Name of the Lab: Electronics Lab
Class: III sem (ET&T), III sem (IT)
Title of the Practical: Plot the V-I characteristics of a (i) Silicon Diode (ii) German Diode

Q1: Explains Insulator, metal and semiconductor?
A1: Insulator: - insulator is a material which does not allow to flow of current trough itself is called insulator. Example: - wood, glass etc
Conductor: - metal is a material which allow to flow of current trough itself is called Conductor. Example: - Al, Ag, Steel etc.
Semiconductor: - a semiconductor is a material which has the resistivity in between semiconductor and insulator. Example: - Ge, Si, C etc
Q2: What is silicon and germanium?
A2: Solid state electronics arises from the unique properties of silicon and germanium, each of which has four valence electrons and which form crystal lattices in which substituted atoms (dopants) can dramatically change the electrical properties.
Q3: Difference between silicon and germanium?
A3: In solid state electronics, either pure silicon or germanium may be used as the intrinsic semiconductor which forms the starting point for fabrication. Each has four valence electrons, but germanium will at a given temperature have more free electrons and a higher conductivity. Silicon is by far the more widely used semiconductor for electronics, partly because it can be used at much higher temperatures than germanium. For silicon diodes, the built-in potential is approximately 0.7 V and 0.3 V for Germanium
Q4: What do you mean by a Diode?
A4: when a p-type semiconductor is joint with an n-type semiconductor through VLSI technology then the resulting device is called pn junction diode. Diode is an electronics component having two terminals, cathode &anode, having non-linear characteristic end allowing the flow current in only 1 direction. The semiconductor diode is formed by forming a junction between P-type & other N-type of semiconductor. Diodes can have more complicated behavior than this simple on-off action.
Q5: Explains the forward biasing of pn junction diode?
A5: Forward biased: - when p type semiconductor is connected to the +ve terminal of the battery and n type material is connected to the –ve terminal of the battery then diode is called forward biased. At this condition, if the applied voltage is greater than the barrier potential of the diode, it starts conduction. After the diode is arrived in the conduction mode, the drop across it remains at 0.7 V. After the conduction starts, if the voltage is increased further, current trough it increases linearly with voltage.
Q6: Explains the reverse biasing of pn junction diode?
A6: Reverse biased: - when p type semiconductor is connected to the -ve terminal of the battery and n type material is connected to the +ve terminal of the battery then diode is called Reverse biased. Here there is no conduction at lower voltage values. If we increase the voltage value further, it is observed that at a voltage the current sharply increases due to the breakdown of the P-N junction. This damages the device. So care is to be taken while connecting diode in a circuit. The main applications of diode are:
Q7: What are the knee and breakdown voltages?
A7: Knee voltage is defined as the forward voltage at which barrier is removes and current through the junction starts increasing rapidly.
breakdown voltage is defined as the reverse voltage at which barrier is removed and inverse current through the junction starts increasing rapidly. It can be damages the diode.
Q8: What is voltage- Current (V-I) characteristics of diode?
A8: A semiconductor diode's behavior in a circuit is given by its current–voltage characteristic, or I–V graph .The shape of the curve is determined by the transport of charge carriers through the so-called depletion layer. In forward biasing after knee voltage current increase sharply and in reverse biasing small leakage current flow and after reverse breakdown voltage sharply inverse current will flow.

Q9: Testing of silicon diode using multimeter?

A9: To check an ordinary silicon diode using a digital multimeter. Connect the positive lead of multimeter to the anode and negative lead to cathode of the diode. If multimeter displays a voltage between 0.6 to 0.7, we can assume that the diode is healthy. This is the test for checking the forward conduction mode of diode. Now connect the positive lead of multimeter to the cathode and negative lead to the anode. If the multimeter shows an infinite reading (over range), we can assume that the diode is healthy.

Q10: Testing of germanium diode using a digital multimeter?

A10: For testing Germanium diodes, the procedure is same but the display will be between 0.25 to 0.3 V to indicate a healthy condition in the forward biased mode. The potential barrier for Germanium diode is between 0.25 and 0.3V.When reverse biased the multimeter will show an infinite reading (over range) indicate healthy condition.

Title of the Practical: verify the action of diode as a (i) Positive Clipper (ii) Negative Clipper

Q1: What is clipper?
A1: In electronics, a clipper is a device designed to prevent the output of a circuit from exceeding a predetermined voltage level without distorting the remaining part of the applied waveform. Series clippers are employed as noise limiters in FM transmitters by clipping excessive noise peaks above a specified level.
Q2: Can you explain clipping circuit?
A2: A clipping circuit consists of linear elements like resistors and non-linear elements like junction diodes or transistors. Thus a clipper circuit can remove certain portions of an arbitrary waveform near the positive or negative peaks. Clipping may be achieved either at one level or two levels Clipping Circuits are also called as Slicers, amplitude selectors or limiters.
Q3: Clipping using Zener Diode?
A3: one or two zener diodes are used to clip the voltage V_{IN}. In the first circuit, the voltage is clipped to the reverse breakdown voltage of the zener diode. In the second, it is limited to the reverse breakdown voltage plus the voltage drop across one zener diode.
Q4: Classification of clipper?
A4: Practical clippers may be classified into two types: (a) Shunt Clippers, and (b) Series Clippers. The series configuration is defined as one where diode is in series with the load In a shunt clipper which uses a diode in conjunction with a resistor the diode forms a parallel path across the output. The network must have capacitor, a diode, and a resistive element, but it also employs an independent dc supply to introduce an additional shift.
Q5: Application of clipper?
A5: It is used in television sets and FM receivers. It is also used for amplifier and different types of op-amps through which we can do some mathematical operations.
Q6: What is positive and negative clipping?
A6: Depending on the orientation of the diode, the positive or negative region of the input signal is “clipped” off and accordingly the diode clippers may be positive or negative clippers.
Q7: What is Positive Clipper **circuit**?
A7: Positive Clipper: The clipper which removes the positive half cycles of the input voltage is called the positive clipper. The positive series clipper circuit (that is, diode in series with the load). while the input is positive, diode D is reverse biased and so the output remains at zero that is, positive half cycle is clipped off. During the negative half cycle of the input, the diode is forward biased and so the negative half cycle appears across the output.
Q8: What is negative clipper circuit?
A8: If the positive clipper circuit is reconnected with reversed polarity, the circuits will become for a negative clipper and the operation will be same.
Q9: What is Combination Clipper?
A9: When a portion of both positive and negative of each half cycle of the input voltage is to be clipped (or removed), combination clipper is employed.
Q10: Drawbacks of Series Diode Clippers?
A10: In series clippers, when diode is in ‘off’ position, there should be no transmission of input signal to output. But in case of high frequency signals transmission occurs through diode capacitance which is undesirable. This is the drawback of using diode as a series element in such clippers.

Title of the Practical: Verify the action of diode as a (i) Positive Clamper (ii) Negative Clamper

Q1: What is clamper?
A clamper is an electronic circuit that prevents a signal from exceeding a certain defined magnitude by shifting its DC value. The clamper does not restrict the peak-to-peak excursion of the signal, but moves it up or down by a fixed value.
Q2: What is clamping circuit?
A2: A circuit that places either the positive or negative peak of a signal at a desired level is known as a clamping circuit. It simply adds or subtracts the dc component to the input signal. These circuits are also known as DC voltage restorers. A diode clamp (a simple, common type) relies on a diode, which conducts electric current in only one direction; resistors and capacitors in the circuit are used to maintain an altered dc level at the clamper output.
Q3: What are the components are required for clamping circuit?
A3: For a clamping circuit at least three components — a diode, a capacitor and a resistor are required. Sometimes an independent dc supply is also required to cause an additional shift.
Q4: What is the necessity for establish the clamping?
A4: The necessity to establish the extremity of the positive or negative signal excursion at some reference level (that is, to introduce a dc component to the input signal) arises in connection with a signal that has passed through a capacitive coupling network and lost its dc component, as in case of television receivers. However, normally the dc component introduced is not identical with the dc component lost in transmission.
Q5: Types of clamp circuit?
A5: Clamp circuits are categorized by their operation; negative or positive and biased and unbiased.
Q6: What is positive and negative clamp circuit?
A6: A clamp circuit adds dc component (positive or negative) to the input signal so as to push it either on the positive side, or on the negative side. When the circuit pushes the signal on the positive side or upward, the negative peak of the signal coincides with the zero level and the circuit is called the positive clamper. On the other hand, when the signal is pushed on the negative side or downward, the positive peak of the input signal coincides with the zero level and the circuit is called the negative clamper.
Q7: Clamping for input protection?
A7: Clamping can be used to adapt an input signal to a device that cannot make use of or may be damaged by the signal range of the original input.
Q8: Principles of operation?
A8: The two components creating the clamping effect are a capacitor, followed by a diode in parallel with the load. The clamper circuit relies on a change in the capacitor's time constant; this is the result of the diode changing current path with the changing input voltage. The magnitude of R and C are chosen so that $\tau = RC$ is large enough to ensure that the voltage across the capacitor does not discharge significantly during the diode's "Non conducting" interval. During the first negative phase of the AC input voltage, the capacitor in the positive clamper charges rapidly. As V_{in} becomes positive, the capacitor serves as a voltage doubler; since it has stored the equivalent of V_{in} during the negative cycle, it provides nearly that voltage during the positive cycle; this essentially doubles the voltage seen by the load. As V_{in} becomes negative, the capacitor acts as a battery of the same voltage of V_{in}. The voltage source and the capacitor counteract each other, resulting in a net voltage of zero as seen by the load.
Q9: Example of clamper?
A9: Clamping circuits are often employed in television receivers as dc restorers. The incoming composite video signal normally processes through capacitive coupled amplifiers which eliminate the dc component thereby losing the black and white reference levels and the blanking level. These reference levels have to be restored before applying the video signal to the picture tube. This is accomplished by employing clamping circuits. Clamping circuits are also used in storage counter, analog frequency meter, capacitance meter, divider and stair-case waveform generator.
Q10: The values of R and C should be taken for good clamping is?
A10: For good clamping action, the circuit time constant t = RC should be at least ten times the time period of the input signal voltage , it is large enough to ensure that the voltage across the capacitor C does not change significantly during the interval the diode is non-conducting.

Title of the Practical: Verify the V-I characteristics of a zener diode

Q1: What is zener diode?
A1: Zener diode is a P-N junction diode specially designed to operate in the reverse biased mode. It is acting as normal diode while forward biasing. It has a particular voltage known as break down voltage or "Zener knee voltage" or "Zener voltage", at which the diode break downs while reverse biased.
Q2: who discovered the zener diode?
A2: The device was named after Clarence Zener, who discovered this electrical property.
Q3: What is the basic principle of zener diode?
A3: The basic principle of zener diode is the zener breakdown. When a diode is heavily doped, it's depletion region will be narrow. When a high reverse voltage is applied across the junction, there will be very strong electric field at the junction. And the electron hole pair generation takes place. Thus heavy current flows. This is known as Zener break down. In reverse biased mode, after the break down of junction current through diode increases sharply. But the voltage across it remains constant.
Q4: Doping in Zener diode?
A3: The Zener diode's operation depends on the heavy doping of its p-n junction allowing electrons to tunnel from the valence band of the p-type material to the conduction band of the n-type material, as a result of the reduced barrier between these bands and high electric fields that are induced due to the relatively high levels of doping on both sides. The breakdown voltage can be controlled quite accurately in the doping process.
Q5: Applications of zener diode?
A5: The Zener diode is therefore ideal for applications such as the generation of a reference voltage (e.g. for an amplifier stage), or as a voltage stabilizer for low-current applications. Zener diodes are also used in surge protectors to limit transient voltage spikes.
Q6: What is voltage- Current (V-I) characteristics of zener diode?
A6: The V-I characteristics is similar as simple diode except zener has low breakdown voltage and after breakdown, voltage across it remains constant (current increases sharply).
Q7: Zener diode as voltage regulator?
A7: Zener diodes are widely used as voltage references and as shunt regulators to regulate the voltage across small circuits. When connected in parallel with a variable voltage source so that it is reverse biased, a Zener diode conducts when the voltage reaches the diode's reverse breakdown voltage. The intrinsic voltage drop of diode is stable over a wide current range and holds output voltage relatively constant even though the input voltage may fluctuate over a fairly wide range. Resistor R is used to limit current through the circuit.
Q8: Limitation of shunt regulator?
A8: Shunt regulators are simple, but the requirements that the resistor be small enough to avoid excessive voltage drop during worst-case operation (low input voltage concurrent with high load current) tends to leave a lot of current flowing in the diode much of the time, making for a fairly wasteful regulator with high quiescent power dissipation, only suitable for smaller loads.
Q9: How can do Testing of Zener diode?
A9: In reverse mode (positive lead of multimeter to the cathode and negative lead to the anode), the multimeter must be in voltage mode. Now slowly increase the output of variable power supply and at the same time observes the voltage shown in the multimeter. The multimeter display increases along with the increase in power supply voltage until the breakdown voltage. Beyond that the multimeter reading stays put despite of the power supply voltage. This is because the Zener diode is now in breakdown region and the voltage across it will remain constant irrespective of the increase in supply voltage and this constant voltage will be equal to the breakdown voltage. If the reading of multimeter in this instant is equal to the breakdown voltage specified by the manufacturer, we can assume that the Zener diode is healthy.
Q10: what is difference between zener diode & simple diode?
A10: zener diode is highly dopped & conduct in reveres bias. In the case of normal diodes the diode damages at the break down voltage. But zener diode is specially designed to operate in the reverse breakdown region and have a greatly reduced breakdown voltage.

Title of the Practical: Set up the circuit and verify the waveforms of (i) H.W. rectifier (ii) F.W. (Centre tapped) rectifier (iii) Bridge rectifier.

Q1: What is the rectifier?
A1: The process of converting A.C. voltage into D.C. voltage which is in only one direction, a process known as rectification is called rectification and it is done by rectifier.
Q2: What is the application of rectifier?
A2: Rectifiers have many uses including as components of power supplies and as detectors of radio signals. Rectifiers may be made of solid state diodes, vacuum tube diodes, mercury arc valves, and other components. Rectifiers also find a use in detection of amplitude modulated radio signals
Q3: What is the type of rectifier?
A3: There are two type of rectifier:-
1. Half wave rectifier 2. Full wave rectifier:- center tape full wave
Bridge full wave
Q4: What is the ripple factor of the rectifier?
A4: The ripple factor of the rectifier: - Half wave recitifer:-1.21, Center tape wave rectifier:-0.48
Bridge full wave:-0.48
Q5: What is the PIV of all type rectifiers?
A5: The PIV of rectifier: - Half wave rectifier=Vm, Center tape wave rectifier=2Vm
Bridge full wave=Vm
Q6: Half wave rectifier?
A5: In a half wave rectifier only one half cycle of ac voltage is taking. The circuit is given. Here only one diode is using. During the positive half cycle of ac voltage the diode conducts. So current flows through load. During the negative half cycle, the diode is reverse biased .So no current flows through the diode. Half-wave rectification can be achieved with a single diode in a one-phase supply, or with three diodes in a three-phase supply.
Q7: Full wave bridge rectifier?
A7: Full wave bridge rectifier: In full wave bridge rectifiers 4 diodes are using. During positive half cycle, D1 and D4 are in forward biased condition. In the negative half cycle of ac D3 and D2 are in forward biased condition. So in both the half cycles current through the load is in single direction. This circuit does not need a centre tap rectifier. But it requires more number of diodes than centre tap and half wave rectifiers
Q8: Full wave centre tap rectifier?
A8: In this method only two diodes are using. But it requires a center tap transformer. During the positive half cycle diode D1 conducts. In the negative half cycle diode D2 conducts. So in both half cycles current flowing through load in same direction. Full-wave rectification converts both polarities of the input waveform to DC (direct current), and is more efficient.
Q9: Why we use Filter?
A9: While half-wave and full-wave rectification suffice to deliver a form of DC output, neither produces constant-voltage DC. In order to produce steady DC from a rectified AC supply, a smoothing circuit or filter is required. In its simplest form this can be just a reservoir capacitor or smoothing capacitor, placed at the DC output of the rectifier. There will still remain an amount of AC ripple voltage where the voltage is not completely smoothed.
Q10: Difference between half wave and full wave rectifier?
A10: The efficiency of half wave rectifier is not as good as that of full wave rectifier because only one half of the input waveform reaches the output, it is very inefficient if used for power transfer. The ripples are maximum in the single phase half-wave rectifier and being reduced in the full-wave rectifier and being reduced further with the increase in the number of phases.

Title of the Practical: Observe the output waveform of a rectifier circuit with (i) Capacitor filters (ii) L – Inductive filter.

Q1: What is filter?
A1: A filter circuit is a device that converts pulsating output of a rectifier into a steady dc level. Hence, it becomes essential to reduce the ripples from the pulsating dc supply available from rectifier circuits to the minimum. This is achieved by using a filter or smoothing circuit which removes (or filters out) the ac components and allows only the dc component to reach the load. Obviously, a filter circuit should be placed between, the rectifier and the load.
Q2: What is filter circuit?
A2: A filter is generally a combination of inductors L and Capacitors C. The filtering action of L and C depends upon the facts that an inductor allows only dc and a capacitor allows ac only to pass. So a suitable L and C network can effectively filter out (or remove) the ac components from the rectified output.
Q3: What are the commonly used types of filter circuits?
A3: (a) Series Inductor filter ,(b) Shunt Capacitor Filter ,(c) Choke Input Filter, (d) Capacitor input or pie filter
Q4: Series Inductor Filter?
A4: In this arrangement a high value inductor or choke L is connected in series with the rectifier element and the load,. The filtering action of an inductor filter depends upon its property of opposing any change in the current flowing through it. The function of the inductor filter may be viewed in terms of impedances. The choke offers high impedance to the ac components but offers almost zero resistance to the desired dc components. Thus ripples are removed to a large extent.
Q5: What is shunt capacitor filter?
A5: In this arrangement a high value Capacitor is connected in parallel with the rectifier element and the load,. The function of the capacitor filter may be viewed in terms of impedances. The capacitor offers zero impedance to the ac components but offers high resistance to the desired dc components, so C bypasses the dc.Thus ripples are removed to a large extent
Q6: What is the drawback of series inductor and shunt capacitor filter?
A6: A simple shunt capacitor filter reduces the ripple voltage but increases the diode current. The diode may get damaged due to large current and at the same time it causes greater heating of supply transformer resulting in reduced efficiency. In an inductor filter, ripple factor increases with the increase in load resistance RL while in a capacitor filter it varies inversely with load resistance RL.From economical point of view also, neither series inductor nor shunt capacitor type filters are suitable.
Q7: What is practical filter circuit?
A7: Practical filter-circuits are derived by combining the voltage stabilizing action of shunt capacitor with the current smoothing action of series choke coil. By using combination of inductor and capacitor ripple factor can be lowered, diode current can be restricted and simultaneously ripple factor can be made almost independent of load resistance (or load current). Two types of most commonly used combinations are choke-input or L-section filter-and capacitor-input or Pi-Filter.
Q8: What is Choke-input filter?
A8: Choke-input filter consists of a choke L connected in series with the rectifier and a capacitor C connected across the load. This is also sometimes called the L-section filter The choke L on the input side of the filter readily allows dc to pass but opposes the flow of ac components Any fluctuation that remains in the current even after passing through the choke are largely by-passed around the load by the shunt capacitor However, a small ripple still remains in the filtered output and this is considered negligible if it than l%.
Q9: What is Capacitor-Input or Pi-Filter?
A9: Such a filter consists of a shunt capacitor C1 at the input followed by an L-section filter formed by series inductor L and shunt capacitor C_2. This is also called the ∏ -filter the input capacitor C1 is selected to offer very low reactance to the ripple frequency. Hence major part of filtering is accomplished by the input capacitor C1. Most of the remaining ripple is removed by the L-section filter consisting of a choke L and capacitor C_2.

Q10: Salient Features of L-Section and Pi-Filters?

A10: 1. In pi-filter the dc output voltage is much larger than that can be had from an L-section filter with the same input voltage.

2. In pi-filter ripples are less in comparison to those in shunt capacitor or L-section filter. So smaller valued choke is required in a pi-filter in comparison to that required in L-section filter.

3. In pi-filter, the capacitor is to be charged to the peak value hence the rms current in supply transformer is larger as compared in case of L-section filter.

4. Voltage regulation in case of pi-filter is very poor, as already mentioned. So n-filters are suitable for fixed loads whereas L-section filters can work satisfactorily with varying loads provided a minimum current is maintained.

5. In case of a pi-filter PIV is larger than that in case of an L-section filter.

Title of the Practical: Obtain the input and output transistor characteristics for CB configuration.

Q1: What is a transistor?
A1: A junction transistor is simply a sandwich of one type of semiconductor material between two layers of the other type. A transistor is a three terminal current sensing device. It can be looked upon as two pn junction placed back to back. The three terminals are named as emitter base & collector.
Q2: Q2: What are the types of transistor?
A2: The transistor may be NPN or PNP type
An NPN bipolar transistor is so called because the outer layers are N-type semiconductors, while the base is a P-type. N stands for negative charge carriers or electrons, and P for positive charge carriers or holes
Q3: What are the different configurations of transistor?
A3: A transistor may be connected in three configurations namely:

a) Common Emitter (CE)
b) Common Base (CB)
c) Common collector (CC)

Q4: What is the meaning of term "Common"?
A4: The term common is used to denote the element that is common to both input and output circuits. Because the common element is often grounded, these configurations are frequently referred to as grounded emitter, grounded base, and grounded collector.
Q5**: What are the characteristics o f each configuration that make it suitable for specific applications?**
A5: Each configuration has particular characteristics that make it suitable for specific applications. An easy way to identify a specific transistor configuration is to follow three simple steps:
1) Identify the element (emitter, base, or collector) to which the input signal is applied.
2) Identify the element (emitter, base, or collector) from which the output signal is taken.
3) The remaining element is the common element, and gives the configuration its name.
Q6: What is Common Base configuration?
A6: The common-base configuration (CB), base is common between input and output circuits. In emitter-base terminal input signal is applied and in collector-base terminal output is taken from it.
Q7: What are the characteristics of CB?
A7: since it has a low input resistance (30 ohms-160 ohms) and a high output resistance (250 kilohms-550 kilohms). However, two factors limit its usefulness in some circuit applications: (1) its low input resistance and (2) its current gain of less than 1. Since the CB configuration will give voltage amplification, and use in some microphone amplifiers. The input and output signals in the common-base circuit are in phase
Q8: What is current gain for CB?
A8: The current gain in the common-base circuit is the ratio of change in collector current(output current) to the change in emitter current(input current) at constant V_{CB} . The term ALPHA (α) is used for gain. Alpha is calculated using the formula:

$$\alpha = \frac{\Delta I_C}{\Delta I_E}$$

This is a current gain of less than 1.
Q9: What is input characteristic of CB?
A9: Input Characteristics, a graph of the base current I_E versus V_{BE} with constant V_{CB} , which is the voltage between the base and the collector, looks like that of an ordinary diode. I_E increases rapidly with small increase in $V_{BE.}$ The I_E is almost independent of $V_{CB.}$
Q10: Output Characteristics of CB configuration?
A10: Output characteristics are found by considering the collector loop. A graph of the collector current I_C versus the collector-base voltage V_{CB} with constant I_E. The I_C varies with V_{CB} only at very low voltages (< 1 v). Beyond this value I_C became constant and dependent upon only I_E . A very large change in produces only a tiny change in the

Title of the Practical: Obtain the input & output transistor characteristics for CE configuration.

Q1: What are the characteristics of CE configuration?

A1: CE configuration has following characteristics:

a) High voltage gain
b) High current gain
c) Medium input impendence.
d) Output impendence equal too the load resistance.

Q2: What is CE configuration?

A2: In common emitter or CE circuit, the base terminal of the transistor serves as the input, the collector is the output, and the emitter is common to both, hence its name. It is used for amplification. A small signal introduced into the base produces a larger signal at the output.

Q3: What is transistor gain for CE configuration?

A3: The transistor gain, or β, is the ratio of the change of collector current I_C to the change of base current I_B. The gain tells how much the input signal is amplified. It is a constant that depends on the transistor type.'

$$\beta = \frac{\Delta I_C}{\Delta I_B}$$

Q4: Input Characteristics of CE configuration?

A4: Input Characteristics, a graph of the base current I_B versus V_{BE} with constant V_{CE}, which is the voltage between the base and the emitter, looks like that of an ordinary diode. The current is zero until V_{BE} reaches 0.7 volts, where it then increases very suddenly.

Q5: Output Characteristics of CE configuration?

A5: Output characteristics are found by considering the collector loop. A graph of the collector current I_C versus the collector-emitter voltage V_{CE} with constant I_B. As V_{CE} increases, I_C will remain zero and then suddenly shoot up when the voltage reaches a certain value, much the same way as I_B. Unlike I_B, I_C will remain constant as V_{CE} increases.

Q6: What are the characteristics of CE?

A6: The common emitter also has a somewhat low input resistance (500 ohms-1500 ohms), because the input is applied to the forward-biased junction, and a moderately high output resistance (30 kilohms-50 kilohms or more), because the output is taken off the reverse-biased junction.

Q7: What is gain?

A7: The term GAIN is used to describe the amplification capabilities of the amplifier. It is basically a ratio of output versus input. Each transistor configuration gives a different value of gain even though the same transistor is used.

Q8: Applications of CE configuration?

A8: In Low frequency voltage amplifier, in Radio, as a low-noise amplifiers, as a switch etc.

Q9: What is the advantage of CE configuration?

A9: The common-emitter configuration (CE) is the arrangement most frequently used in practical amplifier circuits, since it provides good voltage, current, and power gain

Q10: What is the property of CE transistor?

A10: The input signal to the common emitter goes positive when the output goes negative; the two signals (input and output) are 180 degrees out of phase. The common-emitter circuit is the only configuration that provides a phase reversal.

Title of the Practical: Obtain the input & output transistor characteristics for CC configuration

Q1: What is Common Collector configuration (CC)?
A1: In the common-collector circuit, the input signal is applied to the base, the output is taken from the emitter, and the collector is the element common to both input and output. The common collector is equivalent to the electron-tube cathode follower.
Q2: What are the characteristics of CC configuration?
A2: CC configuration has high input and low output resistance. The input resistance for the common collector ranges from 2 kilohms to 500 kilohms, and the output resistance varies from 50 ohms to 1500 ohms. Since a small change in base current controls a large change in emitter current, it is still possible to obtain high current gain in the common collector. The common collector is also referred to as an emitter-follower because the output developed on the emitter follows the input signal applied to the base
Q3: What is current gain?
A3: It is based on the emitter-to-base current ratio called GAMMA (γ), because the output is taken off the emitter. The common-collector current gain, gamma (γ), is defined as

$$\gamma = \frac{\Delta I_E}{\Delta I_B}$$

Q4: Difference among CB, CE, and CC in terms of gain?
A4: The current gain of CC is higher than that in the common emitter, but it has a lower power gain than either the common base or common emitter. Like the common base, the output signal from the common collector is in phase with the input signal.
Q5: Relation among α, β, and γ?
A5: A given transistor may be connected in any of three basic configurations; there is a definite relationship, as pointed out earlier, between alpha (α), beta (β), and gamma (γ). These relationships are:

$$\alpha = \frac{\beta}{\beta + 1} \quad \beta = \frac{\alpha}{1 - \alpha} \quad \gamma = \beta + 1$$

Q6: Give an example for α, β, and γ?
A6: For example, a transistor that is listed on a manufacturer's data sheet as having an alpha of 0.90. We wish to use it in a common emitter configuration. This means we must find beta. The calculations are:

$$\beta = \frac{\alpha}{1 - \alpha} = \frac{0.90}{1 - 0.90} = \frac{0.90}{0.1} = 9$$

Therefore, a change in base current in this transistor will produce a change in collector current that will be 9 times as large. If we wish to use this same transistor in a common collector, we can find gamma ( ) by:

$$\gamma = \beta + 1 = 9 + 1 = 10$$

Q7: Application of CC configuration?
A7: The common-collector configuration (CC) is used mostly for impedance matching. It is also used as a current driver, because of its substantial current gain. It is particularly useful in switching circuitry, since it has the ability to pass signals in either direction (bilateral operation).

Q8: Transistor Configuration Comparison?
A8:

AMPLIFIER TYPE	COMMON BASE	COMMON EMITTER	COMMON COLLECTOR
INPUT/OUTPUT PHASE RELATIONSHIP	0°	180°	0°
VOLTAGE GAIN	HIGH	MEDIUM	LOW
CURRENT GAIN	LOW(□)	MEDIUM(□)	HIGH(□)
POWER GAIN	LOW	HIGH	MEDIUM
INPUT RESISTANCE	LOW	MEDIUM	HIGH
OUTPUT RESISTANCE	HIGH	MEDIUM	LOW

Q9: What is power rating of transistor?
A9: The maximum power that a transistor can handle without destruction is known as power rating of the transistor. While connecting transistor in a circuit, it should be ensure that its power rating is not exceeded otherwise the transistor may be destroyed.
Q10: Can you explain transistor testing?
A10: An ohmmeter can be used to check the transistor, forward biased base-emitter junction should have low resistance (100 ohm-1kohm) and reverse biased collector-base junction should have higher resistance (100kohm).

Title of the Practical: Verify the operation of BJT & FET as a switch

Q1: What is the difference between BJT & FET?
A1: FET is unipolar & voltage driven device but BJT is bipolar & current driven device.
Q2: What is FET?
A2: FET is the Field Effect Transistor. It is 3 terminal voltage controlled device. Its terminals are drain, source and gate. Gate is the controlling terminal.
Q3: What is the operation of FET?
A3: Consider an n channel device. The gate (p material) is diffused. At zero gate voltage there is no reverse voltage at the channel. So as V_{ds} (drain source voltage) increases current I_{ds} also increases linearly. As the voltage is increased, at a particular voltage, pinch off occurs .This voltage is known as pinch off voltage. After pinch off drain current remains stationary .If we apply a gate voltage (negative voltage) the pinch off occurs early.
Q4: Advantages of FET over BJT?
A4:a) No minority carriers
b) High input impedance
c) It is a voltage controlled device
d) Better thermal stability
Q5: Regions of operation of BJT?
A5: The modes of operation can be described in terms of the applied voltages (this description applies to NPN transistors; polarities are reversed for PNP transistors):
Forward-active (or simply, active): The base–emitter junction is forward biased and the base–collector junction is reverse biased. Most bipolar transistors are designed to afford the greatest common-emitter current gain, β_F, in forward-active mode.
Reverse-active (or inverse-active or inverted): By reversing the biasing conditions of the forward-active region, a bipolar transistor goes into reverse-active mode. In this mode, the emitter and collector regions switch roles.
Saturation: With both junctions forward-biased, a BJT is in saturation mode and facilitates high current conduction from the emitter to the collector. This mode corresponds to a logical "on", or a closed switch.
Cutoff: In cutoff, biasing conditions opposite of saturation (both junctions reverse biased) are present. There is very little current, which corresponds to a logical "off", or an open switch.
Q6: What is switch?
A6: A switch is a device that is used to 'open' or 'close' a circuit. Opening a circuit means creating a break in the circuit, preventing current flow and thus, turning it 'off'. Closing a circuit, on the other, means completing the circuit path, thereby allowing current to flow around it and thus, turning it 'on'.
Q7: Which devices are used as switch?
A7: The bipolar transistor, whether NPN or PNP, may be used as a switch. Recall that the bipolar transistor has three regions of operation: the cut-off region, the linear or active region, and the saturation region. When used as a switch, the bipolar transistor is operated in the cut-off region (the region wherein the transistor is not conducting, and therefore makes the circuit 'open') and saturation region (the region wherein the transistor is in full conduction, thereby closing the circuit).
Q8: Why BJT is a good switch?
A8: The bipolar transistor is a good switch because of its large transconductance Gm, with Gm = Ic/Vbe where Ic is the collector-to-emitter (output) current and Vbe is the base-emitter (input) voltage. Its high Gm allows large collector-to-emitter currents to be easily achieved if sufficient excitation is applied at the base.

Q9: Operation of BJT as a switch?

A9: To illustrate this, the simplest way to use an NPN bipolar transistor as a switch is to insert the load between the positive supply and its collector, with the emitter terminal grounded. Applying no voltage at the base of the transistor will put it in the cut-off region, preventing current from flowing through it and through the load In this state, the load is 'off'. Applying enough voltage at the base of the transistor will cause it to saturate and become fully conductive, effectively pulling the collector of the transistor to near ground. This causes a collector-to-emitter current to flow through the load that's limited only by the impedance of the load. In this state, the load is 'on'.

Q10: What is the limitation of transistor switch?

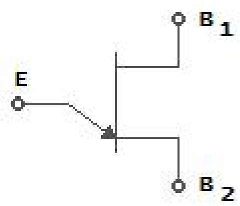
A10: One limitation of this simple design is that the switch-off time of the transistor is slower than its switch-on time if the load is a resistor. This is because of the stray capacitance across the collector of the transistor and ground, which needs to charge through the load resistor during switch-off. On the other hand, this stray capacitance is easily discharged to ground by the large collector current flow when the transistor is switched on. There are, of course, other better designs for using the bipolar transistor as a switch.

Title of the Practical: Verify the V-I characteristics of a UJT.

Q1: What is UJT?

A1: Unijuction transistor has only one p-n junction. It consists of a lightly doped n-type silicon bar. The p- type impurity is diffused into the base producing the pn junction these are referred to as the emitter, base 1 and base 2 respectively. It is also called double based device It is switching device. The single P-N junction accounts for the terminology unijunction. The emitter junction is usually located closer to base-2 (B_2) than base-1 (B_1)

Q2: Symbol of UJT?



Q3: What is inter base resistance?

A3: The resistance of the silicon bar is called inter base resistance R_{BB} represented by the two resistors in series of Rb1 and Rb2.

The inter base resistance is given by

$$R_{bb} = R_{b1} + R_{b2}$$

Q4: What is intrinsic standoff ratio?

A4: If a voltage V_{bb} is applied between the bases with emitter open, the voltage will divide up across R_{b1} and R_{b2}.Voltage across Rb1, $V1 = \frac{Rb1}{(Rb1+Rb2)}Vbb$ $\quad \frac{V1}{Vbb} = \frac{Rb1}{(Rb1+Rb2)}$

The ratio $\frac{V1}{Vbb}$ is called the intrinsic stand-off ratio represented by η . Thus $\eta = \frac{Rb1}{(Rb1+Rb2)}$

Q5: What is the mode of operation of UJT?

A5: The operation of UJT may be explained in three different modes.

1. Cut off region 2. Negative resistance region 3. Saturation region

Q6: Operation of a UJT?

A6: If a progressively rising positive voltage is applied to the emitter the diode will become forward biased when input voltage exceeds η V_{bb} by V_d, the forward voltage drop across the silicon diode. Now the emitter current increases regeneratively until it is limited by the emitter power supply.

Here we can define the peak point voltage of the UJT, $Vp = \eta Vbb + Vd$ Thus when input positive voltage to the emitter is less then V_p, the pn-junction remains reverse biased and the emitter current is practically zero. When the input voltage exceeds V_p, the diode is forward biased and the emitter current reaches a saturation value limited by Rb1and the forward resistance of pn-junction.

Q7: Application of UJT?

A7: The device has-a unique characteristic that when it is triggered, its emitter current increases re generatively (due to negative resistance characteristic) until it are restricted by emitter power supply. The low cost per unit, combined with its unique characteristic, have warranted its use in a wide variety of applications. A few include oscillators, pulse generators, saw-tooth generators, triggering circuits, phase control, timing circuits, voltage-or current-regulated supplies and one of the most important applications of UJTs is to trigger thyristors (SCR, TRIAC, etc.).

Q8: What are the features of UJT?

A8: The worth noting points about UJT are given below:

1) The device, because of one P-N junction, is quite similar to a diode but it differs from an ordinary diode as it has three terminals.
2) The structure of a UJT is quite similar to that of an N-channel JFET.
3) The N-type silicon bar has a high resistance and the resistance between emitter and base-1 is larger than that between emitter and base-2. It is because emitter is closer to base-2 than base-1.
4) UJT is operated with emitter junction forward- biased while the JFET is normally operated with the gate junction reverse-biased.
5) UJT does not have ability to amplify but it has the ability to control a large ac power with a small signal. It exhibits a negative resistance characteristic and so it can be employed as an oscillator.

Q9: What are the characteristics of UJT?

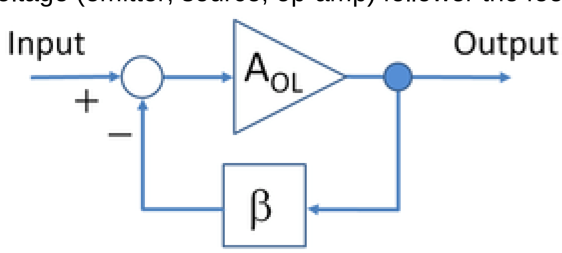
A9: The static emitter characteristic (a curve the relation between emitter voltage V_E and emitter current I_E) of a UJT at a given inter base voltage V_{BB}.Once conduction is established at $V_E = V_P$ the emitter potential V_E starts decreasing with the increase in emitter current I_E. This Corresponds exactly with the decrease in resistance R_B for increasing current I_E. This device, therefore, has a negative resistance region which is stable enough to be used with a great deal of reliability in the areas of applications listed earlier. Eventually, the valley point reaches, and any further increase in emitter current I_E places the device in the saturation region,

Q10: Explain I_p, V_V, and I_V ?

A10: Peak-Point Emitter Current. I_p. It is the emitter current at the peak point. It represents the rnimrnum current that is required to trigger the device (UJT). It is inversely proportional to the interbase voltage V_{BB}.
Valley Point Voltage V_V The valley point voltage is the emitter voltage at the valley point. The valley voltage increases with the increase in interbase voltage V_{BB}.
Valley Point Current I_V The valley point current is the emitter current at the valley point. It increases with the increase in inter-base voltage V_{BB}.

Title of the Practical: Observe the characteristics of a (i) Current series feedback amplifier.
(ii) Voltage series feedback amplifier.

Q1: What is feedback?
A1: Feedback is a mechanism, process or signal that is looped back to control a system within itself. Such a loop is called a feedback loop. In systems containing an input and output, feeding back part of the output to the input.
Q2: Types of feedback?
A2:1)An in-phase feedback signal, where a positive-going wave on the input leads to a positive-going change on the output, will amplify the input signal, leading to more modification. This is known as positive feedback. Positive feedback amplifies possibilities of divergences
2) A feedback signal which is inverted, where a positive-going change on the input leads to a negative-going change on the output, will dampen the effect of the input signal, leading to less modification. This is known as negative feedback. They exist when the fed-back output signal is out of phase with the input signal. This occurs when the fed-back signal is anywhere from 90° to 270° with respect to the input signal.
Q3: Application of feedback in electronic engineering?
A3: The main applications of feedback in electronics are in the designs of amplifiers, oscillators, and logic circuit elements. The processing and control of feedback is engineered into many electronic devices and may also be embedded in other technologies.
Q4: What is open loop and closed loop?
A4: A device is said to be operating open loop if no output feedback is being employed and closed loop if feedback is being used. Electronic feedback loops take two forms: negative feedback loops and positive feedback loops.
Q5: What is negative feedback amplifier?
A5: A negative feedback amplifier (or more commonly simply a feedback amplifier) is an amplifier a fraction of the output of which is combined with the input so that a negative feedback opposes the original signal. The applied negative feedback improves performance (gain stability, linearity, frequency response, step response) and reduces sensitivity to parameter variations due to manufacturing or environment. Because of these advantages, negative feedback is used in this way in many amplifiers and control systems.
Q6: What are the elements of negative feedback amplifier?
A6: A negative feedback amplifier is a system of three elements an amplifier with gain A_{OL}, an attenuating feedback network with a constant $\beta < 1$ and a summing circuit acting as a subtractor (the circle in the figure). The amplifier is the only obligatory; the other elements may be omitted in some cases. For example, in a voltage (emitter, source, op-amp) follower the feedback network and the summing circuit are not necessary.



Q7: What are the advantages of feedback amplifier?
A7: 1) Can increase or decrease input impedance (depending on type of feedback)
2) Can increase or decrease output impedance (depending on type of feedback)
3) Reduces distortion (increases linearity)
4) Increases the bandwidth
5) Desensitizes gain to component variations
6) Can control step response of amplifier
Q8: What is the change of i/p and o/p impedance by negative voltage series feedback?
A8: The negative voltage series feedback increases the input impedance and decreases the output impedance of amplifier. Such a change is profitable in practice as the amplifier can then serve the purpose of impedance matching.

Q9: To obtain very high i/p and o/p impedance in feedback amplifier, the topology mostly used is?
A9: To obtain very high i/p and o/p impedance in feedback amplifier, the topology mostly used is current series feedback amplifier.
Q10: What is the change of the bandwidth by negative current shunt feedback?
A10: The negative current shunt feedback increases the bandwidth of amplifier by the factor $(1+m_I A_i)$.

Title of the Practical: Verify the action of UJT as a relaxation oscillator

Q1: What is UJT?
A1: Unijuction transistor has only one p-n junction. It consists of a lightly doped n-type silicon bar. The p- type impurity is diffused into the base producing the pn junction these are referred to as the emitter, base 1 and base 2 respectively. It is also called double based device.
Q2: What is inter base resistance?
A2: The resistance of the silicon bar is called inter base resistance R_{BB} represented by the two resistors in series of Rb1 and Rb2.
The inter base resistance is given by

$$R_{bb} = R_{b1} + R_{b2}$$

Q3: What is the specification of UJT?
A3: The very basic specifications of a UJT are:
(a)V_{bb} (max) - The maximum interbase voltage that can be applied to the UJT
(b) R_{bb} -the interbase resistance of the UJT
(c) η - The intrinsic standoff ratio which defines Vp.
(d) I_p - The peak point emitter current
Q4: What is intrinsic standoff ratio?
A4: If a voltage V_{bb} is applied between the bases with emitter open, the voltage will divide up across R_{b1} and R_{b2}.Voltage across Rb1, $V1 = \frac{Rb1}{(Rb1 + Rb2)} Vbb \qquad \frac{V1}{Vbb} = \frac{Rb1}{(Rb1 + Rb2)}$

The ratio $\frac{V1}{Vbb}$ is called the intrinsic stand-off ratio represented by η . Thus $\eta = \frac{Rb1}{(Rb1 + Rb2)}$
Q5: Application of UJT?
A5: The device has-a unique characteristic that when it is triggered, its emitter current increases re generatively (due to negative resistance characteristic) until it are restricted by emitter power supply. The low cost per unit, combined with its unique characteristic, have warranted its use in a wide variety of applications. A few include oscillators, pulse generators, saw-tooth generators, triggering circuits, phase control, timing circuits, and voltage-or current-regulated supplies.
Q6: What is relaxation oscillator?
A6 A relaxation oscillator produces a non-sinusoidal output, such as a square wave or sawtooth. The oscillator contains a nonlinear component such as a transistor that periodically discharges the energy stored in a capacitor or inductor, causing abrupt changes in the output waveform.
Q7: What is UJT relaxation oscillator?
A7: UJT Relaxation Oscillator circuit, mainly used for triggering purposes This circuit is ideally suited for triggering an SCR – since UJT is capable of generating sharp, high powered pulses of short duration whose peak and average power don't exceed the power capabilities of the SCR gate for which they are intended.

Oscillator frequency $f_o = \frac{1}{RC \ln(\frac{1}{1-\eta})} - (1)$

η =0.5 (we take)

Substituting the value of η in (1)

$$f_o = \frac{1}{RC \ln(\frac{1}{1-0.5})} = \frac{1}{RC \ln 2} = \frac{1.44}{RC}$$

$$f_o \cong \frac{1.5}{RC} - (2)$$

Q8: How does a UJT relaxation oscillator works?

A8: When power is applied to the given circuit, capacitor C starts charging exponentially through R to the applied voltage V_{CC}. The voltage across C is the voltage applied to the emitter of UJT. When C is charged to V_p , then UJT turns ON. This greatly reduces the effective resistance between emitter and base1 of UJT. A sharp pulse of current flows from base1 to emitter, discharging C through R_{b1}. When the capacitor voltage drops below V_p , UJT is brought back to the previous state and the capacitor again begins to charge towards V_{bb}. This produces a saw tooth wave. R_{b1} and $R_{b2}$are used to protect UJT from overheating. This intern provides sharp pulses across them: Rb1 produces a positive spike and R_{b2}produces a negative spike.

Q9: Practical examples of the use of the relaxation oscillator?

A9: This type of circuit was used as the time base in early oscilloscopes and television receivers. Variants of this circuit find use in stroboscopes used in machine shops and nightclubs. Electronic camera flashes are a monostable version of this circuit, generating one cycle of the saw tooth, the rising edge as the flash capacitor is charged and the rapid falling edge as the capacitor is discharged and the flash is produced upon receiving the firing signal from the shutter button. Use as a time base in oscilloscopes was discontinued when the much more linear Miller Integrator time base circuit using "hard" valves, (vacuum tubes) as a constant current source, was developed.

Q10: What are oscillators?

A10: Oscillators produce a waveform (mostly sine or square waves) of desired amplitude and frequency. They can take input from the output itself. For a complete oscillator circuit we require a feedback device, amplifier and feedback factor.

Title of the Practical: Setup an RC phase shift oscillator and analyze its' operation.

Q1: What are oscillators?

A1: Oscillators produce a waveform (mostly sine or square waves) of desired amplitude and frequency. They can take input from the output itself. For a complete oscillator circuit we require a feedback device, amplifier and feedback factor. Oscillators designed to produce a high-power AC output from a DC supply are usually called inverters

Q2: Application of electronic oscillator?

A2: An electronic oscillator is an electronic circuit that produces a repetitive electronic signal, often a sine wave or a square wave. They are widely used in innumerable electronic devices. Common examples of signals generated by oscillators include signals broadcast by radio and television transmitters, clock signals that regulate computers and quartz clocks, and the sounds produced by electronic beepers and video games.

Q3: Types of electronic oscillator?

A3: There are two main types of electronic oscillator: the harmonic oscillator and the relaxation oscillator.

Q4: What is Harmonic oscillator?

A4: The harmonic, or linear, oscillator produces a sinusoidal output. The basic form of a harmonic oscillator is an electronic amplifier with the output attached to an electronic filter, and the output of the filter attached to the input of the amplifier, in a feedback loop. When the power supply to the amplifier is first switched on, the amplifier's output consists only of noise. The noise travels around the loop, being filtered and re-amplified until it increasingly resembles the desired signal.

Q5: Types of Harmonic oscillator?

A5: There are many ways to implement harmonic oscillators, because there are different ways to amplify and filter. Some of the different circuits are:

- Hartley oscillator
- Colpitts oscillator
- Cross-coupled LC oscillator
- crystal oscillator
- Phase-shift oscillator
- RC oscillator (Wien Bridge and "Twin-T")

Q6: What are LC oscillators?

A6: Inductive oscillators also known as LC oscillators are built of an tank circuit, which oscillates by charging and discharging a capacitor through an inductor. These oscillators are typically used when a tunable precision frequency source is necessary, such as with radio transmitters and receivers

Q7: What is phase-shift oscillator?

A7: A phase-shift oscillator is a simple electronic oscillator. It contains an inverting amplifier, and a feedback filter which 'shifts' the phase of the amplifier output by 180 degrees at the oscillation frequency.The filter produces a phase shift that increases with frequency. It must have a maximum phase shift of considerably greater than 180° at high frequencies, so that the phase shift at the desired oscillation frequency is 180°.

Q8: How to produced 180° phase shift?

A8: The most common way of achieving this kind of filter is using three identical cascaded resistor-capacitor filters, which together produce a phase shift of zero at low frequencies, and 270 degrees at high frequencies. At the oscillation frequency each filter produces a phase shift of 60 degrees and the whole filter circuit produces a phase shift of 180 degrees.

Q9: Mathematics for calculating the oscillation frequency?

A9: The mathematics for calculating the oscillation frequency and oscillation criterion for this circuit is surprisingly complex, due to each R-C stage loading the previous ones. The calculations are greatly simplified by setting all the resistors (except the negative feedback resistor) and all the capacitors to the same values, if R1 = R2 = R3 = R, and C1 = C2 = C3 = C, then:

$$f_{\text{oscillation}} = \frac{1}{2\pi RC\sqrt{6}}$$

And the oscillation criterion is:

$R_{feedback} = 29(R)$

Q10: How to implement the phase-shift oscillator?

A10: A version of this circuit can be made by putting an op-amp buffer between each R-C stage which simplifies the calculations. The voltage gain of the inverting channel is always unity.

Title of the Practical: Setup the circuit and observe the action of bitable multivibrators & obtain the output waveform

Q1: What is relaxation oscillator?
A1: A relaxation oscillator produces a non-sinusoidal output, such as a square wave or sawtooth. The oscillator contains a nonlinear component such as a transistor that periodically discharges the energy stored in a capacitor or inductor, causing abrupt changes in the output waveform.
Q2: Types of relaxation oscillator circuits?
A2: Types of relaxation oscillator circuits include:
Multivibrator
Ring oscillator
Delay line oscillator
Rotary traveling wave oscillator
Q3: What is multivibrator?
A3: A multivibrator is an electronic circuit used to implement a variety of simple two-state systems such as oscillators, timers and flops. A form of electronic circuit that employs positive feedback to cross-couple two devices so that two distinct states are possible, for example, one device ON and the other device OFF, and in which the states of the two devices can be interchanged either by use of external pulses or by internal capacitance coupling. When the circuit is switched between states, transition times are normally very short compared to the ON and OFF periods. Hence, the output waveforms are essentially rectangular in form.
Q4: Types of multivibrator circuits?
A4: There are three types of multivibrator circuit: astable, monostable, bistable
Q5: What is bistable multivibrator?
A5: As the name implies, the bistable multivibrator has two stable states. As the name implies, the bistable multivibrator has two stable states. If a trigger of the correct polarity and amplitude is applied to the circuit, it will change states and remain there until triggered again.
Q6: Operation of bistable multivibrator?
A6: If a sharp negative pulse is applied to the base of the ON transistor, its collector current decreases and its collector voltage rises. A fraction of this rise is applied to the base of the OFF transistor, causing some collector current to flow. The resultant drop in collector voltage, transferred to the base of the ON transistor, causes a further rise at its collector. The action is thus one of positive feedback, with nearly instantaneous transfer of conduction from one device to the other. There is one such reversal each time a pulse is applied to the gate of the ON transistor.
Q7: Application of Multivibrators?
A7: Multivibrators find applications in a variety of systems where square waves or timed intervals are required. The 555 timer is a popular IC chip which can be used to implement all three multivibrator modes. Other applications included early television systems, where the various line and frame frequencies were kept synchronized by pulses included in the video signal.
Q8: What are the different names of the bistable multivibrator?
A8: The bistable multivibrator that most technicians know is commonly known by other names: the ECCLES-JORDAN circuit and, more commonly, the FLIP-FLOP circuit
Q9: What happened when voltmeter is connected to the output of a flip-flop?
A9: If a voltmeter were connected to the output of a flip-flop, it would measure either a small positive or negative voltage, or a particularly low voltage (essentially 0 volts). No matter which voltage is measured, the flip-flop would be stable. Remember, stable means that the flip-flop will remain in a particular state indefinitely. It will not change states unless the proper type of trigger pulse is applied.
Q10: Uses of the flip-flop circuit?
A10: Flip-flops are used in switching-circuit applications (computer logic operations) as counters, shift registers, clock pulse generators, and in memory circuits. They are also used for relay-control functions and for a variety of similar applications in radar and communications systems.

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Title of the Practical: Setup the circuit and observe the action of monostable multivibrators & obtain the output waveform

Q1: What is Monostable multivibrator?
A1: A monostable or one-shot multivibrator has only one stable state. If one of the normally active devices is in the conducting state, it remains so until an external pulse is applied to make it nonconducting. The second device is thus made conducting and remains so for a duration dependent upon RC time constants within the circuit itself.
Q2: When Monostable Multivibrators deliver the output pulse?
A2: Monostable Multivibrators deliver a single output pulse when it is triggered externally only returning back to its first original and stable state after a period of time determined by the time constant of the RC coupled circuit.
Q3: What is the operation of Monostable Multivibrators?
A3: When power is firstly applied, the base of transistor TR2 is connected to Vcc via the biasing resistor, thereby turning the transistor "fully-ON" and into saturation and at the same time turning TR1 "OFF" in the process. This then represents the circuits "Stable State" with zero output. If a trigger pulse is now applied at the result in transistor TR2 now fully "OFF". This then represents the circuit's second state, the "Unstable State" with an output voltage equal to Vcc, transistor TR1 which results automatically returning back to its original stable state awaiting a second trigger pulse to restart the process once again.
Q4: Application of Monostable Multivibrators?
A4: Monostable Multivibrators can therefore be considered as triggered pulse generators and are generally used to produce a time delay within a circuit as the frequency of the output signal is the same as that for the trigger pulse input the only difference being the pulse width.
Q5: Disadvantage of Monostable Multivibrators?
A5: One main disadvantage of Monostable Multivibrators is that the time between the application of the next trigger pulse has to be greater than the preset RC time constant of the circuit to allow the capacitor time to charge and discharge.
Q6: Which device is used for producing Monostable Multivibrators?
A6: As well as producing Monostable Multivibrators from individual discrete components such as transistors, we can also construct monostable circuits using commonly available integrated circuits. The following circuit shows how a basic monostable multivibrator circuit can be constructed using just two 2-input Logic "NOR" Gates.
Q7: What is the time period of monostable multivibrator?
The time of period monostable multivibrator remains in unstable state is given by $t = \ln(2)R_2C_1$. If repeated application of the input pulse maintains the circuit in the unstable state, it is called a retriggerable monostable. If further trigger pulses do not affect the period, the circuit is a non-retriggerable multivibrator.
Q8: Monostable Multivibrators can produce which type of pulse?
A8: Monostable Multivibrators can produce a very short pulse or a much longer rectangular shaped waveform whose leading edge rises in time with the externally applied trigger pulse and whose trailing edge is dependent upon the RC time constant of the feedback components used.
Q9: How to change the time consonant of Monostable Multivibrators?
A9: The time constant of Monostable Multivibrators can be changed by varying the values of the Capacitor, C2 the Resistor, R2 or both.
Q10: Uses of Monostable Multivibrators?
A10: Monostable Multivibrators are generally used to increase the width of a pulse or to produce a time delay within a circuit as the frequency of the output signal is always the same as that for the trigger pulse input, the only difference is the pulse width.

Title of the Practical: Setup the circuit and observe the action of astable multivibrators &obtain the output waveform

Q1: What is Astable multivibrator?
A1: astable, in which the circuit is not stable in either state—it continuously oscillates from one state to the other. Due to this, it does not require an input (Clock pulse or other). It is also called free-running multivibrator.
Q2: What is the operation of astable multivibrator?
A2: The astable multivibrator has capacitance coupling between both of the active devices and therefore has no permanently stable state. Each of the two devices functions in a manner similar to that of the capacitance-coupled half of the monostable multivibrator. It will therefore generate a periodic rectangular waveform at the output with a period equal to the sum of the OFF periods of the two devices.
Q3: Period of oscillation of astable multivibrator?
A3:Period of oscillation is very roughly, the duration of state 1 (low output) will be related to the time constant R_2C_1 as it depends on the charging of C1, and the duration of state 2 (high output) will be related to the time constant R_3C_2 as it depends on the charging of C2. The result is that when first powered up, the period will be quite long as the capacitors are initially fully discharged, but the period will quickly shorten and stabilise.
Q4: Why it is called free-running multivibrator?
A4: It is called free-running because it alternates between two different output voltage levels during the time it is on. The output remains at each voltage level for a definite period of time. The output on an oscilloscope, continuous square or rectangular waveforms. The astable multivibrator has two outputs, but NO inputs.
Q5: What are protective components?
A5: While not fundamental to circuit operation, diodes connected in series with the base or emitter of the transistors are required to prevent the base-emitter junction being driven into reverse breakdown when the supply voltage is in excess of the V_{eb} breakdown voltage, typically around 5-10 volts for general purpose silicon transistors.
Q6: How to obtain high degree of frequency stability of astable multivibrators?
A6: Some astable multivibrators must have a high degree of frequency stability. One way to obtain a high degree of frequency stability is to apply triggers. A negative input trigger to the base of Q1 (through C1) causes Q1 to go into saturation, which drives Q2 to cutoff. The circuit will remain in this condition as long as the base voltage of Q2 is positive.
Q7: Application of astable multivibrator?
A7: Before the advent of low-cost integrated circuits, chains of multivibrators found use as frequency dividers. A free-running multivibrator with a frequency of one-half to one-tenth of the reference frequency would accurately lock to the reference frequency. This technique was used in early electronic organs, Other applications included early television systems, where the various line and frame frequencies were kept synchronized by pulses included in the video signal.
Q8: The operation of astable multivibrator is similar to which device?
A8: The operation of astable multivibrator is similar to the oscillator.
Q9: ON and OFF time for astable multivibrator?
A9: ON time for Q_1 (or OFF time for Q_2): $T_1 = 0.694R_2C_1$
OFF time for Q_1 (or ON time for Q_2): $T_2 = 0.694R_3C_2$
Q10: Total time period and frequency of square wave?
A10: Total time period: $T = T_1 + T_2 = 0.694(R_2C_1 + R_3C_2)$
(As $R_2 = R_3 = R$ and $C_1 = C_2 = C$) **T = 1.4 RC second.**
Frequency: $f = 1/T =$ **0.7/ RC Hz**