Exp. No. Date:

APPLICATIONS OF DIODES

OBJECTIVE

The purpose of the experiment is to

(i) experiment the use of diodes in limiting, clamping and rectifying circuits.
(ii) analyze the use of diodes in clipping circuits and to measure the voltage limits of both biased and unbiased clipping circuits.
(iii) study the characteristics of bridge rectifier and to examine the operation of Zener diode as shunt voltage regulator.

EQUIPMENT AND COMPONENTS USED

30 MHz Dual Channel Digital Storage Oscilloscope (DSO)

3 MHz Function Generator

0-30 V dc dual regulated power supply

1N4007 Diode

1Z5V6 Zener Diode

Resistor 220 Ω, 1 kΩ, ¼W

Electrolytic Capacitor 10μF/25V, 100μF/63V

Breadboard, Connecting wires, BNC Cables and Probes

PRE-LAB

1. Read the specifications of the following diodes from its datasheet:

Device Part Number: 1N4001
Device Manufacturer: _____
Description: _____

Peak Repetitive Reverse Voltage, V_{RRM} =

Average Rectified Forward Current, $I_{F(av)}$ =

Maximum RMS Voltage, V_{RMS} =

DC Reverse Voltage, V_R =

Maximum reverse current I_{RM} =

Maximum instantaneous forward voltage drop V_F =

Device Part Number: 1N4007
Device Manufacturer: _____
Description: _____

Peak Repetitive Reverse Voltage, V_{RRM} =

Average Rectified Forward Current, $I_{F(av)}$ =

Maximum RMS Voltage, V_{RMS} =

DC Reverse Voltage, V_R =

Maximum reverse current I_{RM} =

Maximum instantaneous forward voltage drop V_F =

2. Read the specifications of 1Z5V6 Zener diode from its datasheet.

Device Part Number: 1Z5V6

Device Manufacturer: _____

Nominal Zener voltage, V_Z =

Zener test current, I_{ZT} =

Maximum Zener impedance, Z_{ZT} @ I_{ZT} =

Z_{ZK} @ I_{ZK} =

Zener Knee current I_{ZK} =

Power dissipation, P_D =

PRACTICE PROCEDURE

1. Unbiased Clippers

1. Connect the circuit as shown in Figure 1**.**
2. Apply sine wave of 10Vp-p, 1 kHz from function generator.
3. Observe the input, output waveforms and its transfer characteristics on DSO screen.

Repeat the above steps for Figure 2, Figure 3 and Figure 4.

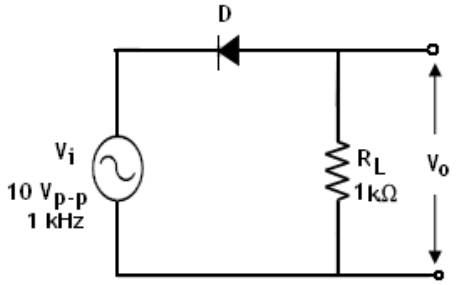


Figure 1: Unbiased Series Positive Clipper

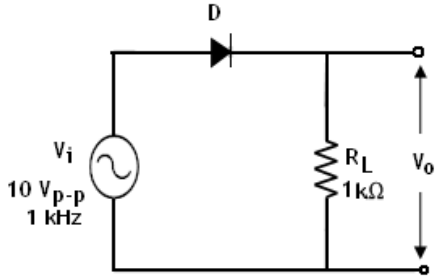
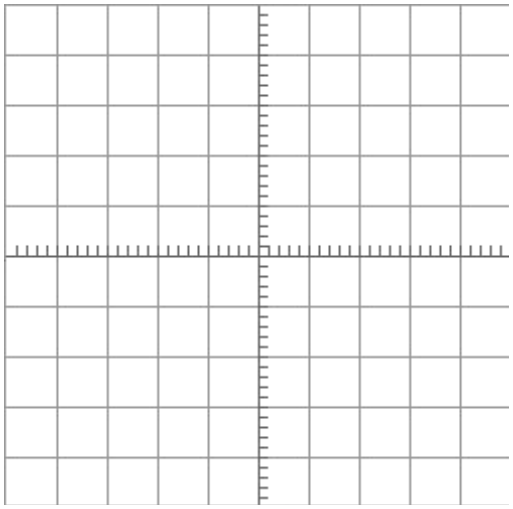


Figure 2: Unbiased Series Negative Clipper

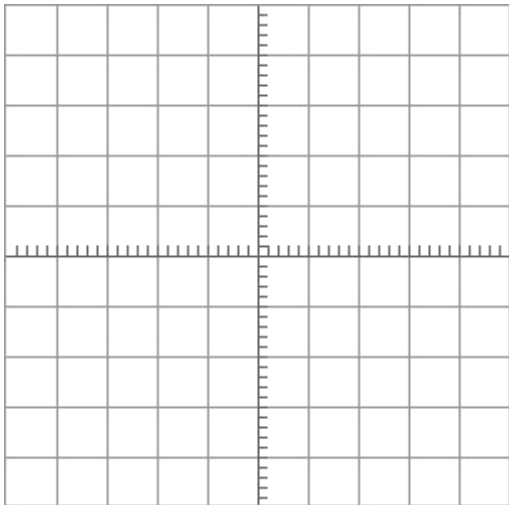
Observations

Volt/div = Time/div =



Output waveform

Volt/div = Time/div =



Output waveform

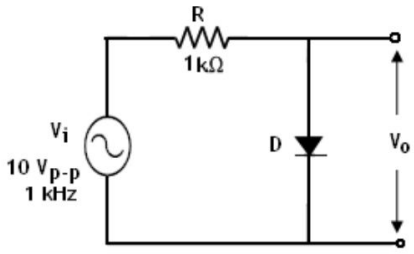


Figure 3: Unbiased Shunt Positive Clipper

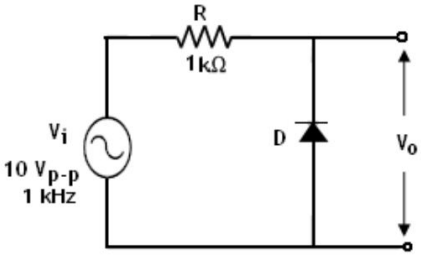
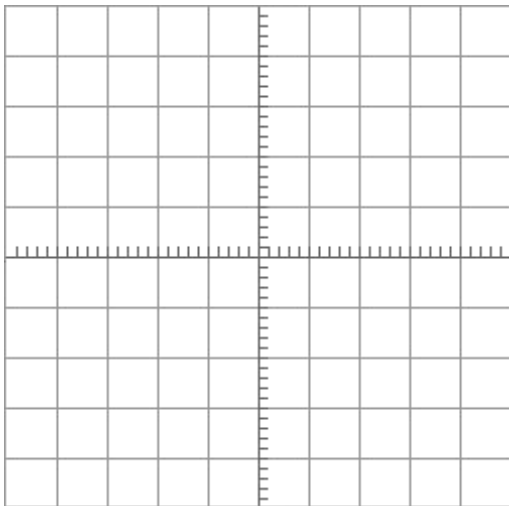


Figure 4: Unbiased Shunt Negative Clipper

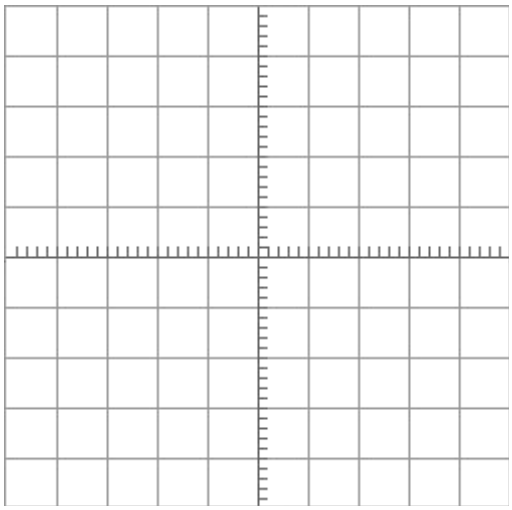
Observations

Volt/div = Time/div =



Output waveform

Volt/div = Time/div =



Output waveform

INFERENCE

2. Biased Clippers

1. Connect the circuit as shown in Figure 5.
2. Apply sine wave of 10Vp-p, 1 kHz from function generator and 2 V dc from regulated power supply.
3. Observe the input, output waveforms and its transfer characteristics on DSO screen.

Repeat the above steps for Figure 6.

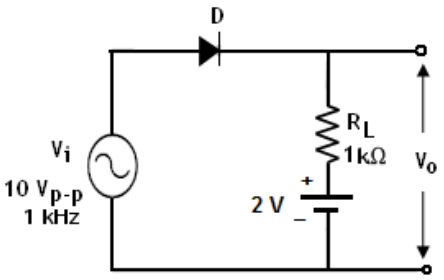


Figure 5: Biased Series Negative Clipper

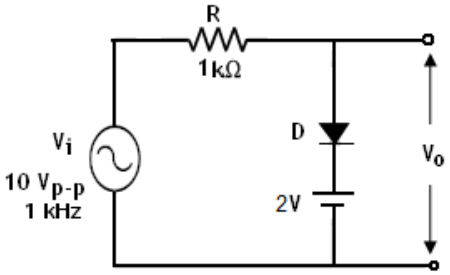
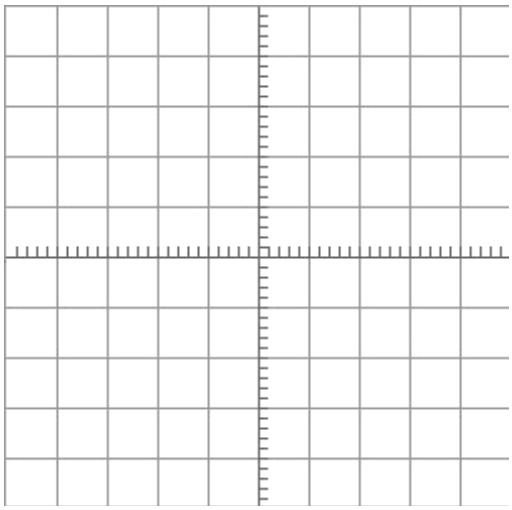


Figure 6: Biased Shunt Positive Clipper

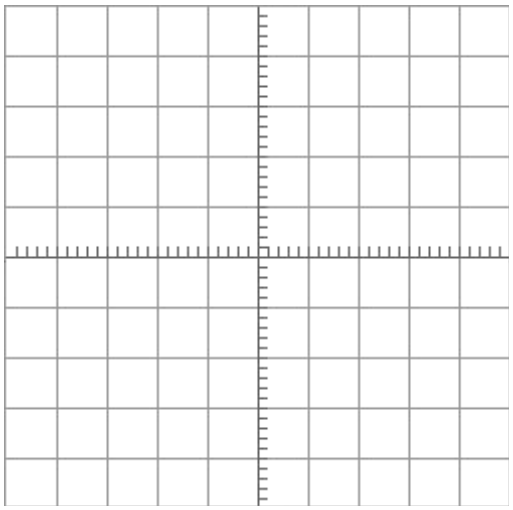
Observations

Volt/div = Time/div =



Output waveform

Volt/div = Time/div =



Output waveform

INFERENCE

3. Clampers and Voltage multipliers

1. Connect the circuit as shown in Figure 7 and Figure 8.
2. Apply sine wave of 10Vp-p, 1 kHz from function generator.
3. Observe the input and output waveforms on DSO screen.
4. Measure the peak value of the output signal.

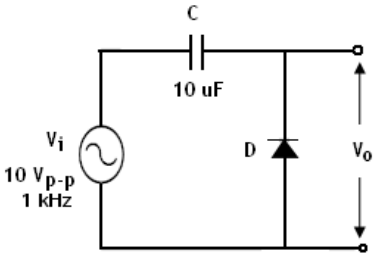


Figure 7: Unbiased Positive Clamper

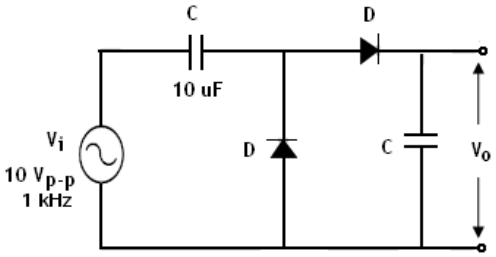
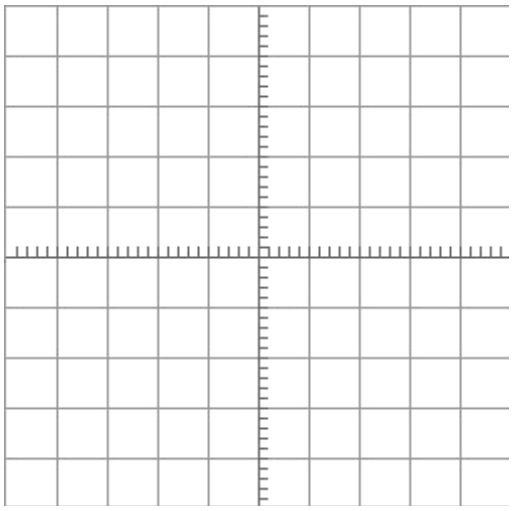


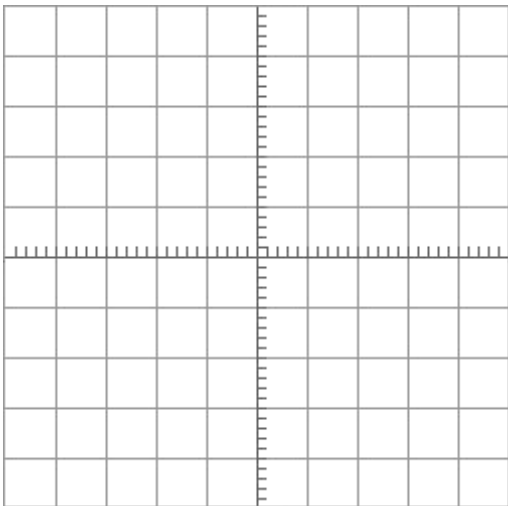
Figure 8: Voltage doubler

Volt/div = Time/div =



Output waveform

Volt/div = Time/div =



Output waveform

Inference

4. Bridge rectifiers

1. Connect the circuit as shown in Figure 9 without capacitor.
2. Apply sine wave of 20Vp-p, 50 Hz from function generator.
3. Observe the input and output waveforms on DSO screen.
4. Measure the peak value of output V_m and calculate V_{rms} and V_{dc}. Note: $V_{rms} = V_m/\sqrt{2}$, $V_{dc} = 2V_m/\pi$.
5. Connect the capacitor filter and observe the output. Measure the peak value of output V_m and peak to peak ripple voltage V_{rpp}.

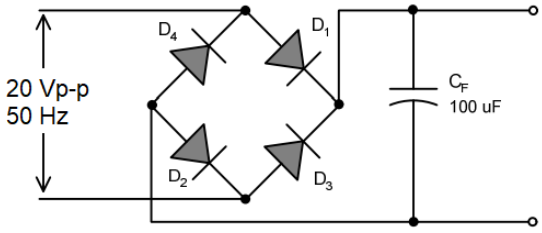


Figure 9: Bridge Rectifier

Observations

	Bridge Rectifier Without filter
V_m	
$V_{rms} = V_m/\sqrt{2}$	
$V_{dc} = 2V_m/\pi$	
Ripple factor, r $r = \sqrt{(V_{rms}/V_{dc})^2 - 1}$	

	Bridge Rectifier With filter
V_m	
V_{rpp}	
$V_{r,rms} = V_{rpp}/2\sqrt{3}$	
$V_{dc} = V_m - V_{rpp}/2$	
Ripple factor, r $r = V_{r,rms}/V_{dc}$	

Inference

5. Bridge rectifiers with Zener regulators

1. Connect the circuit as shown in Figure 10 without load resistor.
2. Observe the output waveforms on DSO screen. Compare with the waveforms obtained for rectifiers with filter.
3. Measure the no load voltage, V_{NL}.
4. Connect 220 Ω resistor as R_L and measure the full load voltage, V_{FL}.
5. Calculate the percentage regulation. Note: % regulation = $(V_{NL} – V_{FL})/V_{FL}$ x 100.

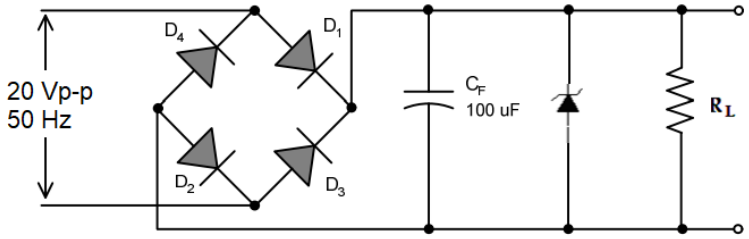


Figure 10: Bridge Rectifier with Zener regulator

Observations

V_{NL} =

V_{FL} =

Inference

RESULTS AND CONCLUSION

Prepared by:
Name: _____ Reg. No.: _____

Date of Experiment: ……

Date of Report Submission: ……

Signature

ASSESSMENT

Student Task	Max. Marks	Graded Marks
Pre-lab Preparation	10	
Results & Inference	10	
Post-lab / Viva-voce	10	
Total	30	