21ECC101J- ELECTRONIC SYSTEM AND PCB DESIGN

SEMESTER- II

Record

ACADEMIC YEAR: 2022-2023 EVEN

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DATE: **COORDINATOR**

Submitted for the Practical Examination held on ______________, in ______________________________________**SRM INSTITUTE OF SCIENCE & TECHNOLOGY,** Tiruchirappalli Campus.

Date: **Internal Examiner**

Experiment No 1
STUDY OF ELECTRON DEVICES AND ELECTRONIC COMPONENTS

OBJECTIVES

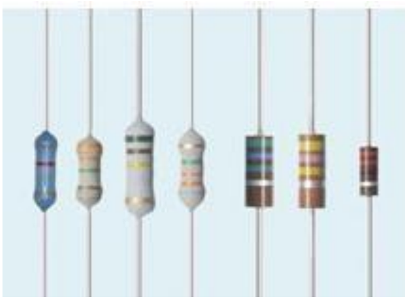
a. To get familiar with basic electronic components such as Resistor, capacitors,Inductor
b. To test and understand the function of various electronic components.

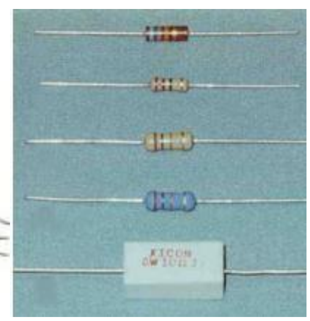
THEORY

RESISTORS

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. The current through a resistor is in direct proportion to thevoltage across the resistor's terminals. This relationship is represented byOhm's law. Adevice used in electrical circuits to maintain a constant relation between current flow and voltage. Resistors are used to step up or lower the voltage at different points in a circuit and to transform a current signal into a voltage signal or vice versa, among other uses. Theelectrical behavior of a resistor obeys Ohm's law for a constant resistance; however, someresistorsaresensitive toheat, light, or other variables.

Resistorsareoneofthemostusedcomponentsinacircuit.Mostarecolorcoded, but some have their value in Ohms and their tolerance printed on them. A multimeter that cancheck resistance can also be helpful, providing the resistor is already removed from the board(measuring it while still soldered in can give inaccurate results, due to connections with therestof thecircuit). They are typically marked with an “R” on a circuit board.





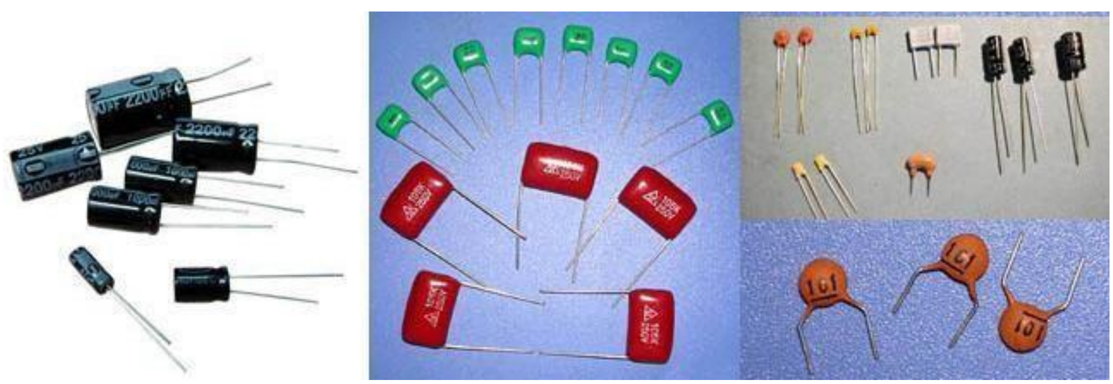
POTENTIOMETERS

Potentiometers are variable resistors. They normally have their value marked with the maximum value in Ohms. Smaller trim pots may use a 3-digit code where the first 2 digits aresignificant, and the 3rd is the multiplier (basically the number of 0′s after the first 2 digits).For example, code 104 = 10 followed by four 0′s = 100000 Ohms = 100K Ohms. They mayalso have a letter code on them indicating the taper (which is how resistance changes inrelation to how far the potentiometer is turned). They are typically marked with an “VR” on acircuitboard.

CAPACITORS

A capacitor (originally known as a condenser) is a passive two-terminal electrical component used to store energy electrostatically in an electric field. By contrast, batteriesstore energy via chemical reactions. The forms of practical capacitors vary widely, but allcontain at least two electrical conductors separated by a dielectric (insulator); for example,one common construction consists of metal foils separated by a thin layer of insulating film.Capacitorsarewidely usedasparts ofelectricalcircuits inmany commonelectricaldevices.

Capacitors are also very commonly used. A lot have their values printed on them, some are marked with 3-digit codes, and a few are color coded. The same resources listed above for resistors can also help you identify capacitor values. They are typically marked with an “C” on a circuit board.



INDUCTORS

An inductor, also called a coil or reactor, is a passive two-terminal electrical component which resists changes in electric current passing through it. It consists of a conductor such as a wire, usually wound into a coil. When a current flows through it, energy is stored in a magnetic field in the coil. When the current flowing through an inductor changes, the time-varying magnetic field induces a voltage in the conductor, according to Faraday’s law of electromagnetic induction, which by Lenz's law opposes the change in current that created it. Inductors, also called coils, can be a bit harder to figure out their values. If they are colorcoded, the resources listed for resistors can help, otherwise a good meter that can measureinductancewill beneeded. They are typically marked with an “L” on a circuit board.

EQUIPMENT REQUIRED
Electronic components (Resistor, capacitors, Inductor),Multimeter

Resistancemeasurement

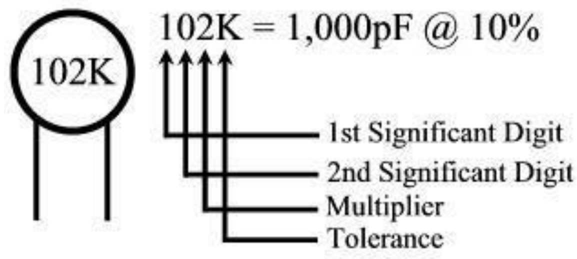
Procedure

1. Connect probes: black probe to COM terminal and red probe to terminal marked with‘ Ω’
2. Set function to resistance measurement
3. Set to the appropriate range(refer to above)
4. Connect the two probes’crocodile clips to the resistor(or to the resistor circuit via jumper wires)to make measurement
5. Note the reading, adjust range if necessary
6. Take the more accurate reading.

Determine the value for the given data

No.	Colourcode	ActualValue	MeasuredValue (DMM)
1	Red,red,black		
2	Red,black,orange		
3	Blue,gray,green		
4		10M	
5		33K	

A2.Determiningcapacitorvalues



Code	Tolerance
C	±0.25pF
J	±5%
K	±10%
M	±20%
D	±0.5pF
Z	80%/-20%

Determine the value of the ceramic capacitors :

No	Code number	Actual value
1	104	
2	223	
3	68	
4		0.47 F
5		33nF

RESULT :

EXPERIMENT NO 2

STUDY OF INSTRUMENTS AND EQUIPMENTS

OBJECTIVES

a. To get familiar with basic electronic instrument and Equipment handling and usage procedure for Digital Multimeter, DC power supply, Function Generator and CRO.
b. To study the self test/calibration procedure of CRO.

A DIGITAL MULTIMETER

INTRODUCTION

A Multimeter is an electronic device that is used to make various electrical measurements, such as AC and DC voltage, AC and DC current, and resistance. It is called a Multimeter because it combines the functions of a voltmeter, ammeter, and ohmmeter. Multimeter may also have other functions, such as diode test, continuity test, transistor test,TTL logic test and frequency test.

PARTS OF MULTIMETER

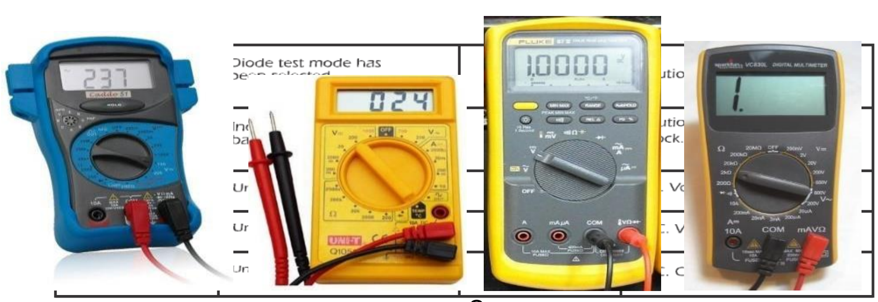
A Multimeter has three parts:

- Display
- Selection Knob
- Ports

The **display** usually has four digits and the ability to display a negative sign. A few multimeter have illuminated displays for better viewing in lowlight situations.

The **selection knob** allows the user to set the multimeter to read different things such as milliamps(mA) of current, voltage(V) and resistance(Ω).

Two probes are plugged into two of the **ports** on the front of the unit. **COM** stands forcommon and is almost always connected to Ground or '-' of a circuit. The **COM** probe isconventionally black but there is no difference between the red probe and black probe other thancolor. **10A**isthe special port used when measuring large currents(greaterthan200mA). **mAVΩ** is the port that the red probe is conventionally plugged in to. This port allows the measurement of current(upto200mA),voltage(V),and resistance(Ω).The probes have a *banana* type connector on the end that plugs into the multimeter. Any probe with a banana plug will work with this meter.

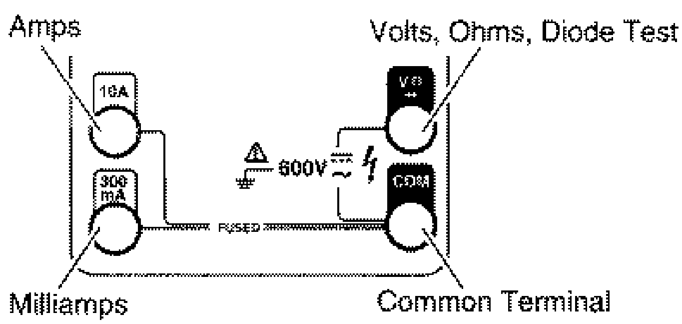


SAFETY MEASURES

- Be sure the test leads and rotary switch are in the correct position for the desired measurement.
- Never use the meter if the meter or the test leads look damaged. Never measure resistance in a circuit when power is applied.
- Never touch the probes to a voltage source when a test lead is plugged into the 10A or 300mA input jack.
- To avoid damage or injury, never use the meter on circuits that exceed 4800 watts. • Never apply more than the rated voltage between any input jack and earth ground.
- Be careful when working with voltages above 60V DC or30V AC rms. Such voltages pose a shock hazard.
- Keep your fingers behind the finger guards on the test probes when making measurements.
- To avoid false readings, which could lead to possible electric shock or personal injury, replace the battery as soon as the battery indicator appears.

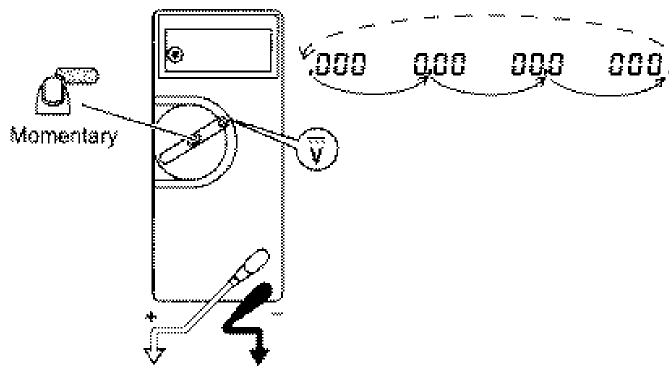
INPUTJACKS

The black lead is always plugged into the common terminal. The red lead is plugged intothe 10 A jack when measuring currents greater than 300 mA, the 300 mA jack when measuring currents less than 300mA,and the remaining jack (V-ohms-diode)for all other measurements.



RANGE FIXING

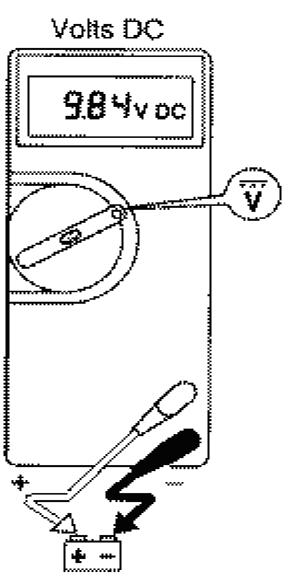
The meter defaults to auto range when first turned on. You can choose a manual range inV AC, V DC, A AC, and A DC by pressing the button in the middle of the rotary dial. To return to auto range, press the button for one second.

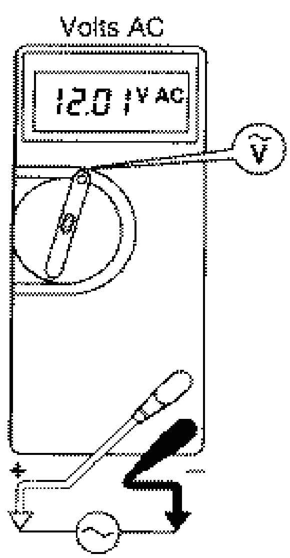


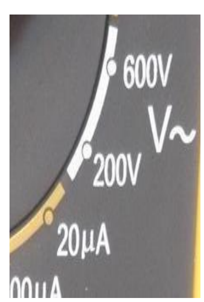
PROCEDURE FOR MEASUREMENT – VOLTAGE MEASUREMENT

D.C./A.C.Voltage Measurment

1. Connect the positive(red) test lead to the 'V/mA' jack socket and the negative(black) leadtothe'COM' jack socket.
2. Set the selector switch to the desired mV D.C./D.C.V/A.C. V range.
3. Connect the test leads to the circuit to be measured.
4. Turn on the power to the circuit to be measured, the voltage value should appear the digital display along with the voltage polarity(if reversed only).

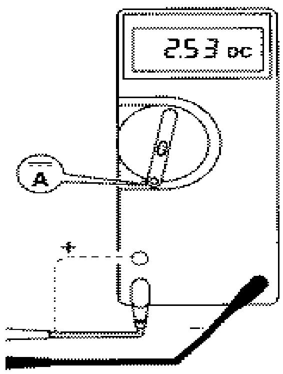






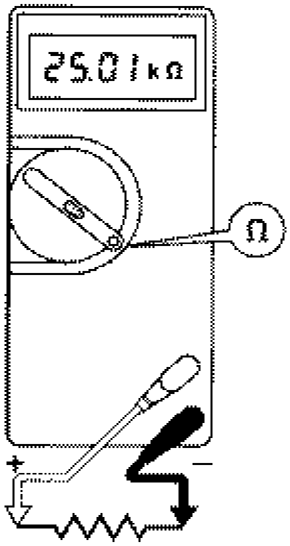
CURRENT MEASUREMENT

1. Connect the positive(red) test lead to the 'V/mA' jack socket and the negative(black) lead to the 'COM' jack socket(for measurements up to 200mA). For measurements between 200mA and 10A connect the red test lead to the '10mA' socket200A and 10A connect the red test lead to the '10mA' socket.
2. Set the selector switch to the desired uA/mA/A range.
3. Open the circuit to be measured and connect the test leads in **SERIES** with the load in which current is to be measured.
4. To avoid blowing an input fuse, use the 10A jack until you are sure that the current is lessthan 300 mA. Turn off power to the circuit. Break the circuit. (For circuits of more than 10 amps, use a current clamp.) Put the meter in series with the circuit and turn power on.



RESISTANCE MEASUREMENT

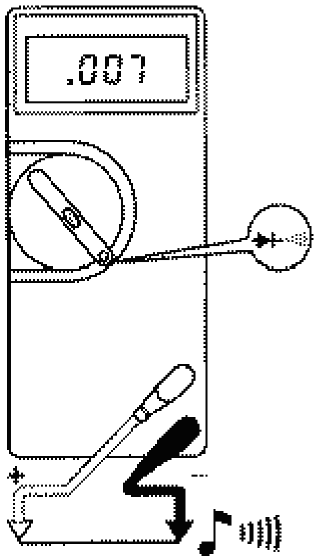
1. Connect the positive(red) test lead to the 'V/mA' jack socket and the negative(black) lead to the 'COM' jack socket.
2. Set the selector switch to the desired 'OHM Ω'.
3. If the resistance to be measured ia part of a circuit, turn off the power and discharge all capacitors before measurement.
4. Connect the test leads to the circuit to be measured.
5. The resistance value should now appear on the digital display.
6. If the resistance to be measured is part of a circuit, turn off the power and discharge all capacitors before measurement.

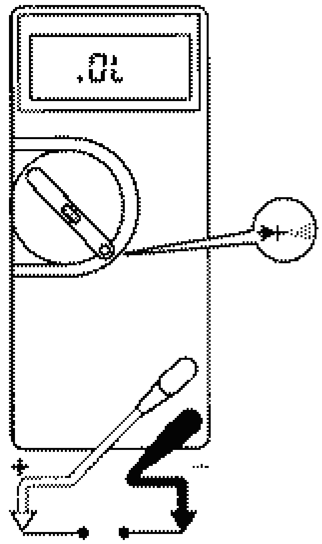


CONTINUITY TEST

This mode is used to check if two points are electrically connected. It is often used to verify connectors. If continuity exists (resistance less than 210 ohms), the beeper sounds continuously.

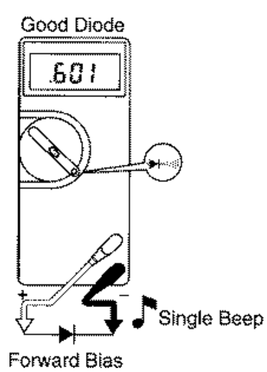
1. Connect the positive(red) test lead to the ‘V/mA’ jack socket and the negative(black) lead to the ‘COM’ jack socket.
2. Set the selector switch to the))) position.
3. Connect the test leads to two points of the circuit to be tested. If the resistence is Ohms the buzzer will sound.
4. If the resistance to be measured is part of a circuit, turn off the power and discharge all capacitors before measurement.

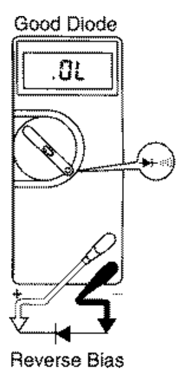


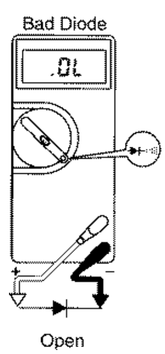


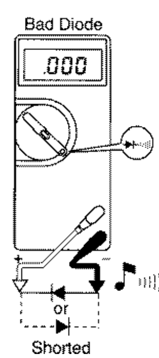
DIODE TEST

1. Connect the positive (red) test lead to the 'V/mA' jack socket and the negative(black) lead to the 'COM' jack socket.
2. Set the selector switch to the ⯈| position.
3. Connect the test leads to be measured.
4. Turn on the power to the circuit to be measured and the voltage value should appear on the digital display.









General Operation

Connection of Probes:

All multimeters come with two probes. They are to be connected to the terminals on the meter itself. The Black probe is to be connected to the COM terminal. Red probe is to be connected to terminal marked with :

- ‘V-Ω for voltage measurement,
- ‘mA’ or ‘20A’ for current measurement (there are two terminals, one for 2A range and the other for 20A range)
- ‘V-Ω for resistance measurement.

Setting of function:

The multimeter uses different circuits internally to measure different things. Therefore, you must select the correct function before using it.

Setting of Range:

- You can change the sensitivity of the meter by selecting different range for measurement. Set the range to the first range that is higher than the maximum value you expect to measure. This will give a more accurate reading. If you do not know what to expect, use the highest range first. After a reading is obtained, set the range to the appropriate one to get a better reading.
- When the value measured exceeds the existing range, the display will flash. When this happens, set the multimeter to a higher range until some values are displayed.

Precautions:

1. For current measurement, the maximum input current is 2A (if the RED mA and BLACK COM terminals are used) or 20A (if the RED 20A and BLACK COM terminals are used). Excessive current will blow the fuse on the 2A range, which must be replaced. The 20A range, however, is not protected by the fuse.
2. For voltage measurement (use the RED V-Ω and BLACK COM terminals), the maximum input voltage on :
   - all DC ranges is 1200V DC or peak AC
   - the 20V, 200V and 1000V AC ranges is 1000V rms continuous
   - the 2V and 200mV AC ranges is 1000V rms for not more than 15 seconds.
3. To avoid electrical shock and/or instrument damage, do not connect the COM input terminals to any source of more than 500 volts DC or peak AC above earth ground.

Resistance measurement

Procedure

1. Connect probes: black probe to COM terminal and red probe to terminal marked with ‘□ ’
2. Set function to resistance measurement
3. Set to the appropriate range (refer to above)
4. Connect the two probes’ crocodile clips to the resistor (or to the resistor circuit via jumper wires) to make measurement
5. Note the reading, adjust range if necessary
6. Take the more accurate reading.

Voltage measurement

Procedure

7. Connect probes: black probe to COM terminal and red probe to terminal marked with 'V'
8. Set function to voltage measurement
9. Set to the appropriate range (refer to above)
10. Set the AC-DC selection - depends on what type of signal you want to measure
11. Touch the two points where you want to make measurement
12. Note the reading, adjust range if necessary
13. Take the more accurate reading.

Note

Reading obtained is the voltage of where the red probe touch with reference to where the black probe touches. This may not indicate the voltage level from ground. To find the voltage level of a point from ground, black probe should be touching a ground point and the red probe on the point you want to measure.

Current measurement

Procedure

1. Connect probes: black probe to COM terminal and red probe to terminal marked with 'A'
2. Set function to current measurement
3. Set to the appropriate range
4. Set AC-DC selection - depends on what type of signal you want to measure
5. Off the power to the circuit
6. Break the path which we want to make measurement
7. Connect the path with the two probes so that current now flow through the multimeter
8. On the power
9. Note the reading, change range if necessary
10. Take the more accurate reading.

Note

Use the 20A range if you are not sure of the current to be measured.

2B DC VARIABLE POWER SUPPLY

- To study the function and operation of regulated power supply.

Equipment required

- Multimeter
- Dual DC variable regulated Power supply (0-30) Volts

Theory

A **power supply** is a device that supplies electric power to an electrical load. The term is most commonly applied to electric power converters that convert one form of electrical energy to another, though it may also refer to devices that convert another form of energy (mechanical, chemical, solar) to electrical energy. A regulated power supply is one that controls the output voltage or current to a specific value; the controlled value is held nearly constant despite variations in either load current or the voltage supplied by the power supply's energy source.

A power supply may be implemented as a discrete, stand-alone device or as an integral device that is hardwired to its load. Examples of the latter case include the low voltage DC power supplies that are part of desktop computers and consumer electronics devices.

Commonly specified power supply attributes include:

- The amount of voltage and current it can supply to its load.
- How stable its output voltage or current is under varying line and load conditions.

POWER SUPPLIES TYPES

- Battery
- DC power supply
- AC power supply
- Linear regulated power supply
- Switched mode power supply
- Programmable power supply
- Uninterruptible power supply
- High voltage power supply
- Voltage multipliers

DC POWER SUPPLY

SPECIFICATION

1. Adjustable 0~30V/0~2A
2. The design is limit the voltage overload
   The power supply input **220V, 230V, 240V AC**
3. Output voltage: 0-30V DC
4. Work temperature: -10°C-40°C

MAIN FUNCTION

1. Output constant current adjustable.
2. Output constant voltage adjustable.
3. LCD voltage and current display.
4. Constant voltage and current operation in individual.
5. Over current protection.

Adjustable power supply

2C CATHODE-RAY OSCILLOSCOPE (CRO)

Objective

- To introduce the basic structure of a cathode-ray Oscilloscope.
- To get familiar with the use of different control switches of the device.
- To visualize an ac signal, measure the amplitude and the frequency.
- To do self test/ calibration of CRO

Equipment Required

- Cathode-ray Oscilloscope
- Function Generator
- BNC connector

Theory

The device consists mainly of a vacuum tube which contains a cathode; anode, grid, X&Y-plates, and a fluorescent screen (see Figure below). When the cathode is heated (by applying a small potential difference across its terminals), it emits electrons. Having a potential difference between the cathode and the anode (electrodes), accelerate the emitted electrons towards the anode, forming an electron beam, which passes to fall on the screen.

When the fast electron beam strikes the fluorescent screen, a bright visible spot is produced. The grid, which is situated between the electrodes, controls the amount of electrons passing through it thereby controlling the intensity of the electron beam. The X&Y- plates are responsible for deflecting the electron beam horizontally and vertically.

A sweep generator is connected to the X-plates, which moves the bright spot Horizontally across the screen and repeats that at a certain frequency as the source of the signal. The voltage to be studied is applied to the Y-plates. The combined sweep and Y voltages produce a graph showing the variation of voltage with time.

Experimental Figures

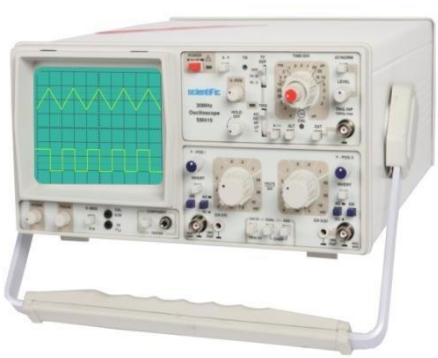


Fig 1. Cathode Ray tube Oscilloscope

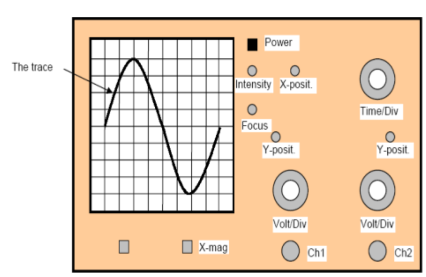
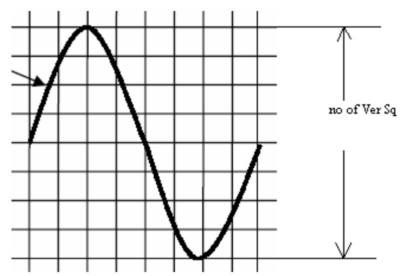


Fig 2. Out Line Diagram of CRO

Procedure

1. Turn on the Oscilloscope
2. Adjust the intensity and the focus of the trace.
3. Use the X & Y knobs to center the trace horizontally and vertically.
4. Connect the cable from Ch1 of the CRO to Function generator.
5. A signal will appear on the screen.
6. Make sure that the inner red knobs of the Volt/Div and the Time/Div are locked clockwise.
7. Set the frequency of the generator to 100 Hz.
8. Adjust the Volt/Div and the Time/Div knobs so that you get a suitable size signal
9. Count the number of vertical squares lying within the signal, then calculate the peak to peak value as:



Vp-p = No. vertical Div * Volt/Divs

1. Count the number of horizontal squares lying within the one Duty Cycle, then calculate time value as:

Time = No. Horizontal Div * Time/Divs

11.Calculate the Frequency of signal by using the formula:

Freq = 1 /Time

Result:

2D FUNCTION GENERATOR

Objective

1. To get familiarization and study the operation of a function generator instrument
2. To identify key function generator specifications
3. To visualize the types of waveforms produced by a function generator

Equipment Required

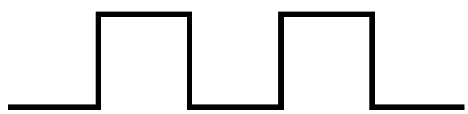
- Oscilloscope
- Function generator.
- BNC connector cable

Theory

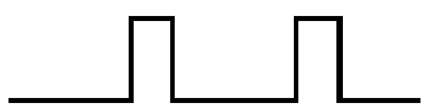
A **function generator** is electronic test equipment used to generate different types of waveforms over a wide range of frequencies. Function generators are capable of producing a variety of repetitive waveforms, generally from the list below

- ***Sine wave:*** A function generator will normally have the capability to produce a standard sine wave output. This is the standard waveform that oscillates between two levels with a standard sinusoidal shape.

Square wave: A square wave is normally relatively easy for a function generator toproduce. It consists of a signal moving directly between high and low levels.

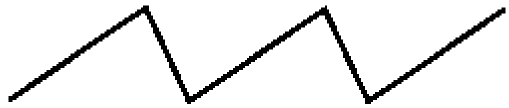


- ***Pulse:*** A pulse waveform is another type that can be produced by a function generator. It is effectively the same as a square wave, but with the mark space ratio very different to 1:1.



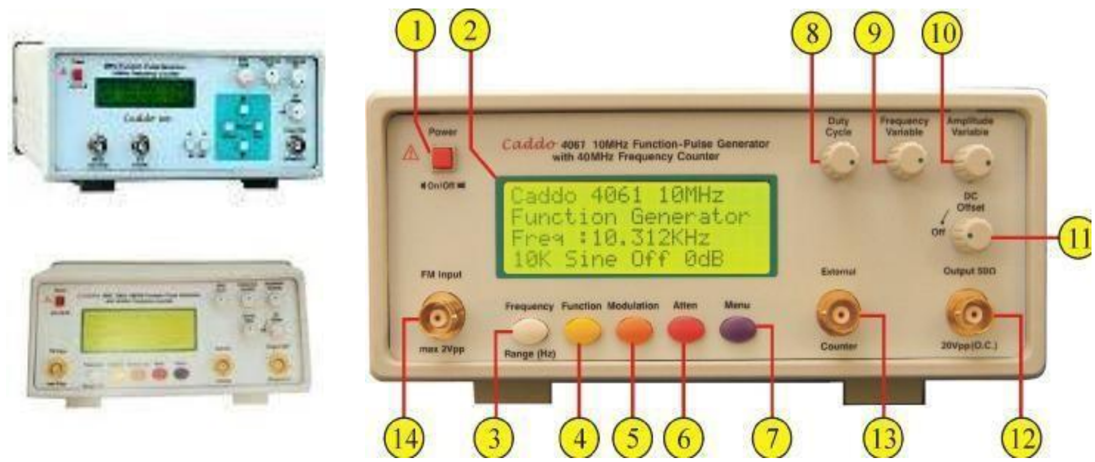
- ***Triangular wave:*** This form of signal produced by the function generator linearly moves between a high and low point.

- ***Saw tooth wave:*** Again, this is a triangular waveform, but with the rise edge of the waveform faster or slower than the fall, making a form of shape similar to a saw tooth.



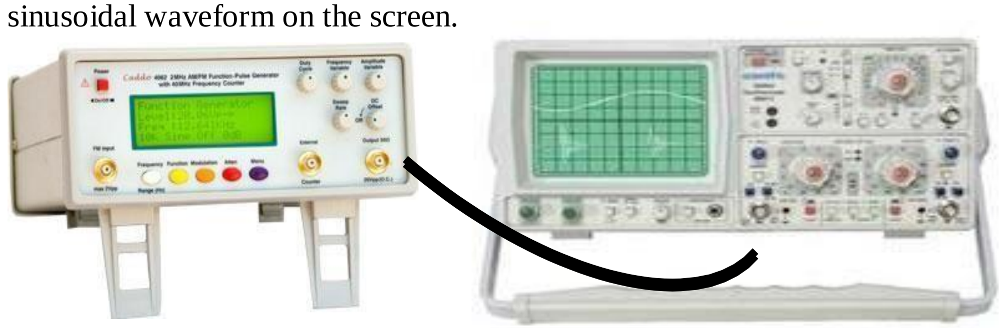
These waveforms can be either repetitive or single-shot Function generators are used in the development, test and repair of electronic equipment.

Types of Function Generator



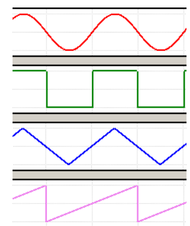
PROCEDURE

1. Turn on the oscilloscope
2. Connect the function generator to one vertical channel of the oscilloscope using BNC Connector
3. Select the type of wave form by pressing Function control button.
4. Set the waveform at desired frequency by adjusting Frequency variable control button.
5. Now adjust the amplitude control of the function generator to establish a 4 V peak-to-peak (p-p) sinusoidal waveform on the screen.



Function Generator connected

Function Generator Controls :

Knobs Number	Control Name	Functions
1	Power	Push button switch to power ON the instrument.
2	LCD Display	20 x 4 Character bright back lit Liquid Crystal Display.
3	Frequency	Used for selection of frequency range step by step.
4	Function	Used for selection of Particular waveform. A total number of 6 different waveforms : ❖ *Sine* ❖ *Square* ❖ *Triangle* ❖ *Ramp* ❖ *Pulse* ❖ *TTL are available.* 
5	Modulation	Used for selection of Frequency Modulation.
6	Attenuation	Used for Selection of 20dB or 40dB attenuation
7	Menu	Used for selection of Function Generator/Frequency counter mode.
8	Duty Cycle	When pulse output function is selected, this controls the pulse duty cycle from 15% to 85%.
9	Frequency Variable	In conjunction with frequency range, selected by frequency key on front Panel.
10	Amplitude Variable	In conjunction with attenuators (6), this varies the level of output.
11	DC Offset	This control provides DC offset. Approximately ±5VDC is superimposed on the output. Keep the control off if DC offset is not required.
12	Output (BNC connector)	Output of 10 MHz function generator i.e. 20Vpp (Open Circuit)
13	External Counter (BNC Connector)	Input BNC connector for measuring the frequency of external signal when External Counter mode is selected by Menu key on the LCD display. 
14	Modulation Input	Maximum modulation Input i.e. 2Vpp.

Result :

EXPERIMENT NO :

DESIGN AND ANALYSIS OF RL AND RC USING SCHEMATIC IN CAD TOOL

Aim:

Design and simulate series RC and RL circuit

Theory:

Thefundamentalpassivelinearcircuitelementsaretheresistor(R),capacitor(C) andinductor(L).Thesecircuit elementscanbecombinedtoformanelectrical circuitinfourdistinctways:theRCcircuit,theRLcircuit,theLCcircuit andtheRLC circuitwiththeabbreviations indicatingwhichcomponentsareused.

These circuits exhibit important types of behaviour that are fundamental to analogueelectronics.In particular,theyareabletoactaspassivefilters.This article considers the RL circuit in both series and parallel as shown in the diagrams.Inpractice,however,capacitors(andRCcircuits)areusuallypreferredto inductorssince theycanbemoreeasilymanufacturedandaregenerallyphysically smaller,particularlyforhighervaluesof components.BothRCandRLcircuitsform a single-polefilter.

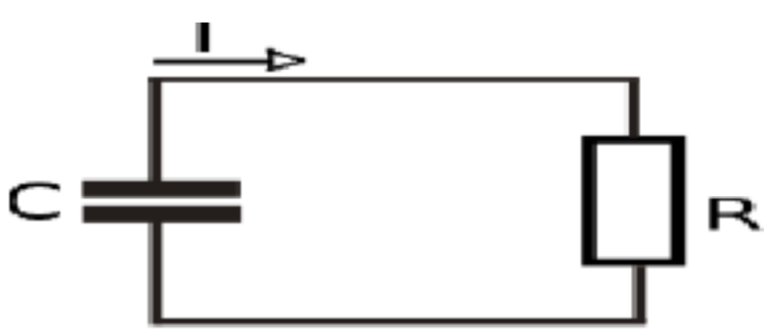
Dependingonwhetherthereactiveelement(CorL)isinserieswiththeload,or parallel with the load will dictate whether the filter is low-pass or high-pass.FrequentlyRLcircuitsareusedforDCpowersuppliestoRFamplifiers, wheretheinductorisusedtopass DCbiascurrentandblocktheRFgettingback into the powersupply

RC circuit:

Therearethreebasic,linearpassivelumpedanalogcircuitcomponents:the resistor(R),thecapacitor(C),andthe inductor(L).Thesemaybecombinedinthe RCcircuit,theRLcircuit,theLCcircuit,andtheRLCcircuit,withthe abbreviations indicating which components are used.

These circuits, among them, exhibit a large number of important types of behaviour that are fundamental to much of analog electronics. In particular, they areabletoactaspassive filters.ThisarticleconsiderstheRCcircuit,inbothseries and parallel forms, as shown in the diagrams below.

NATURAL RESPONSE:

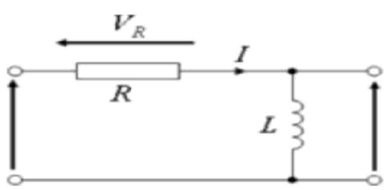


RC circuit :

The simplest RC circuit is a capacitor and a resistor in series. When a circuit consists of only a charged capacitor and a resistor, the capacitor will discharge its stored energy through the resistor. The voltage across the capacitor, which is time dependent, can be found by using Kirchhoff's current law, where the current charging the capacitor must equal the current through the resistor. This results in the linear differential equation.

Solving this equation for V yields the formula for exponential decay: where V_0 is the capacitor voltage at time t = 0.

SERIES RL CIRCUIT:



By viewing the circuit as a voltage divider, we see that the olta e across the inductor is:

$$V_L(s) = \frac{Le}{R + Le} V_{in}(s)$$

and the voltage across the resistor is:

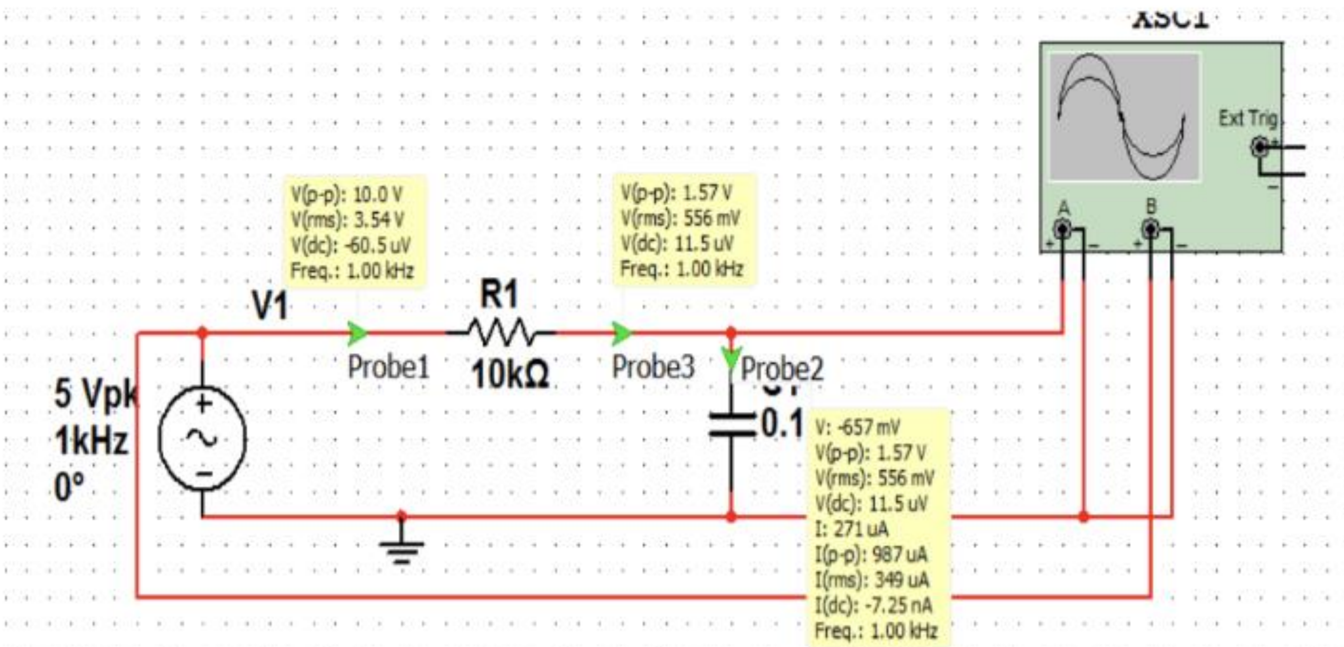
$$V_R(s) = \frac{\;}{R + Ls} V_{in}(s)$$

Current

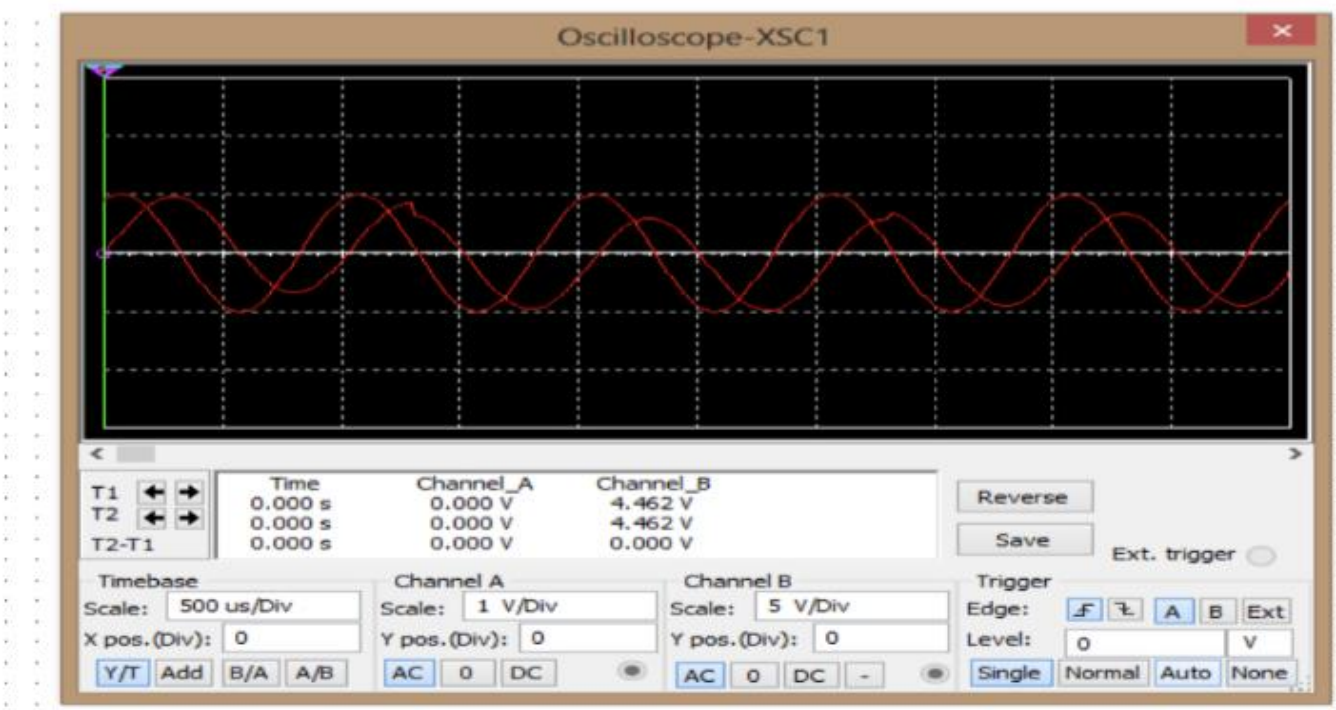
The current in the circuit is the same everywhere since the circuit is in series:

$$I(s) — \frac{F,(s)}{R + Le}$$

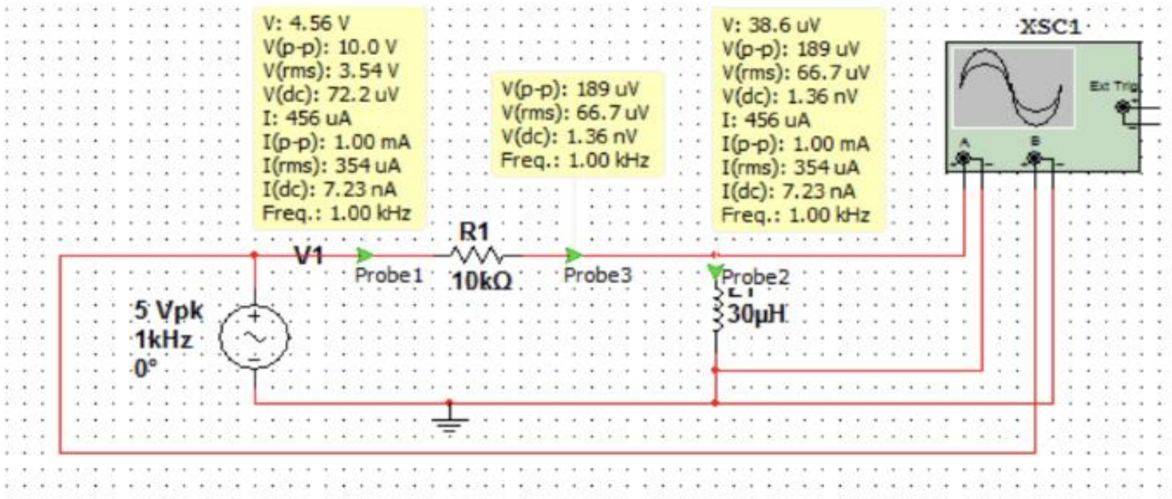
Design: RC Circuit



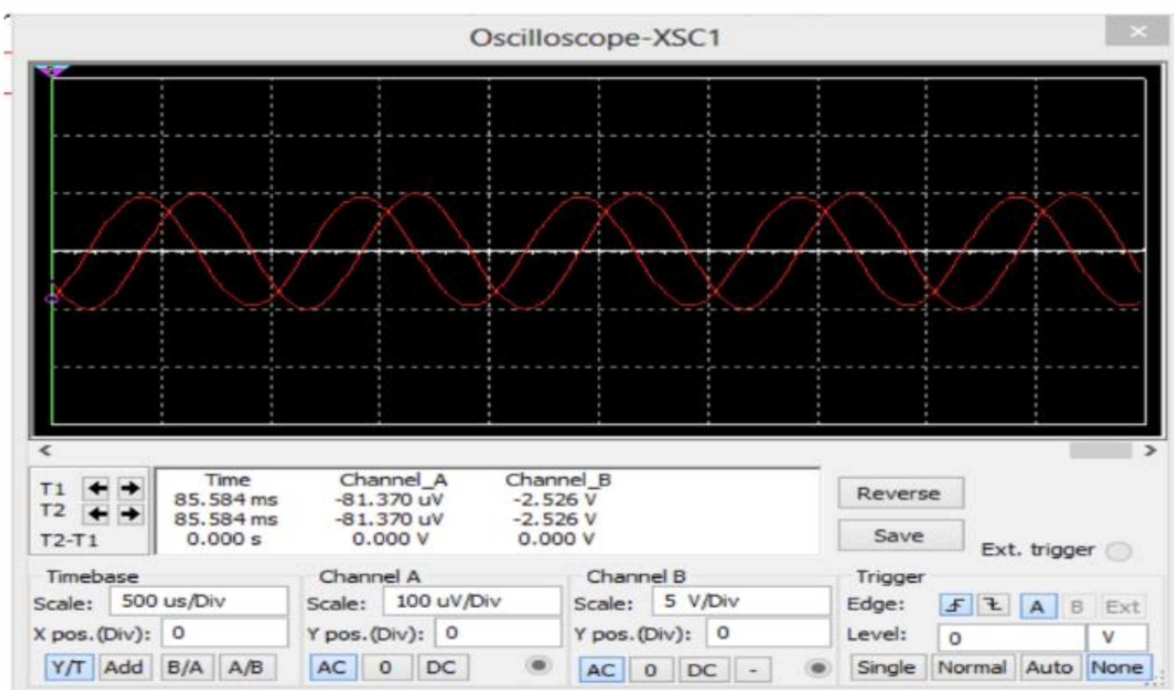
Result:-



RL Circuit:-



Result:-



CONCLUSION:

Thus, we design and simulated the series RL and RC circuit .

EXPERIMENT NO:

Design and Implementation of Series and Parallel RLC Circuit using simulation package and demonstrate its working.

AIM:

To construct a Series and Parallel RLC Circuit and to draw its performance characteristics.

APPARATUS REQUIRED:

S.No	Particulars	Type	Range	Quantity
1	Resistor			
2	Capacitor			
3	Inductor			
4	AC voltage source			
5	Voltage measurement probe			

SOFTWARE REQUIRED:

www.multisim.com

THEORY:

RLC circuit consists of three electrical components, a resistor (R), an inductor (L), and a capacitor (C), which are connected in series or parallel with each other. The circuit's name is derived from the letters used to describe the components. The order or arrangement of the RLC circuit components can vary.

SERIES RLC CIRCUIT:

A resonant circuit consists of R, L, and C elements and whose frequency response characteristic changes with changes in frequency. The behaviour of a series RLC circuit whose source voltage is a fixed frequency steady state sinusoidal supply.

Series RLC circuits that two or more sinusoidal signals can be combined using phasors providing that they have the same frequency supply.

FORMULA:

I. Inductive reactance: $X_L = 2\pi fL = □L$

II. Capacitive reactance: $X_C = \frac{1}{(2□□□)} = \frac{1}{(□□)}$

III. When $X_L > X_C$, the circuit is inductive.

IV. When $X_L < X_C$, the circuit is capacitive.

V. Total circuit reactance = $X_T = X_L – X_C$ or $X_C – X_L$

VI. Total circuit impedence = $Z=\sqrt{(□^2 + □^2)} = R + jX$

PROCEDURE:

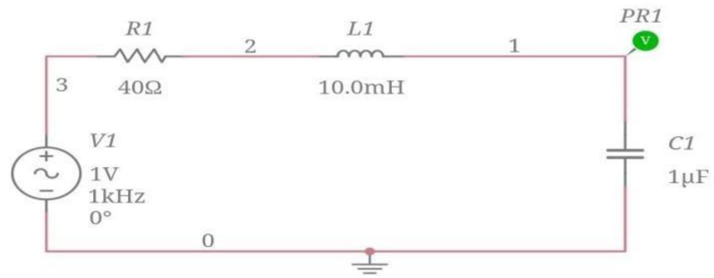
1.Give the connections as per the circuit diagram.

2.Give 40 ohm , 50Hz and 1uf input to the circuit.

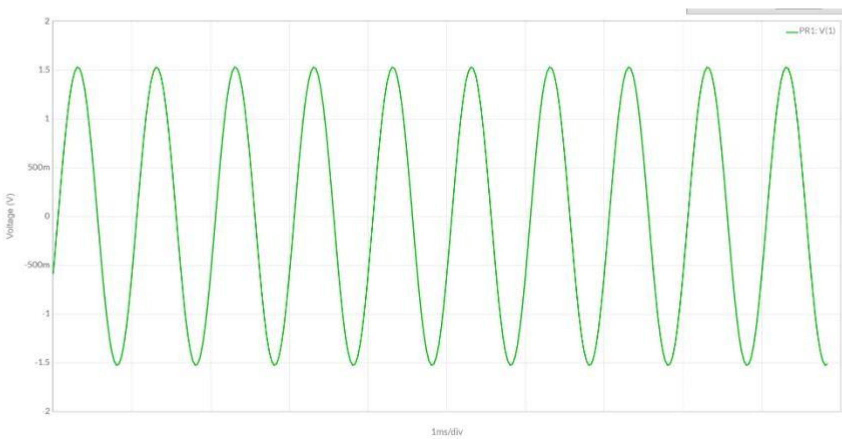
3.Measure the output across the Load and input voltage.

4.Plot its performance graph.

CIRCUIT DIAGRAM:



STIMULATING WAVEFORM:



PARALLEL RLC CIRCUIT:

The Parallel RLC Circuit is the exact opposite to the series circuit. Like series RLC circuit, parallel RLC circuit also resonates at particular frequency called resonance frequency i.e., there occurs a frequency at which inductive reactance becomes equal to capacitive reactance but unlike series RLC circuit, in parallel RLC circuit the impedance becomes maximum, and the circuit behaves like purely resistive circuit leading to unity electrical power factor of the circuit.

FORMULA:

I. Apparent power $S = VI = I^2 Z = \frac{\square^2}{\square}$

II. Active power $P = VI \cos\square = \square^2\square = \frac{\square^2\square}{\square}$

III. Reactive power $Q = VI \sin\square = \square^2\square = \frac{\square^2}{\square}$

IV. Power factor $\cos\square = \frac{\square}{\square} = \frac{\square}{\square} = \frac{\square\square}{\square}$

PROCEDURE:

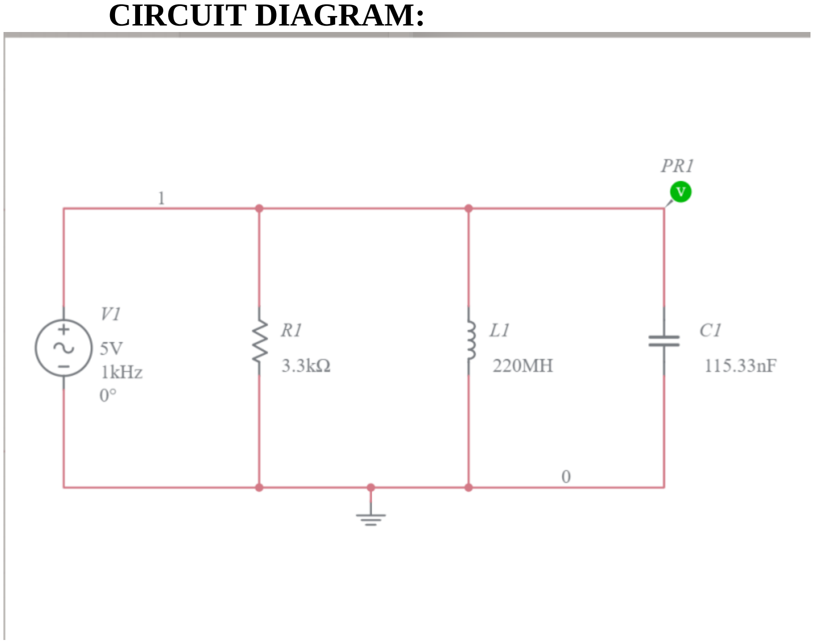
1.Give the connections as per the circuit diagram.

2.Give 3.3 ohm, 220mH and 115.33nf input to the circuit.

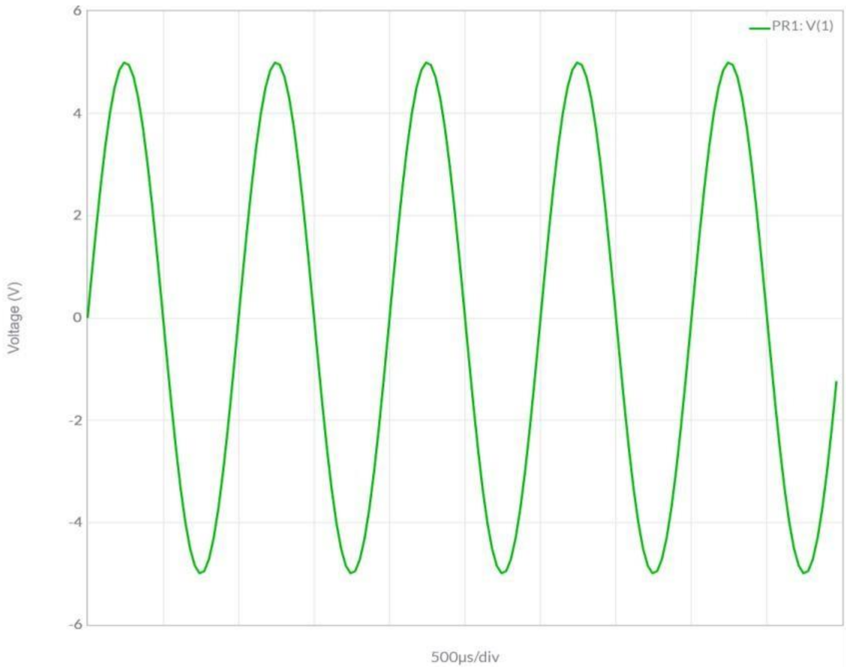
3.Measure output across the Load and input voltage.

4.Plot its performance graph.

CIRCUIT DIAGRAM:



SIMULATING WAVE FORM:



RESULT:

Thus, the performance characteristics of Series RLC Circuit and Parallel RLC Circuit were obtained.

Experiment No:

Design and Implementation of Half Wave and Full Wave Rectifiers using simulation package and demonstrate its working

Aim

To construct a Half wave and Full wave rectifier using diode and to draw itsperformancecharacteristics.

Apparatus Required:

S.No	Particulars	Type	Range	Quantity
1	Diode	1N4001		4
2	Resistor		100 to 10000Ω	As per required
3	Capacitor		470µF	1
4	AC voltage source		4V, 50Hz	1
5	Voltage Measurement probe.			2

Software Required:

https://www.multisim.com/

1)a)<u>**Half wave rectifier**</u>

Theory

The process of converting an alternating current into direct current is known as rectification. The unidirectional conduction property of semiconductor diodes (junction diodes) is used for rectification. Rectifiers are of two types: (a) Half waverectifier and (b) Full wave rectifier.

In a half-wave rectifier circuit, during thepositive half-cycle of the input, the diode is forward biased and conducts. Currentflows through the load and a voltage is developed across it. During the negative halfcycle, it is reverse bias and does not conduct. Therefore, in the negative halfcycle of the supply, no current flows in the load resistor as no voltage appears across it. Thus the dc voltage across the load is sinusoidal for the first half cycle only and a pure a.c. input signal is converted into a unidirectional pulsating outputsignal.

Another type of circuit that produces the same output as a full-wave rectifieris that of the Bridge Rectifier. This type of single-phase rectifier uses 4 individualrectifying diodes connected in a "bridged" configuration to produce the desiredoutput but does not require a special center tapped transformer, thereby reducing its size and cost. The single secondary winding is connected to one side of the diode bridge network and the load to the other side. The 4 diodes labeled D arranged in "series pairs" with only two diodes conducting current during each half cycle. During the positive half cycle of the supply, diodes D1 and D2 conduct in se D3 and D4 are reverse biased and the current flows through the load as shown below. During the negative half cycle of the supply, diodes D3 and D4 conduct in series, but diodes D1 and D2 switch of as they are now reverse biased. The current flowing through the load is the same direction as before.

Formula:

Half wave rectifier without filter:

I. $V_{rms} = \frac{V_m}{2}$; V_m = Peak voltage magnitude

II. $V_{dc} = \frac{V_m}{\pi}$

III. Ripple factor = $\sqrt{\left(\frac{V_{rms}}{V_{dc}}\right)^2 - 1}$

IV. % Efficiency = $\left(\frac{V_{dc}}{V_{rms}}\right)^2 \times 100\%$

Half wave rectifier with filter:

I. $V_{rms} = \frac{V_{rpp}}{(\sqrt{3} \times 2)}$; V_{rpp} = Peak to peak voltage magnitude

II. $V_{dc} = V_m - \frac{V_{rpp}}{2}$

III. Ripple factor = $\frac{V_{rms}}{V_{dc}}$

Procedure:

Without Filter

I. Give the connections as per the circuit diagram.
II. Give 6 V, 50Hz Input to the circuit.
III. Measure the rectifier output across the Load and input voltage.
IV. Plot its performance graph.

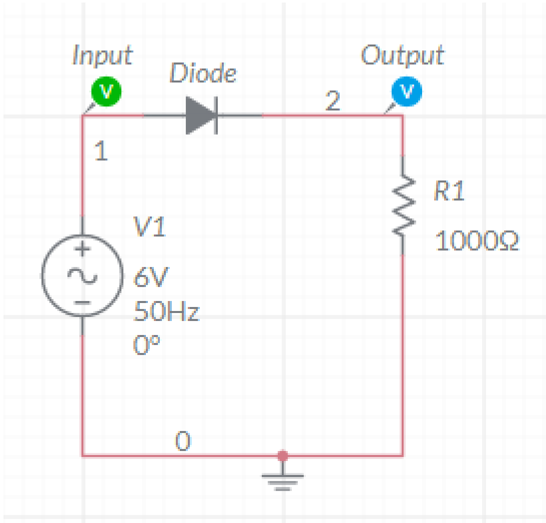
With Filter

I. Give the connections as per the circuit diagram.
II. Give 6 V, 50Hz Input to the circuit.
III. Connect the Capacitor across the load.

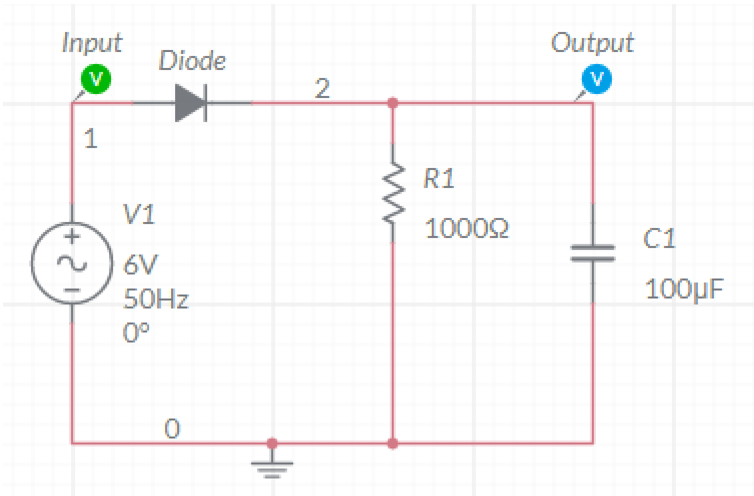
IV. Measure the rectifier output across the different load and input voltage

V. Plot its performance graph.

Circuit Diagram:

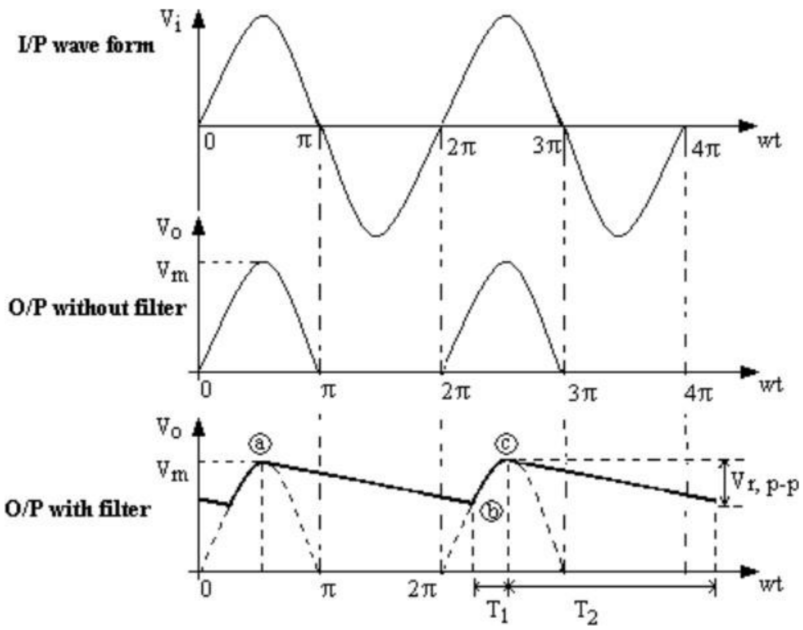


Half wave Rectifier – Without filter

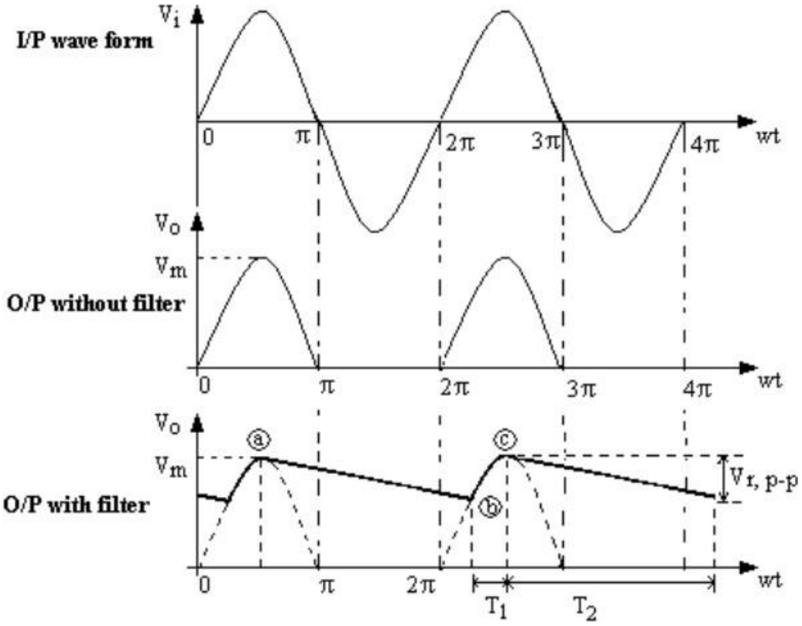


Half wave Rectifier – With filter

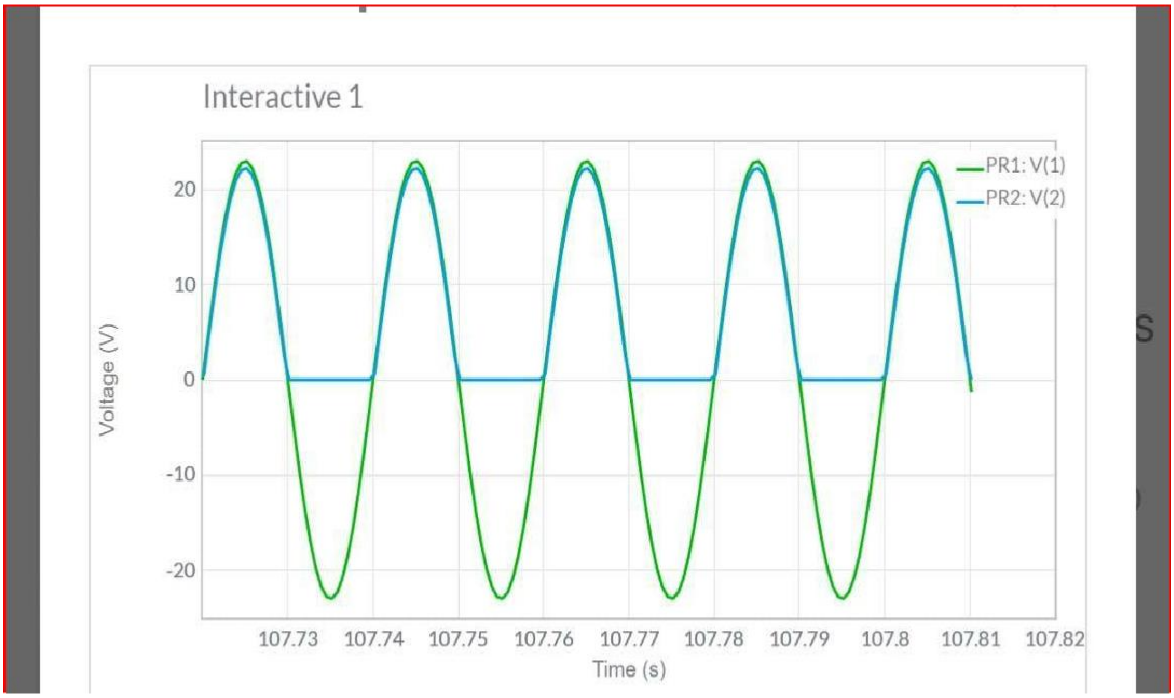
Model graph for half wave rectifier



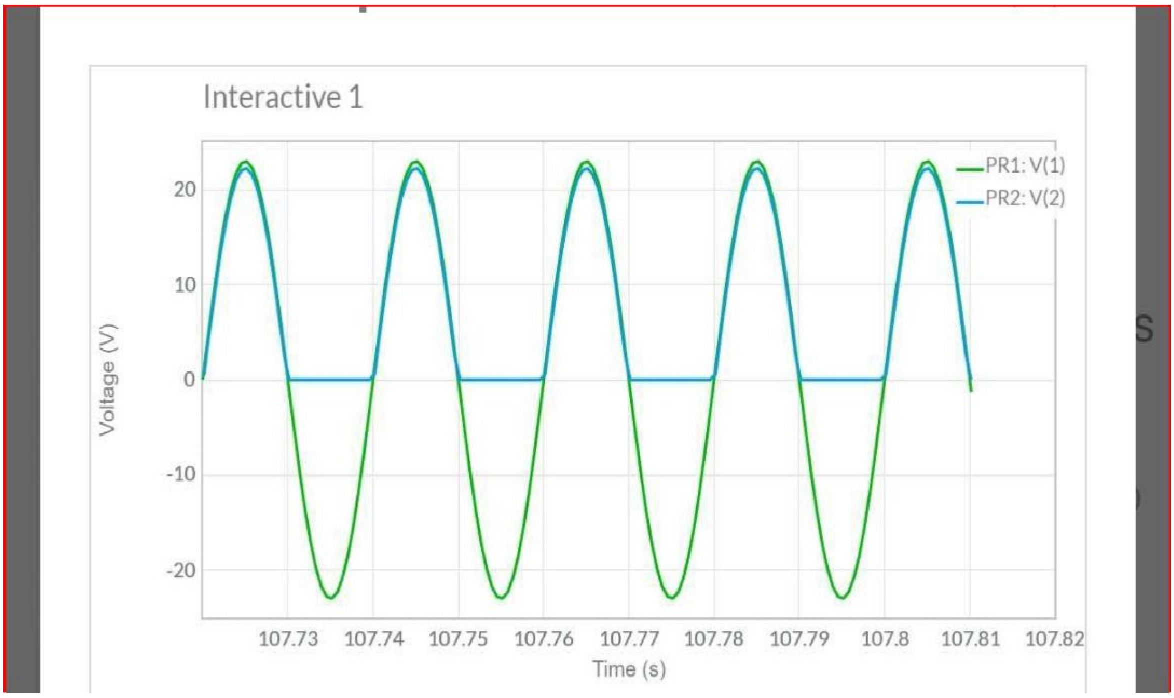
Model graph for half wave rectifier



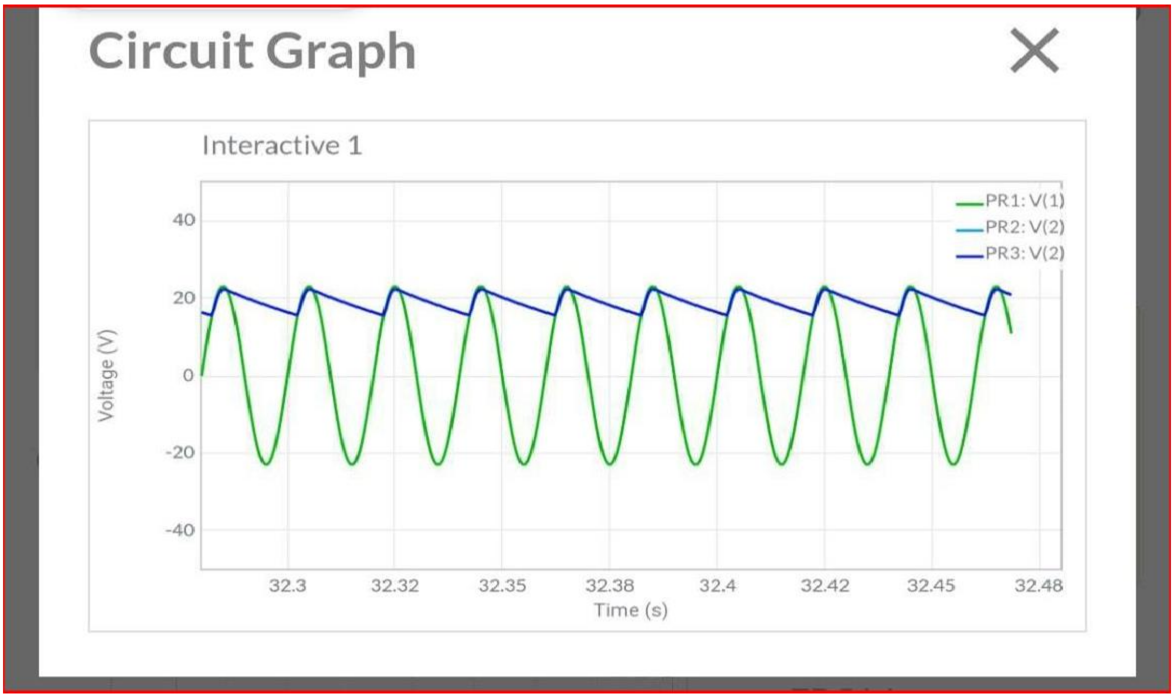
Simulation waveform for without filter:



Simulation waveform for without filter:



Simulation waveform for with filter:

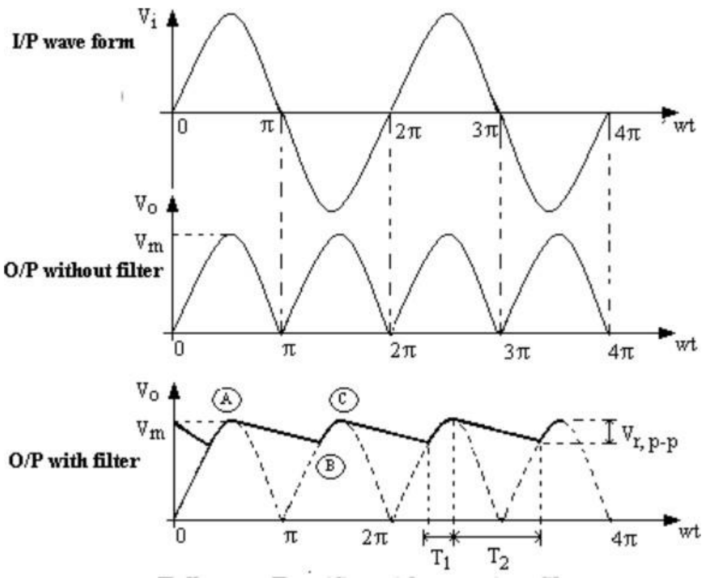


Full wave rectifier

Theory

Another type of circuit that produces the same output as a full-wave rectifier is that of the Bridge Rectifier. This type of single-phase rectifier uses 4 individualrectifying diodes connected in a "bridged" configuration to produce the desiredoutput but does not require a special center tapped transformer, thereby reducing its size and cost. The single secondary winding is connected to one side of the diode bridge network and the load to the other side. The 4 diodes labeled D arranged in "series pairs" with only two diodes conducting current during each half cycle. During the positive half cycle of the supply, diodes D1 and D2 conduct in se D3 and D4 are reverse biased and the current flows through the load as shown below . During the negative half cycle of the supply, diodes D3 and D4 conduct in series, but diodes D1 and D2 switch of as they are now reverse biased. The current flowing through the load is the same direction as before.

Model Graph:



FORMULA:

Full wave rectifier without filter:

I. $V_{rms} = \frac{V_m}{\sqrt{2}}$; V_m = Peak voltage magnitude

II. $V_{dc} = \frac{2V_m}{\pi}$

III. Ripple factor = $\sqrt{\left(\frac{V_{rms}}{V_{dc}}\right)^2 - 1}$

IV. % Efficiency = $\left(\frac{V_{dc}}{V_{rms}}\right)^2 \times 100\%$

Full wave rectifier with filter:

I. $\square_{\square\square\square} = \frac{\square_{\square\square\square}}{(\sqrt{3}\times 2)}$; V_{rpp} = Peak to peak voltage magnitude

II. $\square_{\square\square} = \square_{\square} - \square_{\square\square\square}$

III. Ripple factor $= \frac{\square\square\square\square}{\square_{\square\square}}$

Procedure:

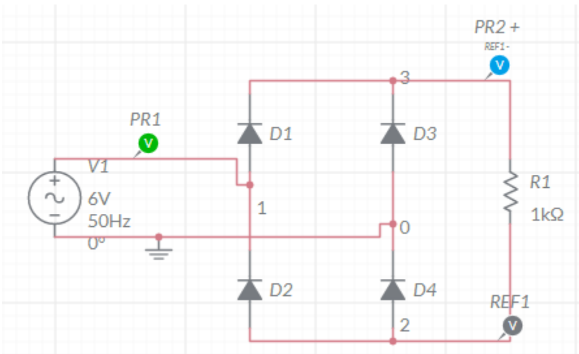
Without Filter

I. Give the connections as per the circuit diagram.
II. Give 6 V, 50Hz Input to the circuit.
III. Measure the rectifier output across the Load and input voltage.
IV. Plot its performance graph.

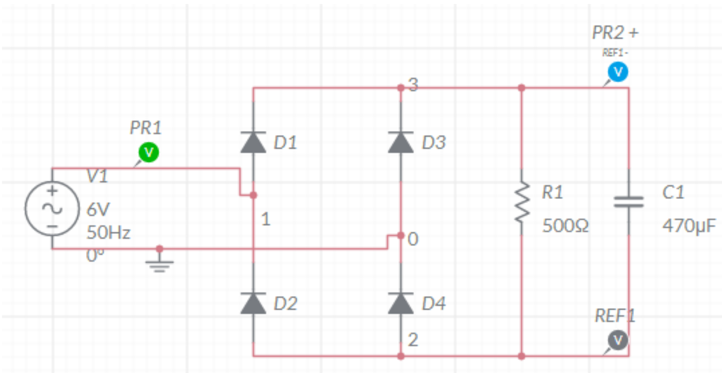
With Filter

I. Give the connections as per the circuit diagram.
II. Give 6 V, 50Hz Input to the circuit.
III. Connect the Capacitor across the load.
IV. Measure the rectifier output across the different Load and input voltage.
V. Plot its performance graph.

Circuit Diagram:

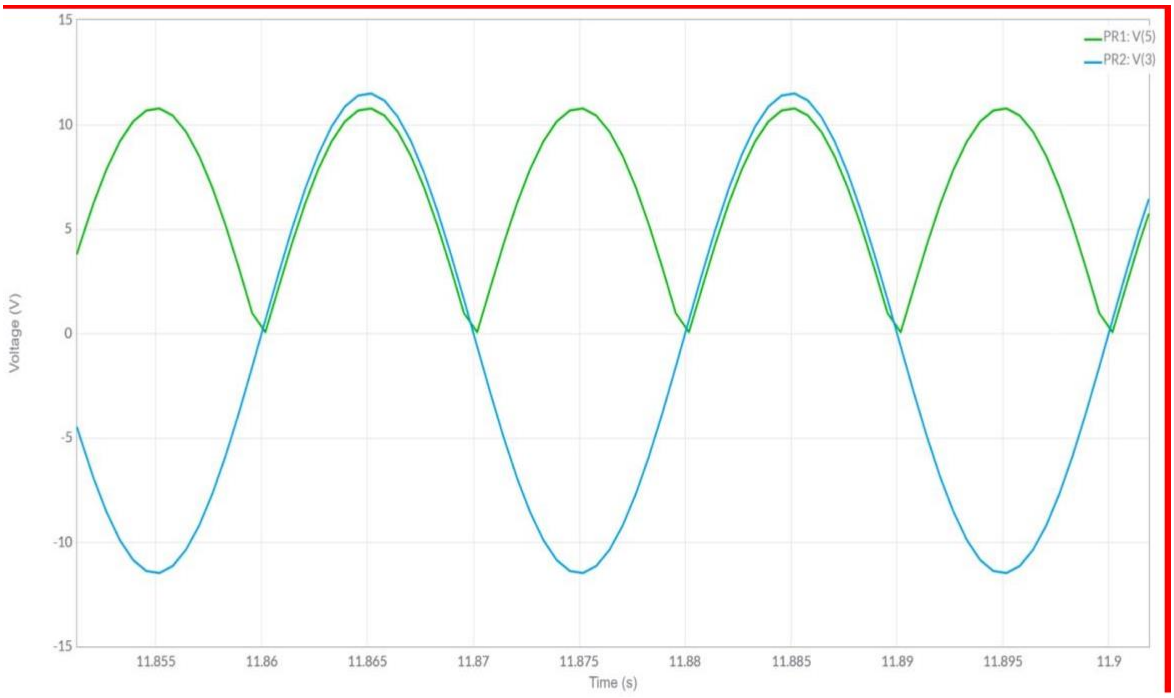


Full wave Rectifier – Without filter

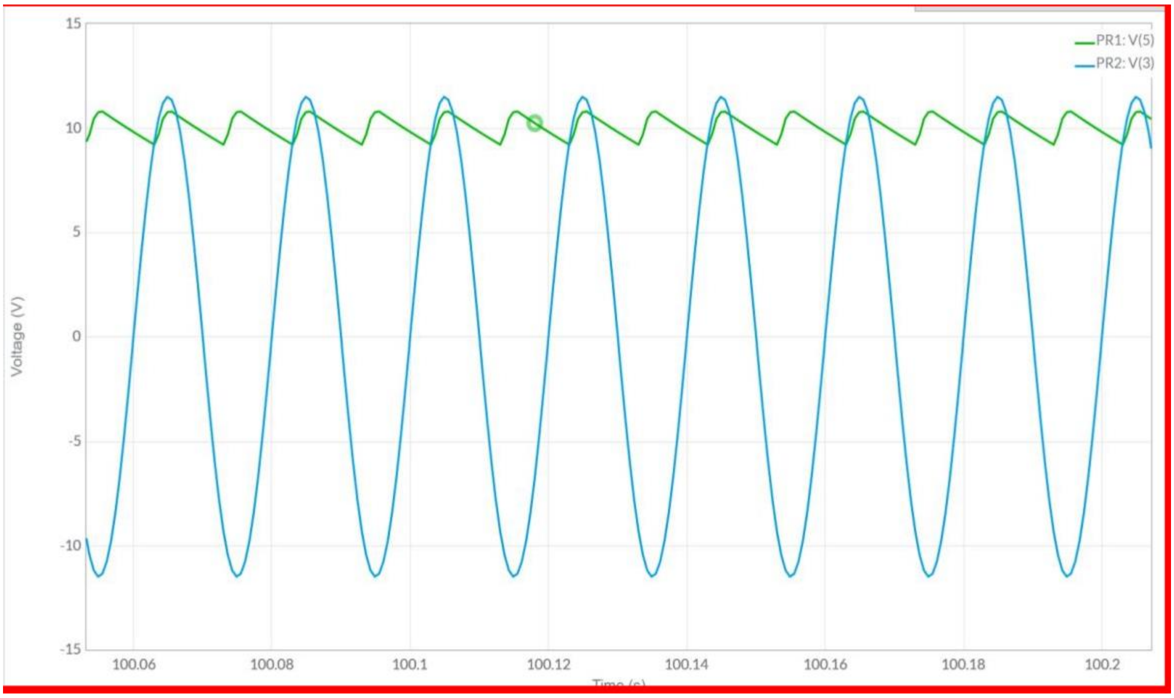


Full wave Rectifier – With filter

Simulation waveform for without filter:



Simulation waveform for with filter:



Result:

Thus, the performance characteristics of single phase Half wave and Full wave rectifier were obtained.

EXPERIMENT NO :

DESIGN AND IMPLEMENTATION OF CLIPPER AND CLAMPER CIRCUIT USING SIMULATION PACKAGE AND DEMONSTRATE ITS WORKING

AIM :

To construct a clipper and clamper circuit using simulation package and draw its performance characteristics.

APPARATUS REQUIRED :

CIRCUIT TYPE	APPARATUS REQUIRED	TYPE	RANGE	QUANTITY
CLIPPER	DIODE	1N4148	NA	DEPENDS ON THE CIRCUIT DESIGN
	RESISTOR	NA	DEPENDS ON THE CIRCUIT DESIGN	DEPENDS ON THE CIRCUIT DESIGN
	POWER SUPPLY	DC POWER SUPPLY	DEPENDS ON THE CIRCUIT DESIGN	1
CLAMPER	CAPACITOR	ELECTROLYTIC OR CERAMIC	DEPENDS ON THE CIRCUIT DESIGN	DEPENDS ON THE CIRCUIT DESIGN
	DIODE	1N4148 OR SIMILAR	NA	DEPENDS ON THE CIRCUIT DESIGN
	RESISTOR	NA	DEPENDS ON THE CIRCUIT DESIGN	DEPENDS ON THE CIRCUIT DESIGN
	POWER SUPPLY	DC POWER SUPPLY	DEPENDS ON THE CIRCUIT DESIGN	1

SOFTWARE REQUIRED :

https://www.multisim.com

A) CLIPPER CIRCUIT:

THEORY:

A clipper circuit is an electronic circuit that is used to clip or limit the amplitude of a signal. It works by selectively conducting or blocking portions of the input signal. The two common types of clipper circuits are the positive clipper and the negative clipper.

In a positive clipper circuit, the portion of the input signal that is above a certain voltage threshold is clipped or removed, while the portion of the signal below the threshold is allowed to pass through unaltered. This is achieved by using a diode that conducts only in the forward direction.

In a negative clipper circuit, the portion of the input signal that is below a certain voltage threshold is clipped or removed, while the portion of the signal above the threshold is allowed to pass through unaltered. This is achieved by using a diode that conducts only in the reverse direction.

Clipper circuits are used in various applications such as in audio circuits, where they are used to prevent distortion and in communication circuits, where they are used to limit the amplitude of the signal to prevent overloading of the receiving circuit.

FORMULA :

CLIPPER POSITIVE CIRCUIT FORMULA :

V_out = V_clip (if V_in > V_clip)

V_out = V_in (if V_in <= V_clip)

where V_out is the output voltage of the clipper circuit.

CLIPPER NEGATIVE CIRCUIT FORMULA :

V_out = V_clip (if V_in < V_clip)

V_out = V_in (if V_in >= V_clip)

where V_out is the output voltage of the clipper circuit.

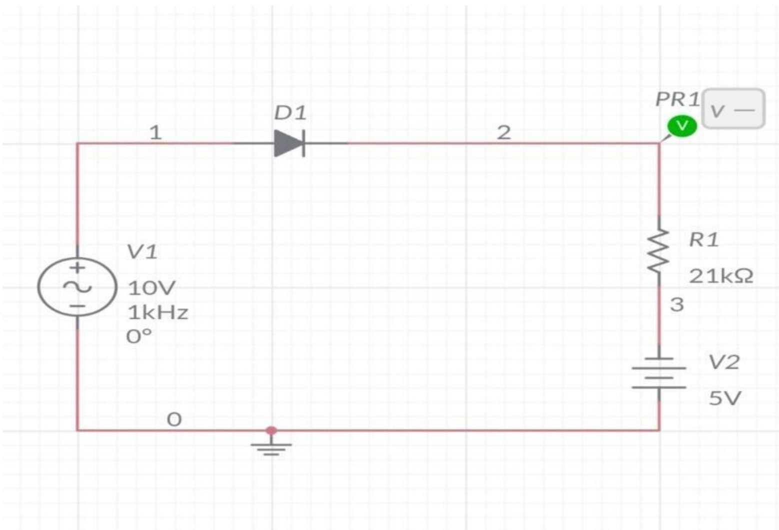
PROCEDURE :

- **Choose the clipping voltage level.**
- **Select a diode with a breakdown voltage greater than the clipping voltage level.**
- **Choose a resistor value that limits the current through the diode to a safe value.**
- **Draw the circuit diagram of the positive clipper circuit.**

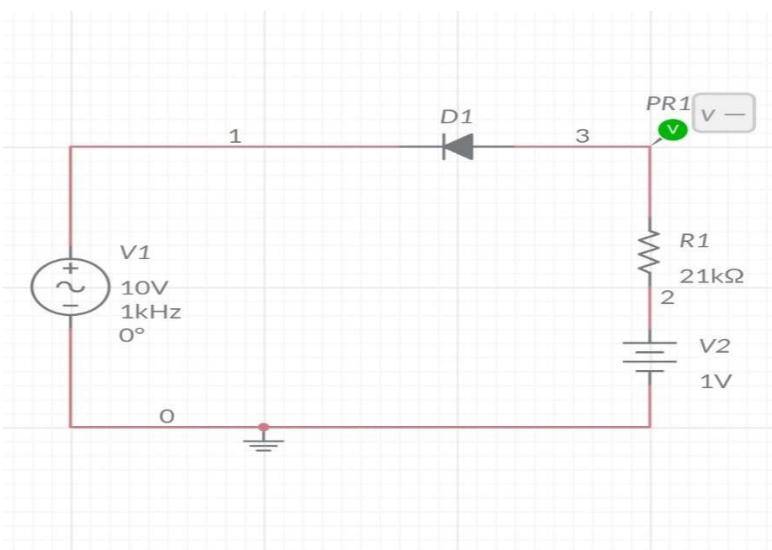
- **Analyze the circuit and determine the output voltage for different input voltage levels.**
- **Build the circuit and test it using a signal generator and an oscilloscope.**
- **Fine-tune the resistor value if necessary to achieve the desired clipping level.**
- **Verify that the circuit clips the input signal at the desired voltage level and that the output waveform is free from distortion.**

CIRCUIT DIAGRAM :

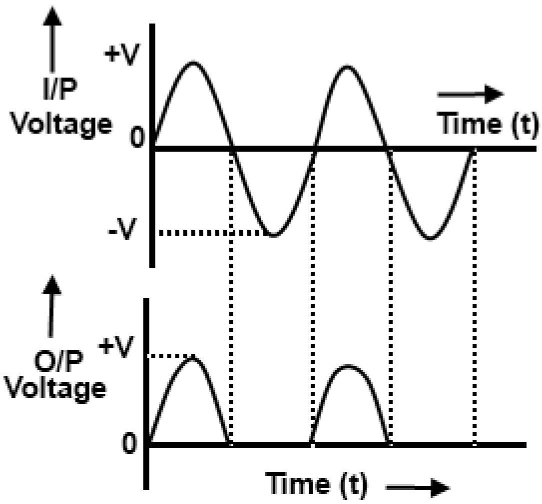
POSITIVE CLIPPER DIAGRAM :



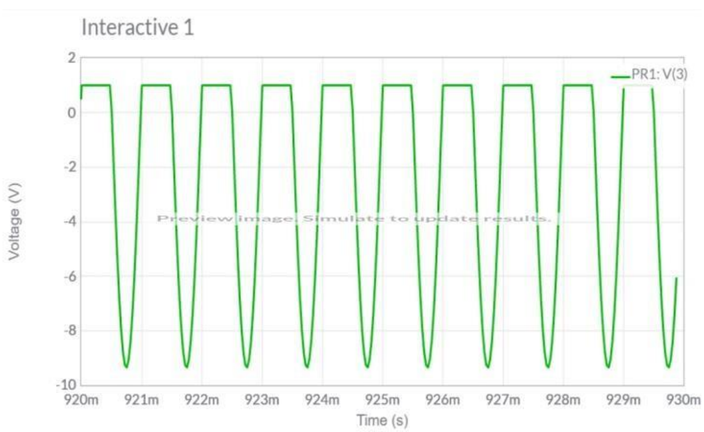
NEGATIVE CLIPPER DIAGRAM :



MODEL GRAPH FOR SIMULATION :



SIMULATION WAVEFORM FOR CLIPPER POSITIVE CIRCUIT :



SIMULATION WAVEFORM FOR CLIPPER NEGATIVE CIRCUIT :

B) CLAMPER CIRCUIT :

THEORY :

A clamper circuit is an electronic circuit that shifts the DC level of an input signal to a desired level. It works by adding a DC voltage level, also known as a DC bias, to the input signal. The resulting output waveform has the same shape as the input waveform, but is shifted up or down in voltage.

The two common types of clamper circuits are the positive clamper and the negative clamper. In a positive clamper circuit, the DC level is added to the input waveform such that the output waveform is shifted upwards. In a negative clamper circuit, the DC level is added to the input waveform such that the output waveform is shifted downwards.

Clamper circuits are used in various applications such as in video circuits, where they are used to shift the black level of the video signal, and in audio circuits, where they are used to bias the input signal to the correct operating point.

FORMULA :

CLAMPER POSITIVE CIRCUIT FORMULA :

$V_{out} = V_{in} + V_{c}$ (if $V_{in} < V_{DC}$)

$V_{out} = V_{in}$ (if $V_{in} \geq V_{DC}$)

where V_{out} is the output voltage of the clamper circuit, V_{DC} is the desired DC level, and V_{c} is the voltage across the capacitor.

CLAMPER NEGATIVE CIRCUIT FORMULA :

$V_{out} = V_{in} - V_{c}$ (if $V_{in} > V_{DC}$)
$V_{out} = V_{in}$ (if $V_{in} \leq V_{DC}$)

where V_{out} is the output voltage of the clamper circuit, V_{DC} is the desired DC level, and V_{c} is the voltage across the capacitor.

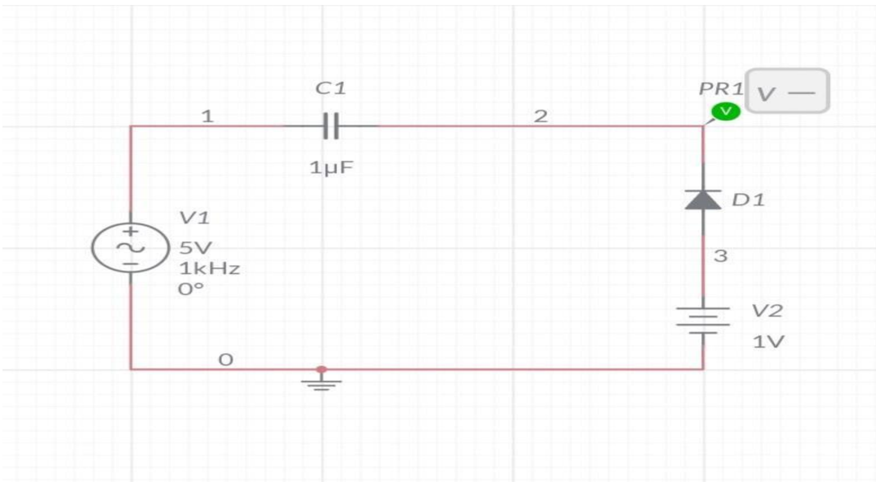
PROCEDURE :

- Gather the required components: a capacitor, a diode, a resistor, a voltage source (such as a battery), and a signal source (such as a function generator)
- Connect the diode to the capacitor in series, with the anode of the diode connected to the positive terminal of the capacitor.
- Connect the signal source to the other end of the capacitor.
- Connect the resistor in parallel with the capacitor, with one end of the resistor connected to the negative terminal of the capacitor.

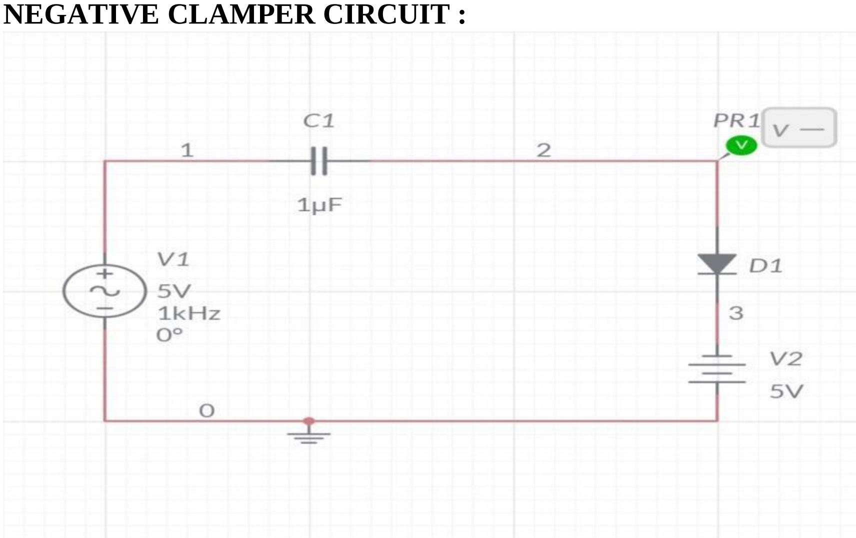
- Connect the voltage source in series with the diode, with the positive terminal of the voltage source connected to the anode of the diode.
- Connect the output terminal of the circuit to the junction between the diode and the capacitor.
- Turn on the voltage source and apply the input signal to the circuit.
- Observe the output waveform, which should be shifted upwards from the input signal by the voltage of the voltage source.

CIRCUIT DIAGRAM :

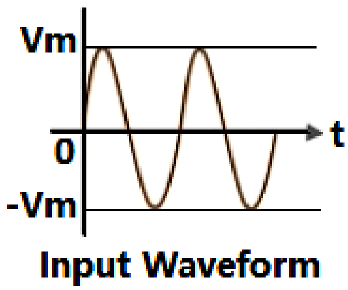
POSITIVE CLAMPER CIRCUIT :

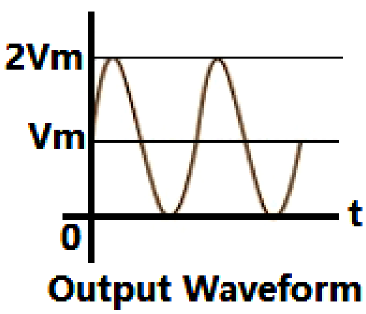


NEGATIVE CLAMPER CIRCUIT :

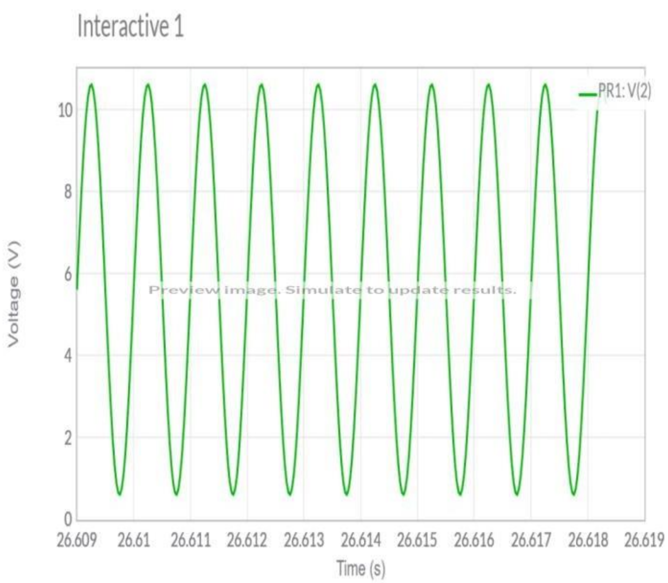


MODEL GRAPH FOR SIMULATION :

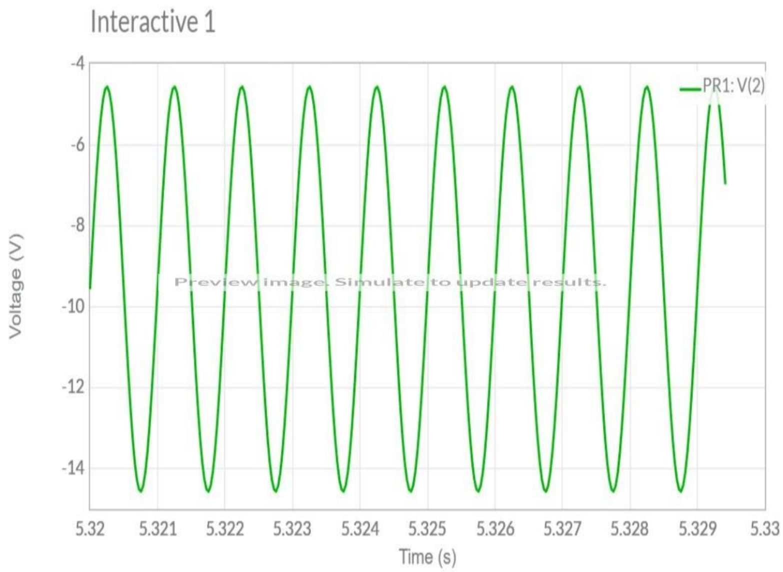




SIMULATION WAVEFORM FOR POSITIVE CLAMPER CIRCUIT :



SIMULATION WAVEFOR, FOR NEGATIVE CLAMPER CIRCUIT :



RESULT :

Thus the performance characteristics of clipper and clamper circuit were obtained here.

Experiment no:

PCB Layout design of RL,RC,and RLC circuit.

Aim:

- To design and analyse RL,RC AND RLC Circuit.
- PCB Layout design.

Software required:

https://easyeda.com

Introduction

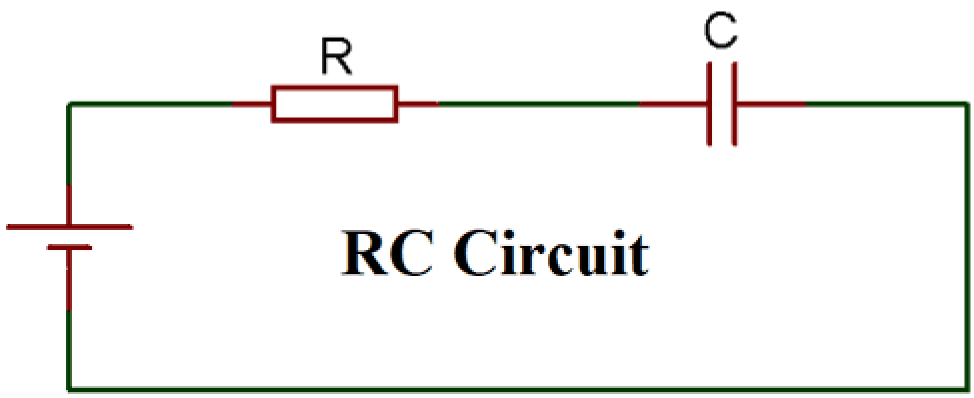
Theory:

The whole of electronics components can be slip into two broad categories, one being the Active components and the other as Passive components. The Passive components include the Resistor (R), Capacitor (C) and the Inductor (L). These arethe three most used components in electronics circuit and you will find them in almost every application circuit. These three components together in different combinations will form the **RC, RL and RLC circuits** and they have many applications like from filtering circuits, Tube light chokes, multivibrators etc..

- **Resistor:** Resistors are denoted by the letter "R". A resistor is an elementthat dissipates energy mostly in form of heat. It will have a Voltage drop across it which remains fixed for a fixed value of current flowing throughit.
- **Capacitor:** Capacitors are denoted by the letter "C". A capacitor is an elementwhich stores energy (temporarily) in form of electric field. Capacitor resistschanges in voltage. There are many types of capacitors, out of which the ceramic capacitor and the electrolytic capacitors are mostly used. They charge in one direction and discharge in opposite direction
- **Inductor:** Inductors are denoted by the letter "L". A Inductor is also similar to capacitor, it also stores energy but is stored in form of magnetic field. Inductors resist changes current. Inductors are normally a coil wound wire and is rarely used compared to the former two components.

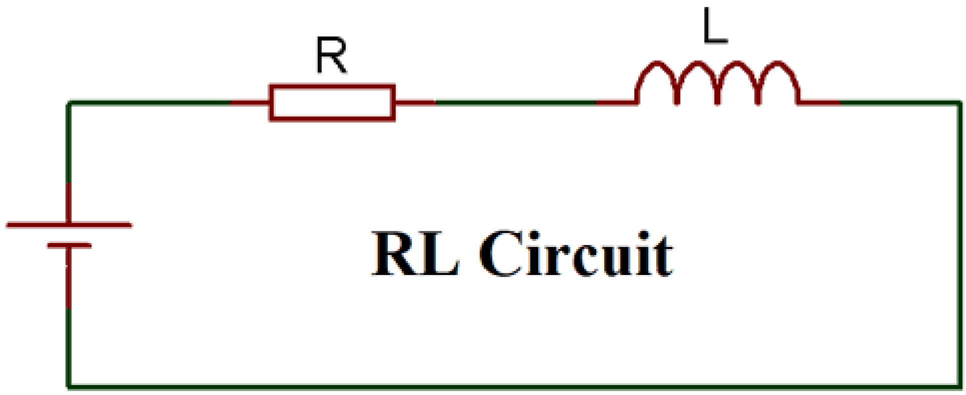
RC circuit:

- The **RC circuit** (**Resistor Capacitor Circuit**) will consist of a Capacitor and aResistor connected either in series or parallel to a voltage or current source.
- Thesetypes of circuits arealso calledas **RC filters** or **RC networks** sincetheyaremost commonly used in filtering applications.
- An RC circuit can be used to make some crude filters like low-pass, high-passand Band-Pass filters.
- A **first order RC circuit** will consist of only one Resistor and one Capacitor .



RL Circuit:

- The **RL Circuit** (**Resistor Inductor Circuit**) will consist of an Inductor and aResistor again connected either in series or parallel.
- A series RL circuit will be driven by voltage source and a **parallel RL circuit** will be driven by a current source.
- RL circuit are commonly used in as passive filters, a **first order RL circuit** withonly one inductor and one capacitor is shown below

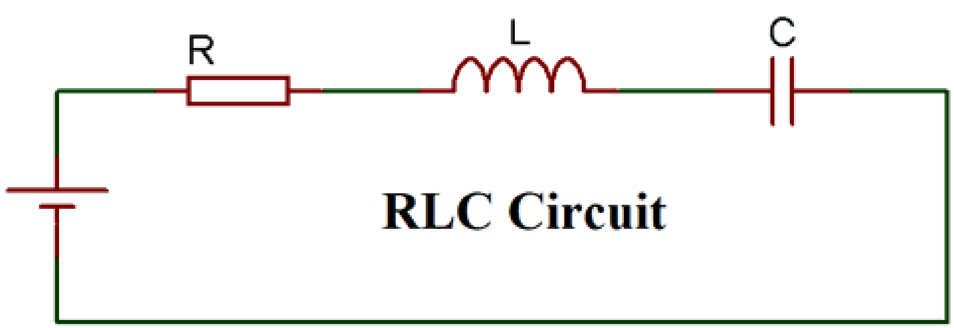


- Similarly in a **RL circuit** we have to replace the Capacitor with an Inductor.

The Light bulb is assumed to act as a pure resistive load and the resistance of thebulb is set to a known value of 100 ohms.

RLC Circuit:

- A **RLC circuit** as the name implies will consist of a Resistor, Capacitor andInductor connected in **series or parallel**.
- The circuit forms an **Oscillator circuit** which is very commonly used in Radioreceivers and televisions.
- It is also very commonly used as damper circuits in analog applications. Theresonance property of a **first order RLC circuit** is discussed below



- The **RLC circuit** is also called as series resonance circuit, oscillating circuit or a tuned circuit. These circuit has the ability to provide a resonant frequency signal.
- RLC circuit analysis forms the language used to build and understand circuit models for linear time-invariant (LTI) systems with reactiveimpedance.
- Building a circuit model for a complex electrical system takes some experience and foresight, where real circuit elements and parasitics are combined to form an equivalent RLC network.

FORMULAS:

Equation for RC Circuit:

$$\mathbf{Qdq=-\int CR1\ dt}$$

- RC circuit equations describe the relationship between the voltage, current, andcharge of a capacitor and a resistor in a series circuit.
- The differential equation of RC circuit is **qdq=−∫CR1 dt**.
- The transient response time of a RC circuit is measured by $\tau = R \times C$, in seconds. The capacitor charges up through the resistor until it reaches the supply voltageof the battery.

Equation for RL Circuit:

$$\mathbf{V = I \times R + VL = L\ (di/dt)}$$

- The voltage drop across inductor and resistor is given by ,

$$VR = I \times R\ ,$$

$$VL = L\ (di/dt)$$

So, the RL circuit formula is given by **V = I × R + VL= L (di/dt).**

Equation for an RLC circuit:

Formula for the resonant frequency of the RLC circuit:

$$\mathbf{f = 1\ /\ [2\pi * \sqrt{(L * C)}]}$$

where:

- f is the resonant frequency.
- L is the impedance of the inductor.
- C is the capacitance of the capacitor.

Calculating Q Factor of the RLC circuit:

The Q factor or quality factor shows the quality of the RLC circuit. While designinga RLC circuit, one should aim to achieve the higher Q-factor. Below is the formulafor the Q-factor of a RLC circuit:

$$Q = 1/R * \sqrt{(L/C)}$$

where:

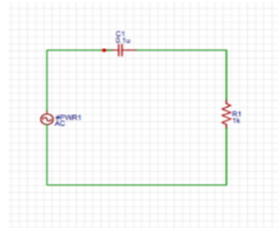
- Q is the Q-factor
- R is the resistance.

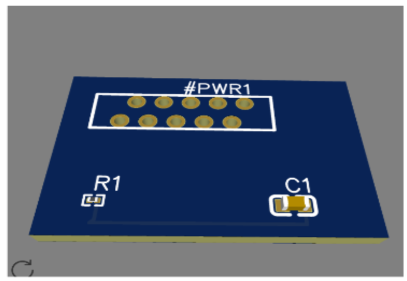
Applications:

The Resistors, Inductors and Capacitors maybenormal andsimplecomponents but when they are combined to gather to form circuits like RC/RL and RLC exhibit complex behavior which makes it suitable for a wide range of application.Few of them are listed below

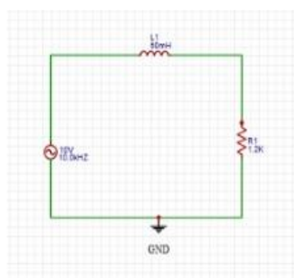
- Communication systems
- Signal Processing
- Voltage/Current magnification
- Radio wave transmitters
- RF amplifiers
- Resonant LC circuit
- Variable tunes circuits
- Oscillator circuits
- Filtering circuit

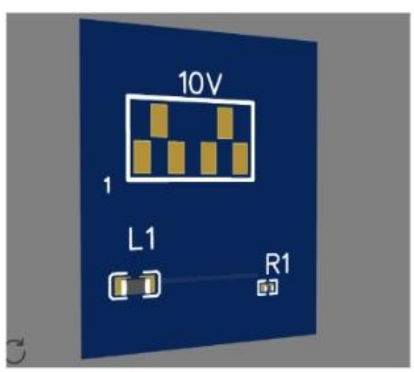
RL CIRCUIT SCHEMATIC TO PCB DESIGN :



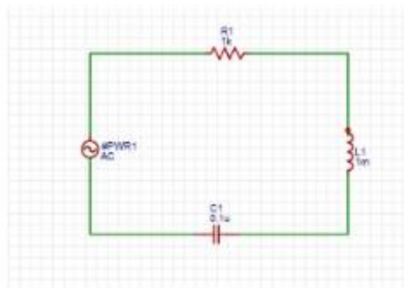


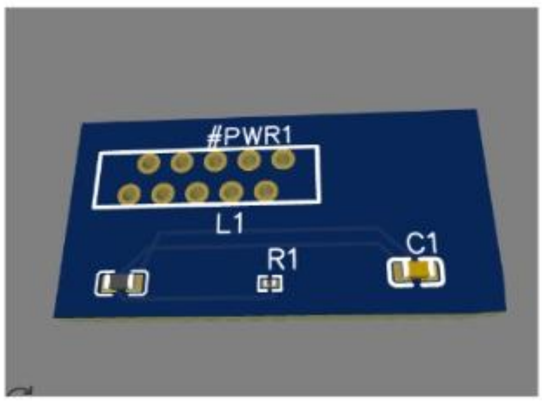
RC CIRCUIT SCHEMATIC TO PCB DESIGN :





RLC CIRCUIT SCHEMATIC TO PCB DESIGN :





RESULT :

Thus,the PCB layout design of half wave and full wave rectifier were obtained.

EXPERIMENT NO -

DESIGN OF SINGLE DIGIT PULSE COUNTER

AIM:

- To Design and analyse single digit pulse counter.
- PCB Layout Design - Design of single digit pulse counter

SOFTWARE REQUIRED:

https://easyeda.com

COMPONENT USED:

Capacitor	470 µ Farad
Resistor	10K and 100k ohm
555 timer IC	NE555
7 segments display	Current consumption:30 mA
400 series IC	4017

INTRODUCTION:

• Digital counters are needed everywhere in this digital world, and 7 segment display is one the best component to display the numbers.

• Counters are needed in object/products counters, digital stopwatches, calculators, timers etc.

• To use the 7 segments with ease, there is a 7 segments driver IC which is IC CD4026, so we are building 7 segment counter circuit using 4026

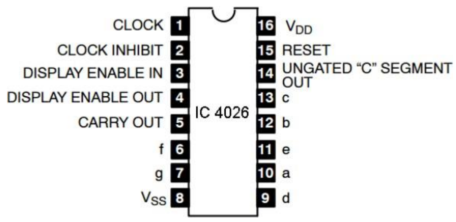
• 4026 IC is a 4000 series IC.

• It is a CMOS seven-segment counter IC and can be operated at very low power.

• It is a decade counter, counts in decimal digits (0-9).

• It is used to display numbers on seven segment displays and it increment the number by one, when a clock pulse is applied to its PIN 1.

• Means more the clock pulse rate, faster the numbers change in 7 segment Display



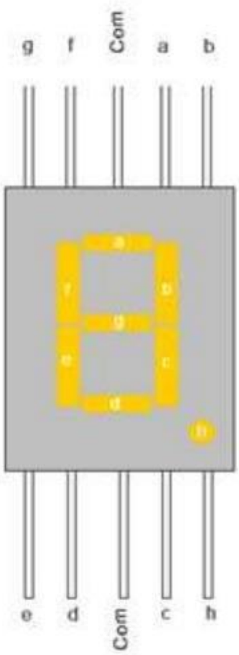
It consists 8 LEDs, each LED used to illuminate one segment/line of the unit and the 8thLED used to illuminate DOT in 7 segment display.

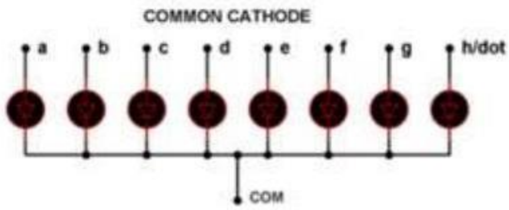
• We can refer each line/segment "a, b, c, d, e, f, g" and for dot character we will use "h".

• There are 10 pins, in which 8 pins are used to refer a, b, c, d, e, f, g and h/dp, the two middle pins are common anode/cathode of all he LEDs.

• IC 4026 is used to drive common cathode 7 segment display.

• In common cathode 7 segment display cathodes of all the LEDs are connected together, and all the positive terminals are left alone.





• It consists 8 LEDs, each LED used to illuminate one segment/line of the unit and the 8thLED used to illuminate DOT in 7 segment display.

• We can refer each line/segment "a, b, c, d, e, f, g" and for dot character we will use "h".

• There are 10 pins, in which 8 pins are used to refer a, b, c, d, e, f, g and h/dp, the two middle pins are common anode/cathode of all he LEDs.

• IC 4026 is used to drive common cathode 7 segment display.

• In common cathode 7 segment display cathodes of all the LEDs are connected together, and all the positive terminals are left alone.

LAB WORK:

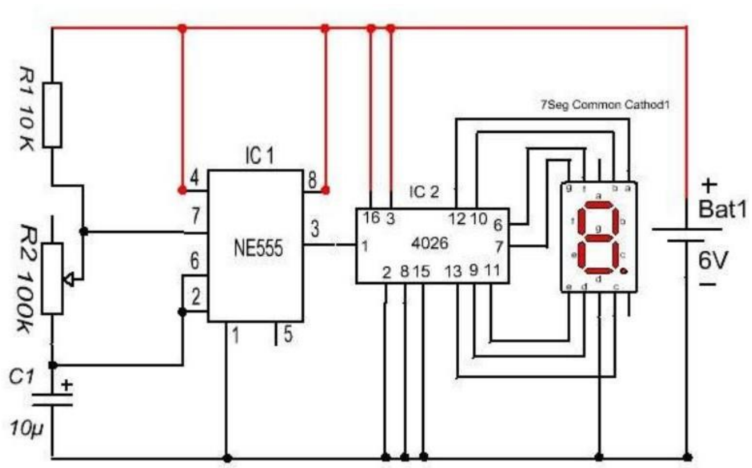
• Circuit is quite easy and self-explanatory, we have interfaced the 7 segments to the 4026 IC, PIN 4,5,14 is left open as we haven't used them, PIN 15 used to Reset the counter with the help of a PUSH button Switch.

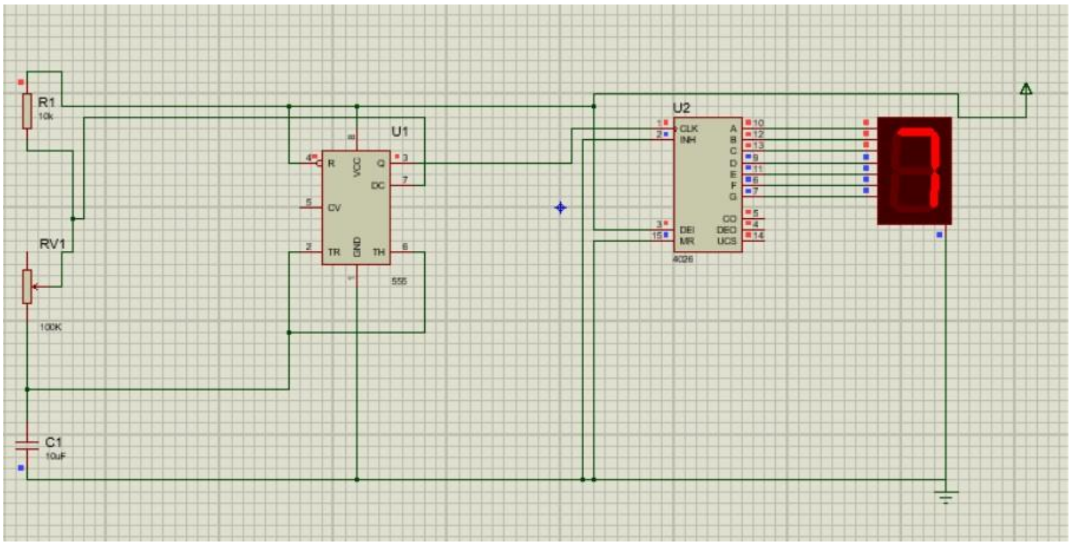
• PIN 2 is kept LOW to avoiding the freezing and PIN 13 is kept HIGH to enable the IC.

• Now, another main component of this circuit, other than IC4026, is 555 timer IC.

• 555 timer is used here to provide the clock pulse on each Button Press, whenever we press the button the counter advance by one.

• 555 Timer IC is used here in Monostable mode.





OBSERVATION:

1. Calculate the timing with the values of resistor and capacitor.

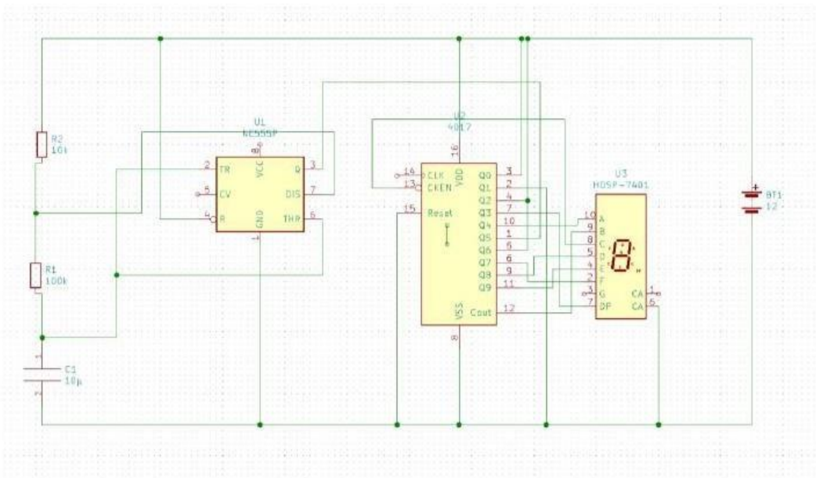
T= 1.1 * R * C

T= 1.1*(100k + 10k) * 10µ

T= 1.1*(110000) * 10µ

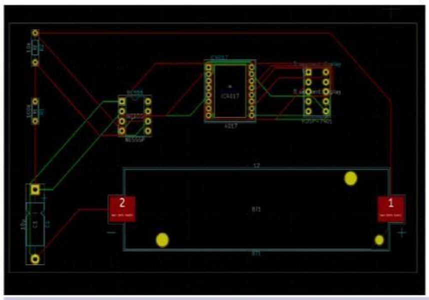
T = 1.21 second

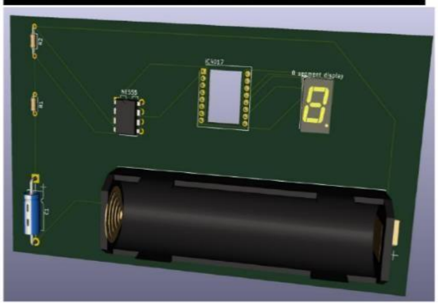
2. Obtain the schematic and PCB layout of single digit pulse counter



T = 1.1 * R * C, where T is the time period in seconds and R, C are the values of timing resistor and capacitor used.

RESULT:





Experiment no:

PCB Layout design of Half wave and full wave rectifier.

Aim:

- To design and analyze Half and full wave rectifier
- PCB Layout design.

Software required:

https://easyeda.com

Apparatus Required:

s.no	particulars	type	range	quantity
1	Diode	IN4001		
2	Resistor		100 TO 10000Ω	As per required
3	capacitor		470 µF	1
4	Ac voltage source		4V,50Hz	12
5	Voltage measurement probe			

1)a) Half wave rectifier:

Theory:

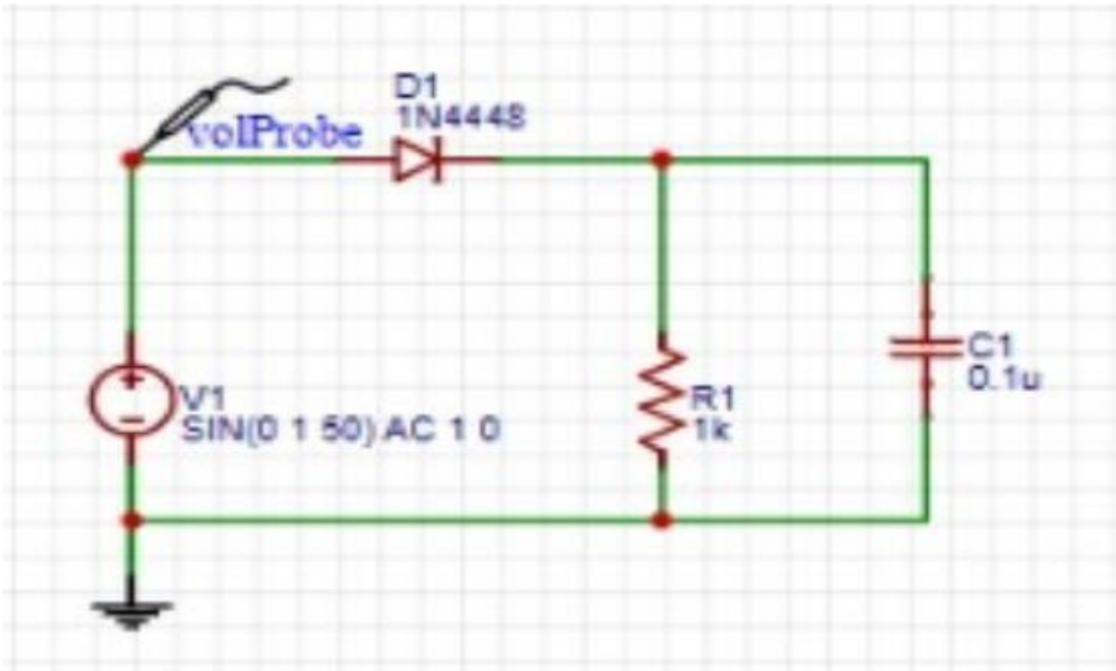
The process of converting an alternating current into direct current is known as rectification. The unidirectional conduction property of semiconductor diodes (junction diodes) is used for rectification. two types: (a) Half wave rectifier and (b) Full wave rectifier.

In a half-wave rectifier circuit, during the positive half-cycle of the input, the diode is forward biased and conducts. Current flows through the load and a voltage are developed across it. During the negative half cycle, it is reverse bias and does not conduct. Therefore, in the negative half cycle of the supply, no current flows in the load resistor as no voltage appears across it. Thus, the dc voltage across the load is sinusoidal for the first half cycle only and a pure ac input signal is converted into a unidirectional

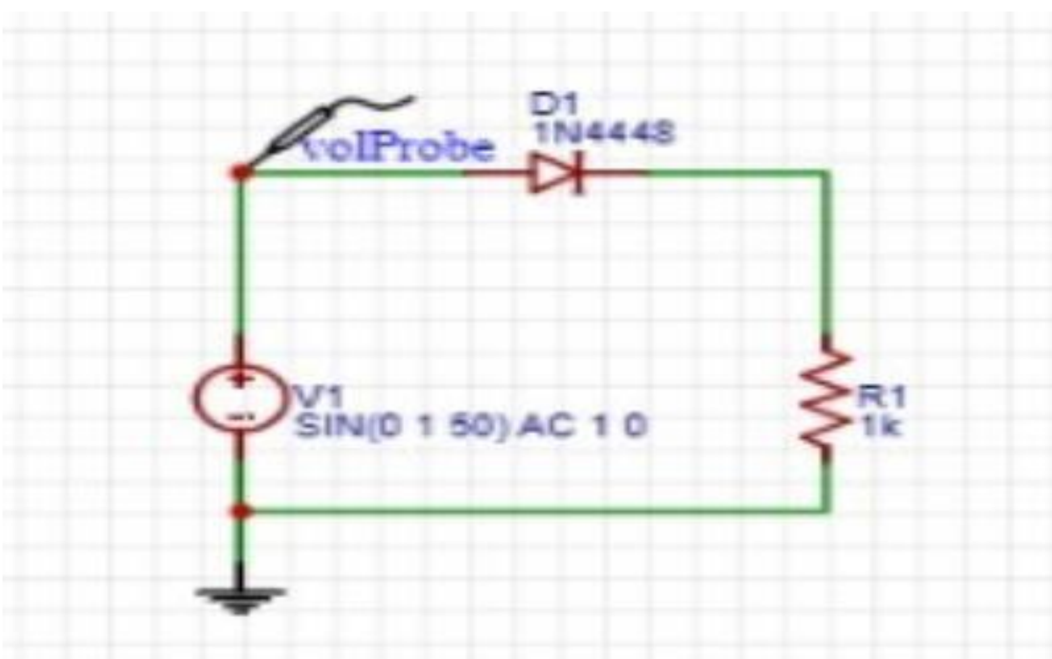
pulsating output signal.

Another type of circuit that produces the same output as a full-wave rectifieris that of the Bridge Rectifier. This type of single-phase rectifier uses 4 individualrectifying diodes connected in a "bridged" configuration to produce the desiredoutput but does not require a special center tapped transformer, thereby reducing its size and cost. The single secondary winding is connected to one side of the diode bridge network and the load to the other side. The 4 diodes labeled D arranged in "series pairs" with only two diodes conducting current during each half cycle. During the positive half cycle of the supply, diodes D1 and D2 conduct in se D3 and D4 are reverse biased and the current flows through the load as shown below. During the negative half cycle of the supply, diodes D3 and D4 conduct in series, but diodes D1 and D2 switch of as they are now reverse biased. The current flowing through the load is the same direction as before.

Half wave rectifier with filter :



Half wave without filter :



Formula:

Half wave rectifier without filter:

I. □□□□ = □□ 2 ; Vm = Peak voltage magnitude II. □□□ = □□ □

III. Ripple factor = √(□□□□ □□□) 2 − 1 IV. % Efficiency = (□□□ □□□□) 2 × 100%

IV. % Efficiency = (□□□ □□□□) 2 × 100%

Half wave rectifier with filter:

I. □□□□ = □□□□ (√3×2) ; Vrpp = Peak to peak voltage magnitude

II. □□□ = □□ − □□□□ 2 III. Ripple factor = □□□□ □□

III. Ripple factor = □□□□ □□

Procedure:

Without Filter

I. Give the connections as per the circuit diagram.

II. Give 6 V, 50Hz Input to the circuit.

III. Measure the rectifier output across the Load and input voltage.

IV. Plot its performance graph

With Filter

I. Give the connections as per the circuit diagram.

II. Give 6 V, 50Hz Input to the circuit.

III. Connect the Capacitor across the load.

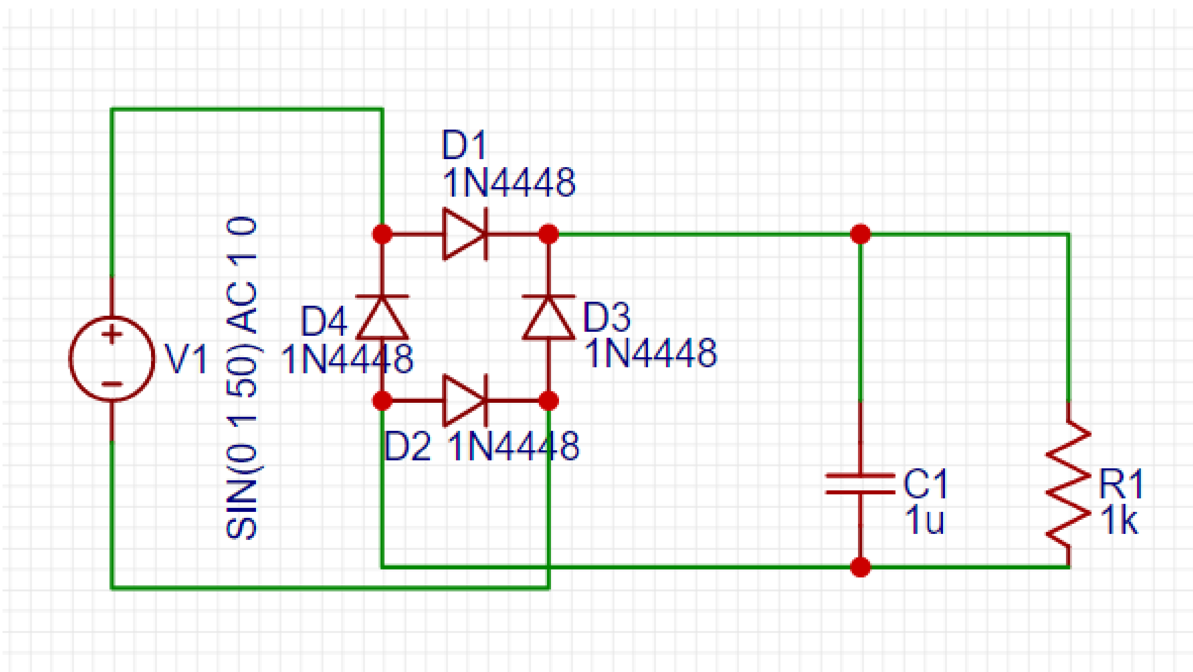
IV. Measure the rectifier output across the different load and input voltage

Plot its performance graph

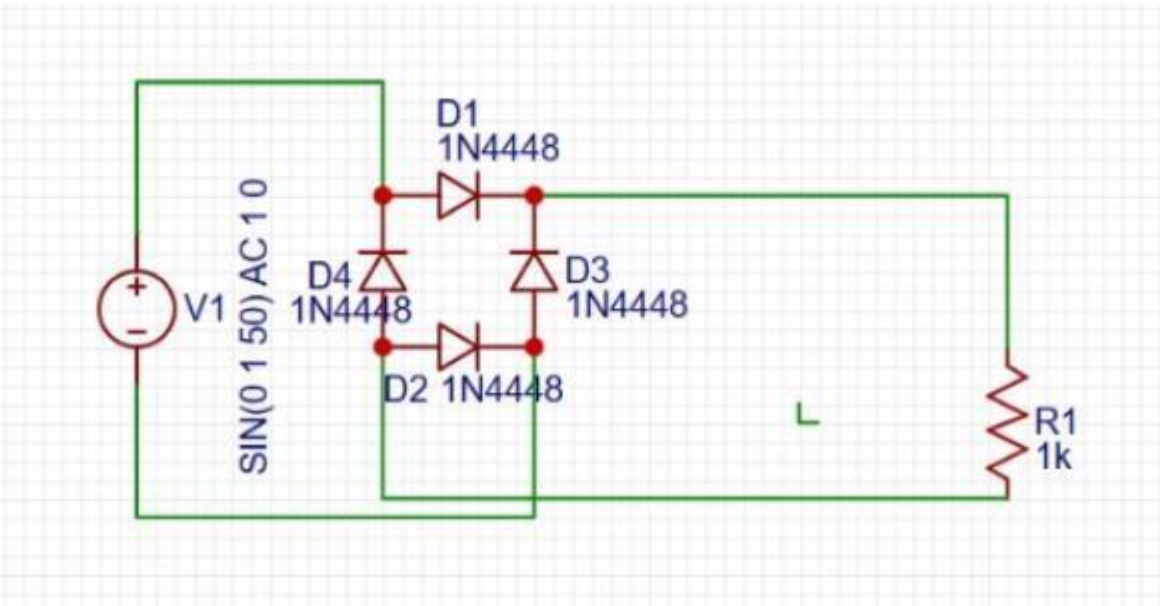
Theory

Another type of circuit that produces the same output as a full-wave rectifier is that of the Bridge Rectifier. This type of single-phase rectifier uses 4 individual rectifying diodes connected in a "bridged" configuration to produce the desired out put but does not require a special center tapped transformer, thereby reducing its size and cost. The single secondary winding is connected to one side of the diode bridge network and the load to the other side. The 4 diodes labeled D arranged in "series pairs" with only two diodes conducting current during each half cycle. During the positive half cycle of the supply, diodes D1 and D2 conduct in se D3 and D4 are reverse biased and the current flows through the load as shown below. During the negative half cycle of the supply, diodes D3 and D4 conduct in series, but diodes D1 and D2 switch of as they are now reverse biased. The current flowing through the load is the same direction as before.

Full wave with filter



Full wave rectifier without filter



FORMULA

Full wave rectifier without filter:

I.; Vm =Vm/√2, Vm= Peak voltage magnitude

II. $V_{dc}=2V_m/\pi$

III. Ripple factor = $\sqrt{((V_{rms}/V_{dc})^2 - 1)}$

IV. % Efficiency = $(V_{dc}/V_{rms})^2 2\times100\%$

Full Wave Rectifier:

I. $V_{rms}=V_{rpp}/(\sqrt{3}\times2)$; Vrpp = Peak to peak voltage magnitude
II. $V_{dc}=V_m-V_{rpp}$
III. III. Ripple factor = V_{rpp}/V_{dc}

Procedure:
Without Filter

Give the connections as per the circuit diagram.

II. Give 6 V, 50Hz Input to the circuit.

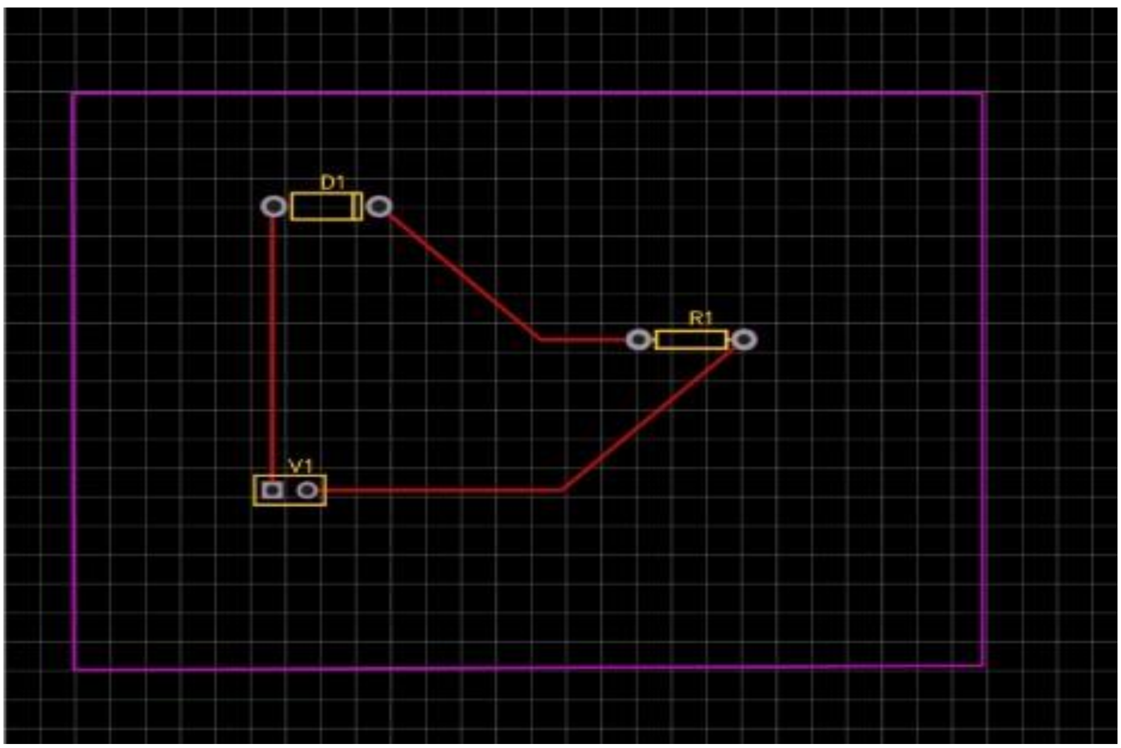
IV. Measure the rectifier output across the Load and input voltage.
V. Plot its performance graph.

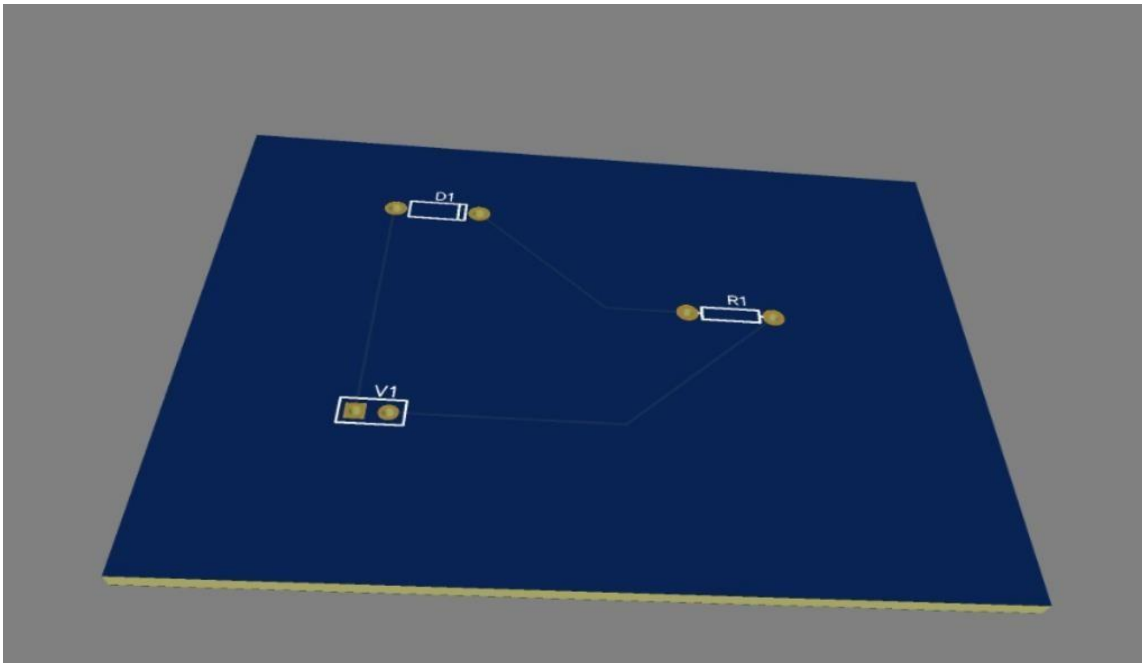
With Filter

I. Give the connections as per the circuit diagram.
II. Give 6 V, 50Hz Input to the circuit.
III. Connect the Capacitor across the load.
IV. Measure the rectifier output across the different Load and input voltage.
V. Plot its performance graph.

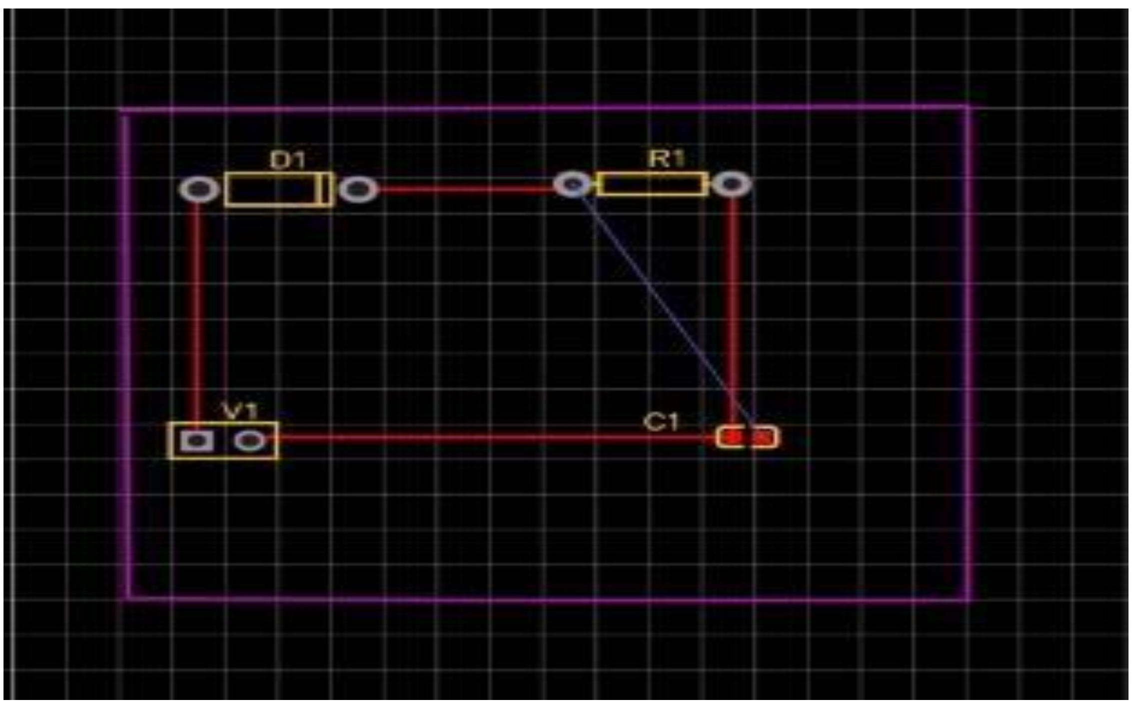
Schematic to PCB layout

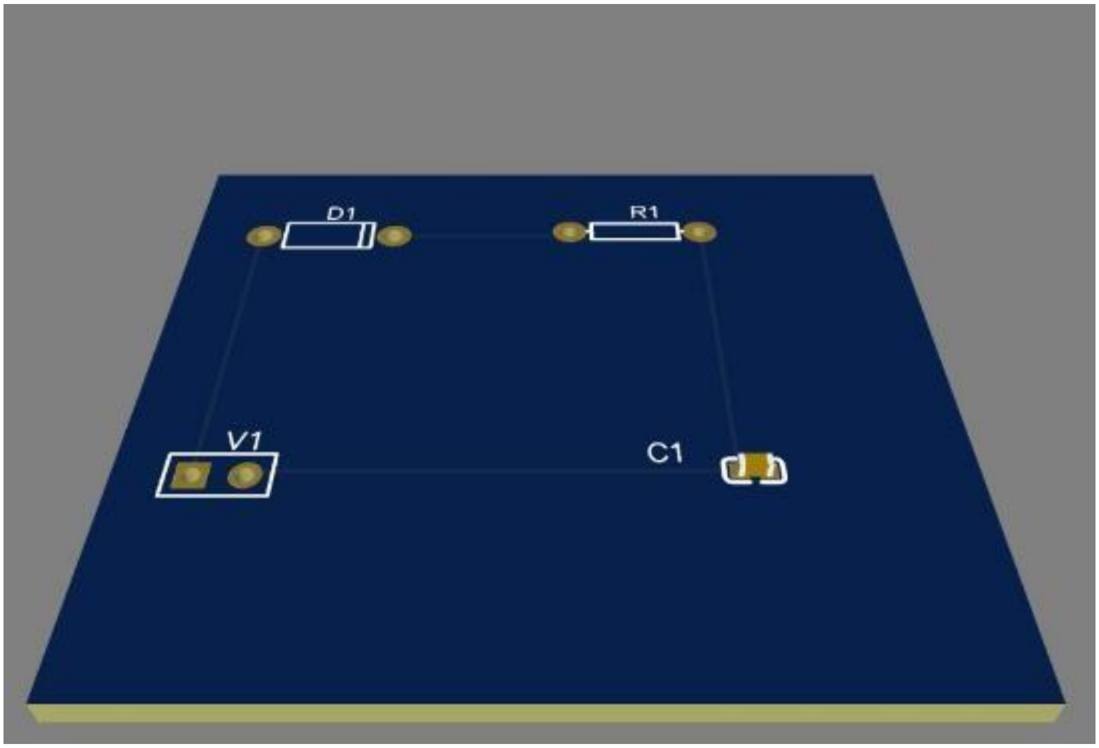
Half wave rectifier without filter :



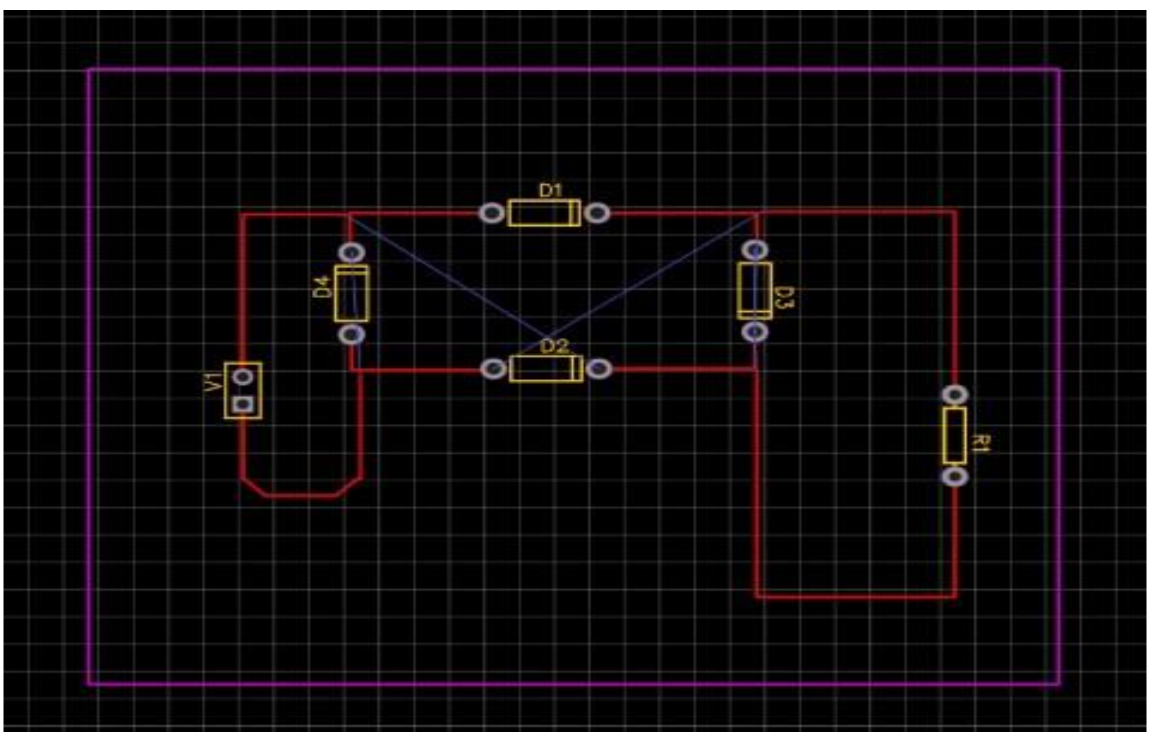


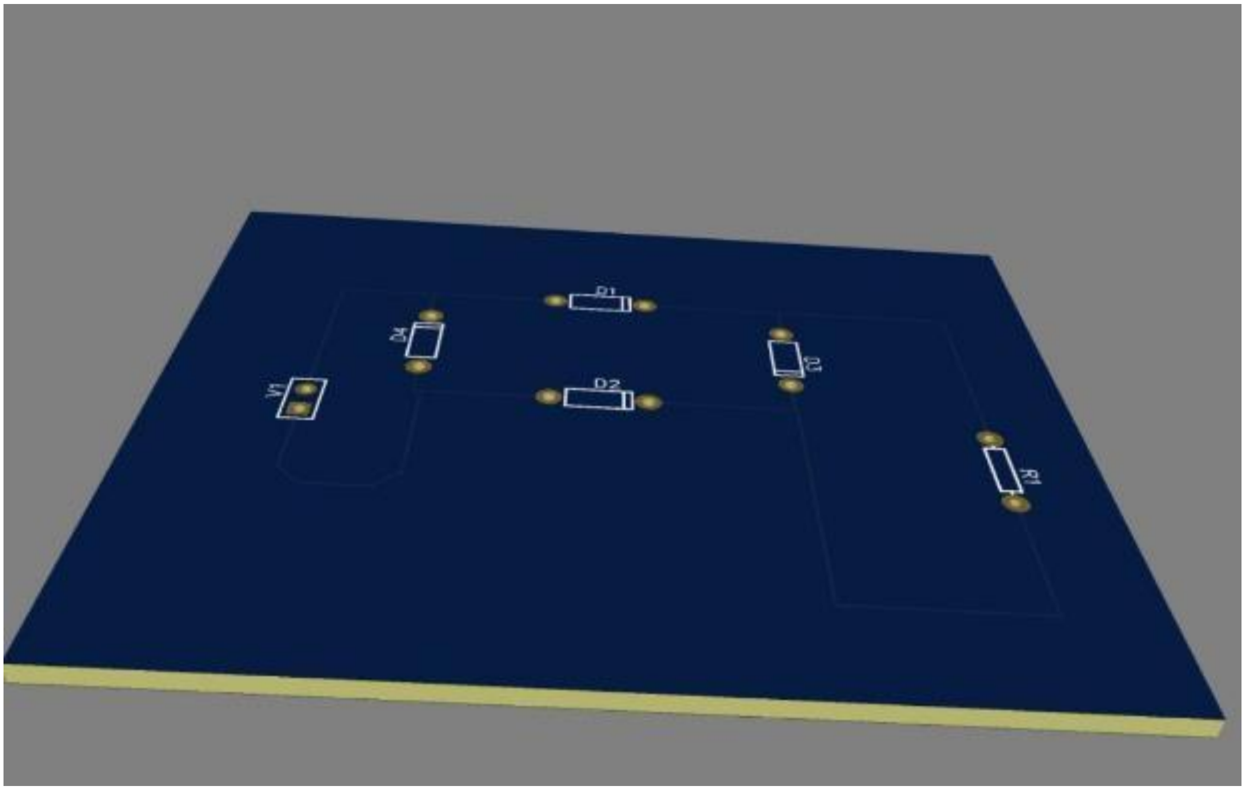
Half wave rectifier with filter



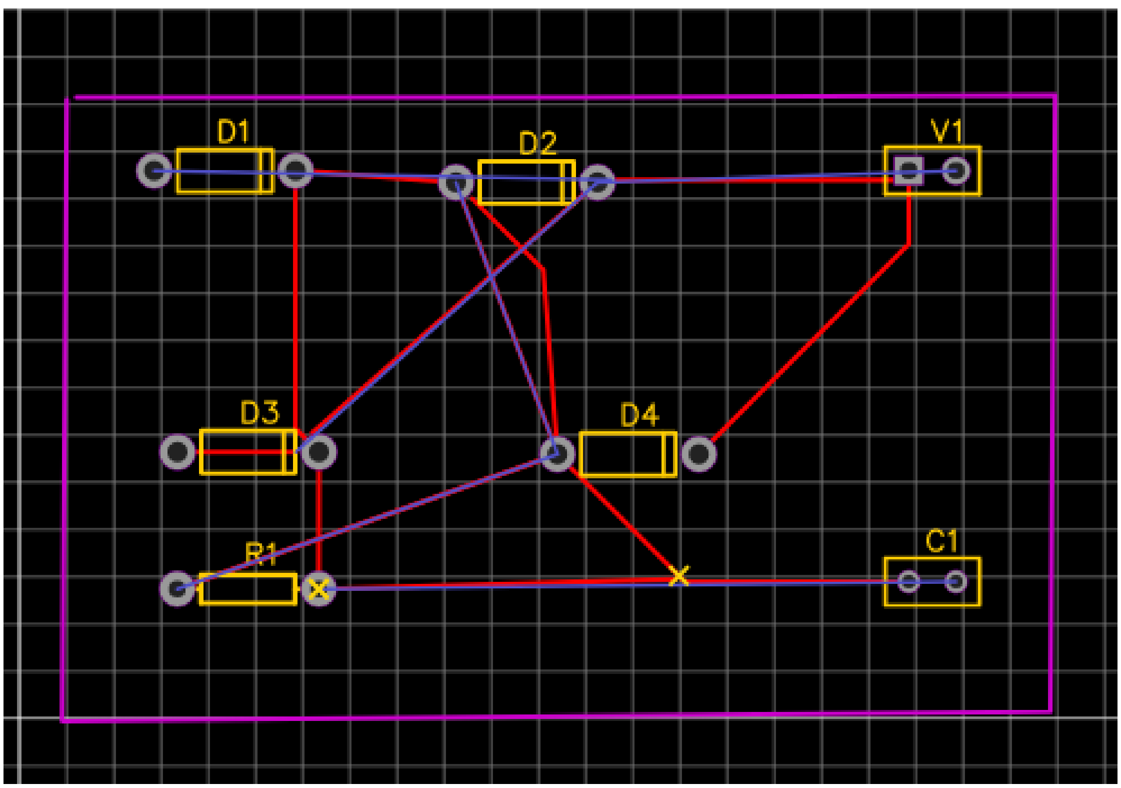


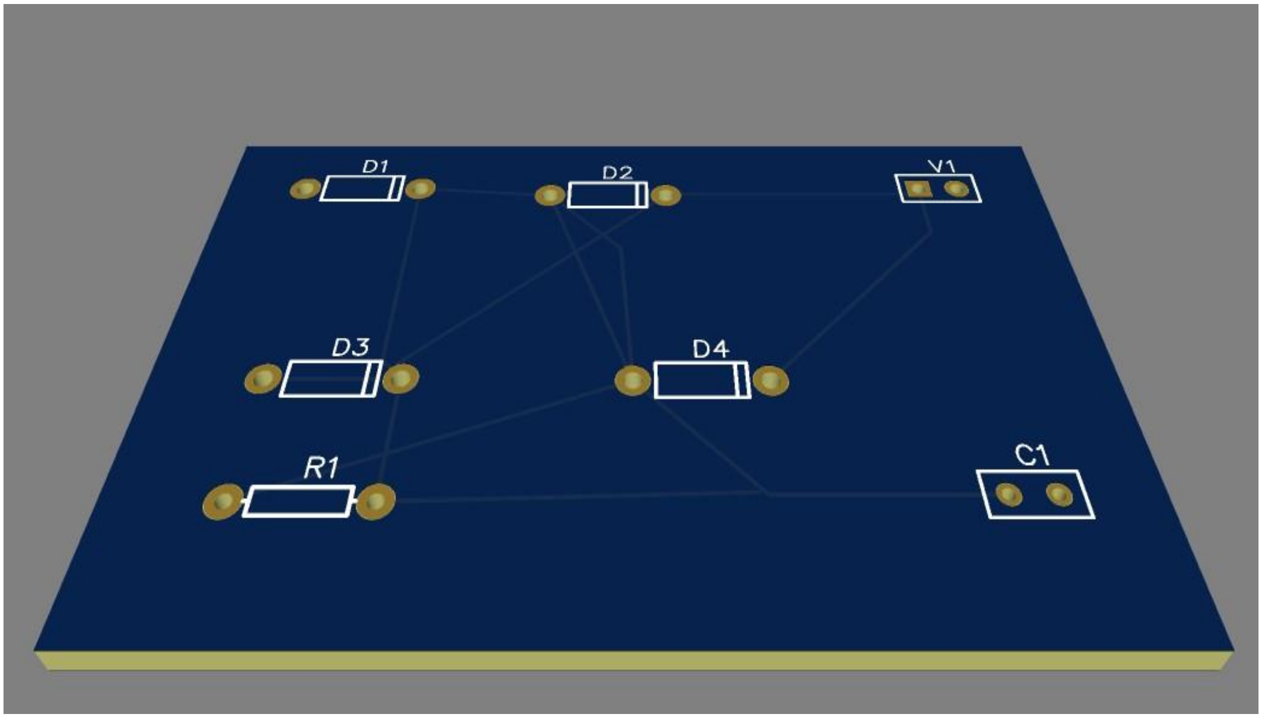
Full wave rectifier without filter :





Full wave rectifier with filter :





RESULT

Thus,the PCB layout design of half wave and full wave rectifier were obtained.