ELECTRONICS LAB-332

SEMESTER 4

CHARACTERISTICS OF P-N JUNCTION DIODE

AIM

To determine the forward characteristics of a p-n junction diode and determine the static and dynamic resistance.

COMPONENTS AND EQUIPMENTS REQUIRED

SI No	NAME	SPECIFICATION	QUANTITY
1	POWER SUPPLY	0-30V	1 NO
2	VOLTMETER	0-20V	1 NO
3	AMMETER	0-100 mA	1 NO
4	DIODE	IN 4001-Si OR OA 79-Ge	1 NO
5	RESISTOR	1KΩ	1 NO
6	POTENTIOMETER	1KΩ	1 NO
7	BREAD BOARD		1NO
8	CONNECTING WIRES		AS REQUIRED

THEORY

When a P type and N type semiconductors are joined together, a junction diode is created .It has a unique ability to permit current only in one direction. The lead connected to P type is called anode and the lead connected to N type is called cathode.If the anode of the diode is connected to the +ve terminal of a battery and cathode to the –ve terminal,the set up is called forward bias.the diode does not pass any current till the battery voltage exceeds the potential barrier(o.7 V for Si & 0.3 V for Ge). Once the battery potential exceeds the barrier potential high forward current in the order of mA flows through the diode due to the movements of hole and electrons.

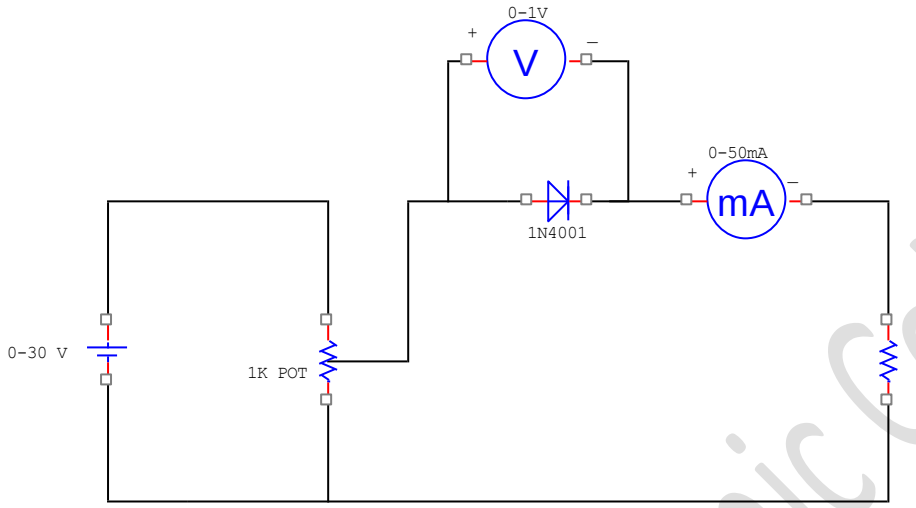
The static resistance or DC resistance is the ratio of DC voltage across the diode to the DC current flows through it. Dynamic resistance or AC resistance of the diode at any point is the reciprocal of the slope of the charaecteristic at that point.

ie dynamic resistance= change in voltage/ change in current = $\Delta V/\Delta I$

PROCEDURE

1. Set up the circuits as shown in figure on bread board.
2. Switch on the power supply
3. Varying the voltage across the diode in steps and find corresponding current.

4. Repeat the above steps for different values of voltage



TABULATION:

V in volt	I in mA

RESULT

Plotted the forward characteristics of PN junction Si diode and its

Static resistance =…….

Dynamic resistance =…….

V-I CHARACTERISTICS OF ZENER DIODE

AIM

To plot VI characteristics of a zener diode and determine the breakdown voltage (V_{BR}) and dynamic resistance.

COMPONENTS AND EQUIPMENTS REQUIRED

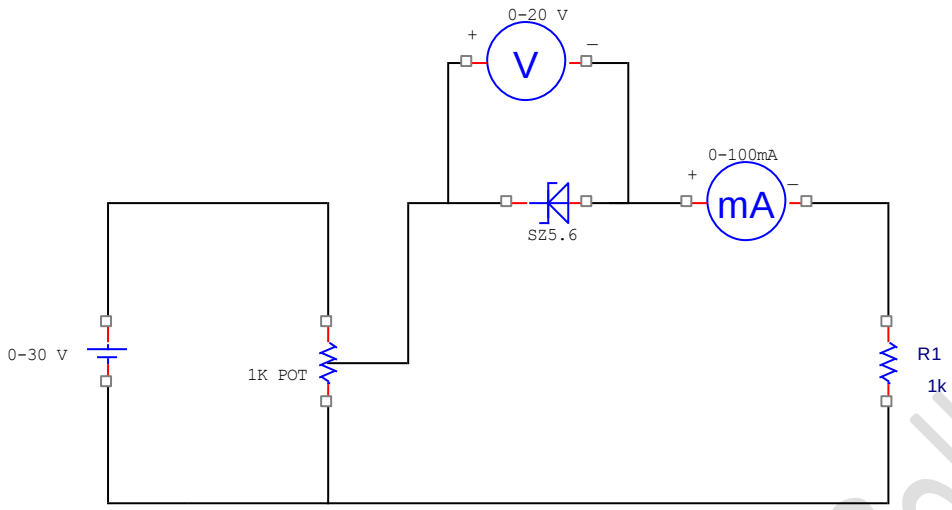
SI No	NAME	SPECIFICATION	QUANTITY
1	POWER SUPPLY	0-30V	1 NO
2	VOLTMETER	0-20V	1 NO
3	AMMETER	0-100 µA	1 NO
4	ZENER DIODE	5.6 V	1 NO
5	RESISTOR	1KΩ	1 NO
6	POTENTIOMETER	1KΩ	1 NO
7	BREAD BOARD		1NO
8	CONNECTING WIRES		AS REQUIRED

THEORY

An ordinary diode will not permit current when it is reverse biased. If the reverse biased voltage exceed the peak inverse voltage rating diode may get destroyed, due to avalanche break down. Zener diodes are special kind of diode designed to operate in the break down region without causing the damage to them. when diode is heavily doped its depletion layer become very narrow. When the applied reverse bias voltage across the diode is increased, the electric field across the depletion layer becomes more intense and electrons get pulled out from the covalent bond, generating electron-hole pairs. Thus heavy reverse current flows. This phenomenon is called zener breakdown.

PROCEDURE

- Wire the circuit as shown in fig. after testing the component.
- Vary the input voltage and note down the ammeter and voltmeter readings and enter it in the tabular column.
- Calculate the dynamic zener resistance.



TABULATION

V in volt	I in mA

RESULT

Plotted the VI characteristics of Zener diode and its

Break down voltage (V_{BR}) = …….

Dynamic resistance = …….

HALFWAVE RECTIFIER

AIM

To study the characteristics of a half wave rectifier.

COMPONENTS AND EQUIPMENTS REQUIRED

SI No	NAME	SPECIFICATION	QUANTITY
1	TRANSFORMER	0-12V	1 NO
2	DIODE	IN 4001	1 NO
3	RESISTOR	1KΩ	1 NO
4	CAPACITOR	470 μF , 25 V	1 NO
5	BREAD BOARD		1 NO
6	CONNECTING WIRES		AS REQUIRED

THEORY

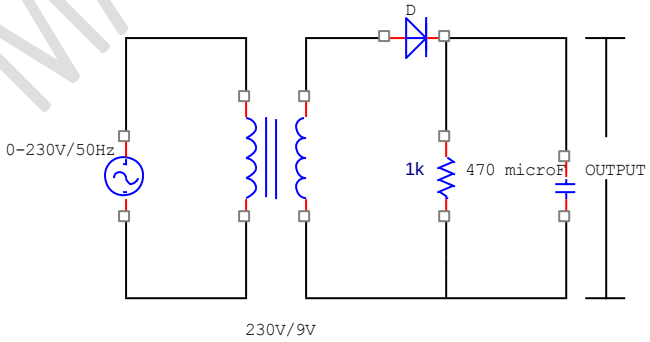
A rectifier converts AC to pulsating DC by eliminating the negative half cycle of the input voltage . During positive half cycle of the input voltage, upper end of the secondary of the transformer is positive and lower end is negative. Therefore the diode is forward biased and hence it conducts and out put voltage is equal to input voltage.

During negative half cycle of the input voltage, upper end of the secondary of the transformer is negative and lower end is positive. Therefore the diode is reverse biased and hence it does not conduct and out put voltage is equal to zero.

$V_{rms} = V_m / 2 \quad V_{dc} = V_m / \prod$

Ripple factor= Ripple voltage/dc voltage

$$\gamma = \sqrt{\left(\frac{Vrms}{Vdc}\right)^2 - 1}$$



PROCEDURE

1. Set up the circuits on bread board
2. Observe wave form across R_L on the CRO.
3. Note the peak value
4. Calculate the ripple factor and V_{dc} using the equations.
5. Repeat the same procedure with filter circuit.

RESULT

Studied the characteristics of half wave rectifier.

Theoretical value of ripple factor =……...

Practical value of ripple factor =……

Difference between Theoretical value and Practical value =……...

CENTRE TAPPED RECTIFIER

AIM

To study the characteristics of a centre tapped rectifier.

COMPONENTS AND EQUIPMENTS REQUIRED

SI No	NAME	SPECIFICATION	QUANTITY
1	TRANSFORMER	9-0-9V	1 NO
2	DIODE	1N 4001	2 NO
3	RESISTOR	1KΩ	1 NO
4	CAPACITOR	470 µF , 25 V	1 NO
5	BREAD BOARD		1 NO
6	CONNECTING WIRES		AS REQUIRED

THEORY

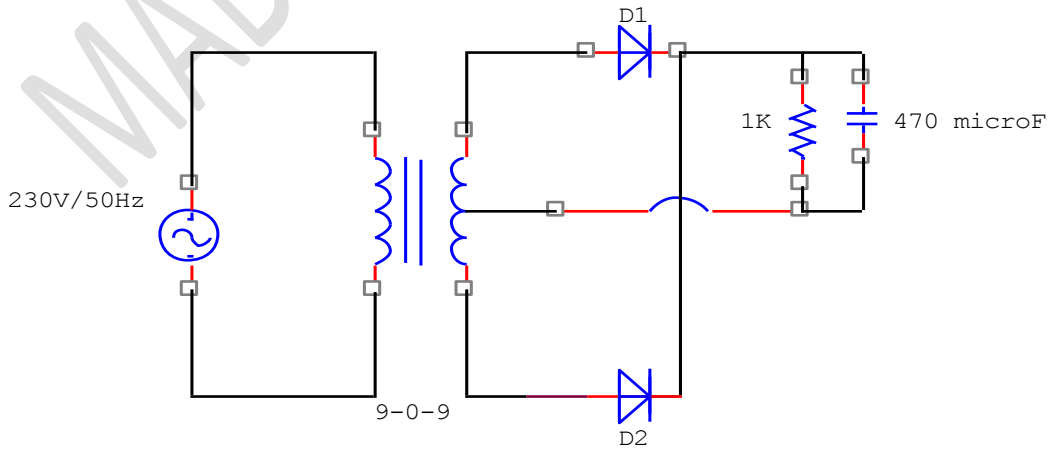
A rectifier converts AC to pulsating DC.During positive half cycle of the input voltage, upper end of the secondary of the transformer is positive and lower end is negative. Therefore the diode D_1 is forward biased and diode D_2 is reverse biased .Therefore D_1 conducts and out put voltage is equal to input voltage.

During negative half cycle of the input voltage, upper end of the secondary of the transformer is negative and lower end is positive. Therefore the diode D_1 is reverse biased and diode D_2 forward biased, hence it conducts and output voltage is same as that of positive half cycle.

$V_{rms} = V_m / \sqrt{2}$ $V_{dc}=2\ V_m / \prod$

Ripple factor = Ripple voltage/dc voltage

$$\gamma = \sqrt{\left(\frac{Vrms}{Vdc}\right)^2 - 1}$$



PROCEDURE

1. Set up the circuits on bread board
2. Observe the transformer secondary voltage(V_{ac}) and wave form across R_L on the CRO.
3. Note the peak value
4. Calculate the ripple factor and V_{dc} using the equations.
5. Repeat the same procedure with filter circuit.

RESULT

Studied the characteristics of centre tapped rectifier.
Theoretical value of ripple factor =……...
Practical value of ripple factor =……
Difference between Theoretical value and Practical value =……...

BRIDGE RECTIFIER

AIM

To study the characteristics of a centre tapped rectifier.

COMPONENTS AND EQUIPMENTS REQUIRED

SI No	NAME	SPECIFICATION	QUANTITY
1	TRANSFORMER	0-12V	1 NO
2	DIODE	IN 4001	4 NO
3	RESISTOR	1KΩ	1 NO
4	CAPACITOR	470 μF , 25 V	1 NO
5	BREAD BOARD		1 NO
6	CONNECTING WIRES		AS REQUIRED

THEORY

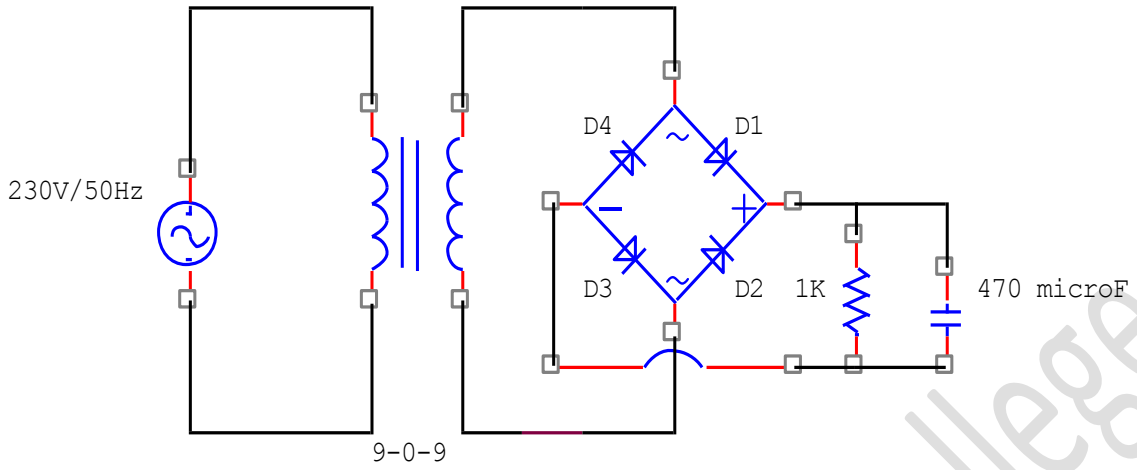
A rectifier converts AC to pulsating DC.During positive half cycle of the input voltage, upper end of the secondary of the transformer is positive and lower end is negative. Therefore the diode D_1 and D_3 are forward biased and diode D_2 and D_4 are reverse biased .Therefore diode D_1 and D_3 conducts and out put voltage is equal to the input voltage.

During negative half cycle of the input voltage, upper end of the secondary of the transformer is negative and lower end is positive. Therefore the diode D_1 and D_3 are reverse biased and diode D_2 and D_4 are forward biased, hence it conducts and out put voltage is same as that of positive half cycle.

$V_{rms} = V_m / \sqrt{2}$ $V_{dc}=2 V_m / \prod$

Ripple factor= Ripple voltage/dc voltage

$$\gamma = \sqrt{\left(\frac{Vrms}{Vdc}\right)^2 - 1}$$



PROCEDURE

1. Set up the circuits on bread board
2. Observe the transformer secondary voltage(V_{ac}) and wave form across R_L on the CRO.
3. Note the peak value
4. Calculate the ripple factor and V_{dc} using the equations.
5. Repeat the same procedure with filter circuit.

RESULT

Studied the characteristics of bridge rectifier.
Theoretical value of ripple factor =……...
Practical value of ripple factor =……
Difference between Theoretical value and Practical value =……...

COMMON EMITTER TRANSISTOR CHARACTERISTICS

AIM

To plot the VI characteristics of common emitter configuration of a given transistor and plot the DC load line.

COMPONENTS AND EQUIPMENTS REQUIRED

SI No	NAME	SPECIFICATION	QUANTITY
1	POWER SUPPLY	0-30 V	2 NOS
2	VOLTMETER	0-10V, 0-30V	1 EACH
3	AMMETER	0-100 mA, 0-100 μA	1 EACH
4	TRANSISTOR	BC 107	1 NO
5	RESISTOR	1.5 KΩ	1 NO
6	POTENTIOMETER	1 KΩ	2 NOS
7	BREAD BOARD		1 NO
8	CONNECTING WIRES		AS REQUIRED

THEORY

A transistor is a 3 terminal active device. The 3 terminals are emitter(E),base(B)and collector(C).In CE configuration we make the emitter common to both input and output for normal operation.The base-emitter junction is forward biased and collector-emitter junction is reverse biased.

The input characteristics is plotted between input current(I_B) and the input voltage(V_{BE}) with keeping output voltage (V_{CE}) constant. The input dynamic resistance r_i is calculated using the equation

$r_i = \Delta V_{BE}/\Delta I_B$, keeping V_{CE} is constant.

The output characteristics is plotted between output current(I_C) and the output voltage(V_{CE}) with keeping input current (I_B)constant.

The output dynamic resistance r_0 is calculated using the equation

$r_o = \Delta V_{CE}/\Delta I_C$, keeping I_B is constant.

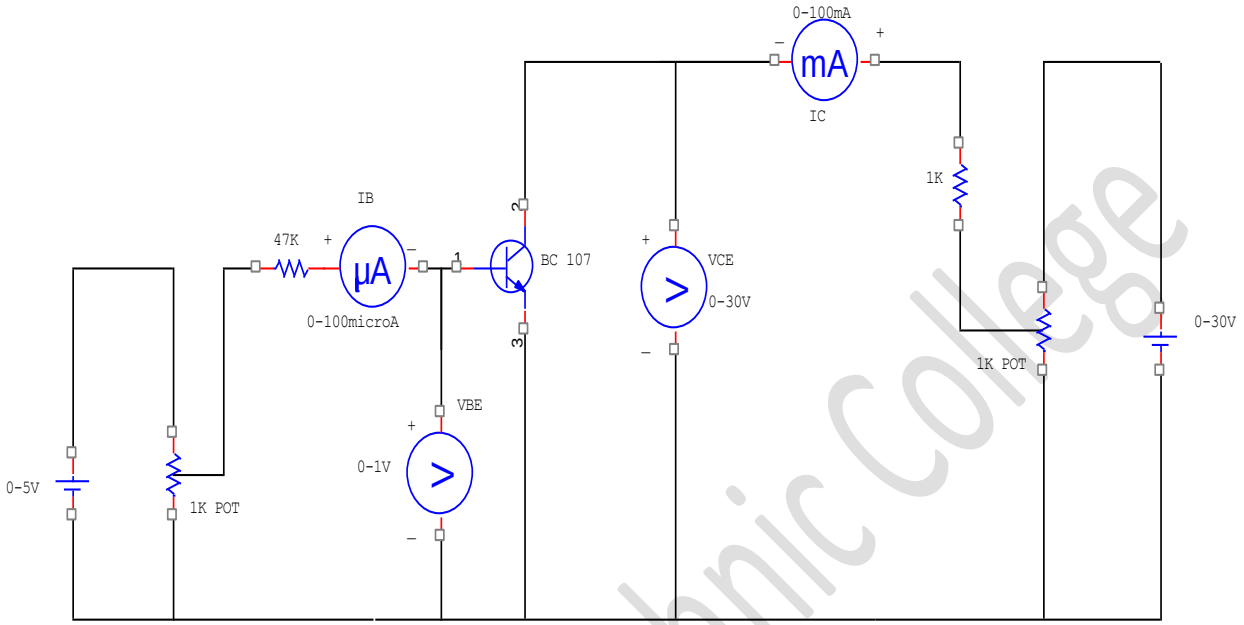
PROCEDURE

For input characteristics

1. Check the transistor using multimeter. Switch on the power supply keeping rheostat at minimum position. Switch off the collector to emitter power supply.
2. Note down the base current for different values of $V_{BE.}$
3. Repeat the step 2 for different values of V_{CE} , say 3V, 6V.
4. Draw the characteristics on a graph sheet and calculate dynamic input resistance.

For out put characteristics

1. Check the transistor using multimeter. Switch on the power supply keeping rheostat at minimum position. Switch off the base to emitter power supply.
2. Note down the collector current for different values of $V_{CE.}$
3. Repeat the step 2 for different values of base current , say 80μA, 100μA.
4. Draw the characteristics on a graph sheet and calculate dynamic out put resistance.



TABULATION

Input charecteristics

V_{CE} = 0V		V_{CE} = 3V		V_{CE} = 6V	
I_B	$V_{BE.}$	I_B	$V_{BE.}$	I_B	$V_{BE.}$

Out put charecteristics

I_B = 60μA		I_B = 80μA		I_B = 100μA	
I_C	$V_{CE.}$	I_C	$V_{CE.}$	I_C	$V_{CE.}$

RESULT

Plotted the input and out put charecteristics of a CE transistor.

Dynamic input resistance = ……

Dynamic out put resistance = …….

RC PHASE SHIFT OSCILLATOR

AIM

To set up an RC phase shift oscillator and to observe the sinusoidal output waveform.

COMPONENTS AND EQUIPMENTS REQUIRED

SI No	NAME	SPECIFICATION	QUANTITY
1	POWER SUPPLY	12 V	1 NO
2	TRANSISTOR	BC 107	1 NO
3	RESISTORS	4.7 KΩ	3 NOS
		10 K, 2.2K, 47K, 680Ω	1 EACH
4	CAPACITORS	0.01μF	3 NOS
		22μF , 1μF	1 EACH
5	BREAD BOARD		1 NO
6	CONNECTING WIRES		AS REQUIRED

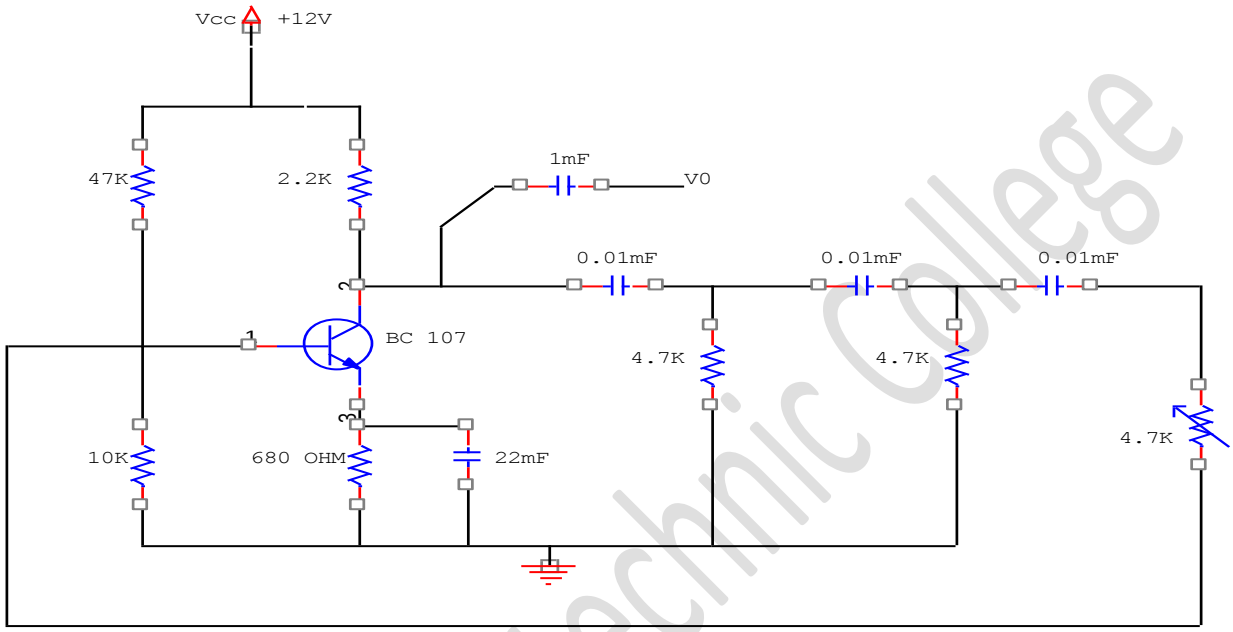
THEORY

An oscillator is an electronic circuit for generating an ac signal voltage with a dc supply as the only input requirement. The frequency of the generated signal is decided by circuit constants. An oscillator requires an amplifier and a positive feed back from out put to input. The barkhausen criterian for sustained oscillation is (1) loop gain=1 ie $A\beta = 1$, where A is the gain and β is the feed back factor
(2) Total phase shift $=0^0$ or 360^0

A CE amplifier introduces a 180^0 phase shift and feed back network another 180^0. Feed back network consist of 3 RC network each produces a 60^0 and hence total 180^0.

Frequency of oscillation $f = 1/ 2\prod RC\sqrt{6}$

VCC_ARROW



PROCEDURE

1. Set up the amplifier part of the oscillator and test the dc conditions.
2. Connect the feedback network and observe the sine wave on CRO and measure its amplitude and frequency.

RESULT

Observed the sinusoidal wave form at the out put of oscillator.

ASTABLE MULTIVIBRATOR

AIM

To set up an astable mulitivibrator using transistors, study its performance and observe the wave form at various points.

COMPONENTS AND EQUIPMENTS REQUIRED

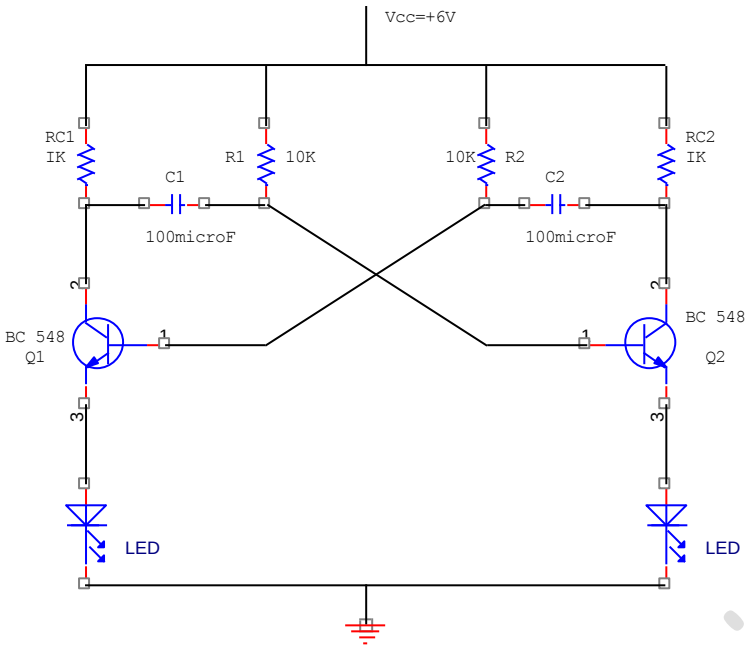
SI No	NAME	SPECIFICATION	QUANTITY
1	POWER SUPPLY	6 V	1 NO
2	TRANSISTOR	BC 548	2 NOS
3	RESISTORS	10 KΩ	2 NOS
		1KΩ	2 NOS
4	CAPACITORS	100μF	2 NOS
5	LED	GREEN, RED	1 EACH
6	BREAD BOARD		1 NO
7	CONNECTING WIRES		AS REQUIRED

THEORY

Astable multivibrator is also called free running oscillator. It does not have a stable state. This circuit transist from one quasi stable state to the other and back automatically depending upon the charging and discharging time of two capacitors.

When one transistor is in ON state other remains in OFF state. The collector voltage of the on transistor is approximately 0.3 V and that of OFF transistor is V_{CC}. Suppose transistor Q_1 is OFF and Q_2 is

ON



PROCEDURE

1. Verify the condition of all components.
2. Set up the circuit and observe the collector and base waveforms of both the transistors.

RESULT

Observed the collector and base waveforms of both the transistors.