R13 SYLLABUS

PART A: Electronic Workshop Practice

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs, SCR, UJT.
3. Soldering Practice- Simple circuits using active and passive components.
4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multimeter, Function Generator, Regulated Power Supply and CRO.

PART B: List of Experiments

(For Laboratory Examination-Minimum of Ten Experiments)

1. P-N Junction Diode Characteristics

Part A: Germanium Diode (Forward bias& Reverse bias) Part B: Silicon Diode (Forward Bias only)

2. Zener Diode Characteristics
Part A: V-I Characteristics
Part B: Zener Diode as Voltage Regulator

3. Rectifiers (without and with c-filter)
Part A: Half-wave Rectifier
Part B: Full-wave Rectifier

4. BJT Characteristics (CE Configuration)
Part A: Input Characteristics
Part B: Output Characteristics

5. FET Characteristics (CS Configuration)
Part A: Drain Characteristics
Part B: Transfer Characteristics

6. SCR Characteristics
7. UJT Characteristics
8. Transistor Biasing
9. CRO Operation and its Measurements
10. BJT-CE Amplifier
11. Emitter Follower-CC Amplifier
12. FET-CS Amplifier

PART C: Equipment required for Laboratory

1. Boxes
2. Ammeters (Analog or Digital)
3. Voltmeters (Analog or Digital)
4. Active & Passive Electronic Components
5. Regulated Power supplies
6. Analog/Digital Storage Oscilloscopes
7. Analog/Digital Function Generators
8. Digital Multimeters
9. Decade Résistance Boxes/Rheostats
10. Decade Capacitance

OBJECTIVES AND OUTCOMES OF THE LAB:

Objectives: The main objective of this curriculum/course is to make the students well versed with basic electronic components and circuits. The students can

- Understand the nature and scope of modern electronics.
- Describe physical models of basic components.
- Provide an overview of the principles, operation, characteristics and application of the basic electronic components.
- Know the testing of components
- Design and construct simple electronic circuits to accomplish a specific function, e.g., designing amplifiers etc.
- Understand their capabilities and limitations and make decisions regarding their best utilization in a specific situation.

Outcomes: The combination of lecture and laboratory sessions provides learning opportunities that should enable the student to do the following upon completion of this course:

- ✓ Use various electronic components and test equipment's like Multimeter , function generator, CRO etc., in order to measure passive components and observe the waveforms
- ✓ Verify the working and Use diodes and transistors for various practical applications.
- ✓ Design the rectifiers, filters and D.C. Regulated power supplies of required voltage and current rating.
- ✓ Design and analysis of amplifier circuits with different biasing techniques.

1. P-N JUNCTION DIODE CHARACTERISTICS

Aim: a) To observe and draw the V-I Characteristics of a P-N Junction diode in Forward and Reverse bias.

b) To calculate the cut-in voltage at which diode conducts.

c) To calculate static and dynamic resistance.

Apparatus Required:

PN Diode IN4007.
Regulated Power supply (0-30V)
Resistor 1KΩ
Ammeters (0-20 mA, 0-750µA)
Voltmeter (0-1V, 0-20V)
Bread board
Connecting wires

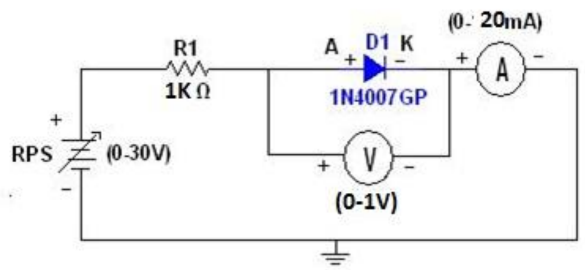
Theory:

A p-n junction diode conducts only in one direction, the V-I characteristics of p-n diode is a curve plotted between the voltage across diode and current through the diode. When external voltage is zero, circuit is open and the potential barrier does not allow the current to flow. Therefore, the circuit current is zero. When P-type Anode is connected to +ve terminal and N- type Cathode is connected to the –ve terminal of supply voltage the diode is considered to be operating under forward bias condition. When the voltage across the diode is increased in the forward biased condition, the potential barrier is reduced and is altogether eliminated at some forward voltage, resulting in the current to flow through the diode and the circuit. The diode is now said to be in the ON state and the current keeps on increasing with an increase in the forward voltage.

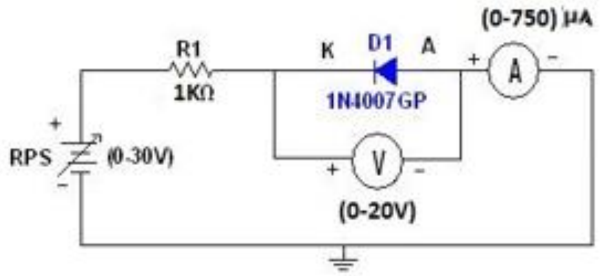
A p-n junction diode is considered to be operating under reverse bias condition when the N-type cathode is connected to +ve terminal and P-type Anode is connected to the –ve terminal of supply voltage. Under reverse bias condition potential barrier across the junction increases with a corresponding rise in the supply voltage, hence junction resistance becomes very high and a very small reverse saturation current flows in the circuit due to minority charge carriers. The diode is now said to be in the OFF state.

Circuit Diagram:
Hardware model

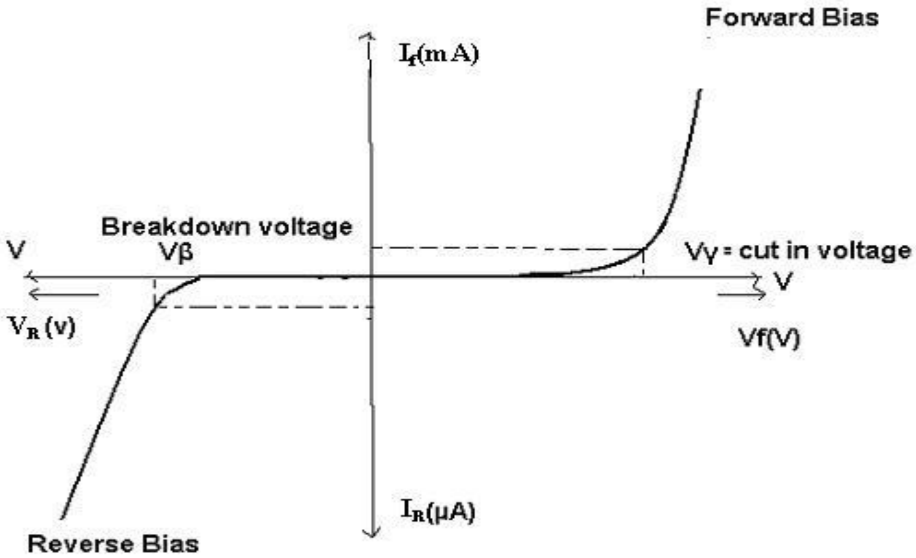
Forward Bias:



Reverse Bias:



Model Waveform:



<u>Procedure</u>:

Forward Bias:-

1. Connections are made as per the circuit diagram.
2. Under forward bias, the RPS +ve terminal is connected to the anode of diode and RPS –ve Terminal is connected to the cathode of the diode.
3. Switch on the power supply and increase the input voltage (supply voltage) in Steps.
4. Note down the corresponding current flowing through the diode and voltage across the Diode for each and every step of the input voltage.
5. Tabulate the readings of voltage and current.
6. Plot the graph between voltage and current.
7. Find the cut-in voltage in forward bias.
8. Calculate the static and dynamic resistances.

Observations:-

S.NO	APPLIED VOLTAGE(V)	VOLTAGE ACROSS DIODE V_f (V)	CURRENT THROUGH DIODE I_f (mA)

Reverse Bias:

1. Connections are made as per the circuit diagram.
2. Under reverse bias, the RPS -ve terminal is connected to the anode of diode and RPS +ve Terminal is connected to the cathode of the diode.
3. Switch on the power supply and increase the input voltage (supply voltage) in Steps.
4. Note down the corresponding current flowing through the diode and voltage across the Diode for each and every step of the input voltage.
5. Tabulate the readings of voltage and current.
6. Plot the graph between voltage and current.
7. Calculate the dynamic resistance.

Observations:

S.NO	APPLIEDVOLTAGE(V)	VOLTAGE ACROSS DIODE V_R(V)	CURRENT THROUGH DIODE I_R(μA)

Calculations:

Forward Bias:

Static resistance $R_D = V_D/I_D$

Dynamic resistance $r_d = \Delta V_d / \Delta I_d$

Reverse Bias:

Dynamic resistance $r_d = \Delta V_d / \Delta I_d$

Applications:

- As Rectifier in DC Power Supplies.
- In Demodulation or Detector Circuits.
- As DC Restorer in clamping networks.
- In clipping circuits used for waveform generation.
- As switches in digital logic circuits.

Results: Forward and Reverse Bias characteristics of p-n diode are obtained.

Cut-in voltage =

Static Resistance in Forward Bias =

Dynamic resistance in Forward Bias =

Static Resistance in Reverse Bias =

Dynamic resistance in Reverse Bias =

Viva Questions:

1. Define depletion region of a diode?

2. What is meant by transition & space charge capacitance of a diode?

3. Is the V-I relationship of a diode Linear or Exponential?

4. Define cut-in voltage of a diode and specify the values for Si and Ge diodes?

5. What are the applications of a p-n diode?

6. Draw the ideal characteristics of P-N junction diode?

7. What is the diode equation?

8. What is PIV?

9. What is the break down voltage?

10. What is the effect of temperature on PN junction diodes?

11. How does the diode act as a switch?

12. Differentiate cut-in and cut-off voltages?

Outcome: Students are able to

1. Analyze the characteristics of PN diode
2. Operate the diode in different biasing conditions and find out the operating point of diode .
3. Calculate the dynamic and static resistance in forward bias and reverse bias.

2. ZENER DIODE CHARACTERISTICS

Aim: a) To observe and draw the V-I Characteristics of a Zener diode in Forward and Reverse bias (Voltage Regulation)

b) To calculate the cut-in voltage at which diode conducts.

c) To calculate static and dynamic resistance.

Apparatus Required:

Zener diode- Z5.1
Regulated Power Supply - (0-30V).
Voltmeter (0-1V, 0-20V)
Ammeter - (0-20mA)
Resistor -1KΩ
Bread Board
Connecting wires

Theory:

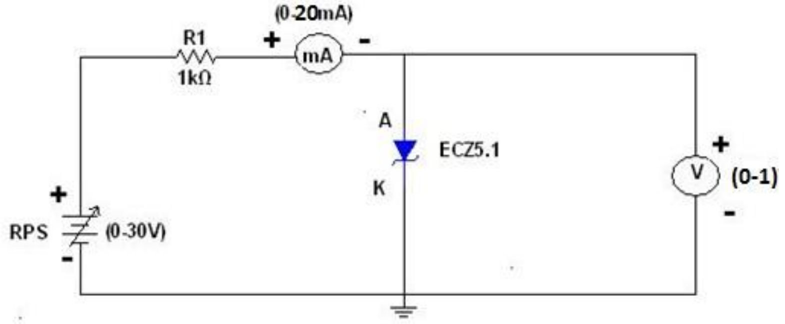
A Zener diode is a heavily doped p-n junction diode specially made to operate in the break down region. Under forward bias condition Zener diode operates similar to an ordinary p-n junction diode. A p-n junction diode normally does not conduct under reverse biased condition, whereas a Zener diode starts conducting heavily, when the reverse bias voltage across it is in

creased to a particular voltage called break down voltage (**V_Z**). To avoid the passage of high current a resistor known as current limiting resistor is connected in series with Zener diode.

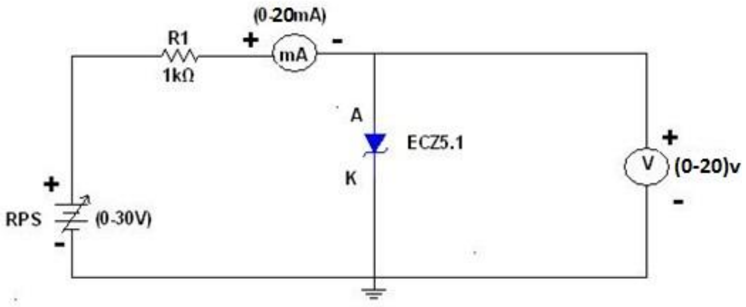
Once the Zener diode starts conducting it maintains constant voltage across the terminals irrespective of the amount of current passing through it, i.e., it has very low dynamic resistance. Hence Zener diode is mostly preferred for operation in voltage regulator circuits.

Circuit Diagram:

Forward Bias:



Reverse Bias:



Procedure:

Forward Bias:

1. Connections are made as per the circuit diagram.
2. Under forward bias, the RPS +ve terminal is connected to the anode of diode and RPS –ve Terminal is connected to the cathode of the diode.
3. Switch on the power supply and increase the input voltage (supply voltage) in Steps.
4. Note down the corresponding Zener current (lz), and the Zener voltage (Vz) across the diode for each and every step of the input voltage.
5. Tabulate the readings of voltage and current.
6. Plot the graph between Zener current (Iz) and Zener voltage (Vz).
7. Find the cut-in voltage in forward bias.
8. Now calculate the static and dynamic resistances.

Observations:

Forward Bias:

S.NO	ZENER VOLTAGE V_f(V)	ZENER CURRENT I_f(mA)

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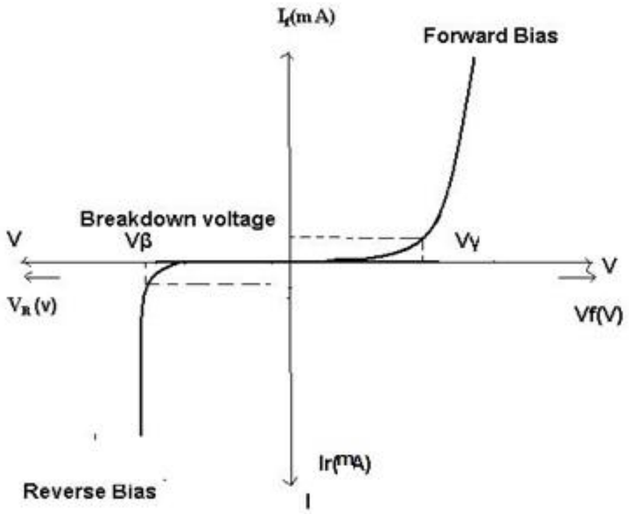
Reverse Bias:

1. Connections are made as per the circuit diagram.
2. For reverse bias, the RPS +ve is connected to the cathode of the diode and RPS –ve is connected to the anode of the diode.
3. Switch on the power supply and increase the input voltage (supply voltage) in Steps.
4. Note down the corresponding current flowing through the diode and voltage across the diode for each and every step of the input voltage.
5. The readings of voltage and current are tabulated.
6. Graph is plotted between voltage and current.
7. Find the Zener breakdown voltage.
8. Now calculate the static and dynamic resistance.

Reverse Bias:

S.NO	ZENER VOLTAGE V_R(V)	ZENER CURRENT I_R(mA)

Model Waveforms:



Applications:

- Shunt Regulator
- Meter protection
- Peak clipper
- Switching operation
- Controlled comparator
- Power supplies

Calculations:

Forward Bias:

Static resistance $R_D = V_D/I_D$

Dynamic resistance $r_d = \Delta V_d / \Delta I_d$

Reverse Bias:

Static resistance $R_D = V_D/I_D$

Dynamic resistance $r_d = \Delta V_d / \Delta I_d$

Results:

Forward Bias:

Cut-in voltage =

Static Resistance in Forward Bias =

Dynamic resistance in Forward Bias =

Reverse Bias:

Break-down Voltage =

Static Resistance in Reverse Bias =

Dynamic resistance in Reverse Bias =

Viva Questions:

1. What type of temperature Coefficient does the zener diode have?

2. If the impurity concentration is increased, how the depletion width effected?

3. Does the dynamic impendence of a zener diode vary?

4. Explain briefly about avalanche and zener breakdowns?

5. Draw the zener equivalent circuit?

6. In which region Zener diode can be used as a regulator?

7. How the breakdown voltage of a particular diode can be controlled?

8. What type of temperature coefficient does the Avalanche breakdown has?

9. Current flow in Zener and avalanche breakdown diodes is mainly due to?

10. What are the applications of zener diode?

Outcome: students are able to

- ✓ Identify the zener diode.
- ✓ Operation of zener diode in different biasing conditions.
- ✓ Understand the characteristics of diode and operating point of diode.
- ✓ Calculate the different resistances in different modes of operation.
- ✓ Applications of diode based on characteristics.

3a) HALF–WAVE RECTIFIER

Aim: a) To obtain the load regulation characteristics of half-wave rectifier.
b) To determine ripple factor and efficiency of a half-rectifier.
1. with Filter
2. without Filter

Apparatus Required:

Bread Board
Multimeter
Transformer (9-0-9)
Diode 1N4007
Capacitor 100µf
Resistor 1KΩ.
CRO
Connecting wires

Theory:

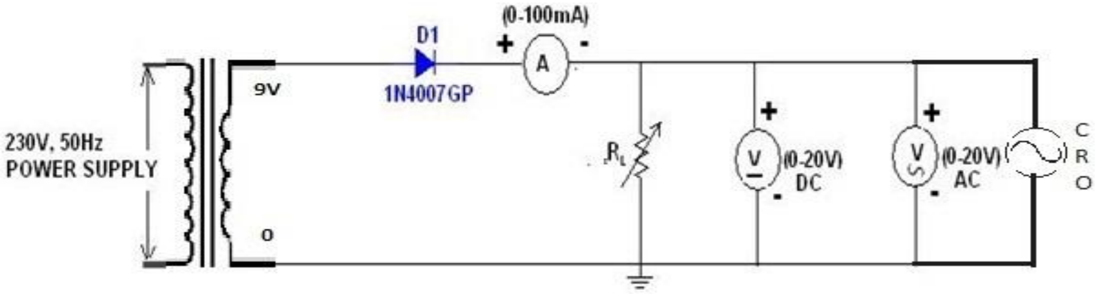
In Half Wave Rectifiers, When AC supply is applied at the input, only Positive Half Cycle appears across the load whereas, the negative Half Cycle is suppressed. During positive half-cycle of the input voltage, the diode D1 is forward biased and current flows through the load resistor R1. Therefore the output voltage across R1 is similar in shape to the +ve half cycle of the input voltage.

During negative half-cycle of the input voltage, the diode D1 is reverse biased and no current flows through the circuit. i.e., the voltage across R1 is zero. The net result is that only the +ve half cycle of the input voltage appears across the load. The average value of the half wave rectified o/p voltage is the value measured on dc voltmeter.

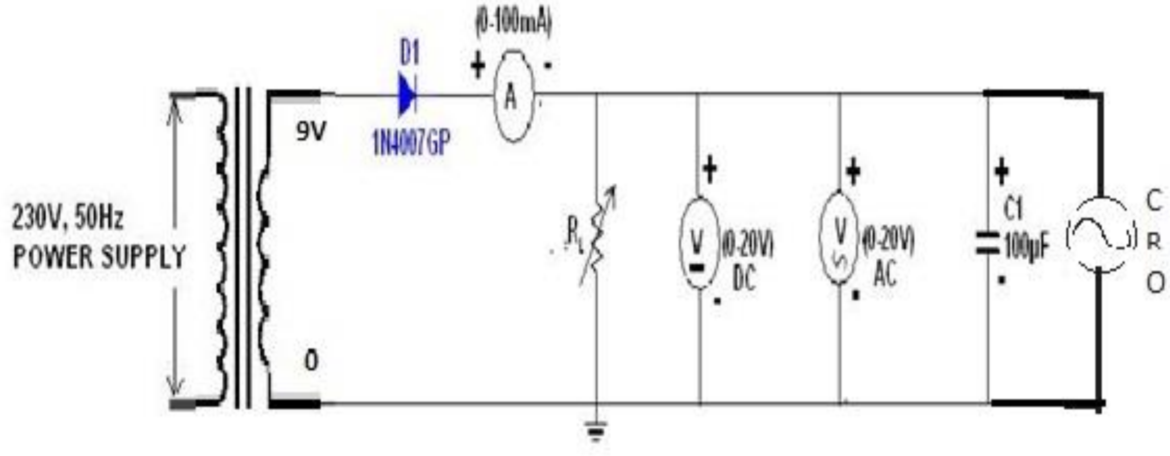
For practical circuits, transformer coupling is usually provided for two reasons.
1. The voltage can be stepped-up or stepped-down, as needed.
2. The ac source is electrically isolated from the rectifier. Thus preventing shock hazards in the secondary circuit.

Circuit Diagram:

Without Filter:



With filter:



3. Measure the ac input voltage of rectifier and dc voltage at the output of the rectifier using multimeter.
4. Find the theoretical value of dc voltage by using the formula,

$$Vdc=V_m/\pi$$

Where Vm= 2Vrms, (Vrms= output ac voltage.)
The Ripple factor is calculated by using the formula

r=ac output voltage (Vrms)/dc output voltage (Vdc)

Regulation Characteristics:-

1. Connections are made as per the circuit diagram.
2. By increasing the value of the DRB (Decade Resistance Box), the voltage across the load and current flowing through the load are measured.
3. The reading is tabulated.
4. Draw a graph between load voltage (V_L) and load current (I_L) taking V_L on X-axis and I_L on y-axis.
5. From the value of no-load voltages, the %regulation is calculated using the formula.

Observations:

Without Filter:-

V_{NL} = V_m =

S.no.	I_{dc}(mA)	V_{dc}(V)	V_{ac}(V)	Ripple factor $r = V_{ac}/V_{dc}$	%Reg = $(V_{NL} - V_{FL})/V_{FL}*100$

With Filter:-

V_{NL} =

Sno.	I_{dc}(mA)	V_{dc}(V)	V_{ac}(V)	Ripple factor $r = V_{ac}/V_{dc}$	%Reg= $(V_{NL} - V_{FL})/V_{FL}*100$

Theoretical Calculations:

Without Filter:-

Vrms=Vm/2

Vdc=Vm/π

Ripple factor $r=\sqrt{(Vrms/Vdc)^2-1}$

=1.21 % Efficiency = P_{dc}/P_{ac} *100

$P_{dc} = V_{dc}^2/R_L$

$P_{ac} = V_{rms}^2/R_L$

With Filter:

Ripple factor r=1/ (2√3 f C R)

Where f =50Hz

C =100μF

R_L=1KΩ

Applications:-

- In Power Supplies

Results:-

1. The Ripple factor for the Half-Wave Rectifier with and without filter is measured.
2. The %regulation of the Half-Wave rectifier is calculated.

Viva Questions:-

1. What is the rectifier?
2. What is the PIV of Half wave rectifier?
3. What is the efficiency of half wave rectifier?
4. What is the difference between the half wave rectifier and full wave Rectifier?
5. What is the o/p frequency of Bridge Rectifier?
6. What is meant by a ripple?
7. What is the function of the filters?

8. What is TUF?

9. What is the average value of o/p voltage for HWR?

10. What is the peak factor?

Outcome: by the completion of this experiment student can

1. Analyze the characteristics of BJT in Common Base Configuration.
2. Calculate h-parameters from the characteristics obtained.
3. Identify different operating regions of transistor.
4. Identify the applications from analyzed parameters.

Outcome: Students are able to

1. analyze the operation of Half Wave rectifier with and without filter.
2. calculate its performance parameters-ripple factor, percentage regulation, efficiency with and without filter.

3b)FULL-WAVE RECTIFIER

Aim: - To Design the Full-Wave Rectifier

a) *T*o obtain the load regulation characteristics of full-wave rectifier.

b) To determine the ripple factor and efficiency of a full-wave rectifier.

1. with Filter
2. without Filter

Apparatus Required:-

Bread Board
Transformer (9-0-9)
P-n Diodes, (lN4007) - 2 No's
Multimeter
Filter Capacitor (100μF/25v) – 1No
Connecting Wires
CRO
Load resistor 1KΩ

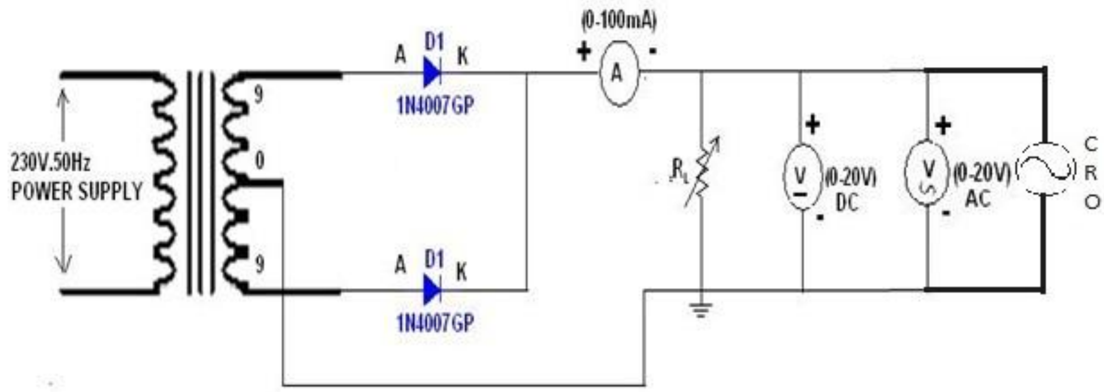
Theory:-

The circuit of a center-tapped full wave rectifier uses two diodes D1&D2. During positive half cycle of secondary voltage (input voltage), the diode D1 is forward biased and D2 is reverse biased. The diode D1 conducts and current flows through load resistor R_L. During negative half cycle, diode D2 becomes forward biased and D1 reverse biased. Now, D2 conducts and current flows through the load resistor R_L in the same direction. There is a continuous current flow through the load resistor R_L, during both the half cycles making the direction of current unidirectional as show in the model graph.

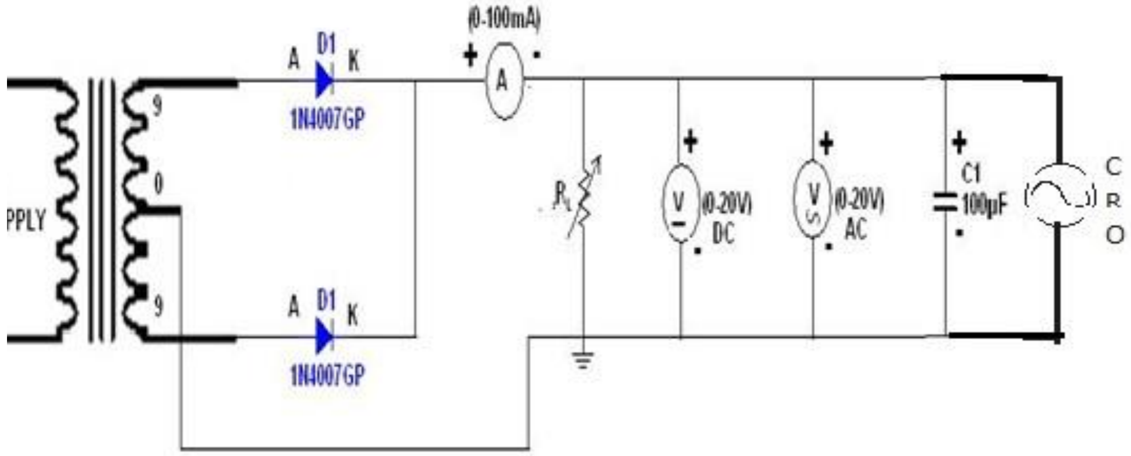
The difference between full wave and half wave rectification is that a full wave rectifier allows unidirectional (one way) current to the load during the entire 360 degrees of the input signal and half-wave rectifier allows the current only during one half cycle (180 degree).

Circuit Diagram:-

With Out Filter:



With Filter:



Procedure:-

1. Connections are made as per the circuit diagram.
2. Connect the primary of the transformer to ac mains and the secondary to the rectifier input.
3. Measure the ac input voltage of rectifier and dc voltage at the output of the rectifier using multimeter.
4. Find the theoretical value of dc voltage by using the formula,

$$Vdc=2Vm/\pi$$

Where Vm= 2Vrms, (Vrms= output ac voltage.)
The Ripple factor is calculated by using the formula
r=ac output voltage (Vrms)/dc output voltage (Vdc).

Pspice model:-

1. Enter in to the Pspice software.
2. Customize the screen and then draw the circuit on the screen .
3. Start the simulation and observe the input and output waveforms.

Regulation Characteristics:-

1. Connections are made as per the circuit diagram.
2. By increasing the value of the rheostat, the voltage across the load and current flowing through the load are measured.
3. The reading is tabulated.
4. Draw a graph between load voltage (V_L) and load current (I_L) taking V_L on X-axis and I_L on y-axis.
5. From the value of no-load voltages, the %regulation is calculated using the formula.

Observations:-

Without Filter:-

V_{NL} =

Sno.	I_{dc}(mA)	V_{dc}(V)	V_{ac}(V)	Ripple factor $r = V_{ac}/V_{dc}$	%Reg = $(V_{NL} - V_{FL})/V_{FL}*100$

WITH FILTER:-

V_{NL} =

Sno.	I_{dc}(mA)	V_{dc}(V)	V_{ac}(V)	Ripple factor $r = V_{ac}/V_{dc}$	%Reg = $(V_{NL} - V_{FL})/V_{FL}*100$

Theoretical Calculations:-

$Vrms = Vm/\sqrt{2}$

$Vdc = 2Vm/\pi$

Without filter:-

Ripple factor, $r = \sqrt{(Vrms/Vdc)^2 - 1} = 0.482$

With filter:-

Ripple factor, $r = 1/(4\sqrt{3}\, f\, C\, R_L)$

Where f =50Hz

C =100µF

R_L=1KΩ

Practical Calculations:-

Without filter:-

Vac=
Vdc=
Ripple factor, r=Vac/Vdc

With filters:-

Vac=
Vdc=
Ripple factor, r=Vac/Vdc

Result:-

1. The Ripple factor for the Half-Wave Rectifier with and without filters are measured.
2. The %regulation of the Half-Wave rectifier is calculated.

Viva Questions:-

1. Define regulation of the full wave rectifier?
2. Define peak inverse voltage (PIV)? And write its value for Full-wave rectifier?
3. If one of the diode is changed in its polarities what wave form would you get?
4. Does the process of rectification alter the frequency of the waveform?
5. What is ripple factor of the Full-wave rectifier?
6. What is the necessity of the transformer in the rectifier circuit?
7. What are the applications of a rectifier?
8. What is meant by ripple and define Ripple factor?
9. Explain how capacitor helps to improve the ripple factor?
10. Can a rectifier made in INDIA (V=230v, f=50Hz) be used in USA (V=110v, f=60Hz)?

Outcome: Students are able to

1. Analyze the operation of Full Wave rectifier with and without filter.
2. Calculate its performance parameters-ripple factor, percentage regulation, efficiency with and without filter.

4. TRANSISTOR COMMON EMITTER CHARACTERSTICS

Aim: a) To draw the input and output characteristics of transistor connected in CE Configuration.

b) To calculate h-parameters

Apparatus Required:

Transistor (BC 107)
R.P.S (0-30V) - 2Nos
Voltmeters (0-20V) - 2Nos
Ammeters (0-20mA, 0-750µA)
Resistors 1KΩ
Bread board

Theory:

A transistor is a three terminal device. The terminals are emitter, base, collector. In common emitter configuration, input voltage is applied between base and emitter terminals and output is taken across the collector and emitter terminals. Therefore the emitter terminal is common to both input and output.

The input characteristics resemble that of a forward biased diode curve. This is expected since the Base-Emitter junction of the transistor is forward biased. As compared to CB arrangement I_B increases less rapidly with $V_{BE.}$ Therefore input resistance of CE circuit is higher than that of CB circuit.

The output characteristics are drawn between I_c and V_{CE} at constant $I_{B.}$ The collector current varies with V_{CE} until few volts only. After this the collector current becomes almost constant, and independent of $V_{CE.}$ The value of V_{CE} upto which the collector current changes with V_{CE} is known as Knee voltage. The transistor always operated in the region above Knee voltage, I_C is always constant and is approximately equal to $I_{B.}$ It operates in three regions: active region, cut-off region and saturation region.

Active region: When E-B junction is forward biased and C-B junction is reverse biased then the transistor is said to be in active region.

Cut-off region: When E-B junction is reverse biased and C-B junction is reverse biased then the transistor is said to be in cut-off region.

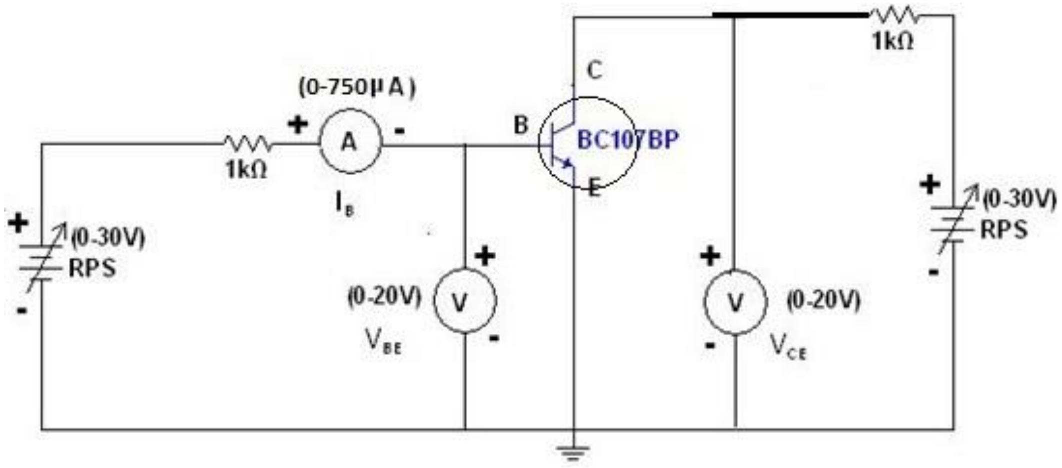
Saturation region: When E-B junction is forward biased and C-B junction is forward biased then the transistor is said to be in saturation region.

The current amplification factor of CE configuration is given by

$$\beta = \Delta I_C/\Delta I_B$$

Circuit Diagram:

Input Characteristics:



Procedure:-

Input Characteristics:

1. Connect the circuit as per the circuit diagram.
2. For plotting the input characteristics the output voltage V_{CE} is kept constant at 1V and for different values of $V_{BE.}$ Note down the values of I_C.
3. Repeat the above step by keeping V_{CE} at 2V and 4V.
4. Tabulate all the readings.
5. Plot the graph between V_{BE} and I_B for constant VCE.

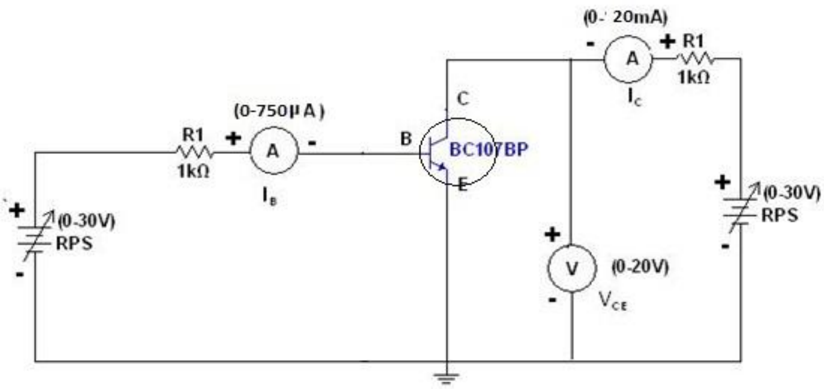
Observations:

Input Characteristics:

S.NO	V_{CE} = 1V		V_{CE} = 2V	
	V_{BE}(V)	I_B(μA)	V_{BE}(V)	I_B(μA)

Circuit Diagram:

Output Characteristics:



Output characteristics:

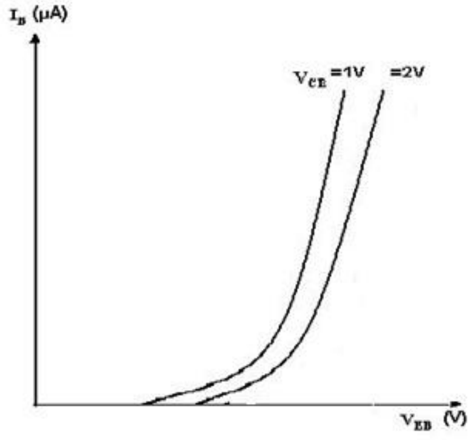
1. Connect the circuit as per the circuit diagram.
2. For plotting the output characteristics the input current IB is kept constant at 10μA and for different values of VCE, note down the values of I_C.
3. Repeat the above step by keeping I_B at 75 μA and 100 μA.
4. Tabulate the all the readings.
5. Plot the graph between V_{CE} and I_C for constant I_B.

Output Characteristics:

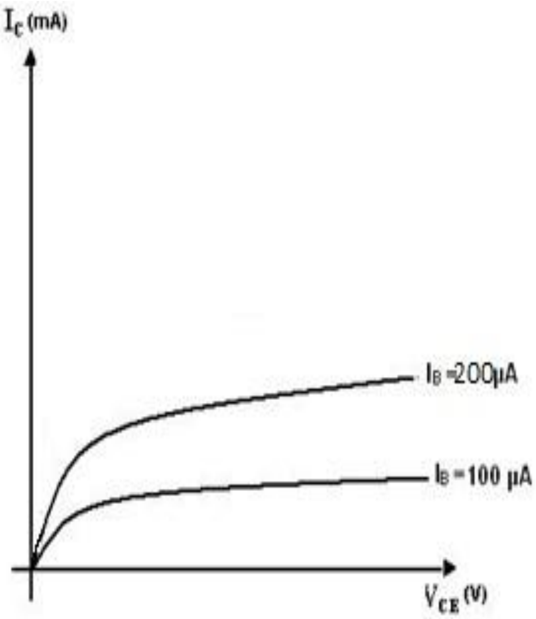
S.NO	I_B = 100 μA		I_B = 200 μA	
	V_{CE}(V)	I_C(mA)	V_{CE}(V)	I_C(mA)

Model Graphs:

Input Characteristics:-



Output Characteristics:-



Applications:-

- Acts as a switch
- As an amplifier
- As an inverter
- In oscillators

Result:- The input and output characteristics of a transistor in CE configuration are drawn and hence dynamic resistance is calculated.

Input Impedance hie = $\Delta V_{BE} / \Delta I_B$ at V_{CE} constant

Output impedance hoe = $\Delta V_{CE} / \Delta I_C$ at I_B constant
Reverse Transfer Voltage Gain hre = $\Delta V_{BE} / \Delta V_{CE}$ at I_B constant
Forward Transfer Current Gain hfe = $\Delta I_C / \Delta I_B$ at constant V_{CE}

Viva Questions:

1. What is the range of β for the transistor?

2. What are the input and output impedances of CE configuration?

3. Identify various regions in the output characteristics?

4. what is the relation between α *and* β

5. Define current gain in CE configuration?

6. Why CE configuration is preferred for amplification?

7. What is the phase relation between input and output?

8. Draw diagram of CE configuration for PNP transistor?

9. What is the power gain of CE configuration?

10. What are the applications of CE configuration?

Outcome: by the completion of this experiment student can

1. Analyze the characteristics of BJT in Common Emitter Configuration.
2. Calculate h-parameters from the characteristics obtained.
3. Identify different operating regions of transistor.
4. Identify the applications from analyzed parameters.

5. FET CHARACTERISTICS

Aim:- a). To draw the drain and transfer characteristics of a given FET.
b).To find the drain resistance (r_d) amplification factor (μ) and Transconductance (g_m) of the given FET.

Apparatus Required:-

FET (BFW-11)
Regulated power supply
Voltmeter (0-20V)
Ammeter (0-20mA)
Bread board
Connecting wires

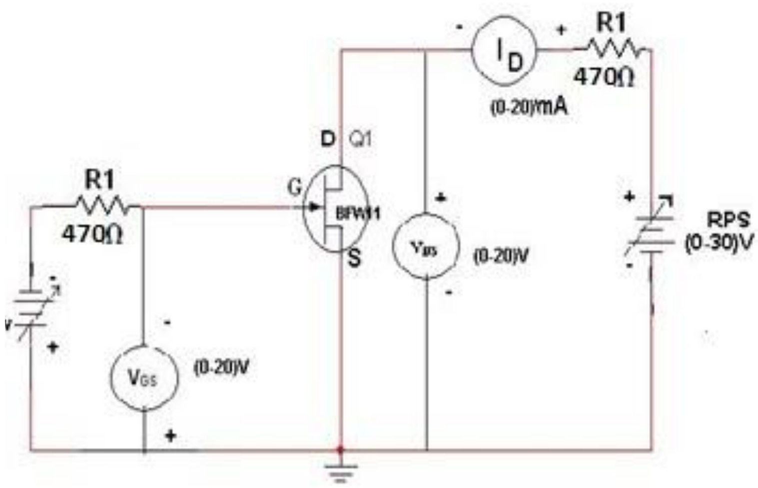
Theory:-

A FET is a three terminal device, having the characteristics of high input impedance and less noise, the Gate to Source junction of the FET s always reverse biased. In response to small applied voltage from drain to source, the n-type bar acts as sample resistor, and the drain current increases linearly with $V_{DS.}$ With increase in I_D the ohmic voltage drop between the source and the channel region reverse biases the junction and the conducting position of the channel begins to remain constant. The V_{DS} at this instant is called "pinch of voltage". If the gate to source voltage (V_{GS}) is applied in the direction to provide additional reverse bias, the pinch off voltage will be decreased.

In amplifier application, the FET is always used in the region beyond the pinch-off.

$$F_{DS}=I_{DSS}(1-V_{GS}/V_P)^2$$

Circuit Diagram:-



Procedure:-

1. All the connections are made as per the circuit diagram.
2. To plot the drain characteristics, keep V_{GS} constant at 0V.
3. Vary the V_{DD} and observe the values of V_{DS} and I_D.
4. Repeat the above steps 2, 3 for different values of V_{GS} at 0.1V and 0.2V.
5. All the readings are tabulated.
6. To plot the transfer characteristics, keep V_{DS} constant at 1V.
7. Vary V_{GG} and observe the values of V_{GS} and I_D.
8. Repeat steps 6 and 7 for different values of V_{DS} at 1.5 V and 2V.
9. The readings are tabulated.
10. From drain characteristics, calculate the values of dynamic resistance (r_d) by using the formula

$$r_d = \Delta V_{DS}/\Delta I_D$$

11. From transfer characteristics, calculate the value of Trans conductance (g_m) By using the formula

$$G_m = \Delta I_D/\Delta V_{GS}$$

12. Amplification factor (μ) = dynamic resistance. Tran conductance

$$\mu = \Delta V_{DS}/\Delta V_{GS}$$

Observations:

Drain Characteristics:

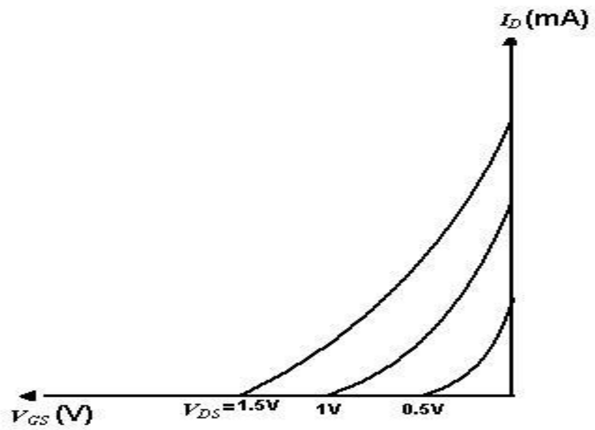
S.NO	V_{GS}=0V		V_{GS}=0.1V		V_{GS}=0.2V	
	V_{DS}(V)	I_D(mA)	V_{DS}(V)	I_D(mA)	V_{DS}(V)	I_D(mA)

Transfer Characteristics:

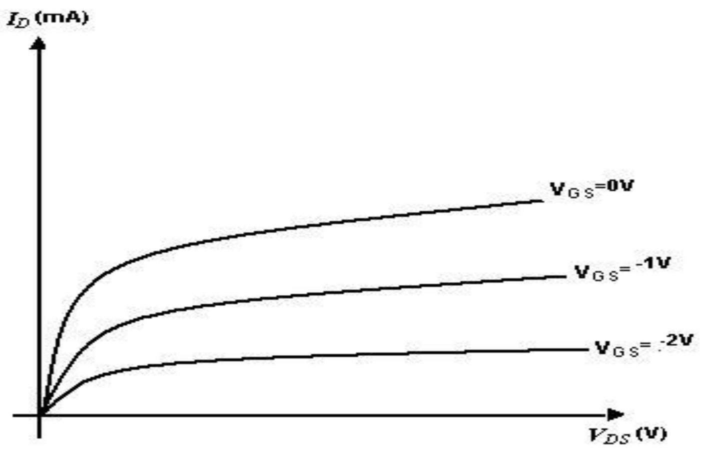
S.NO	V_{DS} =0.5V		V_{DS}=1V		V_{DS} =1.5V	
	V_{GS} (V)	I_D(mA)	V_{GS} (V)	I_D(mA)	V_{GS} (V)	I_D(mA)

Model Graph:

Transfer Characteristics



Drain Characteristics



Precautions:

1. The three terminals of the FET must be carefully identified
2. Practically FET contains four terminals, which are called source, drain, Gate, substrate.
3. Source and case should be short circuited.
4. Voltages exceeding the ratings of the FET should not be applied.

Result:

1. The drain and transfer characteristics of a given FET are drawn
2. The dynamic resistance (r_d), amplification factor (μ) and Tran conductance (g_m) of the given FET are calculated.

Viva Questions:

1. What are the advantages of FET?
2. Different between FET and BJT?
3. Explain different regions of V-I characteristics of FET?
4. What are the applications of FET?
5. What are the types of FET?
6. Draw the symbol of FET.
7. What are the disadvantages of FET?
8. What are the parameters of FET?

Outcome: Students are able to

1. Analyze the Drain and transfer characteristics of FET in Common Source configuration.
2. Calculate the parameters transconductance (**g_m**), drain resistance (**r_d**) and amplification factor (**μ**).

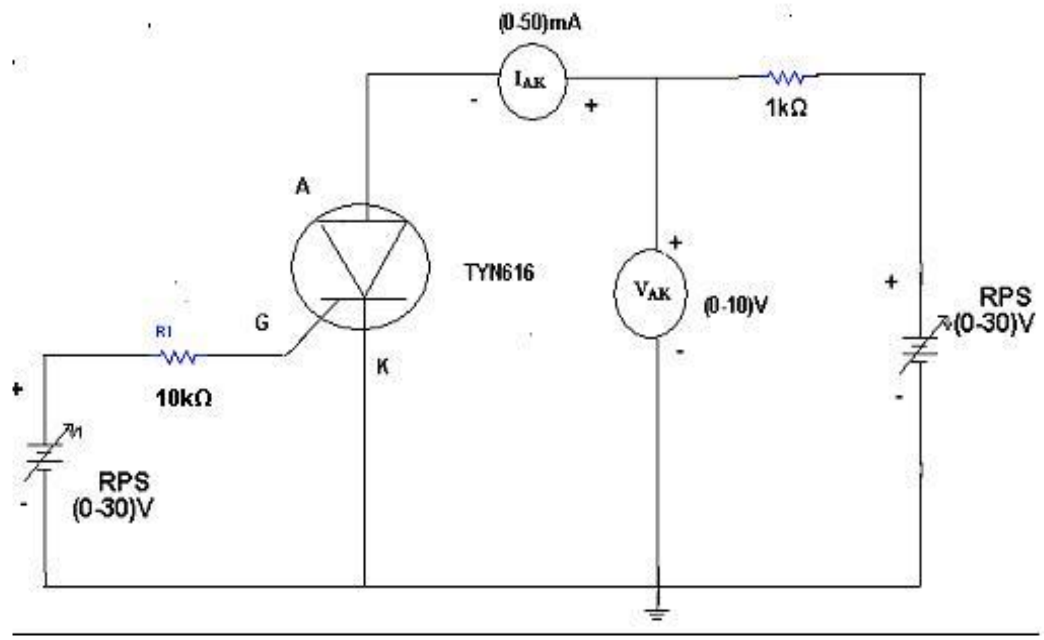
6. SILICON-CONTROLLED RECTIFIER (SCR) CHARACTERISTICS

Aim: To obtain the V-I Characteristics of SCR using both pspice and hardware model's

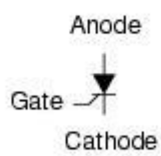
Apparatus Required:

SCR (TYN616)
Regulated Power Supply (0-30V)
Resistors 10kΩ, 1kΩ
Ammeter (0-50) µA
Voltmeter (0-10V)
Breadboard
Connecting Wires.

Circuit Diagram:



Theory: It is a four layer semiconductor device being alternate of P-type and N-type silicon. It consists of 3 junctions J_1, J_2, J_3 the J_1 and J_3 operate in forward direction and J_2 operates in reverse direction and three terminals called anode A, cathode K , and a gate G. The operation of SCR can be studied when the gate is open and when the gate is positive with respect to cathode.



Schematic symbol

When gate is open, no voltage is applied at the gate due to reverse bias of the junction J_2 no current flows through R_2 and hence SCR is at cut off. When anode voltage is increased J_2 tends to breakdown.

When the gate positive, with respect to cathode J_3 junction is forward biased and J_2 is reverse biased .Electrons from N-type material move across junction J_3 towards gate while holes from P-type material moves across junction J_3 towards cathode. So gate current starts flowing, anode current increase is in extremely small current junction J_2 break down and SCR conducts heavily.

When gate is open thee break over voltage is determined on the minimum forward voltage at which SCR conducts heavily. Now most of the supply voltage appears across the load resistance. The holfing current is the maximum anode current gate being open , when break over occurs.

Procedure:

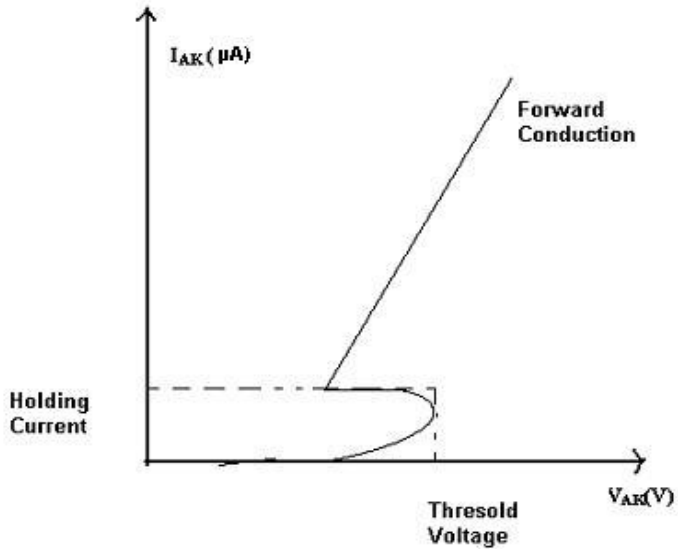
1. Connections are made as per circuit diagram.
2. Keep the gate supply voltage at some constant value
3. Vary the anode to cathode supply voltage and note down the readings of voltmeter and ammeter. Keep the gate voltage at standard value.
4. A graph is drawn between V_{AK} and I_{AK}.

Observations:

V_{AK}(V)	I_{AK} (μA)

.

Model Graphs:-



Applications:-

i) Speed control for motors
ii) Temperature control for electric hot plate
iii) Dimmer switch for domestic lighting
iv) Dimmer control

Result: SCR Characteristics are obtained and plotted.

Viva Questions

1. What the symbol of SCR?
2. IN which state SCR turns of conducting state to blocking state?
3. What are the applications of SCR?
4. What is holding current?
5. What are the important type‟s thyristors?
6. How many numbers of junctions are involved in SCR?
7. What is the function of gate in SCR?

8. When gate is open, what happens when anode voltage is increased?

9. What is the value of forward resistance offered by SCR?

10. What is the condition for making from conducting state to non-conducting state?

Outcome: Students can

1. Understand the operation and characteristics of SCR.
2. Identify different properties of SCR from charcterisitcs.
3. Identify the applications.

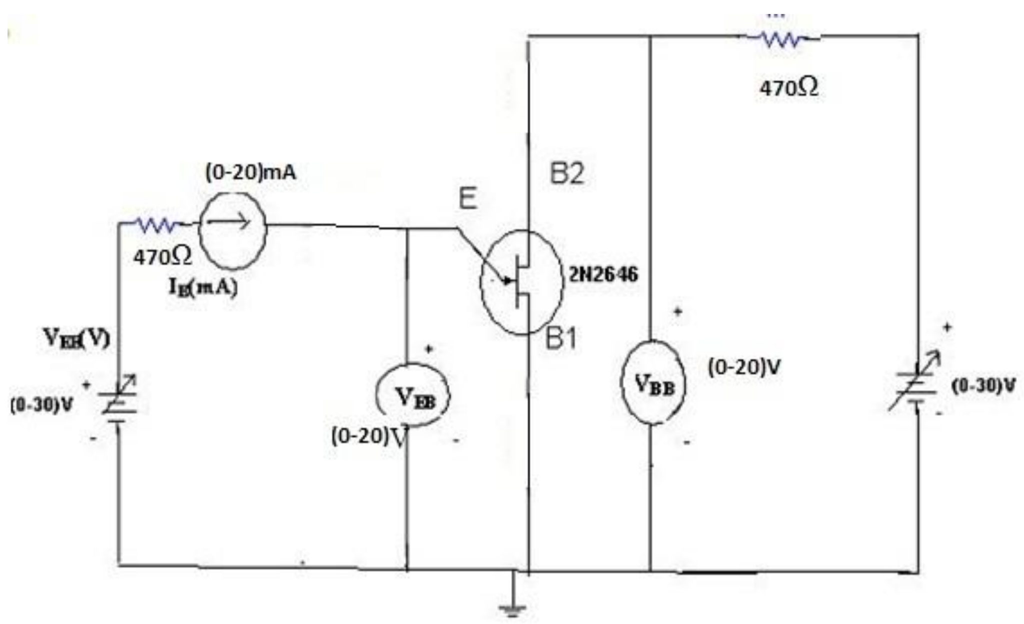
7. UJT CHARACTERISTICS

Aim: To observe the characteristics of UJT and to calculate the Intrinsic Stand-Off Ratio (η).

Apparatus Required:

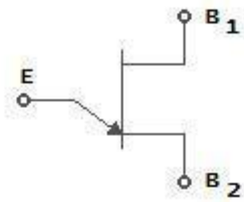
Regulated Power Supply (0-30V, 1A) - 2Nos
UJT 2N2646
Resistors 470Ω - 2Nos
Multimeters - 2Nos
Breadboard
Voltmeter (0-20) V
Ammeter (0-20) mA
Connecting Wires

Circuit Diagram:



Theory:

A Unijunction Transistor (UJT) is an electronic semiconductor device that has only one junction. The UJT Unijunction Transistor (UJT) has three terminals an emitter (E) and two bases (B1 and B2). The base is formed by lightly doped n-type bar of silicon. Two ohmic contacts B1 and B2 are attached at its ends. The emitter is of p-type and it is heavily doped. The resistance between B1 and B2, when the emitter is open-circuit is called interbase resistance.The original unijunction transistor, or UJT, is a simple device that is essentially a bar of N type semiconductor material into which P type material has been diffused somewhere along its length. The 2N2646 is the most commonly used version of the UJT.



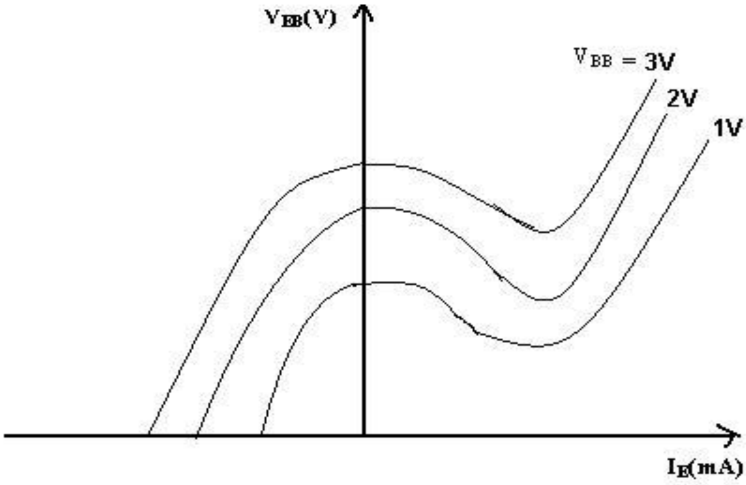
Circuit symbol

The UJT is biased with a positive voltage between the two bases. This causes a potential drop along the length of the device. When the emitter voltage is driven approximately one diode voltage above the voltage at the point where the P diffusion (emitter) is, current will begin to flow from the emitter into the base region. Because the base region is very lightly doped, the additional current (actually charges in the base region) causes (conductivity modulation) which reduces the resistance of the portion of the base between the emitter junction and the B2 terminal. This reduction in resistance means that the emitter junction is more forward biased, and so even more current is injected. Overall, the effect is a negative resistance at the emitter terminal. This is what makes the UJT useful, especially in simple oscillator circuits. When the emitter voltage reaches V_p, the current starts to increase and the emitter voltage starts to decrease. This is represented by negative slope of the characteristics which is referred to as the negative resistance region, beyond the valley point, R_{B1} reaches minimum value and this region, V_{EB} proportional to I_E.

Procedure:

1. Connection is made as per circuit diagram.
2. Output voltage is fixed at a constant level and by varying input voltage corresponding emitter current values are noted down.
3. This procedure is repeated for different values of output voltages.
4. All the readings are tabulated and Intrinsic Stand-Off ratio is calculated using $\eta = (V_p - V_D) / V_{BB}$
5. A graph is plotted between V_{EE} and I_E for different values of V_{BE}.

Model Graph:



Observations:

V_{BB}=1V		V_{BB}=2V		V_{BB}=3V	
V_{EB}(V)	I_E(mA)	V_{EB}(V)	I_E(mA)	V_{EB}(V)	I_E(mA)

Calculations:

$$V_P = \eta V_{BB} + V_D$$
$$\eta = (V_P - V_D) / V_{BB}$$
$$\eta = (\eta_1 + \eta_2 + \eta_3) / 3$$

Applications:

1. Relaxation Oscillator

Result:

The characteristics of UJT are observed and the values of Intrinsic Stand-Off Ratio is calculated.

Viva Questions.

1. What is the symbol of UJT?
2. Draw the equivalent circuit of UJT?
3. What are the applications of UJT?
4. Formula for the intrinsic standoff ratio?

5. What does it indicates the direction of arrow in the UJT?

6. What is the difference between FET and UJT?

7. Is UJT is used an oscillator? Why?

8. What is the Resistance between B_1 and B_2 is called as?

9. What is its value of resistance between B_1 and $B_{2?}$

10. Draw the characteristics of UJT?

Outcome: Students can

1. Understand the operation and characteristics of UJT.
2. Identify different properties of UJT from charcterisitcs.
3. Identify the applications.

8. DESIGN AND VERIFICATION OF FIXED BIAS AND COLLECTOR TO BASE BIAS CIRCUITS

AIM: 1.To design a fixed bias circuit and observe stability by changing β of the given transistor in CE configuration using both pspice and hardware model's.

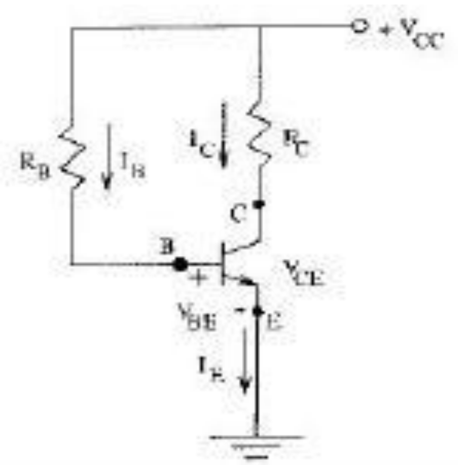
2. To design a collector to base bias circuit and observe stability by changing β of the given transistor in CE configuration.

APPARATUS:

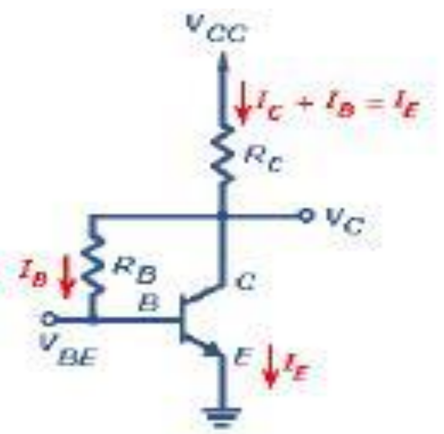
Transistors (BC 107) with different β values
D.R.P.S (O-30V)
Resistors (from design values)
Bread board and connecting wires
PSPICE Simulation Software

CIRCUIT DIAGRAM:

Fixed Bias Circuit



Collector-to-base bias circuit



CALCULATIONS:

Fixed Bias Circuit

Given VCC=10V, IC=4mA, VCE=6V, VBE=0.6V

IC=IB/ β

RB=(VCC-VBE)/IB

RC=(VCC-VCE)/IC

Collector-to-base bias circuit

Given VCC=10V, IC=4mA, VCE=6V, VBE=0.6V

IC=IB/ β

RC=(VCC-VCE)/(IB+IC)

RB={(VCC-VBE-ICRC) β}/IC – RC

PROCEDURE:

1. Assemble the circuit on breadboard with design values of RC, RB and β.
2. Apply VCC and measure VCE and VBE and record the readings in the table.
3. Without changing bias resistors, change the transistors with other β values and repeat the above step.
4. Repeat the above steps using the collector to base bias circuit and tabulate all the readings.

OBSERVATIONS:

Fixed Bias:

β value	V_{CE}	V_{BE}	Ic=(Vcc-Vce)/Rc

Collector to base bias:

β value	V_{CE}	V_{BE}	Ic=(Vcc-Vce)/Rc-Ib

PRECAUTIONS:

1. The supply voltage should not exceed the rating of the transistor
2. Meters should be connected properly according to their polarities

VIVA QUESTIONS:

1. What are the applications of fixed bias configuration?

2. What are the applications of collector to base bias configuration?

3. What are the disadvantages of fixed bias configuration?

4. How to overcome the disadvantages of fixed bias configuration.

Outcome: Students can able to

1. Design a fixed bias circuit and observed stability by changing β of the given transistor in CE configuration.

2. Design a collector to base bias circuit and observed stability by changing β of the given transistor in CE configuration.

9. Study and Operation of CRO

AIM: To observe front panel control knobs and to find amplitude, time period and Frequency for given waveforms.

Apparatus Required:

CRO
Function generator and probes

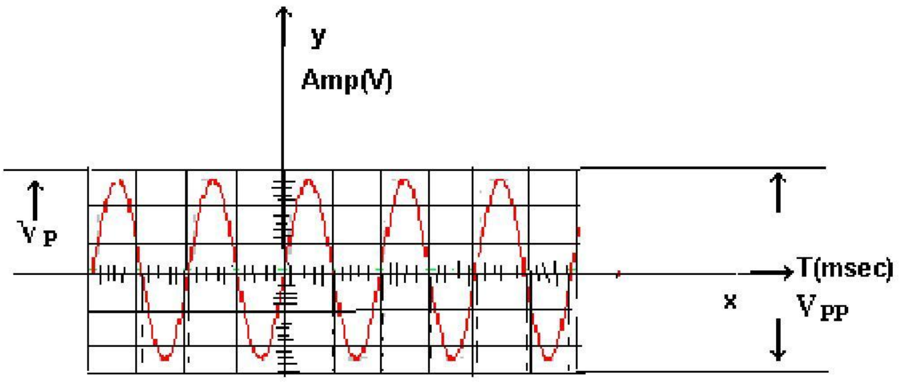
PROCEDURE

1. Understand the significance of each and every knob on the CRO.
2. From the given function generator feed in a sinusoidal wave and adjust the time base knob and the amplitude knob to observe the waveform as a function of time.
3. Measure the time period and amplitude (peak to peak) of the signal. Find the Frequency and verify if the same frequency is given fro the function generator.
4. Observe two waveforms simultaneously on the two channels of a CRO.
5. Repeat the above steps for pulse and triangular waveforms.
6. Report the readings and the waveforms taken.

MEASUREMENTS:

Amplitude = no. of vertical divisions * Volts/div.
Time period = no. of horizontal divisions * Time/div. Frequency=(1/T)Hz

MODEL GRAPHS:



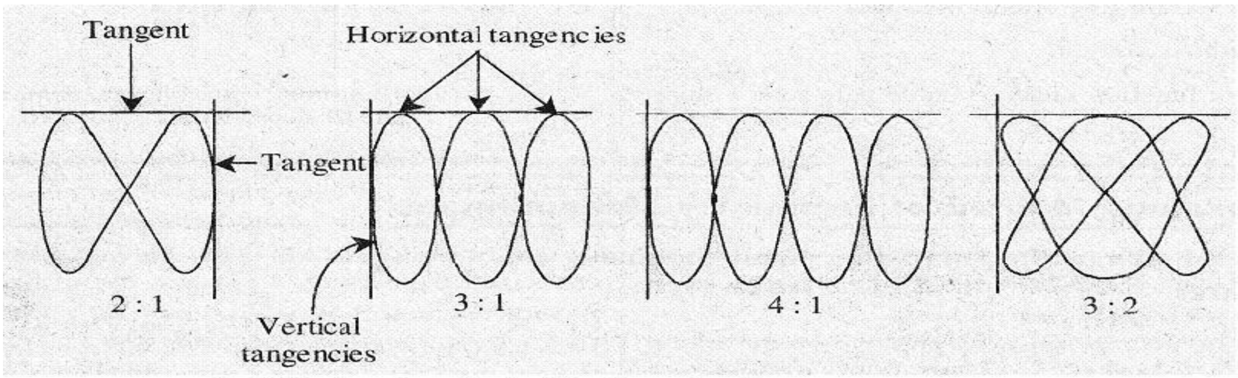


fig 6.2 Lissajous patterns allowing different frequencies ratios

Applications Of CRO:

1. Measurement of current
2. Measurement of voltage
3. Measurement of power
4. Measurement of frequency
5. Measurement of phase angle
6. To see transistor curves
7. To trace and measuring signals of RF, IF and AF in radio and TV.
8. To trace visual display of sine waves.

Viva Questions:

1. How do you measure frequency using the CRO?

2. Can you measure signal phase using the CRO?

3. Suggest a procedure for signal phase measurement using the data from CRO?

4. Can you comment on the wavelength of a signal using CRO?

5. How many channels are there in a CRO?

6. Can you measure DC voltage using a CRO?

Outcome: after completion of this experiment student is able to do the following

- Operation of CRO
- Measurement of amplitude/ voltage, frequency and phase of different signals using CRO.
- Drawing lissajous figures to find phase and frequency.

10. TRANSISTOR CE AMPLIFIER

Aim: 1. To Measure the voltage gain of a CE amplifier using both pspice and hardware model's
2. To draw the frequency response curve of the CE amplifier

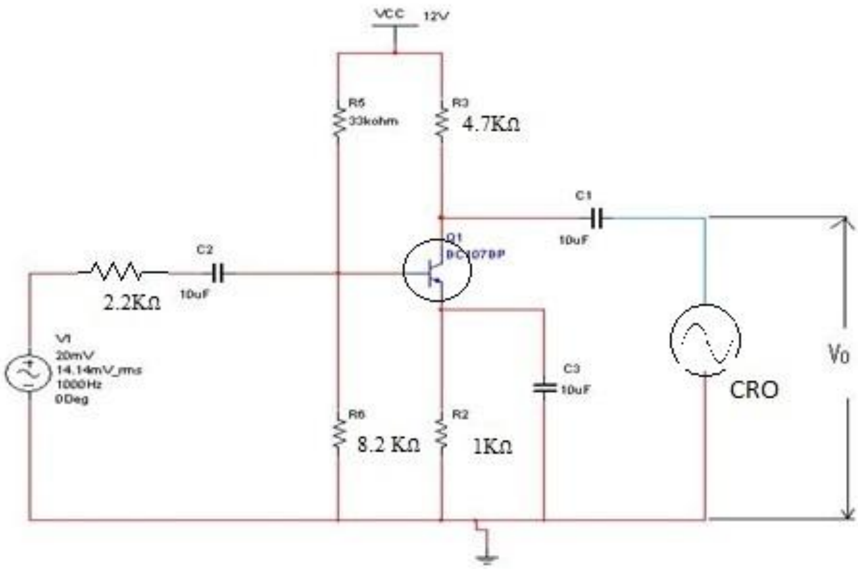
Apparatus:

Transistor BC-107
Regulated power Supply (0-30V, 1A)
Function Generator
CRO
Resistors [33KΩ, 8.2 KΩ, 1KΩ, 2.2KΩ, 4.7KΩ]
Capacitors- 10µF -3No
Bread Board
Connecting Wires
PSPICE Simulation Software

Theory:

The CE amplifier provides high gain &wide frequency response. The emitter lead is common to both input & output circuits and is grounded. The emitter-base circuit is forward biased. The collector current is controlled by the base current rather than emitter current. The input signal is applied to base terminal of the transistor and amplifier output is taken across collector terminal. A very small change in base current produces a much larger change in collector current. When +VE half-cycle is fed to the input circuit, it opposes the forward bias of the circuit which causes the collector current to decrease, it decreases the voltage more –VE. Thus when input cycle varies through a -VE half-cycle, increases the forward bias of the circuit, which causes the collector current to increases thus the output signal is common emitter amplifier is in out of phase with the input signal.

Circuit Diagram:



Procedure:

1. Connect the circuit as shown in circuit diagram
2. Apply the input of 20mV peak-to-peak and 1 KHz frequency using Function Generator
3. Measure the Output Voltage Vo (p-p) for various load resistors
4. Tabulate the readings in the tabular form.
5. The voltage gain can be calculated by using the expression $A_v = (V_0/V_i)$
6. For plotting the frequency response the input voltage is kept Constant at 20mV peak-to-peak and the frequency is varied from 100Hz to 1MHz Using function generator
7. Note down the value of output voltage for each frequency.
8. All the readings are tabulated and voltage gain in dB is calculated by Using The expression $A_v = 20 \log_{10} (V_0/V_i)$
9. A graph is drawn by taking frequency on x-axis and gain in dB on y-axis On Semi-log graph.

The band width of the amplifier is calculated from the graph Using the expression,

Bandwidth, $BW = f_2 - f_1$

Where f_1 lower cut-off frequency of CE amplifier,

and Where f_2 upper cut-off frequency of CE amplifier

The bandwidth product of the amplifier is calculated using the Expression

Gain Bandwidth product=3-dBmidband gain X Bandwidth

Observations:

Input voltage Vi=20mV

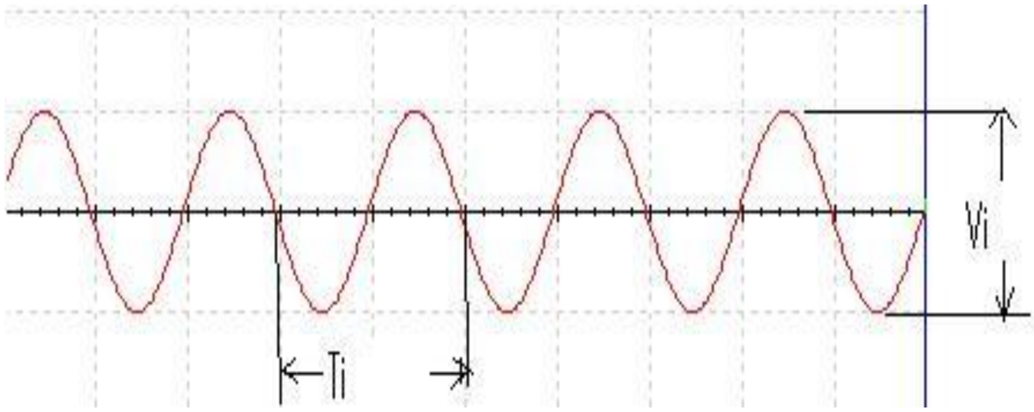
Frequency Response:

Vi=20mv

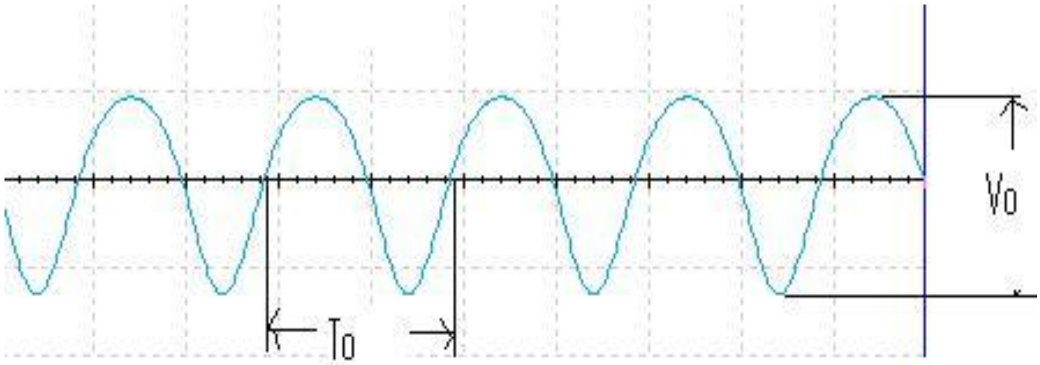
FREQUENCY(Hz)	OUTPUT VOLTAGE (V_0)	GAIN IN dB $A_v = 20 \log_{10} (V_0/V_i)$

Model Graphs:

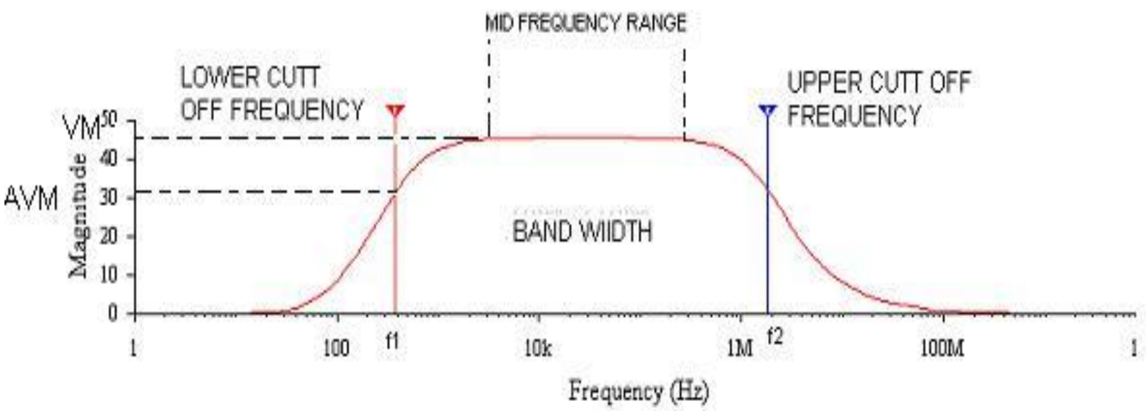
Input Wave Form:



Output Wave Form



Frequency Response:



Result:

The voltage gain and frequency response of the CE amplifier are obtained. Also gain bandwidth product of the amplifier is calculated.

Viva Questions:

1. What is phase difference between input and output waveforms of CE amplifier?

2. What type of biasing is used in the given circuit?

3. If the given transistor is replaced by a p-n-p, can we get output or not?

4. What is effect of emitter-bypass capacitor on frequency response?

5. What is the effect of coupling capacitor?

6. What is region of the transistor so that it is operated as an amplifier?

7. How does transistor acts as an amplifier?

8. Draw the h-parameter model of CE amplifier?

9. What type of transistor configuration is used in intermediate stages of a multistage amplifier?

10. What is early effect?

Outcome: By the completion of this experiment student can

1. Analyze the Common Emitter Amplifier.
2. Calculate voltage gain.
3. Understand the frequency response and calculate the bandwidth from frequency response.
4. Identify the applications.

11. COMMON COLLECTOR AMPLIFIER

Aim: 1. To measure the voltage gain of a CC amplifier.
2. To draw the frequency response of the CC amplifier.

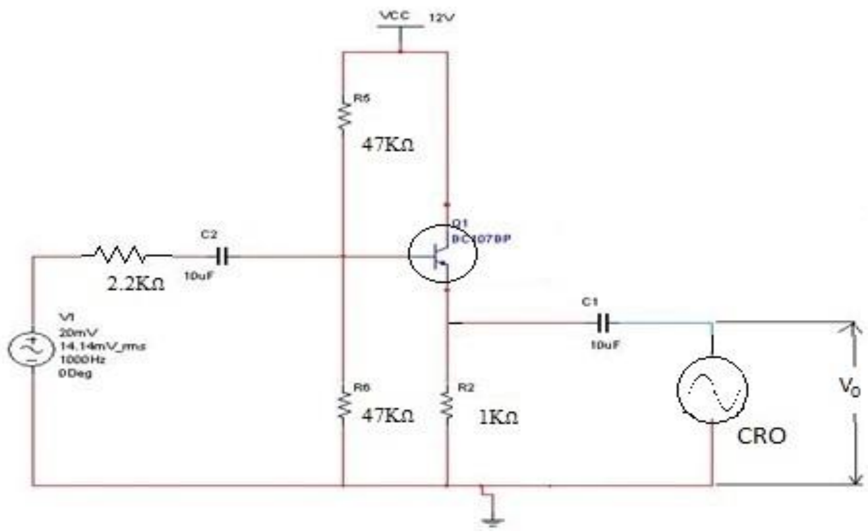
Apparatus Required:

Transistor BC 107
Regulated Power Supply (0-30V)
Function Generator
CRO
Resistors 1KΩ, 2.2KΩ, 47KΩ, 47KΩ
Capacitors 10µF -2Nos
Breadboard
Connecting wires

Theory:

In common-collector amplifier the input is given at the base and the output is taken at the emitter. In this amplifier, there is no phase inversion between input and output. The input impedance of the CC amplifier is very high and output impedance is low. The voltage gain is less than unity. Here the collector is at ac ground and the capacitors used must have a negligible reactance at the frequency of operation. This amplifier is used for impedance matching and as a buffer amplifier. This circuit is also known as emitter follower.

Circuit Diagram:



Procedure:

1. Connections are made as per the circuit diagram.
2. For calculating the voltage gain the input voltage of 20mV peak-to-peak and 1 KHz frequency is applied and output voltage is taken for various load resistors.
3. The readings are tabulated.

The voltage gain calculated by using the expression, $A_V=V_0/V_i$

4. For plotting the frequency response the input voltage is kept constant a 20mV peak-to-peak and the frequency is varied from 100Hzto 1MHz.
5. Note down the values of output voltage for each frequency.

All the readings are tabulated the voltage gain in dB is calculated by using the expression, $A_V=20\log 10(V0/V_i)$

6. A graph is drawn by taking frequency on X-axis and gain in dB on y-axis on Semi-log graph sheet.

The Bandwidth of the amplifier is calculated from the graph using the Expression,

Bandwidth $BW=f_2-f_1$

Where f_1 is lower cut-off frequency of CE amplifier

f_2 is upper cut-off frequency of CE amplifier

7. The gain Bandwidth product of the amplifier is calculated using the Expression,

Gain -Bandwidth product=3-dB midband gain X Bandwidth

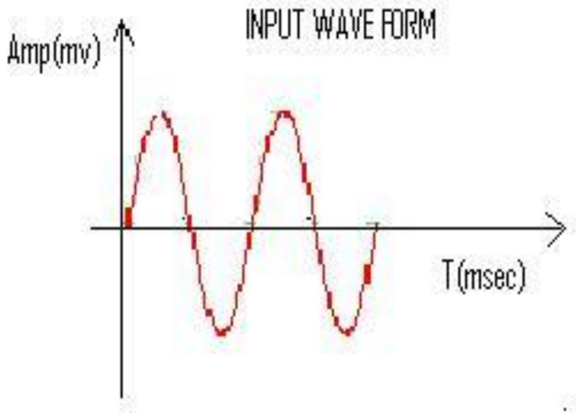
Observations:

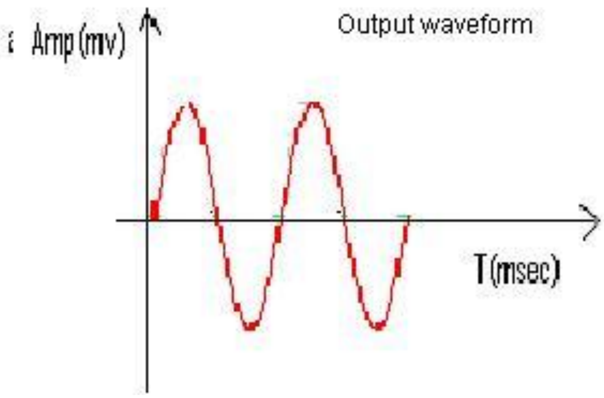
Frequency Response:

V_i=20mV

FREQUENCY(Hz)	**OUTPUT VOLTAGE(V_0)**	**GAIN IN dB A_v=20log 10(V0/V_i)**

Waveforms:





Precautions:

1. The input voltage must be kept constant while taking frequency response.
2. Proper biasing voltages should be applied.

Result:

The voltage gain and frequency response of the CC amplifier are obtained. Also gain Bandwidth product is calculated.

Viva Questions:

1. What are the applications of CC amplifier?

2. What is the voltage gain of CC amplifier?

3. What are the values of input and output impedances of the CC amplifier?

4. To which ground the collector terminal is connected in the circuit?

5. Identify the type of biasing used in the circuit?

6. Give the relation between α, β and γ.

7. Write the other name of CC amplifier?

8. What are the differences between CE,CB and CC?

9. When compared to CE, CC is not used for amplification. Justify your answer?

10. What is the phase relationship between input and output in CC?

Outcome: By the completion of this experiment student can

1. Analyze the Common Collector Amplifier.
2. Calculate voltage gain.
3. Understand the frequency response and calculate the bandwidth from frequency response.
4. Identify the applications.

12. FREQUENCY RESPONSE OF COMMON SOURCE FET AMPLIFIER

AIM: 1. To obtain the frequency response of the common source FET Amplifier
2. To find the Bandwidth.

Apparatus Required:

N-channel FET (BFW11) -1No.
Resistors (470Ω, 4.7kΩ, 1 KΩ, 10 KΩ) -1No.Each
Capacitors 10μF, -2Nos
47μF -1No.
Regulated power Supply (0-30V) -1No.
Function generator -1No.
CRO -1No.
CRO probes -
1pair Bread board
connecting wires

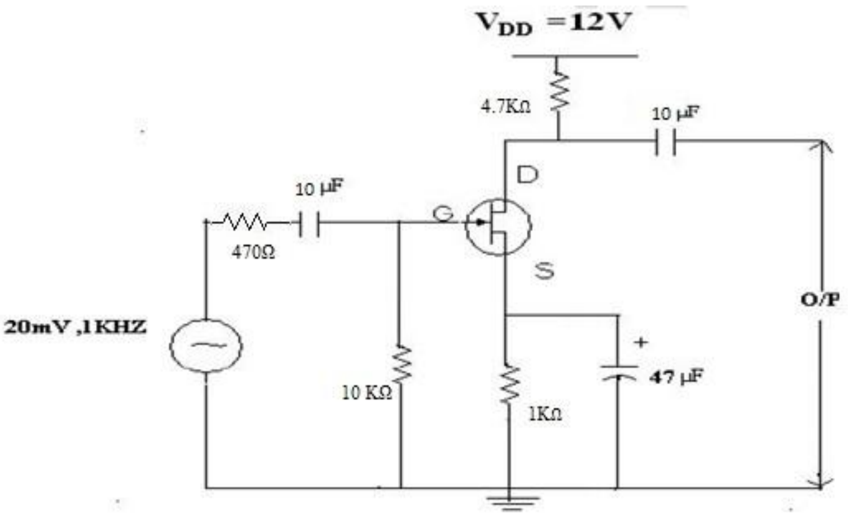
THEORY:

A field-effect transistor (FET) is a type of transistor commonly used for weak-signal amplification (for example, for amplifying wireless (signals). The device can amplify analog or digital signals. It can also switch DC or function as an oscillator. In the FET, current flows along a semiconductor path called the channel. At one end of the channel, there is an electrode called the source. At the other end of the channel, there is an electrode called the drain. The physical diameter of the channel is fixed, but its effective electrical diameter can be varied by the application of a voltage to a control electrode called the gate. Field-effect transistors exist in two major classifications. These are known as the junction FET (JFET) and the metal-oxide- semiconductor FET (MOSFET).

The junction FET has a channel consisting of N-type semiconductor (Nchannel) or P-type semiconductor (P-channel) material; the gate is made of the opposite semiconductor type. In P-type material, electric charges are carried mainly in the form of electron deficiencies called holes. In N-type material, the charge carriers are primarily electrons. In a JFET, the junction is the boundary between the channel and the gate. Normally, this P-N junction is reverse-biased (a DC voltage is applied to it) so that no current flows between the channel and the gate. However, under some conditions there is a small current through the junction during part of the input signal cycle. The FET has some advantages and some disadvantages relative to the bipolar transistor. Field-effect transistors are preferred for weak-signal work, for example in wireless, communications and broadcast receivers. They are also preferred in circuits and systems requiring high impedance. The FET is not, in general, used for high-power amplification, such as is required in large wireless communications and broadcast transmitters.

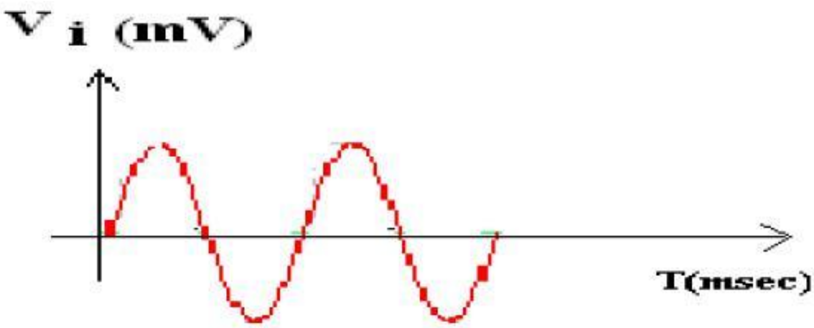
Field-effect transistors are fabricated onto silicon integrated circuit (IC) chips. A single IC can contain many thousands of FETs, along with other components such as resistors, capacitors, and diodes. A common source amplifier FET amplifier has high input impedance and a moderate voltage gain. Also, the input and output voltages are 180 degrees out of Phase.

CIRCUIT DIAGRAM:

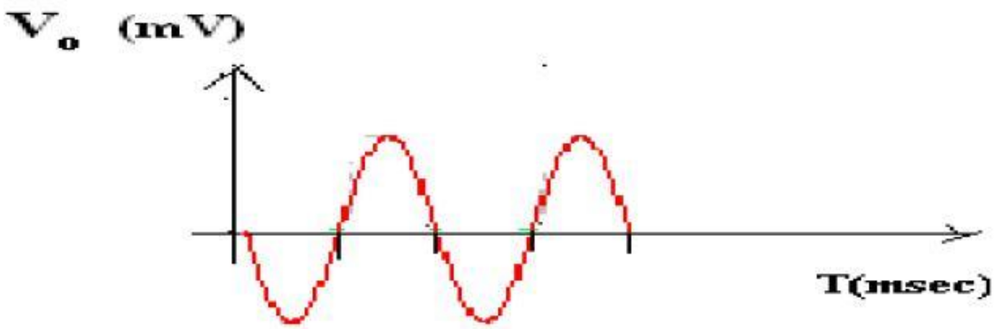


MODEL GRAPHS:

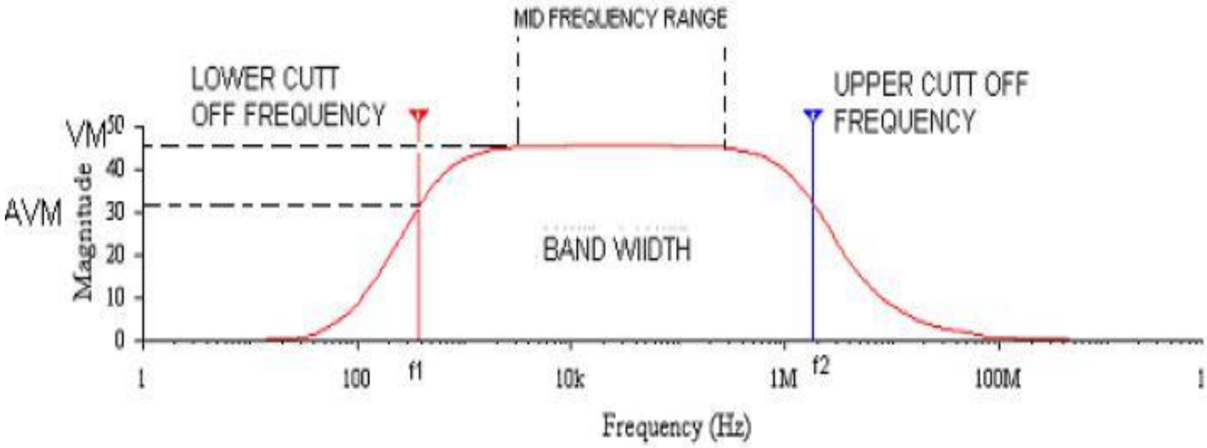
A) INPUT WAVEFORM



B) OUTPUT WAVEFORM



FREQUENCY RESPONSE PLOT:



OBSERVATIONS:

INPUT VOLTAGE (V_i) =20mA

S.No	OUTPUT VOLAGE(Vo)	VOLTAGEGAIN = Vo/Vin	GAIN IN dB= 20 log(Vo/Vin)

PROCEDURE:

1. Connections are made as per the circuit diagram.
2. A signal of 1 KHz frequency and 20mV peak-to-peak is applied at the Input of amplifier.
3. Output is taken at drain and gain is calculated by using the expression,

$$A_v=V_0/V_i$$

4. Voltage gain in dB is calculated by using the expression,

$$A_v=20\log 10(V0/V_i)$$

5. Repeat the above steps for various input voltages.
6. Plot A_v in dB Versus Frequency
7. The Bandwidth of the amplifier is calculated from the graph using the Expression,

$$\textbf{Bandwidth } BW=f_2-f_1$$

Where f_1 is lower 3 dB frequency, f_2 is upper 3 dB frequency

PRECAUTIONS:
1. All the connections should be tight.
2. Transistor terminals must be identified properly

RESULT: The 3-dB Bandwidth of the CS Amplifier is _____.

VIVA QUESTIONS:

1. What is the difference between FET and BJT?

2. FET is unipolar or bipolar?

3. Draw the symbol of FET?

4. What are the applications of FET?

5. FET is voltage controlled or current controlled?

6. Draw the equivalent circuit of common source FET amplifier?

7. What is the voltage gain of the FET amplifier?

8. What is the input impedance of FET amplifier?

9. What is the output impedance of FET amplifier?

10. What are the FET parameters?

11. What are the FET applications

Outcome: By the completion of this experiment student can

1. Analyze the Common Source Amplifier.
2. Calculate voltage gain.
3. Understand the frequency response and calculate the bandwidth from frequency response.
4. Identify the applications.