Parul University

FACULTY OF ENGINEERING AND TECHNOLOGY

BACHELOR OF TECHNOLOGY

BASIC ELECTRONICS

(303107151)

1st SEMESTER

ELECTRICAL ENGINEERING DEPARTMENT

Laboratory Manual

BASIC ELECTRONICS PRACTICAL BOOK

ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT

PREFACE

It gives us immense pleasure to present the second edition of Basic Electronics Practical Book for the B.Tech. 1st year students for PARUL UNIVERSITY.

The Basic Electronics theory and laboratory courses at PARUL UNIVERSITY, WAGHODIA, VADODARA are designed in such a way that students develop the basic understanding of the subject in the theory classes and then try their hands on the experiments to realize the various electronic circuits and learnt during the theoretical sessions. The main objective of the Basic Electronics laboratory course is: Learning Basic Electronics through Experimentations. All the experiments are designed to illustrate functionality of electronics devices and their applications and also to expose the students to various instruments and their uses.

The objective of this Basic Electronics Practical Book is to provide a comprehensive source for all the experiments included in the Basic Electronics laboratory course. It explains all the aspects related to every experiment such as: verification of V-I characteristics of Diodes & Transistors, application-based diode circuits and transistor circuits, circuit design using computer simulation, etc. It also gives sufficient information on how to interpret and discuss the obtained results.

We acknowledge the authors and publishers of all the books which we have consulted while developing this practical book. Hopefully this Basic Electronics Practical Book will serve the purpose for which it has been developed.

INSTRUCTIONS TO STUDENTS

1. The main objective of the Basic Electronics laboratory is: ***Learning Basic Electronics through Experimentations***. ***All the experiments are designed to illustrate functionality of electronics devices and their applications and also to expose the students to various instruments and their uses.***
2. Be prompt in arriving to the laboratory and always come well prepared for the experiment.
3. Be careful while working on the equipment's operated with high voltage power supply.
4. Work quietly and carefully. Give equal opportunity to all your fellow students to work on the instruments.
5. Every student should have his/her individual copy of the *Basic Electronics Practical Book.*
6. Every student have to prepare the notebooks specifically reserved for the Basic Electronics practical work:"*Basic Electronics Practical Book"*
7. Every student has to necessarily bring his/her *Basic Electronics Practical Book*, *Basic Electronics Practical Class Notebook* and *Basic Electronics Practical Final Notebook*, when he/she comes to the Practical to perform the experiment.
8. Record your observations honestly. Never makeup reading or doctor them either to get a better fit on the graph or to produce the correct result. Display all your observations on the graph (if applicable)
9. All the observations have to be neatly recorded in the *Basic Electronics Practical Class Notebook* (as explained in the *Basic Electronics Practical Book*) and verified by the instructor before leaving the laboratory.
10. If some of the readings appear to be wrong then repeat the set of observations carefully.
11. Do not share your readings with your fellow student. Every student has to produce his/her own set of readings by performing the experiment separately.
12. After verification of the recorded observations, do the calculation in the *Basic Electronics Practical Class Notebook* (as explained in the *Basic Electronics Practical Book*) and produce the desired results and get them verified by the instructor.
13. Never forget to mention the units of the observed quantities in the observation table. After calculations, represent the results with appropriate units.
14. Calculate the percentage error in the results obtained by you if the standard results are available and also try to point out the sources of errors in the experiment.
15. Finally record the verified observations along with the calculation and results in the *Basic Electronics Practical Notebook*.
16. Do not forget to get the information of your next allotment (the experiment which is to be performed by you in the next laboratory session) before leaving the laboratory from the Technical Assistant.
17. Finally record the verified observations along with the calculation and results in the *Basic Electronics Practical Final Notebook*.
18. The grades for the Basic Electronics practical course work will be awarded based on your performance in the laboratory, regularity, recording of experiments in the *Basic Electronics Practical Final Notebook*, lab quiz, regular viva-voce and end-term examination.

CERTIFICATE

This is to certify that

Mr./Ms ....with

enrolment no. .... has successfully completed his/her laboratory experiments in the Basic Electronics (203107151) from the department of .... during the academic year ....

Date of Submission:......................... Staff In charge:...........................

Head Of Department:...

TABLE OF CONTENT

EXPERIMENT NO: 1

AIM: To Plot V-I characteristics of PN Junction Diode.

APPARATUS:

PN JUNCTION DIODE CHARACTERISTIC

THEORY: The most important characteristic of PN junction is its ability to conduct current in one direction only. In other direction, it offers very high resistance. This information is obtained by performing this experiment. The circuit is as shown in the fig. the P- region is called the anode, and the N- region is called the cathode.

Forward biased:-

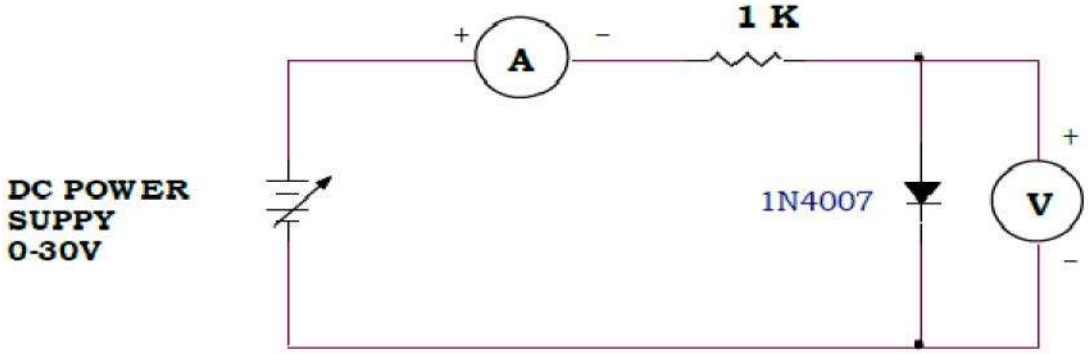
The positive terminal of the battery is connected to anode and negative terminal of the battery is connected to cathode of the diode. Hence, the diode acts as short circuit. In this condition, the resistance of the diode is very small.

Reverse biased-

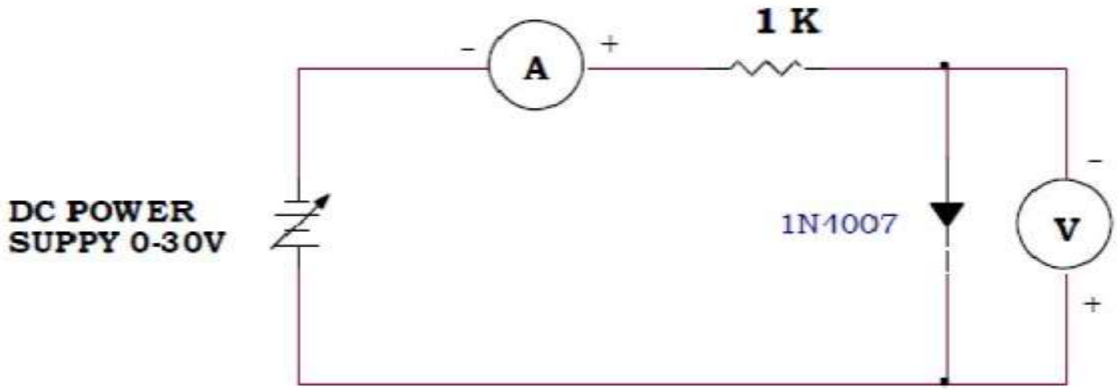
The positive terminal of the battery is connected to cathode and negative terminal of the battery is connected to anode of the diode. Hence, the diode acts as open circuit. In this condition the resistance of the diode is very high.

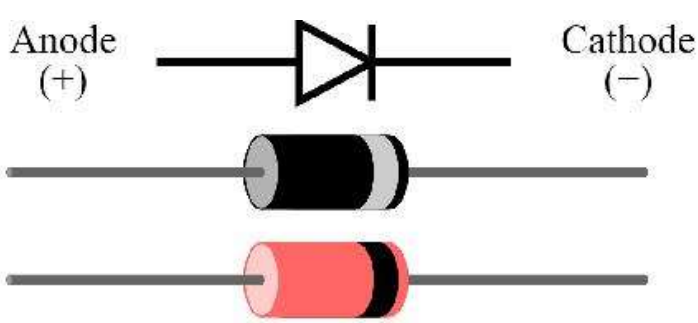
CIRCUIT DIAGRAM:

Circuit diagram (forward bias):

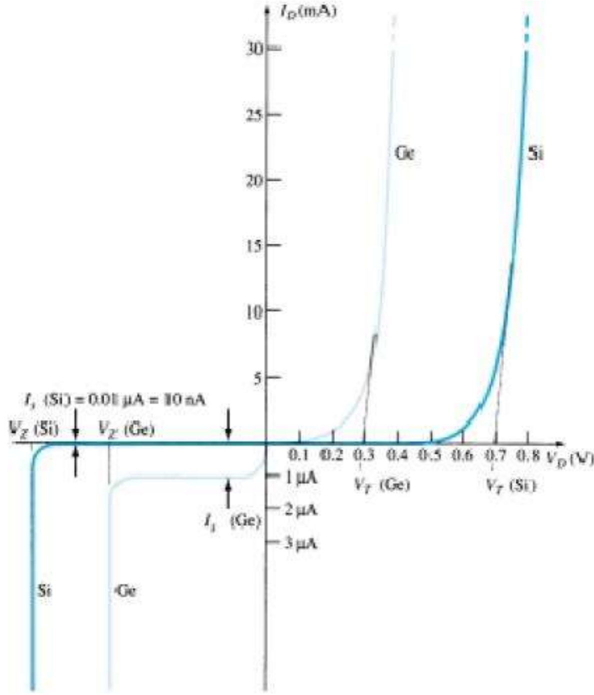


Circuit diagram (reverse bias):





(PN Junction Diode)



(V-I Characteristics of Diode)

PROCEDURE:

OBSERVATION TABLE:

(Forward Bias)

Sr. No.	Supply Voltage	Diode Voltage(V_D)	Diode Current (I_D)
1			
2			
3			
4			
5			
6			
7			
8			
9			

10			
11			
12			
13			
14			

(Reverse Bias)

Sr. No.	Supply Voltage	Diode Voltage(V_D)	Diode Current (I_D)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			

CONCLUSION:

QUESTIONS:

Find the knee voltage from the forward characteristic

Find the forward resistance of the diode.

A	**Performance**		**10**
B	**Report Writing**		**10**
C	**Contex Problem**		**10**
D	**Total**		**10**

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EXPERIMENT NO: 2

AIM: To Plot V-I characteristics of Zener Diode.

APPARATUS:

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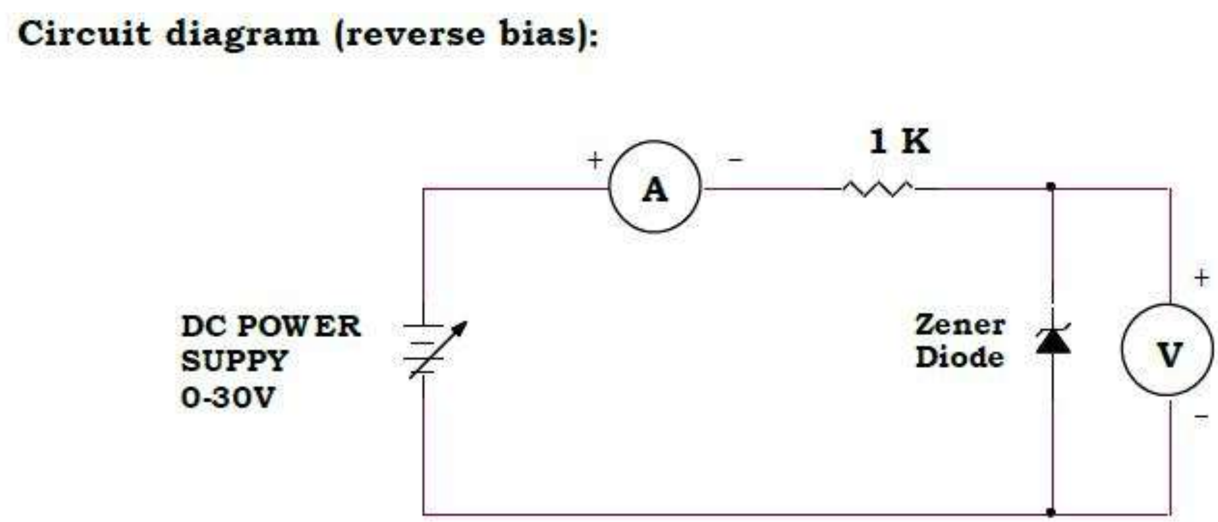
ZENER DIODE CHARACTERISTIC

THEORY: The Zener diode is designed to operate in reverse breakdown region. Zener diode is used for voltage regulation purpose. Zener diodes are designed for specific reverse breakdown voltage called Zener breakdown voltage (VZ). The value of VZ depends on amount of doping. Breakdown current is limited by power dissipation capacity of the zener diode. If power capacity of the Zener is 1 W and Zener voltage is 10V, highest reverse current is 0.1A or 100 mA. If current increases more than this limit, diode will be damaged. Forward characteristics of the Zener diode are similar to normal PN junction diode.

CIRCUIT DIAGRAM:



PROCEDURE:

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OBSERVATION TABLE:

(Reverse Bias)

Sr. No.	Supply Voltage	Diode Voltage(V_D)	Diode Current (I_D)

CONCLUSION:

QUESTIONS:

Find the Zener breakdown voltage from the characteristic.

A	**Performance**		**10**
B	**Report Writing**		**10**
C	**Contex Problem**		**10**
D	**Total**		**10**

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EXPERIMENT NO. 3

AIM: To Observe Half wave Rectifier Circuit

- **Half wave Rectifier without filter**
- **Half wave Rectifier with shunt capacitor filter**

Measure the ripple factor in all above cases

APPARATUS:

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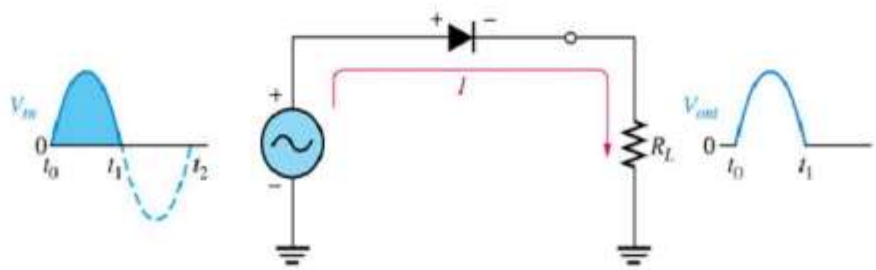
HALF WAVE RECTIFIER WITHOUT FILTER

CIRCUIT DIAGRAM:



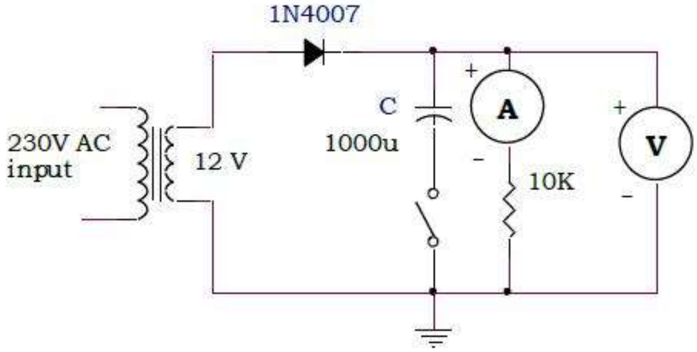
(Half wave Rectifier without filter)

THEORY: One of the very important applications of diode is in DC power supply as a rectifier to convert AC into DC. DC Power supply is the important element of any electronic equipment. This is because it provides power to energize all electronic circuits like oscillators, amplifiers and so on. In electronic equipments, D.C. power supply is must. For example, we can't think of television, computer, radio, telephone, mobile as well as measuring instruments like CRO, multi-meter etc. without DC power supply. The reliability and performance of the electronic system proper design of power supply is necessary. The first block of DC power supply is rectifier. Rectifier may be defined as an electronic device used to convert ac voltage or current into unidirectional voltage or current. Essentially rectifier needs unidirectional device. Diode has unidirectional property hence suitable for rectifier. Rectifier broadly divided into two categories: Half wave rectifier and full wave rectifier. In this experiment, you will construct half wave rectifier.

In half wave rectifier only half cycle of applied AC voltage is used. Another half cycle of AC voltage (negative cycle) is not used. Only one diode is used which conducts during positive cycle. The circuit diagram of half wave rectifier without capacitor is shown in the following figure. During positive half cycle of the input voltage, anode of the diode is positive compared with the cathode. Diode is in forward bias and current passes through the diode and positive cycle develops across the load resistance RL. During negative half cycle of input voltage, anode is negative with respected to cathode and diode is in reverse bias. No current passes through the diode hence output voltage is zero.

<u>**HALF WAVE RECTIFIER WITH CAPACITOR FILTER**</u>

CIRCUIT DIAGRAM:



(Half wave Rectifier with capacitor filter)

THEORY: Half wave rectifier without filter capacitor convert AC voltage into pulsating DC voltage. Filter capacitor is used to obtain smooth DC voltage. Construct above circuit to perform this practical.

PROCEDURE:

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OBSERVATIONS:

Half wave Rectifier without filter

- AC input voltage (RMS) V_{RMS} =
- DC output voltage V_{DC} =
- DC current : I_{DC} =
- AC output voltage (Ripple voltage) : V_R =
- Ripple factor: (V_R / V_{DC}) =

Half wave Rectifier with capacitor filter

- AC input voltage (RMS) V_{RMS} =

- DC output voltage V_{DC} =
- DC current : I_{DC} =
- AC output voltage (Ripple voltage) : V_R =
- Ripple factor: (V_R / V_{DC}) =

CALCULATION:

CONCLUSION:

QUESTIONS:

Find the rectification efficiency of half wave rectifier.

A	**Performance**		**10**
B	**Report Writing**		**10**
C	**Contex Problem**		**10**
D	**Total**		**10**

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EXPERIMENT NO. 4

AIM: To Observe Rectifier Circuit

- **Full wave rectifier without filter.**
- **Full wave Rectifier with shunt capacitor filter**

Measure the ripple factor in all above cases

APPARATUS:

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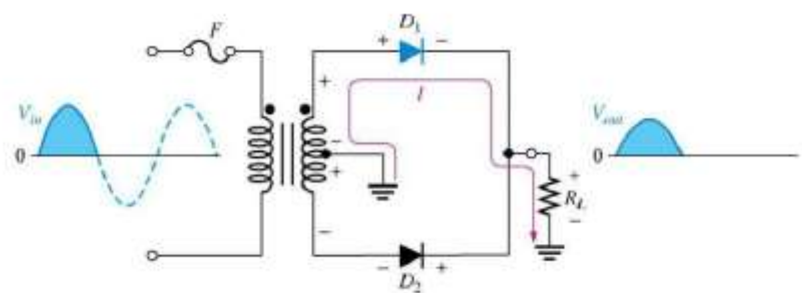
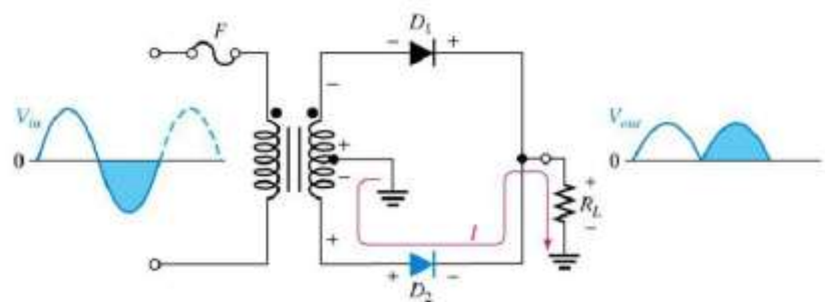
FULL WAVE RECTIFIER WITHOUT FILTER

CIRCUIT DIAGRAM:



(a) During positive half-cycles, D_1 is forward-biased and D_2 is reverse-biased.



(b) During negative half-cycles, D_2 is forward-biased and D_1 is reverse-biased.

(Full wave rectifier without filter)

THEORY: Full wave rectifier utilizes both the cycle of input AC voltage. Two or four diodes are used in full wave rectifier. If full wave rectifier is designed using four diodes it is known as full wave bridge rectifier. Full wave rectifier using two diodes without capacitor is shown in the following figure. Center tapped transformer is used in this full wave rectifier. During the positive cycle diode D1 conducts and it is available at the output. During negative cycle diode D1 remains OFF but diode D2 is in forward bias hence it conducts and negative cycle is available as a positive cycle at the output as shown in the following figure. Note that direction of current in the load resistance is same during both the cycles hence output is only positive cycles.

Advantages:

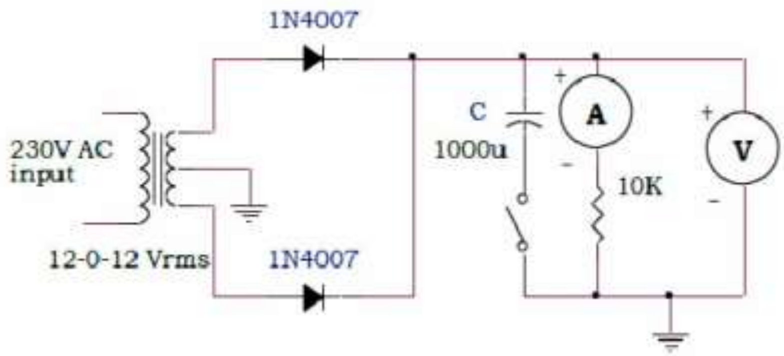
- The rectification efficiency is double than half wave rectifier
- Ripple factor is less and ripple frequency is double hence easy to filter out.
- DC output voltage and current is higher hence output power is higher.
- Better transformer utilization factor
- There is no DC saturation of core in transformer because the DC currents in two halves of secondary flow in opposite directions.

Disadvantages:

- Requires center tap transformer
- Requires two diodes compared to one diode in half wave rectifier

FULL WAVE RECTIFIER WITH CAPACITOR FILTER

CIRCUIT DIAGRAM:



(Full wave rectifier with capacitor filter)

THEORY: Full wave rectifier without filter capacitor convert AC voltage into pulsating DC voltage. Filter capacitor is used to obtain smooth DC voltage. The average voltage with full wave capacitor filter is higher than the average voltage with half wave capacitor filter. Construct following circuit to perform this practical.

PROCEDURE:

OBSERVATIONS:

Full wave Rectifier without filter

- AC input voltage (RMS) V_{RMS} =
- DC output voltage V_{DC} =
- DC current : I_{DC} =
- AC output voltage (Ripple voltage) : V_R =
- Ripple factor: (V_R / V_{DC}) =
-

Full wave Rectifier with capacitor filter

- AC input voltage (RMS) V_{RMS} =
- DC output voltage V_{DC} =
- DC current : I_{DC} =
- AC output voltage (Ripple voltage) : V_R =
- Ripple factor: (V_R / V_{DC}) =

CALCULATION:

CONCLUSION:

QUESTIONS:

Find the rectification efficiency of full wave rectifier.

A	**Performance**		**10**
B	**Report Writing**		**10**
C	**Contex Problem**		**10**
D	**Total**		**10**

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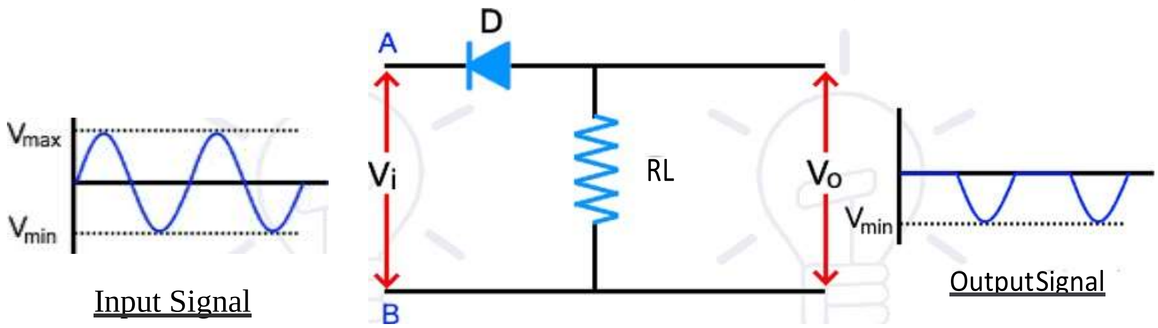
EXPERIMENT-5

AIM: To perform series and Parallel Clipper circuit with biasing Voltage.

APPARATUS:

A) Series Positive Clippers

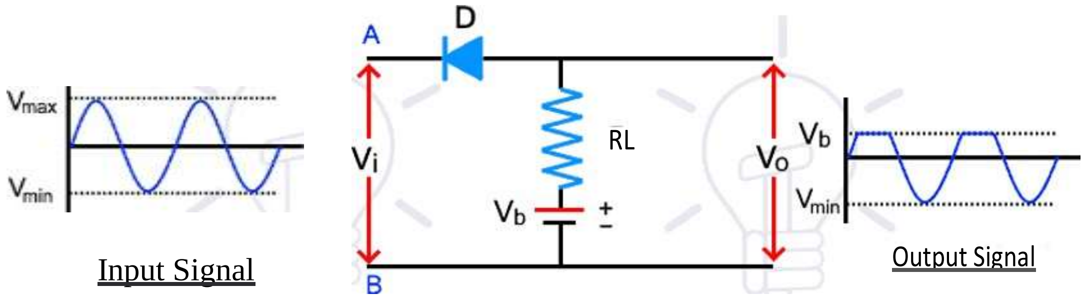
- Series positive clippers remove or clips the positive half of the waveform. In a series positive clipper, the diode is in reverse biased and in series with the output as shown in the figure below.



a. Series positive clipper

Series Positive Clippers with Bias

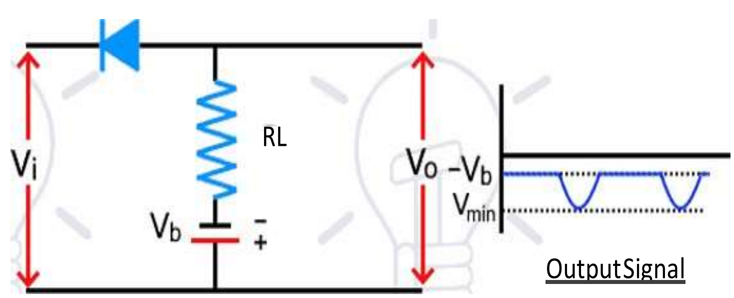
a. Positive Bias



b. **Series** Positive Clipper with Positive Bias

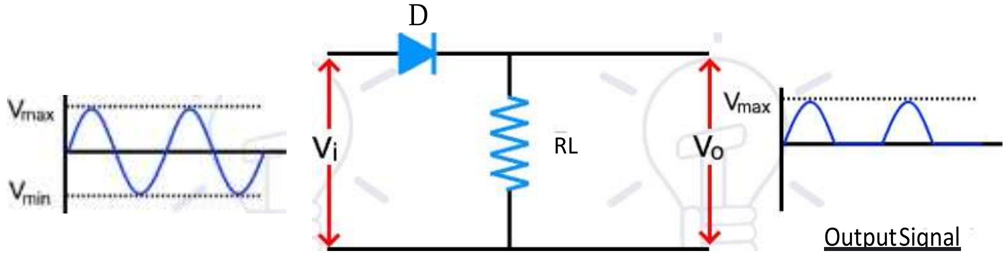
b. Negative Bias

- the battery in the negative biased series positive clipper is connected in reverse with the diode as shown in the figure below.



Series Negative Clippers

- The series negative clipper circuit clips the negative half of the input cycle. its circuit diagram is given below.

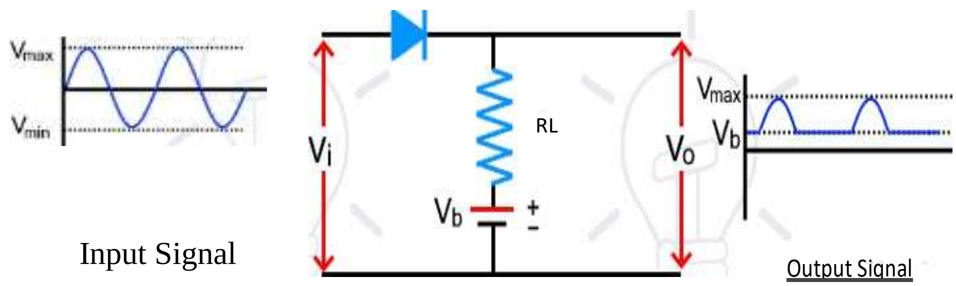


Input Signal **a. Series Negative Clippers**

Series Negative Clippers with Bias

- The series negative clipper is biased with either positive or negative voltage battery to modify the waveform instead of clipping the whole negative half.

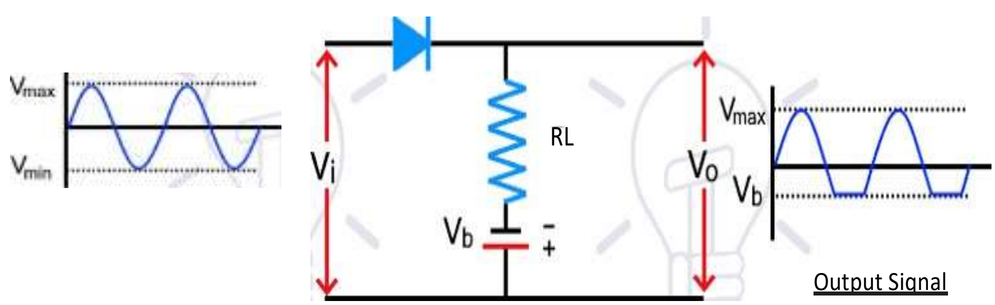
a) Positive Bias



Input Signal

b. Series Negative Clipper with Positive Bias

b) Negative Bias



Shunt Clippers

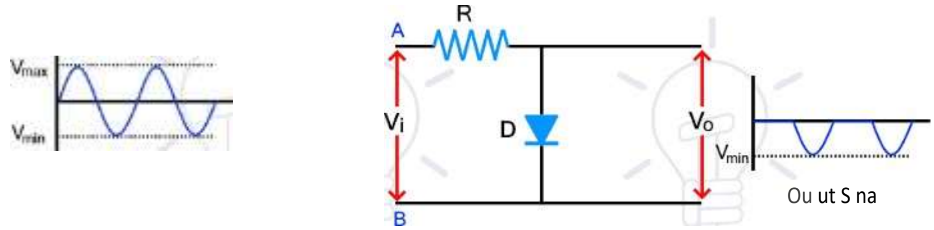
- In shunt clippers, the diode is connected in parallel with the output. The input signal appears the output when the diode is blocking as opposed to the series clippers.

» The shunt clippers can also be divided into positive and negative clippers.

1. Shunt Positive Clippers
2. Shunt Negative Clippers

1. Shunt Positive Clippers

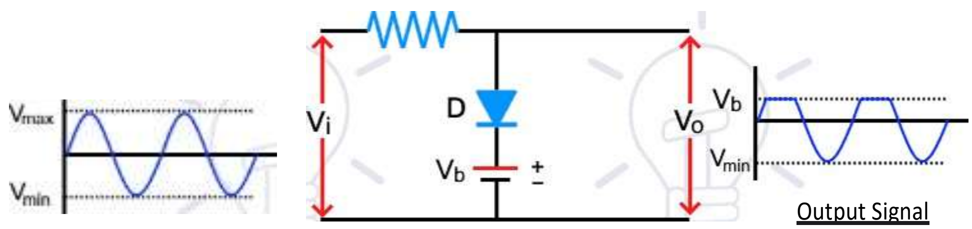
« The shunt positive clipper clips the positive half cycle of the input waveform. The circuit diagram of the shunt positive clipper is given below.



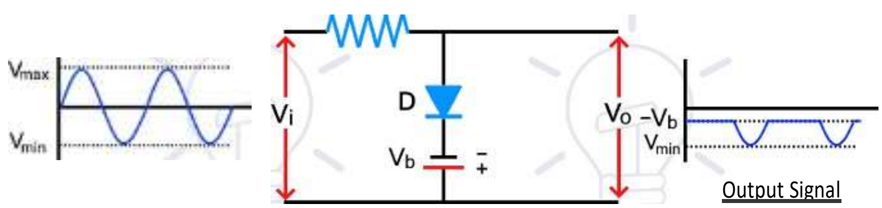
Shunt Positive Clippers with Bias

- The biasing is done by using another fixed voltage source such as a battery inside the circuit to modify the waveform furthermore. The voltage source can be connected in either positive or negative biasing.

a) Positive Bias

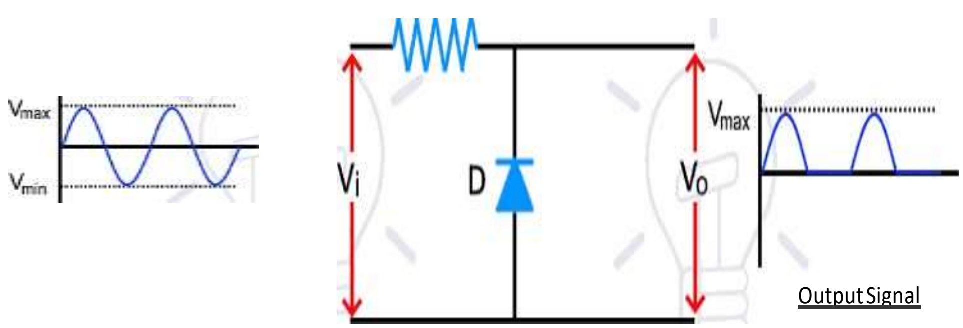


b) Negative Bias



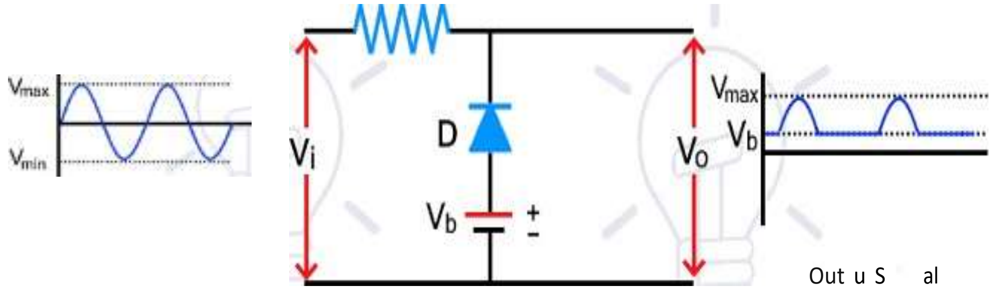
2. Shunt Negative Clippers

- The shunt negative clipper clips the negative half of the input waveform. The circuit diagram is given below.



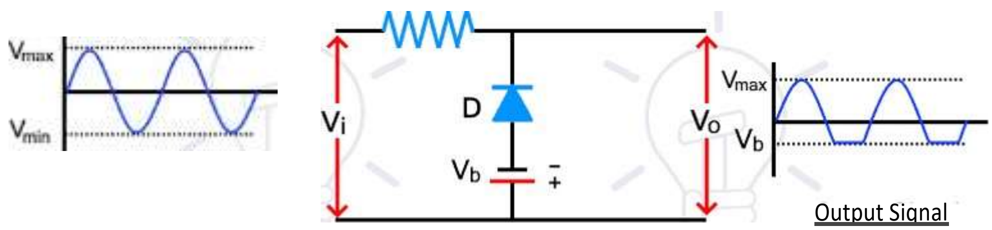
Negative Clippers with Bias

a) Positive Bias



b) Negative Bias

- During the positive half cycle, the diode is reversed biased for both input and battery voltage. thus, the diode blocks the voltage and the signal appears at the output for the whole positive half cycle.



PROCEDURE:

CONCLUSION:

QUESTION:

What are the practical applications of clipper circuit?

A	**Performance**		**10**
B	**Report Writing**		**10**
C	**Contex Problem**		**10**
D	**Total**		**10**

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EXPERIMENT:6

AIM: To perform positive and negative clamper circuits.

APPARATUS:

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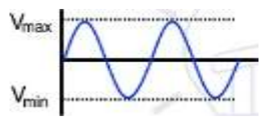
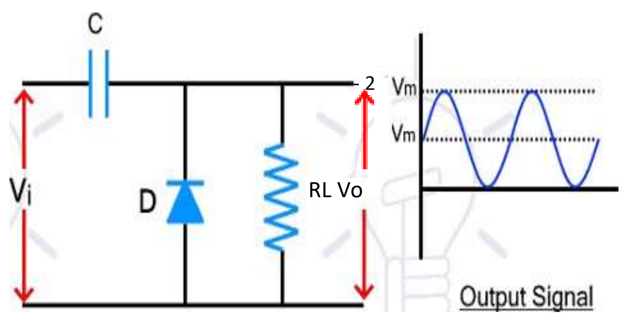
CIRCUIT DIAGRAM:

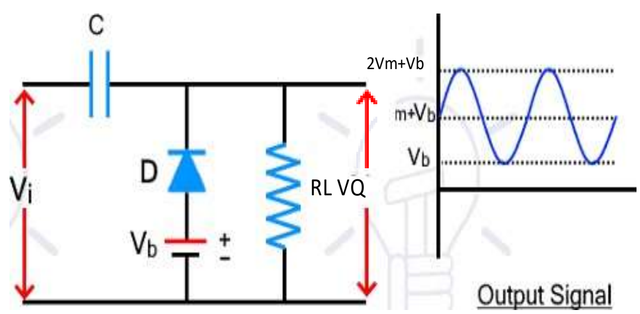
1. **POSITIVE CLAMPER CIRCUIT**



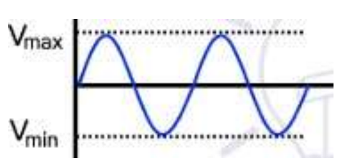
Input Signal



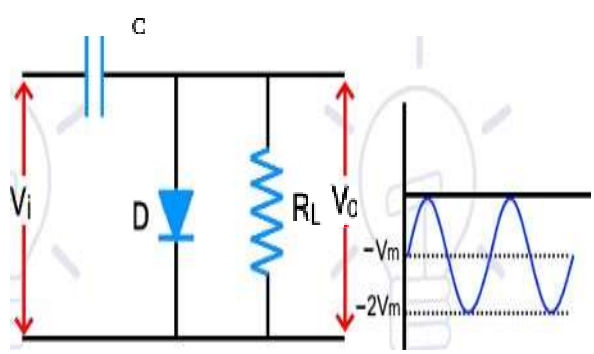
Positive Clamper



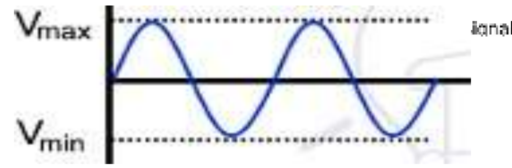
2. **NEGATIVE CLAMPER CIRCUIT**

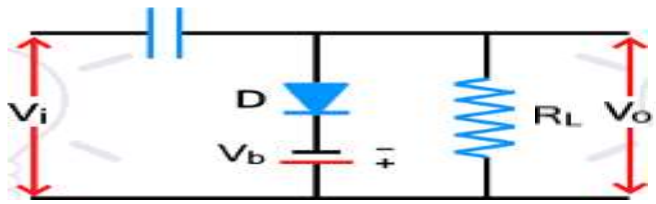


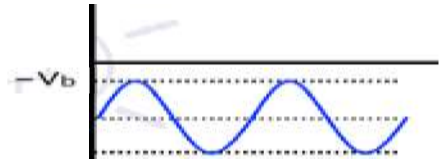
Input Signal



Negative Clamper







PROCEDURE:

CONCLUSION:

QUESTIONS:

What are the practical applications of clamper circuit?

A	**Performance**		**10**
B	**Report Writing**		**10**
C	**Contex Problem**		**10**
D	**Total**		**10**

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EXPERIMENT NO. 7

AIM: To plot characteristics of LED & Photo Diode

APPARATUS:

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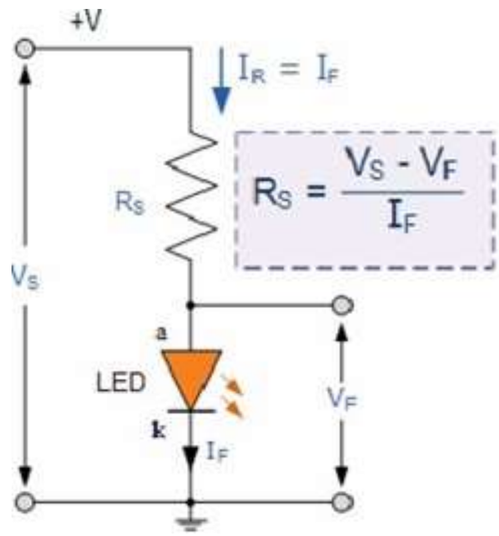
CIRCUIT DIAGRAM:

LIGHT EMITTING DIODE (LED)



(Circuit diagram for LED Characteristics)

THEORY: Light Emitting Diodes or LED´s, are among the most widely used of all the different types of semiconductor diodes available today. They are the most visible type of diode that emit a fairly narrow bandwidth of either visible light at different coloured wavelengths, invisible infra-red light for remote controls or laser type light when a forward current is passed through them. A "**Light Emitting Diode**" or **LED** as it is more commonly called, is basically just a specialised type of PN junction diode, made from a very thin layer of fairly heavily doped semiconductor material.

When the diode is forward biased, electrons from the semiconductors conduction band recombine with holes from the valence band releasing sufficient energy to produce photons which emit a monochromatic (single colour) of light. Because of this thin layer a reasonable number of these photons can leave the junction and radiate away producing a coloured light output.

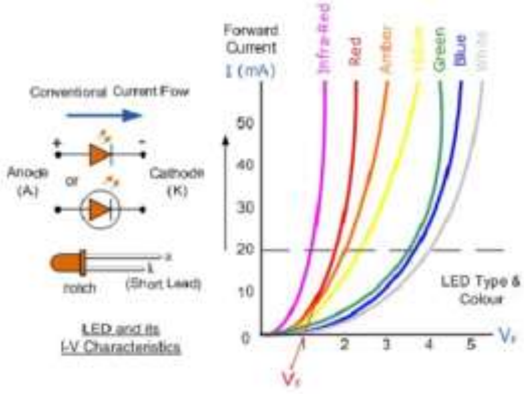
(LED Construction)

Then we can say that when operated in a forward biased direction **Light Emitting Diodes** are semiconductor devices that convert electrical energy into light energy. The construction of a Light Emitting Diode is very different from that of a normal signal diode. The PN junction of an LED is surrounded by a transparent, hard plastic epoxy resin hemispherical shaped shell or body which protects the LED from both vibration and shock. Surprisingly, an LED junction does not actually emit that much light so the epoxy resin body is constructed in such a way that the photons of light emitted by the junction are reflected away from the surrounding substrate base to which the diode is attached and are focused upwards through the domed top of the LED, which itself acts like a lens concentrating the amount of light. This is why the emitted light appears to be brightest at the top of the LED.

However, not all LEDs are made with a hemispherical shaped dome for their epoxy shell. Some indication LEDs have a rectangular or cylindrical shaped construction that has a flat surface on top or their body is shaped into a bar or arrow. Also, nearly all LEDs have their cathode, (K) terminal identified by either a notch or flat spot on the body, or by one of the leads being shorter than the other, (the Anode, A).

Unlike normal incandescent lamps and bulbs which generate large amounts of heat when illuminated, the light emitting diode produces a "cold" generation of light which leads to high efficiencies than the normal "light bulb" because most of the generated energy radiates away within the visible spectrum. Because LEDs are solid-state devices, they can be extremely small and durable and provide much longer lamp life than normal light sources.

How does a light emitting diode get its colour? Unlike normal signal diodes which are made for detection or power rectification, and which are made from either Germanium or Silicon semiconductor materials, **Light Emitting Diodes** are made from exotic semiconductor compounds such as Gallium Arsenide (GaAs), Gallium Phosphide (GaP), Gallium Arsenide Phosphide (GaAsP), Silicon Carbide (SiC) or Gallium Indium Nitride (GaInN) all mixed together at different ratios to produce a distinct wavelength of colour. Different LED compounds emit light in specific regions of the visible light spectrum and therefore produce different intensity levels. The exact choice of the semiconductor material used will determine the overall wavelength of the photon light emissions and therefore the resulting colour of the light emitted



(LED Characteristics and symbol)

PROCEDURE:

OBSERVATION TABLE:

Supply Voltage	Voltage Across LED	LED Current

CONCLUSION:

QUESTIONS:

1. Find forward voltage drop across LED

EXPERIMENT NO. 8

AIM: Designing of power supply using Voltage regulator IC
Design of +5 Volt DC Power Supply using 7805
Design adjustable voltage regulator using LM317 & LM 337

APPARATUS:

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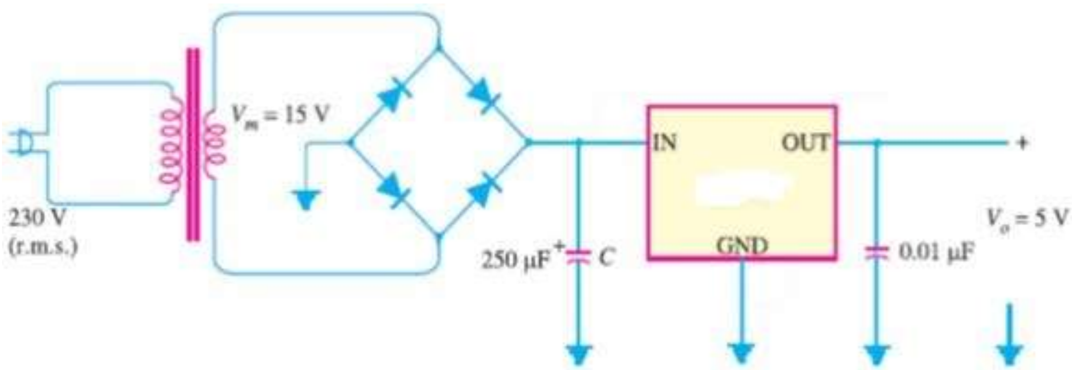
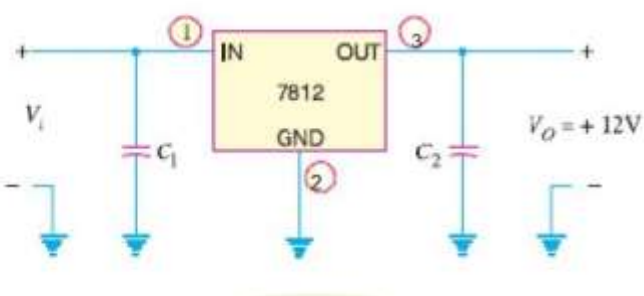
CIRCUIT DIAGRAM:



(Circuit Diagram for Fixed Positive Voltage Regulators Using 7805)

Type number	Output voltage
7805	+5.0 V
7806	+6.0 V
7808	+8.0 V
7809	+9.0 V
7812	+12.0 V
7815	+15.0 V
7818	+18.0 V
7824	+24.0 V



(Pin Out for fixed positive voltage regulator 78xx series and available different types)

Type number	Output voltage
7905	−5.0 V
7905.2	−5.2 V
7906	−6.0 V
7908	−8.0 V
7912	−12.0 V
7915	−15.0 V
7918	−18.0 V
7924	−24.0 V

The 7900 series

(Pin out for fixed negative voltage regulator 79xx series)

THEORY:

FIXED POSITIVE VOLTAGE REGULATOR

This IC regulator provides a fixed positive output voltage. Although many types of IC regulators are available, the 7800 series of IC regulators is the most popular. The last two digits in the part number indicate the d.c. output voltage. For example [See Table below], the 7812 is a + 12V regulator whereas the 7805 is a + 5V regulator. Note that this series (7800 series) provides fixed regulated voltages from +5 V to + 24V.

FIXED NEGATIVE VOLTAGE REGULATOR

This IC regulator provides a fixed negative output voltage. The 7900 series of IC regulators is commonly used for this purpose. This series (7900) is the negative-voltage counterpart of the7800 series. Note that 7900 series provides fixed regulated voltages from – 5V to – 24 V. In the 79xx series pin no. 1 is ground, pin no. 2 is input and pin no. 3 is output.

PROCEDURE:

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OBSERVATION TABLE:

Serial Number	IC Number (Volt Regulator IC)	Theoretical Value	Practical Reading
1			
2			
3			
4			
5			

CONCLUSION:

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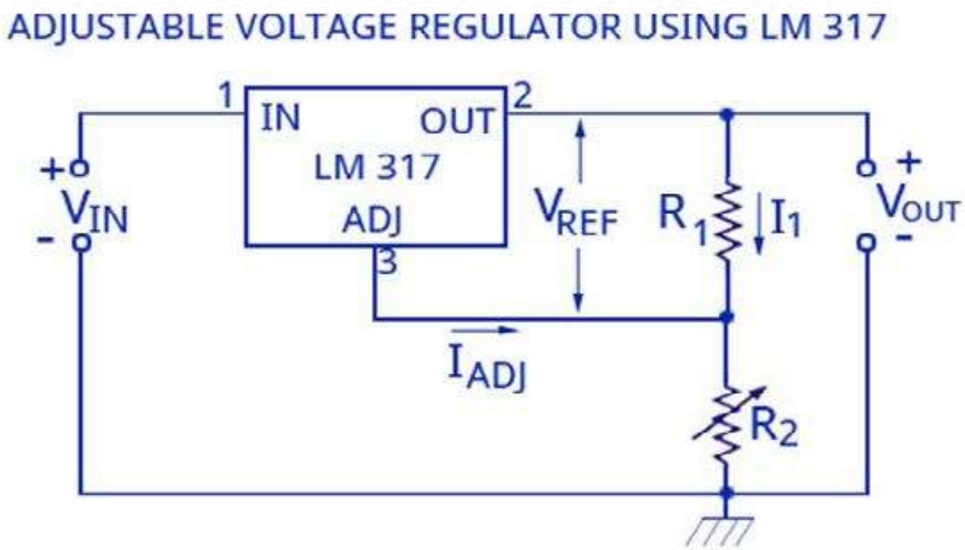
ADJUSTABLE VOLTAGE REGULATOR

CIRCUIT DIAGRAM:



(Adjustable positive voltage regulator circuit)

THEORY: An adjustable voltage regulator is a kind of regulator whose regulated output voltage can be varied over a range. There are two variations of the same; known as positive adjustable voltage regulator and negative adjustable regulator. LM317 is a classic example of positive adjustable voltage regulator, whose output voltage can be varied over a range of 1.2 volts to 57 volts. LM337 is an example of negative adjustable voltage regulator. LM337 is actually a complement of LM317 which are similar in operation & design; with the only difference being polarity of regulated output voltage. There may be certain conditions where a variable voltage may be required.

The resistors R1 and R2 determine the output voltage Vout. The resistor R2 is adjusted to get the output voltage range between 1.2 volts to 57 volts. The output voltage that is required can be calculated using the equation:

$$V_{OUT} = V_{REF}\,(1+R_2 / R_1) + I_{ADJ}\,R_2$$

In this circuit, the value of V_{REF} is the reference voltage between the adjustment terminals and the output taken as 1.25 Volt. The value of I_{ADJ} will be very small and will also have a constant value. Thus the above equation can be rewritten as

$$V_{OUT} = 1.25 * (1+R_2 / R_1)$$

The load regulation is 0.1 percent while the line regulation is 0.01 percent per volt. This means that the output voltage varies only 0.01 percent for each volt of input voltage. The ripple rejection is 80 db, equivalent to 10,000. The LM 337 series of adjustable voltage regulators is a complement to the LM 317 series devices. The negative adjustable voltage regulators are available in the same voltage and current options as the LM 317 devices.

PROCEDURE:

OBSERVATION TABLE:

R1	R2	Theoretical Vout	Practical Vout

CALCULATIONS:

CONCLUSION:

QUESTIONS:

What is the objective the voltage regulator?

A	**Performance**		**10**
B	**Report Writing**		**10**
C	**Contex Problem**		**10**
D	**Total**		**10**

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EXPERIMENT NO. 9

AIM: **Verify the operation of schottky diode in rectification process at high frequency**

APPARATUS:

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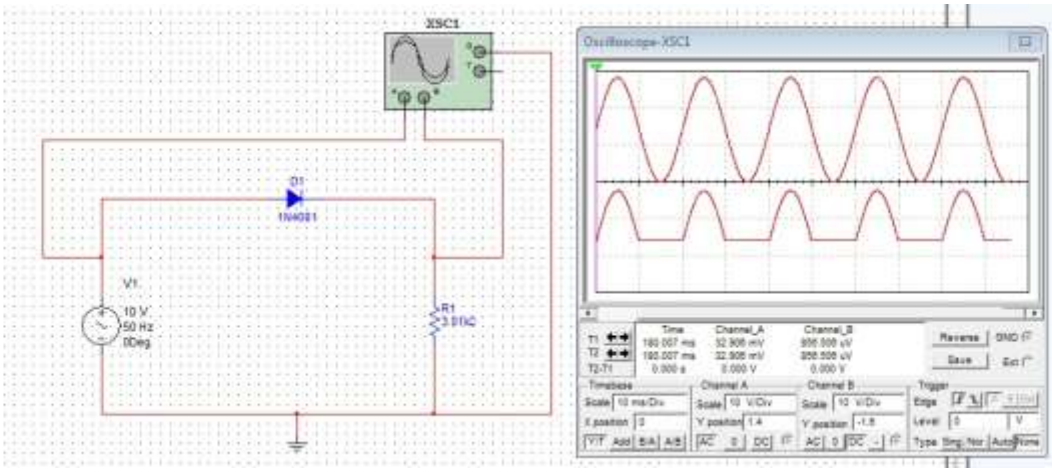
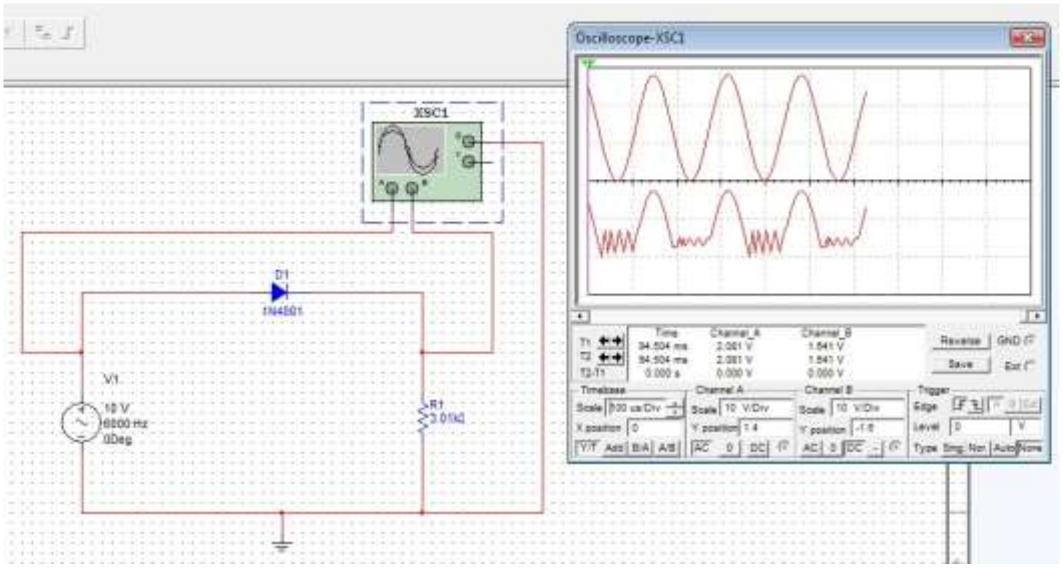
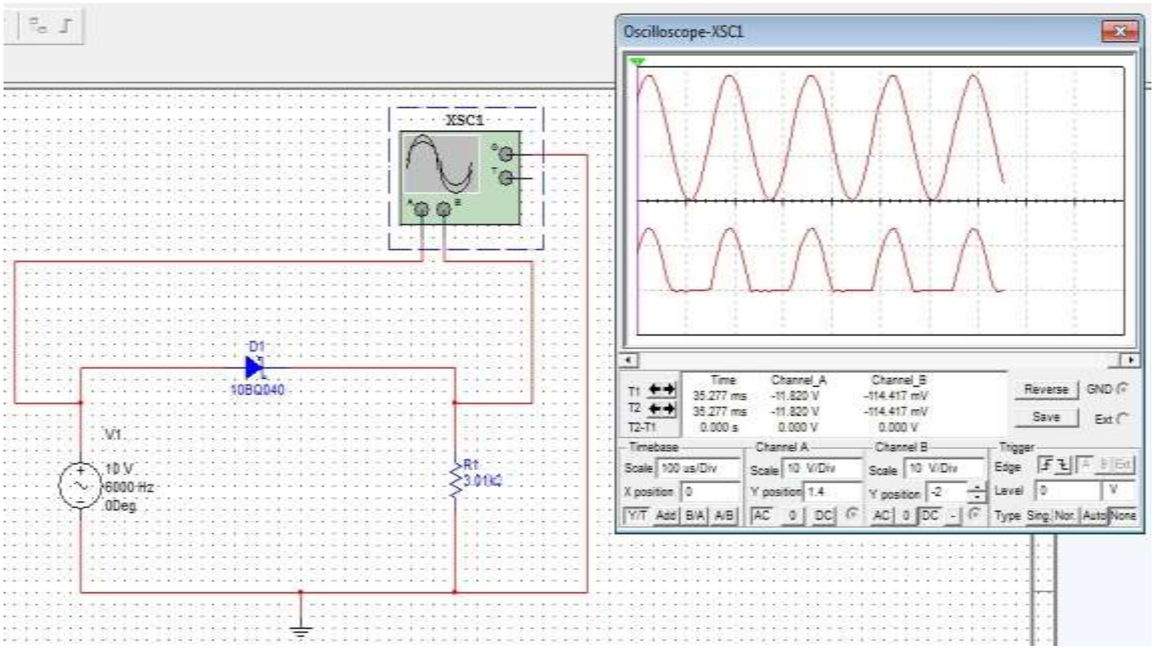
CIRCUIT DIAGRAM:



(Rectification at 50 Hz using PN Junction Diode)



(Rectification at 6000 Hz using PN Junction Diode)



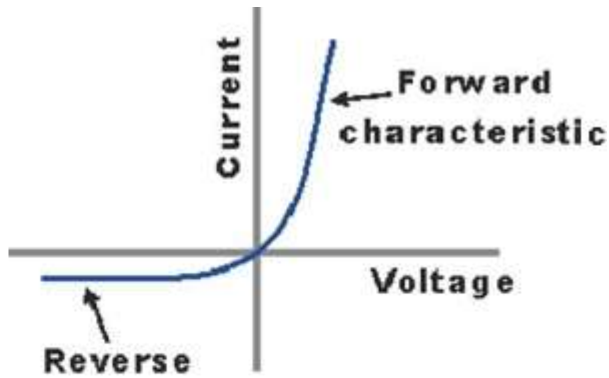
(Rectification at 6000 Hz using Schottky Diode)

THEORY: Schottky diode is a very useful form of diode. It is widely used within electronics circuits because it has some particularly useful characteristics. Its characteristics mean that it can be used where other forms of diode do not perform so successfully. The Schottky diode is what is called a majority carrier device. This gives it tremendous advantages in terms of speed because it does not rely on holes or electrons recombining when they enter the opposite type of region as in the case of a conventional diode. By making the devices small the normal RC type time constants can be reduced, making these diodes an order of magnitude faster than the conventional PN diodes. This factor is the prime reason why they are so popular in radio frequency applications.

The diode also has a much higher current density than an ordinary PN junction. This means that forward voltage drops are lower making the diode ideal for use in power rectification applications. Its main drawback is found in the level of its reverse current which is relatively high. For many uses this may not be a problem, but it is a factor which is worth watching when using it in more exacting applications.

The overall I-V characteristic is shown below. It can be seen that the Schottky diode has the typical forward semiconductor diode characteristic, but with a much lower turn on voltage. At high current levels it levels off and is limited by the series resistance or the maximum level of current injection. In the reverse direction breakdown occurs above a certain level. The mechanism is similar to the impact ionisation breakdown in a PN junction. The IV characteristic is generally that shown below.

In the forward direction the current rises exponentially, having a knee or turn on voltage of around 0.2 V. In the reverse direction, there is a greater level of reverse current than that experienced using a more conventional PN junction diode.



(V – I Characteristics of schottky diode)

The use of a guard ring in the fabrication of the diode has an effect on its performance in both forward and reverse directions. Both forward and reverse characteristics show a better level of performance. However the main advantage of incorporating a guard ring into the structure is to improve the reverse breakdown characteristic. There is around a 4: 1 difference in breakdown voltage between the two - the guard ring providing a distinct improvement in reverse breakdown. Some small signal diodes without a guard ring may have a reverse breakdown of only 5 to 10 V.

PROCEDURE:

- Open Multisim 8 software
- Make schematic as per circuit diagram
- Simulate and measure the output.

CONCLUSION:

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QUESTIONS:

Give application of Schottky diode.

A	**Performance**		**10**
B	**Report Writing**		**10**
C	**Contex Problem**		**10**
D	**Total**		**10**

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EXPERIMENT NO. 10

AIM: **To Plot & Study input-output characteristics of common Emitter configuration of Transistor**.

APPARATUS:

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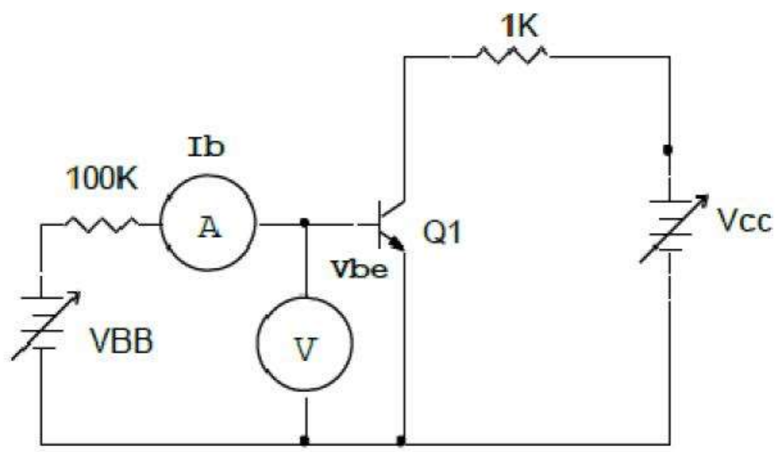
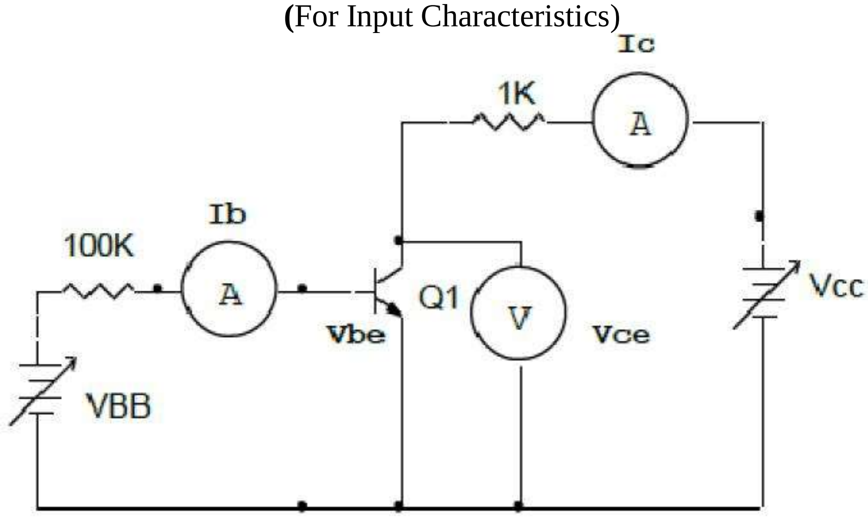
CIRCUIT DIAGRAM:



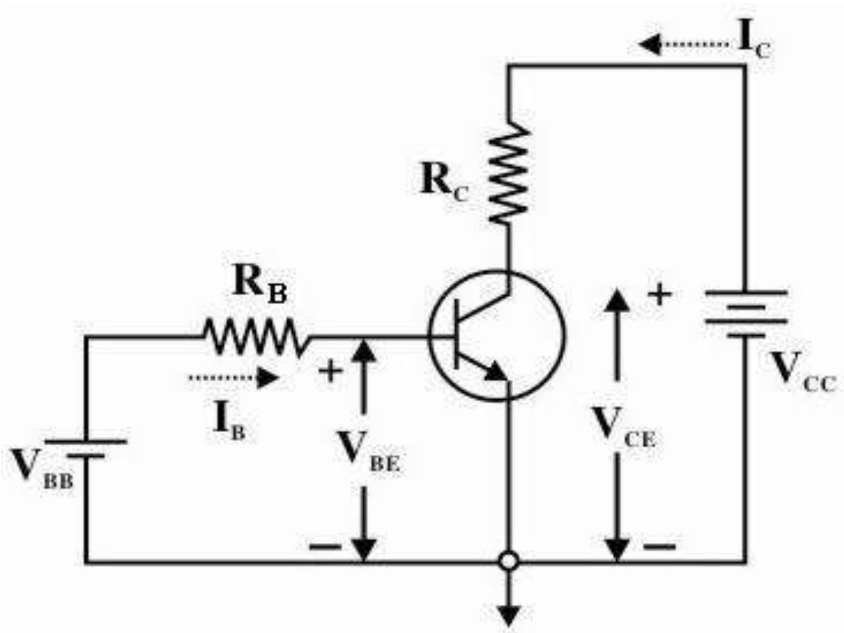
(For Input Characteristics)



(For Output Characteristics)

THEORY: Transistor is three terminal active device having terminals collector, base and emitter. Transistor is widely used in amplifier, oscillator, electronic switch and so many other electronics circuits for variety of applications. To understand operation of the transistor, we use three configurations common emitter, common base and common collector. In this practical, we will understand common emitter configuration. As the name suggest, emitter is common between input and output. Input is applied to base and output is taken from collector.

We will obtain input characteristics and output characteristics of common emitter (CE) configuration. We will connect variable DC power supply at VBB and VCC to obtain characteristics. Input voltage in CE configuration is base-emitter voltage Vbe and input current is base current Ib. Output voltage in CE configuration is collector to emitter voltage VCE and output current is collector current Ic. We will use multi-meter to measure these voltages and currents for different characteristics. Collector to emitter junction is reverse biased and base to emitter junction is forward biased.



(Circuit Diagram for CE Configuration**)**

The CE configuration is widely used in amplifier circuits because it provides voltage gain as well as current gain. In CB configuration current gain is less than unity. In CC configuration voltage gain is less than unity. Input resistance of CE configuration is less than CC configuration and more than CB configuration. Output resistance of CE configuration is more than CC configuration and less than CB configuration.

PROCEDURE:

For Input characteristics

For Output characteristics

OBSERVATION TABLE:

For Input characteristics

Sr. No.	V_{CE} =		V_{CE} =	
	V_{BE} (Volt)	I_B(μA)	V_{BE} (Volt)	I_B(μA)
1.				
2.				
3.				
4.				
5.				
6.				
7.				

For Output characteristics

Sr. No.	I_B =		I_B =	
	V_{CE} (Volt)	I_C(mA)	V_{CE} (Volt)	I_C(mA)
1.				
2.				
3.				
4.				
5.				
6.				
7.				

CONCLUSION:

QUESTIONS:

Compare CE & CB configuration of the transistor

What is use of CC configuration?

A	**Performance**		**10**
B	**Report Writing**		**10**
C	**Contex Problem**		**10**
D	**Total**		**10**

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