Pre-Lab:
Zener Voltage Regulator

OBJECTIVES:

1. To construct the basic linear power supply circuit.
2. To demonstrate the operation of a practical four fundamental blocks in a basic power supply circuit
3. To obtain measured values of peak, average, and rms output voltages from each component of power supply circuit.

INTRODUCTION:

Power companies supply alternating current. This alternating current needs to be changed to direct current to power various types of electronic circuits. In general, power is the backbone of any electronic system and the power supply is what feeds the system.

Basically, a power supply takes the ac energy provided by the wall outlet and converts it to DC energy. DC power supply consists of four fundamental blocks: transformer, rectifier, filter, and voltage regulator. In this prelab, we will investigate the function and effect of each component.

PROCEDURE:

PART 1: Transformer Circuit

a) Construct the circuit shown in Figure 1.1.

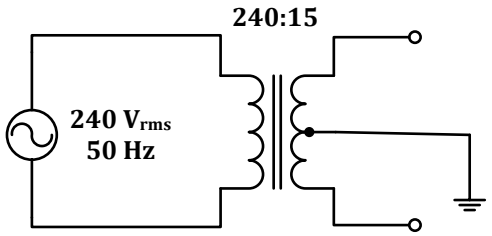

Figure 1.1

b) Measure the rms primary and secondary voltages. Record the values in Table 1.1. *Attach the instrument connection and the measurement readings.*

c) Connect the oscilloscope so that channel 1 is across the transformer primary and channel 2 is across the transformer secondary. Measure the amplitude of the primary voltage, v_{pri}, and the secondary voltage, v_{sec}. Record the values in Table 1.1. *Attach the instrument connection and the waveforms with the measurement readings.*

PART 2: Rectifier Circuit

a) Connect two diodes to the circuit in Figure 1.1 as shown in Figure 1.2.

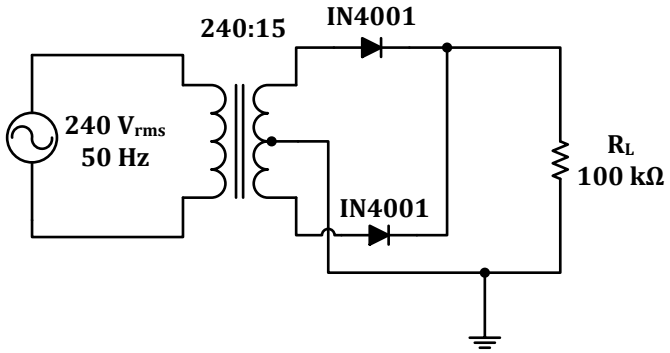

Figure 1.2

b) Connect the oscilloscope so that channel 1 is across the transformer secondary and channel 2 is across the resistor R_L. Measure the amplitude of the load voltage. Record the values in Table 1.2. *Attach the instrument connections and the measurement readings.*

c) Measure the DC level of the output waveforms. Record the value in Table 1.2.

PART 3: Filter Circuit

a) Add a capacitor C_1 in parallel with resistor R_1 as shown in Figure 1.3. Note the polarity of the capacitor. Choose any value of C_1 between 10 µF – 47 µF.

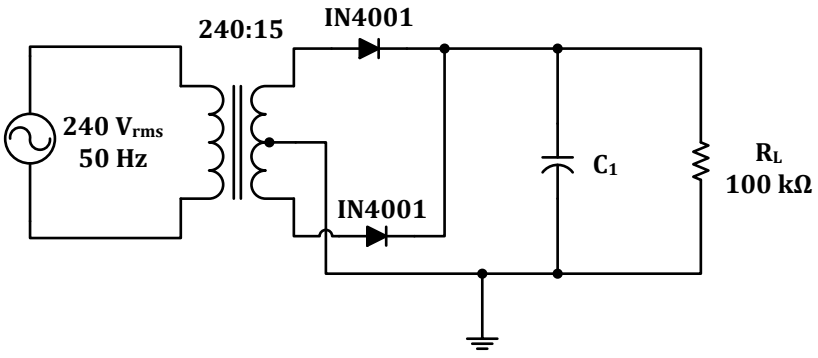

Figure 1.3

b) Measure the peak-to-peak ripple voltage across R_1 and the ripple frequency. Record the values in Table 1.3. To measure the ripple voltage, switch the oscilloscope vertical input to AC coupling. This allows you to magnify the small ac ripple voltage without including the much larger dc level. *Attach the instrument connections and the measurement readings..*

c) Measure the DC voltage across R_1. Record the value in Table 1.3. *Attach the instrument connections and the measurement reading.*

d) Investigate the effect of the capacitor on the ripple voltage by replacing C_1 with 100 µF capacitor. Repeat steps (b) – (d).

e) For C_1 = 100 µF, investigate the effect of the load resistance by replacing R_L with 10 kΩ resistor. Repeat steps (e) – (g).

PART 4: Voltage Regulator

a) Construct the circuit shown in Figure 1.4.

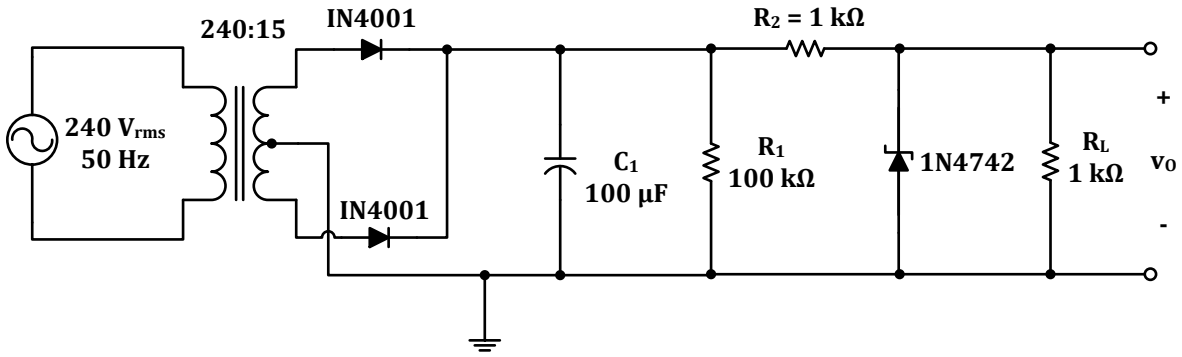

Figure 1.4

b) Measure the peak-to-peak ripple load voltage. Record the value in Table 1.4. *Attach the instrument connections and the measurement reading.*

c) Measure the dc load voltage. Record the value in Table 1.4. *Attach the instrument connections and the measurement reading.*

DISCUSSIONS:

1. Discuss the function of each block of the basic power supply circuit.
2. Discuss the changes in the ripple of the output of the filtered rectifier when either the filter capacitor or load resistance changes.
3. Why did you still get ripple voltage at the output even though you are using zener diode to regulate the voltage?

Group:
Contributed members:
1.
2.
3.
4.

RESULTS

Table 1.1: Transformer primary and secondary voltages

	v_{rms} (V)	v_{peak} (V)
v_{pri}		
v_{sec}		

Table 1.2: Rectified voltages

$v_{R1(p)}$ (V)	$v_{R1(DC)}$ (V)

Table 1.3: Filtered voltages

R_1 = 100 kΩ; C_1 = 10 µF		R_1 = 100 kΩ; C_1 = 100 µF		R_1 = 10 kΩ; C_1 = 100 µF	
$V_{R1(pp)}$ (mV)	$V_{R1(avg))}$ (V)	$V_{R1(pp)}$ (mV)	$V_{R1(avg))}$ (V)	$V_{R1(pp)}$ (mV)	$V_{R1(avg))}$ (V)

Table 1.4: Regulated voltages

$V_{RL(pp)}$ (V)	$V_{RL(avg)}$ (V)