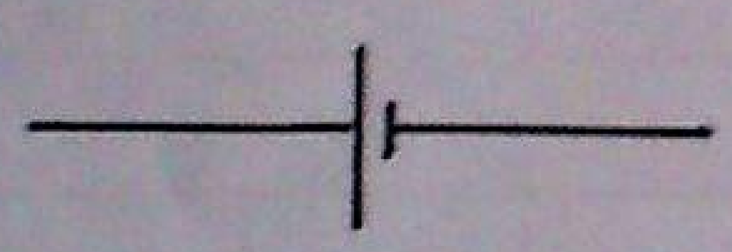
" Symbolic Diagrams of Circuit Elements "

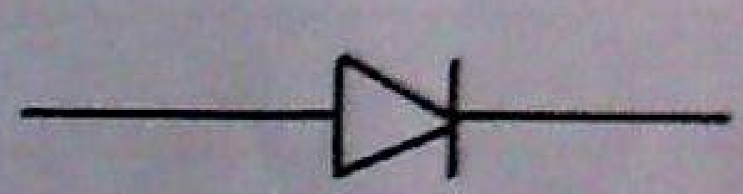
Resistor

Inductor

Capacitor



Battery



Diode

" Every electronic device is composed of these minor circuit elements "

Date Aug. 4, 2011

Expt. No. ....

Page No. 1

" AN INTRODUCTION TO VARIOUS DEVICES AND COMPONENTS USED IN ANALOG ELECTRONICS "

- ACTIVE DEVICES : An active device is any type of circuit component with ability to electrically control electron flow. In order for a circuit to be properly called electronic, it must contain atleast one active device. Active devices include vacuum tubes, transistors, silicon controlled rectifiers (SCRs), etc.

  All active devices control flow of electrons through them. Some active devices allow a voltage to control this current, while other active devices allow another current to do the job. Devices that utilize a static voltage as controlling signal are called "voltage controlled devices." Devices working on the principle of one current controlling another current are called "current controlled devices."

- PASSIVE DEVICES : components incapable of controlling current by means of another electrical signal are called Passive devices. Examples of passive devices are resistors, capacitors, inductors, transformers and even diodes. They are used to build hardware. They always have a gain less than 1 ; thus they can't oscillate or amplify a signal and combination of passive components can only multiply a signal by value less than one. They can shift the phase of a signal, they can reject a signal because it is not made upto current frequencies. They can control complex circuits, but they can't multiply by more than one because they lack gain.

- DIODES : Diodes are basically a one-way valve for electronic current. They let it flow in one direction (from positive to negative) and not in the other direction. Most diodes are similar in appearance to a

Teacher's Signature : ....

resistor and will have a painted line on one end showing the direction or flow. If the negative side is on the negative end of the circuit, current will flow.

- **INTEGRATED CIRCUITS**: IC's are complex circuits inside one simple package where silicon and metal are used to simulate resistors, capacitors, transistors, etc. It's a space solving miracle.

- **TRANSISTORS**: An electrically controlled switch commonly used in electronic devices is nothing but a transistor. Transistors are the fundamental building blocks of circuitary in computers, cellular phones and all other modern electronic devices.
The semiconductors control electrical current flowing between two terminals by applying voltage across a wired terminal. Transistors amplify when built into a proper circuit. A weak signal can be boosted tremendously, lets you have low flowing one side of transistor. The current stops because silicon isn't a good conductor. It stops as Si changes transistor's internal crystalline structure, causing Si to go from an insulator to a conductor. It now allows larger current to go through, picking up the weak signal along the way and impressing it on a large.

- **CAPACITORS**: A passive component that stores energy in an electric field between a pair of conductors (called plates). The process of storing energy in a capacitor is known as "charging", involving electronic (rather electrical) charges of equal magnitude but opposite polarity building up on each plate. A capacitor's ability to store charge is measured by its capacitance, in units of farad.
Capacitors are often used by engineers in electric and electronic

circuits as energy storage devices. They can also be used to differentiate between high frequency and low frequency signals. This property makes them useful in electronic filters.

- **RESISTORS:** A resistor is a passive component that dissipates energy in the form of heat when current flows through it. A resistor to a two-terminal electronic device that produces a voltage across its terminals is proportional to the electric current passing through it in accordance with Ohm's Law.

The primary characteristics of a resistor are the resistance, tolerance, maximum working voltage and power rating. Practical resistor can be made of various compounds and films, as well as resistance wires (i.e. wires made of high resistivity alloy, such as Ni).

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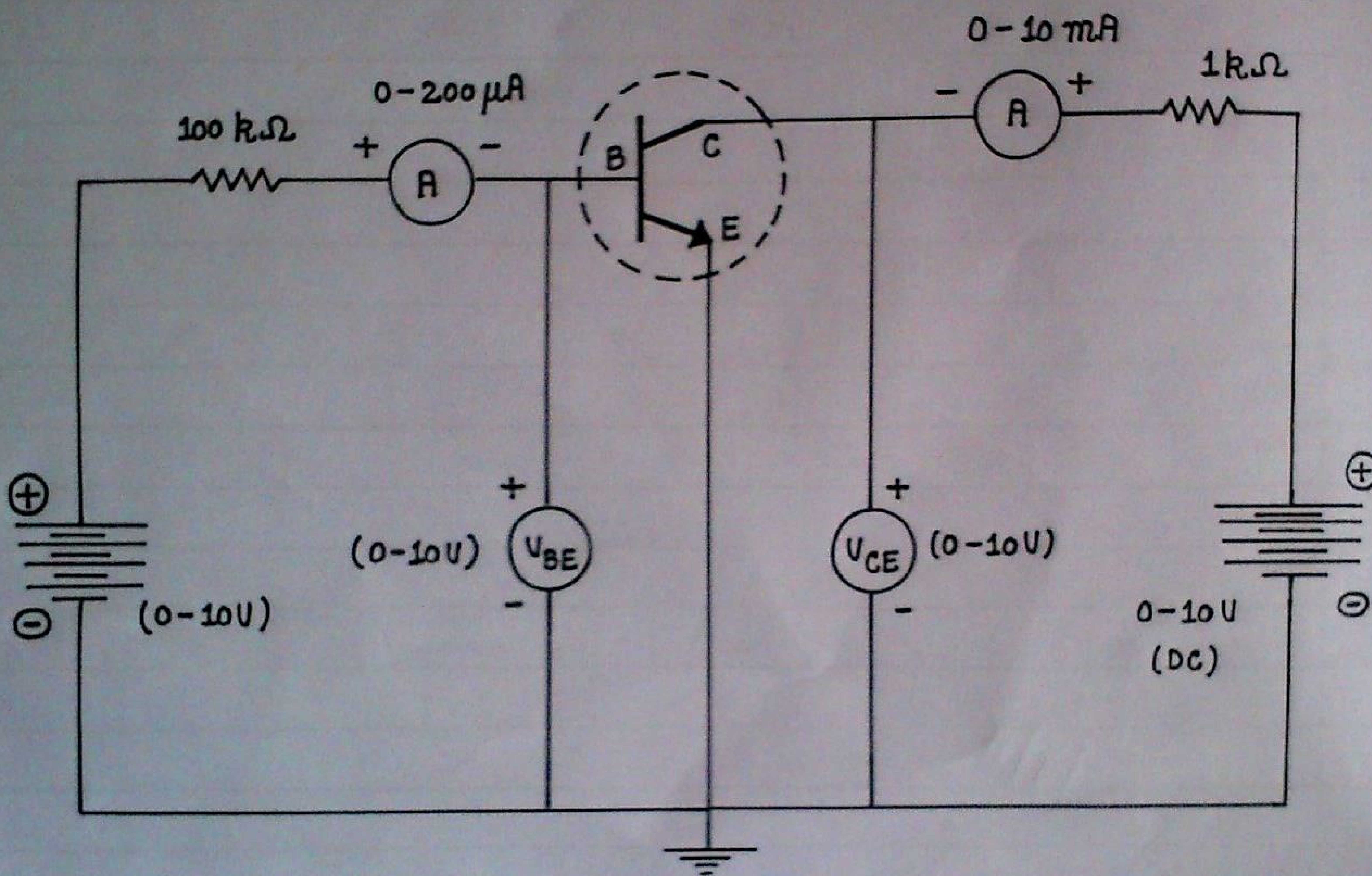
" NPN TRANSISTOR IN CE CONFIGURATION "



" Diagrammatic representation of the experimental circuit board showing various components being used, in a simplified layout, with appropriate wire connections. "

Date Aug. 11, 2011

Expt. No. __________

" Experiment No. 1 "

- **Aim** : To study and plot the input and output characteristics of a given transistor in common emitter (CE) configuration.

- **Apparatus** : Two 0-10 DC variable regulated power supplies, ammeter : 0-200 μA, 0-20 mA, voltmeter 0-10 V, pnp transistor (5K, 100A), npn transistor (SL100), resistance.

- **Theory** : In this circuit, input is applied between base and emitter. Here emitter of transistor is common to both input and output circuit and hence named common emitter configuration.

- **Input Characteristic** : It is the curve between base current (I_B) and base emitter voltage (V_{CE}).

- **Input Resistance** : It is the ratio of characterized change in base emitter voltage (ΔV_{BE}) to change in base current (ΔI_B) at constant V_{CE}, viz. $r_i = \Delta V_{BE} / \Delta I_B$ at constant V_{CE}.

- **Output Characteristic** : It is the curve between collector current (I_c) and collector emitter voltage (V_{CE}) at constant base current I_B.

- **Output Resistance** : It is the ratio of change in collector emitter voltage (ΔV_{CE}) to change in collector current (ΔI_c) at constant base current I_B, viz. $r_o = \Delta V_{CE} / \Delta I_c$ at constant I_B.

P.T.O.

Teacher's Signature :

OBSERVATION TABLES: LABORATORY READINGS

Input Characteristics :-

$V_{CE} = 3.67\ V$

S.No.	V_{BE} (V)	I_B (μA)
(1)	0.450	0.0
(2)	0.506	0.1
(3)	0.523	0.5
(4)	0.540	1.2
(5)	0.563	3.0
(6)	0.584	15.9
(7)	0.586	22.1
(8)	0.592	53.8
(9)	0.597	87.2
(10)	0.601	107.8

$V_{CE} = 5\ V$

S.No.	V_{BE} (V)	I_B (μA)
(1)	0.513	0.2
(2)	0.542	1.2
(3)	0.567	3.4
(4)	0.577	5.1
(5)	0.588	9.3
(6)	0.592	31.3
(7)	0.595	45.0
(8)	0.596	58.1
(9)	0.600	80.2
(10)	0.602	94.0

Output Characteristics :-

$I_B = 20\ \mu A$

S.No.	V_{CE} (V)	I_C (mA)
(1)	0.000	0.000
(2)	0.011	0.059
(3)	0.028	0.246
(4)	0.032	0.302
(5)	0.045	0.524
(6)	0.063	0.986
(7)	0.076	1.350
(8)	0.097	2.001
(9)	0.147	3.024
(10)	1.140	4.446

$I_B = 15\ \mu A$

S.No.	V_{CE} (V)	I_C (mA)
(1)	0.000	0.000
(2)	0.013	0.057
(3)	0.038	0.296
(4)	0.064	0.735
(5)	0.082	1.133
(6)	0.130	2.149
(7)	2.042	2.568
(8)	3.050	2.605
(9)	4.020	2.639
(10)	9.000	2.781

- **Procedure :-**

(a) **Input Characteristics :**

(i) Make connections as shown in the figure.

(ii) Set collector voltage V_{CE} to a fixed value say at 3.67 V and vary V_{BE} in steps and note the corresponding value of I_B in each step.

(iii) Repeat step (ii) for other values of V_{CE}.

(iv) Plot the input characteristics.

(b) **Output Characteristics :**

(i) Set base current I_B to a fixed value say 20 μA.

(ii) Vary V_{CE} in steps and note down the corresponding I_C at constant I_B.

(iii) Repeat step (ii) for other values of I_B.

(iv) Plot the output characteristics.

- **Sources of Error and Precautions :-**

(i) All connections should be neat and tight (secured).

(ii) Ammeters and Voltmeters must be of appropriate range.

(iii) I_C should be less than I_B.

(iv) Zero settings of the ammeters and voltmeters must be checked and adjusted accordingly.

(v) Current or Voltage must not exceed the maximum operating limit of the instruments.

(vi) Readings should be precise and accurate.

P.T.O.

" INPUT AND OUTPUT CHARACTERISTICS OF NPN TRANSISTOR "

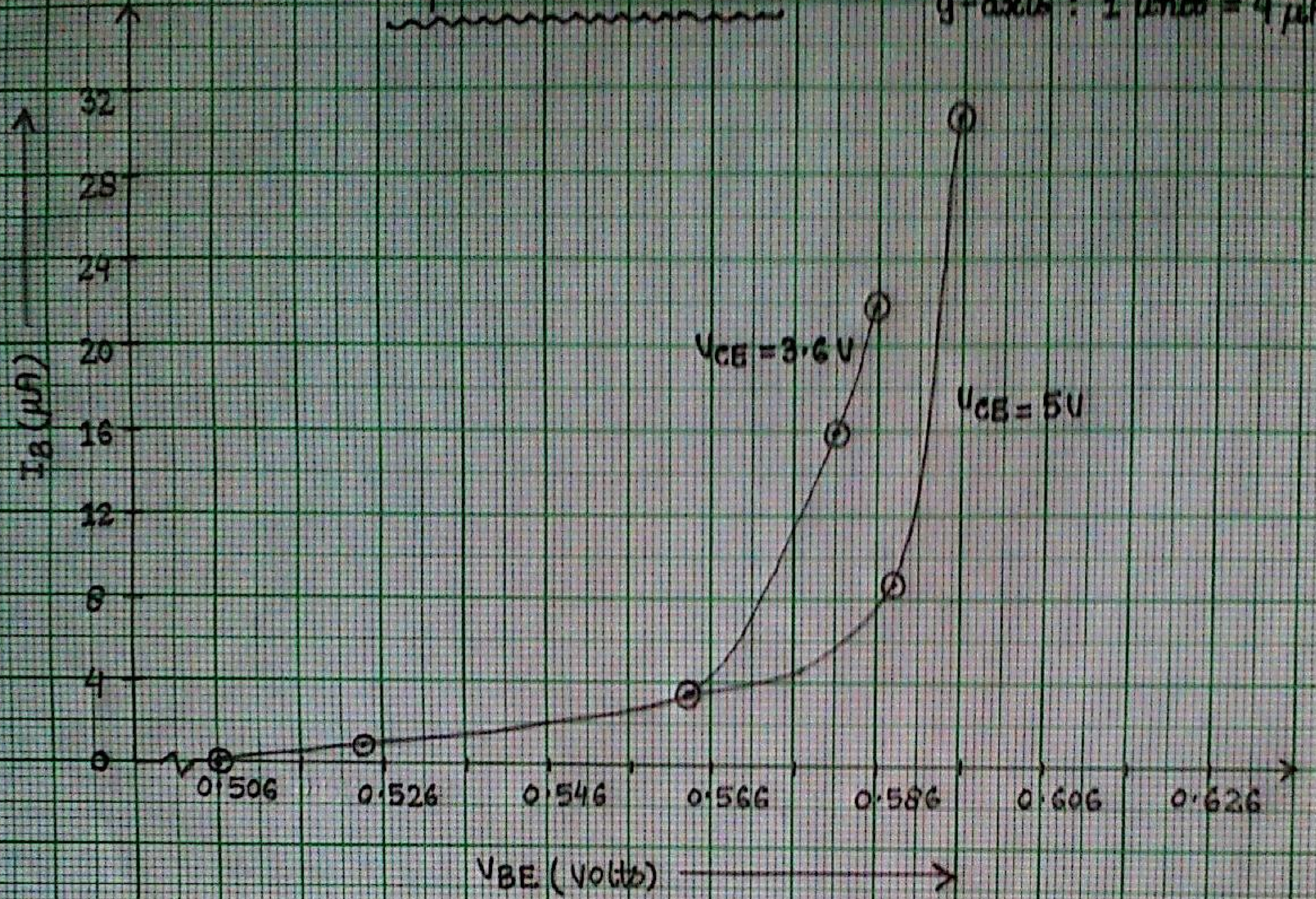
(CE configuration)

Input Characteristics

SCALE :-

x-axis : 1 unit = 0.01 V

y-axis : 1 unit = 4 μA

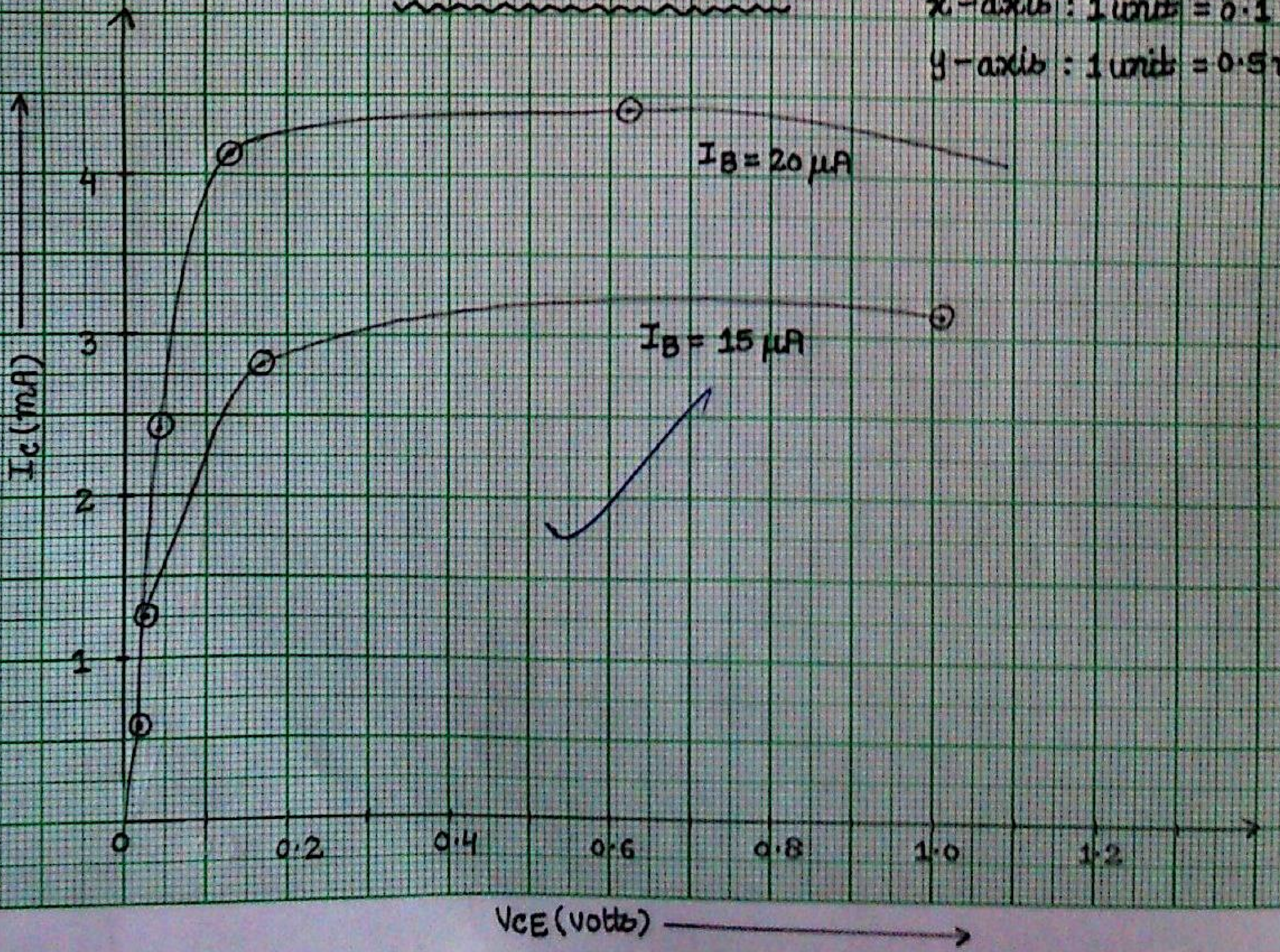


Output Characteristics

SCALE :-

x-axis : 1 unit = 0.1 V

y-axis : 1 unit = 0.5 mA



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Expt. No.

• **Inference :** The input and output characteristics of the npn transistor in common emitter configuration have been plotted on graph.
Input characteristics are depicted through $I_B (\mu A)$ versus V_{BE} (volt) graph. WHEREAS
output characteristics are depicted through $I_C (mA)$ versus V_{CE} (volt) graph.

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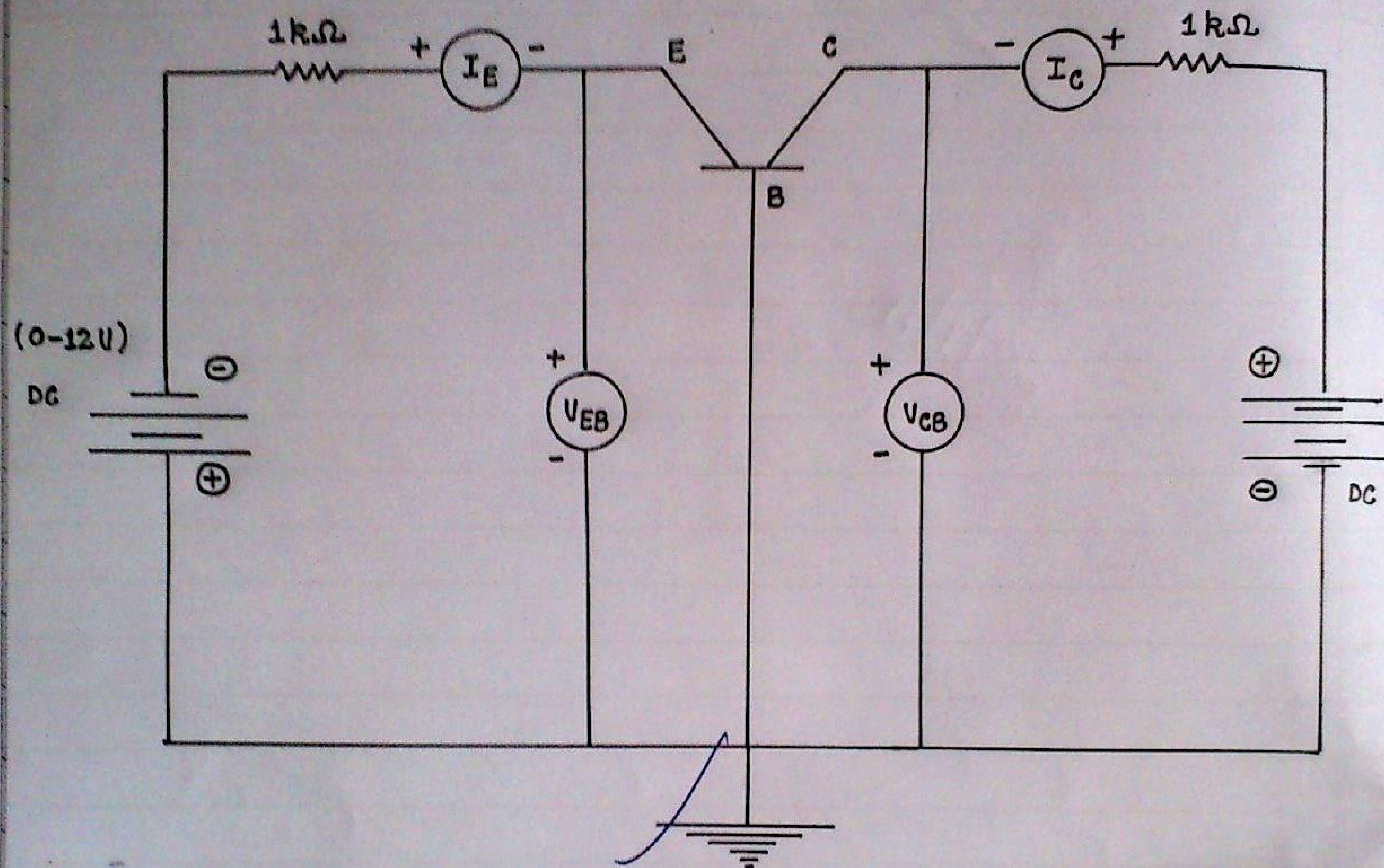
" NPN TRANSISTOR IN CB CONFIGURATION "



" Diagrammatic representation of the experimental circuit board showing various components being used, in a simplified layout, with appropriate wire connections. "

Experiment No. 2

• **Object :** To study and plot the input and output characteristics of the given transistor in common base (CB) configuration.

• **Apparatus :** Two 0-12 V DC variable regulated power supplies, two ammeters 0-20 mA, two voltmeters 0-20 V, npn transistor (5K, 100A), two resistors of 1 kΩ each and connecting wires.

• **Procedure :**

Input characteristics :-

1. Using suitable patch cords, make connections as shown in the figure for NPN transistor.
2. The typical input characteristics for some of the transistors increase steadily after a certain point.
3. In order to plot these characteristics, perform the following steps:-

(i) Set the collector voltage, V_{CB} to a certain value, say 1 volt.

(ii) Now, vary the emitter base voltage, V_{EB} in steps of say 0.1 volt starting from zero and observe the corresponding values of emitter current.

(iii) Repeat step (ii) for different values of collector voltages, V_{CB} : 2V, 5V, collector open.

(iv) Plot the input characteristics.

• Output characteristics :-

1. In order to plot these characteristics, perform the following steps :-

(i) Set the emitter current to a certain value, say 1 mA.

(ii) Now vary the collector base voltage (V_{CB}) in steps of 1 V starting from zero and observe the corresponding collector currents (I_B).

(iii) Ensure that the emitter current remains constant, when collector voltage is being raised, by minor adjustment in the emitter base voltage.

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OBSERVATION TABLES : LABORATORY READINGS

Input Characteristics :-

$V_{CB} = 0.9\,V$

V_{BE}(V)	I_E(mA)
0.125	0.000
0.296	0.000
0.341	0.000
0.428	0.001
0.465	0.005
0.543	0.096
0.557	0.163
0.604	0.925

$V_{CB} = 2.085\,V$

V_{BE}(V)	I_E(mA)
0.384	0.000
0.464	0.805
0.497	0.017
0.542	0.094
0.580	0.385

Output Characteristics :-

$I_E = 1.034$ mA

V_{CB}(V)	I_B(mA)
0.100	1.016
0.200	1.016
0.300	1.016
0.400	1.016
0.500	1.016
0.600	1.016
0.700	1.016

$I_E = 2.018$ mA

V_{CB}(V)	I_B(mA)
0.145	1.990
0.254	1.991
0.374	1.990
0.728	1.990
1.012	1.990

(iv) Repeat step (ii) for different values of emitter currents, say 2mA, 4mA, 8mA.

(v) Plot the family of output characteristics.

- To plot the saturation region :-

Reverse the supply connected to the output circuit. This will forward bias the collector junction. (Reverse the voltmeter polarity too). Set the emitter current to a certain value, say 1mA.

Now vary the collector base voltage (V_{CB}), note the corresponding collector current until I_C becomes zero. Typical value of V_{CB} (sat.) = 0.6 V.

- Points to remember :-

(i) The cut-in voltage, V_γ is approximately 0.2 V for Ge transistor and approximately 0.6 V for a Si transistor.

(ii) The collector current, I_C should be less than emitter current, I_E.

(iii) The value for current gain α_F is always less than 1.

- Note : The input and output characteristics are sharply increasing curves.

P.T.O.

"INPUT AND OUTPUT CHARACTERISTICS OF NPN TRANSISTOR"

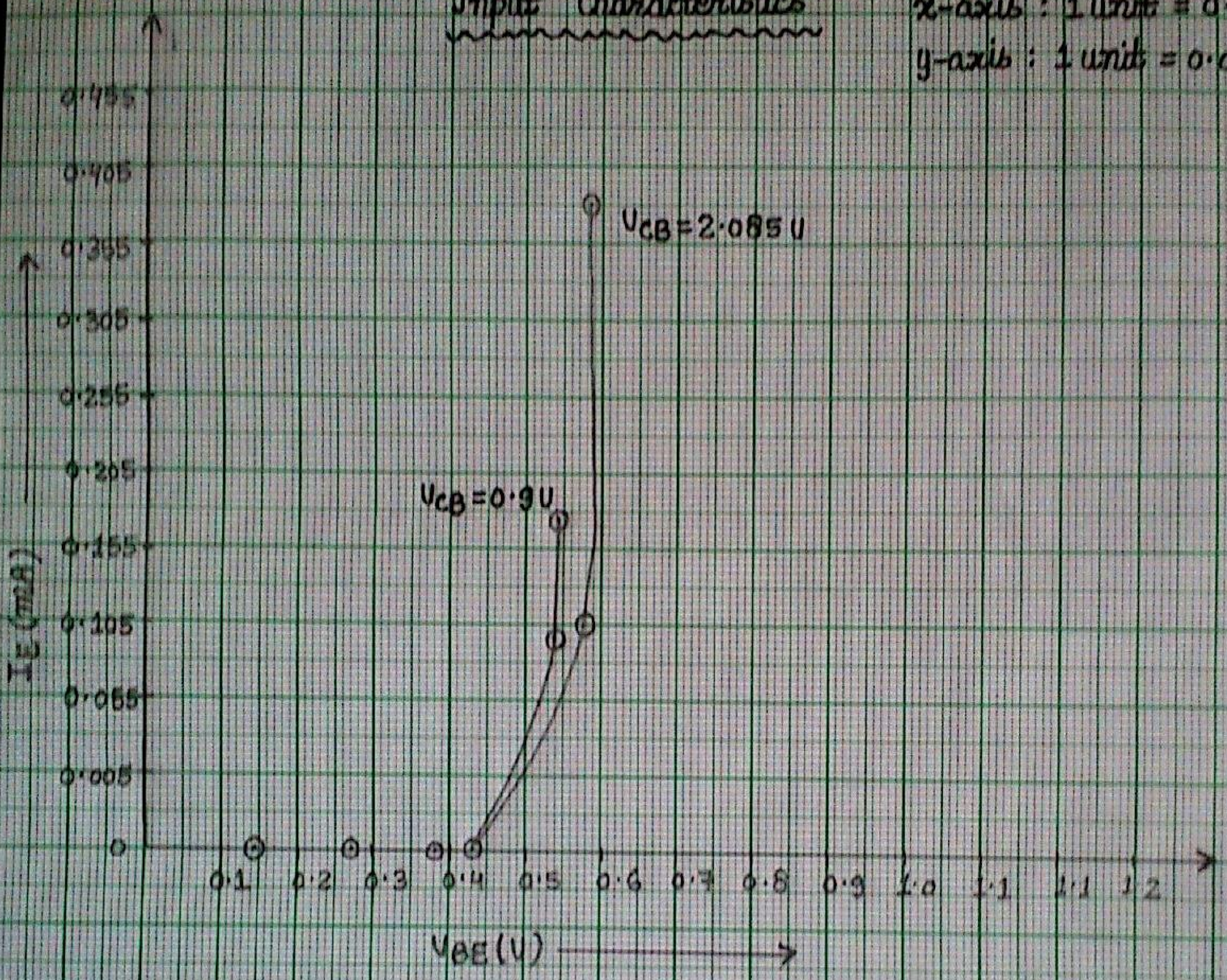
(CB Configuration)

Input Characteristics

SCALE :-

x-axis : 1 unit = 0·1 V

y-axis : 1 unit = 0·05 mA

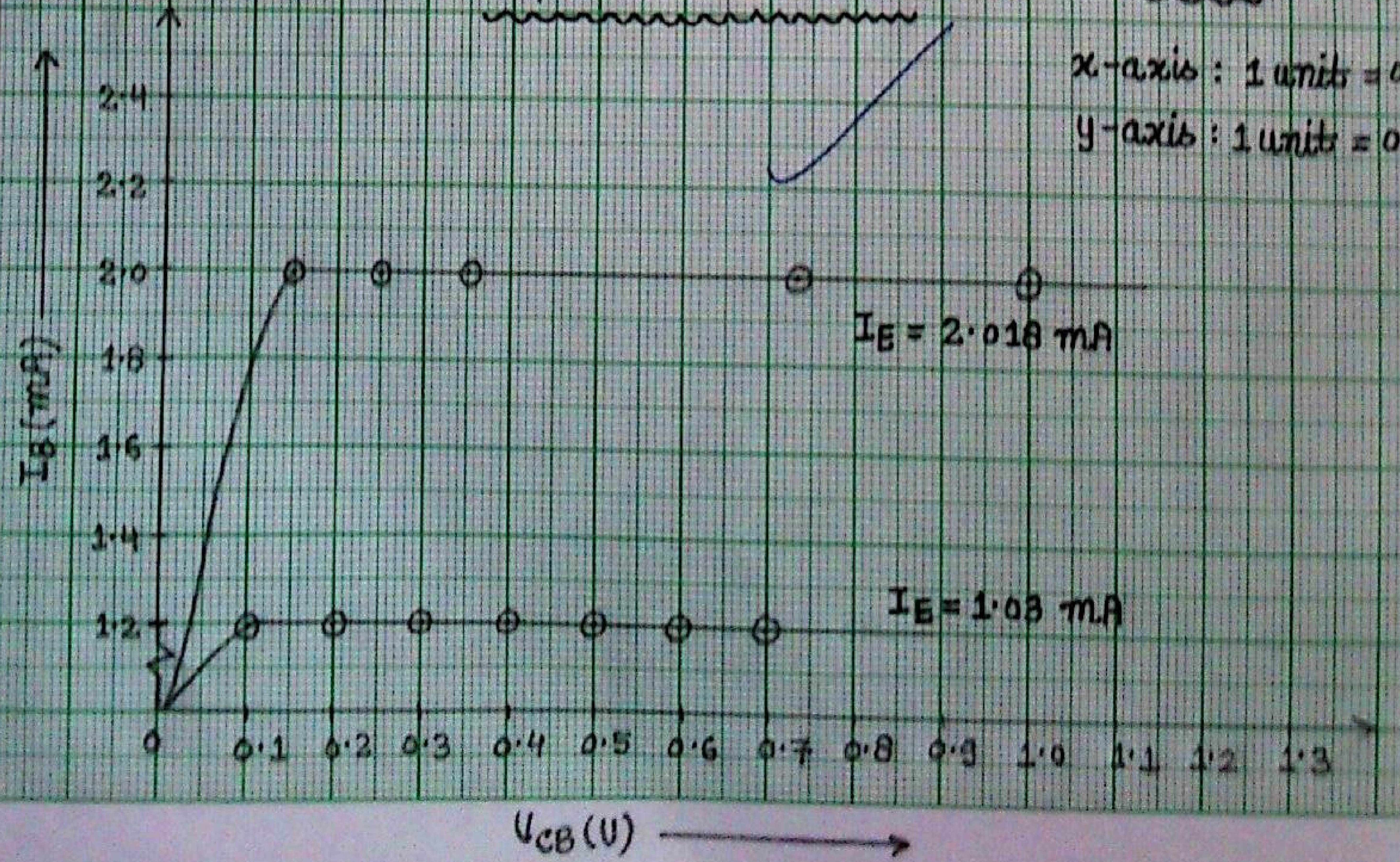


Output Characteristics

SCALE :-

x-axis : 1 unit = 0·1 V

y-axis : 1 unit = 0·2 mA



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- **Inference:** Input characteristics are a plot of I_E (mA) vs V_{BE} (V).

WHEREAS

Output Characteristics are a plot of I_B (mA) vs V_{CB} (V).

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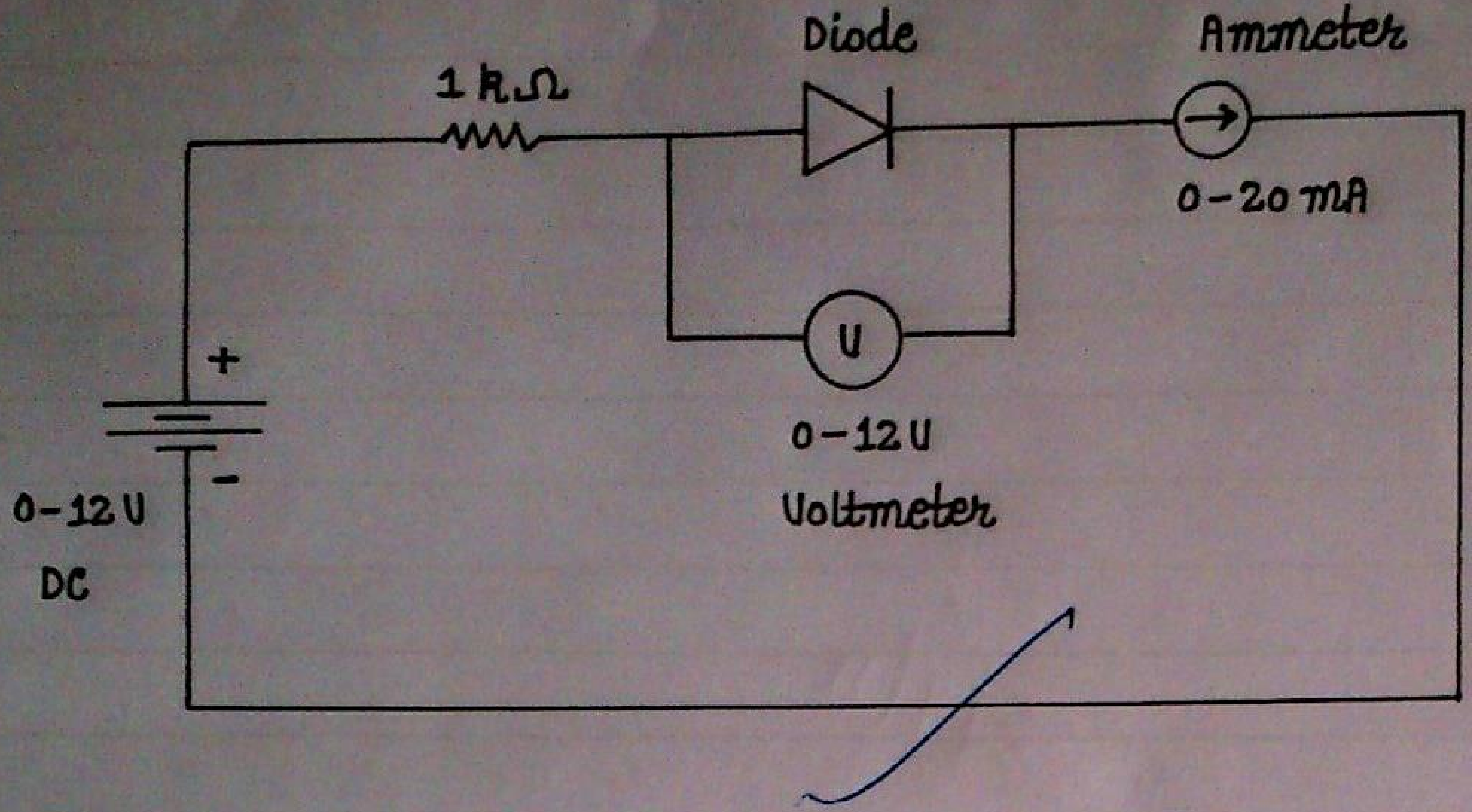
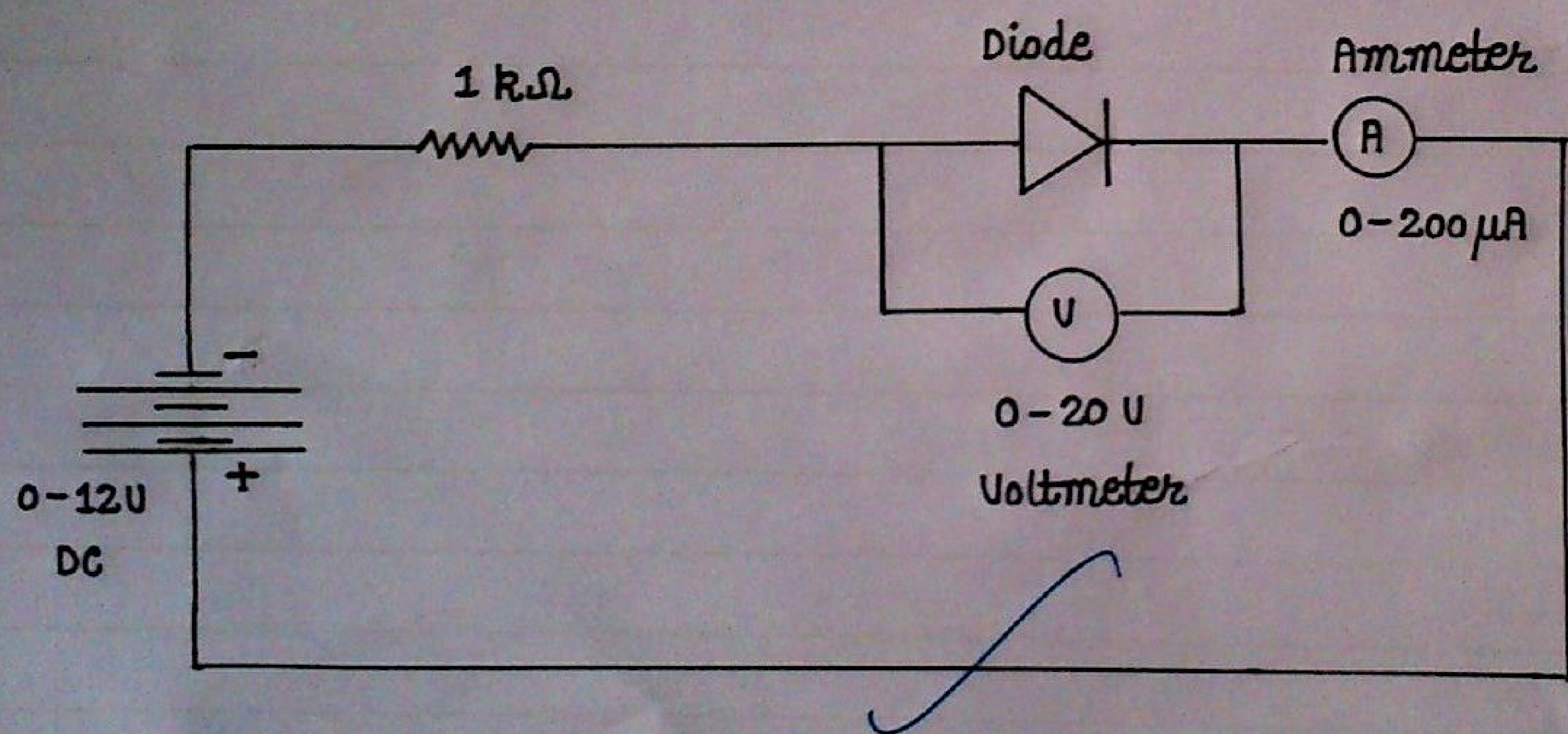
FORWARD BIASED



REVERSE BIASED



" Diagrammatic representation of the experimental circuit for forward and reverse biasing of a p-n junction diode "

Note : For forward and reverse biasing of zener diode, simply replace  with  in above circuits.

Experiment No. 3

• **Object:** To plot the forward and reverse bias characteristics for :-

(i) p-n junction diode

(ii) Zener diode

and also calculate the resistance of diodes from their characteristic curves.

• **Apparatus Required :-**

(i)	Experiment kit	
(ii)	Voltmeter	0–20 V
(iii)	Voltmeter	0–20 V
(iv)	Milli-ammeter	0–11 mA
(v)	Micro-ammeter	0–200 μA
(vi)	Connecting wires	

• **Theory:** The semiconductor behaves as an insulator initially, then as a conductor, and at higher temperatures (at which resistivity drops steeply) the characteristics of the semiconductor are predominantly of conductive nature. Conductivity of semiconductors lies between that of an insulator and a conductor.

A p-n junction diode is made by fusing a p-type semiconductor with an n-type semiconductor. In forward biasing the diode behaves as a conductor and in reverse biasing, it behaves as an insulator.

• **Zener diode:** It is made up of specially doped semiconductor and in reverse bias, the breakdown can be made reversible. There are 2 types of breakdown, one is the "Zener breakdown" and the other is the "Avalanche breakdown". Zener diodes are used for regulating output voltage.

" OBSERVATION TABLES : LABORATORY READINGS "

For p-n junction diode

S.No.	Forward Bias		Reverse Bias	
	V_D(volt)	I_D(mA)	V_D(volt)	I_D(μA)
(1)	0·270	0·001	2·041	0·12
(2)	0·300	0·002	2·542	0·15
(3)	0·419	0·037	3·000	0·20
(4)	0·503	0·252	4·040	0·30
(5)	0·553	0·693	5·010	0·58
(6)	0·610	2·018	6·300	0·60
(7)	0·650	4·600	7·050	0·70
(8)	0·693	10·800	8·080	0·80
(9)	—	—	9·090	1·00
(10)	—	—	10·220	1·10
(11)	—	—	11·010	1·20

For zener diode

S.No.	Forward Bias		Reverse Bias	
	V_D(volt)	I_D(mA)	V_D(volt)	I_D(μA)
(1)	0·000	0·000	4·65	1·7
(2)	0·100	0·000	5·06	3·8
(3)	0·200	0·000	5·20	6·0
(4)	0·300	0·000	5·32	8·4
(5)	0·400	0·000	5·41	11·5
(6)	0·450	0·001	5·51	15·7
(7)	0·604	0·001	5·62	23·5
(8)	0·703	0·004	5·74	37·0
(9)	0·755	0·025	5·83	53·0
(10)	0·790	0·031	5·92	84·5

- **Procedure for a p-n junction diode :-**

(i) Using suitable patch cords, make connections as shown in the figure for forward bias and reverse bias characteristics.

(ii) The typical forward and reverse characteristics are plotted on the graph.

- **Forward Bias Characteristics :-**

Vary the diode voltage (V_D) in step of 0-1V starting from 0 (zero) and observe the corresponding value of Diode current (I_D) in milli-ammeter (mA). Plot the graph.

- **Reverse Bias Characteristics :-**

Using suitable patch cords, make connections as shown in the figure for reverse characteristics. In order to plot reverse bias characteristics, perform the following steps : Vary the diode voltage (V_D) in step of 1V starting from zero and observe the corresponding value of diode current (I_D) in μA.

- **Procedure for zener diode :-**

Using suitable patch cords, make connections as shown in fig. for forward characteristics. In order to plot forward bias characteristics, perform the following steps :-

Vary the diode voltage (V_D) in step of 0.1V starting from zero and observe the corresponding value of diode current (I_D) in mA.

Similarly, for the reverse bias characteristics observe V_D and I_D. Note the region where small change of zener voltage shows a greater change in the zener diode current (I_Z); this is indeed the breakdown zener voltage.

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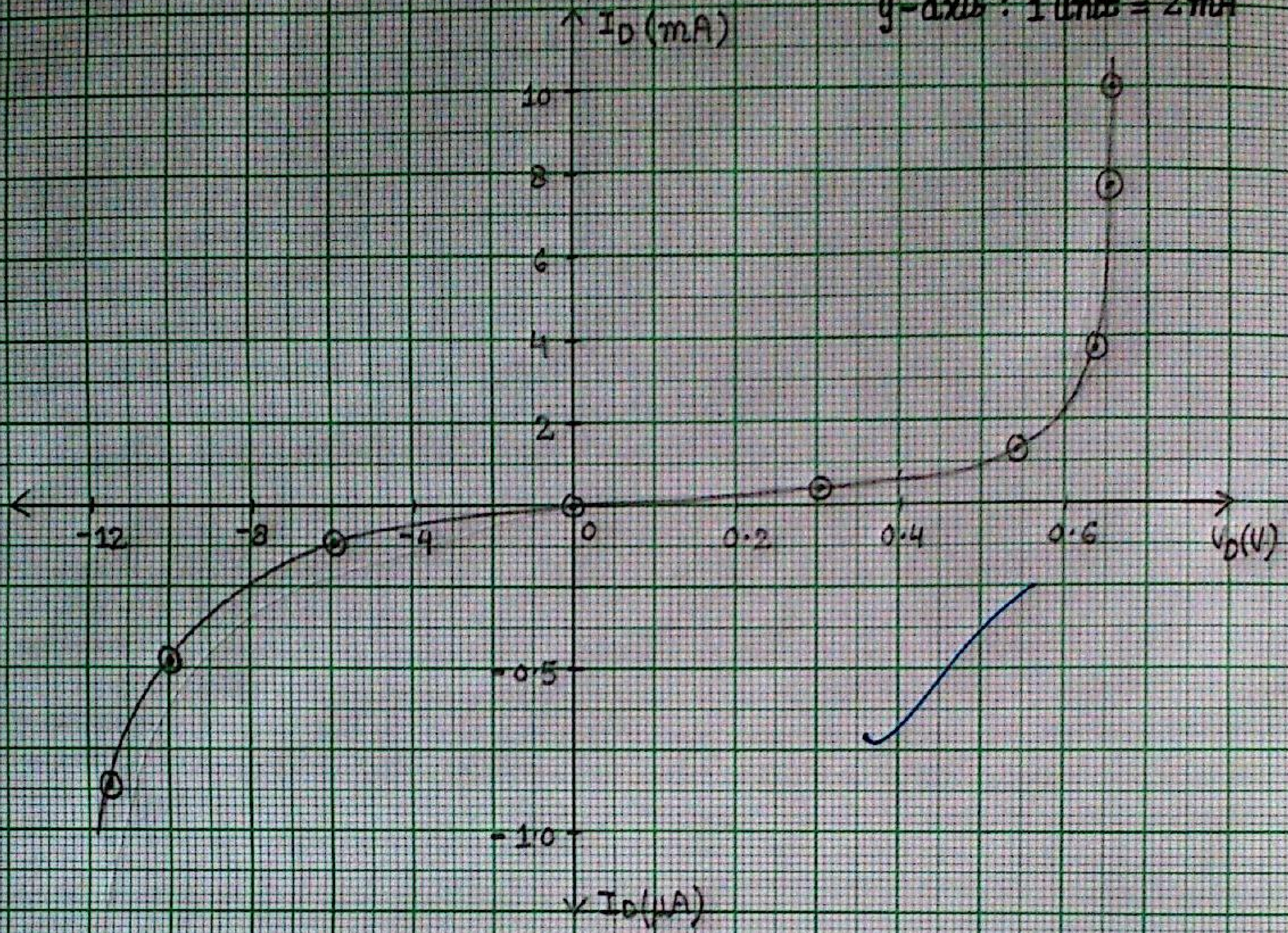
p-n junction diode

SCALE :-

x-axis : 1 unit = 0·1 V

y-axis : 1 unit = 2 mA

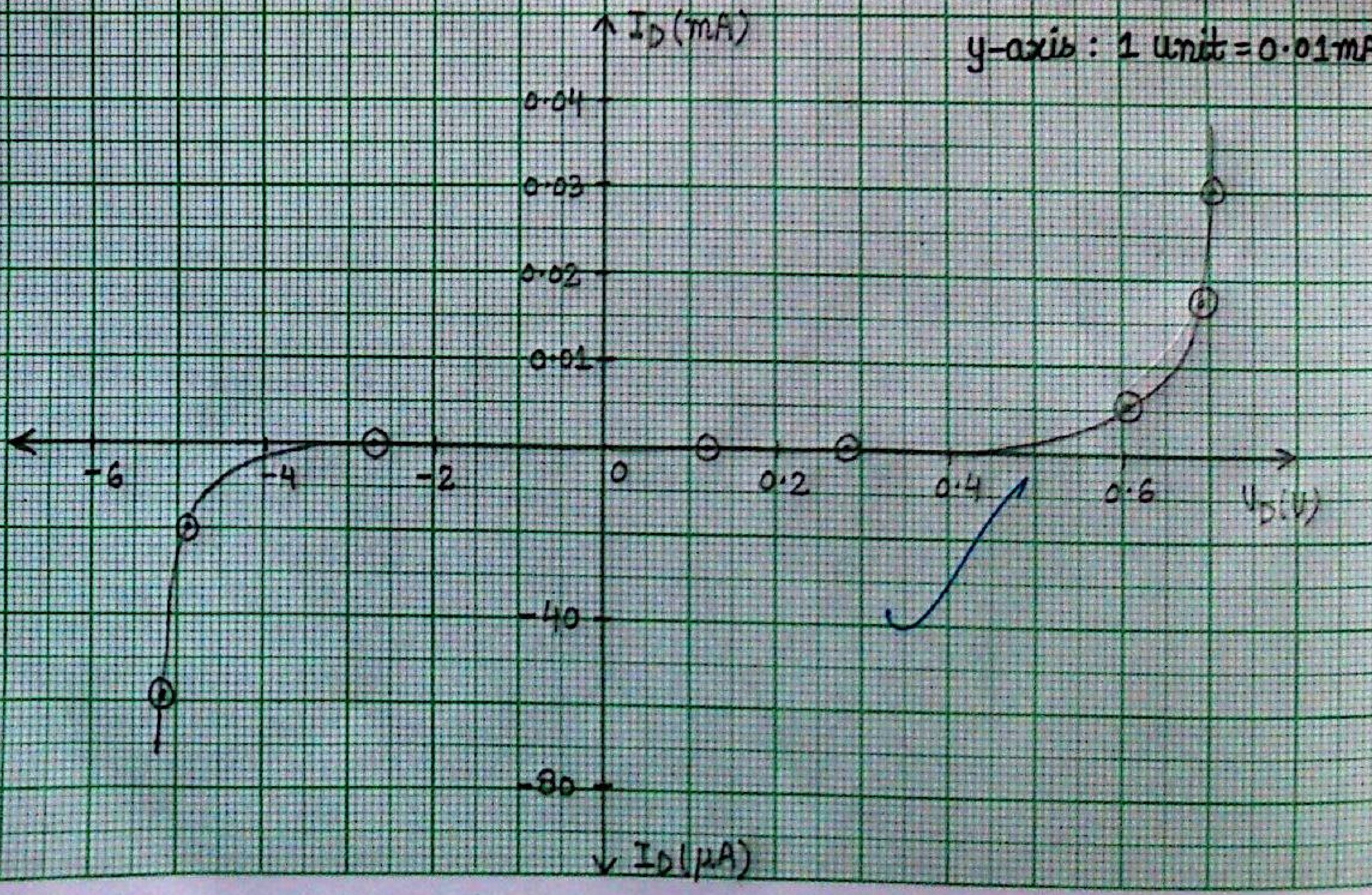


Zener diode

SCALE :-

x-axis : 1 unit = 0·1 V

y-axis : 1 unit = 0·01 mA



- Inference :-

(i) Static Resistance $R_D = V_D / I_D$

(ii) Dynamic Resistance $R_d = \Delta V_D / \Delta I_D$

(iii) Static Resistance for diode : $V_D = 0.553\ V$ and $I_D = 0.693 \times 10^{-3}$

So, $\boxed{R_D = 798\ \Omega}$

(iv) Dynamic Resistance for diode : $\Delta V_D = 0.1\ (5.553 - 5.503)$; $\Delta I_D = (2.2 - 1.75) \times 0.3066$

So, $\boxed{R_d = 113.37\ \Omega}$

(v) Static Resistance for zener diode : $V_D = 0.755\ V$ and $I_D = 0.025 \times 10^{-3} A$

So, $\boxed{R_{DZ} = 30.2\ k\Omega}$

(vi) Dynamic Resistance for zener diode : $\Delta V_D = (6.01 - 5.92)$ and $\Delta I_D = 157.1 - 84.5$

So, $\boxed{R_d = 1.24\ k\Omega}$

- Sources of Error and Precautions :-

(i) Keep variable power supply in anticlockwise before the starting of experiment.

(ii) Do not exceed the diode current beyond the limit i.e. 10 mA.

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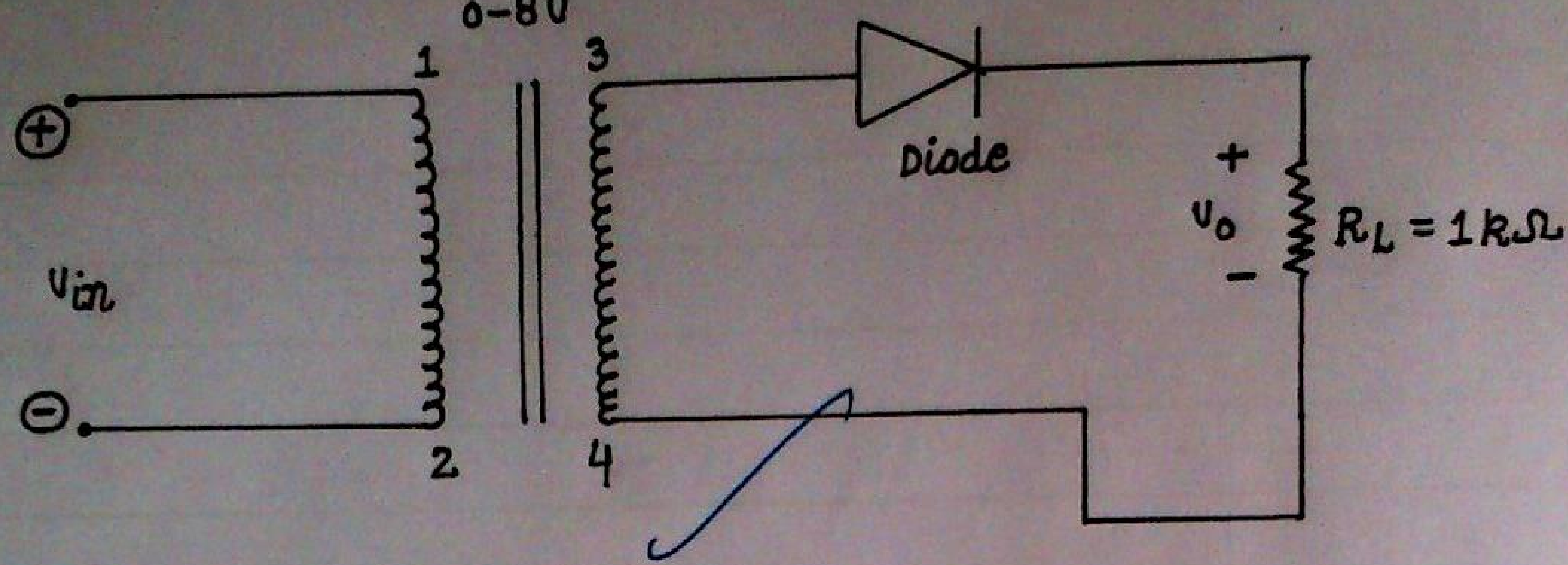
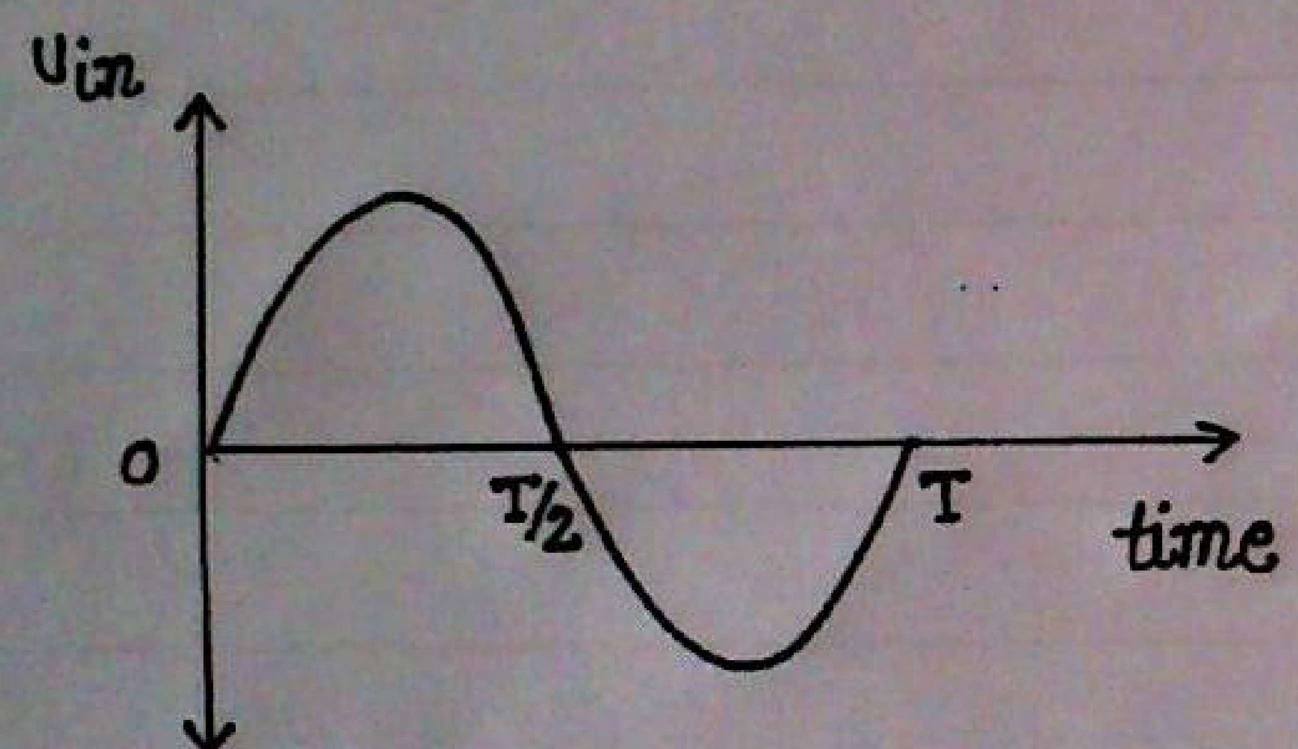
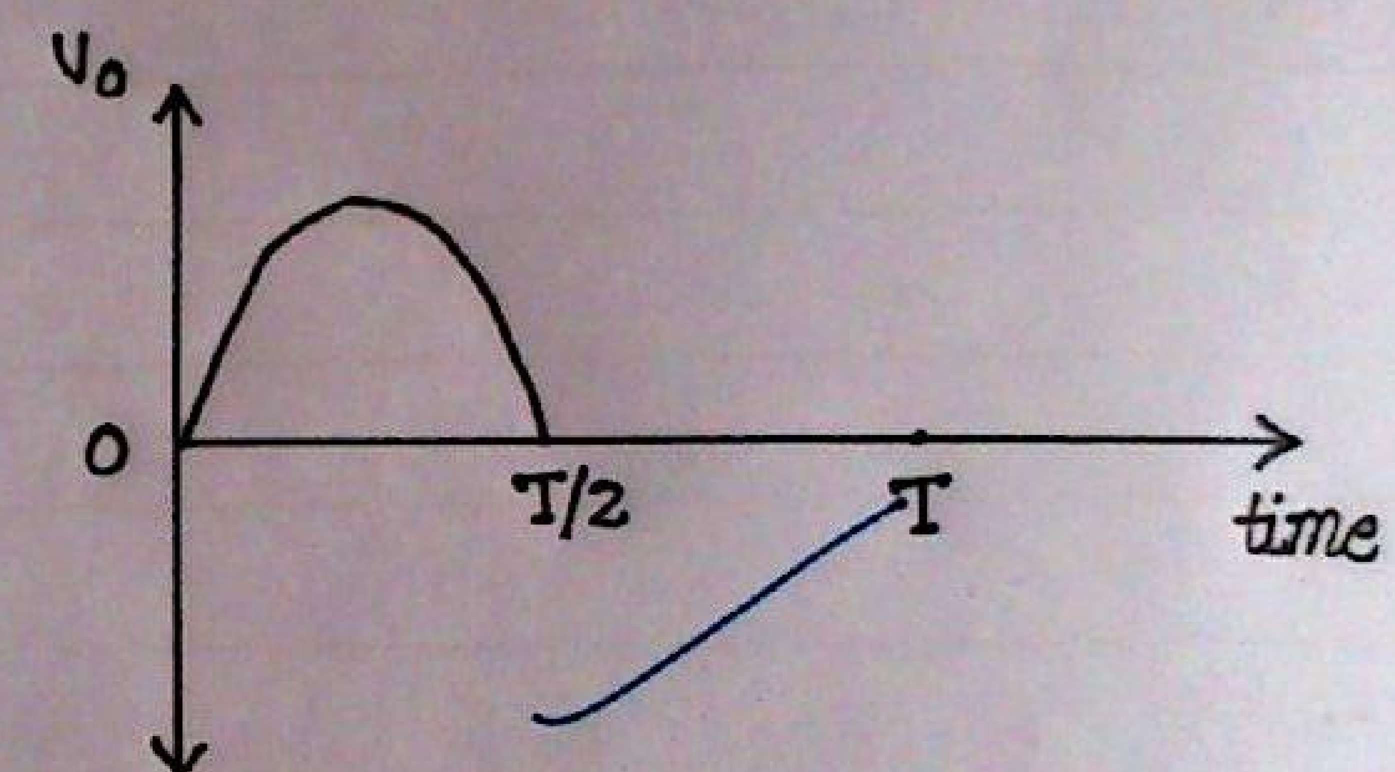
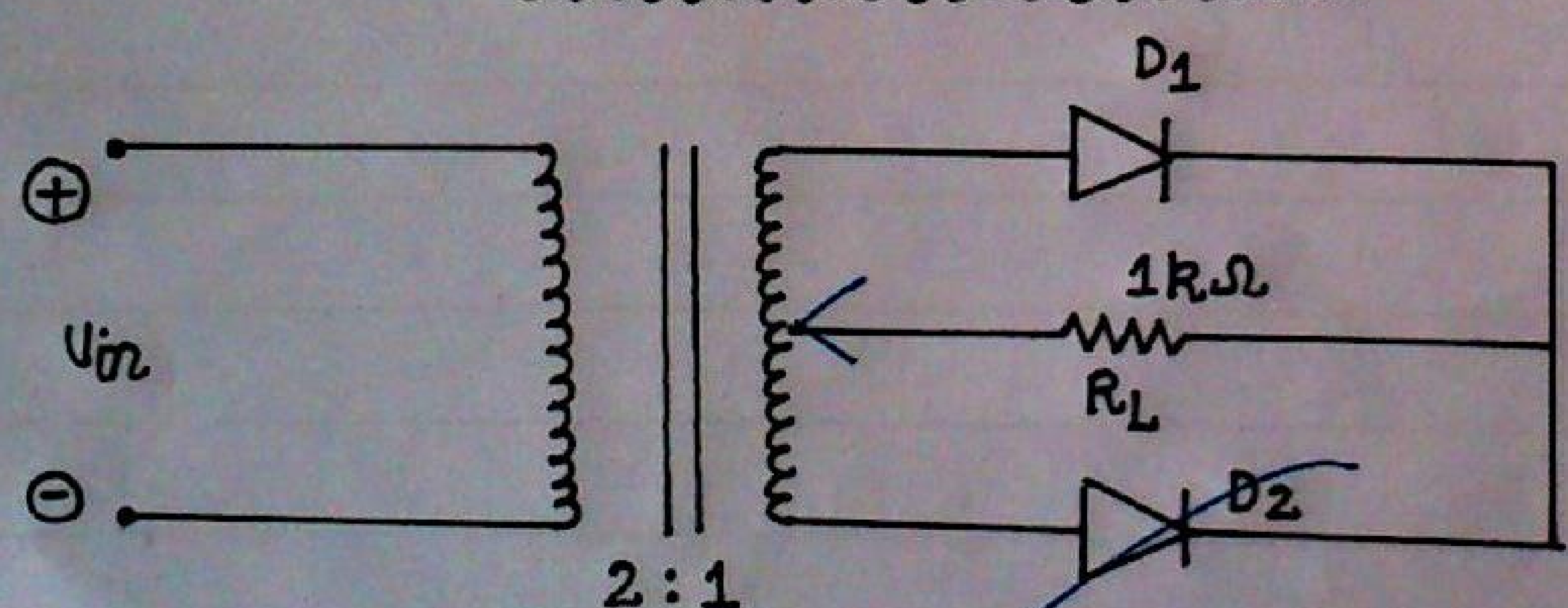
HALF WAVE RECTIFIER



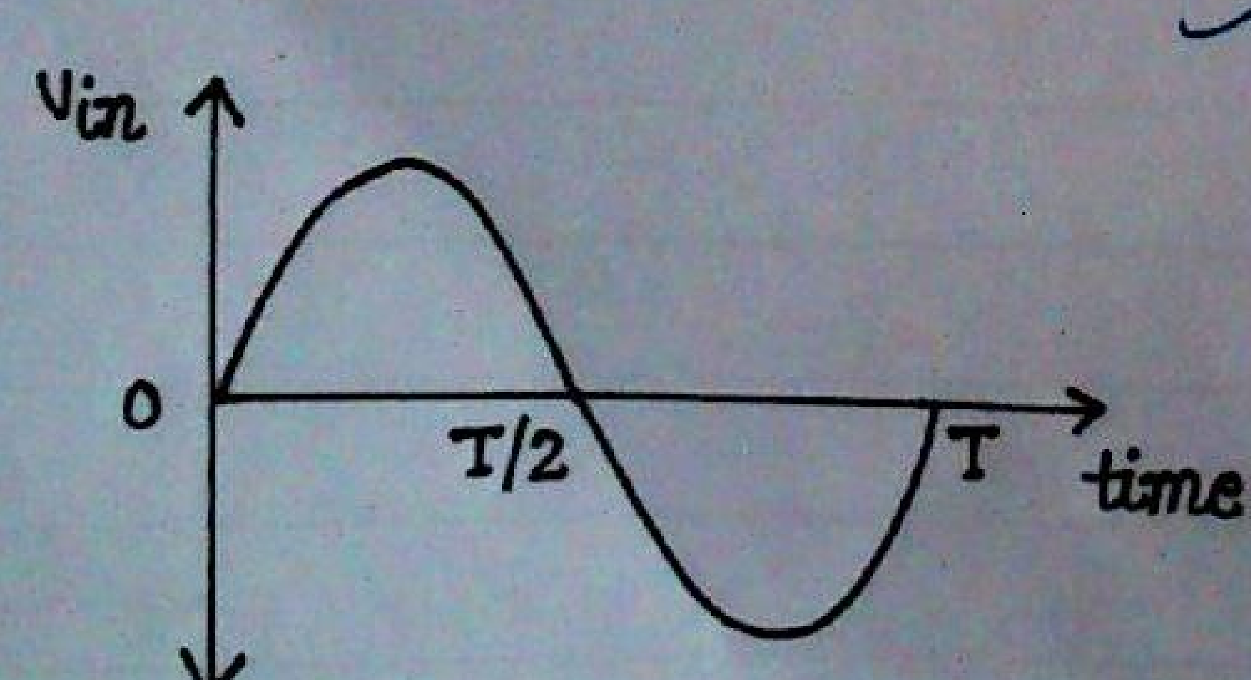


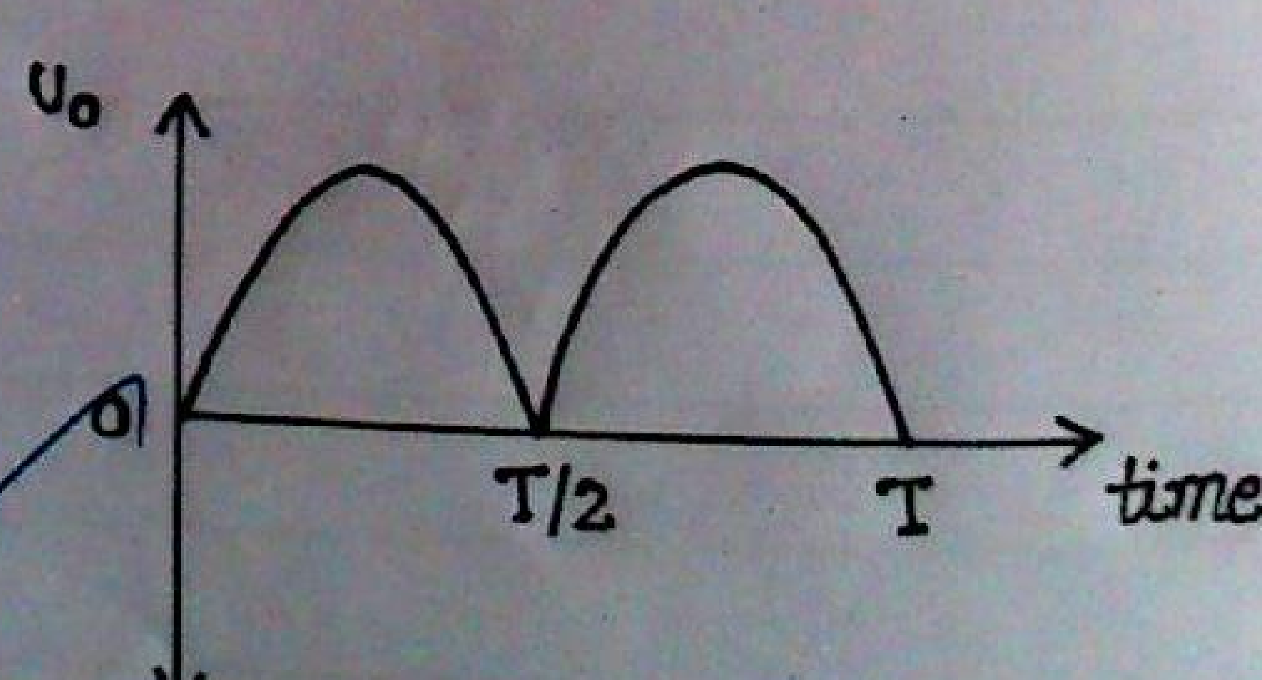


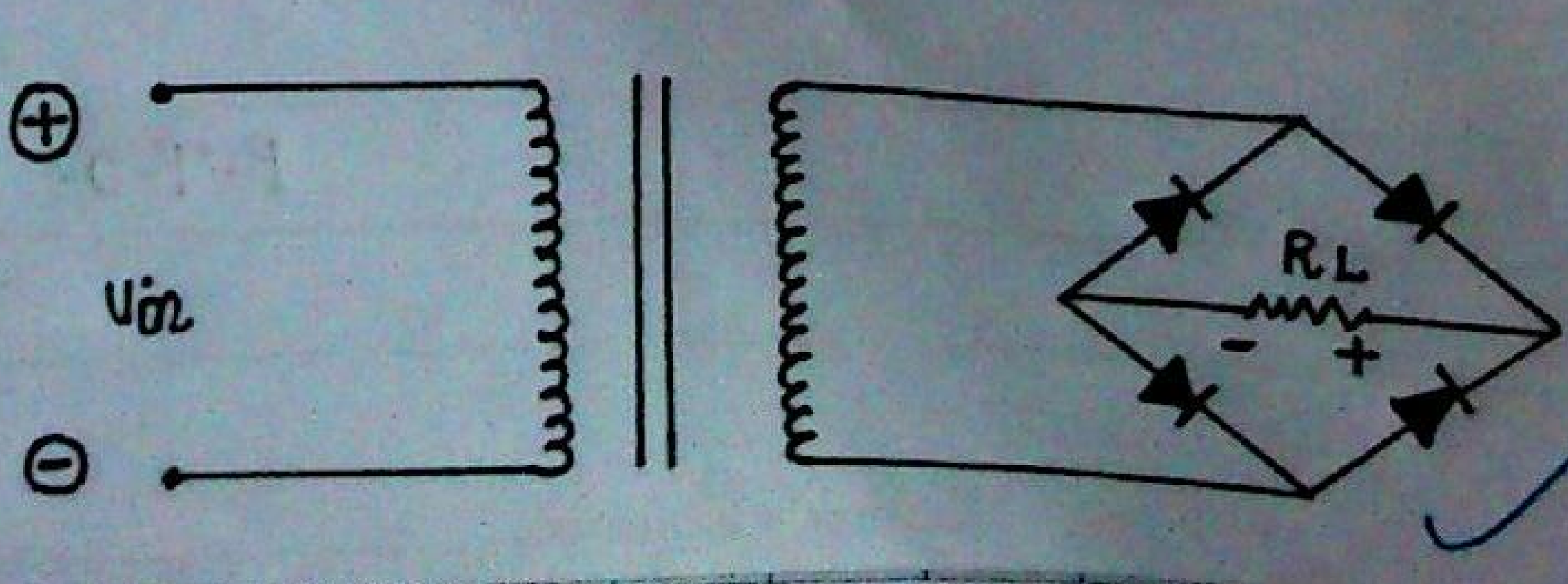
FULL WAVE RECTIFIERS



Centre Tapped







Bridged

"Experiment No. 4"

• **Aim:** To study the following rectifier circuits :-

(i) Half wave rectifier

(ii) Full wave rectifier

(iii) Bridge rectifier

and also find the ripple factor as well as different filter circuits.

• **Apparatus:** Digital storage oscilloscope / cathode ray oscilloscope and circuit board.

• **Components used :-**

(i) Diode BY127 → 4

(ii) Resistance 1 kΩ and 10 kΩ → 1

(iii) Transformer 8-0-8 or 0-8 → 1

(iv) Capacitor 1000 µF / 35V → 1

(v) Inductor 45 mH → 1

• **Theory:** In electronics, a diode is a terminal device. It has electrical properties that vary depending upon directional flow of charge carrier through it. Most common function of diode is to allow an electric current to flow in one direction but to block it in opposite direction. Real diodes don't display such perfect on-off directionality but usually have complicated and non-linear electrical characteristics, which depend on particular type of diode technology.

• **Rectifier:** A rectifier is an electrical device that converts AC to DC, a process known as rectification.

Uses: Rectifiers are used as components of power supply and as detectors of radio signals.

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A circuit which performs the opposite function of changing DC to AC is called an inverter; when only one diode is used to rectify AC (by blocking the negative portion of the waveform), diodes can be alternatively used too, (by blocking the positive portion of the waveform).

- **Half Wave Rectification**: A half wave rectifier is a special type of dipper. In half wave rectification either the positive or the negative waveform is blocked out since only half of the waveform reaches output; its a very inconvenient way of power transfer.

- **Full Wave Rectification**: Complete AC waveform is converted to DC waveform. It is used also by centre tapped transformer.

- **Procedure** :-

(i) Make connections as shown in the figure.
(ii) Observe the input waveform (in the figure shown).
(iii) Observe the output waveform (in the oscilloscope).
(iv) Draw the output waveform.
(v) Measure the DC voltage across source.
(vi) Measure the rms value of waveform.
(vii) Ripple factor $= \left(\frac{V_{rms}^2}{V_{dc}^2} - 1\right)^{1/2}$

- **Sources of Error and Precautions** :-

(i) All connections must be tight and secure.
(ii) Positive and negative terminals of devices must be appropriately connected.

P.T.O.

Date

Expt. No.

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• Inference : Ripple factor comes out to be as follows:-

Half wave rectifier = 1·208

Full wave rectifier = 0·478

Bridge rectifier = 0·481

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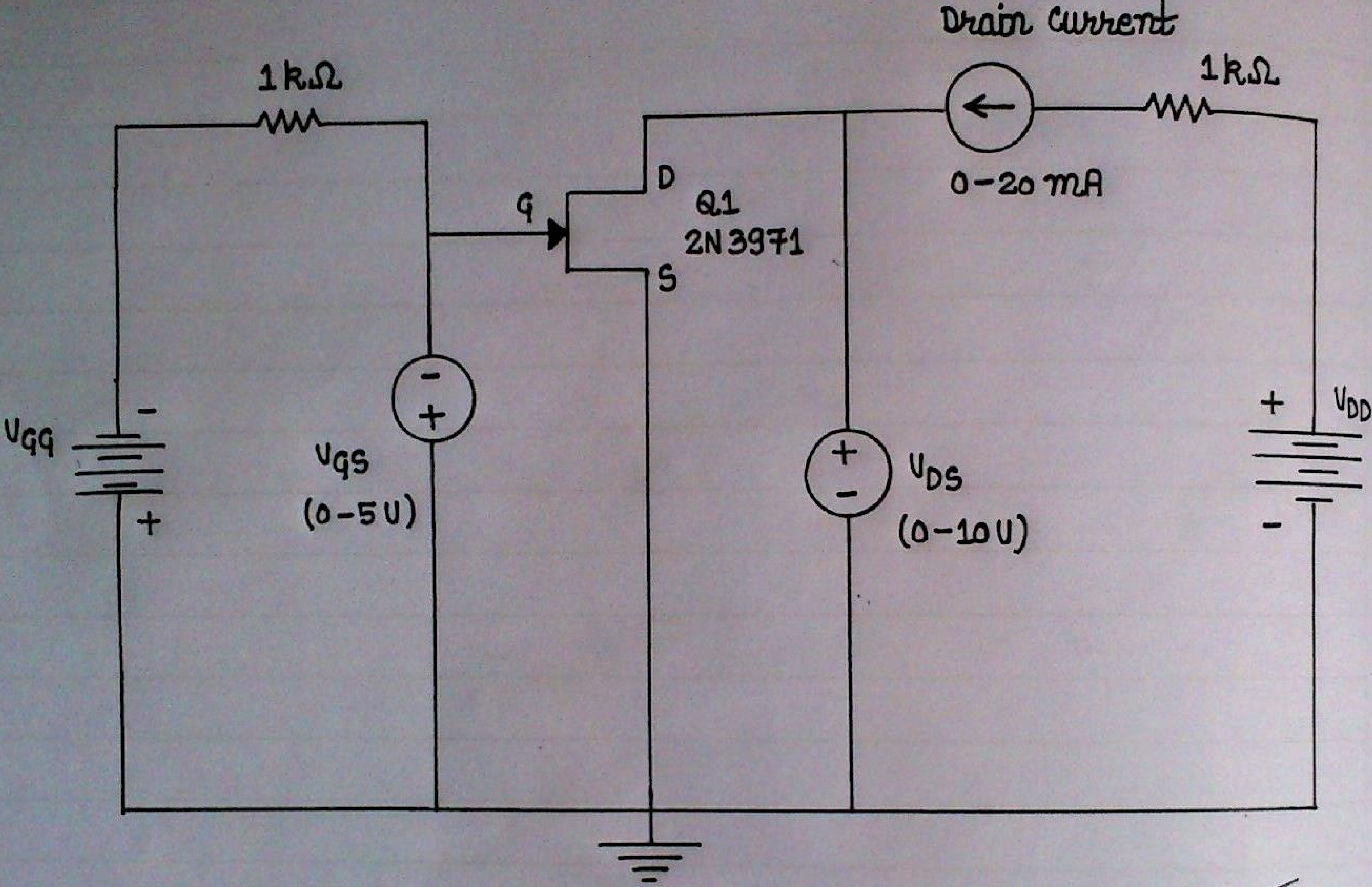
29/9/11

" CIRCUIT DIAGRAM OF AN N-CHANNEL JFET "



" Diagrammatic Representation of an experimental setup demonstrating a three terminal, voltage controlled device known as Junction Field Effect Transistor (JFET) "

"Experiment No. 5"

- **Object:** To draw the drain and transfer characteristics of an N-channel junction field effect transistor, (JFET).

- **Apparatus Required :-**

(i) Voltmeter 0-20 V 2 in Nos.
(ii) Milli-ammeter 0-20 mA 1 in No.
(iii) Bread Board
(iv) Connecting Wires

- **Theory:** JFET is a three terminal device (drain, source, gate) similar to BJT. JFET is a voltage controlled device, whereas BJT is a current controlled device.

- **Drain Characteristics (for NTE 312, JFET) :-**

The relationship in JFET between an output parameter i_D and an input parameter V_{GS} is more complex. In the saturation region, there exists a square law transfer relationship.

Transconductance Characteristics: JFET can be treated as a two port non-linear network. The transfer characteristics wherein the input parameter is the voltage across gate and source; and the output parameter is the drain current are called the transconductance characteristics. The transfer gain is nothing but conductance.

- **Procedure :-**

(i) Connect the circuit as shown in the figure.
(ii) Set $V_{GS} = 0$ volt. Keep 0-5 V variable power supply at anticlockwise direction for making $V_{GS} = 0$ V.
(iii) Now increase the V_{DS} in steps of say 1 volt starting from zero and observe the corresponding drain current (I_D) in milli-ammeter.

Teacher's Signature :

"OBSERVATION TABLES : LABORATORY READINGS"

Drain characteristics :-

$V_{GS} = -2V$

V_{DS} (volt)	I_D (mA)
0.0	0.0
0.2	0.9
0.5	2.1
1.0	3.7
1.3	4.5
1.7	5.2
2.0	5.7
2.3	6.0
2.5	6.1
2.8	6.2

$V_{GS} = -3V$

V_{DS} (volt).	I_D (mA)
0.0	0.0
0.2	0.6
0.4	1.1
0.6	1.6
1.0	2.2
1.4	2.7
1.6	2.8
2.0	3.0
2.3	3.1

Transfer characteristics :-

$V_{DS} = 1V$

V_{GS} (volt)	I_D (mA)
0.0	6.9
1.0	6.5
2.0	5.7
2.5	4.8
3.0	3.4
4.0	1.0
4.5	0.3
4.8	0.1
5.0	0.1

$V_{DS} = 0.5V$

V_{GS} (volt)	I_D (mA)
0.0	3.8
1.0	3.6
2.0	3.3
2.5	3.1
3.0	2.7
3.5	1.9
4.0	0.9
4.5	0.3
5.0	0.1

Observations :-

At $V_{GS} = -2V$, $r_d = 0.57\ k\Omega$; $R_{DS} = 0.27\ k\Omega$

At $V_{GS} = -3V$, $r_d = 0.8\ k\Omega$; $R_{DS} = 0.45\ k\Omega$

Also, $g_m = 2.8\ m\Omega^{-1}$ at $V_{DS} = 1V$; $g_m = 0.8\ m\Omega^{-1}$ at $V_{DS} = 0.5V$

(iv) Repeat step 2 for different V_{GS} values say $-0.5V, -1V, -1.5V, -2V$.

(v) Plot the graph between V_{DS} v/s I_D.

- Transfer Characteristics :-

(i) The circuit will remain same for obtaining the transfer characteristics.

(ii) Set the $V_{DS} = 3V$, by varing the 0-12 volt variable power supply.

(iii) Now increase the V_{GS} in steps of say -0.5 V starting from zero and observe the corresponding drain current I_D until I_D becomes zero.

(iv) Repeat step 2 for different values of V_{DS}.

(v) Plot the graph between V_{GS} and I_D.

- Sources of error and precautions :-

(I) Do not exceed the drain current I_D above 10 mA.

(ii) Take proper care of JFET while fixing on the board.

(iii) All connections must be tight and secure.

(iv) Zero settings of the ammeters and voltmeters must be checked and adjusted accordingly.

(v) Readings should be precise and accurate.

(vi) Ammeters and Voltmeters must be of appropriate range.

P.T.O.

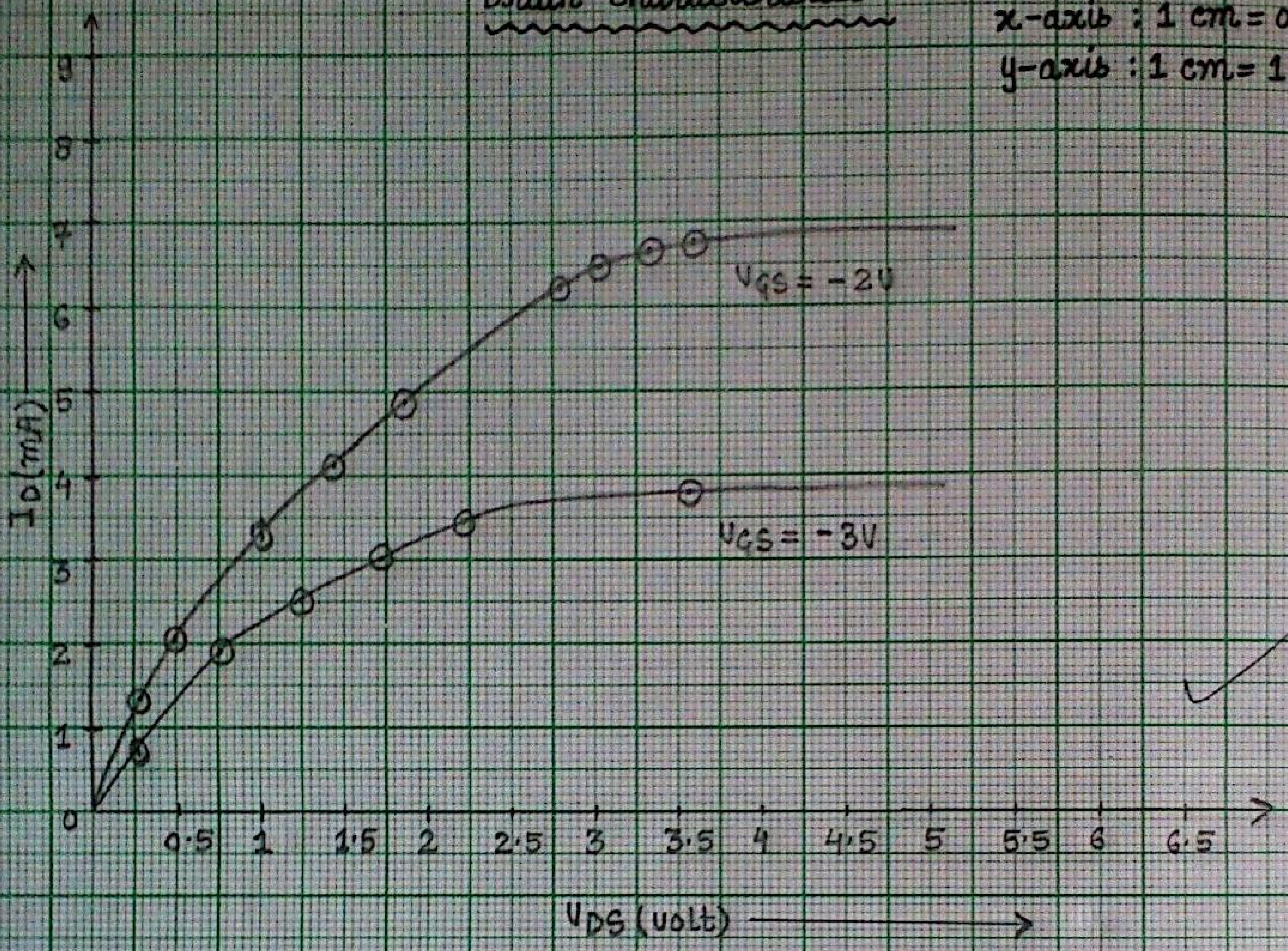
"Drain and Transfer Characteristics of an N-channel JFET"

"Drain Characteristics"

SCALE :-

x-axis : 1 cm = 0.5 V

y-axis : 1 cm = 1 mA

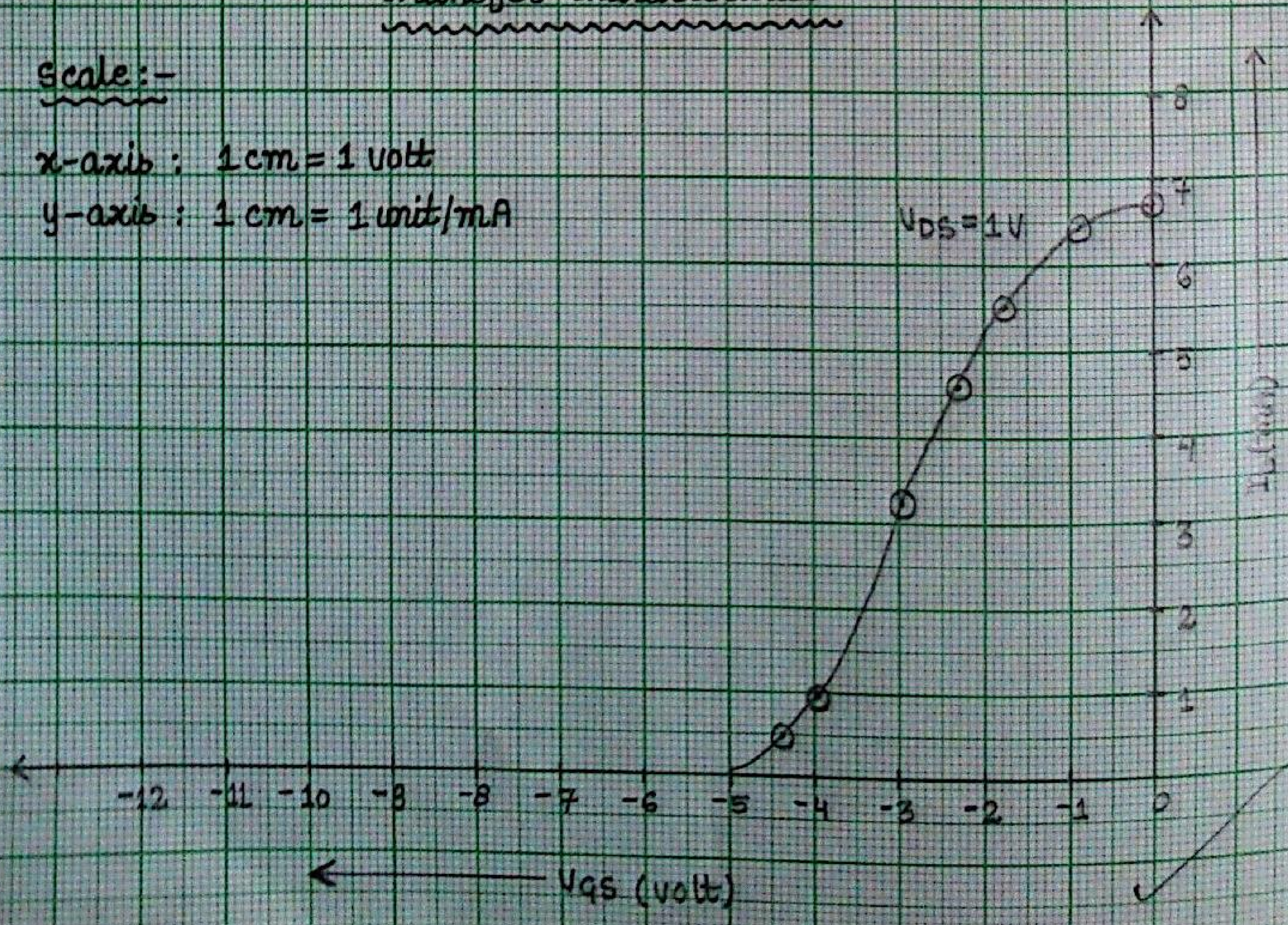


Transfer Characteristics

Scale :-

x-axis : 1 cm = 1 volt

y-axis : 1 cm = 1 unit/mA



• **Inference :** We have the following results :-

(i) At $V_{GS} = -2V \longrightarrow V_{DS} = 0.57\ k\Omega$ and $R_{DS} = 0.27\ k\Omega$

(ii) At $V_{GS} = -3V \longrightarrow r_{DS} = 0.8\ k\Omega$ and $R_{DS} = 0.45\ k\Omega$

(iii) At $V_{DS} = 1V \longrightarrow g_m = 2.8\ m\Omega^{-1}$

(iv) At $V_{DS} = 0.5V \longrightarrow g_m = 1.8\ m\Omega^{-1}$

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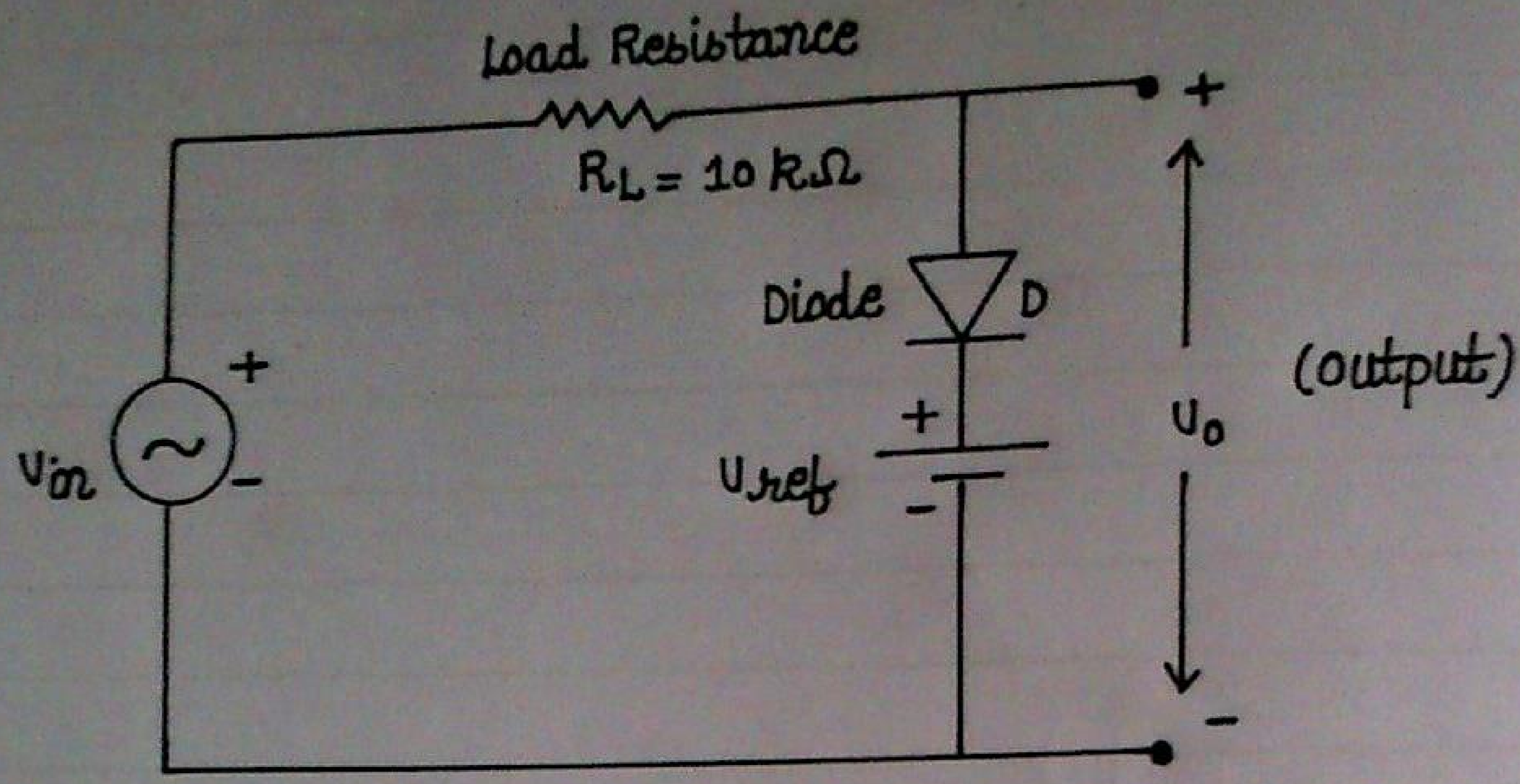
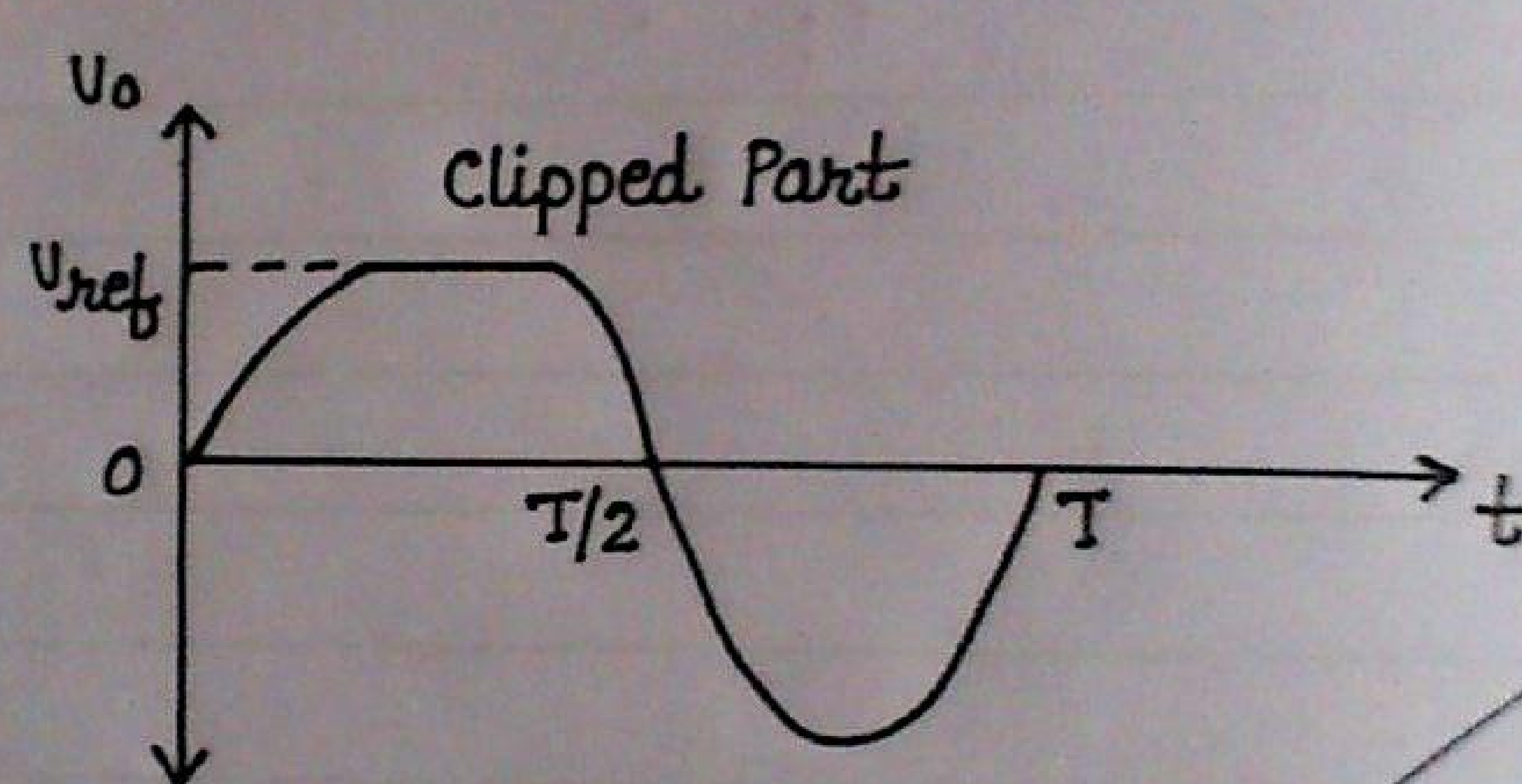
Pradeep
4/11/11

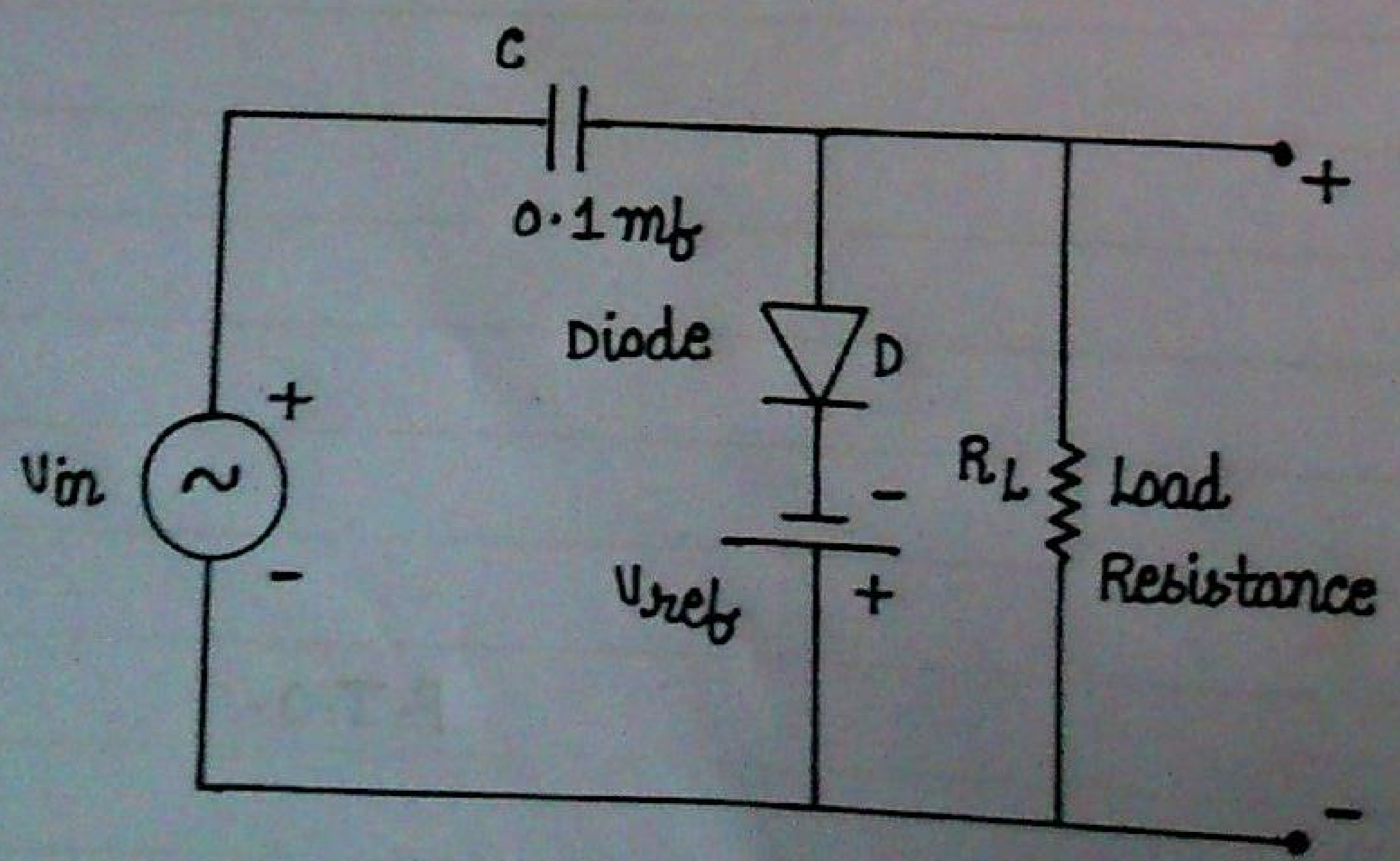
"Parallel clipper circuit with DC bias"

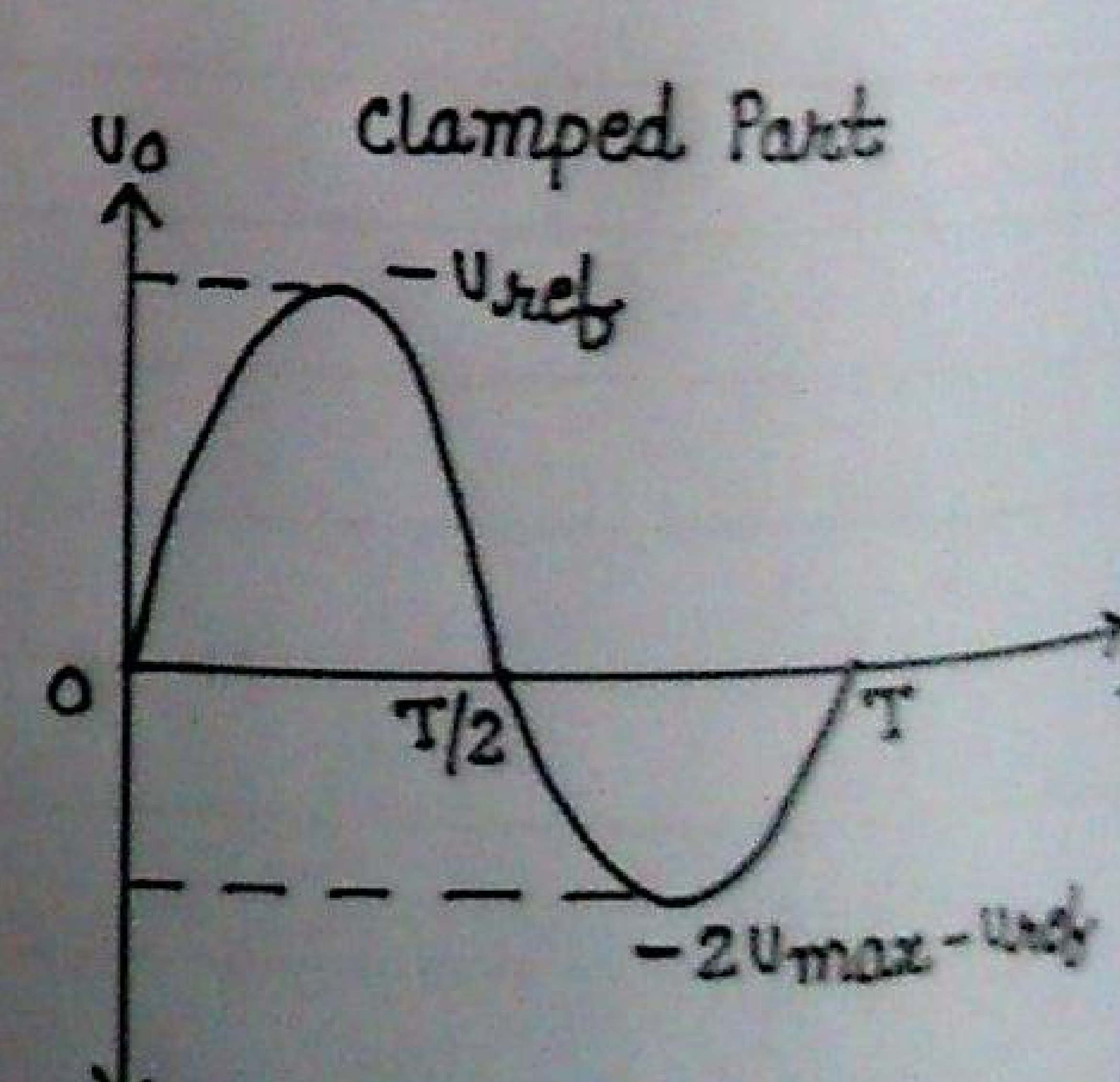


$$V_o = \begin{cases} V_{ref}, & V_o > V_{ref} \\ V_{in}, & V_o \le V_{ref} \end{cases}$$



"Clamper circuit with DC bias"





$-V_{max} - V_{ref}$ is regarded as x-axis / time axis.

Expt. No. ______ Date Oct. 20, 2011

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"Experiment No. 6"

- Aim: To study the clipping and clamping circuits.

- Apparatus Required :-

(i) Experimental kit
(ii) signal generator
(iii) CRO
(iv) connecting leads

- Theory :-

- Clipper : The electronic device that is used to limit a voltage to certain levels is called a limiter or a clipper. It can clip in negative, positive or both alternation of an AC voltage. Clipping circuits are of various types :-

(i) Series clipper
(ii) Parallel clipper
(iii) Series bias clipper
(iv) Parallel bias clipper

- Clamper: The electronic device that is used to shift voltage in output wrt input at some point is called a clamper.

- Procedure :-

(i) Connect the circuit using suitable patch cords as shown in circuit diagram.
(ii) Apply a sinusoidal input of 5 V and 1 kHz.
(iii) Observe the input signal on channel 1 on CRO and output signal from circuit on channel 2 on CRO.
(iv) Repeat the experiment for different clipping and clamping circuits.

Teacher's Signature : ______

Date

Expt. No.

(v) Sketch the wave shape and label the amplitudes.

(vi) Indicate the type of clipping in each case.

(vii) Draw transfer characteristics for different clipping and clamping circuits.

- Inference: Clipping and clamping circuits play a major role in implementation of larger circuits.

Pradeep
4/11/11