Exp. No. Date:

LINEAR REGULATED POWER SUPPLY

OBJECTIVE

The purpose of the experiment is to

design series transistor regulator and plot load current vs output voltage, Input voltage vs output voltage for a constant load current.
study the effect of capacitive filters on bridge rectifiers.
design a linear power supply circuit with series pass transistors and with fixed voltage regulators.

EQUIPMENT AND COMPONENTS USED

30 MHz Dual Channel Digital Storage Oscilloscope (DSO)
3 MHz Function Generator
0-30 V dc regulated power supply
4 ½ digit Digital Multimeter
1N4007 Diode
1Z5V6 Zener Diode
SL100 Transistor
LM7812
Resistor 330 Ω, 270 Ω, ½ W
Electrolytic Capacitor 100 µF/63V, 470 µF/63V
Breadboard and Connecting wires
BNC Cables and Probes

PRE-LAB

1. Design the transistor series regulator circuit. Determine the voltage regulation (line and load).

2. Comment on the effect of increasing capacitor values in rectifier circuits with filter.

DESIGN

Specifications

Output Voltage, Vo = 5 V (regulated)

Output Current, I_L = 0 - 50 mA

Input Voltage, V_i = 10 - 15 V

Maximum power dissipated in the transistor = $(V_{imax} – V_o)\ I_{max}$

Select a transistor whose P_{dmax} is greater than the power dissipation calculated above and whose V_{CEO} is greater than $(V_{imax} – V_o)$.

Calculate base current $I_B = I_{max} / h_{fe.min}$.

Select a zener having breakdown voltage equal to

V_Z = (Vo + 0.6) volts

V_Z = 5 + 0.6 = 5.6 V

Referring datasheet for zener diodes, power dissipation of the zener diode is found.

The wattage rating of the zener = $V_Z\ I_{Zmax}$

Select zener diode of 5.6 V, 400mW

Input = 10 – 15 V Output = 0 - 50 mA at 5V

Take h_{femin} = 100, I_B =

I_{Zmax} =

I_{Zmin} = 10% of I_{Zmax} =

$$R_{\max} = \frac{V_{i\min} - V_z}{I_{z\min} + I_B} =$$

$$R_{\min} = \frac{V_{i\max} - V_z}{I_{z\max}} =$$

Select R = average of R_{min} and R_{max} =

Power rating of R is to be fixed considering maximum I^2R loss.

$$I^2R = \left(\frac{V_{i\max} - V_z}{R}\right)^2 \times R =$$

Select R as _____ Ω, _____W

CIRCUIT DIAGRAM

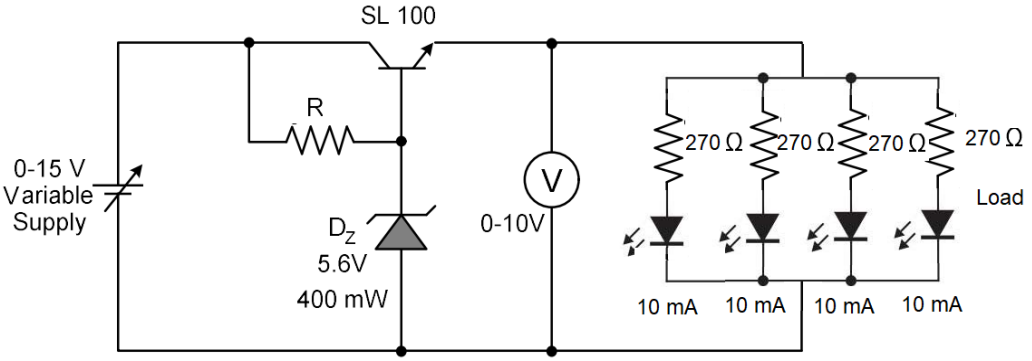


Figure 1: Transistor series regulator

PRACTICE PROCEDURE

1. Transistor series regulator

1. Set up the circuit as per the circuit diagram shown in Figure 1.
2. Vary the input voltage and measure the output voltage.
3. Plot the graph between input and output voltages, and is called line regulation.
4. Keep the input voltage as constant. For various load current I_L measure output voltage Vo.
5. Plot the graph between load current and output voltage, and is called load regulation

Table1: Line regulation

I_L = mA

S.No.	Input Voltage, V_i Volts	Output Voltage, V_o Volts
1.	5 V	
2.	6 V	
3.	7 V	
4.	8 V	
5.	9 V	
6.	10 V	
7.	11 V	
8.	12 V	
9.	13 V	
10	14 V	

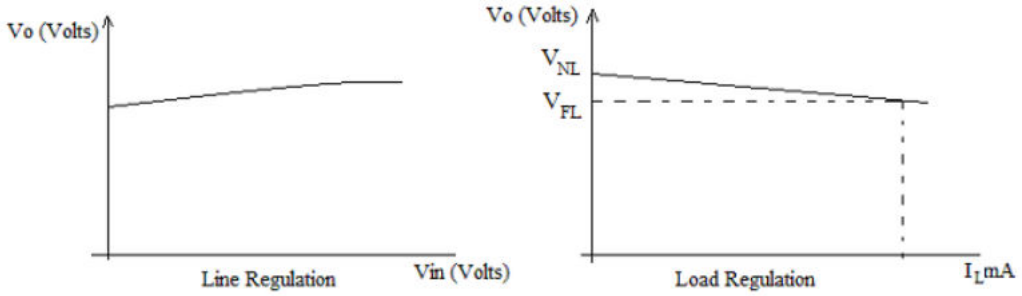
Table1: Load regulation

Vi = 10 V

S.No	Load current, I_L mA	Output Voltage, V_o Volts
1.	No load	
2.	10 mA	
3.	20 mA	
4.	30 mA	
5.	40 mA	
6.		

Inference

Model Graph



2. Bridge rectifiers with Capacitive filter

1. Connect the circuit as shown in Figure 2 without capacitor.
2. Apply sine wave of 20Vp-p, 50 Hz from function generator and connect 220 Ω resistor as R_L.
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}.
6. Change the capacitor value to 470 uF and observe the output.

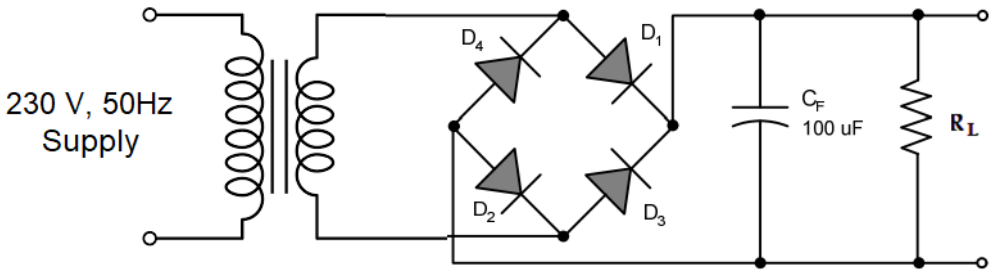


Figure 2: Bridge Rectifier with capacitive filter

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

3. Linear Power Supply

1. Connect the circuit as shown in Figure 3.
2. Observe the output voltage.

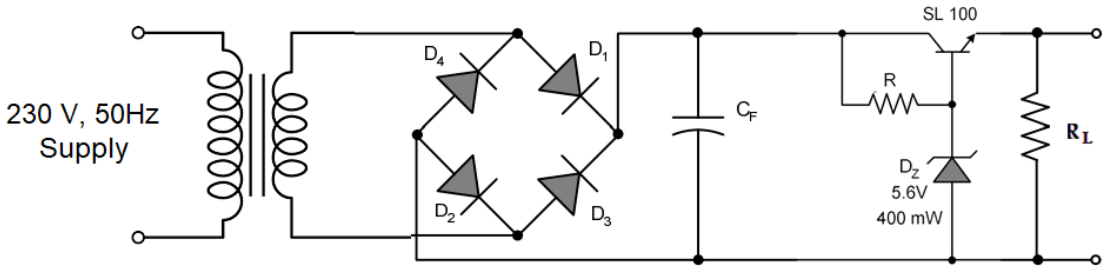


Figure 3: Linear Power supply

Inference

4. Fixed Voltage regulator

1. Connect the circuit as shown in Figure 4.
2. Observe the output voltage.

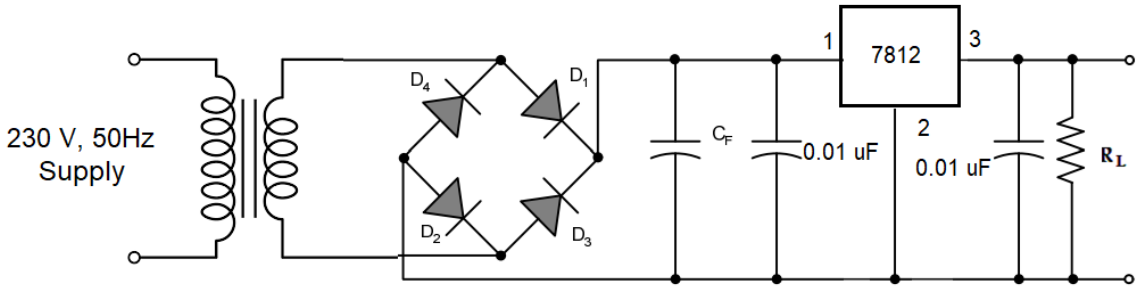


Figure 4: Fixed Power Sypply

Inference

UNDERSTANDING & LEARNING

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 / Conduction	10	
Results & Inference	10	
Post-lab / Viva-voce	10	
Total	30	