Analog Electronics Lab

(EE-222-F)

LAB MANUAL

IV SEMESTER

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EXPERIMENT NO. 1

AIM: To get familiar with working knowledge of the following instruments.

THEORETICAL CONCEPT:

A. CATHODE RAY OSCILLOSCOPE:

The cathode-ray oscilloscope (CRO) is a common laboratory instrument that provides accurate time and amplitude measurements of voltage signals over a wide range of frequencies. Its reliability, stability, and ease of operation make it suitable as a general purpose laboratory instrument. The heart of the C RO is a cathode-ray tube shown schematically in Fig. 1.

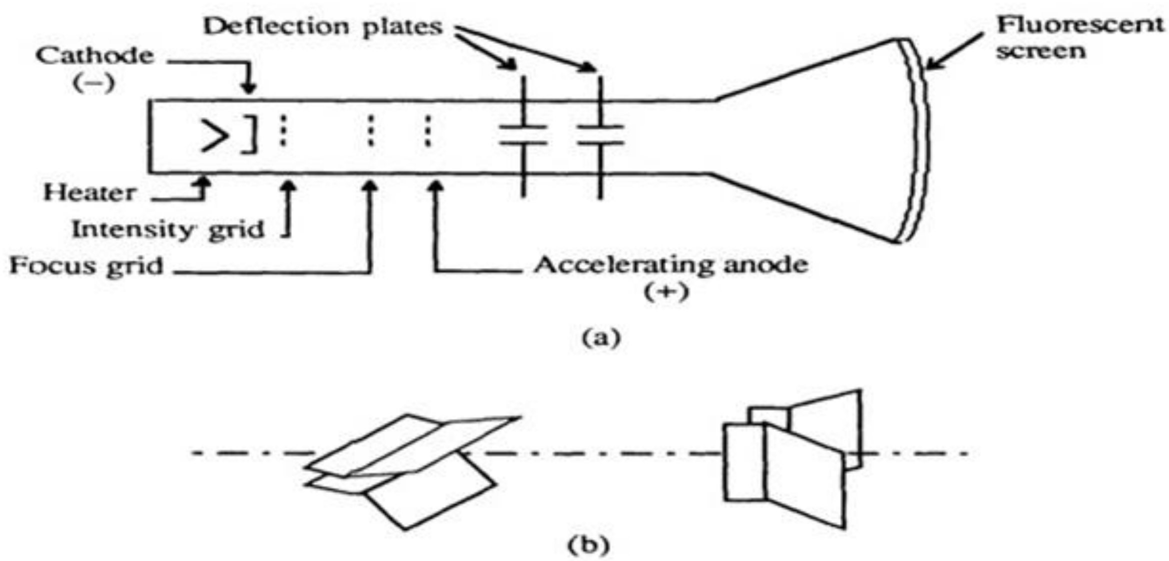
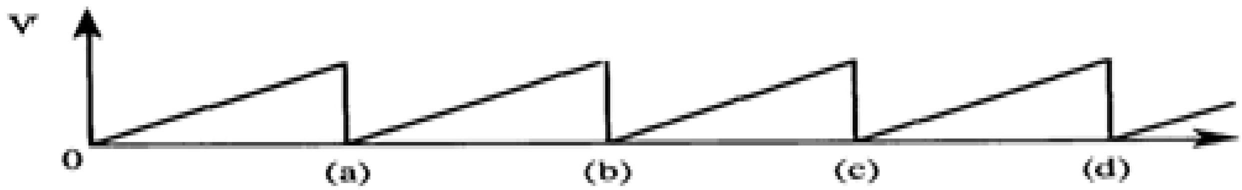


Figure 1. Cathode-ray tube: (a) schematic, (b) detail of the deflection plates.

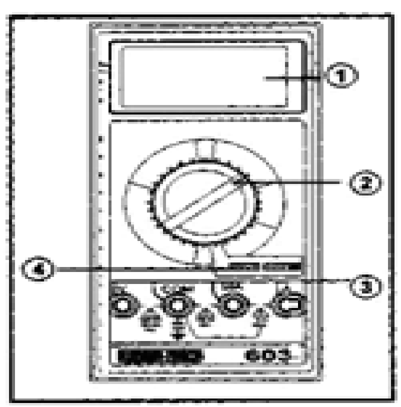
The cathode ray is a beam of electron s which are emitted by the heated cathode (Negative electrode) and accelerated toward the fluorescent screen. The assembly of the cathode, intensity grid, focus grid, and accelerating anode (positive electrode) is called an electron gun. Its purpose is to generate the electron beam and control its intensity and focus between the electron gun and the fluorescent screen 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. The linear deflection or sweep of the beam horizontally is accomplished by use of a sweep generator that is incorporated in the oscilloscope circuitry. The voltage output of such a generator is that of a saw tooth wave as shown in Fig. 2. application of one cycle of this voltage difference, which increases linearly with time, to the horizontal plates causes the beam to be deflected linearly with time across the tube face. When the voltage suddenly falls to zero, as at points (a) (b) (c), etc...., the end of each sweep - the beam flies back to its initial position. The horizontal deflection of the beam is repeated periodically, the frequency of this periodicity is adjustable by external controls.



To obtain steady traces on the tube face, an internal number of cycles of the unknown signal that is applied to the vertical plates must be associated with each cycle of the sweep generator. Thus, with such a matching of synchronization of the two deflections, the pattern on the tube face repeats itself and hence appears to remain stationary. The persistence of vision in the human eye and of the glow of the fluorescent screen aids in producing a stationary pattern. In addition, the electron beam is cut off (blanked) during fly back so that the retrace sweep is not observed.

B. THE MULTIMETER STRUCTURE:

A multimeter is used to make various electrical measurements, such as AC and DC voltage, AC and DC current, and resistance. It is called a multimeter because it combines the functions of a voltmeter, ammeter, and ohmmeter. Multimeters may also have other functions, such as diode and continuity tests. The descriptions and pictures that follow are specific to the fluke 73 Series III multimeter, but other multimeters are similar.



Important note: The most common mistake when using a multimeter is not switching the test leads when switching between current sensing and any other type of sensing (voltage, resistance). It is critical that the test leads be in the proper jacks for the measurement you are making.

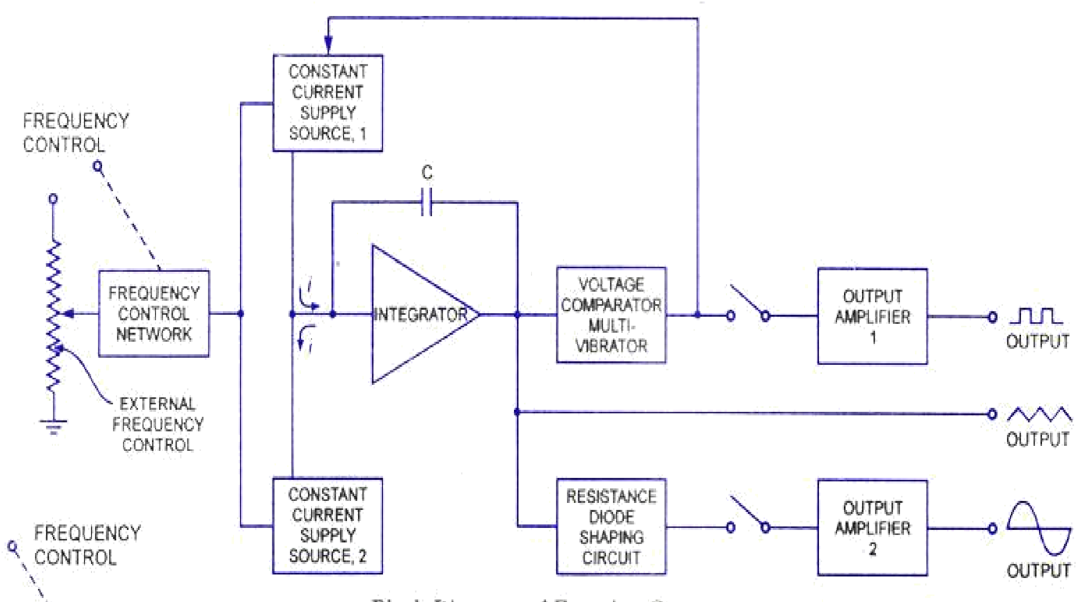
Safety Information

- Be sure the test leads and rotary switch are in the correct position for the desired measurement.
- Never use the meter if the meter or the test leads look damaged.
- Never measure resistance in a circuit when power is applied.
- Never touch the probes to a voltage source when a test lead is plugged into the 10 A or 300 mA input jack.

- To avoid damage or injury, never use the meter on circuits that exceed 4800 watts.
- Never apply more than the rated voltage between any input jack and earth ground (600 V for the Fluke 73).
- Be careful when working with voltages above 60 V DC or 30 V AC rms. Such voltages pose a shock hazard.
- Keep your fingers behind the finger guards on the test probes when making measurements.
- To avoid false readings, which could lead to possible electric shock or personal injury, replace the battery as soon as the battery indicator appears.

B. FUNCTION GENERATOR:

A function generator is a device that can produce various patterns of voltage at a variety of frequencies and amplitudes. It is used to test the response of circuits to common input signals. The electrical leads from the device are attached to the ground and signal input terminals of the device under test.



Block Diagram of Function Generator

Features and controls

- Most function generators allow the user to choose the shape of the output from a small number of options.
- Square wave - the signal goes directly from high to low voltage. Sine wave - the signal curves like a sinusoid from high to low voltage. Triangle wave - the signal goes from high to low voltage at a fixed rate.
- The amplitude control on a function generator varies the voltage difference between the high and low voltage of the output signal.
- The direct current (DC) offset control on a function generator varies the average voltage of a signal relative to the ground.
- The frequency control of a function generator controls the rate at which output signal oscillates. On some function generators, the frequency control is a combination of different controls.
- One set of controls chooses the broad frequency range (order of magnitude) and the other selects the precise frequency. This allows the function generator to handle the enormous variation in frequency scale needed for signals.

How to use a function generator?

- After powering on the function generator, the output signal needs to be configured to the desired shape. Typically, this means connecting the signal and ground leads to an oscilloscope to check the controls.
- Adjust the function generator until the output signal is correct, then attach the signal and ground leads from the function generator to the input and ground of the device under test.
- For some applications, the negative lead of the function generator should attach to negative input of the device, but usually attaching to ground is sufficient.

Conclusions:

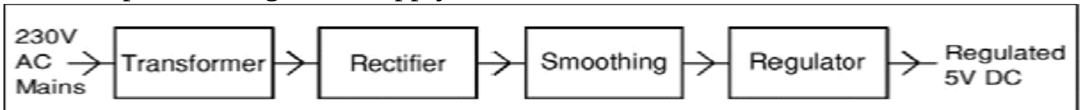
- A function generator is a device that can produce various patterns of voltage at a variety of frequencies and amplitudes.

D. REGULATED POWER SUPPLY

Types of Power Supply

There are many types of power supply. Most are designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. A power supply can by broken down into a series of blocks, each of which performs a particular function.

For example a 5V regulated supply:



Block Diagram of a Regulated Power Supply System

Each of the blocks is described in more detail below:

- Transformer - steps down high voltage AC mains to low voltage AC.
- Rectifier - converts AC to DC, but the DC output is varying.
- Smoothing - smoothes the DC from varying greatly to a small ripple.
- Regulator - eliminates ripple by setting DC output to a fixed voltage

POWER:

Push button switches for supplying power to instrument.

OUTPUT ON:

Push button for switching (ON / OFF) the three output voltages.

3 and 6 V/mA (Push button):

Switch the display from voltage in to current reading or vice versa. When push buttons are pressed, the current supplied from the terminals 12 and 17 is displayed with a resolution of 1 mA. In released position voltages across the terminals 12 and 17 are displayed with a resolution of 0.1 V.

4 AND 7 DIGITAL DISPLAYS (7-Segment LED):

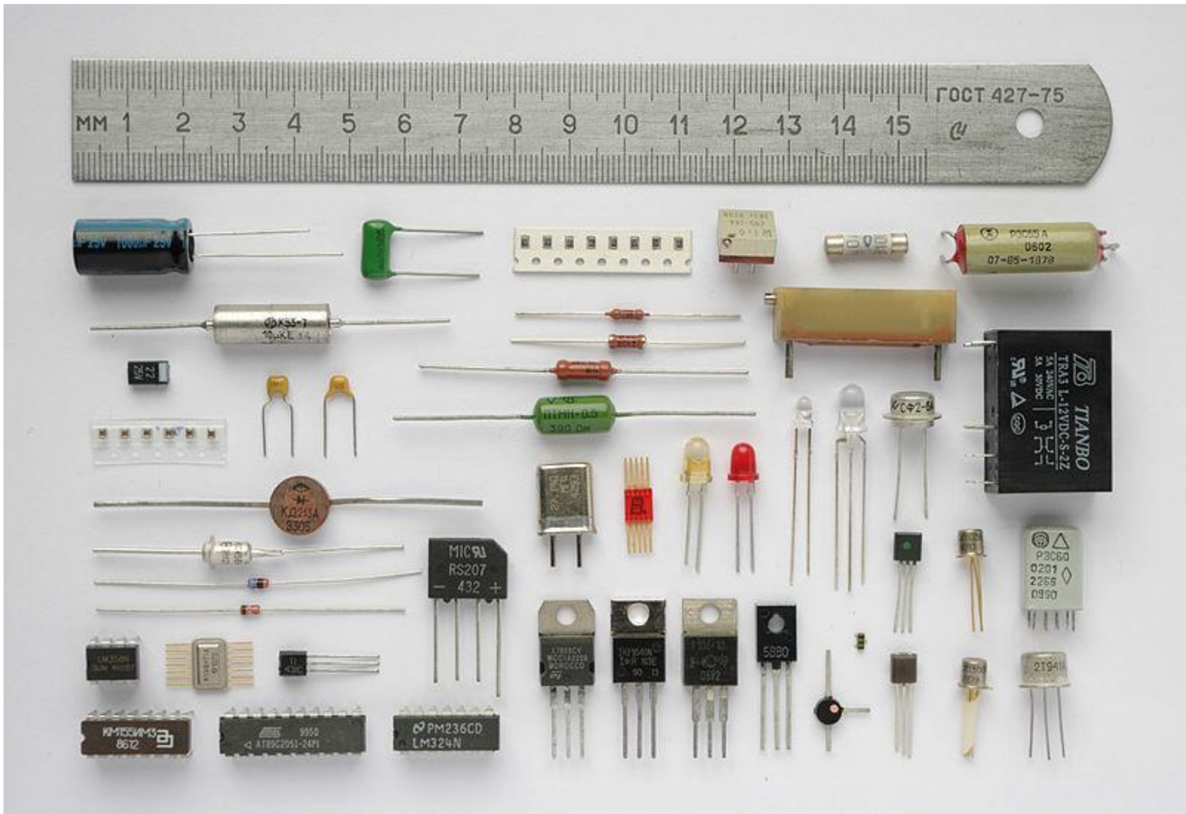
Digital display with 3-digit readout for output voltage and current. On the left side of the instrument the voltage and current readings for terminals 3 is indicated. The corresponding values for the terminals 4 are indicated on the right side of the display.

5V AND 8V INDICATORS:

Two LEDs indicate the unit of the display. The mA LED flashes when the 0 – 30V DC output is used in constant current mode, or output current required is in excess of specified value, in CV mode.

E. ACTIVE, PASSIVE COMPONENTS

An electronic component is a basic electronic element and may be available in a discrete form (a discrete device or discrete component) having two or more electrical terminals (or leads). These are intended to be connected together, usually by soldering to a printed circuit board, in order to create an electronic circuit and a discrete circuit with a particular function (for example an amplifier, radio receiver, or oscillator). Basic electronic components may be packaged discretely, as arrays or networks of like components, or integrated inside of packages such as semiconductor integrated circuits, hybrid integrated circuits, or thick film devices.



A component may be classified as passive or active. The strict physics definition treats passive components as ones that cannot supply energy themselves; whereas a battery would be seen as an active component since it truly acts as a source of energy.

Passive components are ones which cannot introduce net energy into the circuit they are connected to. They also cannot rely on a source of power except for what is available from the (AC) circuit they are connected to. As a consequence they are unable to amplify (increase the power of a signal); although they may well increase a voltage or current such as is done by a transformer or resonant circuit. Among passive components are familiar two-terminal components such as resistors, capacitors, inductors, and transformers.

Active components rely on a source of energy (usually from the DC circuit, which we have chosen to ignore) and are usually able to inject power into a circuit although this is not part of the definition. This includes amplifying components such as transistors, triode vacuum tubes (valves), and tunnel diodes.

Passive components can be further divided into lossless and lossy components:

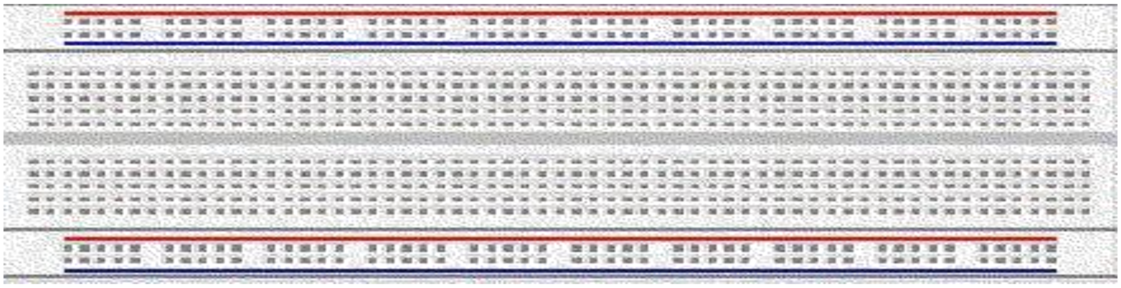
Lossless components do not have a net power flow into or out of the component. This would include ideal capacitors, inductors, transformers, and the (theoretical) gyrator.

Lossy or **dissipative** components do not have that property and generally absorb power from the external circuit over time. The prototypical example is the resistor. In practice all non-ideal passive components are at least a little lossy, but these are typically modeled in circuit analysis as consisting of an ideal lossless component with an attached resistor to account for the loss.

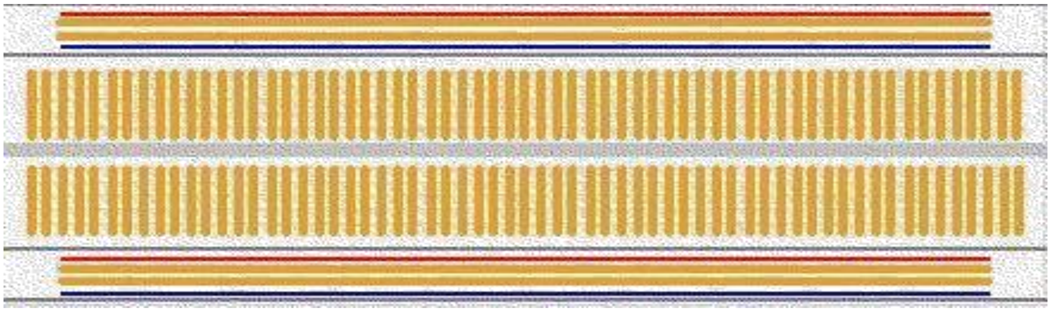
Most passive components with more than two terminals can be described in terms of two-port parameters satisfying the principle of reciprocity, although there are some rare exceptions In contrast, active components (which have more than two terminals) generally lack that property. Note that these distinctions only apply to components listed below which would be modeled as elements within circuit analysis. Practical items which act as transducers or have other connections to the outside world such as switches cannot be subject to this form of classification since they defy the view of the electronic circuit as a closed system.

F. BREAD BOARD

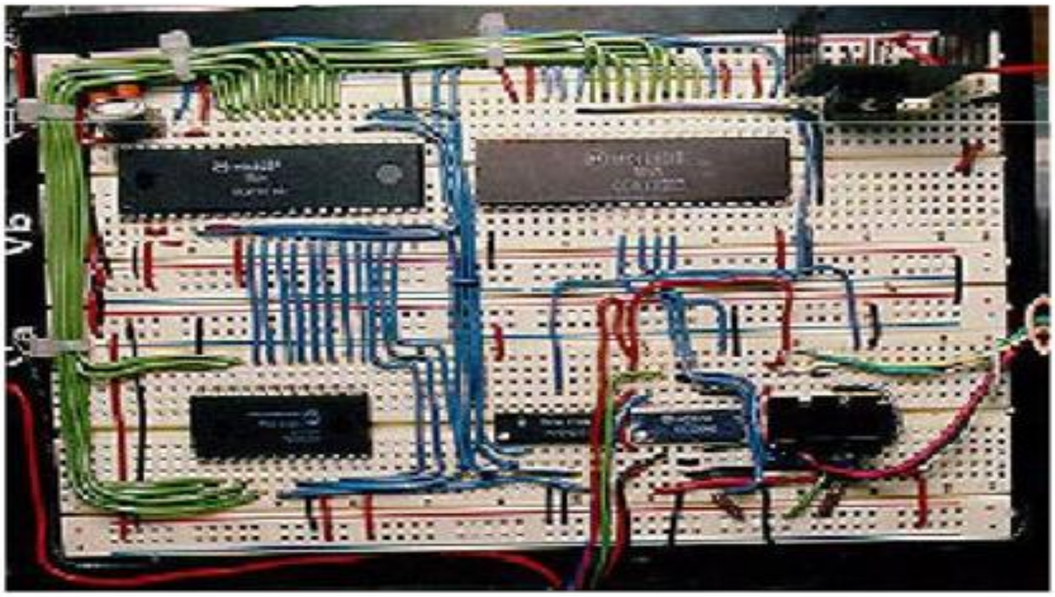
A breadboard is used to build and test circuits quickly before finalizing any circuit design. The breadboard has many holes into which circuit components like ICs and resistors can be inserted. A typical breadboard is shown below:



The bread board has strips of metal which run underneath the board and connect the holes on the top of the board. The metal strips are laid out as shown below. Note that the top and bottom rows of holes are connected horizontally while the remaining holes are connected vertically.



To use the bread board, the legs of components are placed in the holes. Each set of holes connected by a metal strip underneath forms a node. A node is a point in a circuit where two components are connected. Connections between different components are formed by putting their legs in a common node. The long top and bottom row of holes are usually used for power supply connections. The rest of the circuit is built by placing components and connecting them together with jumper wires. ICs are placed in the middle of the board so that half of the legs are on one side of the middle line and half on the other. A completed circuit might look like the following.



Bread boarding tips:

It is important to breadboard a circuit neatly and systematically, so that one can debug it and get it running easily and quickly. It also helps when someone else needs to understand and inspect the circuit. Here are some tips:

1. Always use the side-lines for power supply connections. Power the chips from the side-lines and not directly from the power supply.
2. Use black wires for ground connections (0V), and red for other power connections.
3. Keep the jumper wires on the board flat, so that the board does not look cluttered.
4. Route jumper wires around the chips and not over the chips. This makes changing the chips when needed easier.
5. You could trim the legs of components like resistors, transistors and LEDs, so that they fit in snugly and do not get pulled out by accident.

EXPERIMENT NO. 2

AIM: To study of V-I characteristics of a diode.

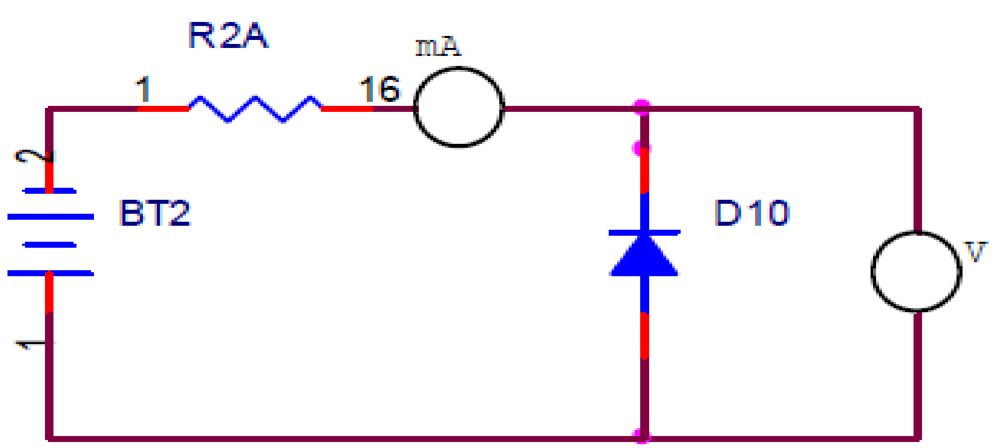
THEORETICAL CONCEPT: A P-N junction is known as Semiconductor diode or crystal diode. It is the combination of P-type and N-type Semiconductor. This offers nearly zero resistance to current on forward biasing and nearly infinite Resistance to the flow of current when in revere biased.

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.

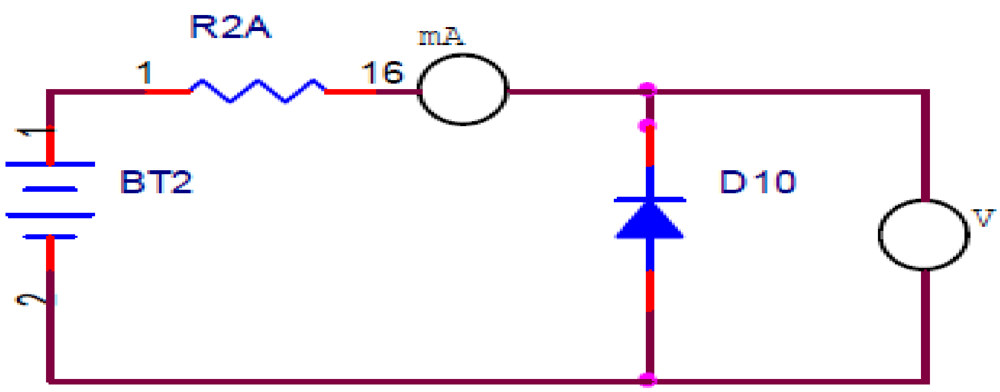
Reverse biasing: When P-type semiconductor is connected to the –ve terminal and N-type to +ve terminal. Nearly zero current flow in this condition.

EXPERIMENTAL SET UP:

(1) When diode is forward biased



(2) When diode is reverse biased



SPECIFICATION OF APPARATUS USED: Diode characteristics kit, power supply, ammeter (0-20mA), voltmeter (0-20V) and connecting leads.

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 and voltmeter readings for each step.
(5) Plot the graph of voltage and current.
(6) Connect the circuit as shown in fig.

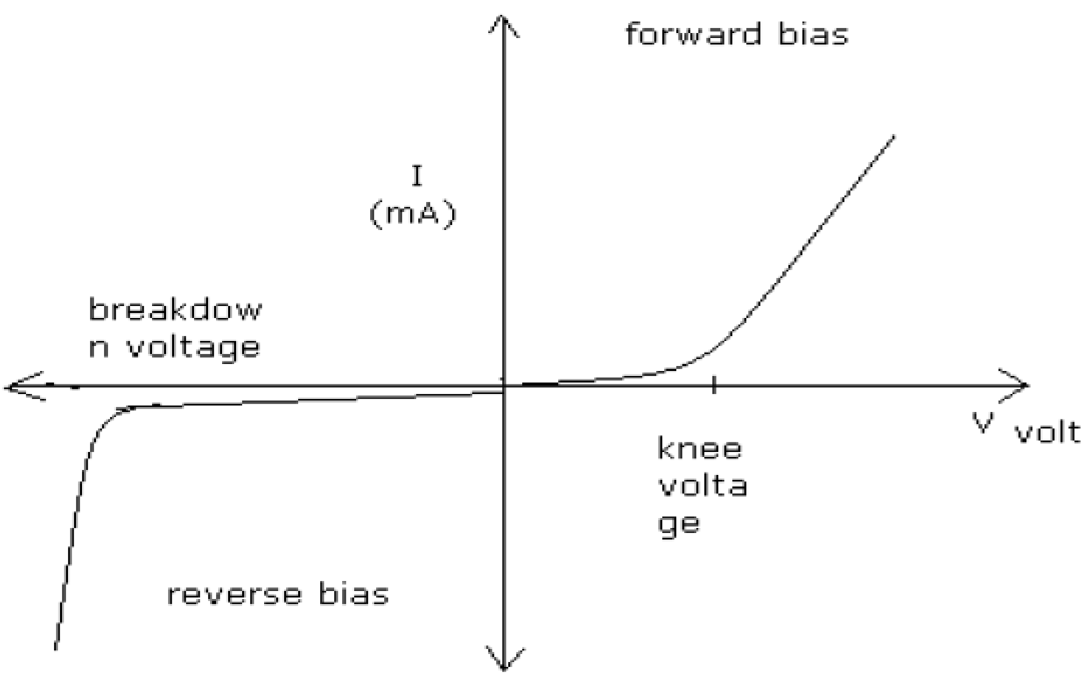
PRECAUTIONS:

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

OBSERVATION DATA:

S.NO	When Diode Is Forward Biased		When Diode Is Reverse Biased	
	Current(mA)	Voltage(V)	Current [μA)	Voltage(V)
1.				
2.				
3.				

GRAPH:



RESULT AND COMMENTS: The graph has been plotted between voltage and current. The diode doesn’t conduct in reverse bias state and conduct in forward bias state.

EXPERIMENT NO. 3

AIM: To study and draw the characteristics of half wave and full wave rectifiers**.**

THEORETICAL CONCEPT: Rectification is a process of conversion of AC to DC. In half-wave rectifier, only one diode is used. During +ve half cycle the diode is forward biased and 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.

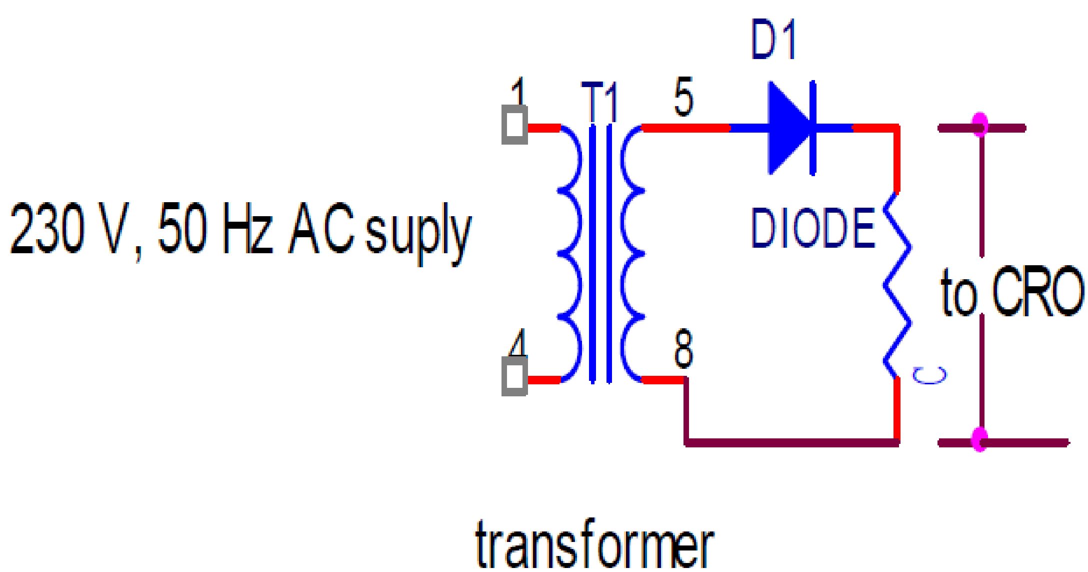
Full Wave Rectifier: In full-wave rectifier, when AC supplied at the input, both the half cycle current flows through the load in the same direction. The following two circuits are commonly employed.

Centre-tap full-wave Rectifier: In this rectifier two diode and a center-tap transformer is used. During +ve half cycle the diode D1 is forward biased and D2 is reverse biased. Output will be obtained across load resistor R. During –ve half cycle diode D1 is reverse biased andD2 is forward biased. Output will be obtained cross load resistor R and the direction of output is same i.e., DC output is obtained.

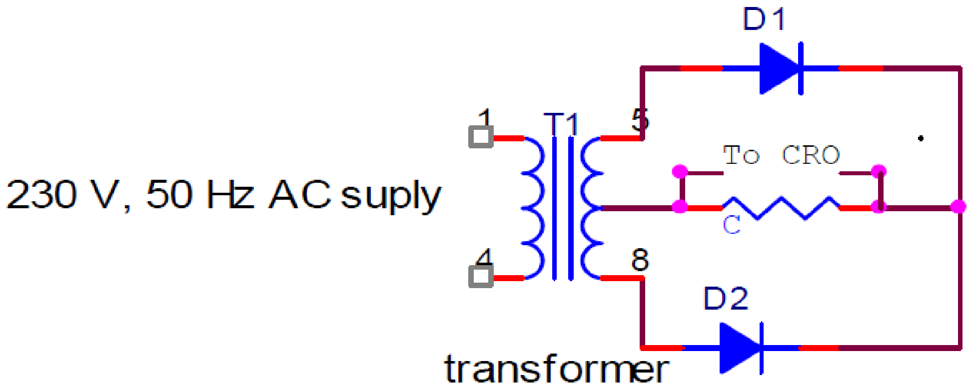
Bridge Rectifier: The circuit contains four diodes connected to form a bridge. In this an ordinary transformer is used. During +ve half cycle of secondary voltage, diodes D1 and D3 are forward biased and diodes D2 and D4 are reverse biased and vice versa.

EXPERIMENTAL SET UP:-

HALF WAVE RECTIFIER



FULL WAVE RECTIFIER



SPECIFICATION OF APPARATUS USED: Power supply, rectifier kit, CRO, connecting leads.

PROCEDURE:

1. Connect the circuit as per the circuit diagram
2. The output is noted down on CRO.
3. Graph is drawn by noting down peak to peak amplitude of input and output voltage.

PRECAUTIONS:

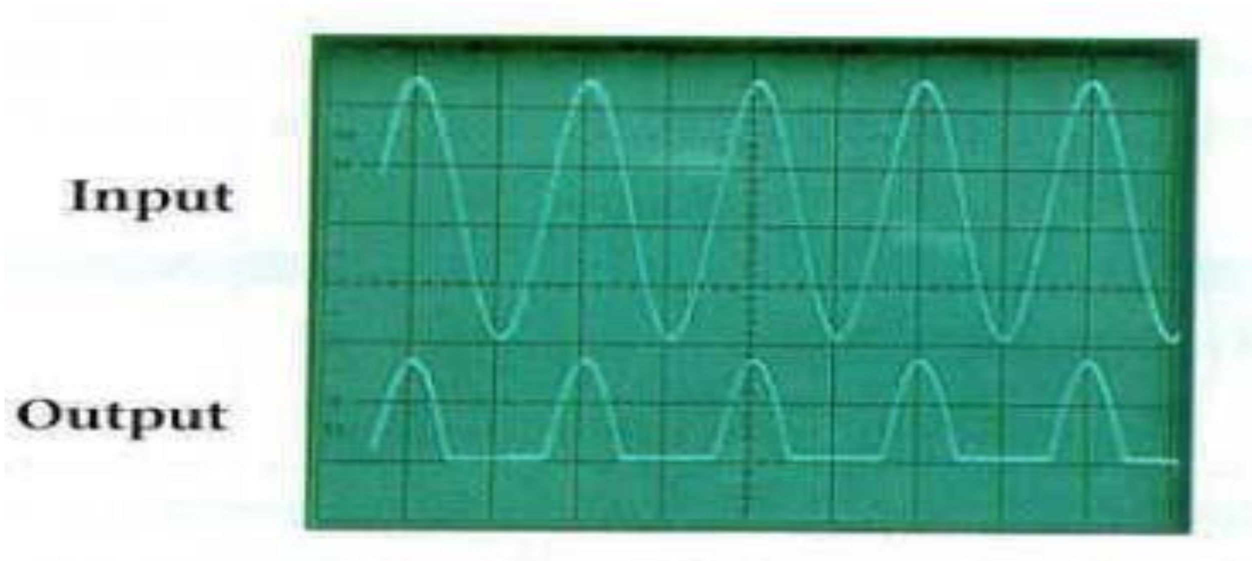
1. Connections should be tight
2. Handle the equipments with care.

OBSERVATION DATA:

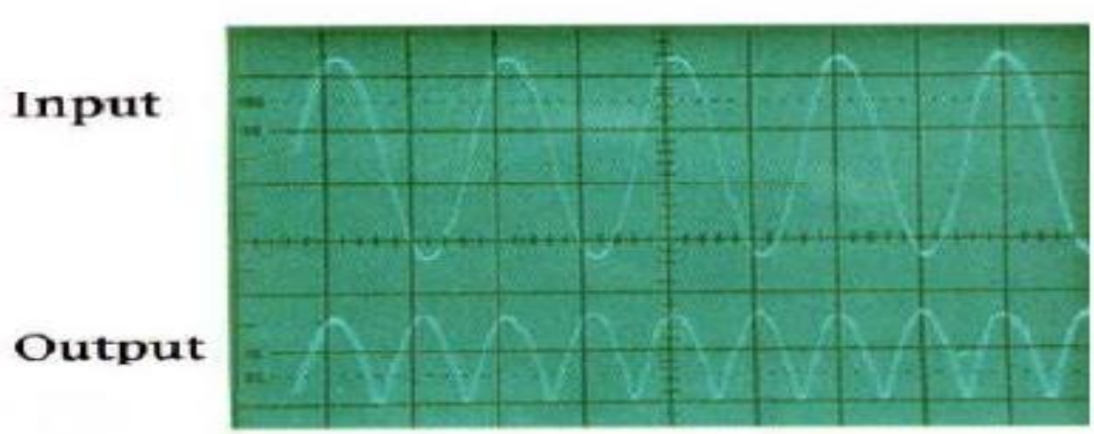
S. No	RECTIFIRES	INPUT(V)	OUT PUT(V)
1	HALF WAVE		
2	CENTER TAP FULL WAVE		
3	BRIDGE FULL WAVE (FW)		

GRAPH:

Half wave rectifier



Full wave rectifier



RESULT AND COMMENTS: Waveforms of full wave and half wave rectifier have drawn.

EXPERIMENT NO. 4

AIM: To study zener diode characteristics.

THEORETICAL CONCEPT:-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 breakdown or zener breakdown.

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.

EXPERIMENTAL SET UP:-

Fig (1) - Forward Bias Condition:

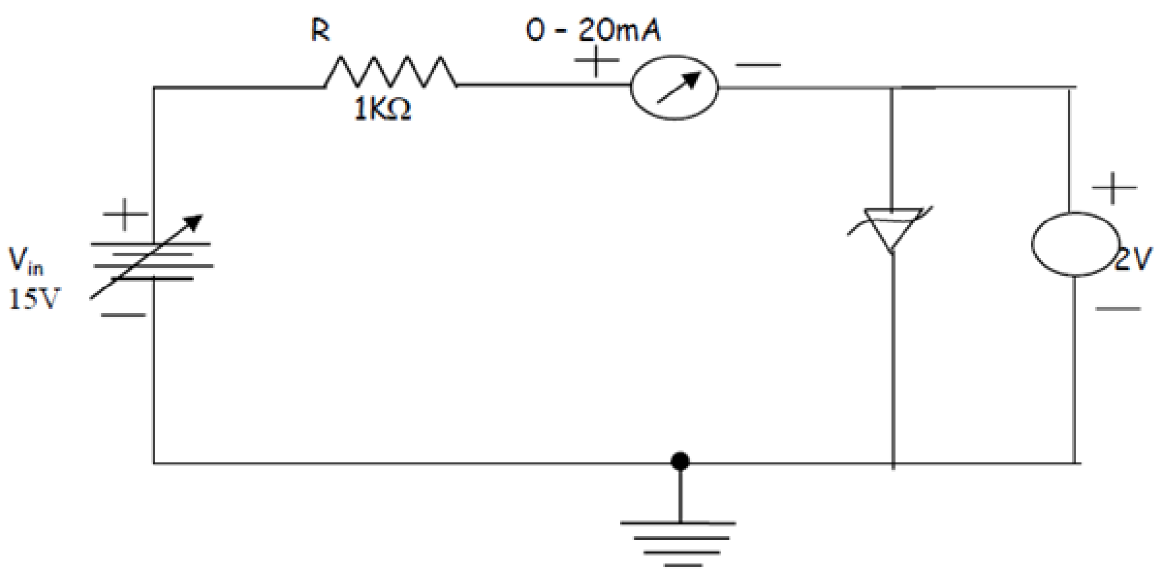
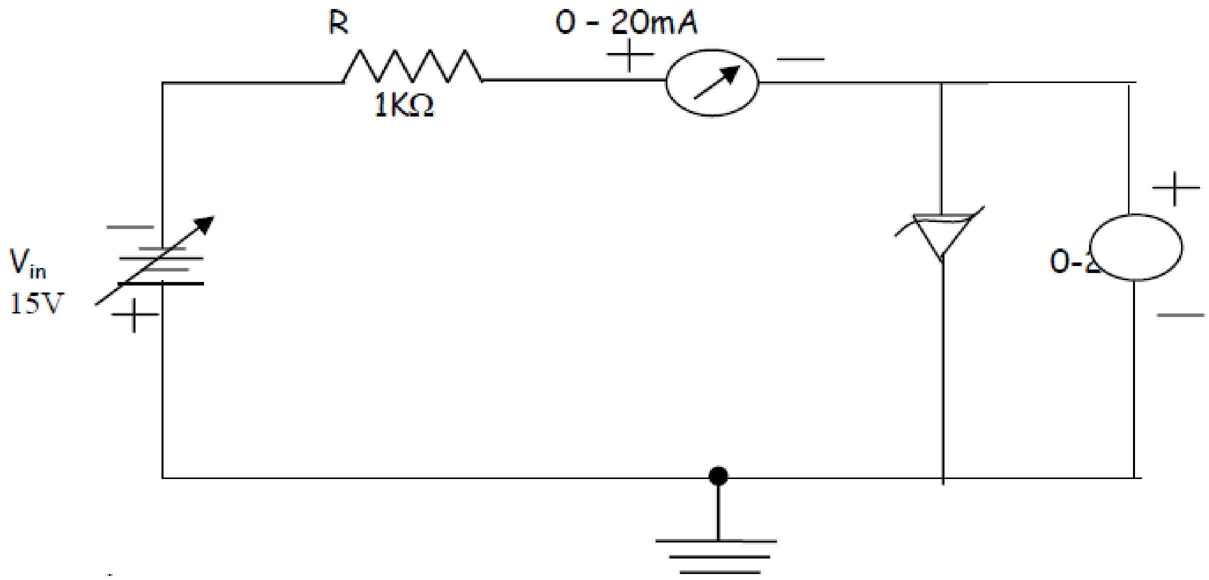


Fig (2) - Reverse Bias Condition:



SPECIFICATION OF APPARATUS USED:-Regulated DC power supply, voltmeter, connecting wires, kit

Specifications:

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

PROCEDURE:

Forward biased condition:

1. Connect the circuit as shown in fig (1).
2. Vary Vzf gradually and note down the corresponding readings of Izf.
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 Vzr gradually and note down the corresponding readings of Izr.
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.

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. Does not switch **ON** the power supply unless you have checked the circuit connections as per the circuit diagram.

OBSERVATIONS DATA:

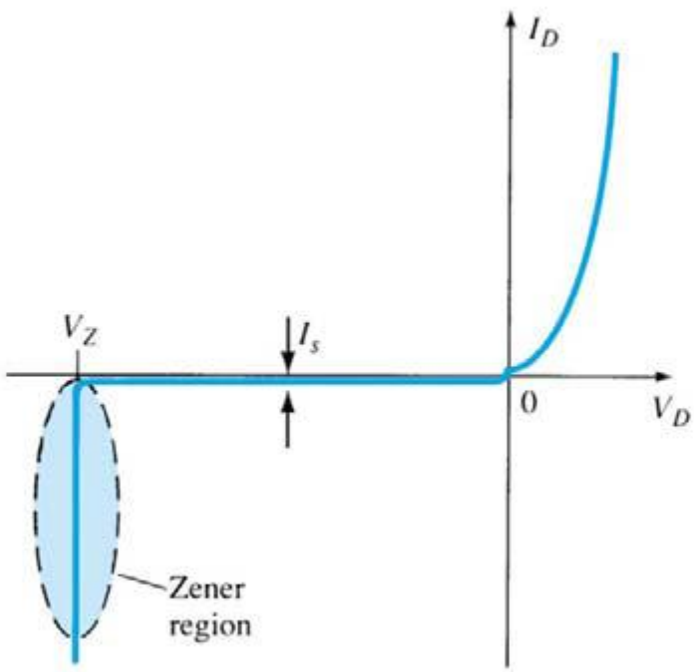
Zener diode in forward bias:

Sr. No.	**Forward voltage across the diode (Vzf)**	**Forward current across the diode (Izf)**

Zener diode in Reverse bias:

Sr. No.	**Reverse voltage across the diode** (Vzr)	**Reverse current across the diode (**Izr**)**

GRAPH:



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 resistance $R_{dc} = V_r / I_r$
Dynamic reverse resistance $r_{ac} = \Delta V_r / \Delta I_r$

RESULT AND COMMENTS:-

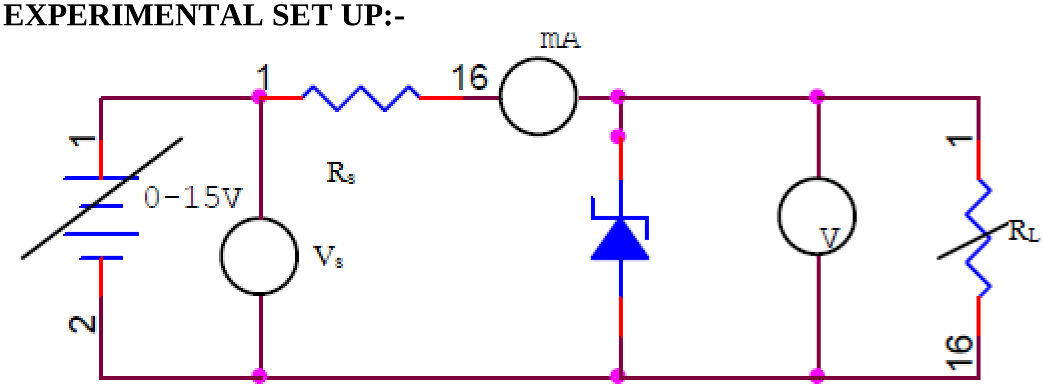
1. The zener diode characteristics have been studied.
2. The zener resistance at the breakdown voltage was found to be = ………

EXPERIMENT NO. 5

AIM: To study zener diode as voltage regulator.

THEORETICAL CONCEPT: 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 lode current increases, the Zener current decrease so that current through resistance R_s is constant. As output voltage = $V_{in} - I_{rs}$, and I is constant, Therefore, output Voltage remains unchanged. The input voltage Vin increase, more current will flow through the zener, the voltage drop across Rs will increase but lode voltage would remain constant.

EXPERIMENTAL SET UP:-



SPECIFICATION OF APPARATUS USED: Power supply, zener diode, two voltmeter and connected leads ammeter.

PROCEDURE:

(a) Connect the circuit as per the circuit diagram.
(b) Keep load resistance constant (take maximum value of load resistance)
(c) Vary input voltage and note down output voltage.
(d) Now keep input voltage constant and vary load resistance and note down corresponding voltmeter reading.
(e) Plot the respective graph.

PRECAUTIONS:

(a) Connections should be tight.
(b) Handle the equipments with care.

OBSERVATION DATA:

S. No	V_s(VOLT)	V(VOLT)	R_L(E)	V (VOLT)

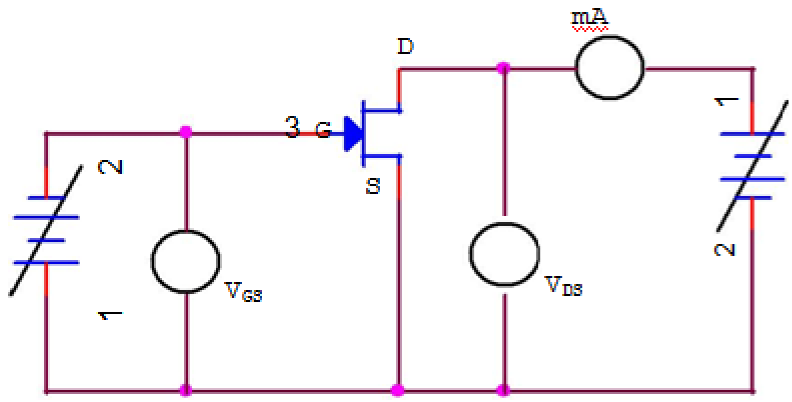
RESULT AND COMMENTS: Studied how zener diode is used as a voltage regulator**.**

EXPERIMENT NO. 6

AIM: To study and draw the characteristics of FET in common source configuration.

THEORETICAL CONCEPT:-A FET is a three terminal semiconductor device in which current conduction is by one type of carries and is controlled by the effect of electric field. There are two types of FET namely JFET and 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 and 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 with respect to source. The drain is given +ve potential with respect to source.

EXPERIMENTAL SET UP:-



SPECIFICATION OF APPARATUS USED: Power supply, FET characteristic Kit, connecting leads, two multimeters.

PROCEDURE:

Input characteristics:

(a)Connect the circuit as per the circuit diagram
(b)Keep drain-source voltage constant
(c)Vary gate-source voltage in steps and note down drain current
(d) 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.

PRECAUTIONS:

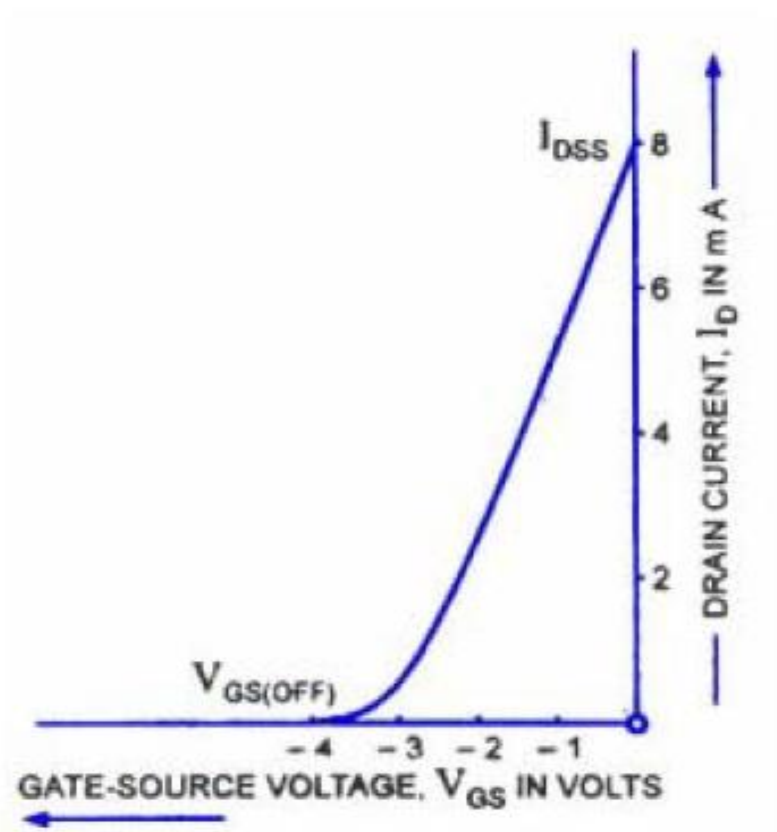
(a)Connections should be tight.
(b)Handle the equipments with care.

OBSERVATION TABLE:

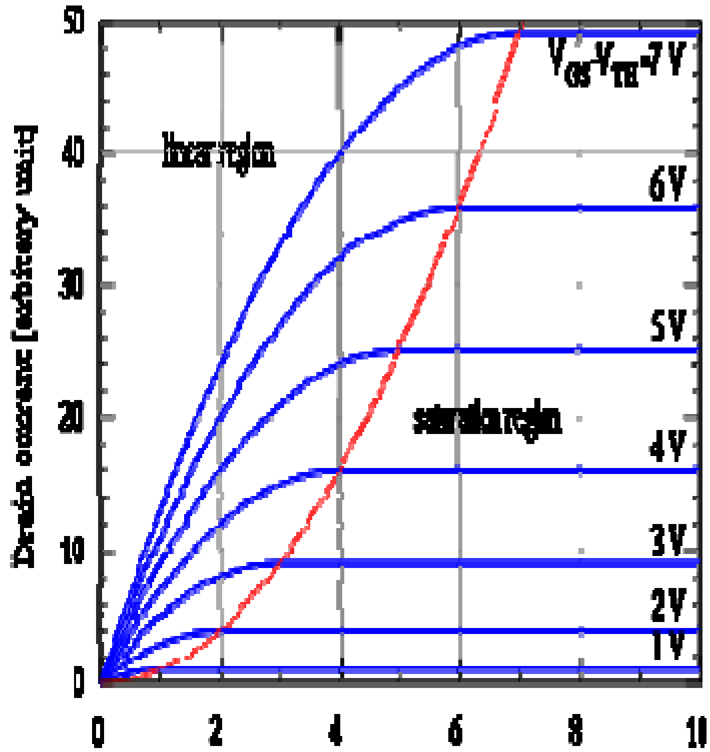
S. No	I/P at const. V_{DS}		O/P at const. V_{GS}	
	V_{GS} (V)	I_D (mA)	V_{DS} (V)	I_D (mA)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

GRAPH:

Input characteristics:



Output characteristics:



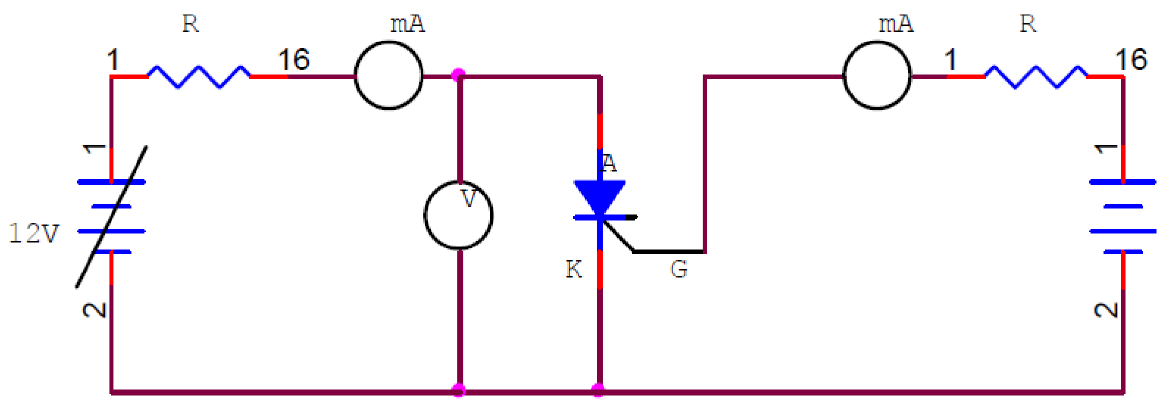
RESULT AND COMMENTS: Input and output characteristics is obtained.

EXPERIMENT NO. 7

AIM: To study and draw the characteristics of SCR.

THEORETICAL CONCEPT: Silicon control rectifier (SCR) is a four layer, three terminal semiconductor devices, the end 'P' forms the anode and the end 'N' forms the cathode and 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 with respect to cathode the SCR start conducting. If some small gate voltage is applied, the SCR trigger at some low 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 to be reduced to zero.

EXPERIMENTAL SET UP:



SPECIFICATION OF APPARATUS USED: Power supply, SCR kit, voltmeter, ammeter, connecting leads.

PROCEDURE:

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

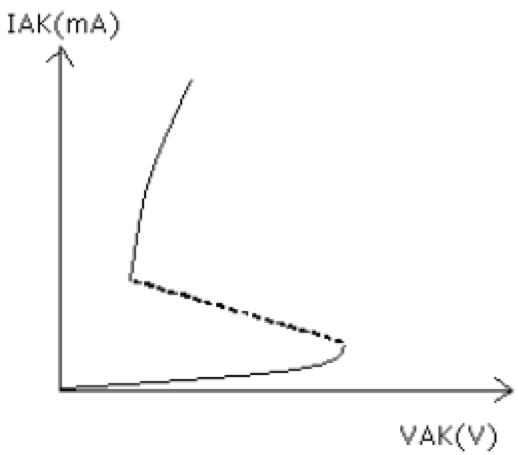
PRECAUTIONS:

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

OBSERVATION DATA:

Sr. No.	V_{AK}(Volt)	I_{AK}(mA)
1		
2		
3		
4		
5		

GRAPH:



SCR Characteristics

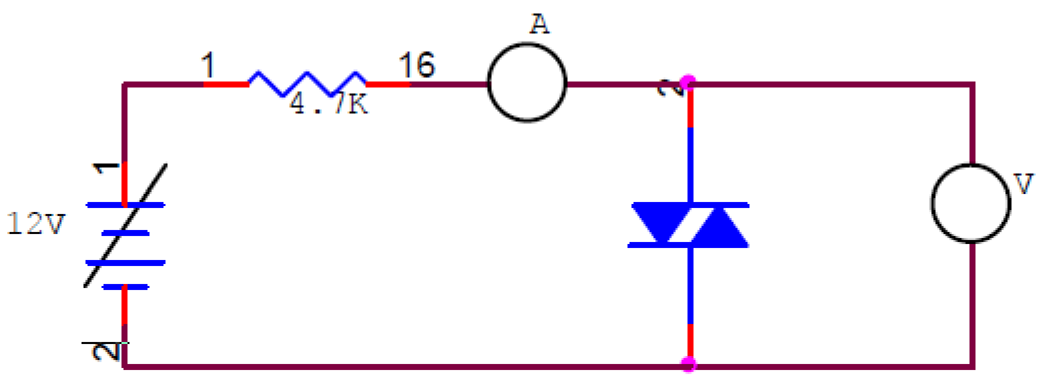
RESULT AND COMMENTS: The characteristics of thyristor have been plotted. The SCR will not conduct until it is not triggered by gate voltage.

EXPERIMENT NO. 8

AIM: To study and draw the characteristics of DIAC**.**

THEORETICAL CONCEPT:

Diac: A Diac is a two terminal and 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 for DIAC

SPECIFICATION OF APPARATUS USED: Power supply, Diac characteristic, connecting leads, ammeter and voltmeter.

PROCEDURE:

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

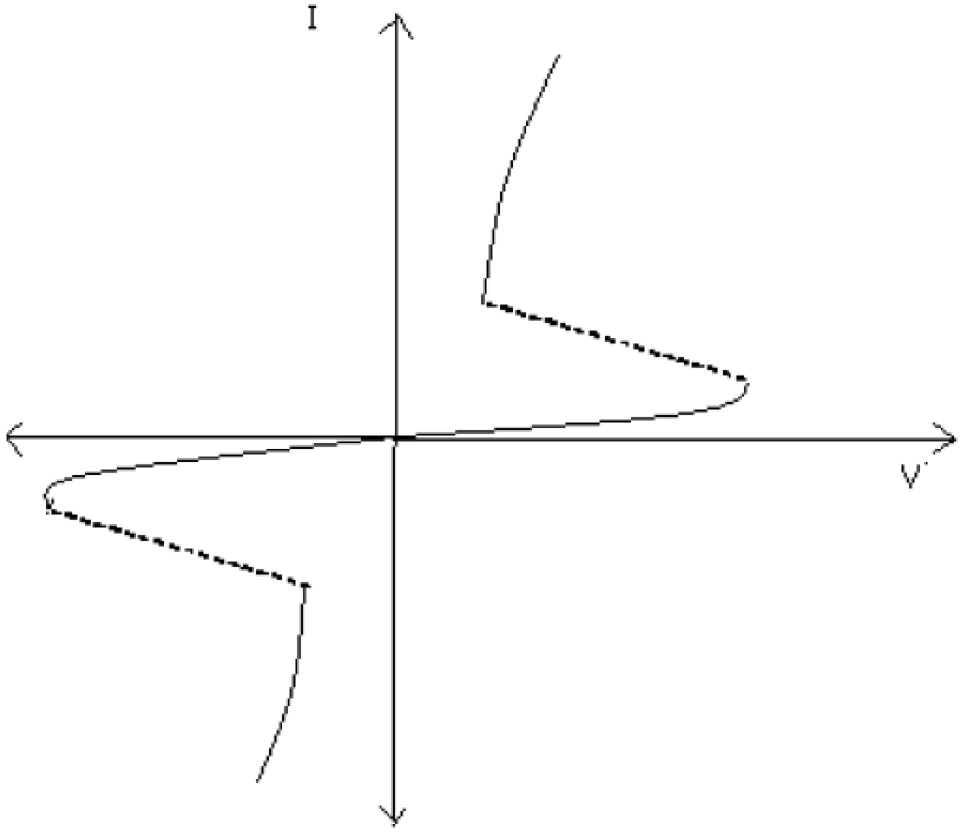
PRECAUTION:

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

OBSERVATION DATA:

Sr. No.	**DIAC characteristics**	
	I(mA)	V(volt)
1		
2		
3		

GRAPH:
DIAC Characteristic:



RESULT AND COMMENTS: The characteristics of DIAC have been plotted.

EXPERIMENT NO. 9

AIM: To plot V-I characteristic of TRIAC.

THEORETICAL CONCEPT:-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 TRIA 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. Because of its bidirectional conduction property, the TRIAC is widely used in the field of power electronics for control purpose.

EXPERIMENTAL SET UP:-

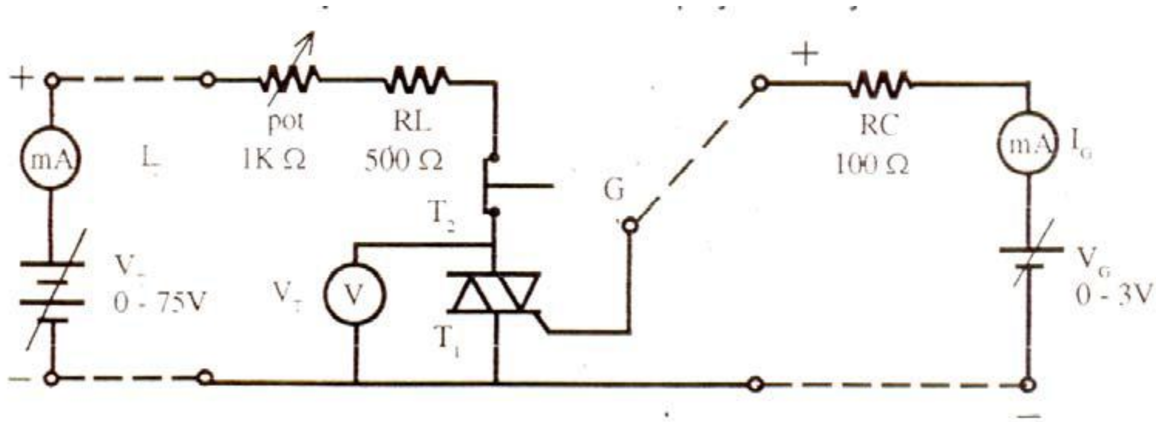


Fig 1.
Circuit diagram for quadrent I. **Dashed** line connections for I+.

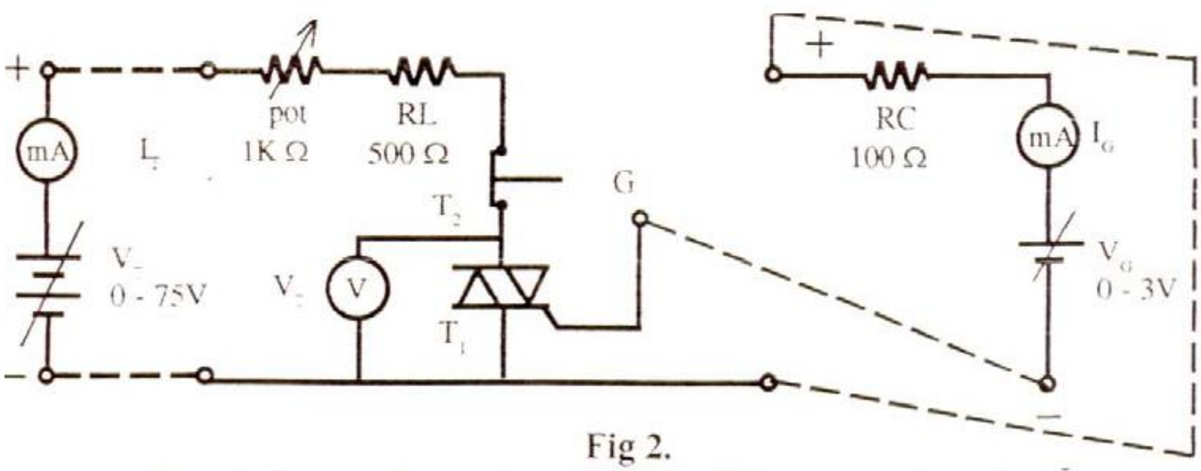


Fig 2.
Circuit diagram for quadrent I. **Dashed** line connections for I-.

SPECIFICATION OF APPARATUS USED:- Power supply, TRIAC characteristics kit, connecting leads, ammeter and voltmeter.

PROCEDURE:

(a) Make connection as per the circuit diagram.
(b) Apply +ve supply to the circuit.
(c) Increase the voltage step by step and note down the corresponding current values.

(d) After a certain voltage, the TRIAC enters into the negative resistance region.
(e) Now apply reserve polarity and repeat the whole procedure again.

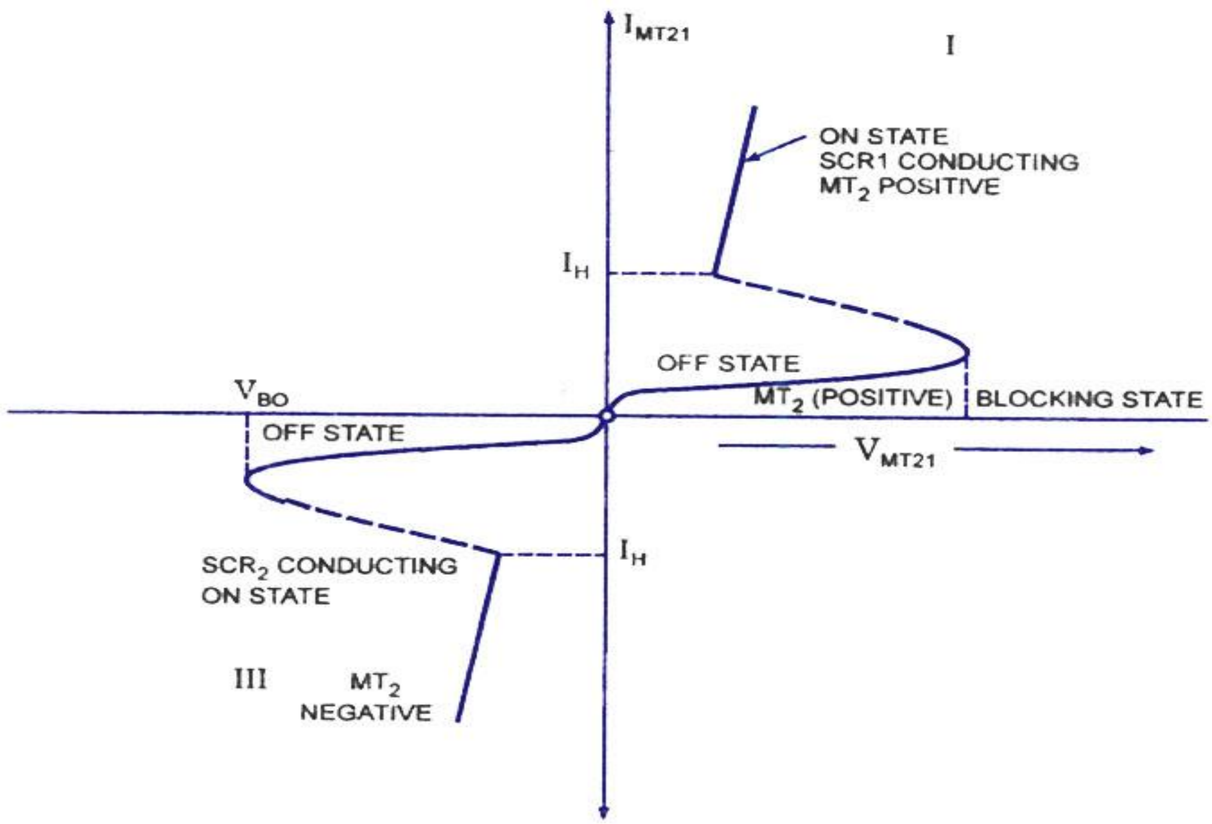
PRECAUTIONS:

(a) Always connect the voltmeter in parallel and ammeter in series.
(b) Connection should be proper and tight.
(c) Switch 'on' the supply after completing the circuit.
(d) DC supply should be increased slowly in steps.
(e) Reading of voltmeter and ammeter should be accurate.

OBSERVATION DATA:

S. No.	V(volt)	I(mA)

GRAPH:



V-I Characteristic of a Triac

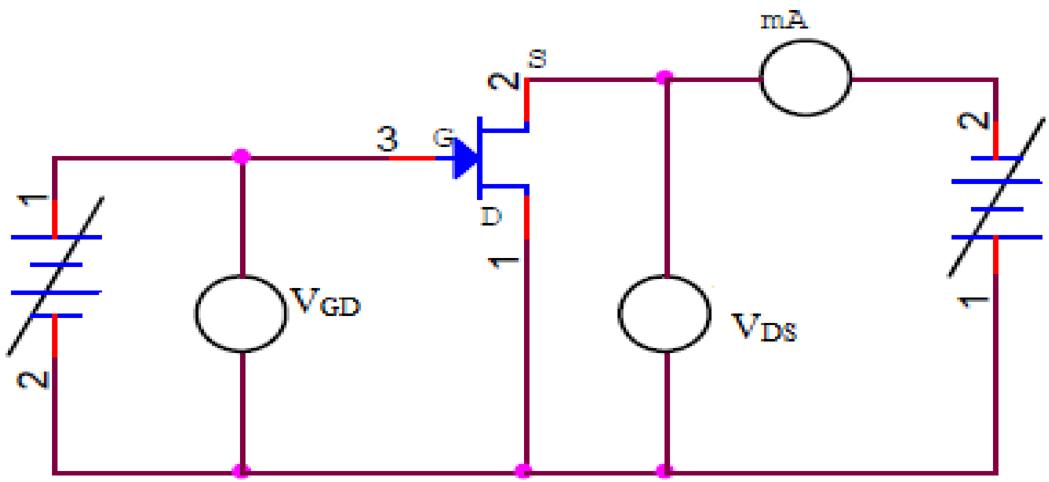
RESULT AND COMMENTS: The characteristic of TRIAC have been plotted.

EXPERIMENT NO. 10

AIM: To study and draw the characteristics of FET in common drain configuration.

THEORETICAL CONCEPT:-: A FET is a three terminal semiconductor device in which current conduction is by one type of carriers and is controlled by the effect of electric field. There are two types of FET namely JFET and 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 and 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 with respect to source. The drain is given +ve potential with respect to source. Drain is common in input and output.

CIRCUIT DIAGRAM:



PROCEDURE:

Input characteristics:

(a) Connect the circuit as per the circuit diagram.
(b) Keep drain-source voltage constant.
(c) Vary gate-drain voltage in steps and note down drain current.
(d) Readings are tabulated and graph is drawn.

Output characteristics:

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

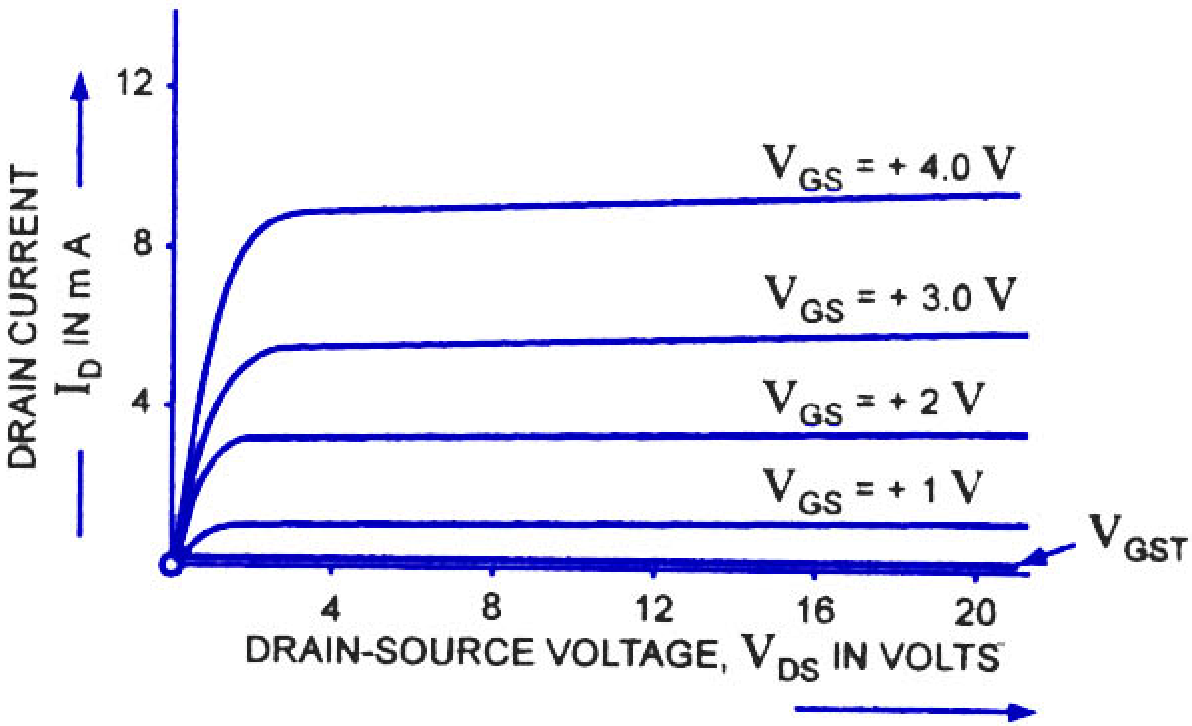
PRECAUTIONS:

(a)Connections should be tight.
(b)Handle the equipments with care.

OBSERVATION TABLE:

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

GRAPH:



Drain Characteristics

RESULT AND COMMENTS: Input and output characteristics is obtained.