ECE101-1L – FUNDAMENTALS OF ELECTRONIC CIRCUITS (LAB)

Activity #3: Diode Wave Shaping and Zener Diode Voltage Regulation

Objectives:

- Use Multisim and TinkerCAD for this activity
- Use diodes with bias voltages as clippers, clampers, and DC restorers.
- Measure and Observe the performance of a typical Zener diode

Procedures:

Part A. Multisim
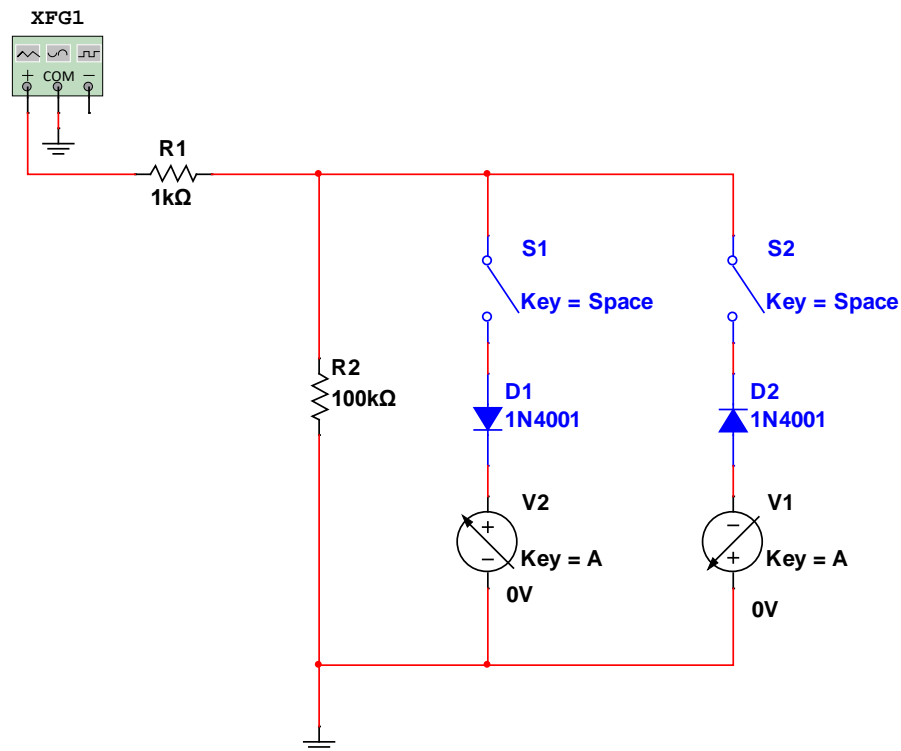
1. Define Clippers in Electronics (include the 2 types)

   _____
   _____

2. Define Clampers in Electronics (include the 2 types)

   _____
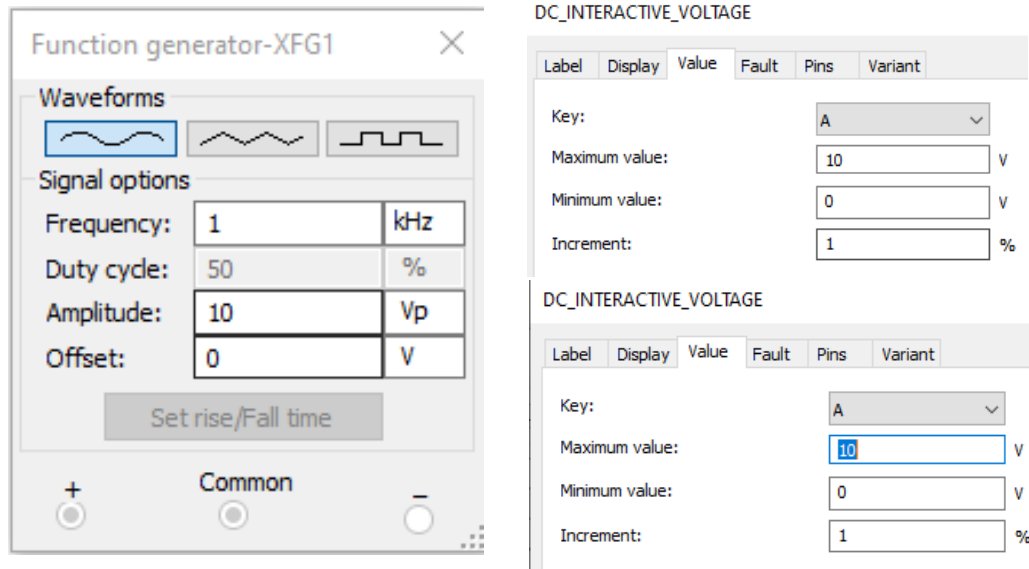   _____

3. Open Multisim
4. Create the schematic diagram shown below
   (*Function Generator, Resistor, Switch, Diode, DC Interactive Voltage*)
   See Video for Details

5. Adjust Function Generator and DC Interactive Voltage Settings shown below

6. Place an Oscilloscope at the Output and Run the Simulation
    a. Screenshot the output waveform shown in oscilloscope

    _____
    _____

    b. measure the voltage (Vpk-pk)

    _____
    _____

7. While the simulation is running, Turn the switch (S1 and S2) to CLOSED position and observe the Output at the oscilloscope
    a. Screenshot the output

    _____

    b. Explain what happens

    _____

8. Switch the S1 to OPEN position and observe the waveform
    a. Screenshot the output

    _____

    b. What function does S1 /D1 Part do? (Positive Clipper or Negative Clipper)

    _____

9. Switch the S1 to CLOSED and S2 to OPEN position and observe the waveform
    a. Screenshot the output

    _____

    b. What function does S2 /D2 Part do? (Positive Clipper or Negative Clipper)

    _____

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10. Create the schematic shown below (similar to previous circuit but change the resistor to "CAPACITOR ELECTROLYTIC" with a value of 0.1uF, *be careful of the polarity*
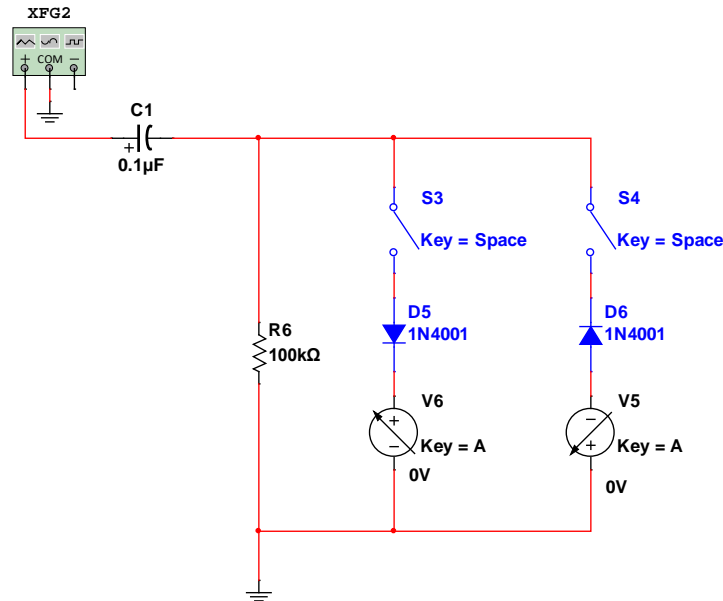
11. Place and Oscilloscope at the output
12. Run the Simulation and Switch the S3 to CLOSED position
    a. Screenshot the output

    _____
    b. Base on your answer in Question #2 and Question 12.a what type of Clamper is this?

    _____
    c. Switch S3 to OPEN Position

13. Switch the S4 to CLOSED position
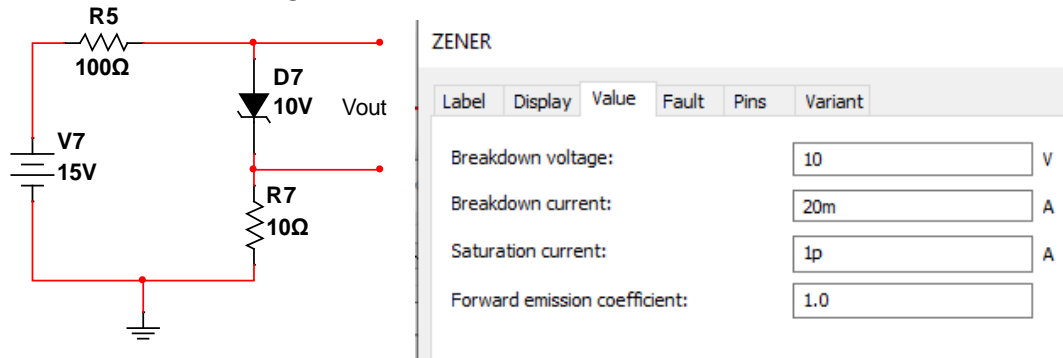   a. Screenshot the output

    _____
    b. Base on your answer in Question #2 and Question 13.a what type of Clamper is this?

    _____
    c. Switch S4 to OPEN Position

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14. What is a Zener Diode?

_____
_____

15. What is the Symbol of Zener diode?

_____
_____

16. Create the Schematic shown below "DIODE VIRTUAL>>ZENER". Change the settings of Zener Diode Breakdown Voltage to 10V
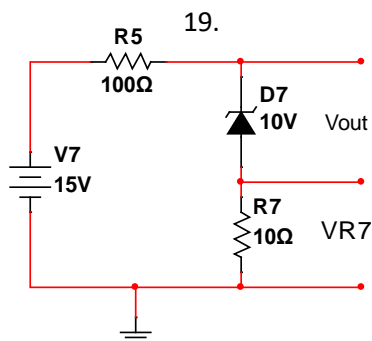

17. Measure the Voltage output using Multimeter
    a. Vout:

_____

    b. Is the Zener Diode Forward Biased or Reversed Biased?

_____

18. Change the Zener Diode Orientation

19.

20. Measure the Voltage output using Multimeter
    a. Vout:

_____

   b. Is the Zener Diode Forward Biased or Reversed Biased?

_____

21. Adjust the V7 (DC Voltage to the Values shown below and complete the table
Calculate the Current (Ir7) using the formula (VR7/R7)

V7 (Supply Voltage)	Current (IR7)
0	0
2	
4	
6	
8	
10	
12	
14	
16	
18	
20	

22. Change all Values to NEGATIVE (V7) and Current (IR7). Graph the Values V7 Supply voltage at the horizontal axis and the Current IR7 for the Vertical Axis. Screenshot the Graph you obtain
You can use MSExcel to Plot your graph (Scatter with Lines)

_____
_____

Part B. TinkerCAD

1. Create the Circuit Diagram using TinkerCAD
   (Function Generator, Power Supply, Resistor, Diode)
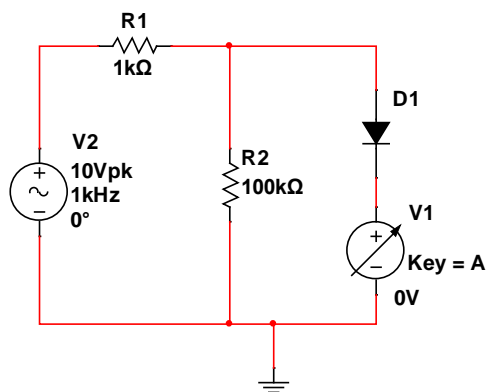
2. Place an Oscilloscope at the Output
3. Adjust the **DC Supply** at 1.8 V level
    a. Screenshot the output waveform

    _____

    b. Is the Circuit a Positive Clipper or Negative Clipper?

    _____

4. Create the circuit diagram using tinkerCAD
    (Function Generator, Power Supply, Resistor, Diode)

    R1
    1kΩ

    V2
    10Vpk
    1kHz
    0°

    R2
    100kΩ

    D1

    V1
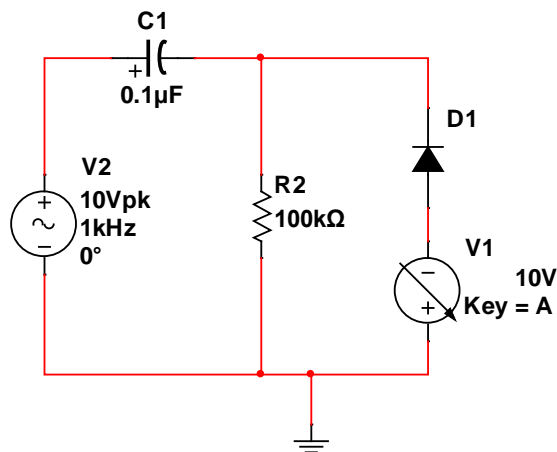   **0V**
    Key = A
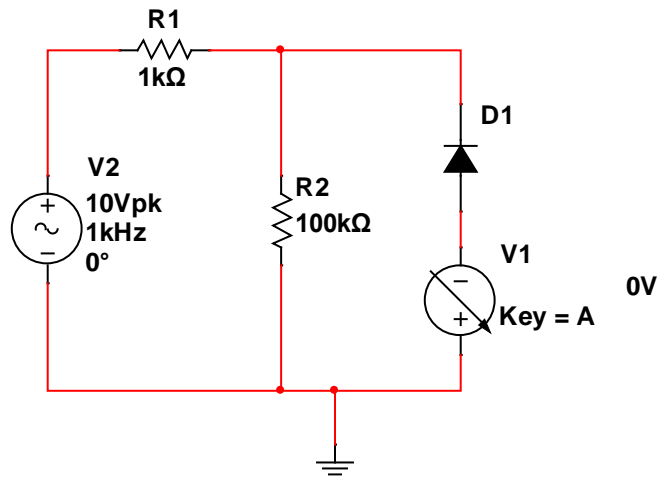
5. Place an Oscilloscope at the Output
6. Adjust the **DC Supply** at 1.8 V level
    a. Screenshot the output waveform

    _____

    b. Is the Circuit a Positive Clipper or Negative Clipper?

    _____

7. Create the Circuit shown below using tinkerCAD

    C1
    0.1µF

    V2
    10Vpk
    1kHz
    0°

    R2
    100kΩ

    D1

    V1
    10V
    Key = A

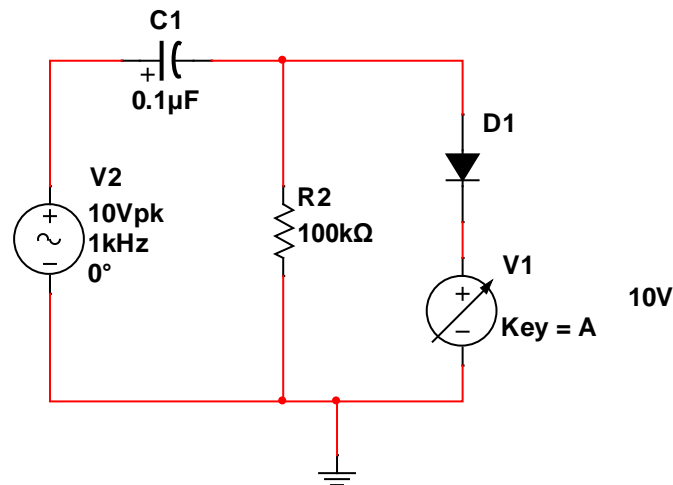Prepared by: Jonathan R. Oracion

8. Place an Oscilloscope at the Output
9. Slowly Adjust the DC Supply Voltage to 2V
    a. What do you observe?

    _____

    b. Screenshot the Output of the oscilloscope

    _____

    c. Identify the type of Clamper used

    _____

10. Create the Schematic Shown below

C1
$+$ 0.1µF

V2
$+$ 10Vpk
$\sim$ 1kHz
$-$ 0°

R2
100kΩ

D1
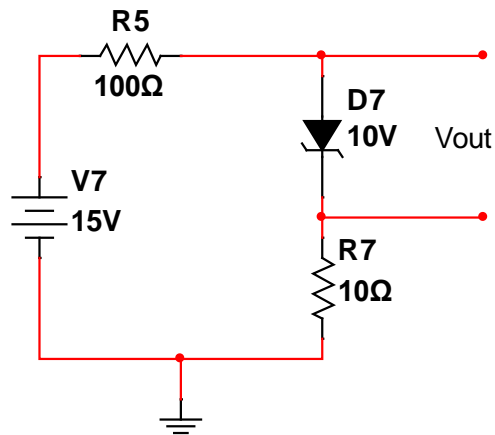
V1
$+$
$-$ Key = A
10V

11. Place an Oscilloscope at the Output
12. Slowly Adjust the DC Supply Voltage to 2V
    a. What do you observe?

    _____

    b. Screenshot the Output of the oscilloscope

    _____

    c. Identify the type of Clamper used

    _____

13. Create the Circuit Using TinkerCAD

14. Screenshot your Circuit
15. Measure the Output Voltage

Discussions:

_____
_____
_____
_____

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