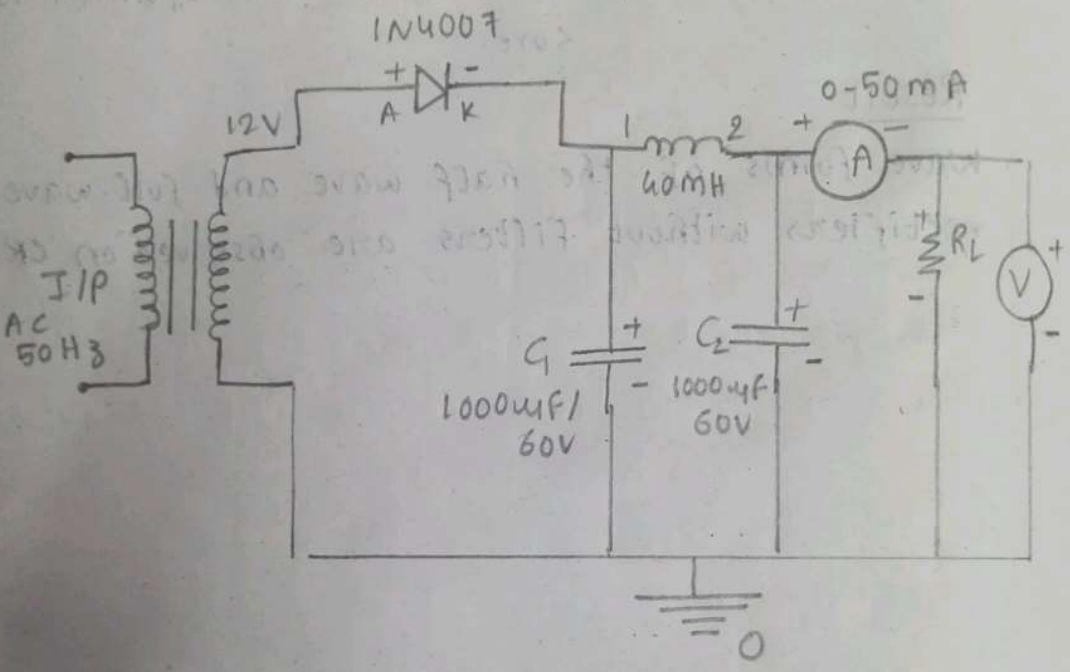
Circuit diagrams

Half wave rectifier with Filter



Rectifiers with filters

Aim: To determine the following parameters of halfwave and fullwave rectifier circuits with filters.

1. ripple factor
2. Variation in % of regulation
3. To observation the O/P on CRO

Apparatus

1. Ammeters	0-50mA	-1
2. Digital multimeter		-1
3. Decade resistance box		-1
4. Decade inductance box		-1

Components

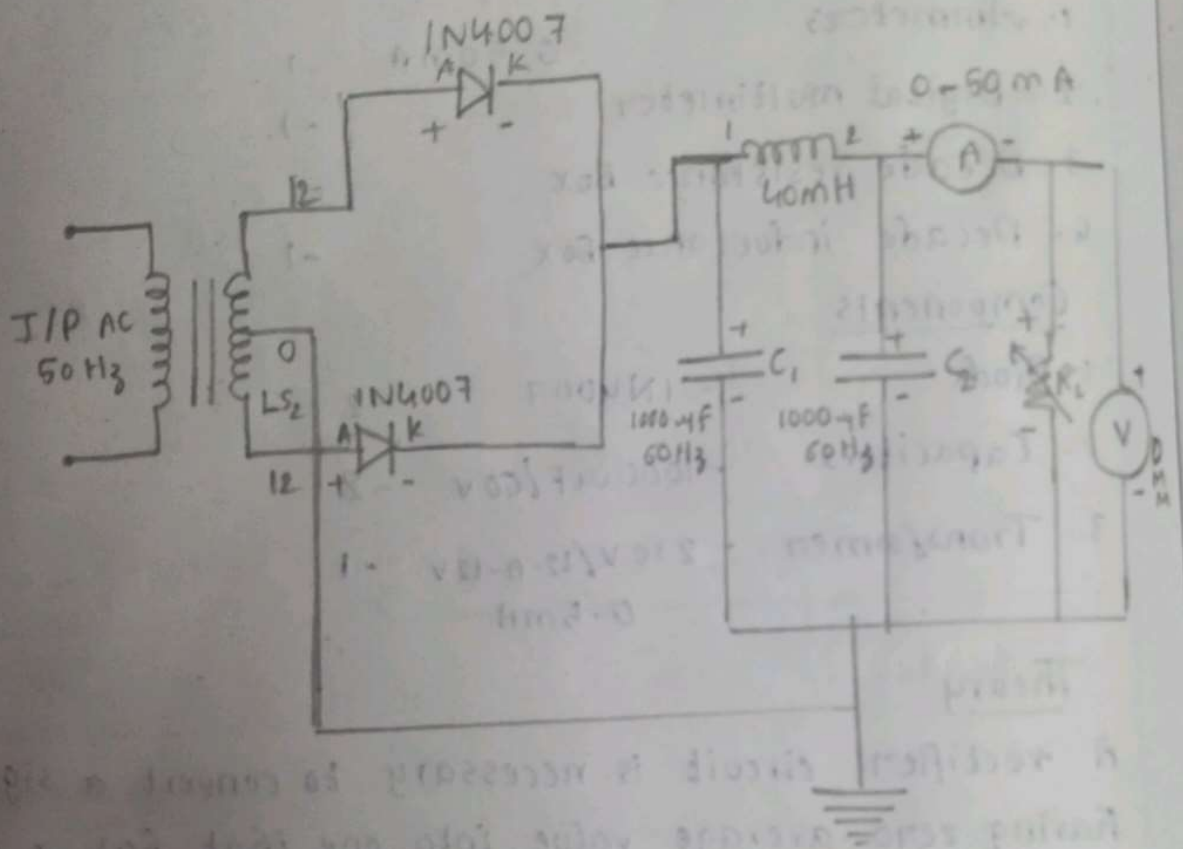
1. Diode	- IN4007	-2
2. Capacitors	- 1000 μF/60V	-2
3. Transformer	- 230V/12-0-12V 0.5mA	-1

Theory

A rectifier circuit is necessary to convert a signal having zero average value into one that has a non-zero average. A filter circuit is necessary to provide a more steady DC voltage.

The action of this system depends upon the fact that the capacitors restore energy during the conduction period and deliver this energy to the load during the non-conducting period. In this way the time during which the current passes through the load is prolonged and the ripple is considerably to be decreased.

Full wave Rectifier with filter



The diode will be forward biased when the transformer voltage v_i exceeds the capacitor voltage, then the capacitors starts charging in stepping with the applied voltage. The diode will be reverse biased when the transformer voltage V_i falls below the capacitor voltage. Then the capacitor starts discharging through the load resistor.

Let the capacitor is initially charged during capacitor first quarter cycle, the diode conducts and the capacitor charges with the input voltage upto $V_0 = V_m$. when v_i falls below V_m diode is not conducting and the capacitor discharges at slower rate than input voltage. On the time constant $R_L C$ is large as compared with the period of input wave form the discharge is low. Thus only a small decrease in V_0 occurs between t_1 and t_2. At time $t_1 = t_2$ v_i equals the capacitor voltage. The diode again conducts between t_2 and t_3 does not conduct between t_3 and t_4. The process is repeated.

Ripple factor

The filtered output has a DC value and some AC variations (ripple). Smaller the AC variation with respect to the DC level, the better the filter circuit operation. The filter voltage waveform with DC and ripple voltages is shown below.

Observations

Half wave rectifiers

S.NO	Input	Output

Full wave rectifier

S.NO	Input	Output

Procedure

Half wave

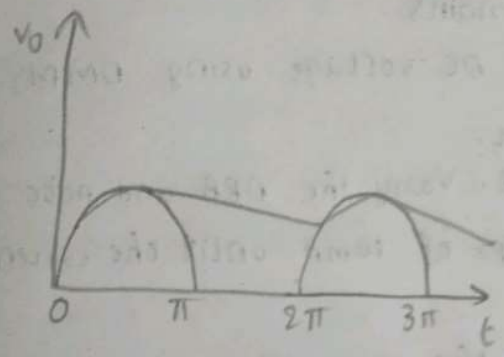
1. Connect the circuit as shown
2. Give input from AC mains.
3. Measure the no load DC voltage using DMM.
   let this be V_{NL}.
4. Now connect the DRB. Vary the DRB and note the values of I_{DC} in steps of 10mA untill the current reaches 100mA.
5. At each step measure the V_{DC} and V_{AC}. Calculate ripple factor 'r' as the ratio of V_{AC} and V_{DC}
6. Plot the graphs of V_{DC} Vs I_{DC}, r Vs I_{DC} and % regulation Vs I_{DC}.

Full wave

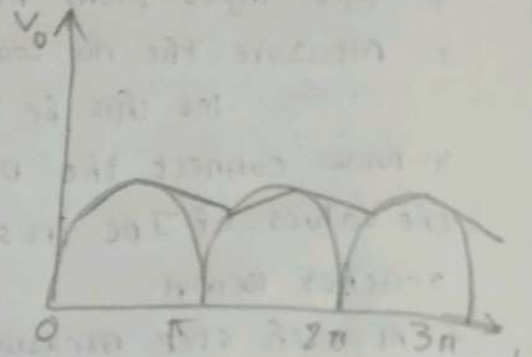
1. Connect the circuit as shown.
2. Give input from AC mains
3. Measure the no load DC voltage using DMM.
   let this be V_{NL}.
4. Now connect the DRB. Vary the DRB and note the values of I_{DC} in steps of 10mA until the current reaches 100mA.
5. At each step measure the V_{DC} and V_{AC}. Calculate ripple factor 'r' as ratio of V_{AC} and V_{DC}.
6. Plot the graphs of V_{DC} Vs I_{DC}, r vs I_{DC} and % regulation vs I_{DC}.

Model wave forms

Half wave



Full wave



Theoritical calculations

Half wave

Full wave

Discussions

1- Only the capacitor input filter is preffered to choke input filter because the DC output is much larger and ripples are less in comparrisions to those in choke input filters.

ii) Series inductors and L-section filters cannot be used with half-wave rectifiers because operation of series inductor depends upon the current through it and needs a minimum current to flow at all times.

iii) After converts pulsating output of rectifier into a steady DC level.

Precautions

i) Never remove or insert a diode into a circuit with voltage applied.

ii) when testing a diode, ensure that test voltage did not exceed the diodes maximum allowable voltage.

iii) Ensure a replacement diode into a circuit was in the correct direction.

iv) The correct connection of the transformer is made sure.

Result

Wave forms of halfwave and full wave rectifiers with filters are observed on CRO.