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Date 27/08/20

Expt. No. 4

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AIM: To Study Half-Wave Rectifier

REQUIREMENTS:

Diode, Resistor, CRO Tube, Connecting wires, Step down Transformer, Capacitor

THEORY:

The conversion of AC to DC is called 'rectification'. Electronic devices can convert AC power into DC power with high efficiency. During the positive half cycle, the diode is forward biased and it conducts, and hence a current flows through the load resistor. During the negative half cycle, the diode is reverse biased and it is equivalent to an open circuit, hence the current through the load resistor is zero. Thus, the diode conducts only for one half cycle and results in half wave rectification. The input and output voltage waveform may be analytically written as:

$$V_{in} = V_p \sin \omega t \quad , 0 \le t \le T$$

and, $$V_{out} = V_{pi} \sin \omega t \quad , 0 \le t \le T$$

where, $V_{pi} = V_p - V_\gamma$

and, V_γ is the cut-in voltage of the diode.

The average (dc) value of half wave rectified sine wave voltage is represented by, $V_{dc} = \frac{V_{pi}}{\pi}$

RMS voltage at the load resistance can be calculated as, $V_{RMS} = \frac{V_{pi}}{\sqrt{2}} = \frac{V_{pi}}{2}$

BAID

Teacher's Signature : _____

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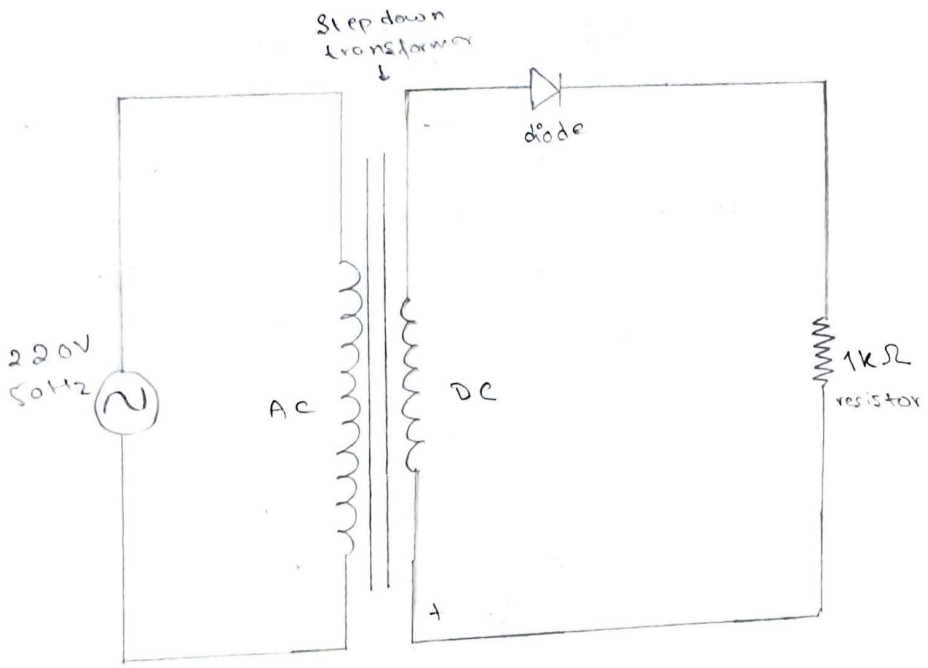


fig.: Circuit Diagram without filter capacitor.

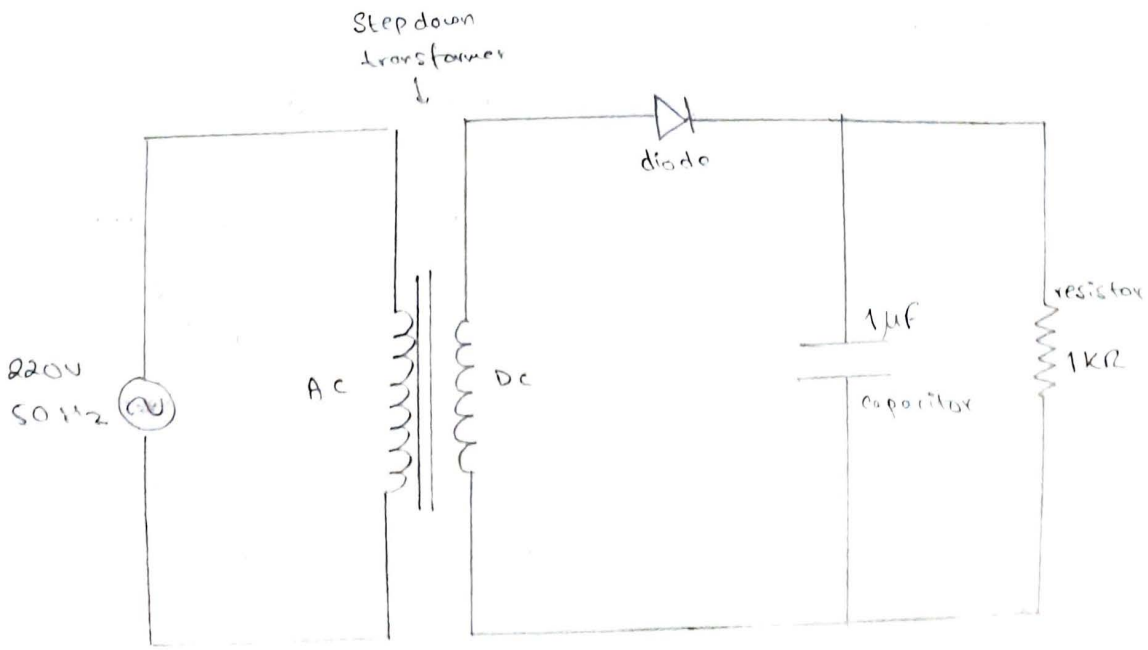


fig: Circuit diagram with filter capacitor

PROCEDURE:

1. The connections were made as per the circuit diagram.
2. The input signal was input and adjusted as specified.
3. The input and output wave forms observed on the CRO tube screen were scaled and traced.
4. The values of AC and DC voltages from the CRO were noted down and a graph was plotted accordingly to obtain the necessary waveforms.
5. A capacitor was connected as per the circuit diagram and the processes (2) to (4) were repeated.

OBSERVATIONS:

Without capacitor:

AC input voltage (peak), V_m = 40mV

Time taken for one complete cycle, T_0 = 20ms

$\therefore$ Frequency, f = 50Hz

With filter capacitor:

AC input voltage (peak), V_m = 40mV

for the negative half cycle, the peak voltage is not ordinary.

Time taken for one complete cycle, T_0 = 20ms

$\therefore$ frequency, f = 50Hz

CALCULATIONS :

for the values of voltages on 'without capacitor' circuit.

$$V_{DC} = \frac{V_m}{\pi} = \frac{40}{3.1415} = 12.73 \text{ mV}$$

$$V_{RMS} = \frac{V_m}{2} = \frac{40}{2} = 20 \text{ mV}$$

$$\text{Ripple factor, } \gamma = \sqrt{\left(\frac{V_{RMS}}{V_{DC}}\right)^2 - 1} = \sqrt{\left(\frac{20}{12.73}\right)^2 - 1}$$

$$= \sqrt{(1.57)^2 - 1}$$

$$= \sqrt{2.46 - 1}$$

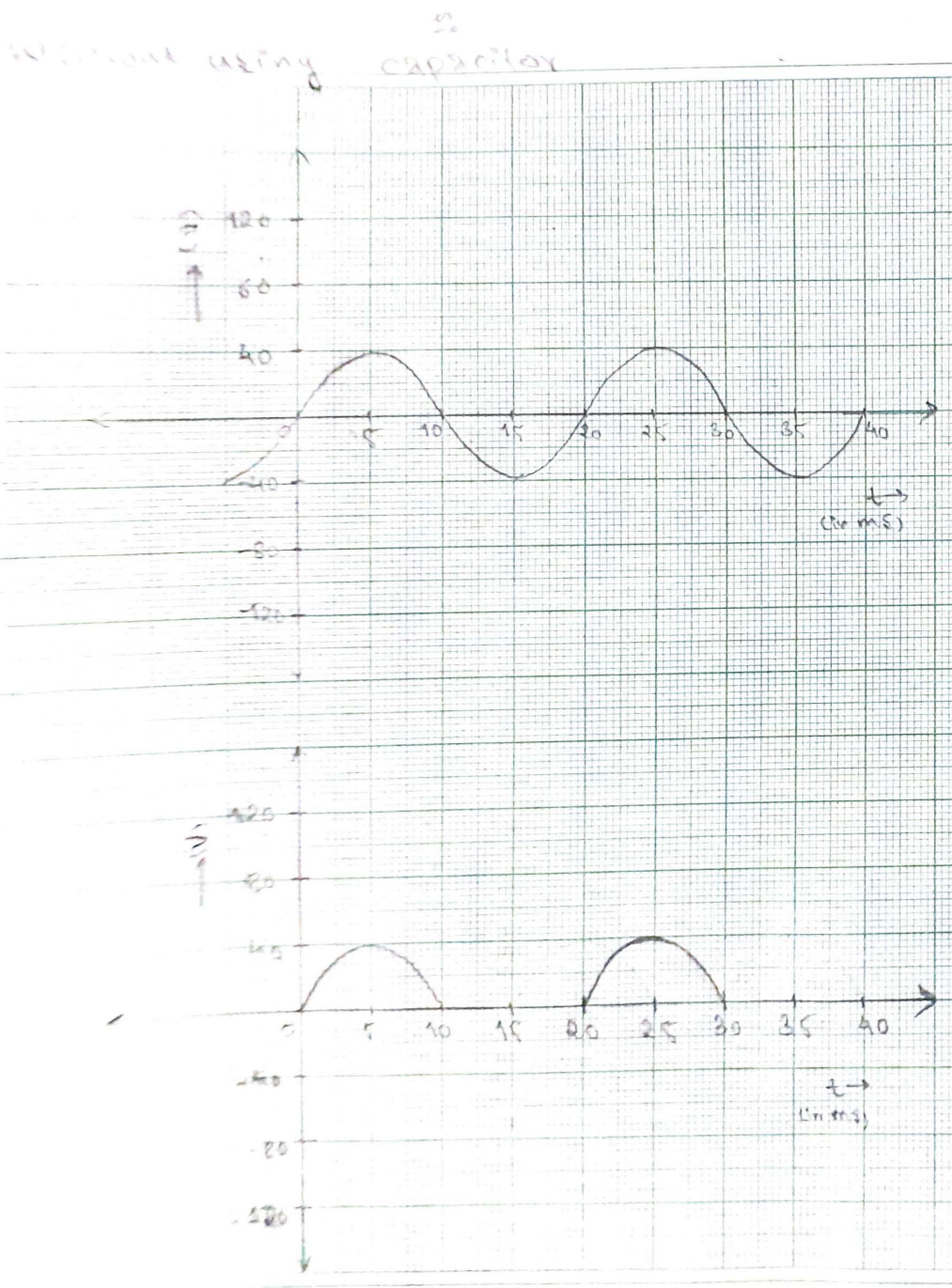
$$= \sqrt{1.46}$$

$$\therefore \gamma = 1.20$$

CONCLUSION:

The DC voltage, RMS voltage and Ripple factor for half wave rectifier were studied.

Without using capacitor



Using filter capacitor