EXPERIMENT 05: FULL WAVE CENTER TAP RECTIFIER WITH C FILTER

AIM: To examine the input and output waveforms of Full Wave Center Tap Rectifier and also calculate its ripple factor.

1. Without Filter
2. With Capacitor Filter

APPARATUS: Digital Multimeter, Center tap Transformer (9V-0-9V), Diode 1N4007 ,Capacitor 100 µf , Resistors, Breadboard, CRO and CRO probes and connecting wires.

THEORY:

The circuit of a center-tapped full wave rectifier uses two diodes D1 and D2. During positive half cycle of secondary voltage (input voltage), the diode D1 is forward biased and D2 is reverse biased. So the diode D1 conducts and current flows through load resistor R_L.

During negative half cycle, diode D2 becomes forward biased and D1 reverse biased. Now, D2 conducts and current flows through the load resistor R_L in the same direction. There is a continuous current flow through the load resistor R_L, during both the half cycles and will get unidirectional current as show in the model graph. The difference between full wave and half wave rectification is that a full wave rectifier allows unidirectional (one way) current to the load during the entire 360 degrees of the input signal and half-wave rectifier allows this only during one half cycle (180 degree).

THEORITICAL CALCULATIONS:

Without Filter:

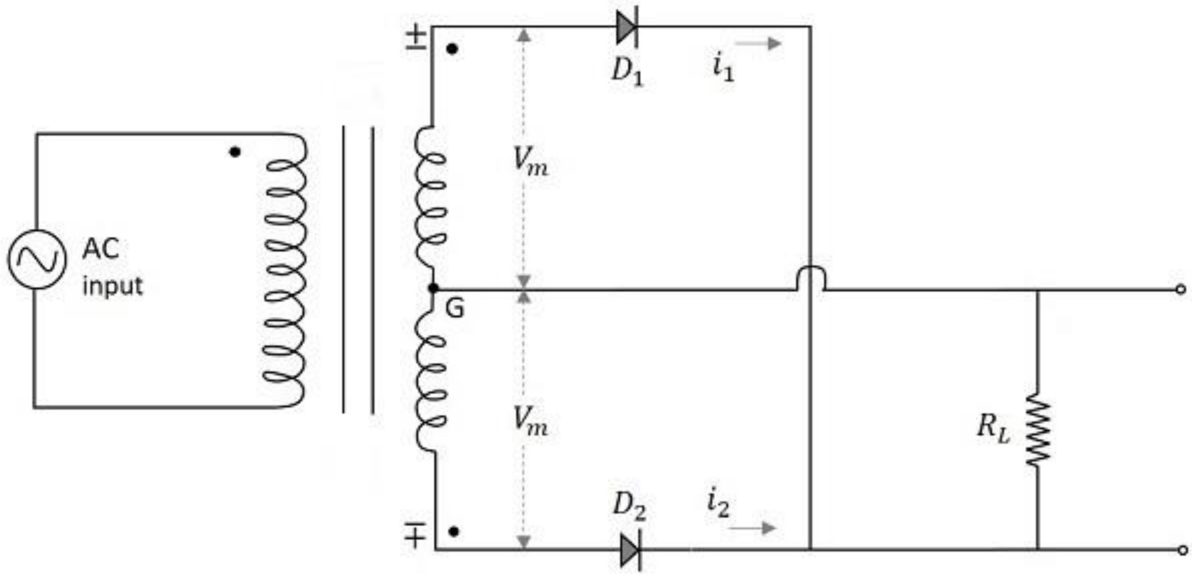
$$\mathbf{V_{rms}=V_m/\sqrt{2}}$$
$$\mathbf{V_m=\sqrt{2}V_{rms}}$$
$$\mathbf{V_{dc}=2V_m/\pi}$$

Ripple factor r = $\sqrt{\left(\frac{V_{rms}}{V_{dc}}\right)^2 - 1}$**=0.48**

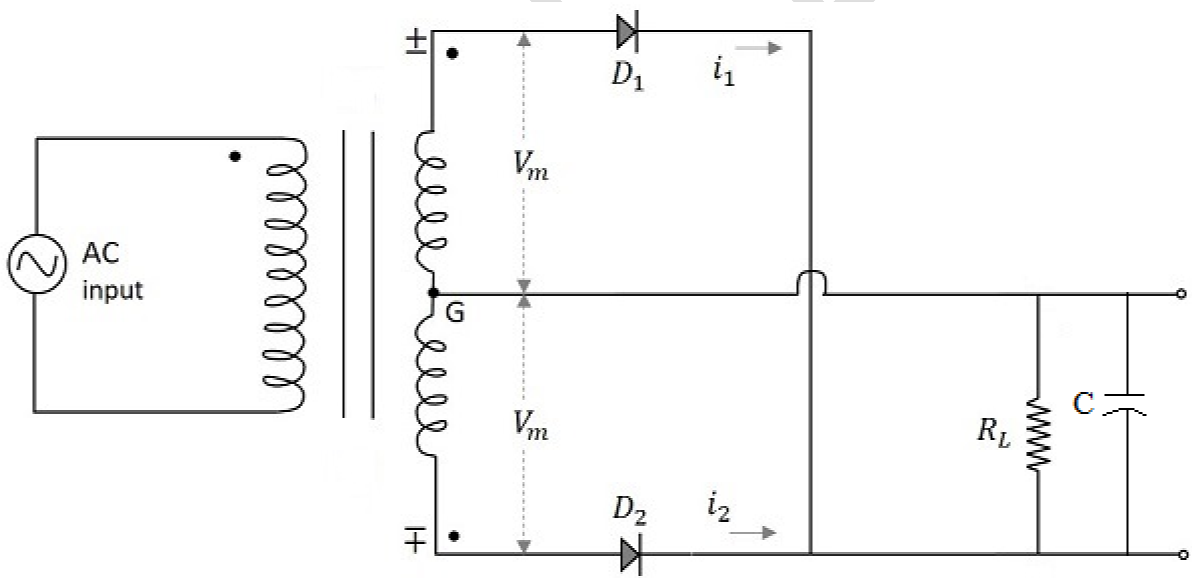
With Filter:

$$\textbf{Ripple factor, } r = \frac{1}{4\sqrt{3}f \cdot C \cdot R}$$

CIRCUIT DIAGRAM:



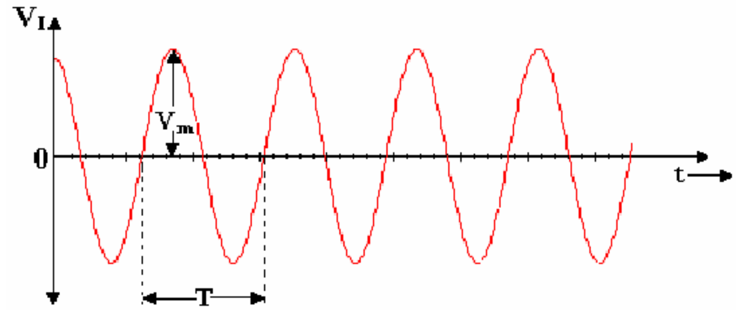
Circuit diagram of a center-tapped full wave rectifier



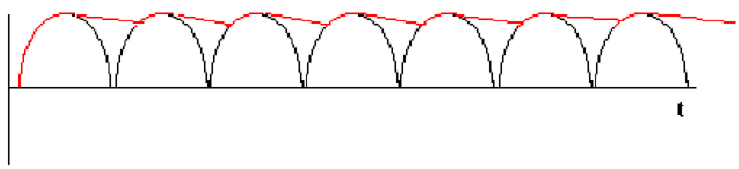
Circuit diagram of a center-tapped full wave rectifier with C filter

EXPECTED WAVEFORMS: (only for reference)

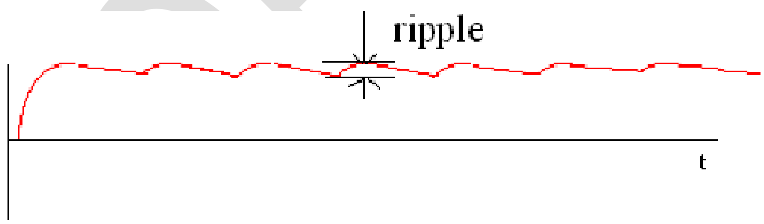
A) INPUT WAVEFORM



B) OUTPUT WAVEFORMS WITH FILTER:



C) OUTPUT RIPPLES



PROCEDURE:

Without filter:

1. Connect the circuit as per the circuit diagram
2. Connect CRO across the load R_L
3. Note down the peak value V_m of the signal observed on the CRO
4. Switch the CRO into DC mode and observe the waveform. Note down the DC shift
5. Calculate V_{rms} and V_{dc} values by using the formulae

$$V_{rms} = \frac{V_m}{\sqrt{2}}, \qquad I_{rms} = \frac{I_m}{\sqrt{2}}, \qquad V_{dc\ or\ Avg.} = \frac{2V_m}{\pi}, \qquad I_{dc\ or\ Avg.} = \frac{2I_m}{\pi}$$

6. Calculate the ripple factor by using the formulae

$$Ripple\ factor = \frac{Vac}{Vdc} = \sqrt{\left(\frac{V_{rms}}{V_{dc}}\right)^2 - 1}$$

With filter:

1. Connect the capacitor filter across the load in the above circuit diagram
2. Proceed with the same procedure mentioned above to measure V_{ac} value from the CRO and also dc shift from CRO.
3. Calculate V_{ac} & V_{dc} by using the formulas

$$Ripple\ factor = \frac{Vac}{Vdc} = \frac{1}{4\sqrt{3}f \cdot C \cdot R}$$

where V_{ac} is the peak to peak amplitude of filter output

4. Calculate ripple factor

OBSERVATIONS:

WITHOUT FILTER:

R_L (KΩ)	V_{ac} (Volts)	V_{dc} (Volts)	$Ripple\ factor = \frac{V_{ac}}{V_{dc}}$

WITH FILTER:

R_L (KΩ)	V_{ac} (Volts)	V_{dc} (Volts)	*Ripple factor* $r = \frac{V_{ac}}{V_{dc}} = \frac{1}{4\sqrt{3}f \cdot C \cdot R}$

Note : Plot the graph on separate graph paper according to observation reading noted during laboratory session.

CONCLUSION:

POST LAB QUESTIONS:

1. Define peak inverse voltage (PIV)? And write its value for Full-wave rectifier?
2. What is the necessity of the transformer in the rectifier circuit?
3. Explain how capacitor helps to improve the ripple factor?
4. Can a rectifier made in INDIA (V=230v, f=50Hz) be used in USA (V=110v, f=60Hz)?