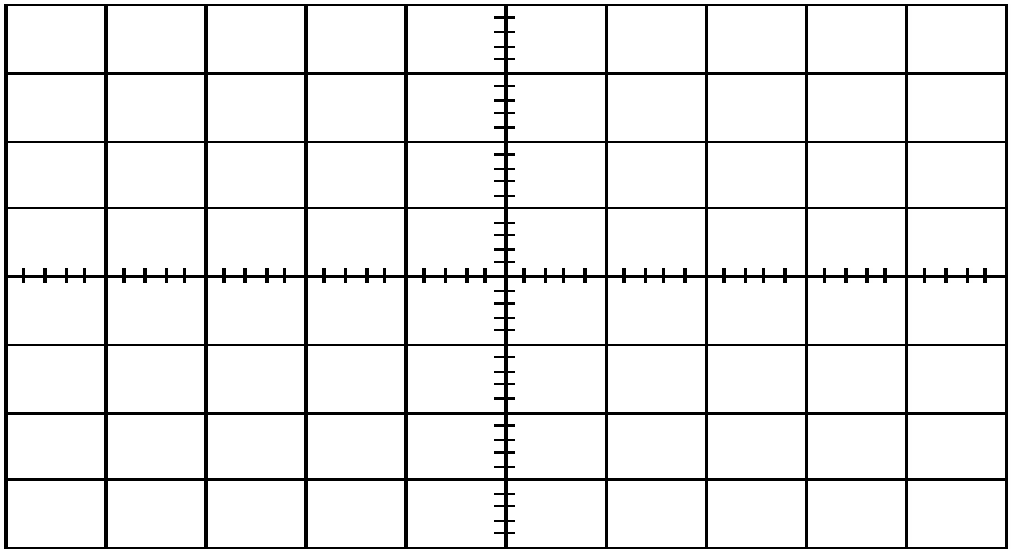
(Measured)I_D =

d) Set the DC supply to the levels appearing in Table 7.1 and measure both V_D and V_R. Record the values of V_D and V_R in Table 7.1 and calculate the corresponding level of I_D using $I_D = V_R/R$

Table 7.1

E(V)						
V_D(V)						
V_R(V)						
$I_D=V_R/R$(mA)						

e) Using the data of Table 7.1 sketch the curve of Id vs VD and ID vs VR on the graph as shown in fig. 7.2. Choose and appropriate scale of both Voltage and Current



Operation of Zener Diode:

Zener diodes are a special kind of diode which permits current to flow in the forward direction. What makes them different from other diodes is that Zener diodes will also allow current to flow in the reverse direction when the voltage is above a certain value. This breakdown voltage is known as the Zener voltage. In a standard diode, the Zener voltage is high, and the diode is permanently damaged if a reverse current above that value is allowed to pass through it. Zener diodes are

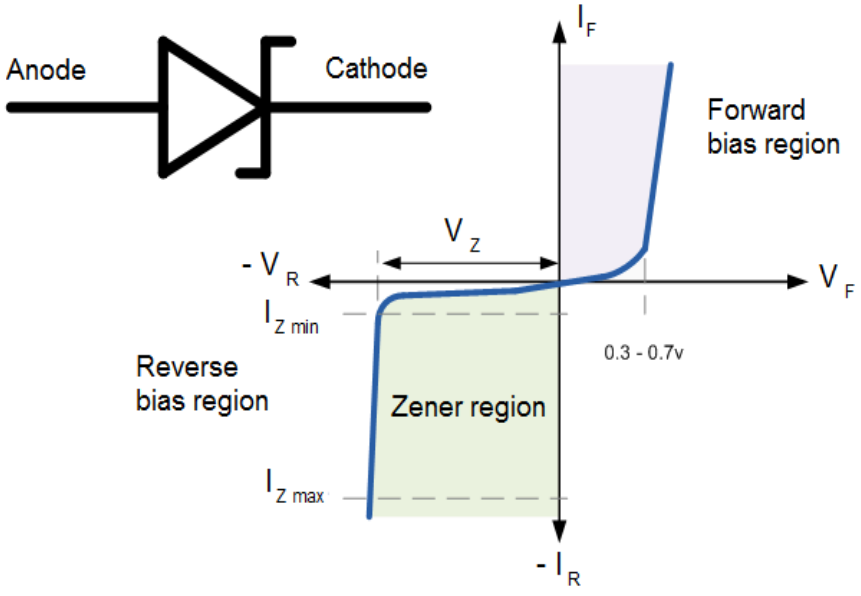


Figure 7.3: Characteristics of Zener Diode

designed in a way where the Zener voltage is a much lower value. There is a controlled breakdown which does not damage the diode when a reverse current above the Zener voltage passes through

a Zener diode.

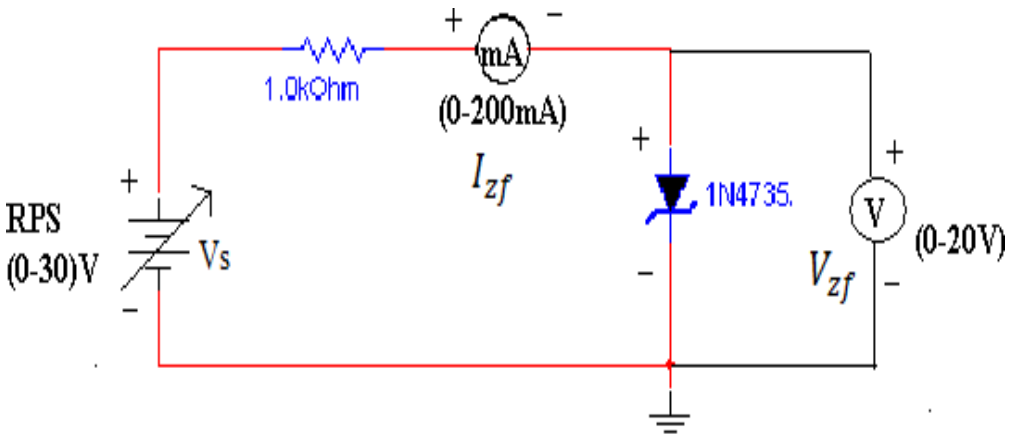


Figure 7.4: Forward Bias Condition

Procedure:

Forward Bias Condition:

a) Connect the circuit as shown in Figure 7.4.

b) Initially vary Vs in steps. Once the current starts increasing vary Vs in steps of 2V up to 20V. Note down the corresponding readings of Vz and Iz in Table 7.2.

Table 7.2: Forward Bias Condition:

Vs(volts)	Forward Voltage across the diode V_{zf} (volts)	Forward Current through the diode I_{zf} (mA)

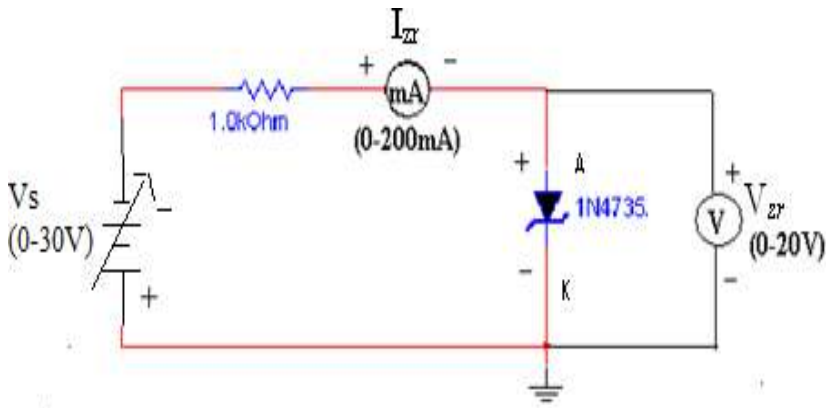


Figure 7.5: Reverse Bias Condition

Reverse Bias Condition:

a) Connect the circuit as shown in Figure 7.5.

b) Vary Vs gradually in steps of 2V up to 20V and note down the corresponding readings of Vz and Iz.

c) Tabulate different reverse currents obtained for different reverse voltages.

Observations:

Table 7.3: Reverse Bias Condition:

Vs(volts)	Reverse Voltage across the diode V_{zf} (volts)	Reverse Current through the diode I_{zf} (mA)

d) With help of measured values in table 3 draw V-I characteristics of diode

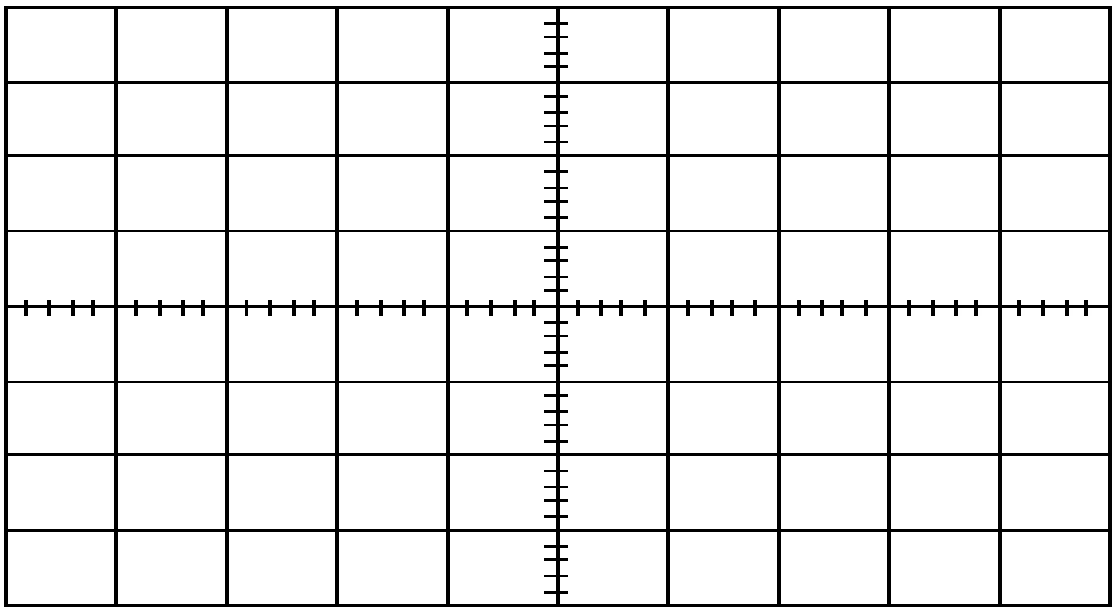


Figure 7.6: V-I characteristics of diode

Lab Exercise and Summary

Summary should cover Introduction, Procedure, Data Analysis and Evaluation.

Student's Signature: _____ **Date: _____**

LABORATORY SKILLS ASSESMENT (Psychomotor)

Total Marks: 100

Criteria (Max Marks)	Level 1 0% ≤ S < 50%	Level 2 50% ≤ S< 70%	Level 3 70% ≤ S< 90%	Level 4 90%≤ S ≤100%	Score (S)
Procedural Awareness (20)	Selects inappropriate skills and/or strategies required by the task	Selects and applies appropriate skills and/or strategies required by the task with some errors	Selects and applies the appropriate strategies and/or skills specific to the task without significant errors	Selects and applies appropriate strategies and/or skills specific to the task without any error	
Practical Implementation (30)	Makes several critical errors in applying procedural knowledge related to light Emitted and Zener Diode	Makes few critical errors in applying procedural knowledge related to light Emitted and Zener Diode	Makes some non-critical errors in applying procedural knowledge related to light Emitted and Zener Diode	Applies the procedural knowledge in perfect ways related to light Emitted and Zener Diode	
Safety (10)	Requires constant reminders to follow safety procedures	Requires some reminders to follow safety procedures	Follows safety procedures with only minimal reminders	Routinely follows safety procedures	
Use of Tool/Equipment (20)	Uses tools, equipment and materials with limited competence	Uses tools, equipment and materials with some competence	Uses tools, equipment and materials with considerable competence	Uses tools, equipment and materials with a high degree of competence	
Participation to Achieve Group Goals (10)	Shows little commitment to group goals and fails to perform assigned roles	Demonstrates commitment to group goals, but has difficulty performing assigned roles	Demonstrates commitment to group goals and carries out assigned roles effectively	Actively helps to identify group goals and works effectively to meet them in all roles assumed	
Interpersonal Skills in Group Work (10)	Rarely interacts positively within a group, even with prompting	Interacts with other group members if prompted	Interacts with all group members spontaneously	Interacts positively with all group members and encourages such interaction in others	
				Marks Obtained	

Instructor's Signature: _____ **Date: _____**

LABORATORY SKILLS ASSESMENT (Affective)

Total Marks: 40

Criteria (Max. Marks)	Level 1 0% ≤ S < 50%	Level 2 50% ≤ S < 70%	Level 3 70% ≤ S < 90%	Level 4 90% ≤ S ≤ 100%	Score (S)
Introduction (5)	Very little background information provided or information is incorrect	Introduction is brief with some minor mistakes	Introduction is nearly complete, missing some minor points	Introduction complete and well-written; provides all necessary background principles for the experiment	
Procedure (5)	Many stages of the procedure are not entered on the lab report.	Many stages of the procedure are entered on the lab report.	The procedure could be more efficiently designed but most stages of the procedure are entered on the lab report.	The procedure is well designed and all stages of the procedure are entered on the lab report.	
Data Record (10)	Data is brief and missing significant pieces of information.	Data provides some significant information and has few critical mistakes.	Data is almost complete but has some minor mistakes.	Data is complete and relevant. Tables with units are provided. Graphs are labeled. All questions are answered correctly.	
Data Analysis (10)	Data is presented in very unclear manner. Error analysis is not included.	Data is presented in ways (charts, tables, graphs) that are not clear enough. Error analysis is included.	Data is presented in ways (charts, tables, graphs) that can be understood and interpreted. Error analysis is included.	Data are presented in ways (charts, tables, graphs) that best facilitate understanding and interpretation. Error analysis is included.	
Report Quality (10)	Report contains many errors.	Report is somewhat organized with some spelling or grammatical errors.	Report is well organized and cohesive but contains some grammatical errors.	Report is well organized and cohesive and contains no grammatical errors. Presentation seems polished.	
				Marks Obtained	

LABORATORY SKILLS ASSESSMENT (Cognitive)

Total Marks: 10

(If any) **Marks Obtained**	

Instructor's Signature: _____ **Date: _____**