**Practical No.18: Check the output waveform of L, C and π filters on CRO of rectifier circuit.**

**I Practical Significance:**

The device which converts the pulsating DC into pure DC is called filter. Voltage regulator keeps the terminal voltage of the D.C. power supply constant, even if the A.C. input to the transformer varies or the load varies. The electronic passive elements like capacitor and inductors are used to perform this function. In this experiment the student will be able to test the performance of L, C, LC and CLC filters.

**II Industry/Employer Expected Outcome(s):**

Filters play active role in different D.C. power supplies used in industries. Depending upon the application different types of filters or their combination can be selected and tested.

**III Course Level Learning Outcome(s):**

Use relevant diode in different Electronic circuits.

**IV Laboratory Learning Outcome(s):**

Filter the ripples by using L, C and π filter.

**V Relevant Affective Domain related outcome(s):**

1. Handle the components with care
2. Make aesthetically clean connections
3. Work in team
4. Follow ethical practices

**VI Relevant Theoretical Background (With diagrams if required):**

A rectifier is a circuit that converts the AC signal into pulsating DC. This pulsating DC is converted into pure DC by using filters circuits. A filter circuit consists of passive components like inductors, capacitors or their combination. For example, an inductor allows AC On the other hand, capacitor allows flowing AC through it, but blocks DC. Therefore capacitor filter is always connected in parallel with the load. Whereas inductor filter is connected in series with the load. Combination of L and C i.e. LC or CLC filters are also widely used for getting better filtered output.

**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 experiment do not exceed the input voltage of the diode beyond the rated voltage of diode. This may lead to damage of the diode.
3. Connect voltmeter and ammeter in correct polarities as shown in the circuit diagram.

**X Procedure:**

**Part I**

1. Connect the Electronic circuit for half wave rectifier on bread board as shown in Figure 1.
2. Connect the primary side of the transformer to AC mains and the secondary side to rectifier input
3. Before switching on power supply, check the connection.
4. Switch ON the power supply and set CRO in DC mode adjust level accurately.
5. Observe the Waveforms across load resistance $R_1$ for capacitor filter.
6. Connect the inductor as shown in Figure 5 and observe the waveform across load resistor

**Part II**

1. Connect the Electronic circuit for Full wave rectifier on bread board as shown in Figure 2.
2. Connect the primary side of the transformer to AC mains and the secondary side to rectifier input.
3. Before switching on power supply, check the connection.
4. Switch ON the power supply and set CRO in DC mode adjust level accurately.
5. Observe the Waveforms across load resistance $R_1$ for capacitor filter.
6. Connect the inductor as shown in Figure 5 and observe the waveform across load resistor
7. Compare waveforms observed for half wave rectifier and full wave rectifier

**XI Required Resources/apparatus/equipment with specifications:**

| S. No | Instruments/Components | Suggested broad specification | Quantity |
|---|---|---|---|
| 1 | digital multimeter | 3 1/2 digit display digital multimeter | 1 |
| 2 | Transformer (centre tapped) | 6-0-6 V AC, 500 mA. | 1 |
| 3 | Diode | Silicon Diode IN4007 | 2 |
| 4 | Resistor | 1K Ω | 1 |

**XII Actual procedure followed:**

1. connect the electronic circuit for half wave rectifier on bread board as shown in figure 1.
2. Connect the primary side of transformer to AC mains the secondary side to rectifier input.
3. before switching on power supply check the connection.
4. Switch on the power supply and set CRO in DC mode adjust level accurately.
5. connect the inductor as shown in fig 5 and observe the waveform across load resistor.

**XIII Observations and Calculations:**

| S.No. | Rectified output ($V_m$) | $V_{dc}$ (V) measured without filter on CRO | $V_{dc}$ (V) measured without filter on DMM | $V_{dc}$ (V) measured with filter on CRO | $V_{dc}$ (V) measured with filter on DMM |
|---|---|---|---|---|---|
| 1 | 11 V | 15 V | 15 V | 14.5 V | - |

**Calculations:**

$V_{dc}=V_m/\pi$

$15V = \frac{11}{3.14} = 3.5031$

**XIV Results:**

$V_{dc}$ calculated = 3.5031 V

**XV Interpretation of Results:**

we learn to check output waveform of L.C and π filter on CRO of rectifier circuit.

**XVI Conclusions & Recommendations:**

we learn to check output wave form of L.C and π filter on CRO of rectifier circuit.

**XVII Practical Related Questions:**

1. State the effect on output voltage if we replace the capacitor filter with pi filter.
2. Compare output wave form of LC filter and CLC filter for half wave rectifier as well as full wave rectifier
3. Draw the circuit diagram of bridge rectifier with pi filter.

**[Space for Answers]**

Q.1 → Replacing a capacitor filter with a pi filter would likely increase the ripple voltage and decrease the average value of the output voltage.

Q.2 → In a half-wave rectifier, an LC filter provides better smoothing than a CLC filter, resulting in a smaller ripple voltage. For a full-wave rectifier, the difference is less pronounced, with the LC filter still generally offering superior ripple reduction.

Q.3 →

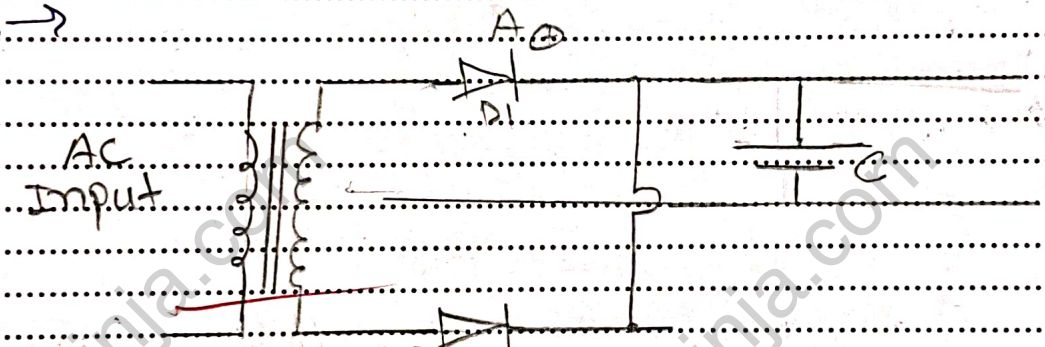
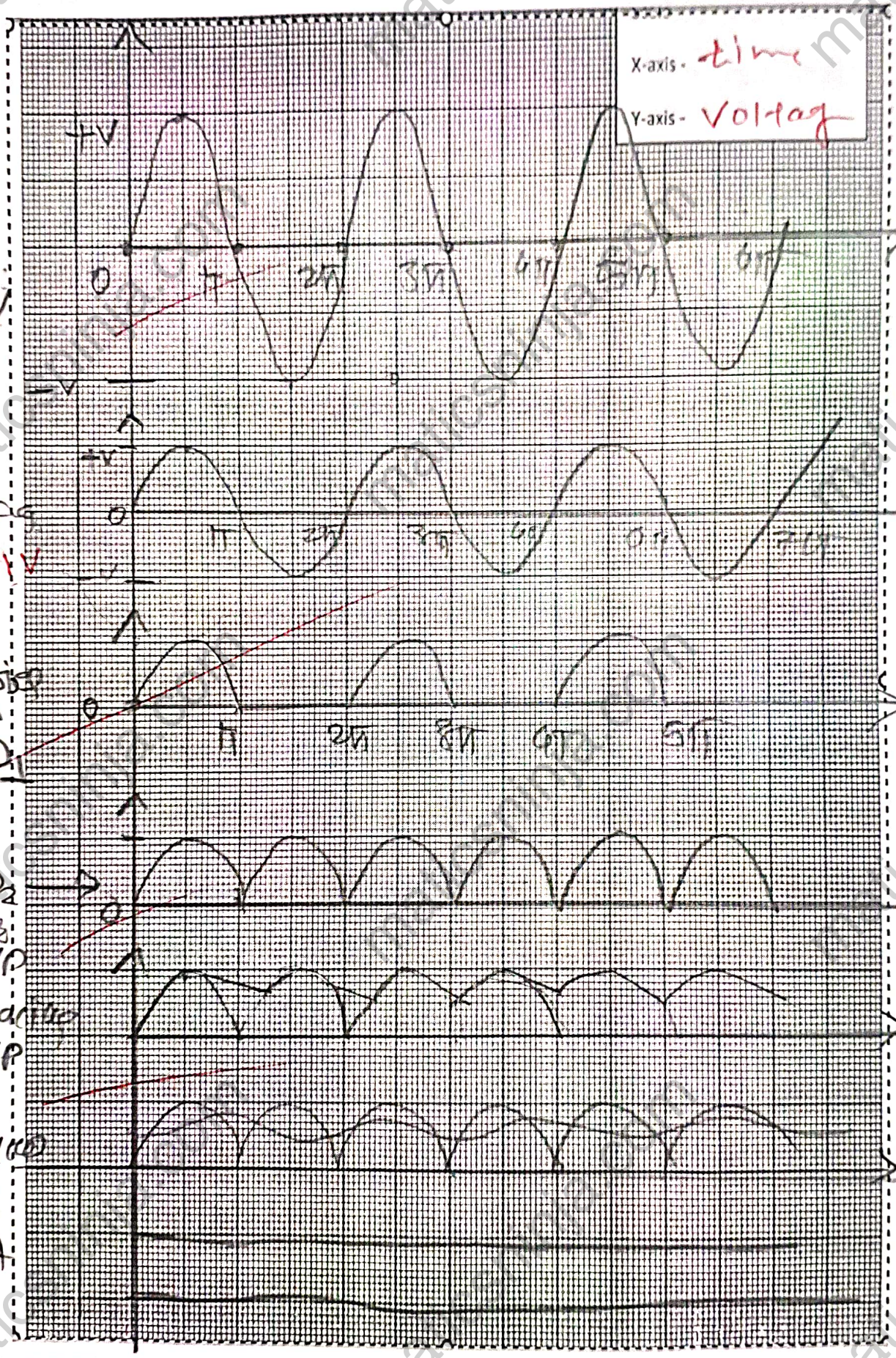



fig: Circuit diagram of bridge rectifier with pi filter

**XVIII References/ suggestions for further reading ; includes websites:**

1. http://nptel.ac.in/courses/117103063/4
2. http://eecs.oregonstate.edu/education/docs/datasheets/XC-600178.pdf

| S. No. | Title of Book / Website | Author | Publication |
|---|---|---|---|
| 1 | Applied Electronics | R.S.Sedha | S. Chand and Co., New Delhi 2008,ISBN 978-8121927833 |
| 2 | Principles of Electronics | V.K.Mehta. | S. Chand and Co., Ram Nagar,New Delhi-110055,11th Edition,2014.ISBN 978-812-192405 |


X-axis - time
Y-axis - Voltag
AC
I/P
240V
+V
0
π
2π
3π
4π
5π
6π
-V
+V
0
π
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