Ex. No. 12	SINGLE PHASE FULL WAVE BRIDGE RECTIFIER
Date:	

AIM

(a) To design and test a 10 V DC power supply with diode bridge rectifier.
(b) To observe waveform at the output of bridge rectifier with and without filter capacitor.

APPARATUS REQUIRED

Sl. No.	Item	Range	Quantity
1.	Transformer	230/12V	1
2.	PN Junction Diode	IN4002	4
3.	Capacitor	Any value in the range 47µF to 100µF (> 30 V)	1
4.	Resistor	Any value in the range 470Ω to 1kΩ 1	1
5.	Breadboard		1
6.	Wires		As required
7.	Oscilloscope with voltage probes		1

THEORY

A power supply can by broken down into a series of blocks, each of which performs a particular function. A transformer first steps down high voltage AC to low voltage AC. A rectifier circuit is then used to convert AC to DC. This DC, however, contains ripples, which can be smoothened by a filter circuit.

The Bridge rectifier plays an important role in DC power supplies, it converts both half cycles of the input AC voltage into DC. The Bridge rectifier circuit is shown in the following figure.

(a) Positive half cycle
During the positive half cycle of the AC input voltage, diodes D1 and D3 are forward biased and they conduct current as shown in the Figure 1. The other two diodes are reverse biased.

(b) Negative half cycle
During the negative half cycle of the AC input voltage, diodes D2 and D4 are forward biased and they conduct current as shown in the Figure 2. The other two diodes are reverse biased. The current through the load resistance will be in the same direction as

during the positive half cycle. As a result of this action, a full wave rectified (unidirectional) output voltage is developed across the load resistance. The output voltage waveforms developed across the load resistance is shown in the Figure 3.

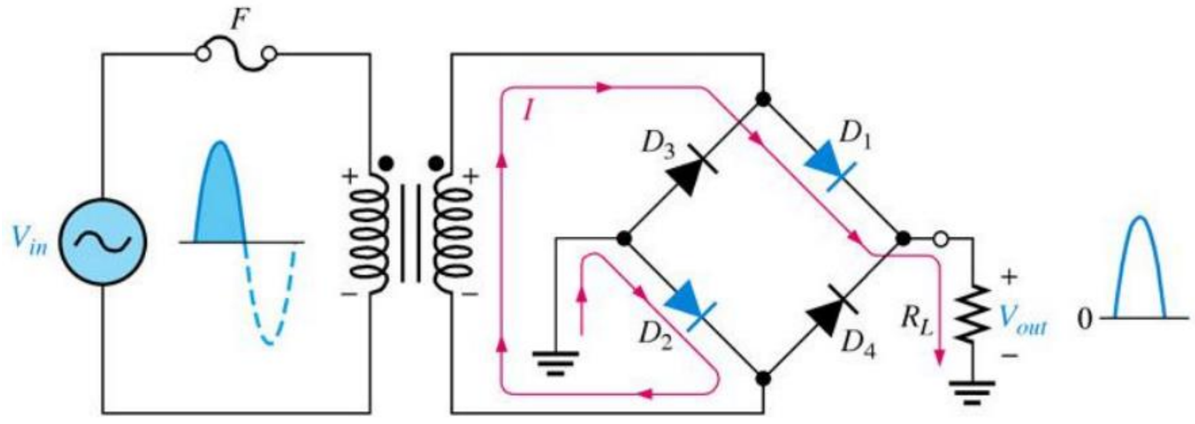


Figure 1.

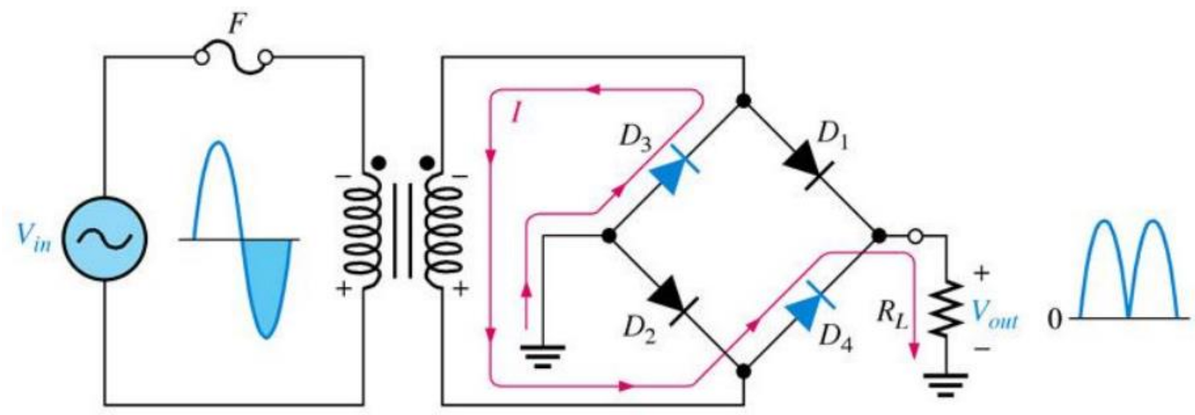


Figure 2.

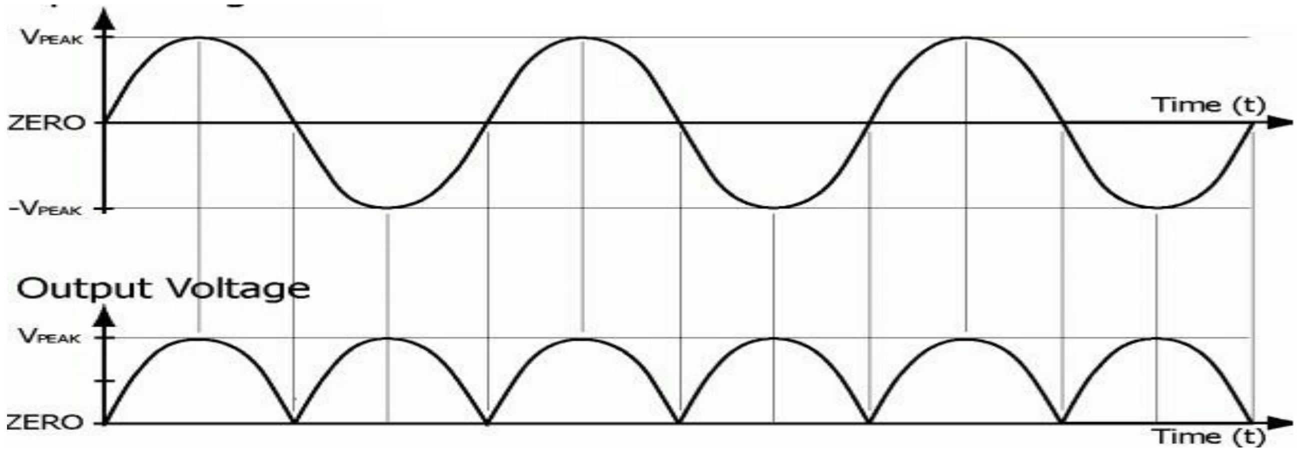


Figure 3.

The output of the rectifier contains dc as well as ac component. The presence of ac component (ripple) is undesirable and hence can be removed with a help of a capacitor filter as shown in Figure 4. The capacitor charges quickly near the peak of the varying DC, and then discharges as it supplies current to the output. Bold line is filtered output and thin line is unfiltered output.

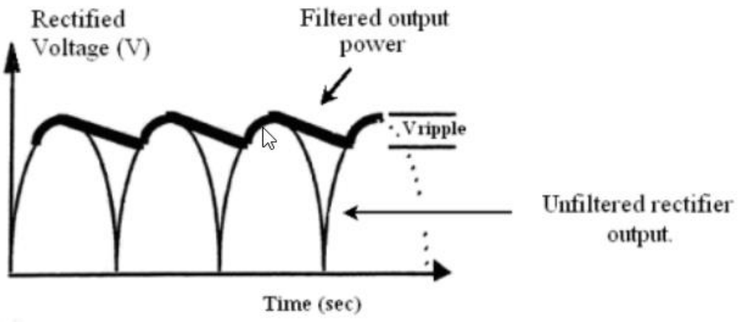
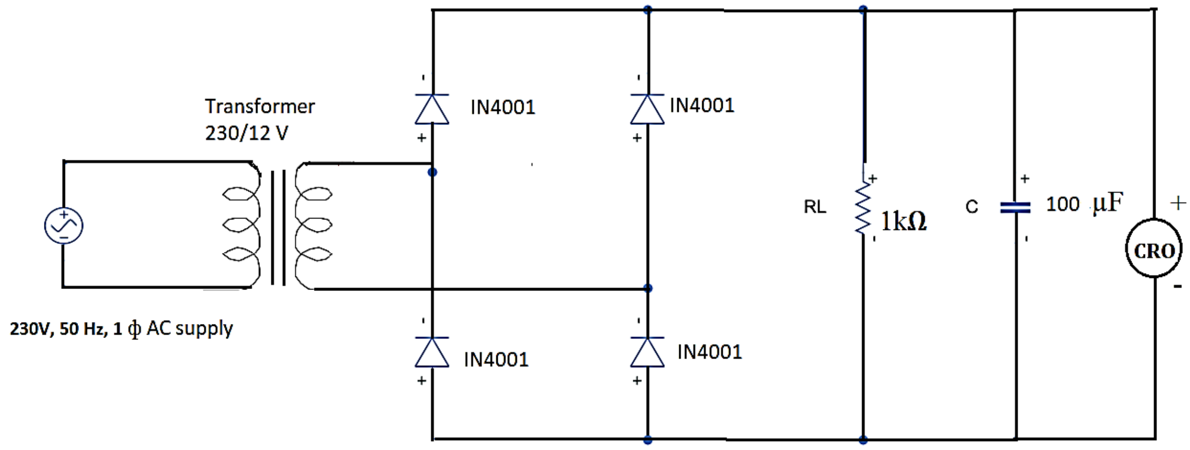


Figure 4.

CIRCUIT DIAGRAM



The RMS and average values of the output voltage (across load) without the filter is given by

$\boldsymbol{V_{rms} = V_m/\sqrt{2}}$

$\boldsymbol{V_{avg} = 2V_m/\pi}$

The RMS value of the filtered output is calculated assuming that the wave as a triangular wave and it is

$\boldsymbol{V_{rms} = (V_{ripple})/2\sqrt{3}}$

where V_{ripple} is the peak to peak value of the filtered output voltage.

$\boldsymbol{V_{avg} = V_m - (V_{ripple}/2)}$

Ripple factor

r = V_{rms}/V_{avg}

Ripple factor is also given by the expression, ***r = 1 / (4√3fRC),***

where f is the mains supply frequency 50 Hz, R is the load resistance and C is the filter capacitance.

EXPERIMENTAL PROCEDURE:

1. Plug the transformer in to the AC power socket and measure the voltage at the secondary side of the transformer using oscilloscope.

2. Build the rectifier circuit along with resistive load using 4 diodes, 1 resistor and the transformer as shown in the circuit diagram.

3. Observe and measure the load voltage VL with the help of an oscilloscope. Record the resulting waveform.

4. Repeat the experiment with filter capacitor by connecting the capacitor across the resistive load as shown in the circuit diagram. Now, observe and measure the load voltage VL again with the help of an oscilloscope. Record the resulting waveform.

OBSERVATIONS:

<table>
<tr><td colspan="6">Without Filter</td></tr>
<tr><td>S.No</td><td colspan="2">V_m</td><td>$V_{rms} = V_m/\sqrt{2}$</td><td>$V_{avg}=2V_m/\pi$</td><td>$r=\sqrt{[(V_{rms}/V_{avg})^2-1]}$</td></tr>
<tr><td>1</td><td colspan="2"></td><td></td><td></td><td></td></tr>
<tr><td colspan="6">With Filter</td></tr>
<tr><td>S.No</td><td>V_m</td><td>V_{ripple}</td><td>$V_{rms} = (V_{ripple})/2\sqrt{3}$</td><td>$V_{dc}=V_m-(V_{ripple}/2)$</td><td>$r=V_{rms}/V_{avg}$</td></tr>
<tr><td>1</td><td></td><td></td><td></td><td></td><td></td></tr>
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RESULT

Thus the performance characteristics of 1φ Full wave rectifier were obtained.