AC-DC Converter

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Contents

Abstract—**This manual provides the design of a mobile charger.**

1 Components

Component	Value	Quantity
Step Down Transformer	230V AC - 12V AC - 750 mA	1
Diode		4
Capacitor	100 μF	1
Regulator	LM7805	1
Jumper Wires	M-M	20

TABLE I

2 Circuit Diagram

The circuit diagram is shown in 2.0

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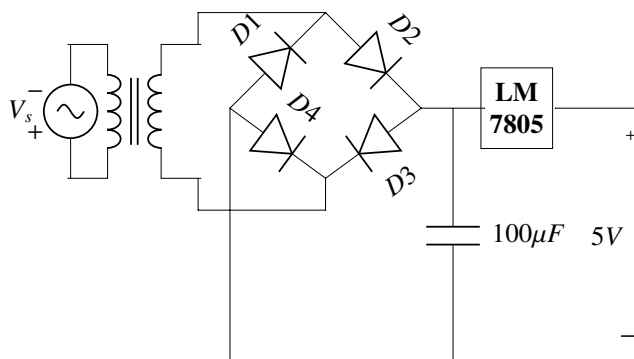

Fig. 2.0: AC-DC circuit diagram

3 Connections

Problem 3.1. Connect the various components in Table I as per Fig. 2.0.

Problem 3.2. Observe the output of the Bridge Rectifier between junctions of D1,D4 and D2,D3 on oscilloscope. What do you observe?
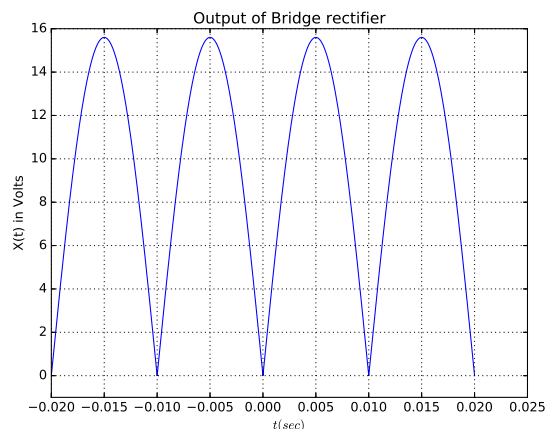
Solution:

Fig. 3.2

4 FUNCTIONING

4.1 Ripple Filter

Problem 4.1. Measure the output of the capacitor filter using multimeter. What do you observe?

4.2 Regulator

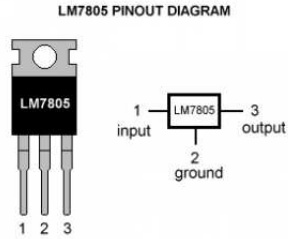The pin description of LM7805 is shown in Fig. 4.1

Fig. 4.1

Problem 4.2. Connect pin 1 and pin 2 of LM7805 to positive and Ground terminals of capacitor.

Problem 4.3. Measure the Voltage across and current passing through the pin 3 and Ground of LM7805. What do you observe?

5 FOURIER SERIES ANALYSIS OF AC-DC CONVERTER

Problem 5.1. The output of the transformer is 12V rms. Find the peak voltage from the rms voltage.

Solution:

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

Problem 5.2. The threshold voltage for each diode in Fig. 2.0 is $V_{th} = 0.7V$. What is the peak voltage of the Bridge rectifier output?

Solution:

$$V_r = V_m - 2V_{th}$$

Problem 5.3. The Bridge rectifier output can be expressed as

$$V(t) = V_r \left| \sin\left(2\pi f_0 t\right) \right| \qquad (5.3.1)$$

If

$$V(t) = \sum_{n=0}^{\infty} a_n \cos 2\pi n f_0 t + b_n \sin 2\pi n f_0 t \qquad (5.3.2)$$

find a_n and b_n.

Problem 5.4. Assuming that $f_0 = 100Hz$, in Problem 5.3 compute a_0 and compare it with the ripple filter output.

Problem 5.5. Demonstrate your results through a Python script.