Elements of Electronics & Communication Engineering

Assignment # 01

Q1. Consider the following circuit diagram:

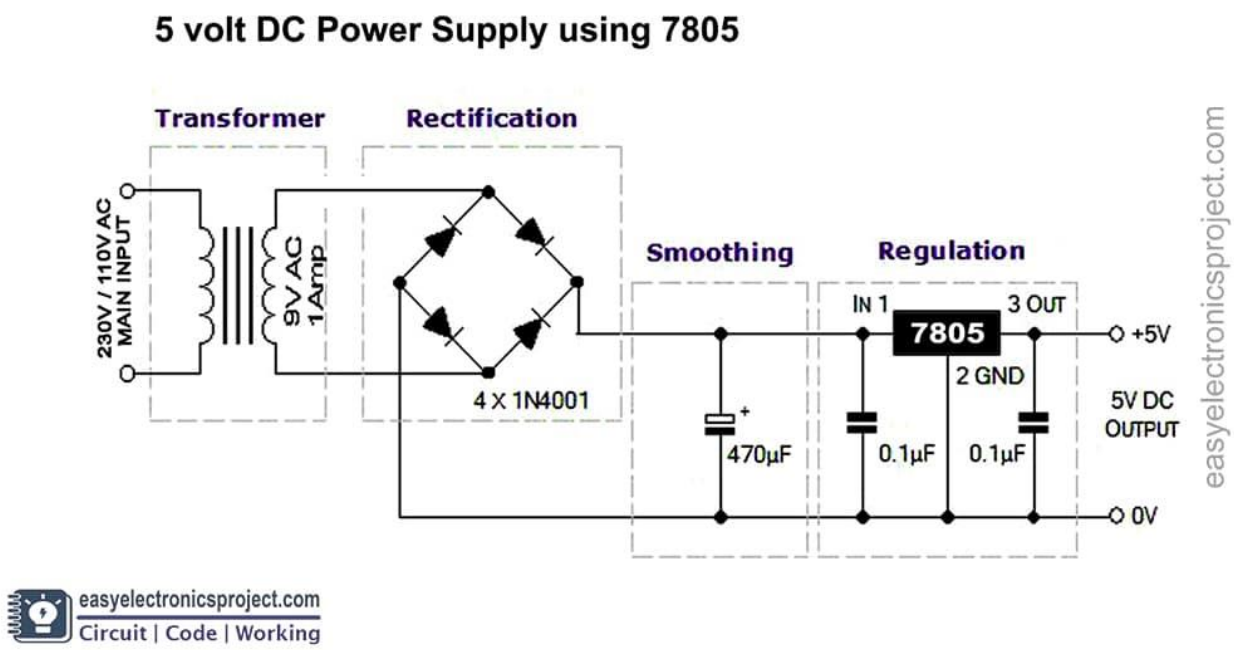


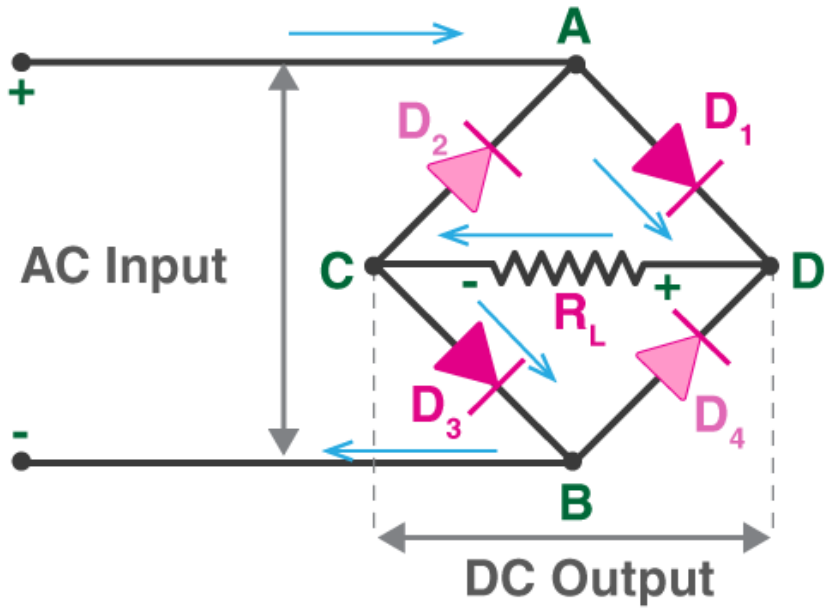
Fig 1.1 Circuit diagram of a IC 7805 based 5V Charger

i. Explain the working of the Rectification Circuit.

Working

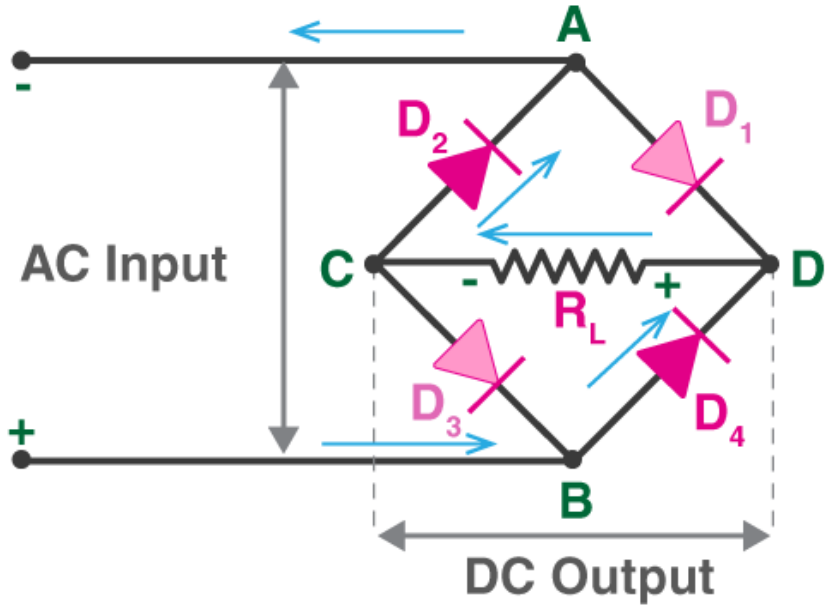
When an AC signal is applied across the bridge rectifier, terminal A becomes positive during the positive half cycle while terminal B becomes negative. This results in diodes D_1 and D_3 becoming forward biased while D_2 and D_4 becoming reverse biased.

The current flow during the positive half-cycle is shown in the figure below:



During the negative half-cycle, terminal B becomes positive while terminal A becomes negative. This causes diodes D_2 and D_4 to become forward biased and diode D_1 and D_3 to be reverse biased.

The current flow during the negative half cycle is shown in the figure below:

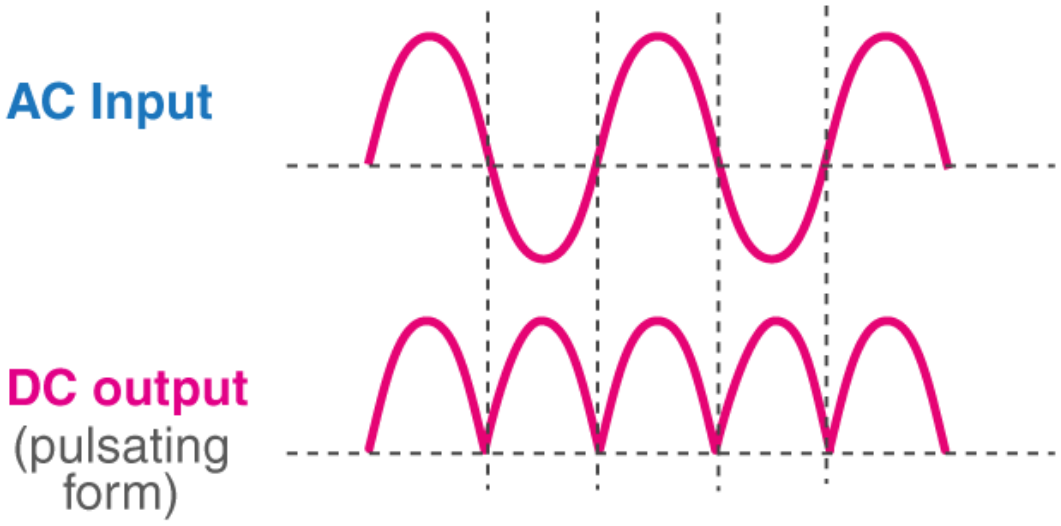


From the figures given above, we notice that the current flow across load resistor R_L is the same during the positive and negative half-cycles. The output DC signal polarity may be either completely positive or negative. In our

case, it is completely positive. If the diodes' direction is reversed, we get a complete negative DC voltage.

Thus, a bridge rectifier allows electric current during both positive and negative half cycles of the input AC signal.

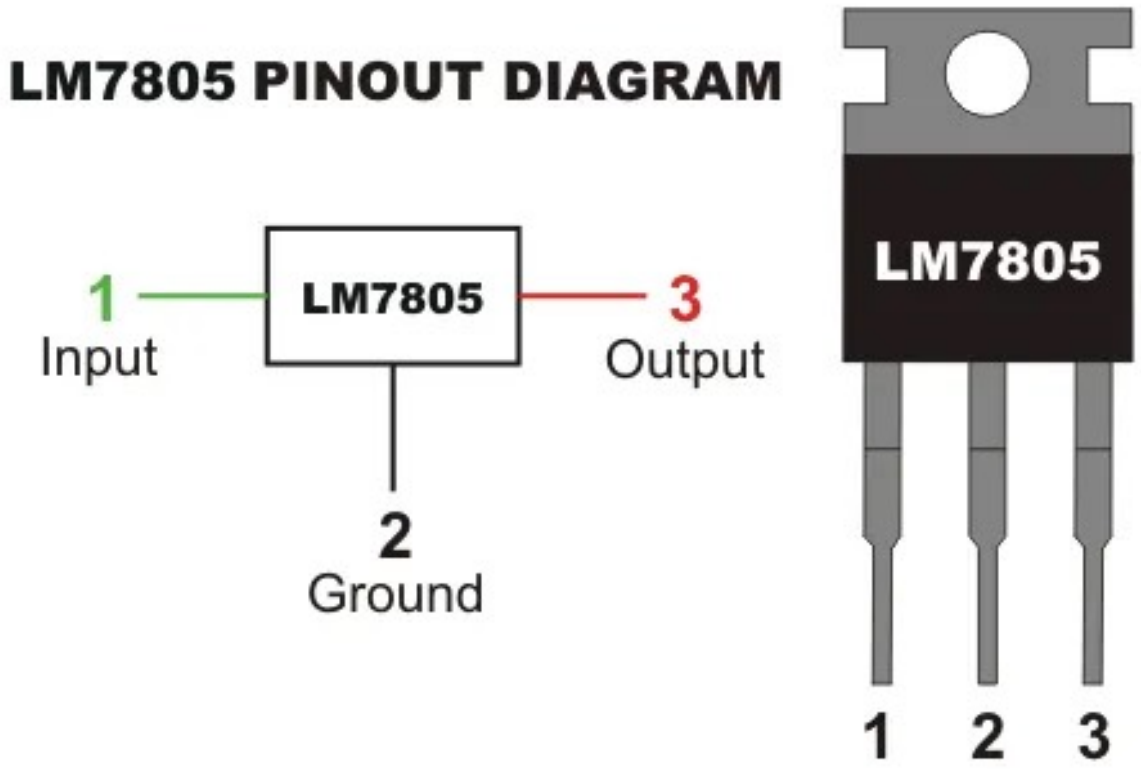
The output waveforms of the bridge rectifier are shown in the below figure.



ii. Explain the working of IC 7805.

All voltage sources cannot able to give fixed output due to fluctuations in the circuit. For getting constant and steady output, the voltage regulators are implemented. The integrated circuits which are used for the regulation of voltage are termed as voltage regulator ICs. Here, we can discuss the IC 7805.

The **voltage regulator IC 7805** is actually a member of the 78xx series of voltage regulator ICs. It is a fixed linear voltage regulator. The xx present in 78xx represents the value of the fixed output voltage that the particular IC provides. For 7805 IC, it is +5V DC regulated power supply. This regulator IC also adds a provision for a heat sink. The input voltage to this voltage regulator can be up to 35V, and this IC can give a constant 5V for any value of input less than or equal to 35V which is the threshold limit.



PIN 1-INPUT
The function of this pin is to give the input voltage. It should be in the range of 7V to 35V. We apply an unregulated voltage to this pin for regulation. For 7.2V input, the PIN achieves its maximum efficiency.

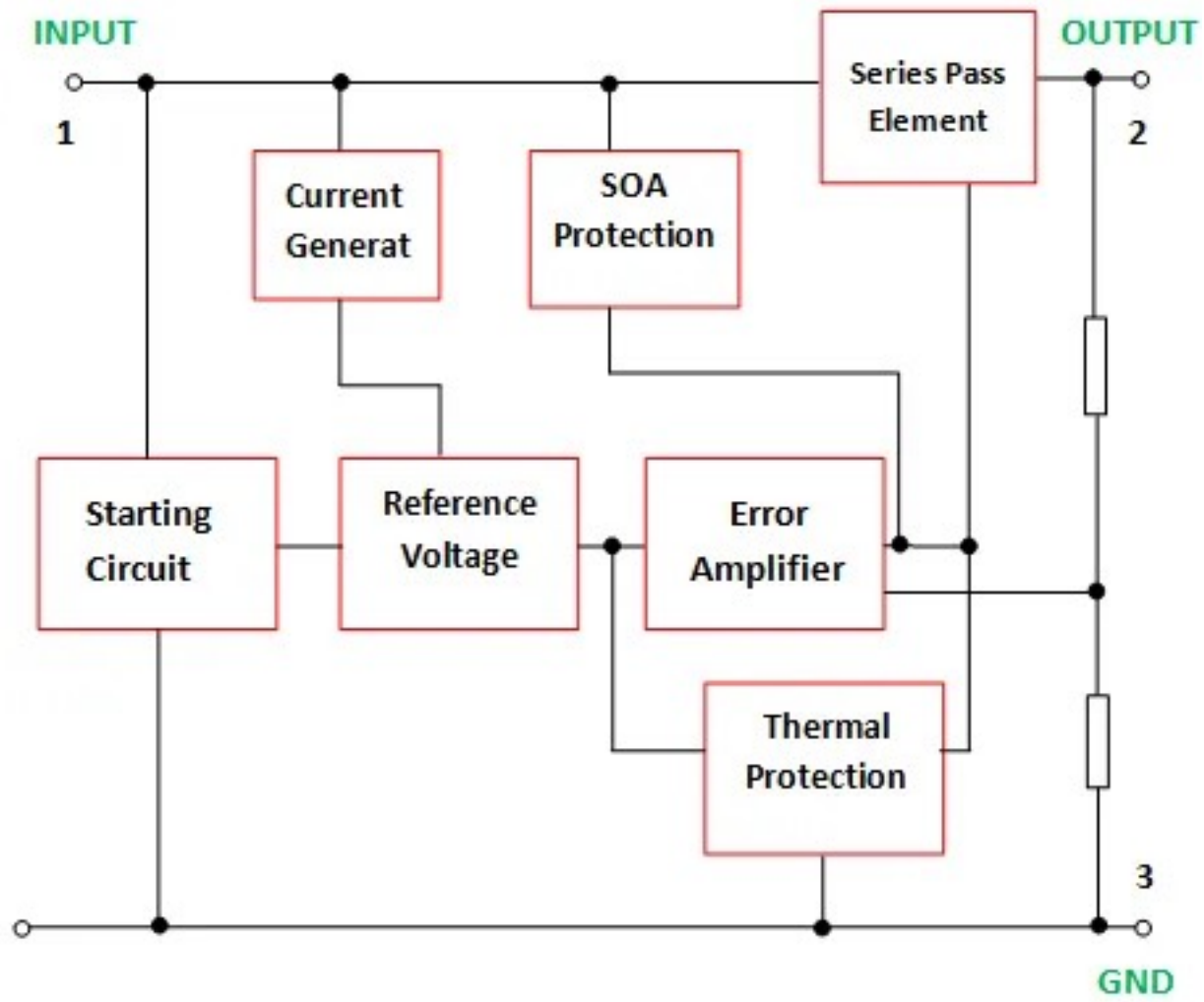
PIN 2-GROUND
We connect the ground to this pin. For output and input, this pin is equally neutral (0V).

PIN 3-OUTPUT
This pin is used to take the regulated output. It will be

$$5V(4.8V - 5.2V)$$

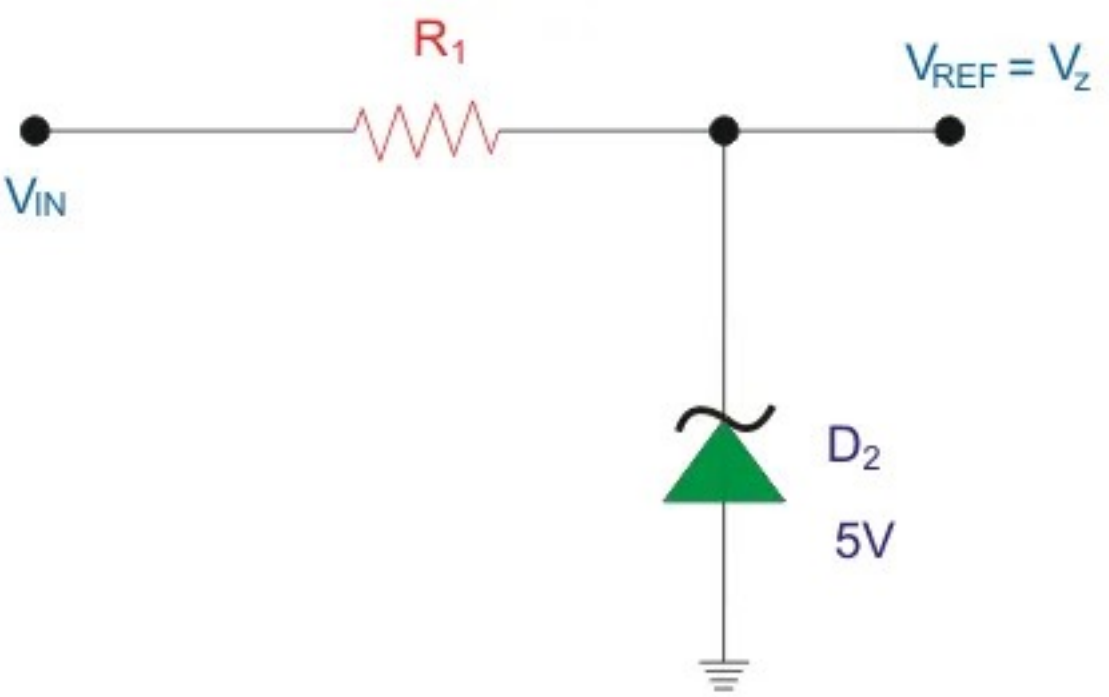
Internal Block Diagram of 7805 Voltage Regulator:-

The internal block diagram of IC 7805 is represented in the figure below:



The block diagram comprises of an error amplifier, series pass element, current generator, reference voltage, current generator, starting circuit, SOA protection and thermal protection.

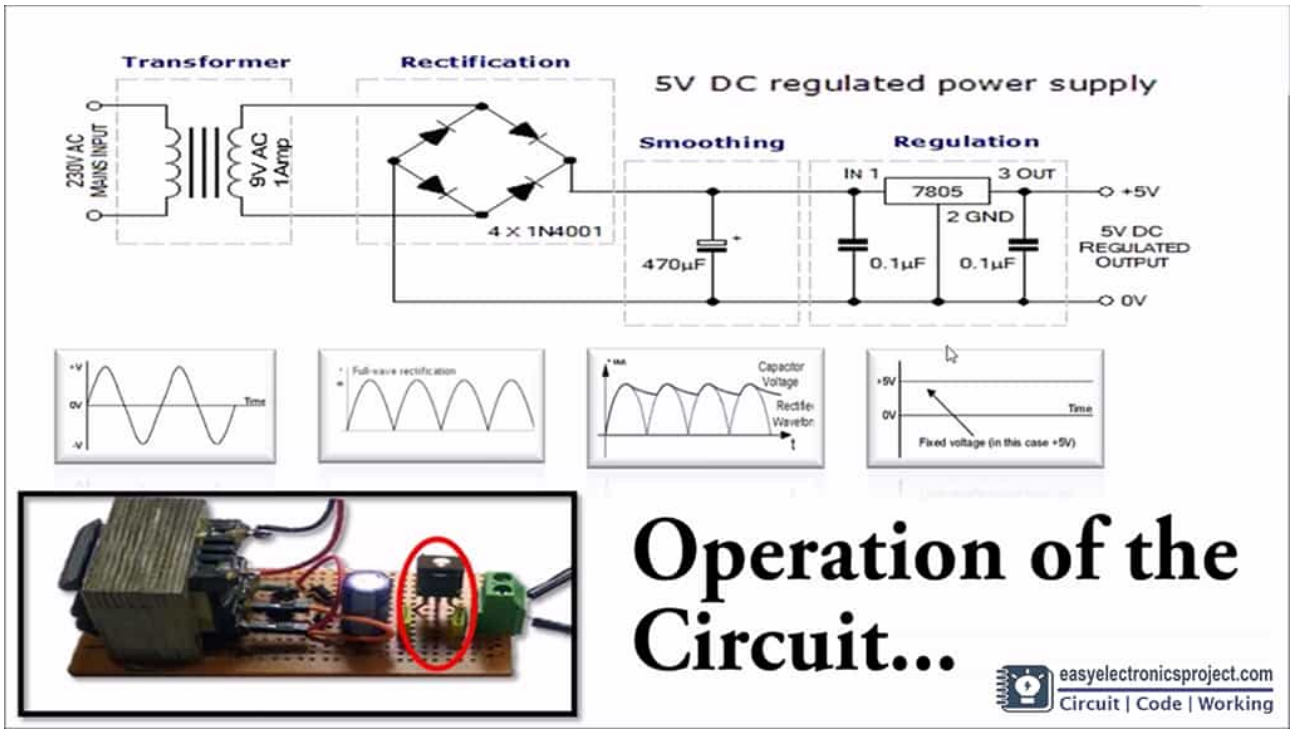
Here the operating amplifier performs as an error amplifier. The Zener diode is used for giving the reference voltage. It is shown below.



Transistor is the series pass element here. It is used for dissipating additional energy in the form of heat. It controls the output voltage by controlling the current among the input and output. SOA is the Safe Operating Area. It is in fact the conditions of voltage and current in which the equipment is expected to work without any self-damage. Here for the SOA protection, bipolar transistor is implemented with a series resistor and an auxiliary transistor. Heat sink is implemented for thermal protection when there is high supply voltage.

iii. Explain the working of Regulation Circuit.

iv. Analyze the working of the circuit as shown in fig 1.1



working of the circuit:-

First, we are using a step-down transformer [Secondary rating 9Volt & 1 Amp] to step down 230V/ 110V AC supply to 9-Volt AC. Then we rectify the 9V AC to 9 V DC using a diode bridge rectifier [Full wave rectifier]. After the rectifier, we have used Capacitors to filter the ripple from the circuit and fed it to the input of the 7805 voltage regulator. 7805 regulates the 9 volt DC to 5 Volt DC and at the output of 7805 ic, we get constant 5 Volt DC output.

Q2. Consider the following circuit diagram:

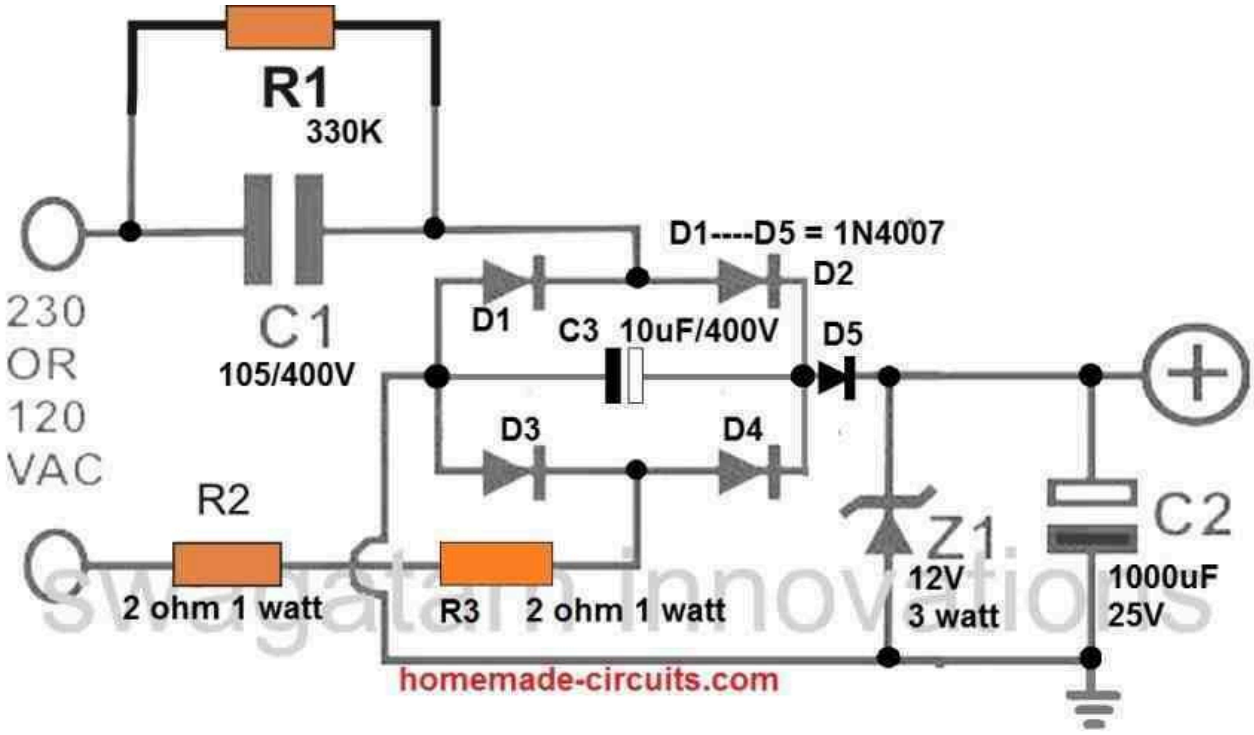


Fig 2.1 Circuit diagram of a Zener Diode based Charger

i. **Identify & Explain the working of the Rectification Circuit.**