



LABORATORY MANUAL

B.Tech. Semester- II

ELECTRONICS ENGINEERING-I LAB

Subject code: ECE-102P

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DEPARTMENT OF APPLIED SCIENCE & HUMANITIES

DRONACHARYA COLLEGE OF ENGINEERING

KHENTAWAS, FARRUKH NAGAR, GURUGRAM (HARYANA)

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Vision and Mission of the Institute

Vision:

Empowering human values and advanced technical education to navigate and address global challenges with excellence.

Mission:

- **M1** - Seamlessly integrate human values with advanced technical education.
- **M2** - Supporting the cultivation of a new generation of innovators who are not only skilled but also ethically responsible.
- **M3** - Inspire global citizens who are equipped to create positive and sustainable impact, driving progress towards a more inclusive and harmonious world.

Vision and Mission of the Department

Vision

- To establish a strong foundation for first-year engineering students, aiming to equip them with the skills to innovate and devise engineering solutions.

Mission

- **M1:** To develop a solid foundation of knowledge and hands on experience in budding technocrats, empowering them to apply scientific principles to address complex engineering challenges.
- **M2:** To provide education that fosters comprehension and collaboration between engineering and other core field of Applied Sciences.
- **M3:** To inculcate values and ethics in students and make them responsible citizens of India.

Program Educational Objectives (PEOs)

- **PEO1:** PEO1: To instill the basic principles of Applied Sciences to enable students learn technical subjects effectively.
- **PEO2:** To equip students with innovative skills that improve their practical understanding enabling them to solve real-world challenges effectively.
- **PEO3:** To enhance students' team-building skills and leadership qualities continuously through social, cultural, and environmental activities.

Programme Outcomes (POs)

- PO1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- PO2: Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- PO3: Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO4: Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- PO6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- PO7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- PO9: Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- PO11: Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

University Syllabus

1. Study of lab equipments and components: CRO, Multimeter, Function Generator, Power supply- Active, Passive Components & Bread Board.
2. Study of V-I Characteristics of Si and Ge Diodes
3. Study of Zener Diode Characteristics and Zener Diode as Voltage Regulator
4. Study of Half Wave and Full Wave Rectifiers
5. Study of Rectifiers with Filters
6. Study of BJT Characteristics
7. Study of FET Characteristics
8. To plot V-I Characteristics of DIAC.
9. To draw V-I characteristics of TRIAC for different values of Gate Currents.
10. Study of Characteristic of silicon-controlled rectifier.

Course Outcomes (COs)

Upon successful completion of the course, the students will be able to:

CO1: To be exposed to the characteristics of basic electronic devices.

CO2: To introduce p-n junction theory, operation of the semiconductor devices and their use in basic electronic circuits.

CO3: To introduce BJT & FET, operation of the semiconductor devices and their use in basic electronic circuits.

CO4: Ability to design and analyze simple rectifiers and voltage regulators using diodes.

CO5: Ability to describe the behavior of special purpose diodes.

CO-PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----------|------------|-----|------------|------------|----------|-----|-----|----------|----------|----------|----------|----------|
| CO1 | | | | 2 | 3 | | | 1 | 2 | 2 | 2 | 2 |
| CO2 | | | 1 | | 3 | | | 1 | 2 | 2 | 2 | 2 |
| CO3 | | | | 2 | 3 | | | 1 | 2 | 2 | 2 | 2 |
| CO4 | 1 | | | 2 | 3 | | | 1 | 2 | 2 | 2 | 2 |
| CO5 | | | 2 | 2 | 3 | | | 1 | 2 | 2 | 2 | 2 |
| CO | 0.2 | | 0.6 | 1.6 | 3 | | | 1 | 2 | 2 | 2 | 2 |

CO-PSO Mapping

| | PSO1 | PSO2 | PSO3 |
|-----------|------|----------|----------|
| CO1 | | 2 | 2 |
| CO2 | | 2 | 2 |
| CO3 | | 2 | 2 |
| CO4 | | 2 | 2 |
| CO5 | | 2 | 2 |
| CO | | 2 | 2 |

Course Overview

Electronics Engineering-I Lab is to equip the students with in-depth basic concepts and understanding of the principles of operation, construction and characteristics of semiconductor devices, and their utilization in basic electronics building blocks and their performances practically. A major part of the module involves students working in teams to develop the knowledge of basic electronic devices, which gives practical experience in the field of electronics.

The following guidelines should be followed regarding award of marks:

Class Work : 50 Marks

Theory : 50 Marks

Total : 100 Marks

Duration of Exam. : 3 Hrs.

General instructions: Practical examination to be conducted immediately after the Pre university examinations covering entire lab experiments given above. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per group should not exceed 5 and in a batch size of not more than 30. Students shall be allowed for the University examination only on submitting the duly certified internal examination record. The external examiner shall endorse the record and conduct the external examination as per guidelines laid by affiliated university.

Electronics Engineering-I Lab (ECE-102P)

List of Experiments mapped with COs

| S.no. | List of Experiments | Course Outcome | Page No. |
|--------------|--|-----------------------|-----------------|
| 1 | Study of lab equipments and components: CRO, Multimeter, Function Generator, Power supply- Active, Passive Components & Bread Board. | CO1 | 1-9 |
| 2 | Study of V-I Characteristics of Si and Ge Diodes | CO2 | 10-12 |
| 3 | Study of Zener Diode Characteristics and Zener Diode as Voltage Regulator | CO4 | 13-17 |
| 4 | Study of Half Wave and Full Wave Rectifiers | CO4 | 18-21 |
| 5 | Study of Rectifiers with Filters | CO4 | 22-24 |
| 6 | Study of BJT Characteristics | CO3 | 25-27 |
| 7 | Study of FET Characteristics | CO3 | 28-30 |
| 8 | To plot V-I Characteristics of DIAC. | CO5 | 31-33 |
| 9 | To draw V-I characteristics of TRIAC for different values of Gate Currents. | CO5 | 34-36 |
| 10 | Study of Characteristic of silicon-controlled rectifier. | CO5 | 37-39 |

DOs and DON'Ts

DOs

1. Be regular to the lab.
2. Follow proper dress code.
3. Maintain Silence.
4. Know the theory behind the experiment before coming to the lab.
5. Put your bags in the designated area
6. Connect circuit properly.
7. Avoid unnecessary talking while doing the experiment.
8. Arrange your chair properly when you are leaving the lab.
9. Ask permission to switch on the power after connecting the wires.

DON'Ts

1. Avoid contact with energized circuits.
2. Disconnect the power source before servicing or changing the connection of equipment.
3. When it is necessary to handle equipment that is plugged in, be sure hands are dry.
4. Do not make circuit changes or perform any wiring when power is on.
5. Powered equipment can be hot! Use caution when handling equipment after it has been operating.
6. Do your wiring, setup, and a careful circuit checkout before applying power.
7. Use wires of appropriate length. Do not allow them to drape over your equipment. Avoid splices, which create live surfaces. When running a pair of wires to adjacent terminals, twist the wires together so they don't dangle. This also neatens your work and will save time.
8. Do not touch anything if your hands are wet. The "one-hand" approach is safest.
9. Tea, Coffee, Water & Eatables are not allowed in the Lab.

General Safety Precautions

Precautions (In case of Injury or Electric Shock)

1. To break the victim with live electric source, use an insulator such as fire wood or plastic to break the contact. Do not touch the victim with bare hands to avoid the risk of electrifying yourself.
2. Unplug the risk of faulty equipment. If main circuit breaker is accessible, turn the circuit off.
3. If the victim is unconscious, start resuscitation immediately, use your hands to press the chest in and out to continue breathing function. Use mouth-to-mouth resuscitation if necessary.
4. Immediately call medical emergency and security. Remember! Time is critical; be best.

Precautions (In case of Fire)

1. Turn the equipment off. If power switch is not immediately accessible, take plug off.
 2. If fire continues, try to curb the fire, if possible, by using the fire extinguisher or by covering it with a heavy cloth if possible isolate the burning equipment from the other surrounding equipment.
 3. Sound the fire alarm by activating the nearest alarm switch located in the hallway.
4. Call security and emergency department immediately:

Emergency : **Reception**
Security : **Main Gate**

Guidelines to students for report preparation

All students are required to maintain a record of the experiments conducted by them. Guidelines for its preparation are as follows:-

1) All files must contain a title page followed by an index page. *The files will not be signed by the faculty without an entry in the index page.*

2) Student's Name, Roll number and date of conduction of experiment must be written on all pages.

3) For each experiment, the record must contain the following

- (i) Aim/Objective of the experiment
- (ii) Apparatus Required
- (iii) Circuit Diagram
- (iv) Observation Table
- (v) Results/ output

Note:

1. Students must bring their lab file along with them whenever they come for the lab.
2. Students must ensure that their lab file is regularly evaluated.

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Lab Assessment Criteria

An estimated 10 lab classes are conducted in a semester for each lab course. These lab classes are assessed continuously. Each lab experiment is evaluated based on 5 assessment criteria as shown in following table. Assessed performance in each experiment is used to compute CO attainment as well as internal marks in the lab course.

| Grading Criteria | Exemplary (4) | Competent (3) | Needs Improvement (2) | Poor (1) |
|--|---|--|--|---|
| AC1: Pre-Lab written work (this may be assessed through viva) | Complete procedure with underlined concept is properly written | Underlined concept is written but procedure is incomplete | Not able to write concept and procedure | Underlined concept is not clearly understood |
| AC2: Program Writing/ Modeling | Assigned problem is properly analyzed, correct solution designed, appropriate language constructs/ tools are applied, Program/solution written is readable | Assigned problem is properly analyzed, correct solution designed, appropriate language constructs/ tools are applied | Assigned problem is properly analyzed & correct solution designed | Assigned problem is properly analyzed |
| AC3: Identification & Removal of errors/ bugs | Able to identify errors/ bugs and remove them | Able to identify errors/ bugs and remove them with little bit of guidance | Is dependent totally on someone for identification of errors/ bugs and their removal | Unable to understand the reason for errors/ bugs even after they are explicitly pointed out |
| AC4: Execution & Demonstration | All variants of input /output are tested, Solution is well demonstrated and implemented concept is clearly explained | All variants of input /output are not tested, However, solution is well demonstrated and implemented concept is clearly explained | Only few variants of input /output are tested, Solution is well demonstrated but implemented concept is not clearly explained | Solution is not well demonstrated and implemented concept is not clearly explained |
| AC5: Lab Record Assessment | All assigned problems are well recorded with objective, design constructs and solution along with Performance analysis using all variants of input and output | More than 70 % of the assigned problems are well recorded with objective, design constructs and solution along with Performance analysis is done with all variants of input and output | Less than 70 % of the assigned problems are well recorded with objective, design constructs and solution along with Performance analysis is done with all variants of input and output | |

LAB EXPERIMENTS

LAB EXPERIMENT 1

OBJECTIVE:

Study of lab equipments and components: CRO, Multimeter, Function Generator, Power supply, Active, Passive Components & Bread Board.

APPARATUS REQUIRED:

CRO, Multimeter, Function Generator, Power supply, Active, Passive Components & Bread Board.

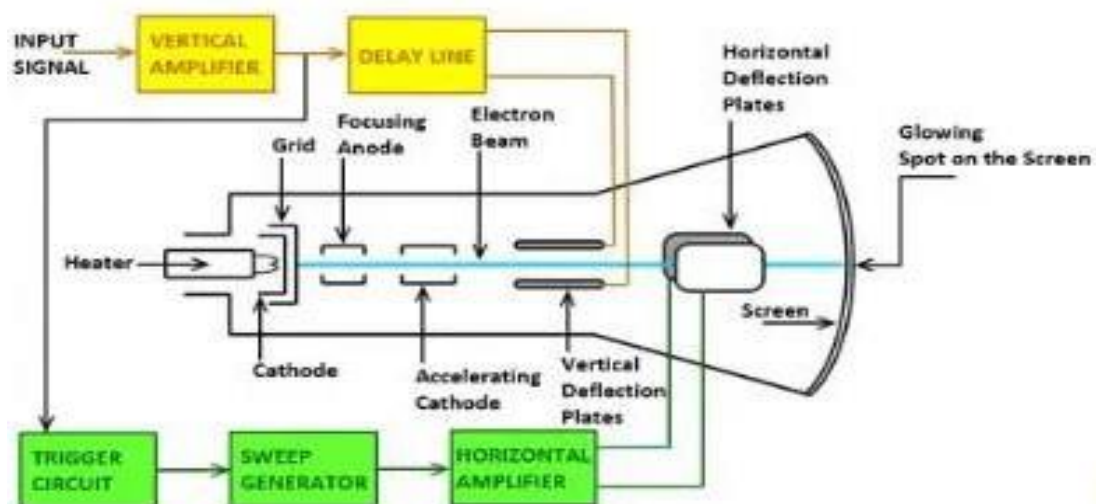
THEORY:

CATHODE RAY OSCILLOSCOPE (CRO):

A Cathode Ray Oscilloscope (CRO) is an instrument generally used in a laboratory to display, measure and analyze various waveforms of electrical circuits. A cathode ray oscilloscope is a very fast X-Y plotter that can display an input signal versus time or another signal.

Cathode ray oscilloscopes use luminous spots which are produced by striking the beam of electrons and this luminous spot moves in response variation in the input quantity. At this moment one question must be arise in our mind that why we are using only an electron beam? The reason behind this is low effects of beam of electrons that can be used for following the changes in the instantaneous values of rapidly changing input quantity. The general forms of cathode ray oscilloscope operate on voltages. So the input quantity that we have talked above is voltage. Nowadays, with the help of transducers it is possible to convert various physical quantities like current, pressure, acceleration etc to voltage thus it enable us to have a visual representations of these various quantities on cathode ray oscilloscope.

The cathode ray is a beam of electrons which are emitted by the heated cathode (negative electrode)



and accelerated toward the fluorescent screen. The assembly of the cathode, intensity grid, focus grid, and accelerating anode (positive electrode) is called an electron gun. Its purpose is to generate the electron beam and control its intensity and focus. Between the electron gun and the fluorescent screen

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are two pair of metal plates - one oriented to provide horizontal deflection of the beam and one pair oriented to give vertical

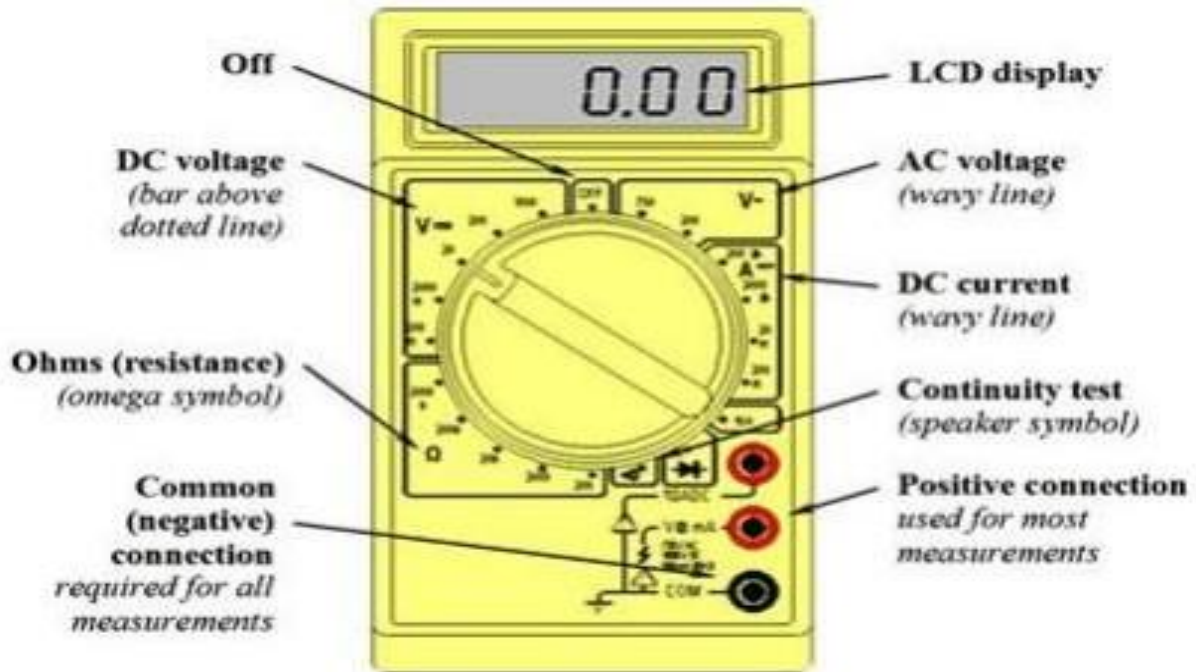
deflection to the beam. These plates are thus referred to as the horizontal and vertical deflection plates. The combination of these two deflections allows the beam to reach any portion of the fluorescent screen. Wherever the electron beam hits the screen, the phosphor is excited and light is emitted from that point. This conversion of electron energy into light allows us to write with points or lines of light on an otherwise darkened screen.

In the most common use of the oscilloscope the signal to be studied is first amplified and then applied to the vertical (deflection) plates to deflect the beam vertically and at the same time a voltage that increases linearly with time is applied to the horizontal (deflection) plates thus causing the beam to be deflected horizontally at a uniform (constant) rate. The signal applied to the vertical plates is thus displayed on the screen as a function of time. The horizontal axis serves as a uniform time scale.

MULTIMETER:

A Multimeter is an electronic instrument, every electronic technician and engineers widely used piece of test equipment. A multimeter is mainly used to measure the three basic electrical characteristics of voltage, current, and resistance. It can also be used to test continuity between two points in an electrical circuit. The multimeter has multi functionalities like, it acts like ammeter, voltmeter, and ohmmeter. Multimeters can be used for testing batteries, household wiring, electric motors, and power supplies.

A multimeter or a multimeter, also known as a VOM (Volt-Ohm meter), is an electronic measuring instrument that combines several measurement functions in one unit. A typical multimeter may include features such as the ability to measure voltage, current and resistance. Multimeters may use analog or digital circuits— analog multimeters (AMM) and digital multimeters (often abbreviated DMM or DVOM.) Analog instruments are usually based on a microammeter whose pointer moves over a scale calibrated for all the different measurements that can be made; digital instruments usually display digits, but may display a bar of a length proportional to the quantity being measured. A multimeter can be a hand-held device useful for basic fault finding and field service work or a bench instrument which can measure to a very high degree of accuracy. They can be used to troubleshoot electrical problems in a wide array of industrial and household devices such as electronic equipment, motor controls, domestic appliances, power supplies, and wiring systems.

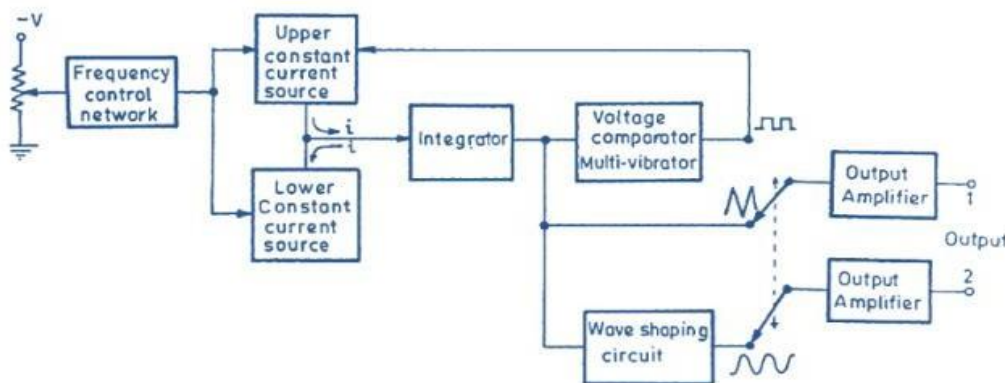


FUNCTION GENERATOR:

A function generator is usually a piece of electronic test equipment or software used to generate different types of electrical waveforms over a wide range of frequencies. Some of the most common waveforms produced by the function generator are the sine, square, triangular and sawtooth shapes. These waveforms can be either repetitive or single-shot (which requires an internal or external trigger source). Integrated circuits used to generate waveforms may also be described as function generator ICs. The function generator is used to generate a wide range of alternating-current (AC) signals. There are various parameters that can be varied for each waveform, three of them are of particular interest:

1. Peak-to-peak voltage (0-10 V)
2. Frequency (0-15MHz)
3. DC offset.

Block Diagram of Function Generator:



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Function generator controls:

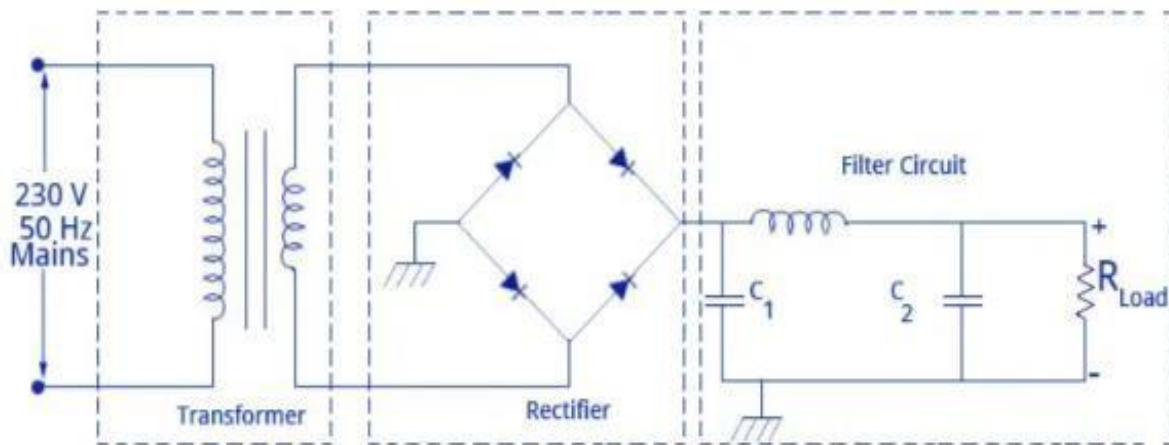
In addition to a selection of the basic waveforms that are available, other controls on the function generator may include:

- **Frequency:** As would be expected, this control alters the basic frequency at which the waveform repeats. It is independent of the waveform type.
- **Waveform type :** This enables the different basic waveform types to be selected:
Sine wave
Square wave
Triangular wave
- **DC offset:** This alters the average voltage of a signal relative to 0V or ground.
- **Duty cycle:** This control on the function generator changes the ratio of high voltage to low voltage time in a square wave signal, i.e. changing the waveform from a square wave with a 1:1 duty cycle to a pulse waveform, or a triangular waveform with equal rise and fall times to a sawtooth.

POWER SUPPLY:

A power supply is an electrical device that supplies electric power to an electrical load. The main purpose of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters.

An unregulated power supply consists of a transformer, a rectifier, and a filter. There are three reasons why such a simple system is not good enough for some applications. The first reason is its poor regulation; the output voltage is far from constant as the load varies. The second one is that the dc output voltage varies directly with the ac input. The third one is that the dc output varies with the temperature, particularly if semiconductor devices are used. An electronic feedback or control circuit is used in conjunction with an unregulated power supply to overcome the above three shortcomings and also to reduce the ripple voltage. Such a system is called a regulated power supply.



Unregulated Power Supply

ACTIVE COMPONENTS:

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An active component is an electronic component which supplies energy to a circuit.

Common examples of active components include:

- Voltage sources
- Current sources
- Generators (such as alternators and DC generators)
- All different types of transistors (such as bipolar junction transistors, MOSFETS, FETs, and JFET)
- Diodes (such as Zener diodes, photodiodes, Schottky diodes, and LEDs)

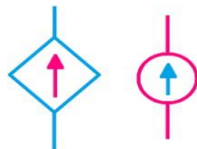
Voltage Sources

A voltage source is an example of an active component in a circuit. When current leaves from the positive terminal of the voltage source, energy is being supplied to the circuit. As per the definition of an active element, a battery can also be considered as an active element, as it continuously delivers energy to the circuit during discharging.



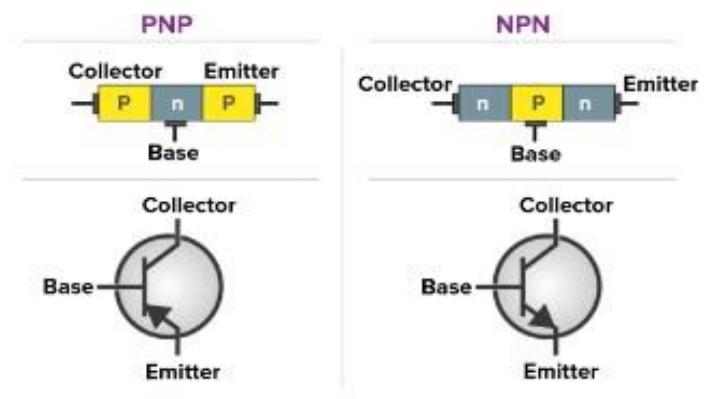
Current Sources

A current source is also considered an active component. The current supplied to the circuit by an ideal current source is independent of circuit voltage. As a current source is controlling the flow of charge in a circuit, it is classified as an active element.



Transistors

Although not as obvious as a current or voltage source—transistors are also an active circuit component. This is because transistors are able to amplify the power of a signal (see our article on transistors as an amplifier if you want to know exactly how).



PASSIVE COMPONENTS:

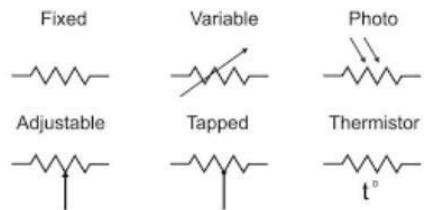
A passive component is an electronic component which can only receive energy, which it can either dissipate, absorb or store it in an electric field or a magnetic field. Passive elements do not need any form of electrical power to operate. As the name 'passive' suggests – passive devices do not provide gain or amplification. Passive components cannot amplify, oscillate, or generate an electrical signal.

Common examples of passive components include:

- Resistors
- Inductors
- Capacitors
- Transformers

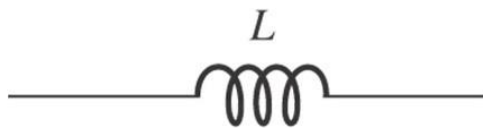
Resistors

A resistor is taken as a passive element since it cannot deliver any energy to a circuit. Instead resistors can only receive energy which they can dissipate as heat as long as current flows through it.



Inductors

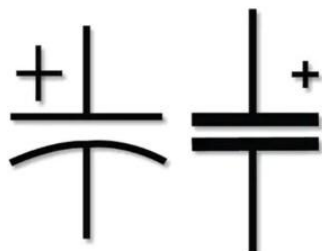
An inductor is also considered as a passive element of circuit, because it can store energy in it as a magnetic field, and can deliver that energy to the circuit, but not in continuous basis. The energy absorbing and delivering capacity of an inductor is limited and transient in nature. That is why an inductor is taken as a passive element of a circuit.



Capacitors

A capacitor is considered as a passive element because it can store energy in it as electric field. The energy dealing capacity of a capacitor is limited and transient – it is not actually supplying energy, it is storing it for later use.

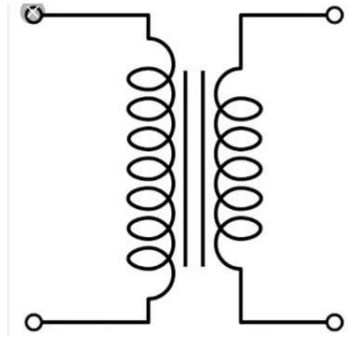
As such it is not considered an active component since no energy is being supplied or amplified.



Transformers

A transformer is also a passive electronic component. Although this can seem surprising since transformers are often used to raise voltage levels – remember that power is kept constant.

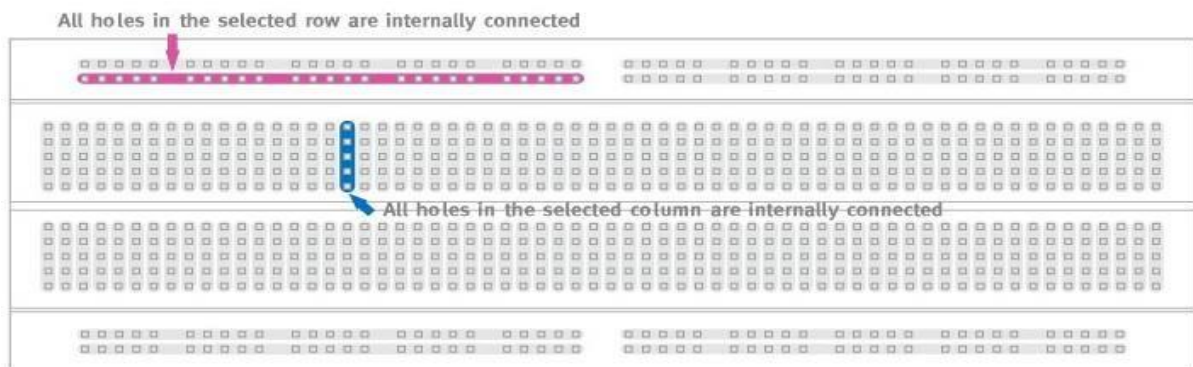
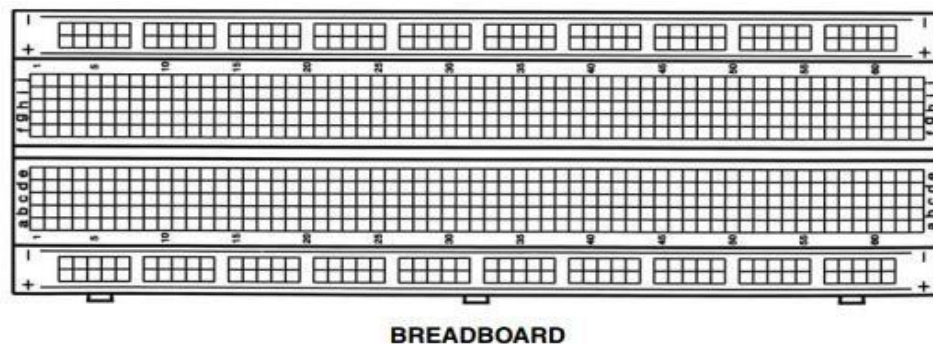
When transformers step up (or step down) voltage, power and energy remain the same on the primary and secondary side. As energy is not actually being amplified – a transformer is classified as a passive element.



BREAD BOARD:

A breadboard is a rectangular plastic board with a bunch of tiny holes in it. These holes let you easily insert electronic components to prototype (meaning to build and test an early version of) an electronic circuit, like this one with a battery, switch, resistor, and an LED (light-emitting diode).

Breadboards are used for mounting electronic components and to make connecting them together easy, and are similar to the printed circuits boards used in most electronic devices. Breadboards make it easy to add and remove components.



RESULT:

We have successfully study of lab equipments and components.

QUIZ QUESTIONS WITH ANSWERS:

Q.1. What is a Cathode Ray Oscilloscope (CRO)?

Ans: A CRO is an electronic device with a CRT as its main component and other associated circuits consisting of a power supply unit, a sawtooth-wave generator, horizon and vertical amplifier.

Q2. How is CRO superior to ordinary instrument?

Ans: CRO is an electronic device that gives graphical representation of alternating quantities under examination. The CRO gives very accurate measurements and is free from the errors introduced by the moving parts.

Q3. For explain what vertical and horizontal plates are provide in a CRO?

Ans: Horizontal and vertical plates are provided between electron gun and screen to deflect the beam according to the input signal.

Q4. What are application of multimeter?

Ans: They can be used to troubleshoot electrical problems in a wide array of industrial and household devices such as electronic equipment, motor controls, domestic appliances, power supplies, and wiring systems.

Q5. In series RLC, when will the resonance occur?

Ans: $X_L = X_C$

Q6. Define electronic component.

Ans: Electronic components are the basic building blocks of electronic system or electronic circuit.

Q7. List different types of electronic components

Ans: Electronic components are mainly classified into two types:

- Passive components
- Active components

Q8. Define passive component.

Ans: A passive component is an electronic component that consumes energy in the form of voltage but does not supply energy.

Q9. What are the characteristics of active components?

Ans: the characteristics of active components are:

- Active components control the electric current flowing through them.
- Active components depend on the external voltage or current to work.
 - Active components amplify the power of an electrical signal.

Q10. Define active component.

Ans: Active component is an electronic component that consumes energy in the form of voltage or current and supplies energy in the form of voltage or current.

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Q11. List different types of passive components

Ans: The different types of passive components include:

- Resistors
- Capacitors
- Inductors

Q12. List different types of active components

Ans: The different types of active components include:

- Diode
- Transistor
- Integrated circuit

EXPERIMENT No. 2

OBJECTIVE:

Study of V-I Characteristics of Diodes.

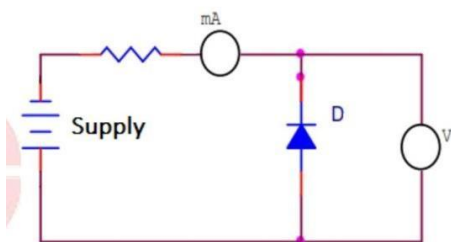
APPARATUS REQUIRED:

Diode Characteristics Kit, Power Supply, Ammeter (0-20mA), Voltmeter (0-20V), Connecting Leads.

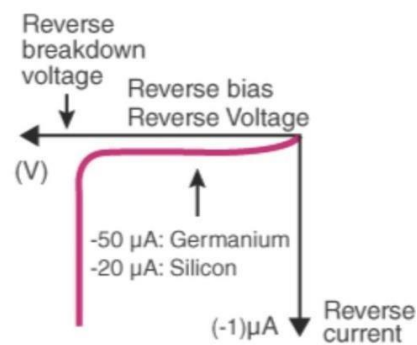
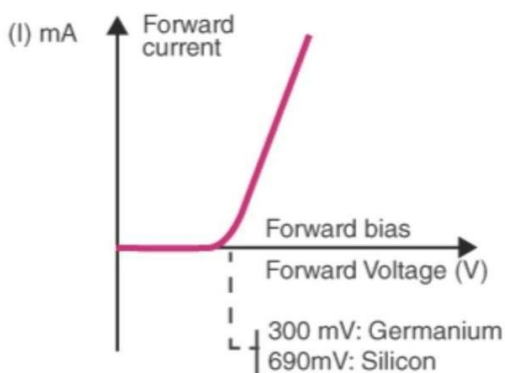
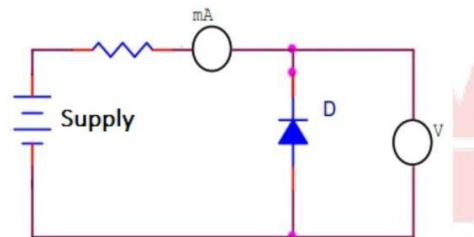
THEORY:

A P-N junction is known as Semiconductor diode or Crystal diode. It is the combination of P-type & N-type Semiconductor. This offers nearly zero resistance to current on forward biasing & nearly infinite Resistance to the flow of current when in reverse biased. Forward biasing: When P-type semiconductor is connected to the +ve terminal and N-type to -ve terminal of voltage source. Nearly zero resistance is offered to the flow of current. Reverse biasing: When P-type semiconductor is connected to the -ve terminal and N-type to +ve terminal. Nearly zero current flow in this condition.

(1) When diode is forward biased



(2) When diode is reverse biased

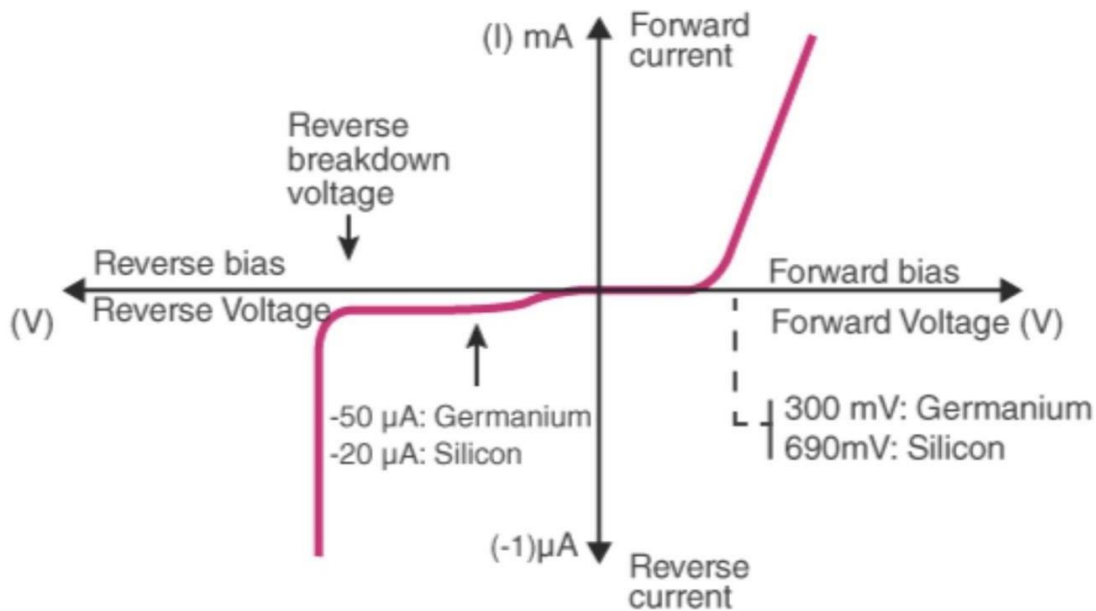


PROCEDURE:

1. Connect the circuit as shown in fig.
2. Switch on the power supply.
3. Vary the value of input dc supply in steps.
4. Note down the ammeter & voltmeter readings for each step.
5. Plot the graph of Voltage Vs Current.

OBSERVATION TABLE:

| S. No. | Forward Biased | | Reverse Biased | |
|--------|----------------|--------|----------------|--------------|
| | V | I (mA) | V | I (μ A) |
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |
| 4. | | | | |
| 5. | | | | |



RESULT:

VI characteristics of semiconductor rectifier diode has been plotted.

PRECAUTIONS:

1. All the connection should be tight.
2. Ammeter is always connected in series in the circuit while voltmeter is parallel to the conductor.
3. The electrical current should not flow the circuit for long time, otherwise its temperature will increase and the result will be affected.
4. Maximum reading of voltmeter should be greater than the electromotive force of the cell.
5. It should be care that the values of the components of the circuit is does not exceed to their ratings (maximum value).
6. Before the circuit connection it should be check out working condition of all the components.

QUIZ WITH ANSWERS:

Q1. Define semiconductor diode?

A. A PN – junction is called semiconductor diode.

Q2. Define depletion layer?

A. The region having uncompensated acceptor and donor ions.

Q3. What do you mean by forward biased?

A. When +ve terminal of battery is connected to P side & -ve terminal to N side of diode.

Q4. What do you mean by reverse biased?

A. When +ve terminal of battery is connected to N side & -ve terminal to P side of diode.

Q5. Define Knee voltage?

A. The forward voltage at which current through the junction starts increasing rapidly.

Q6. Define breakdown voltage?

A. Reverse voltage at which PN junction breaks down with sudden rise in reverse current.

Q7. Define max. Forward current?

A. It is highest instantaneous forward current that a PN junction can conduct without damage to Junction.

Q8. Define max. Power rating?

A. Max. Power that can be dissipated at junction without damage to it.

EXPERIMENT No. 3

OBJECTIVE:

Study of Zener Diode Characteristics and Zener Diode as Voltage Regulator.

APPARATUS REQUIRED:

Regulated DC power supply, Voltmeter, Connecting Wires, kit, Zener Diode, Two Voltmeter and Ammeter.

Specifications:

Breakdown Voltage = 5.1V, Power dissipation = 0.75W, Max. Forward Current = 1A

THEORY:

An ideal P-N Junction diode does not conduct in reverse biased condition. A zener diode conducts excellently even in reverse biased condition. These diodes operate at a precise value of voltage called break down voltage. A zener diode when forward biased behaves like an ordinary P-N junction diode. A zener diode when reverse biased can either undergo avalanche break down or zener break down.

Avalanche break down:-If both p-side and n-side of the diode are lightly doped, depletion region at the junction widens. Application of a very large electric field at the junction may rupture covalent bonding between electrons. Such rupture leads to the generation of a large number of charge carriers resulting in avalanche multiplication.

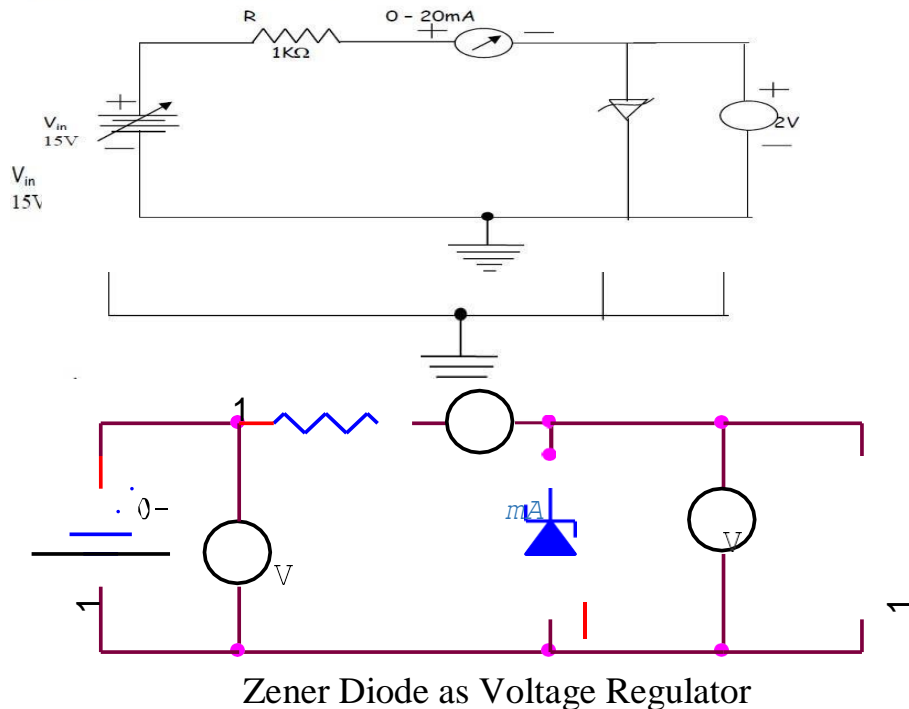
Zener break down:-If both p-side and n-side of the diode are heavily doped, depletion region at the junction reduces. Application of even a small voltage at the junction ruptures covalent bonding and generates large number of charge carriers. Such sudden increase in the number of charge carriers results in zener mechanism.

The Zener diode is operated in the breakdown or zener region, the voltage across it is substantially constant for a large current of current through it. This characteristic permits it to be used as a voltage regulator. As the load Current increases, the Zener current decrease so that current through resistance R_s is constant. As out put voltage = $V_{in} - I_{rs}$, and I is constant, Therefore, output Voltage remains unchanged. The input voltage V_{in} increase, more current will flow through the zener, the voltage drop across R_s will increase but lode voltage would remain constant.

CIRCUIT DIAGRAM:

Circuit Diagram:

Fig (1) - Forward Bias Condition:



PROCEDURE:

Forward biased condition:

1. Connect the circuit as shown in fig (1).
2. Vary V_{zf} gradually and note down the corresponding readings of I_{zf} .
3. Step Size is not fixed because of non linear curve and vary the X-axis variable (i.e. if output variation is more, decrease input step size and vice versa).
4. Tabulate different forward currents obtained for different forward voltages.

Reverse biased condition:

1. Connect the circuit as shown in fig (2).
2. Vary V_{zr} gradually and note down the corresponding readings of I_{zr} .
3. Step Size is not fixed because of non linear curve and vary the X-axis variable (i.e. if output variation is more, decrease input step size and vice versa).
4. Tabulate different reverse currents obtained for different reverse voltages.

Zener Diode as Voltage Regulator:

1. Connect the circuit as per the circuit diagram
2. Keep load resistance constant (take maximum value of load resistance)
3. Vary input voltage and note down output voltage.
4. Now keep input voltage constant and vary load resistance and note down corresponding voltmeter reading.
5. Plot the respective graph

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OBSERVATIONS:

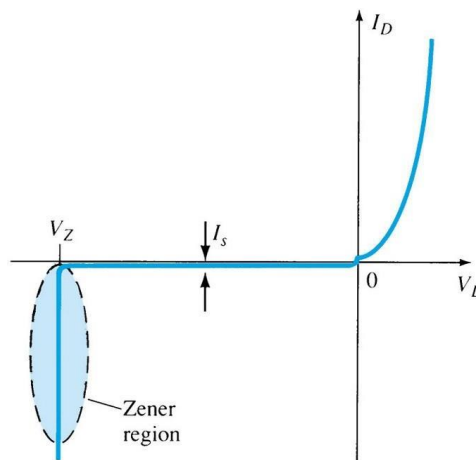
Zener diode in Forward Zener diode & reverse biased condition should be observed.

| | | | |
|---|---|--|--|
| Forward Voltage across the diode V_{z_f} (volts) | Forward current through the diode I_{z_f} (mA) | Reverse Voltage Across diode V_{zr} (volts) | Reverse current through the diode I_{zr} (mA) |
| | | | |

Zener Diode as Voltage Regulator:

| S. No | Vs(VOLT) | V(VOLT) | RL(E) | V (VOLT) |
|-------|-----------|----------|-------|----------|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |

CALCULATIONS FROM GRAPH:



Static forward Resistance $R_{dc} = V_f/I_f$ Dynamic forward Resistance $r_{ac} = \Delta V_f/\Delta I_f$ Static Reverse

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Resistance $R_{dc} = V_r/I_r$ Dynamic Reverse Resistance $r_{ac} = \Delta V_r/\Delta I_r$

PRECAUTIONS:

1. While doing the experiment do not exceed the ratings of the diode. This may lead to damage the diode.
2. Connect voltmeter and Ammeter in correct polarities as shown in the circuit diagram.
3. Do not switch **ON** the power supply unless you have checked the circuit connections as Per the circuit diagram.

RESULT:

1. The zener diode characteristics and zener diode as voltage regulator have been studied.
2. The zener resistance at the breakdown voltage was found to be =

QUIZ WITH ANSWERS:

Q1 Give applications of Zener diode?

A 1: Applications of Zener diode are (a) Voltage regulation (b) Meter protection (c) Zener diode as a peak clipper (d) Zener diode as a reference element

Q2 what is voltage regulation of Zener diode?

A 2: Voltage regulation is a measure of circuit's ability to maintain a constant output voltage even when either input voltage or load current varies.

Q3 what is Zener current?

A 3: The Zener current in the breakdown region of Zener diode is called Zener current.

Q4 Give the equation from which series resistance of Zener diode regulator determined?

A 4: The equation from which series resistance of Zener diode regulator determined is $R_S = (V_S - V_{OUT}) / I_{ZMAX}$ Where V_S is source voltage, V_{OUT} is output voltage & I_{ZMAX} is maximum current through Zener diode.

Q5 Give advantages of Zener diode regulator over other regulators?

A 5: Advantages of Zener diode regulator over other regulators are that they are smaller in size, lighter in weight and have longer life.

Q6. What is Zener diode?

A 6: Zener diode, also sometimes called the breakdown diode is a P-N junction diode specially designed for operation in the breakdown region in reverse bias condition.

Q7 Give several methods used to manufacture of Zener diodes?

A 7: several methods used to manufacture of Zener diodes are diffused structure, diffused and passivated structure and alloy diffused structure.

Q8 In passivated structure of a Zener diode by which layer edges of the junction are covered?

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A 8: In passivated structure of a Zener diode; SiO₂ layer edges of the junction are covered.

Q9 Give the voltage range availability of Zener diodes?

A 9: The voltage range availability of Zener diodes is 2.4v to 200v.

Q10. What is Zener voltage?

A 10: The voltage at which the Zener diode breaks down is called the Zener voltage.

EXPERIMENT No. 4

OBJECTIVE:

Study of Half Wave and Full Wave Rectifiers.

APPARATUS REQUIRED:

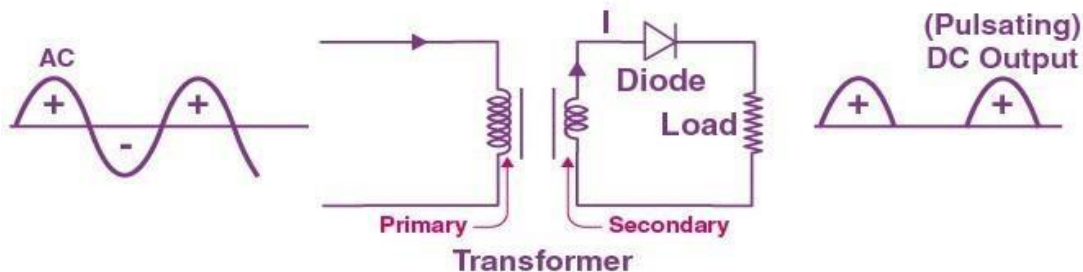
Power supply, rectifier kit, CRO, Connecting leads.

BRIEF THEORY:

Rectification is a process of conversion of AC to DC.

Half Wave Rectifier:

In half-wave rectifier, only one diode is used. During +ve half cycle the diode is forward biased & it conducts current through the load resistor R. During -ve half cycle diode is reverse biased Hence, no current flow through the circuit. Only +ve half cycle appears across the load, whereas, the -ve half cycle is suppressed.



Full Wave Rectifier:

In full-wave rectifier, when a.c supplied at the input, both the half cycle current flows through the load in the same direction. The following two circuits are commonly employed.

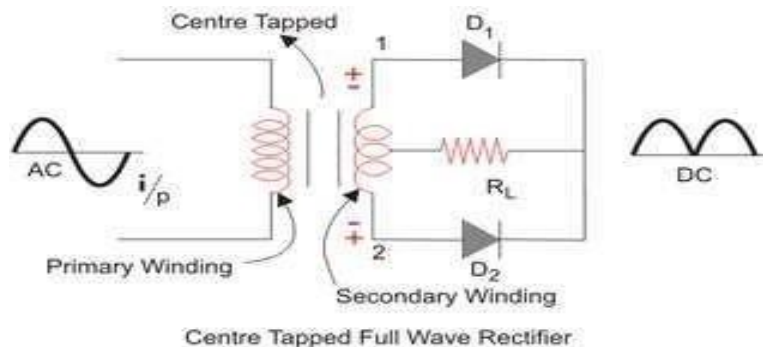
Centre-tap full-wave Rectifier:

In this rectifier, two diode & a center-tap transformer is used. During +ve half cycle the diode D1 is forward biased & D2 is reverse biased. Output will be obtained across load resistor R. During -ve half cycle diode D1 is reverse biased & D2 is forward biased. Output will be obtained cross load resistor R & the direction of output is same i.e., DC output is obtained.

Bridge Rectifier:

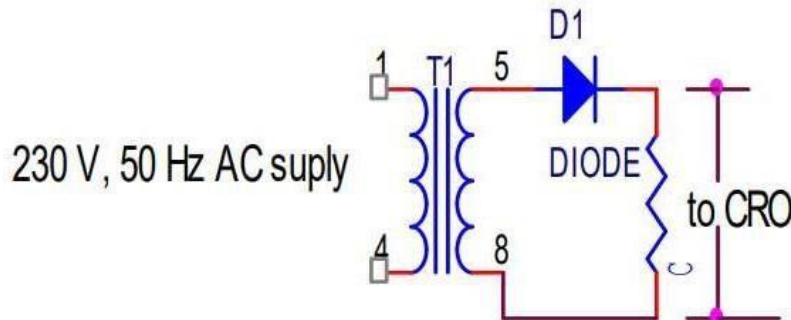
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The circuit Contains four diodes connected to form a bridge. In this an ordinary transformer is used. During +ve half cycle of secondary voltage, diodes D1 & D3 are forward Biased & diodes D2& D4 are reverse biased & vice versa.

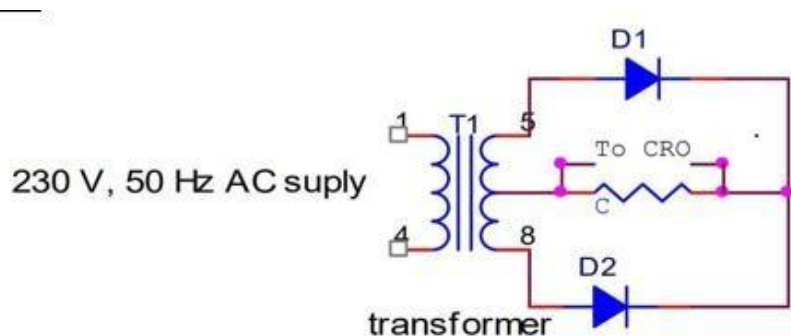


CIRCUIT DIAGRAM:

Half Wave Rectifier:



Full Wave Rectifier:



PROCEDURE:

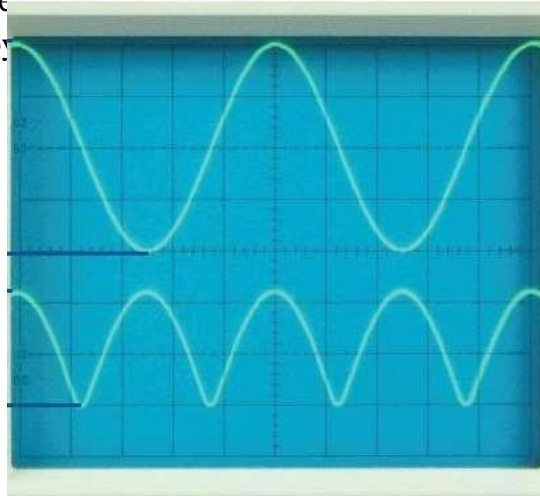
Half Wave Rectifier:

1. Connect the circuit as per the circuit diagram.
2. A high AC voltage is applied to the primary side of the step-down transformer. The obtained secondary low voltage is applied to the diode.
3. The diode is forward biased during the positive half cycle of the AC voltage and reverse biased during the negative half cycle.
4. The output is noted down on CRO.

5. Graph is drawn by noting down peak to peak amplitude of input and output voltage.

Full Wave Rectifier:

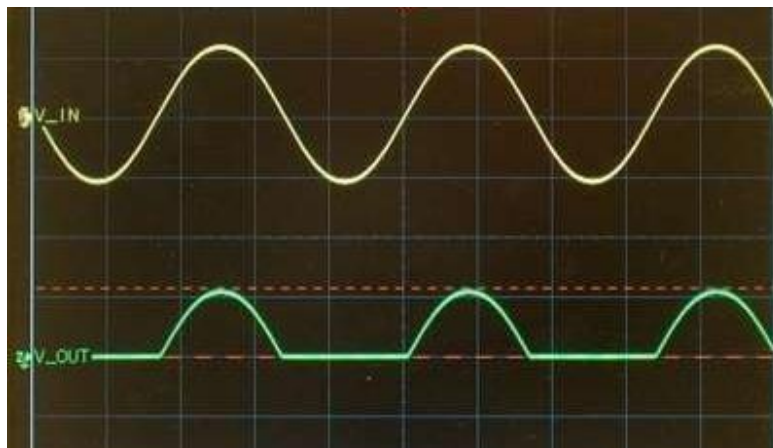
1. Connect the circuit as per the circuit diagram.
2. A high AC voltage is applied to the primary side of the step-down transformer. The obtained secondary low voltage is applied to the diode.
3. The diodes are forward biased during the positive half cycle of the AC voltage and reverse biased during the negative half cycle.
4. The output is noted down.
5. Graph is drawn by noting down peak to peak amplitude of input and output voltage



RESULT: Waveform of Half wave and full wave rectifier is observed.

PRECAUTIONS:

1. All the connection should be tight.
2. Handle the equipment's with care.
3. The electrical current should not flow the circuit for long time, otherwise its temperature will increase and the result will be affected.



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4. It should be care that the values of the components of the circuit is does not exceed to their ratings(maximum value).
5. Before the circuit connection it should be check out working condition of all the components.

QUIZ WITH ANSWERS:

Q1. Define Full wave rectifier?

Ans: In both the half cycles current flows through the load in the same direction.

Q.2. Which are different types of Full Wave rectifier?

Ans: Different types of full wave rectifier are Centre-Tap full wave rectifier & Bridge rectifier.

Q3. How many no. of diodes are used in full wave rectifier?

Ans: 4 No. of diodes are used for Bridge rectifier.

Q4. Give disadvantage of centre-Tap full wave rectifier?

Ans: Necessity of transformer with secondary winding.

Q5. Write ripple factor for FW rectifier?

Ans: The ripple factor for Full wave rectifier is 0.48.

Q6. What is the efficiency of FW rectifier?

Ans: Efficiency of full wave rectifier is 81.2%

Q7. Write advantages of bridge rectifier?

Ans: Suitable for high-voltage applications.

Q8. Write one feature of Full wave rectifier?

Ans: The current drawn in both the primary & secondary of the supply transformer is Sinusoidal.

Q9. Define Transformer Utilization Factor?

Ans: Transformer Utilization Factor (TUF) is the ratio of d.c power to be delivered to the load to the a.c rating of the Transformer secondary.

Q10. Write value for DC current?

Ans: DC current is $I_{dc} = I_m / \Pi$.

EXPERIMENT No. 5

OBJECTIVE:

Study of Rectifiers with Filters.

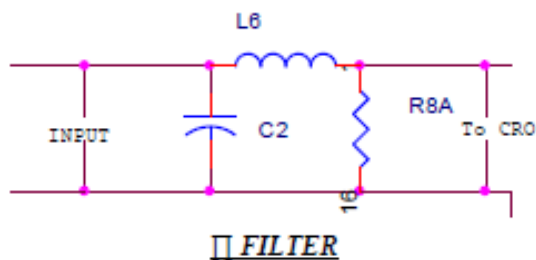
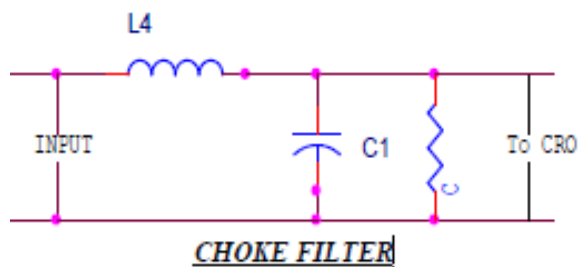
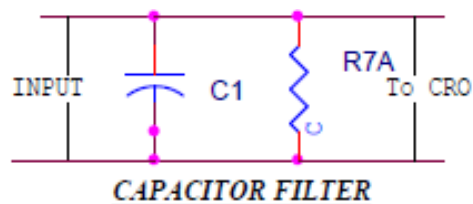
APPARATUS REQUIRED:

Power supply, filter kit, CRO, Connecting leads.

BRIEF THEORY:

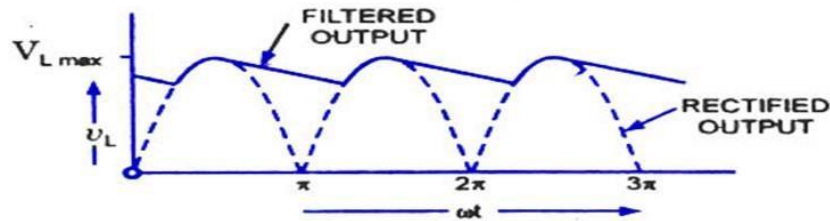
The output from any rectifier is not pure dc but also has some ac components, called ripples along it. It is important to reduce ripples from the pulsating dc supply available from rectifier circuits to the minimum. This is achieved by using a filter circuit which removes the ac components and allows only dc components to reach the load. A filter circuit is a device that converts pulsating output into a steady dc level. A filter circuit is generally a combination of inductors & capacitors. The filtering action of L & C depends upon the facts that an inductor allows dc only & capacitor allows ac only to pass.

CIRCUIT DIAGRAM:

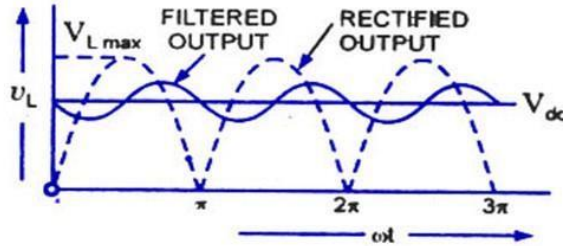


PROCEDURE:

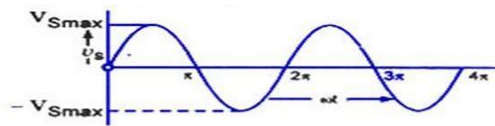
- (a) Connect the circuit as per the circuit diagram.
- (b) First introduce capacitor filter and note down the waveforms on CRO.
- (c) Then introduce inductor filter and note down the waveforms on CRO.
- (d) Now introduce Π -filter and note down the waveforms on CRO.



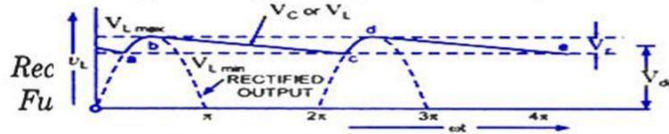
*Rectified and Filtered Output Voltage Waveforms
Full-Wave Rectifier With Capacitor
Input Filter*



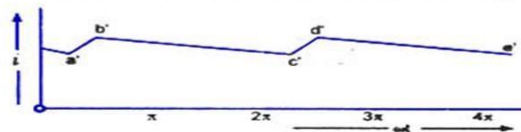
*Rectified and Filtered Output Voltage Waveform
Full-wave Rectifier With Choke-Input Filter*



Input Voltage Waveform To Rectifier



Rectified and Filtered Output Voltage Wavefo



*Load Current Waveform
Half-wave Rectifier With Shunt Capacitor Filter*

PRECAUTIONS:

1. Connections should be tight.
2. Handle the equipments with care.

RESULT:

We have successfully studied Rectifiers with Filters

QUIZ WITH ANSWERS:

Q1. What is filter?

Ans: The device that converts the pulsating output of a rectifier into a steady dc level is known as filter.

Q2. Give commonly used filters?

Ans: Commonly used filters are Series inductor filter Shunt capacitor filter LC filter Π filter.

Q3. Define ripple factor?

Ans: Ripple factor is defined as the ratio of rms value of the ac component to the dc value of the wave.

Q4. What is dc output voltage given by?

Ans: The dc output voltage is given by

$$V_{dc} = I_{dc} R_L$$

Q5. When we can use inductor small?

Ans: We can use inductor filter when R_L is consistently small.

Q6. What happens when the filter capacitor value larger?

Ans: When the filter capacitor value larger, larger will be the peak current in the rectifying diode.

Q7. What is the value of ripple factor for bridge rectifier?

Ans: The value of ripple factor for bridge rectifier is 1.21.

Q8. What is the ripple factor of power supply measured off?

Ans: The ripple factor of a power supply is a measure of purity of power output.

Q9. What happens when form factor of filter is higher?

Ans: Greater the form factor of a filter, higher its ripple factor.

Q10. What is the value of ripple factor for half wave rectifier?

Ans: The value of ripple factor for half wave rectifier is 0.48.

EXPERIMENT No. 6

OBJECTIVE:

Study of BJT Characteristics in common emitter configuration.

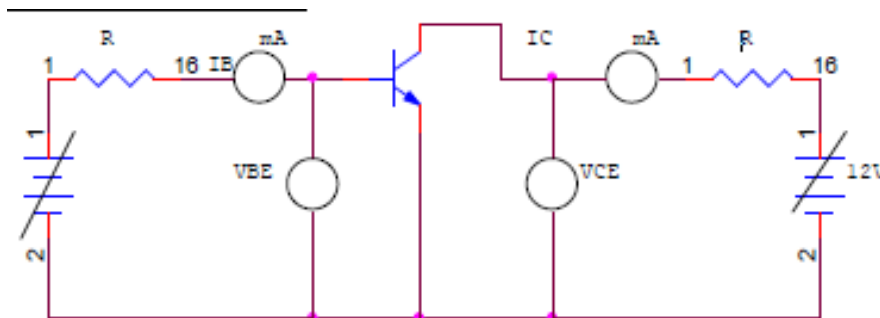
APPARATUS REQUIRED:

Transistor Characteristic kit, Multimeter, Connecting leads and Power Supply .

THEORY: -

In common Emitter configuration input is applied between base and emitter while the output is taken across emitter and collector. Thus the emitter forms the terminal common to both input and output circuits. The load resistance is connected at collector.

CIRCUIT DIAGRAM:



PROCEDURE:

Connect the circuit as per the circuit diagram.

Input characteristics

- a) Keep emitter - collector voltage constant.
- b) Vary emitter-base voltage in steps and note down base current reading.
- c) Readings are tabulated and graph is drawn.

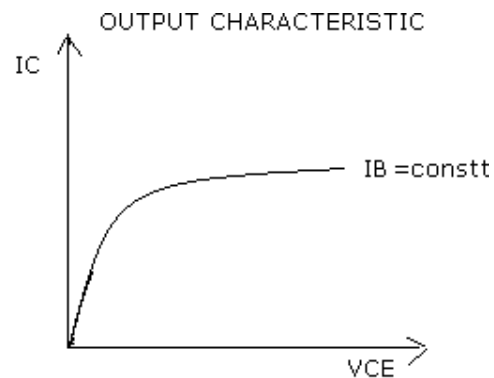
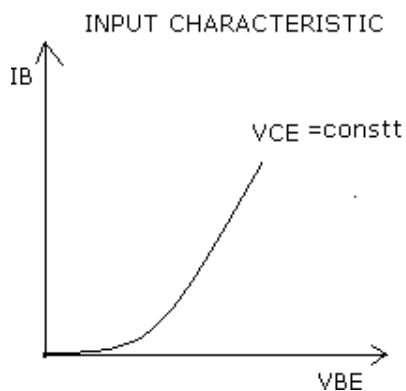
Output characteristics

- a) Keep base current constant.
- b) Vary collector-emitter voltage in steps and note down emitter current.
- c) Readings are tabulated and graph is drawn.

OBSERVATION TABLE:

| S.No | Input charact.(Vce=Cons.) | | Output charact. (Ib = Const.) | |
|------|---------------------------|--------|-------------------------------|--------|
| | Vbe(Volts) | Ib(mA) | Vce(Volts) | Ic(mA) |
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |
| 4. | | | | |
| 5. | | | | |

GRAPH:-



RESULT:

The input and output characteristic of transistor in common emitter configuration has been plotted.

PRECAUTIONS:

1. Connections should be tight.
2. Handle the equipments with care.

QUIZ WITH ANSWERS:

Q1: What do you mean by biasing of transistor?

A. When dc voltages are applied across the different terminals of transistor, it is called biasing.

Q2: What is dc current gain in common base configuration?

A. It is ratio of collector current (Ic) to emitter current (IE)

Q3: What is typical value for d.c. current gain?

A. 0.99

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Q4: What is a.c. current gain in CB configuration?

A. It is ratio of change in collector current to change in emitter current.

Q5: What are input characteristics?

A. These curves relate i/p current & i/p voltage for a given value of o/p voltage.

Q6: What are output characteristics?

A. The curve relate output voltage & output current for a given value of input current.

Q7: Which configuration has highest voltage gain?

A. Common Emitter.

Q8: Which configuration is most widely used?

A. Common Emitter.

Q9: What is operating point?

A. The zero signal values of I_c & V_{ce} .

Q10: Which region is heavily doped in Transistor?

A. Emitter.

EXPERIMENT No. 7

OBJECTIVE:

Study of FET Characteristics.

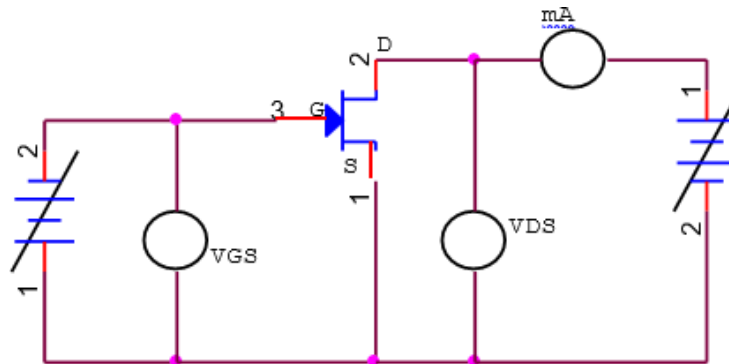
APPARATUS REQUIRED:

Power supply, FET characteristic Kit, connecting leads, two Multimeters.

BRIEF THEORY:

A FET is a three terminal semiconductor device in which current conduction is by one type of carries & is controlled by the effect of electric field. There are two types of FET namely JFET & MOSFET. Again, a JFET can either have N-channel or P-channel. A N-channel JFET has a N-type semiconductor bar, the two ends of which make the Drain & source terminal. On the two sides of this bar, P-N junction is made. This P region makes gate. Usually, these two gates are connected Together to form a single gate .The gate is given a -ve bias w.r.t source. The Drain is given +ve potential w.r.t source.

CIRCUIT DIAGRAM:



PROCEDURE:

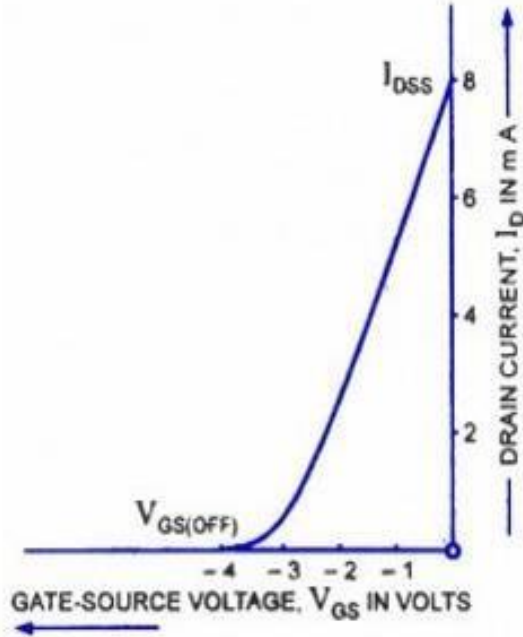
Connect the circuit as per the circuit diagram

Input characteristics

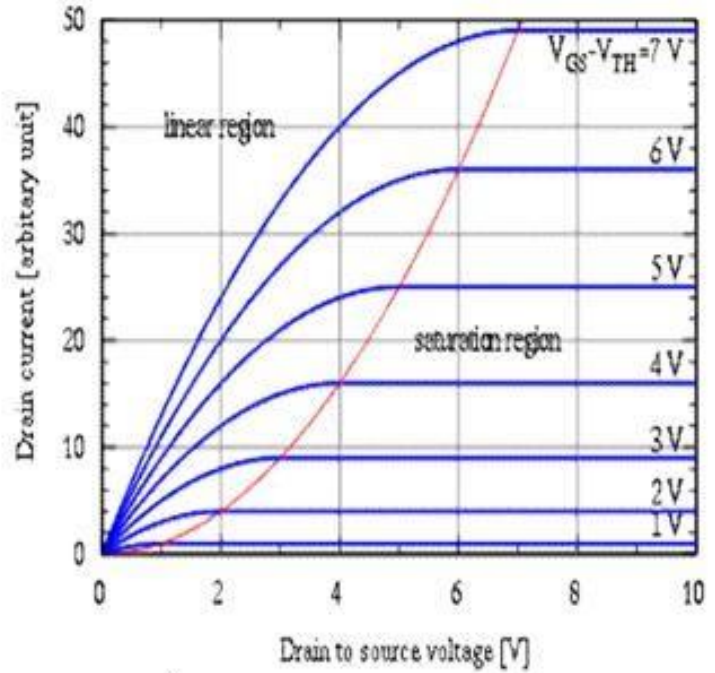
- (a) Keep drain-source voltage constant
- (b) Vary gate-source voltage in steps and note down drain current
- (c) Readings are tabulated and graph is drawn

Output characteristics

- (a) Keep gate-source voltage constant
- (b) Vary drain-source voltage in steps and note down drain current.
- (c) Readings are tabulated and graph is drawn



INPUT CHARACTERISTIC



OUTPUT CHARACTERISTIC

OBSERVATION TABLE:

| S. No | I/P at const. VDS | | O/P at const. VGS | |
|-------|-------------------|---------|-------------------|---------|
| | VGS (V) | ID (mA) | VDS (V) | ID (mA) |
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |

PRECAUTIONS:

1. Connections should be tight.
2. Handle the equipments with care.

RESULT:

Input and output characteristics is obtained.

QUIZ WITH ANSWERS:

Q1. Define FET?

Ans: The field effect transistor is a semi-conductor device which depends for its operation on the control of current by an electric field.

Q2. How many types of FET's are there?

Ans: Two types (a) Junction field effect transistor (JFET).
(b) Metal Oxide Semiconductor FET (MOSFET)

Q3. Write advantages of FET over conventional Transistor?

Ans: Advantages are (a) Thermal stability. (b) Immunity to radiation (c) High input impedance.

Q4. Write one disadvantage of FET?

Ans: Main disadvantage is relatively small Gain- Band Width product.

Q5. Define Drain resistance?

Ans: Drain resistance can be defined as ratio of drain to source voltage to drain current.

Q6. Define Trans conductance?

Ans: Trans conductance can be defined as ratio of drain current to gate to source voltage.

Q7. Define transfer characteristic of FET?

Ans: The curve drawn between drain current and gate-source voltage for a given value of drain-source voltage.

Q8. Write applications of a FET?

Ans: Applications of FET are (A) Low noise amplifier (B) Buffer amplifier (C) Cascade amplifier (D) Analog switch (E) Chopper

Q9. How is Drain current controlled in JFET?

Ans: In JFET drain current is controlled by controlling the reverse bias given to its base.

Q10. Define pinch-off voltage?

Ans: The value of drain-source voltage at which channel is pinched off (i.e. all the free charges from the channel are removed) is called pinch-off voltage.

EXPERIMENT No. 8

OBJECTIVE:

To plot V-I Characteristics of DIAC.

APPARATUS REQUIRED:

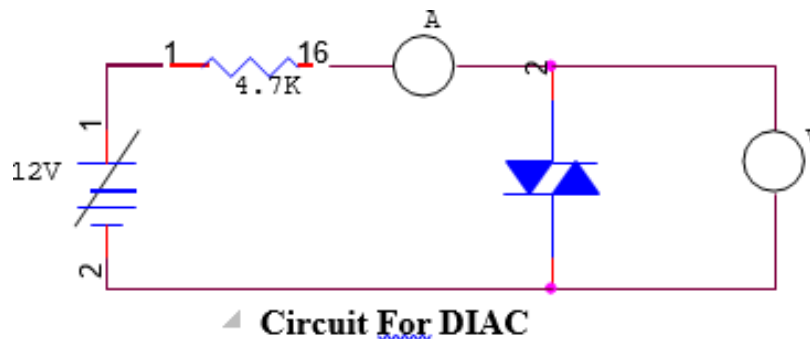
Power supply, DIAC Characteristic, Connecting Leads, Ammeter, and Voltmeter.

BRIEF THEORY:

DIAC:

A Diac is a two terminal & four layer bi-directional semiconductor switching device. 'Di' means two (two terminal device) and 'ac' means alternating current hence diac is a switch. In fact, it is a device which can conduct in both the directions. Only when the applied voltage is more than its break over voltage. It is similar as if two latches are connected in parallel. During +ve half-Cycle, the right four layer diode conducts heavily. During -ve half-cycle, the left diode conducts heavily only when the supply voltage exceeds the break over voltage of the Diac.

CIRCUIT DIGRAM:



PROCEDURE:

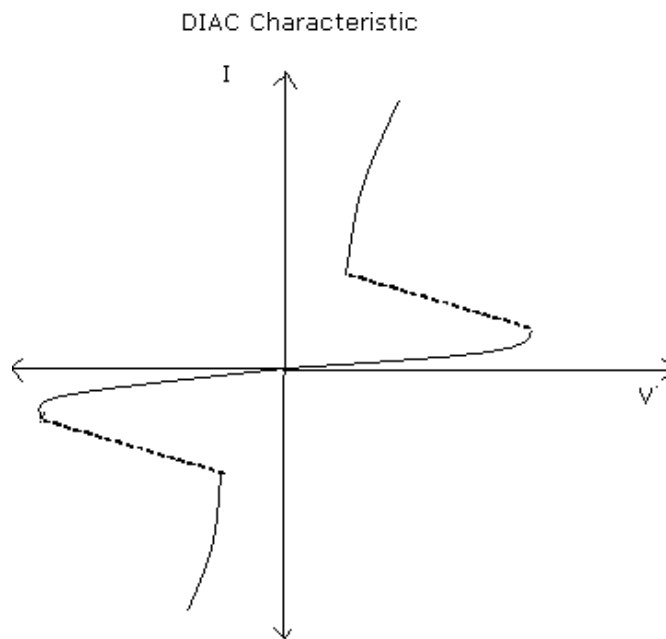
- a) Make connection as per circuit diagram.
- b) Apply +ve supply to the circuit.
- c) Increase the voltage step by step & note down the corresponding current values.
- d) After a certain voltage, the diac enter in -ve resistance region.
- e) Now apply reverse polarity & repeat the whole procedure again.

OBSERVATION TABLE:

| S.No | DIAC Characteristics | |
|------|----------------------|-----------|
| | I (mA) | V (Volts) |
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |

GRAPH:

DIAC Characteristic



RESULT:

The characteristics of DIAC have been plotted.

PRECAUTION:

1. Always connect the voltmeter in parallel & ammeter in series as shown in fig.
2. Connection should be proper & tight.
3. Switch 'ON' the supply after completing the circuit
4. DC supply should be increased slowly in steps
5. Reading of voltmeter & Ammeter should be accurate.

QUIZ WITH ANSWERS:

Q1. Define DIAC?

A. It is a two electrode bidirectional avalanche diode.

Q2. Define VBO?

A. The voltage before which DIAC acts as a open switch.

Q3. Write application of Diac?

A. Heat control circuit..

Q4. Define inter base Resistance?

A. The total resistance of silicon bar from one end to other end.

Q5. Define valley Point?

A. Point beyond which if emitter current increases, device enters into saturation region.

Q6. Define peak Point Emitter Current?

A. Min. current that is required to trigger the device.

EXPERIMENT No. 9

OBJECTIVE:

To draw V-I characteristics of TRIAC for different values of Gate Currents.

APPARATUS REQUIRED:

Power supply, TRIAC characteristics kit, Connecting leads, Ammeter & Voltmeter.

THEORY:

The TRIAC is a three terminal AC switch that is triggered into conduction when a low energy signal is applied to its gate terminal. The TRIAC conducts in either direction when turned on either a positive or negative gate signal triggers it into conduction. Thus, the TRIAC is a three terminals, four layer bidirectional semiconductor device that5 controls ac power. Becauseof its bidirectional conduction property, the TRIAC is widely used in the field of power electronics for control purpose.

CIRCUIT DIAGRAM:

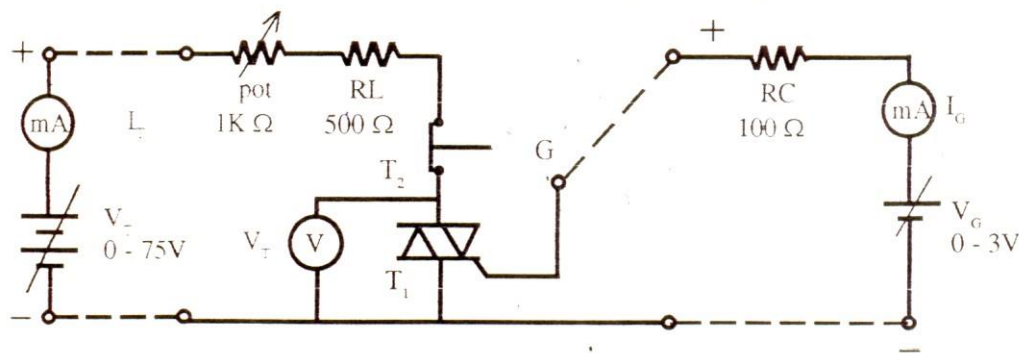


Fig 1.

Circuit diagram for quadrant I. **Dashed** line connections for I.

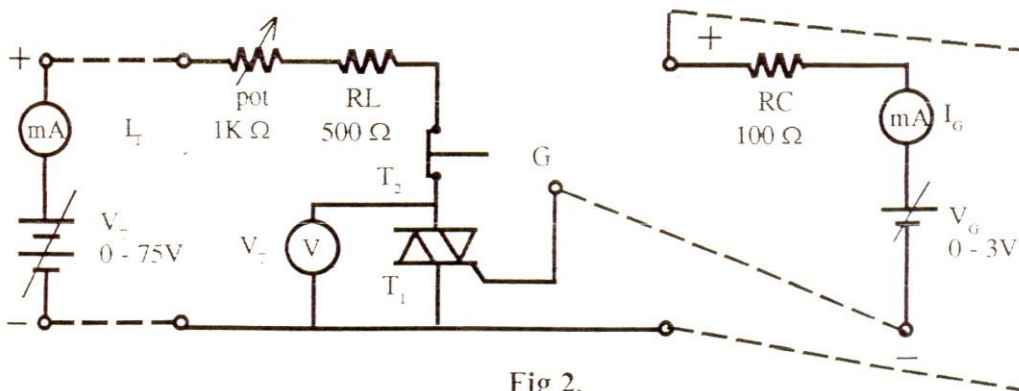


Fig 2.

Circuit diagram for quadrant I. **Dashed** line connections for I.

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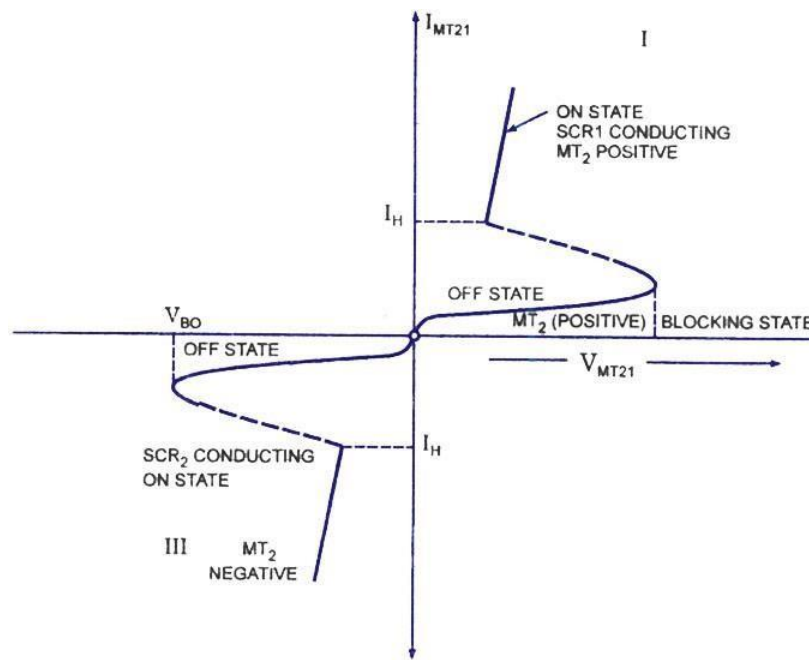
PROCEDURE:

1. Make connection as per the circuit diagram.
2. Apply +ve supply to the circuit.
3. Increase the voltage step by step & note down the corresponding current values.
4. After a certain voltage, the TRIAC enters into the negative resistance region.
5. Now apply reverse polarity & repeat the whole procedure again.

OBSERVATION TABLE:

| S.NO | Volts | Current |
|------|-------|---------|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

GRAPH



V-I Characteristic of a Triac

RESULT:

The characteristic of TRIAC have been plotted.

PRECAUTIONS:

- Always connect the voltmeter in parallel & ammeter in series.
- Connection should be proper & tight.
- Switch 'on' the supply after completing the circuit.
- DC supply should be increased slowly in steps.
- Reading of voltmeter & ammeter should be accurate.

QUIZ WITH ANSWERS:

Q1. Conduction take place in triac is bidirectional or unidirectional?

Ans: Bidirectional.

Q2. Expanded form of the word abbreviated TRIAC ?

Ans: Triode and AC.

Q3. Name three terminal of TRIAC?

Ans: Main Terminal 1(MT1) ,Main Terminal 2 (MT2) and Gate 'G'.

Q-4 What are the ratings of TRIAC available in market?

Ans: Voltage 1200 and Current 300A(rms).

Q-5 Give application of TRIAC?

Ans: TRIACS are extensively used in :- Residential lamp –dimmers, Heat control, Speed control of small single phase series and induction motor.

Q-6 Is TRIAC have a capability to work in rectifier mode?

Ans: Yes

Q-7 By what manner TRIAC is different from SCR?

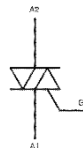
Ans: 1. bidirectional conduction. 2. TRIAC is a combination of two SCRs connected in anti parallel.

Q-8 How many layers are there in TRIAC?

Ans: 5 layers.

Q9 What is the symbol of TRIAC?

Ans



Q10. How TRIAC is differ from DIAC?

Ans: TRIAC have gate terminal and DIAC didn't.

EXPERIMENT No. 10

OBJECTIVE:

Study of Characteristic of silicon-controlled rectifier.

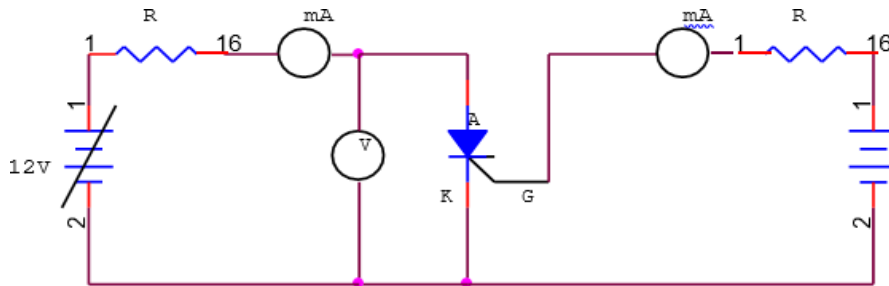
APPARATUS REQUIRED:

Power Supply, SCR Kit. , Voltmeter, Ammeter, Connecting Leads.

BRIEF THEORY:

Silicon control rectifier (SCR) is a four layer, three terminal semiconductor device, the end ‘P’ forms the anode & the end ‘N’ forms the cathode & the gate terminal ‘G’ is from the ‘P’ layer next to cathode. It is a unidirectional device. The device can exist upon either ON state or OFF state depending upon the applied voltage. When anode voltage is +ve w.r.t to cathode the SCR start Conducting. If some small gate voltage is applied, the SCR trigger at somelow value of anode voltage, but it loses its all control on the SCR Current after triggering. Therefore, in order to turn the SCR to OFF position the anode voltage has to be reduced to zero.

CIRCUIT DIAGRAM:



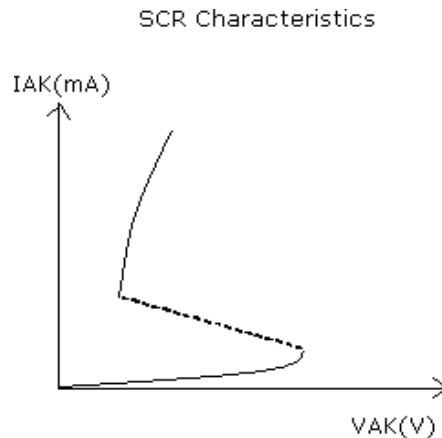
PROCEDURE:

1. Connect the circuit according to the fig.
2. First set $I = 0\text{mA}$, vary input voltage V gradually & measure the current I .
3. Tabulate the readings.
4. Repeat the procedure for different values of I .
5. Draw the graph between V & I .

OBSERVATION TABLE:

| S.No | V_{ak} (Volts) | I_{ak} (mA) |
|------|------------------|---------------|
| | | |
| | | |
| | | |
| | | |

GRAPH:



PRECAUTIONS:

1. Always connect the voltmeter in parallel & ammeter in series as shown in fig.
2. Connection should be proper & tight.
3. Switch 'ON' the supply after completing the circuit
4. DC supply should be increased slowly in steps
5. Reading of voltmeter & Ammeter should be accurate.

RESULT:

The characteristics of SCR have been plotted.

QUIZ WITH ANSWERS:

Q1. Define SCR?

A. It is a controlled rectifier constructed of a silicon material with third terminal for control purpose.

Q2. Define Forward Break over Voltage?

A. It is voltage in forward conducting mode after which SCR starts conducting.

Q3. Define reverse Break down Voltage?

A. If reverse voltage is increased beyond certain value, SCR will break & this voltage is called reverse breakdown voltage.

Q4. Why it is called controlled rectifier?

A. Because its operation as rectifier can be controlled by using gate terminal.

Q5. Define peak forward Voltage?

A. It is limiting positive anode voltage above which SCR get damaged.

Q6. Define peak reverse Voltage?

A. Max. reverse voltage that can be applied to SCR without conduction in reverse direction.

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Q7. Define Holding Current?

A. Min. forward current that must be maintained to keep SCR in conducting state.

Q8. Define forward current Rating?

A. The max. Value of anode current that SCR can handle safely.

Q. 9 Define latching current.

A. Min. device current which must be attained by the device before gate drive is removed.

Q.10 What do you mean by commutation process?

A. Process of turning off the SCR.

This lab manual has been updated by

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Crosschecked By
HOD Applied
Science

Please spare some time to provide your valuable feedback.