Full-Wave_Rectifier -- Overview

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Objective:

After performing this experiment student must be able to

- Understand the Circuit behaviour of the Full wave Rectifier
- Construct the Full wave Rectifier with the required equipment
- Plot output waveform of a Full wave rectifier.
- Evaluate the Ripple factor for the Full wave Rectifier
- Evaluate the efficiency for a Full wave Rectifier.

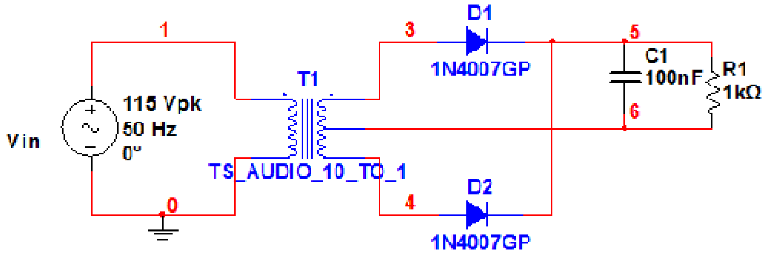
Apparatus:

- Rectifier Diodes 1N4007 (2)
- Resistor 1KΩ
- Center-tap Transformer 12VAC (1)
- Bread board
- Oscilloscope (TBS1000B-Edu) and probes

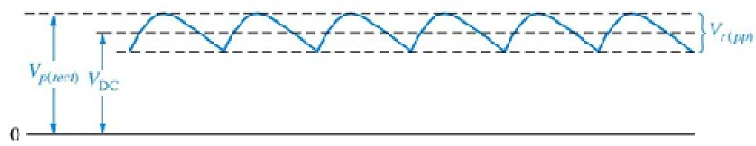
Theory:

- The rectifier circuit converts the AC voltage (a sine wave) to a DC voltage (a flat signal).
- Although the rectification stage makes the sine wave voltage to be positive, the rectifier's result is not as "flat" a DC value as we would like to have from a reliable voltage source, as you will measure in lab.
- In other words though the output of the circuits is a DC current, but its amplitude fluctuates, i.e., it does not change direction but amplitude changes.
- In order to smooth the rectified output voltage, a filter is needed. An electric filter is a Capacitor-Resistor circuit that stores voltage when the rectified DC voltage is high and discharges the stored voltage when the rectified DC is low.
- Recall that the voltage across a capacitor cannot change instantaneously, but rather it requires a certain amount of time before it is fully charged.
- Large capacitance values help to suppress the quickly changing voltage from the rectifier and result in a flatter DC value being supplied to the load. Typical power supply designs use relatively large capacitor values (greater than 1000 μF).

Circuit Diagram:



Model Graph:



Full-Wave_Rectifier -- Procedures

Step 1

- Connect the full-wave rectifier circuit with a capacitor in parallel with load resistor as shown in diagram.
- Measurr the

    Dc load voltage,
    Vout (DC),
    Peak to peak ripple voltage,
    Vr(pp)

  in the output as shown in model graph

- To measure the ripple voltages, switch the oscilloscope to AC coupling.
- This slows you to magnify the small ac ripple voltage without including the much larger dc level.

Step 2

- Measure the ripple frequency at which the waveform repeats.
- Connect

    (a) 100µF
    (b) 1000µF

- Sketch ripple and calculate ripple factor.
- Observe the ripples as you increase the value of capacitance from 100µF to 1000µF

Step 3

Tabulate the observations in the given tabular forms

Full wave Rectifier

S.No	V_m	V_{dc}	V_{rms}	Ripple factor	Efficiency

Step 4

Evaluate the ripple factor of the full wave rectifier (r) by the following formula.

$$\gamma = \sqrt{\left(Vrms^2/V_{dc}^2\right) - 1}$$

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

and $V_{dc} = V_m/\Pi$

V_{dc} is the open circuited voltage

Step 5

Result and Inference:

The circuit behaviour of Full Wave Rectifier is analyzed. The input and output waveforms are observed. The Ripple factor and Efficieny are evaluated.