Practical No.7: Prepare and Test the half wave rectifier with LC filter/ π filter

I Practical Significance

The filter converts the pulsating DC into pure DC. The electronic reactive elements like capacitor and inductor are used for filtering.

II Industry / Employer Expected Outcome

This practical is expected to develop the following skill: **'Use electronic components and circuits in electrical equipment and systems'.**

III Course Level Learning Outcome

Use semiconductor diodes in different rectifier and filter.

IV Laboratory Learning Outcomes

Test half wave rectifier with LC/ π filter on Breadboard:

1. Prepare the circuit for Half Wave Rectifier with LC filter/ pi (π) filter using PN junction Diode.
2. Observe and draw input-output waveforms for sinusoidal wave.

V Relevant Affective Domain related Outcomes

1. Handle components and equipment carefully.
2. Follow all safety precautions

VI Minimum Theoretical Background

The capacitor used in "C" filter reduces the ripple voltage, but causes the diode current to increase. This large current may damage the diode and will further cause heating problem and decrease the efficiency of the filter. On the other hand, a simple series inductor reduces both the peak and effective values of the output current and output voltage. So, the combination of both the filter (Land C), forms a new filter called the L-C filter which will have a good efficiency, with controlled diode current and enough ripple removal factor. The voltage stabilizing action of shunt capacitor and the current smoothing action of series inductor filter can be combined to form a perfect practical filter circuit.

Half wave rectifier without filter capacitor converts AC voltage into pulsating DC voltage. Filter capacitor is used to obtain smooth DC voltage.

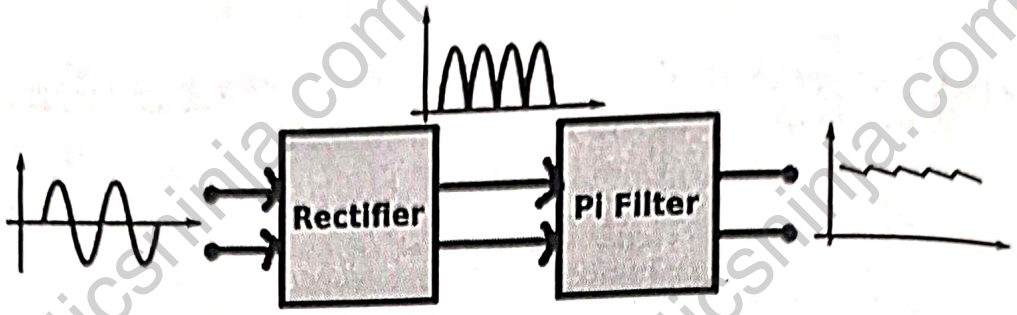


Figure 7.1: Concept of filter

VII Practical setup in Laboratory

(a) Sample

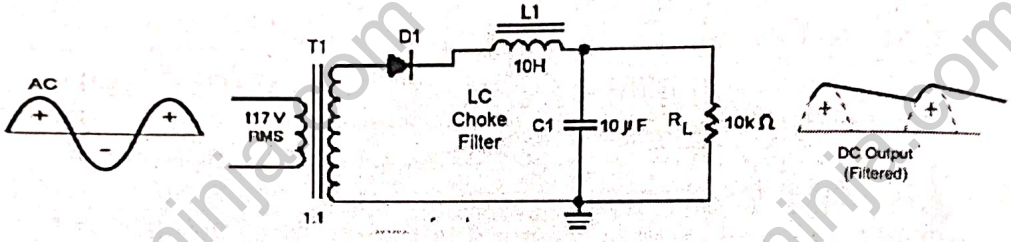


Figure 7.2: Half wave rectifier (HWR) with LC filter

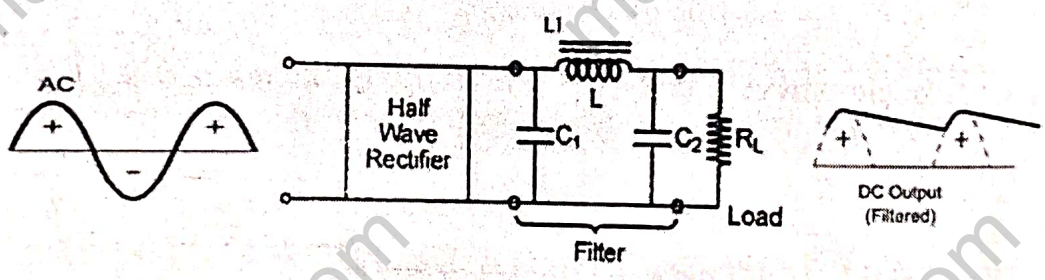
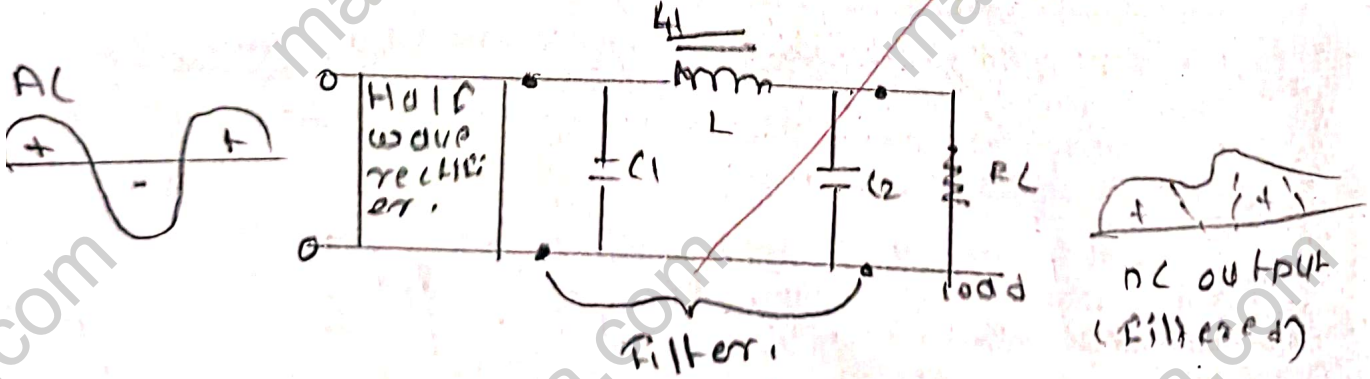
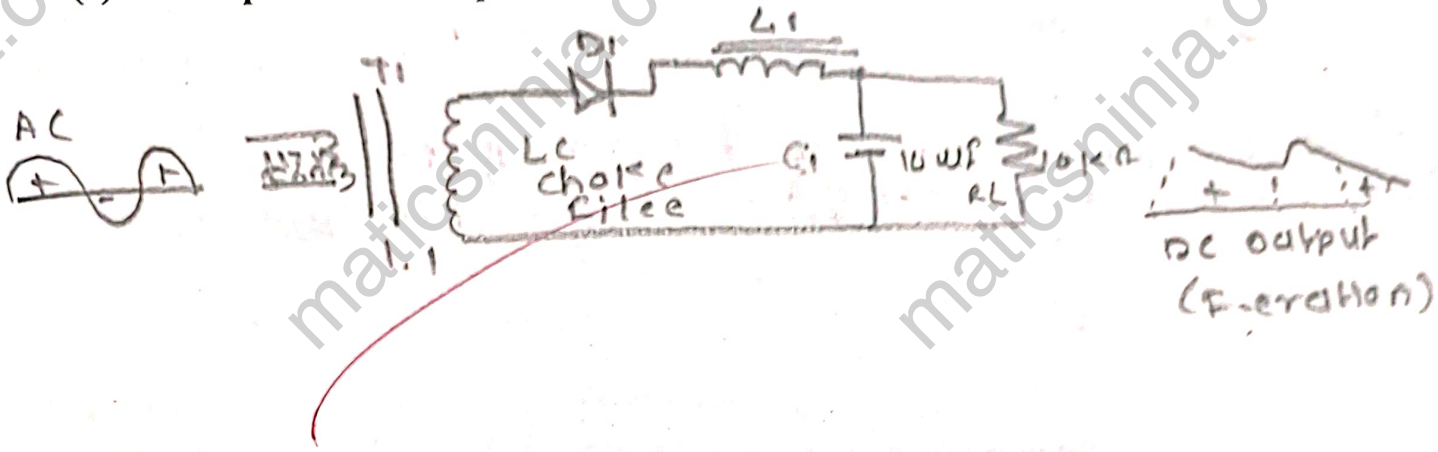


Figure 7.3: Half wave rectifier (HWR) with π filter

(b) Actual Circuit Diagram used in Laboratory



(c) Actual practical set up used in Laboratory



VIII Required Resources/apparatus/equipment with specifications

Sr. No	Instruments/Components	Specification	Quantity
1	Transformer	12-0-12V AC, 500 mA	1
2.	Multimeter	3 ½-digit display with AC and DC voltage measurement and Current measurement facility and Diode testing facility.	1
3.	C.R.O.	25MHz, Dual trace, 15MΩ input impedance	1
4.	Resistor	10KΩ, 0.5 Watt.	1
5.	Diode	Silicon 1N4007	1
6.	Capacitor	10μF (Electrolytic)	2
7.	Inductor	10H	1
8.	Bread board	5.5 CM X 17CM	1
9.	Connecting wires	Single strand Teflon coating (0.6 mm diameter)	As per requirement

IX Precautions to be followed

1. Do not switch ON the power supply unless you have checked the circuit connections as per the circuit diagram.
2. While doing the practical do not exceed the input voltage of the diode beyond the rated voltage of diode as given in datasheet. This may lead to damaging of the diode.

X Procedure

1. Connect the circuit of rectifier with LC / π Filter on bread board as sh figure 7.2
2. Connect the primary side of the transformer to AC mains and the sec side to rectifier input.
3. Before switching ON power supply, check the connection.
4. Record peak voltage across load resistor using CRO.
5. Calculate the DC output voltage and peak to peak ripple voltage.
6. Calculate the ripple factor.
7. Repeat the steps 1 to 6 for figure 7.3
8. Observe and draw the waveforms across LC/ π filter on graph paper.

XI Observation Table

Table 1

Type of Rectifier	Peak Voltage V_m (volts)	$Vdc = V_m / \pi$ (volts)	Peak to peak ripple voltage Vr (volts)	Ripple facto Vr/Vdc
Full wave rectifier with LC filter	81.05	51.6	0.81125	0.015
Full wave rectifier with π filter	85	52.6	0.9454	0.017

Calculations:

XII Results

By performing the experment of LC using rectifire we obtain the value of ripple Factor 0.015.

XIII Interpretation of results

Using of two diodes rectifear in LC filter is helpful in obtaining the value of minium ripple factor.

XIV Conclusions and Recommendation

This practical is helpful to develop the following skills for the industry identify component identification skill component mounting skill.

XV Practical related Questions

1. State the required PIV rating of diode if transformer voltage of 24V.
2. Give the mathematical relationship between rms input AC voltage and DC output voltage in half wave rectifier with and without filter capacitor.

[Space for answers]

1) ------?

→ What is the requirment of the PIV diode used in a bridge rectifier For intencase if you apply 120V RMS AC voltage to a bridge rectifire the value peak AC voltage is 170 v so the PIV must exced 170 volts.

2) ------?

→ The mathematical relataonship between RMS input AC voltage and DC voltage in a half wave rectifire without a filter capacitor is $V_{DC} = V_{RMS}$ Π where V_{DC} is the DC output voltage and V_{RMS} is the RMS input AC voltage.

XVI References / Suggestions for further Reading

1. https://www.elprocus.com/half-wave-rectifier-circuit-working-principle-and-characteristics-2/
2. https://www.youtube.com/watch?v=QGawHsg4NpQ