EASTERN MEDITERRANEAN UNIVERSITY

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

EENG341 LAB
ELECTRONICS I

EXPERIMENT 2
HALF-WAVE & FULL-WAVE RECTIFICATION

Std. No. Name &Surname:
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Group No :_____
Submitted to:_____
Date :_____

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Objectives:

- To recognize a half-wave rectified sinusoidal voltage.
- To understand the term 'mean value' as applied to a rectified waveform.
- To understand the effect of a reservoir capacitor upon the rectified waveform and its mean value.

Simple Half-Wave Rectification

Construct the circuit of Fig. 2.1 where V is the voltmeter. Note that the resistor limits the current to a safe value.

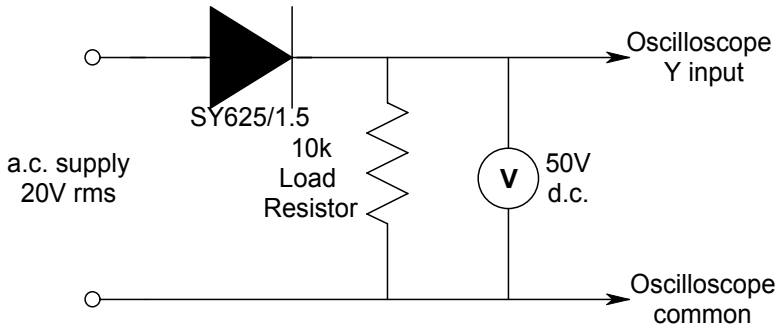

Fig. 2.1. Half-Wave Rectification

- Switch on the oscilloscope and the sinusoidal supply.
- With the oscilloscope d.c. coupled adjust the time-base and the Y amplifier sensitivity to obtain a steady trace of about 4cm vertical and 5ms/cm horizontal.

❖ Measure and record time T and peak voltage V_{pk}:

❖ Sketch the waveform and label it to show the periods when the diode is conducting and those when it is not. Time T depends upon the frequency of your power supply.

❖ Confirm this. V_{pk} should be very nearly equal to the peak voltage of the alternating supply.

Questions

1. Why will V_{pk} not be exactly equal to the peak value of the supply?

2. How much is the difference between the measured and theoretical mean voltage?

(**Hint:** The mean value of a half-sinusoid can be shown by geometry to be : $\frac{V_{pk}}{\sqrt{2}}$.

But at every half-cycle the voltage is zero. The mean value of the waveform, therefore is:

$\frac{V_{pk}}{2\sqrt{2}}$. Note the mean voltage indicated by the voltmeter, and compare it with $0.35V_{pk}$.)

3. The mean voltage you obtain is positive relative to zero. How could you obtain a negative voltage?

(**Hint:** Verify your answer by experiment and sketch the waveform.)

Fig. 2.2.

The Effect of a Reservoir Capacitor

Very often when rectifying an alternating voltage, we wish to produce a steady direct voltage free from variations of the sort observed in Fig. 2.2. One way of doing this is to connect a capacitor in parallel with the load resistor as in Fig. 2.3.

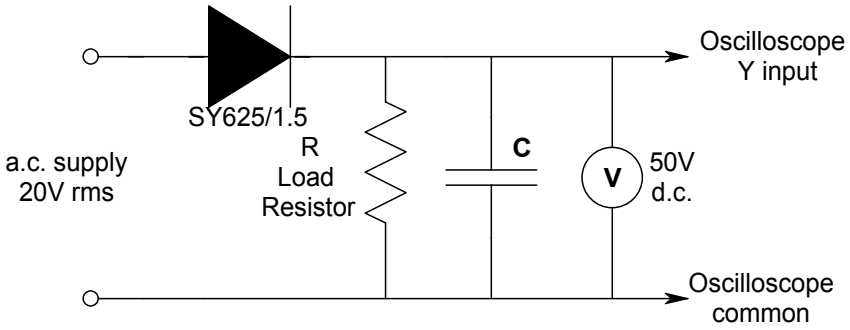

Fig. 2.3. Half-Wave Rectifier with Reservoir Capacitor

- Set C=1μF and R=10kΩ.

❖ Observe the output waveform on the oscilloscope and note the value of the peak-to-peak variations in voltage. Note also the new mean voltage on the voltmeter.

4. Is the new mean voltage greater or less than it was before?

- Now replace the 1μF capacitor by a much larger value of 22μF, and answer the following questions.

5. The variations on the rectified waveform are called ***RIPPLE***. Is the ripple now less than it was with the lower value capacitor?

6. Is the mean rectified voltage now greater or less?

A Bridge Rectifier with Resistive Load

Construct the circuit of Fig. 2.4. Note that the resistor limits the current to a safe value.

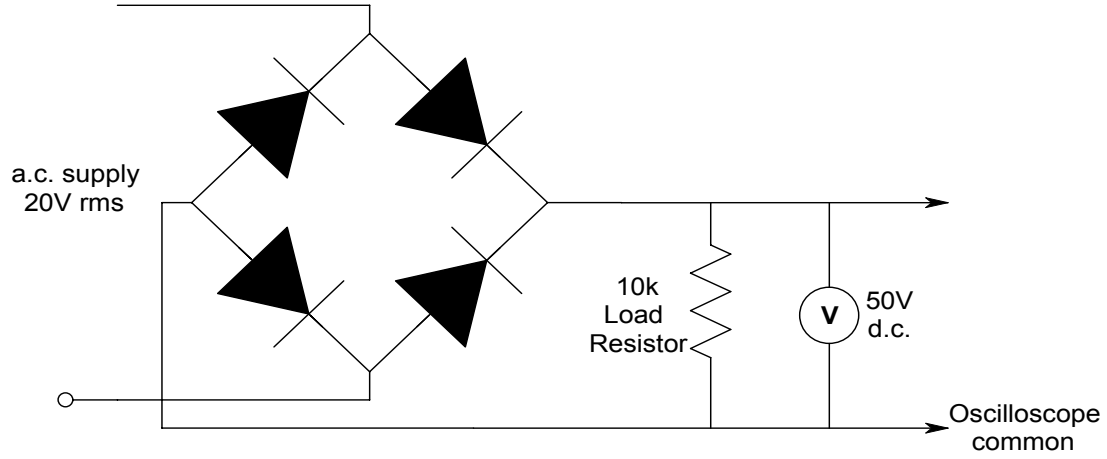

Fig. 2.4. Full-Wave Rectification

- Switch on the sinusoidal supply.

❖ Measure and record time mean value of output voltage indicated on the voltmeter V_m.

❖ Compare the mean value of output voltage indicated on the voltmeter those obtained in the Half-Wave rectification.

Questions

7. The mean value of output voltage indicated on the voltmeter is it the same as it was for half-wave rectifier? If there is any difference explain why?

8. How does the mean value compare with that found for half-wave rectification?

(**Hint:** the mean value of a half-sinusoid can be shown by geometry to be: $\frac{V_{pk}}{\sqrt{2}}$ and V_{pk}=10V. Then every half-cycle is present, this should be the mean value measured. Confirm this from your readings.

The Effect of a Reservoir Capacitor in the Bridge Rectifier

- Add a 1μF capacitor in parallel with the load resistor and note the new mean value of the rectified waveform. Compare this values with those obtain in the Simple Half-Wave rectification for the same load and capacitor values.

CONCLUSIONS: