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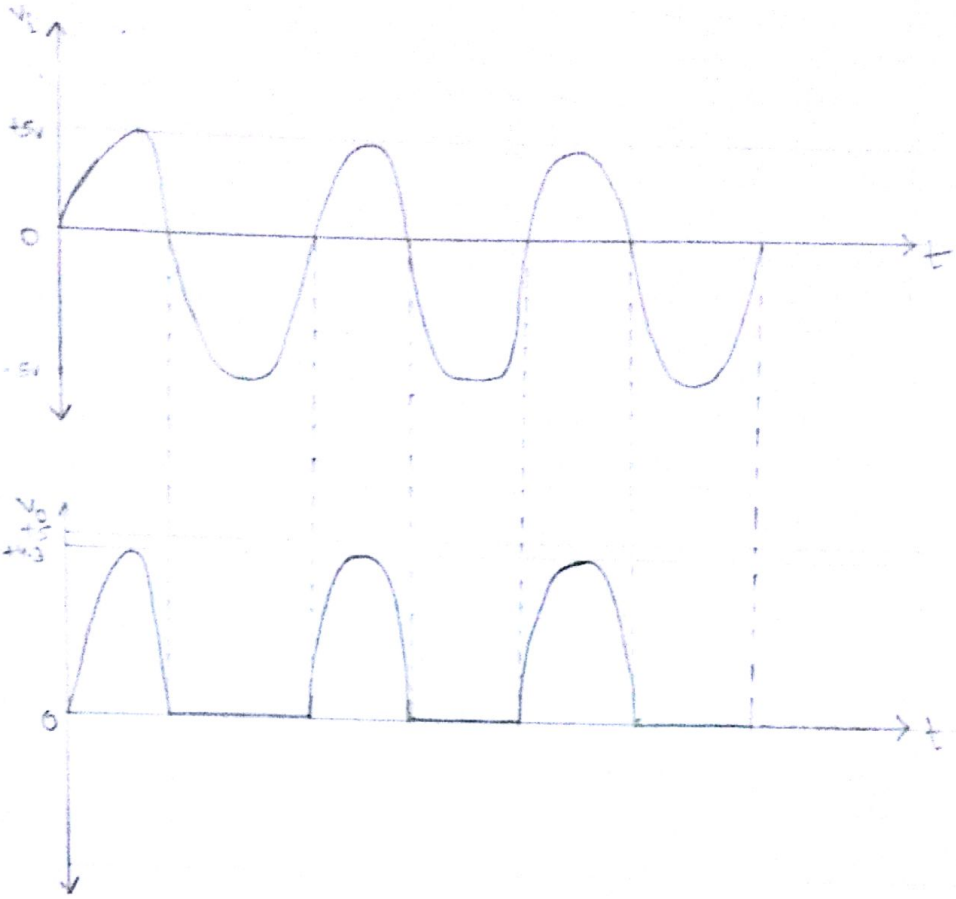
|---|---|
| Regular Session & Group: | Wednesday, Afternoon. (L8) |
| EXPT. NO: | FOUR (4) |
| DATE OF EXPT: | 10/2/2016 |
| STUDENT-1: | K.Y. Ashok (150107027) |
| STUDENT-2: | K. Indramani (150107028) |

(3)

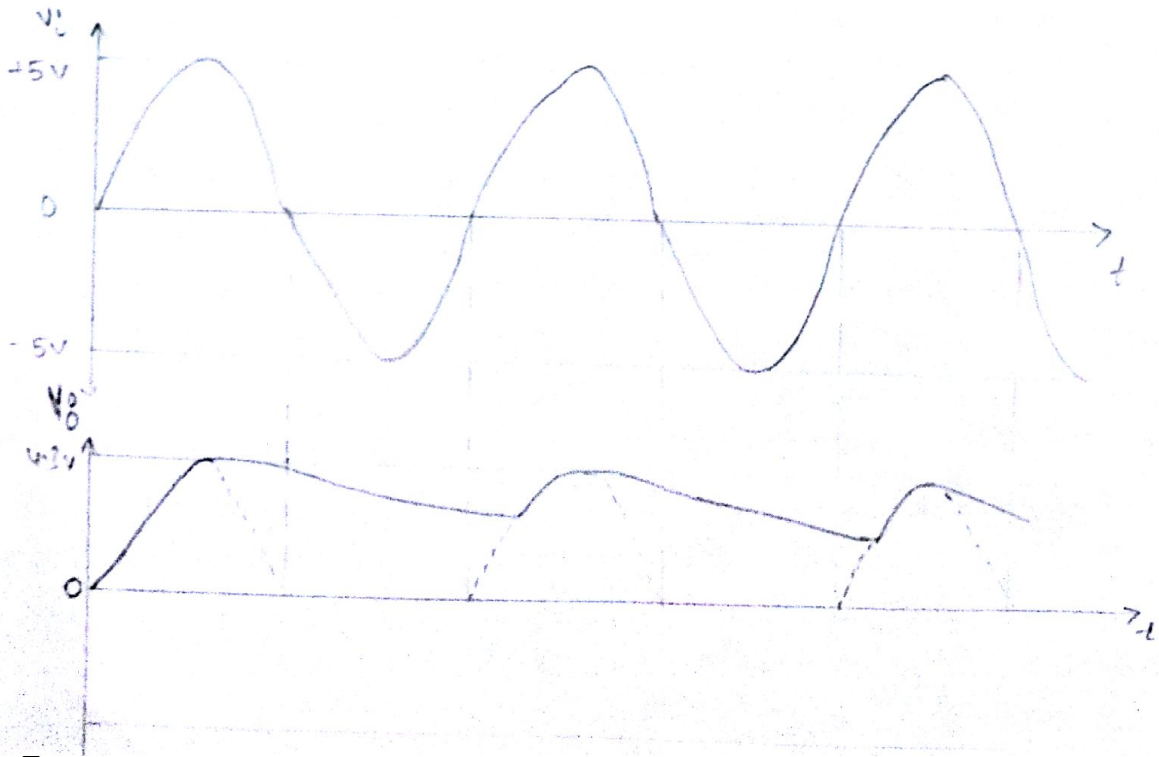
# Exp-4:

## re-observation Reading :-

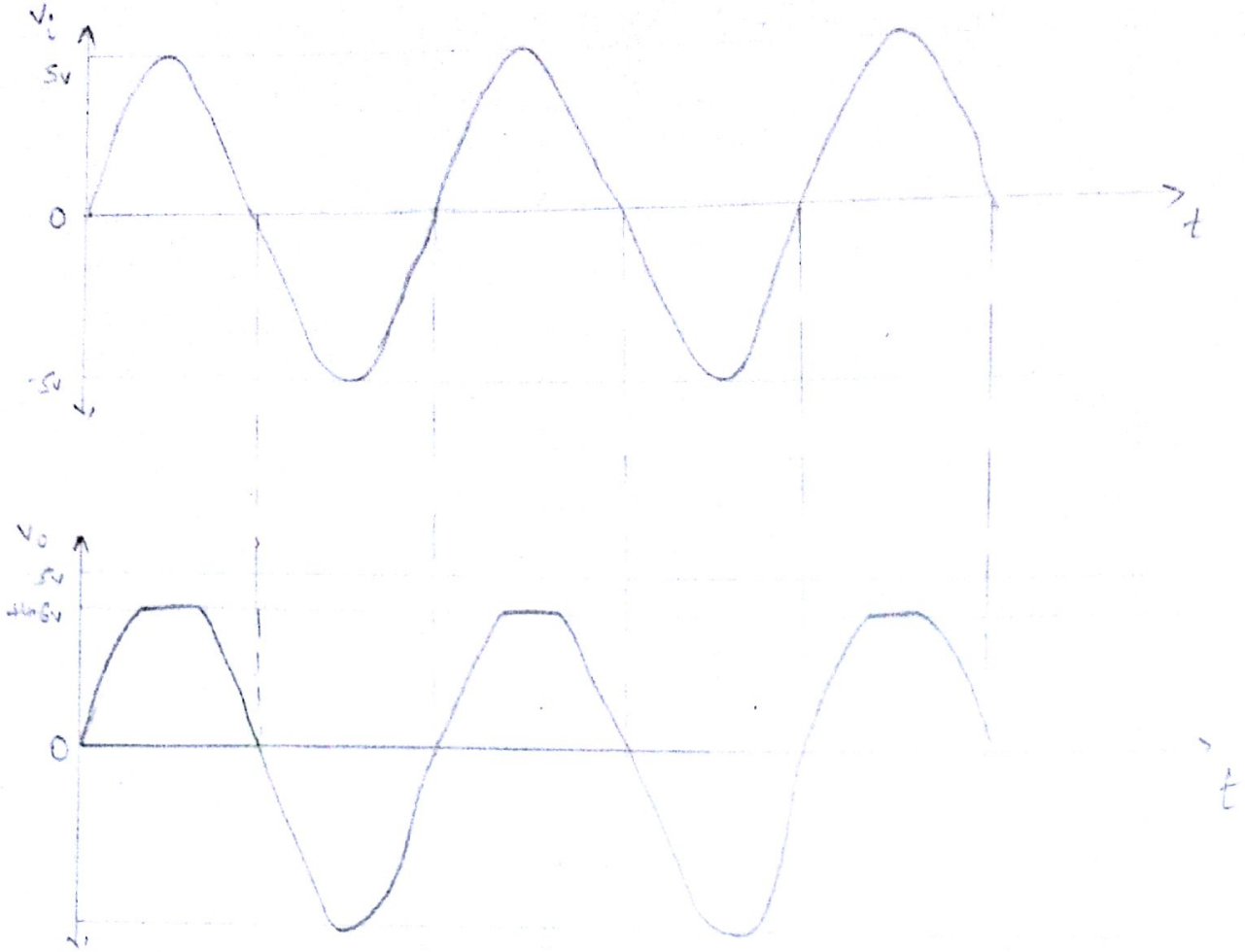
A) Half-Wave Rectifier without filter;




B) Half-Wave Rectifier with Capacitor filter;

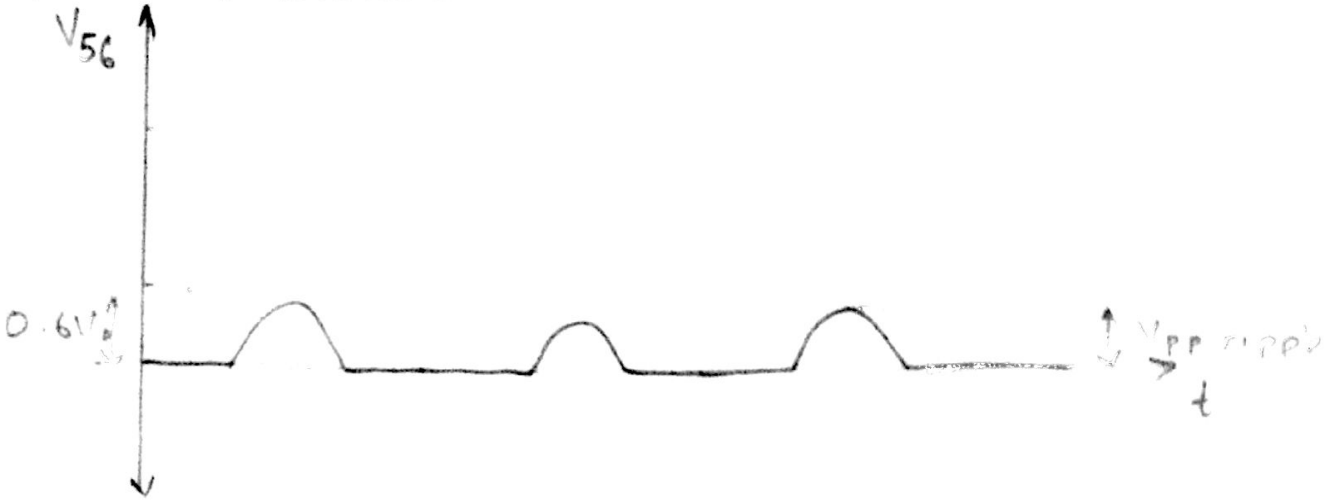


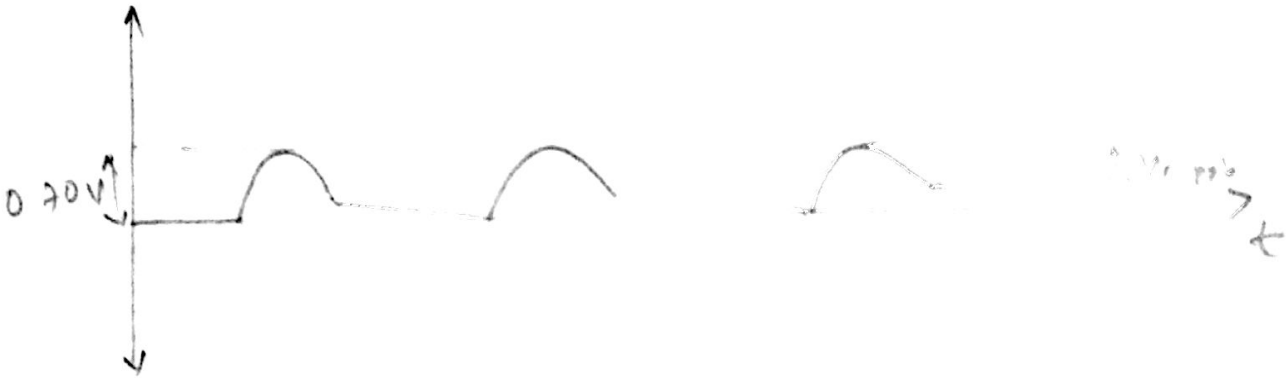
c) clipping .Circuit : Positive · clipper



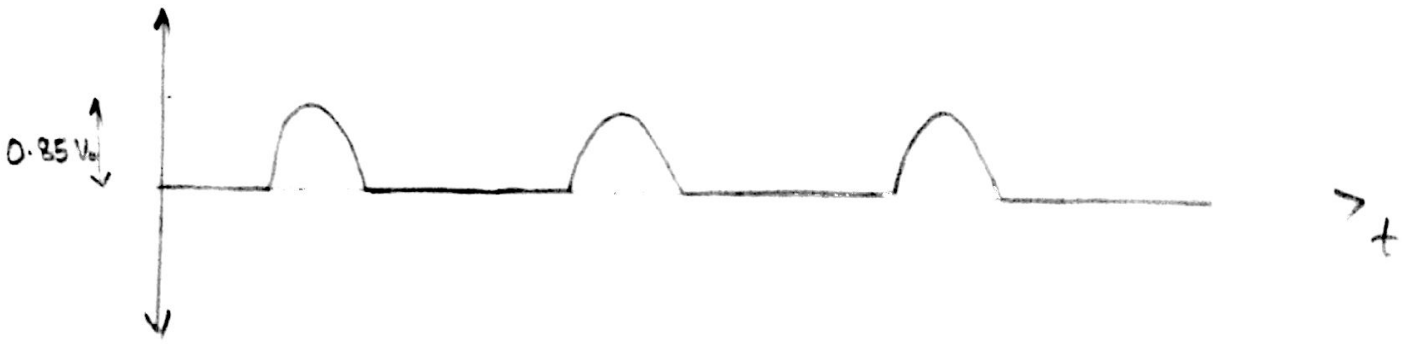
PART-B · With 56Ω Resistance in series

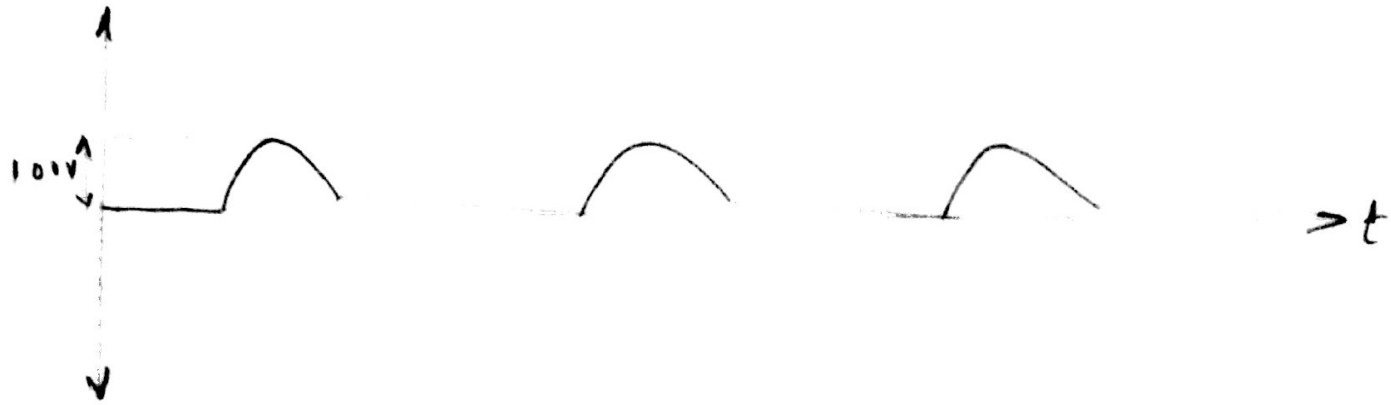
a) With $R_L = 2.2K\Omega$



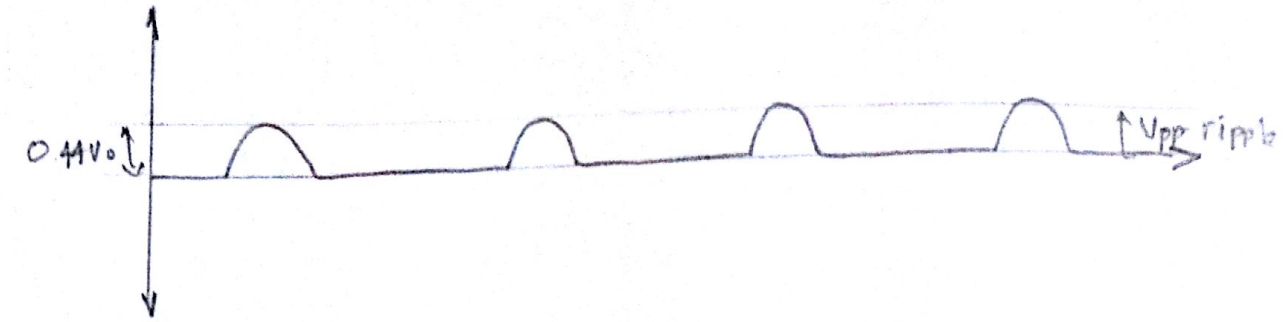



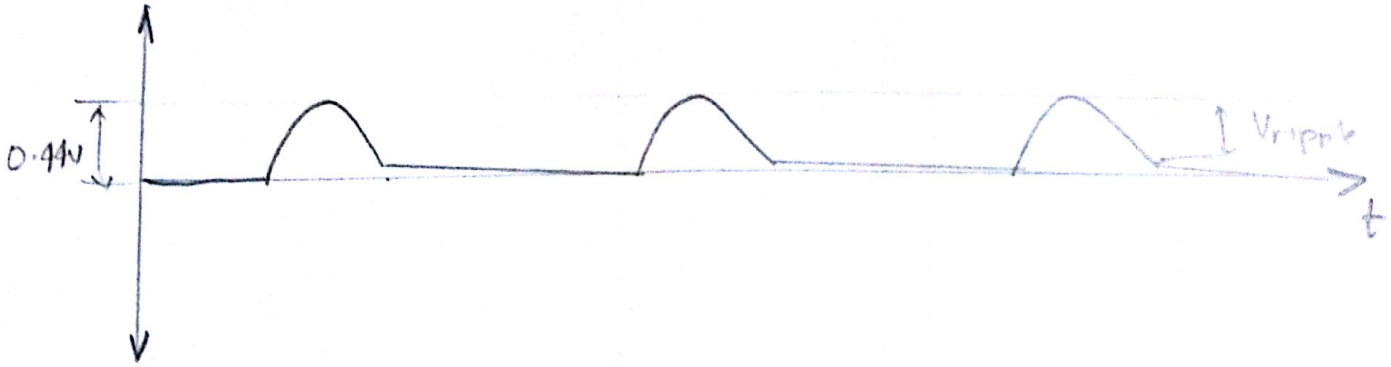

b) With $R_L = 1K\Omega$ :



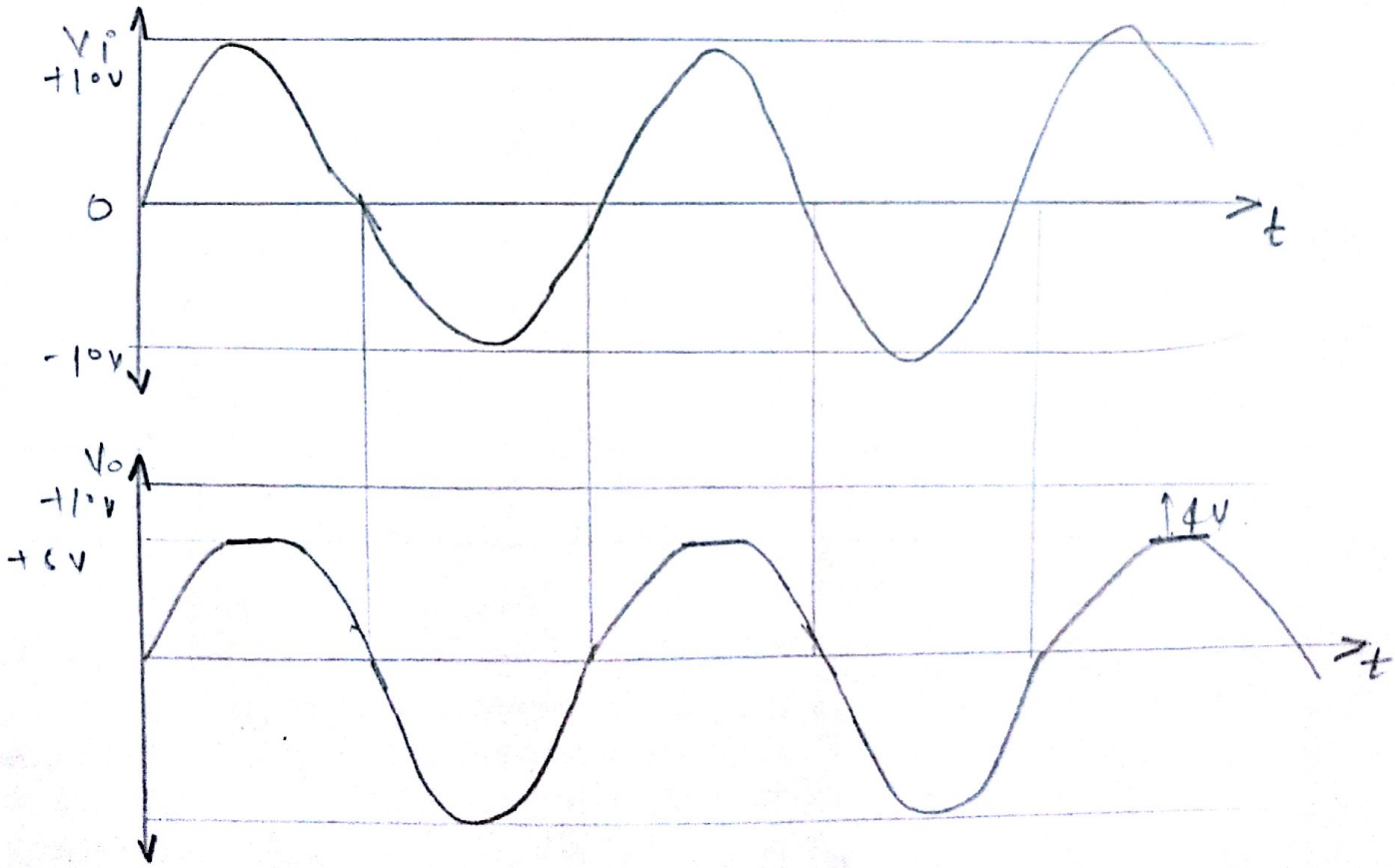



c) With $R_L = 4.7 k\Omega$



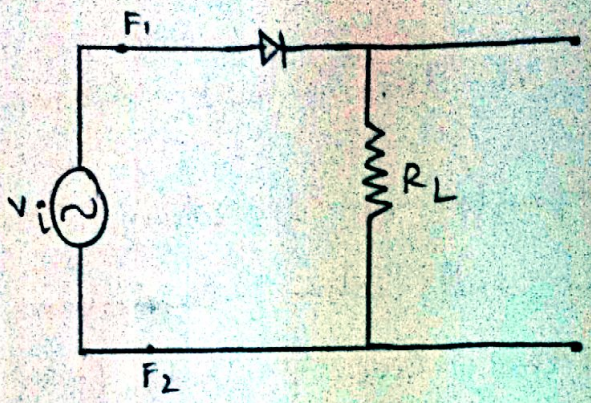

## PART - C



Aim → Design and analysis of Half wave rectifier and clipping circuits.

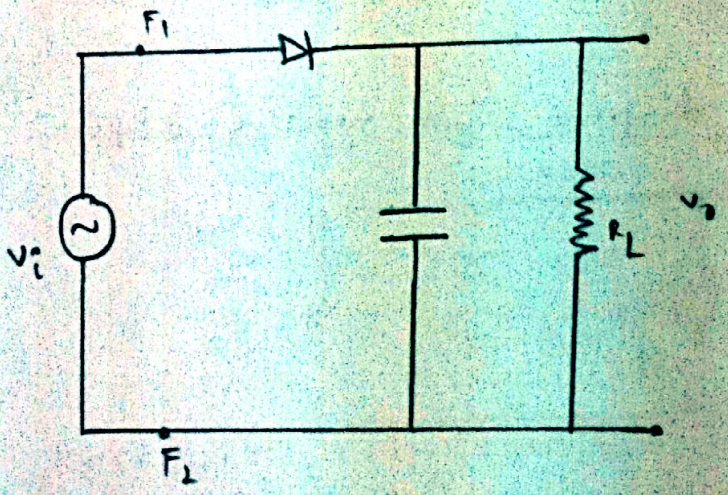
Circuit Diagrams →

PART A:




$R_L = 2.2\ K\Omega$

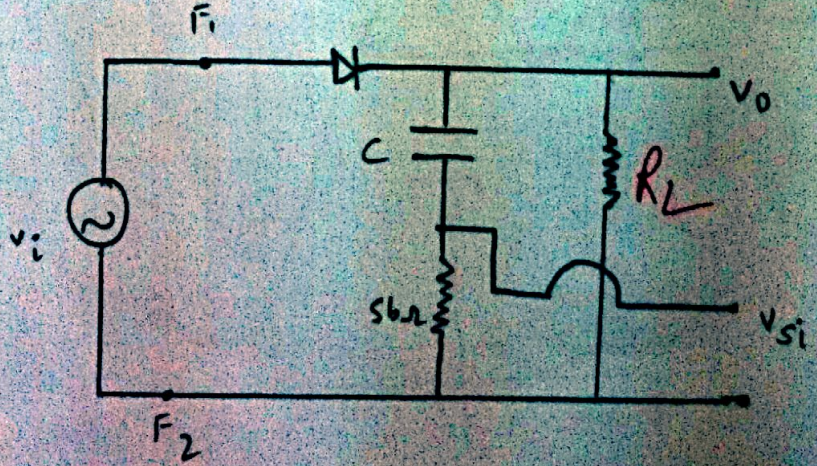
PART B:



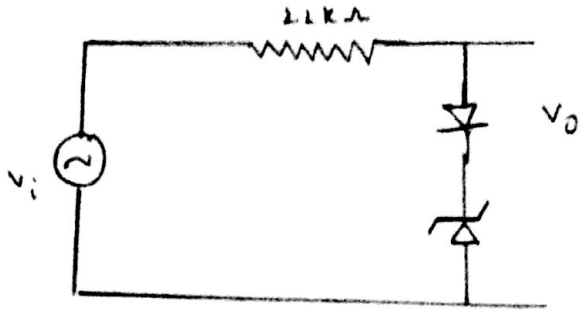

$C = 22\ \mu f$

$R_L = 2.2\ K\Omega, 1K\Omega, 4.7K\Omega$

Half Wave rectifier with;

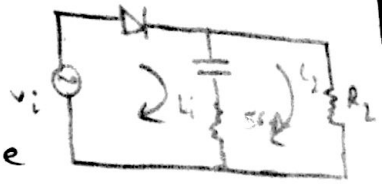


PART C:

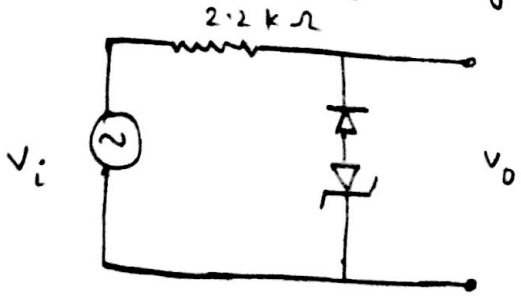



Positive clipper.

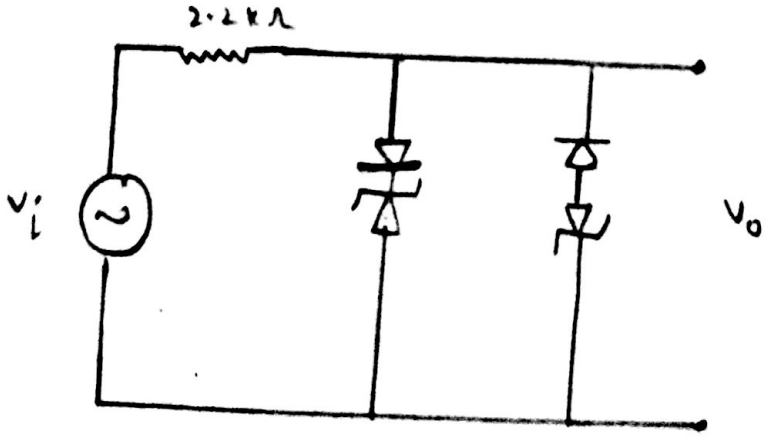
Q.1) If we look at the circuit diagram; when ever Capacitor is in charging mode Current is $I_1$ and when Capacitor is discharging Current in the Circuit is $I_2$ (most of the time). We will see that Capacitor is in charging mode only for short Interval of time.




Q.2) Circuit diagram for negative clipper;




Circuit diagram for Combined positive and negative clipper;



ATIONS:

Setting in put voltage at 10v peak to peak and 500Hz and . Connecting it to Half Wave rectifier . Circuit . the Output . obtained (or) the Oscillator . is similar . to the output expected . but the peak of the Output is about 4.2 v. Hence the voltage . drop across diode . Comes to be 2v . which . may be . due to behaviour . of semi Conductors devices at dabs temperature.

→ When we Connected . a Capacitor . filter in the . Circuit diagram ., We get the plot . similar . to expected graph. and the ripple . voltage was changing with changing of load resistances .

At $R_L = 2.2\ K\Omega$ ; $V_{ripple} = 0.2\ v$

At $R_L = 4.7\ K\Omega$; $V_{ripple} = 0.1\ v$

At $R_L = 1\ K\Omega$; $V_{ripple} = 0.3\ v$

We observed . that as $R_L$ increases ; $V_{ripple}$ also . decreasing.

→ Actually the $V_{ripple}$ is amount of discharging of Capacitor in the equal . to time period of Input frequency . As it is Constant for all resistances . . So , remaining . factors . are $R_L$ and C (i.e . time . Constant) . . So ; when $R_L$ . increases . $R_L C$ increases i.e ; . time Constant . of Capacitor . increases

rather . Call it. And we know that as time Const
Increases . decay amount in a given . time Increases.

→ We found that;

$V_{56\Omega}$ ; 1kΩ = $R_L$

for Current $I_C$ through . 56Ω resistor = 0.85 $V_0$

→ In . clipper . Circuit;

We know that . when ever . $V_i$ . is greater than . 4.6 V ; the diode . is forward . biased . and Hence $V_0 = 4.6$ V.

otherwise . $V_0 = V_i$ .

→ In our . Case of experiment, We got the value 4.3 V rather . than 4.6 V . This may be due to some difference in values . provided . for us and . actual values of voltage . drop across . diode and Zener diode at the given . Conditions as We got some differences in Case of Half Wave rectifiers . as Well.

CONCLUSIONS:

1) Half Wave rectifier . is used . to 'choose' (or) Correct one section of the Wave . . Since We Wanted . the . thave half, We selected . that ( diode . forward . biased) and the (-ve) Half Was discarded ( diode . reversed . biased).

2) In order . to minimise . Oscillations a Capacitor . Was used . in the . rectifier . Circuit.

resistance values used in AC rectifier should be high.

4) The study and effect of different components on the rectifier circuit and dipper circuits was performed.

PRECAUTIONS:

1) Confirm the polarity of the diode.

2) Connect the Capacitor with correct polarity as Capacitor is electrolytic. It will be damaged if connected with incorrect polarity.

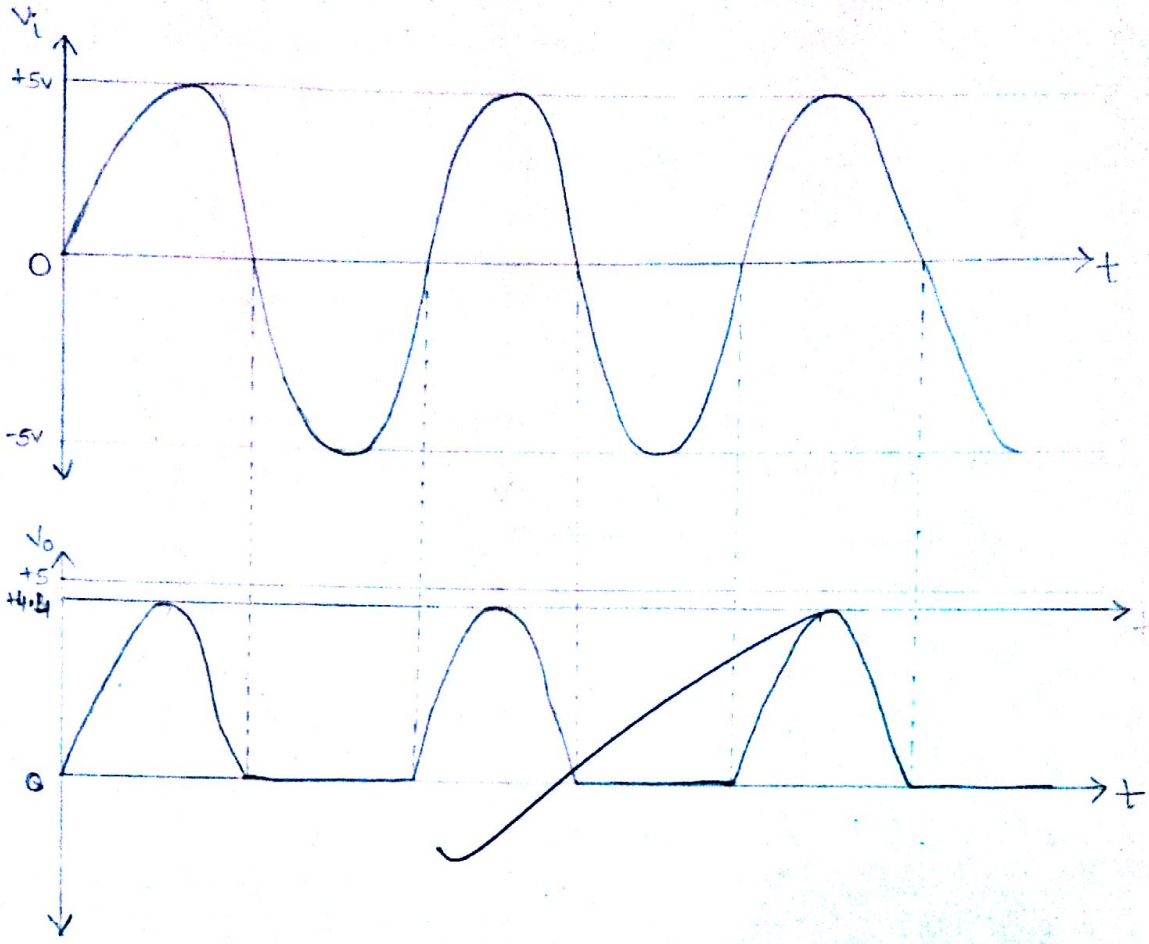
3) Keep ground terminal of Oscilloscope, probe and function generator connected together throughout the experiment.

4) In the Oscilloscope; for higher precision; Increase vertical sensitivity while measuring small voltage (ripple voltage).

...ATIONS :-

...RT-A

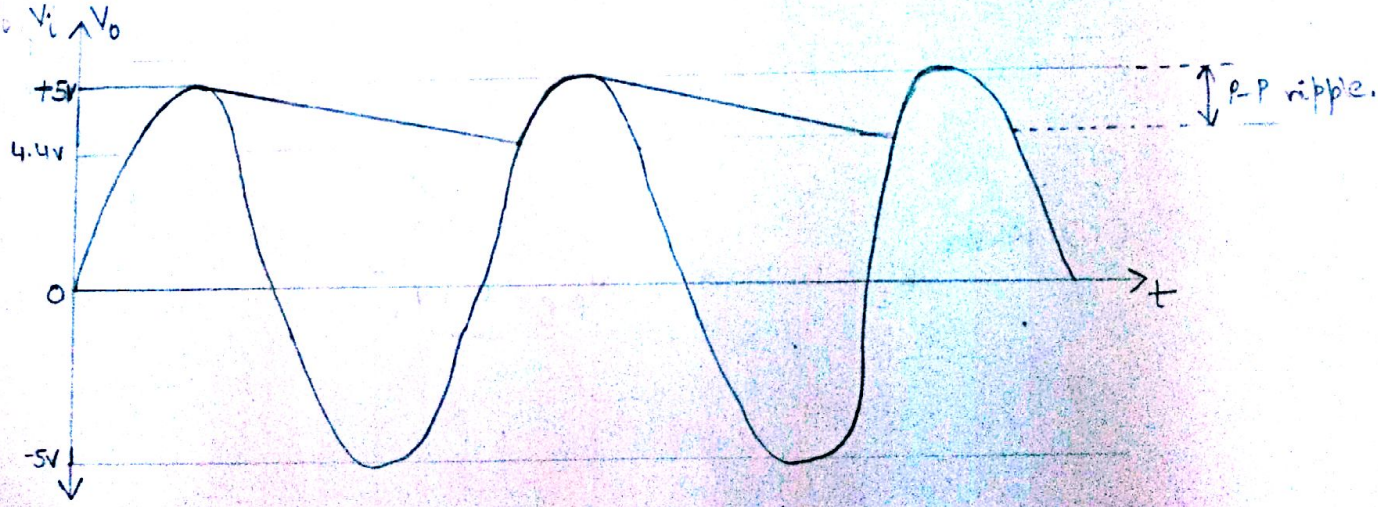
Half-Wave Rectifier without fitter;




PART-B

B) Half-Wave Rectifier with Capacitor Filter;

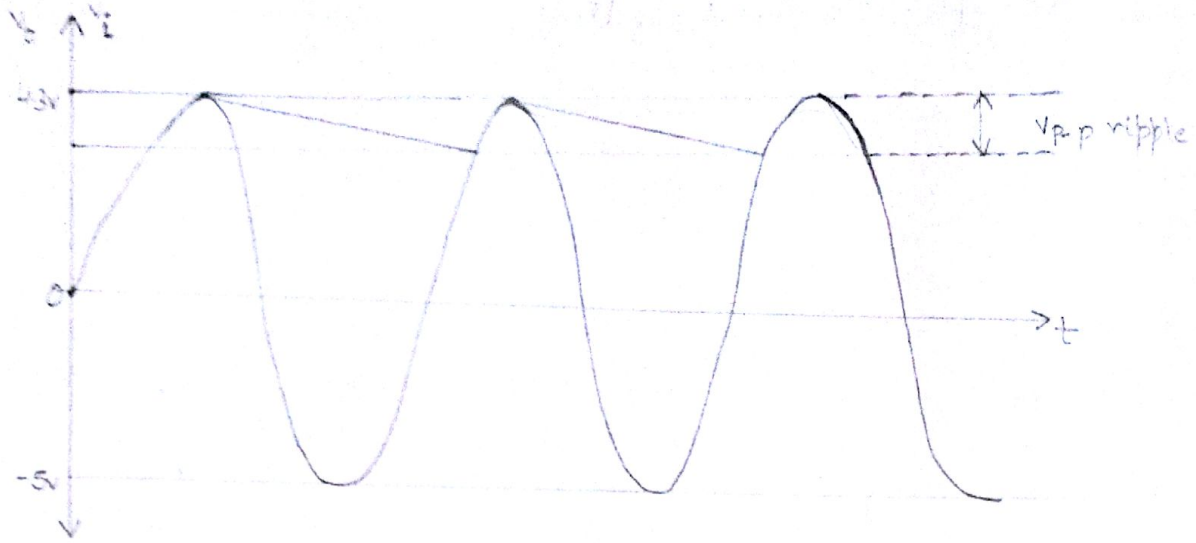
(a)




(a) With $R_L = 2.2K\Omega$ and $C = 22\mu F$;

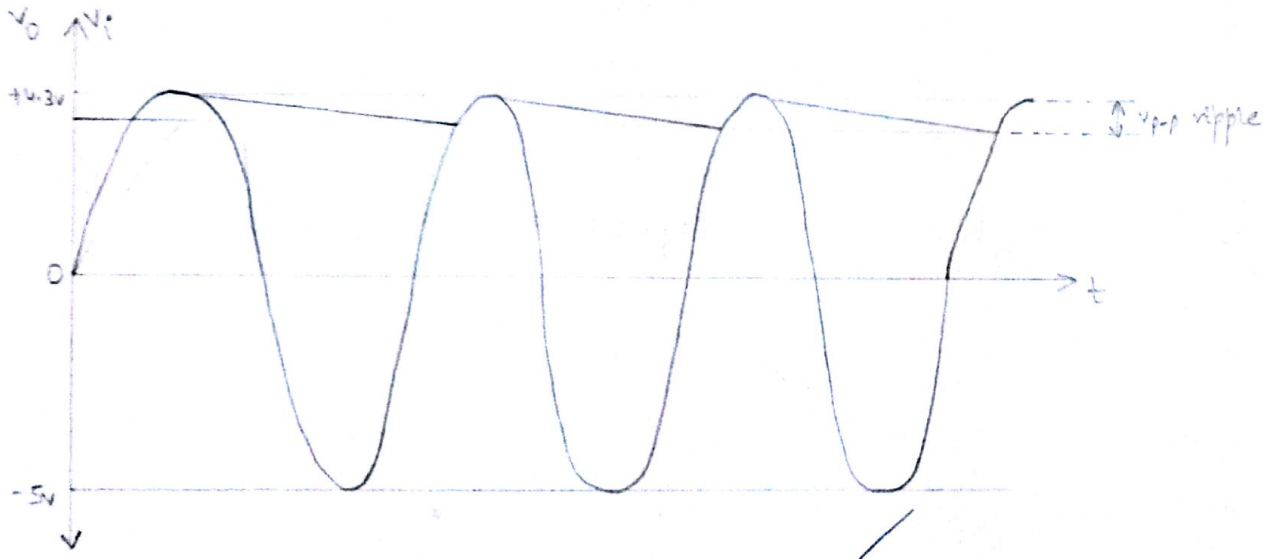
$V_{p-p}$ ripple = 0.2V.

(b)




(b) With $R_L = 1\,K\Omega$ ; $V_{p-p} = 0.3\,V$.

(c)

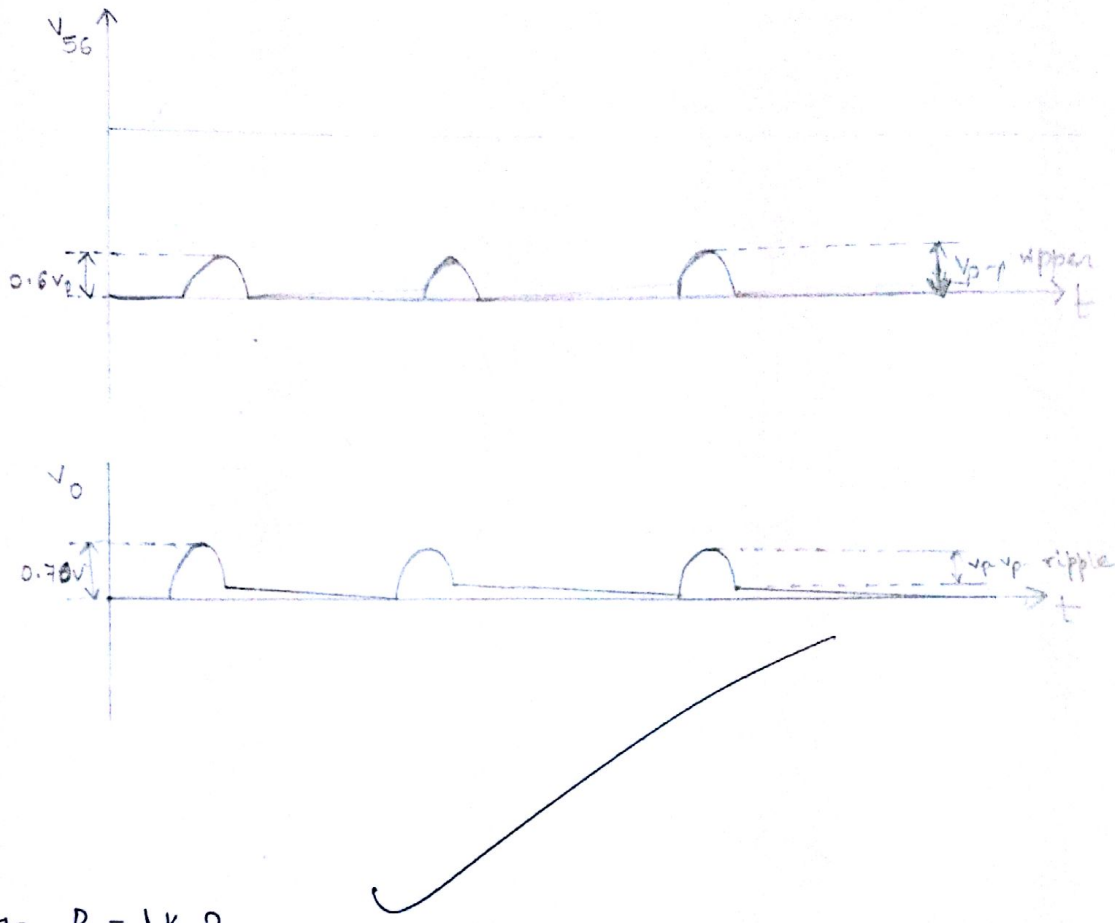



(c) With $R_L = 4.7\,K\Omega$ ; $V_{p-p} = 0.1\,V$.

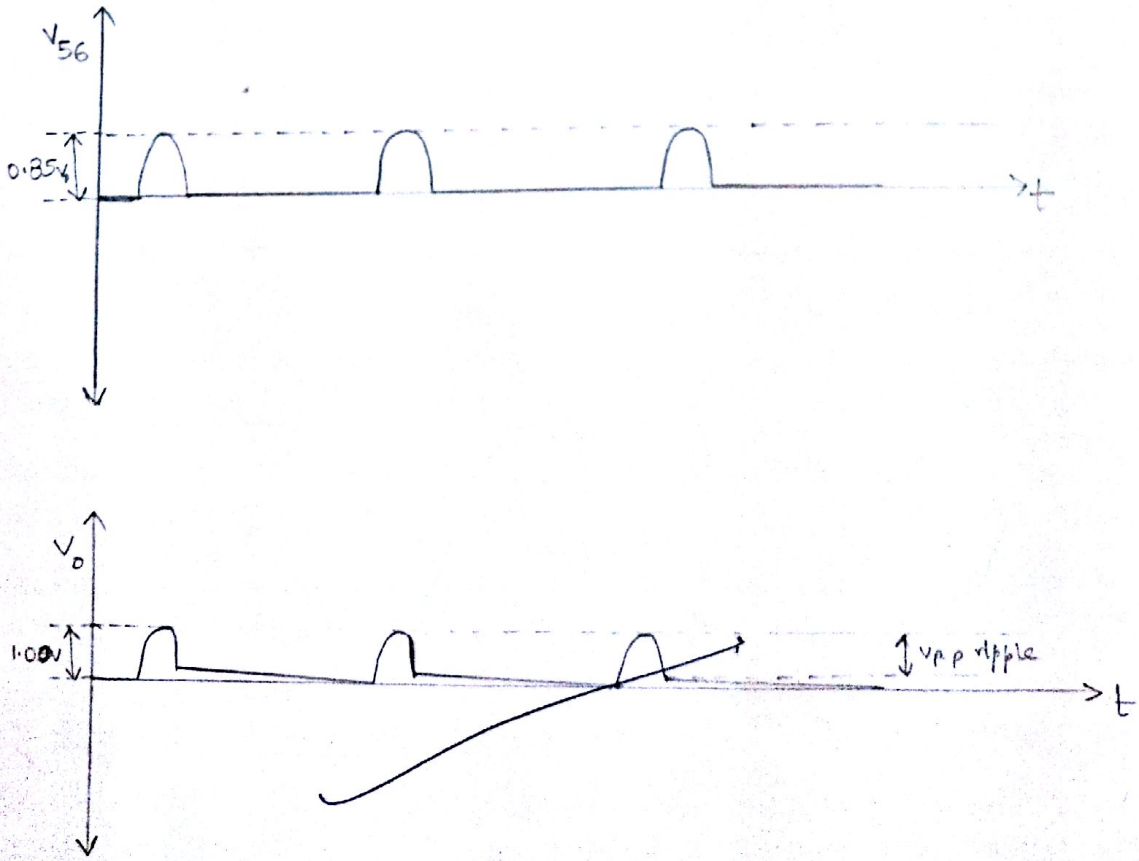
-B:

With $V_{56}$;

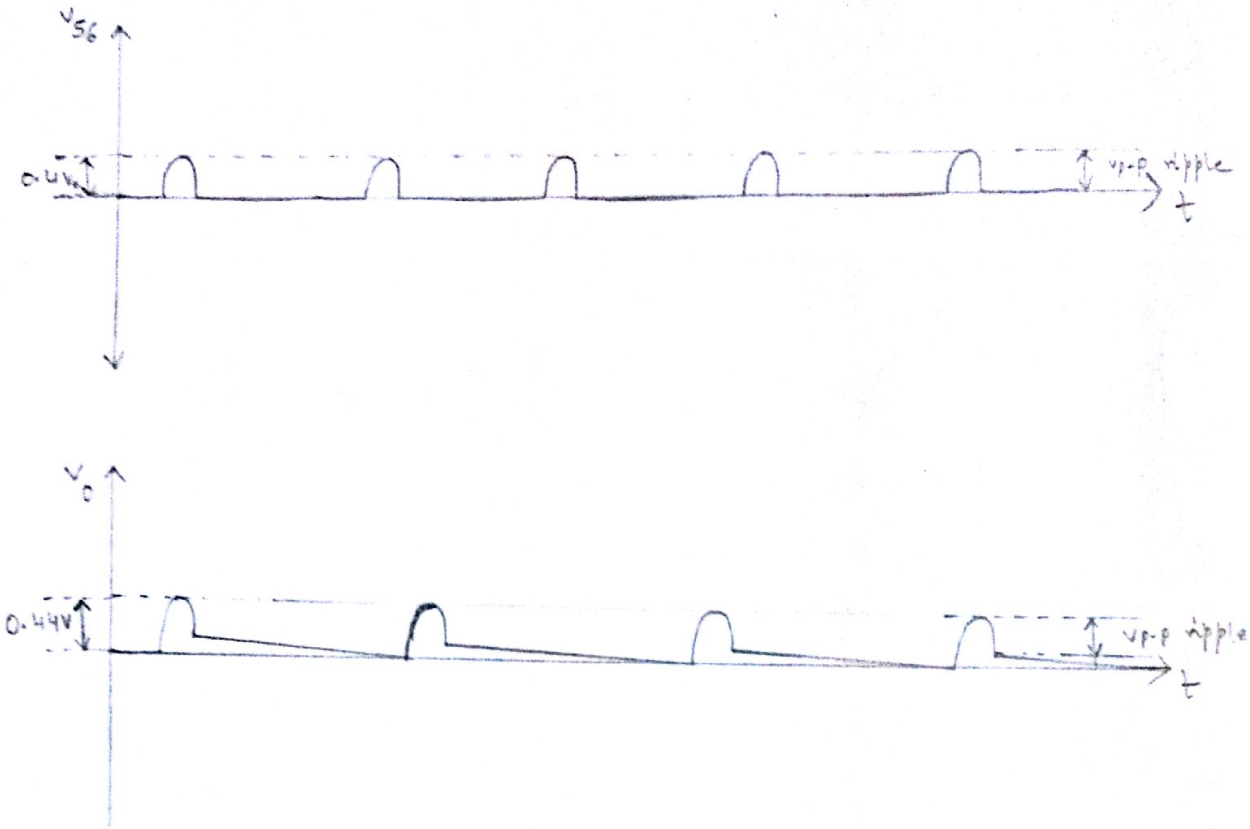
a) With $R_L = 2.2K\Omega$;



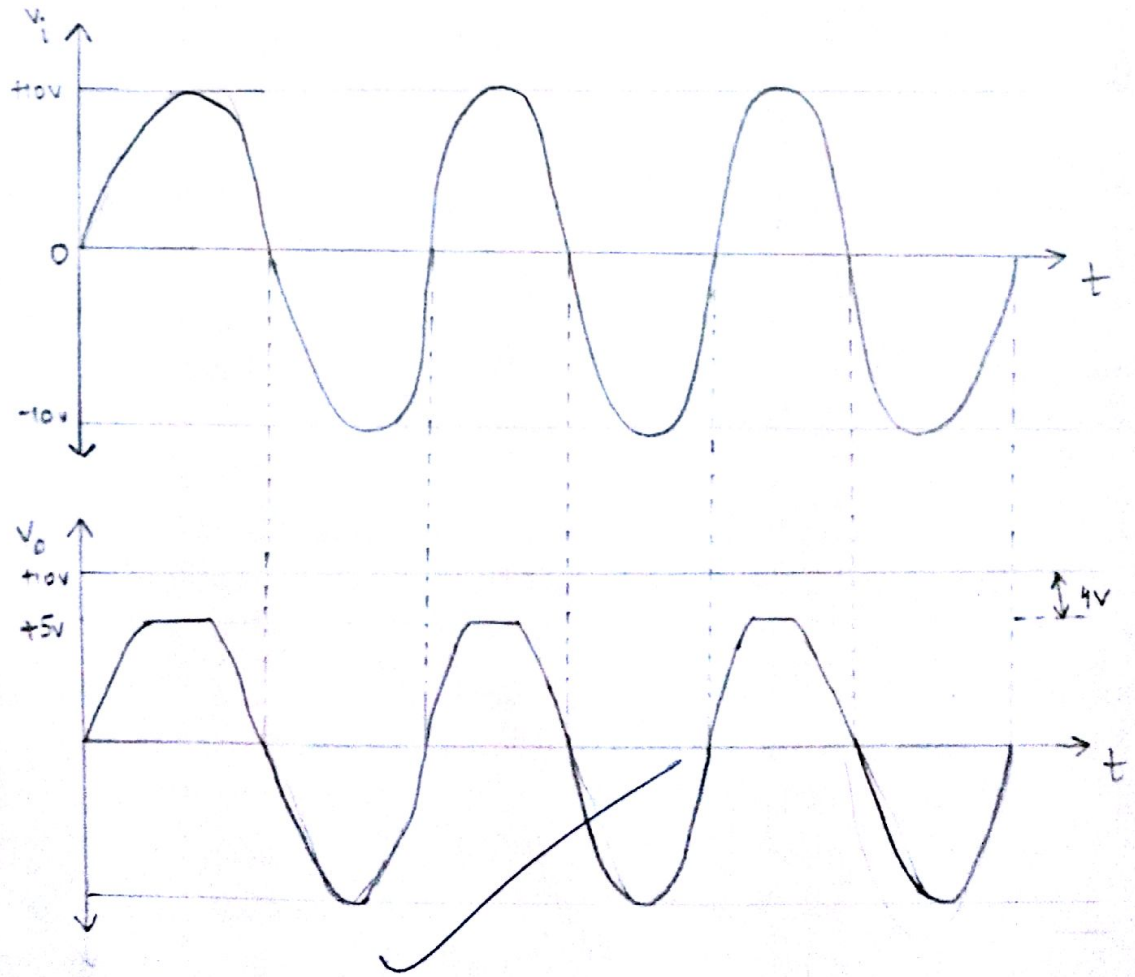

b) With $R_2 = 1K\Omega$;



c) with $R_L = 4.7\ K\Omega$;

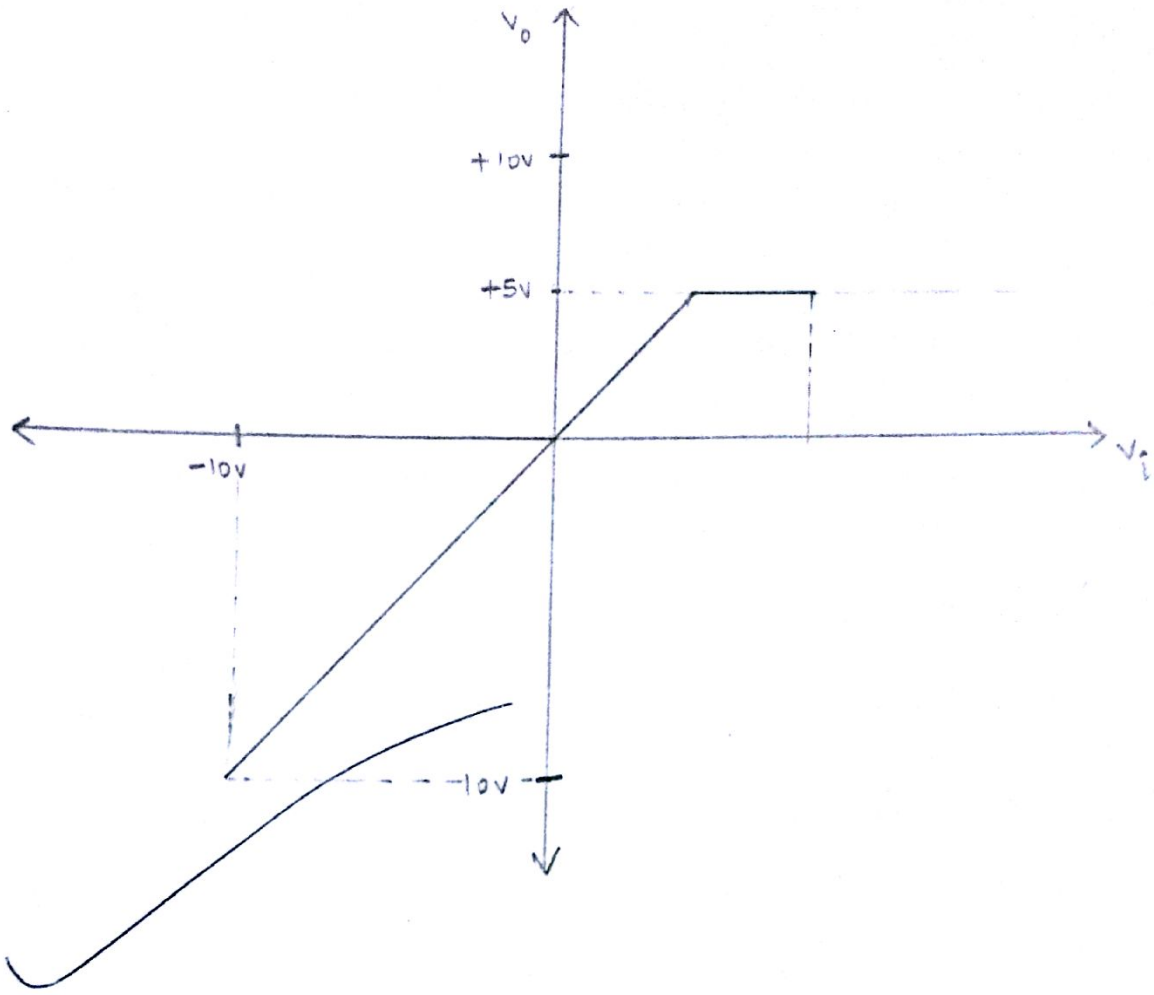



## PART C:-



c:-

b) Positive clipper;




Vijaya,
10/02/2016

**INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI**
**Department of Electronics & Communication Engineering**
**EE102 : Basic Electronics Laboratory**

# EXPT. No. 4 : DIODE CIRCUITS

**OBJECTIVES :** Design and analysis of half wave rectifier and clipping circuits.

## MATERIALS REQUIRED

- Breadboard
- Equipment : Function Generator, Oscilloscope
- Components :
  - Diode : One: Type 1N4007 (Diode voltage drop $V_D$ = 0.7V)
  - Zener Diode : One: (Zener voltage $V_Z$ = 3.9 V)
  - Resistance : Four: 56 Ω, 1 kΩ, 2.2 kΩ, 4.7 kΩ
  - Capacitor : One: 22 μF.

## GENERAL GUIDELINES / PREQUATIONS

1. Connect the capacitor with correct polarity. The capacitor being of electrolytic-type, it is polarized, and will be damaged if connected with incorrect polarity. Similarly, confirm the polarity of the diodes before connecting.
2. Keep ground terminals of oscilloscope probes and function generator outputs connected together throughout the experiment.
3. In an oscilloscope, for higher precision, increase vertical sensitivity (i.e. lower value of volt/div), especially while measuring small amplitude levels (e.g. ripple voltage). You may need to switch to ac coupling while doing so.

## PART A : HALF - WAVE RECTIFIER WITHOUT FILTER

1. Set the function generator to obtain 10 V peak-to-peak sine wave at 500 Hz frequency. Do not connect any circuit to the function generator. Keep dc offset equal to 0. Observe the function generator output on the oscilloscope and verify sine wave generation.
2. Set up the circuit as shown in Fig. 2.1(a) without the capacitor $C$, taking $R_L$ = 2.2 kΩ.
3. Now, connect the function generator to the circuit at points $F_1$ & $F_2$ as shown in Fig. 2.1(a).
4. Display $V_i$ and $V_o$ simultaneously on the oscilloscope. ***Sketch*** $V_i$ and $V_o$ one below the other with identical time and amplitude axes.

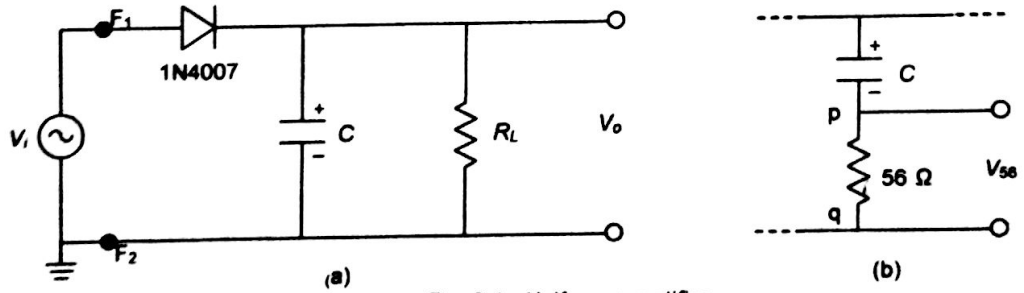



Fig. 2.1 Half-wave rectifier.

## PART B : HALF - WAVE RECTIFIER WITH CAPACITOR FILTER

1. Now connect a capacitor $C$ = 22 μF in the circuit with correct polarity as shown in Fig. 2.1(a).
2. Display $V_i$ and $V_o$ simultaneously on the oscilloscope. ***Sketch*** $V_i$ and $V_o$ overlapping, with the same time and amplitude axes.
3. ***Measure*** peak-to-peak ripple voltage on oscilloscope by enlarging $V_o$ to the maximum extent. You may have to put the input coupling in ac mode while doing this measurement. See the guidelines given at the end. Repeat steps 2 and 3 for $R_L$ = 1 kΩ and 4.7 kΩ. ***Comment*** on the output waveforms and ripple voltages.
4. Connect a 56Ω resistance in series with $C$ of Fig. 2.1(a) as shown in Fig. 2.1(b). The points across this 56Ω resistor are marked as p and q.

**Please note that**: The resistance 56Ω is chosen small enough not to affect the overall performance of the circuit and at the same time to ensure an appreciable voltage across it. This voltage represents the current flowing through the capacitor.

5. Display and ***sketch*** $V_o$ and $V_{56}$ (i.e. voltage across 56Ω between 'p' and 'q') one below the other with identical time axes. Mark the ground reference line.

**Q.1** : Why is $I_C$ ($=V_{56}/56$), the current through the capacitor, negative for some portion of a cycle? Estimate $I_{surge}$ (positive peak of $I_C$).

## PART C : CLIPPING CIRCUIT - POSITIVE CLIPPER

1. Connect the circuit as shown in Fig. 2.2 with R = 2.2 kΩ.
2. Set the function generator to get 20 V peak-to-peak sine wave at 500 Hz frequency. Observe the function generator output on the oscilloscope and verify sine wave generation.
3. Connect the function generator output to the circuit as shown in Fig. 2.2.
4. Display and ***sketch*** $V_i$ and $V_o$ one below the other with identical time and amplitude axes.
5. Superimpose the two waveforms $V_i$ and $V_o$ and observe.
6. Set the oscilloscope in X-Y mode ($V_i$ to Ch2 : X-input and $V_o$ to Ch1 : Y-input) and ***sketch*** $V_o$ versus $V_i$ with equal x and y scales. Label the graph and ticks on the axes.

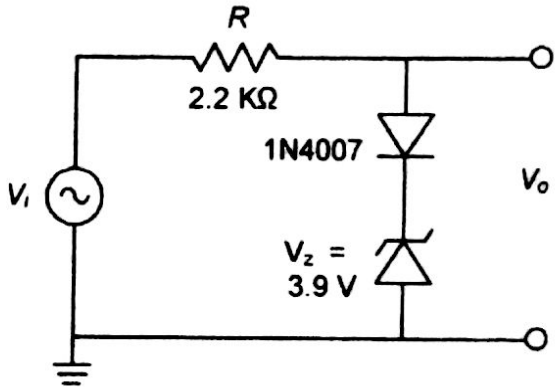



Fig. 2.2 Positive clipper

**Q. 2** : Draw the circuit diagrams for : (a) –ve clipper

(b) +ve and –ve clipper

**Pre observation reading:**

**(a) Draw the expected waveforms at – (i) Step no. 4 of PART A,**

**(ii) Step no. 2 of PART B and**

**(iii) Step no. 4 of PART C.**