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BS-Phy

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UAF

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Practical # 01

Prove the Truth table of Exclusive (XOR) Gate

Define :

The Output will be One when inputs are differents And then the output will be zero when the inputs are Same.

Apparatus :

4 Transistor BFV 420, 5 Risistance, 1 L.E.D, 1 Breadboard, Connecting wires, 1 Battery 9v.

Procedure :

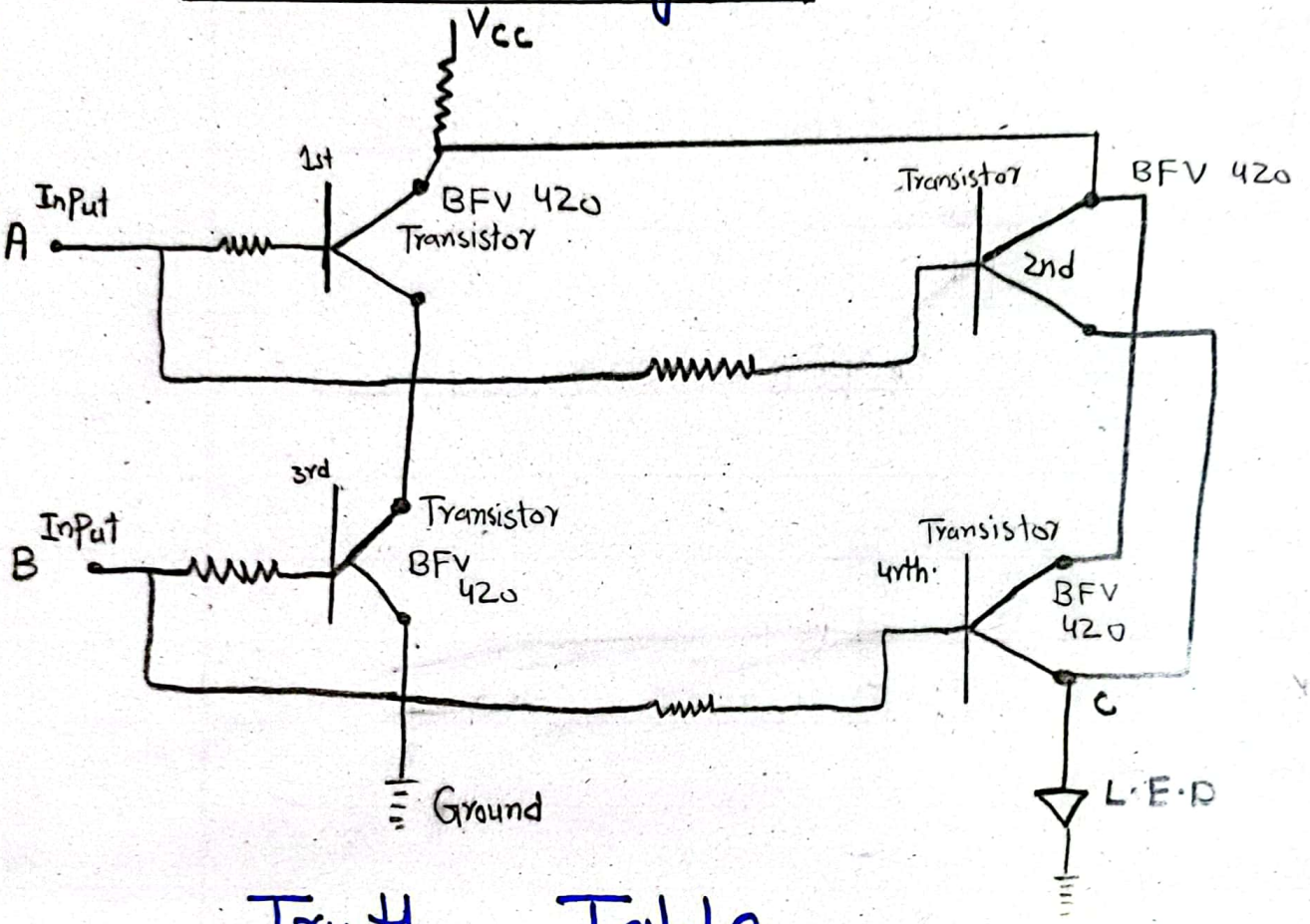
① Connecting all the components On the breadboard carefully according to the circuit diagram.

② 1st we take 4 Transistor of BFV 420 on the breadboard.

③ The collector of the 1st Transistor is connected with the Vcc. by using resistance between collector and Vcc.

④ Connect the emitter of the

circuit - Diagram



Truth - Table

A	B	A ⊕ B
0	0	0
0	1	1
1	0	1
1	1	0

1st transistor with the collector of the 3rd Transistor.

⑤ Ground the Emiller of the 3rd transistor.

⑥ Connect the both collectors of the 1st and 2nd Transistor.

⑦ Connect the Both Collectors of the 2nd and 4th Transistor

⑧ Connect the Both Emitter of the 2nd and 4th Transistor.

⑨ Connect the Positive terminal of the L·E·D with the Emittor of the 4th Transistor. And the negative terminal of the L·E·D is Grounded.

⑩ Connect the Resistance with the base of the 1st transistor

⑪ Connect the Resistance with the base of the 2nd transistor and the both Risistance Connected with each other.

Mathematically :-

$$X = A \oplus B$$

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(12) Same connected the Resistance of the base of the 3rd Transistor

(13) And then the connected the resistance of the 4rth Transistor with the 3rd Transistor of the resistance.

(14) Give the Inputs 1 on the points A and B, then the Junction will complete of the transistor Ist and 3rd. The Output on

(15) the Point C is zero. then the L:E:D will be off.

(15) Give the input 1 on the Point A and the input 0 on the Point B the Junction of the 3rd transistor is not complete. The output on the point C is One then the L:E'D is On.

(16) Give the input 0 on the point A and the input 1 on the

Result :-

The truth table of the exclusive XoR Gate is proved.

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Point B, the Junction of the 1st transistor is not complete, then the output on the point C is One then the L·E·D is O.

(17) Give the inputs "0" on the point A and B the Junction of the 2nd and 4th doer not complete then the output on the Point C is "0" then the L·E·D is OFF.

Result :-

The truth table of the exclusive XOR Gate is proved.

Practical #02

Prove the truth-table of exclusive (XNOR) Gate :-

The Output will be One when input are Same And then the output will be zero when the inputs are different.

Apparatus :-

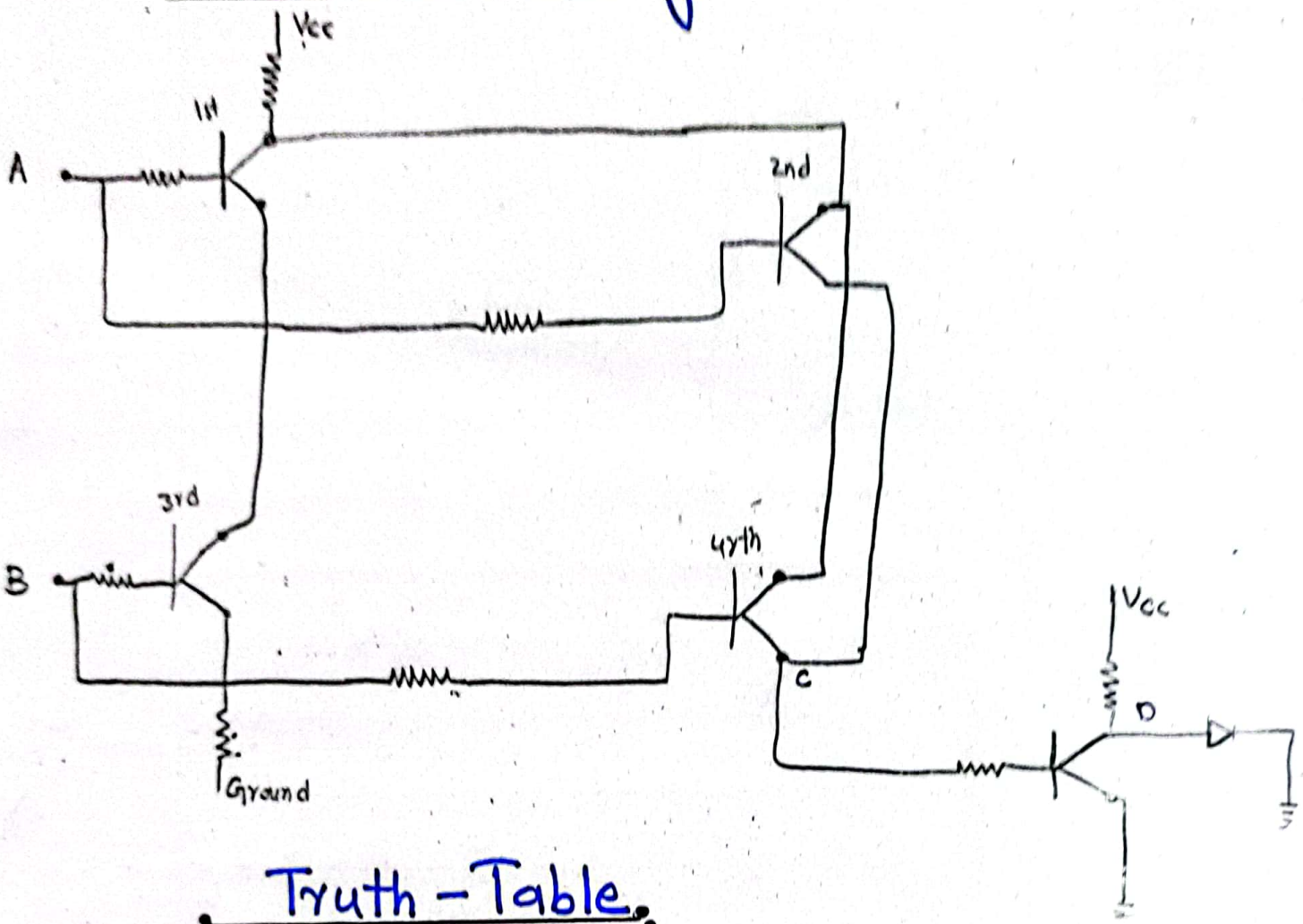
5 Transistor BFV 420, Resistance L.E.D, Breadboard, Connecting wires 1 Battery

Procedure :-

(1) Connecting all the components On the breadboard carefully according to the circuit diagram

(2) 1st We give the Input "0" On the Point A and B The Junction of the transistor 1st, 2nd, 3rd and 4th is not Completed, the Point "C" is zero then the Output on the Point D

Circuit - Diagram



Truth - Table

A	B	$\overline{A \oplus B}$
0	0	1
0	1	0
1	0	0
1	1	1

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is One, then the L.E.D is ON.

(3) Give the Input D on the Point A and Input 1 On the Point B, the Junction of 1st and 2nd Transistor is not Completed And Juction of 3rd and 4rth is Complete, the Point C is 1, the Output on the Point D is "0" then the L.E.D will be OFF.

(4) Give the input 1 on the Point A and the Input 0 on the point B, the Junction of the 1st and 2nd Transister is completed, the Junction of the transister 3rd and 4rth is not completed, the Point C is 01 the output on the Point D is 0, then the

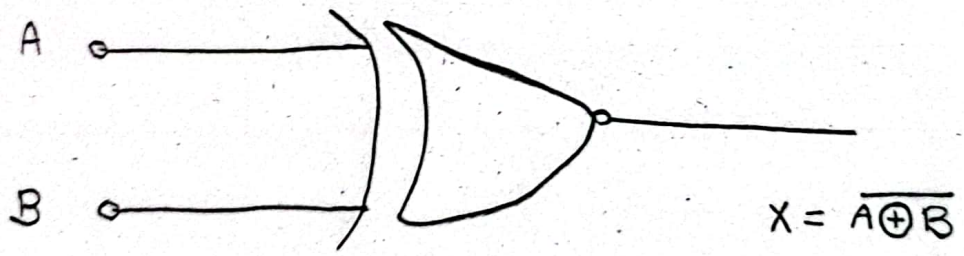
Result

The truth-table of the exclusive (XNOR) Gate is Proved.

Mathematically

$$X = \overline{A \oplus B}$$

Symbol



L·E·D will be OFF.

5 Give the Inputs 1 on the point A and B, the junction of the Transisters 1st, 2nd, 3rd and 4th will be completed. The point C is 1, the output on the Point D is also 1, then the L·E·D will be ON.

Result :-

The truth-table of the exclusive (XNOR) is proved.

Practical no # 03

Common Emitter Biasing of BJT

Simple Biasing of Transistor :-

Principle :-

Base and Emitter must be forward biased but Collector and Base remains reverse biased.

Why we called commen Emitter Biasing of BJT ?

Because current from Collector and Base Comes here.

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Practical #03

Transistor Biassing

When the Voltage is Applied the transistor in working form is called Transistor Biassing.

Apparatus

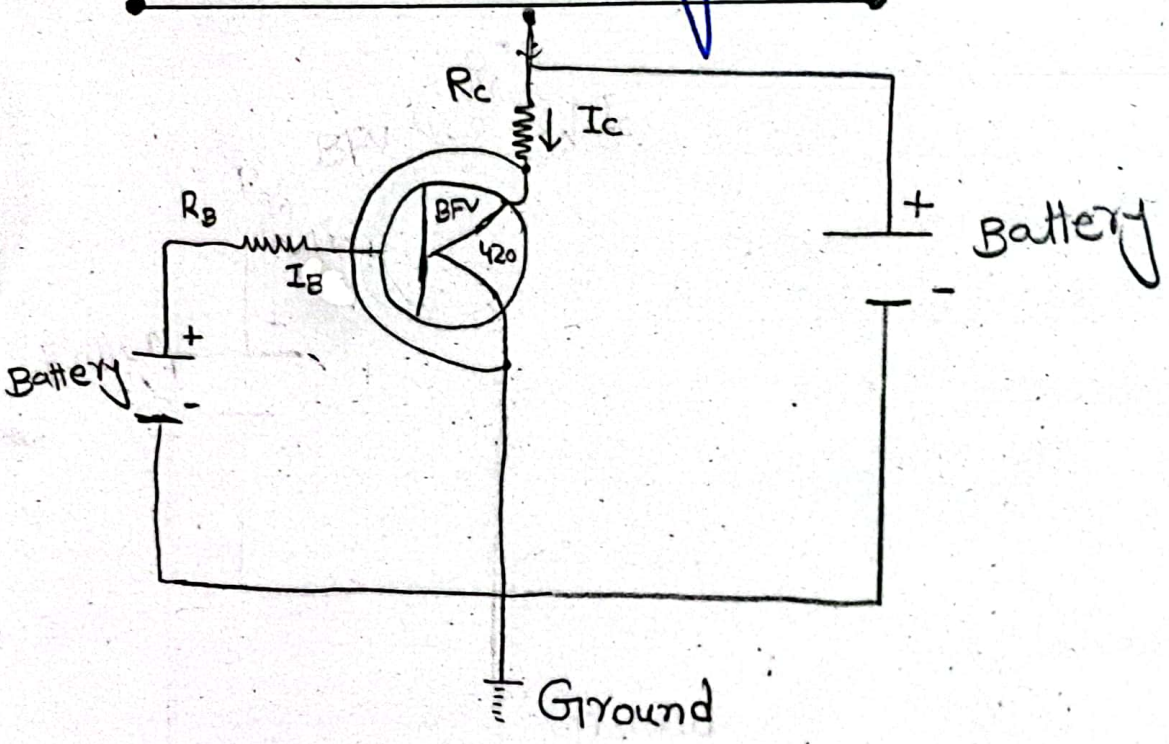
Transistor BFV 420, Two Batteries 9v, Connecting wires, Breadboart. Resistance, Multimeter, Oscillscope

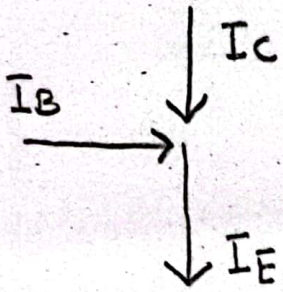
Procedure

(1) Connecting all the components on the breadboard carefully according to the circuit Diagram.

(2) To check the Ic, current, Connect the Positive terminal of the multimeter OR oscillscope with the resistance to Side of Positive terminal of the battery. And negative terminal of the multimeter OR oscilloscope to the resistance of the Collector Side of the transistor.

Circuit-Diagram :-





$$I_E = I_B + I_C$$

(3) To check the I_B, Connect the Positive terminal of the mutimeter OR oscilloscope with the resistance to the positive Side of the battery And negative terminal of the multimeter or oscilloscope Connect with the resistance to the Side of the base of transistor.

(4) To check the Common Collector-Base-Configuration, Connect the One Side of the mutimeter OR oscilloscope to the base. And the other Side of the mutimeter or oscilloscope to the Collector of the Transistor.

(5) To check the Common Emitter- Base Configuration, Connect the Positive terminal of the mutimeter or Oscilloscope with the Base, And negative terminal of the multimeter or oscilloscope.

Calculation :

As we know Base and Emitter is forward bias and act as "PN" Junction diode, in case of "Si" Potential barrier is 0.7V and for "Gr" 0.3V So, we assume it is made of "Si" So, $V_{BE} = 0.7V$.

Now,

From "loop 2" we assume direction of current is anti-clock wise So, by using Kircheff's Voltage law

$$V_{cc} - I_c R_c - V_{CE} = 0$$

OR

$$V_{cc} - V_{CE} = I_c R_c \text{ or } V_{RC} \quad \text{——— (1)}$$

But

$$\therefore V_{CE} = V_{BE} + V_{CB}$$

OR

$$V_{CB} = V_{CE} - V_{BE} \quad \text{——— (2)}$$

Similarly from "loop 1"

$$V_{BB} - I_B R_B - V_{BE} = 0$$

OR

$$V_{BB} - V_{BE} = I_B R_B \text{ or } V_{RB} \quad \text{——— (3)}$$

Similarly According to the transistor's Configuration :

$$I_E = I_B + I_C \quad \text{——— (4)}$$

And

$$B_{DC} = \frac{I_c}{I_B} \text{ (gain)}$$

or

$$I_C = B_{DC} I_B \quad \text{——— (5)}$$

from (3)

$$I_B = \left(V_{BB} - V_{BE} / R_B \right)$$

with the emitter of the transistor.

Working :-

As the base and Emitter forward bias So, electrons from emitter enters into base but as we know base is lightly dopped So, these electron now have two routes or ways either they can move toward's collector or they can move toward +ve V_{BB} through base but as base is lightly dopped. So, it has a few holes So, very small current will flow through base and the remaing will flow through collector as the Collector have large space. In this way a large current (conventional) will flow through Emitter to Collector due to little base current and the transistor works as an amplifier.

Practical no # 04:

Voltage - Devider

Voltage - Devider is a series of resistors or capacitors which can be tapped at any Intermediate Point to produce a sepecific fraction of the Voltage applied between its end.

Apparatus :-

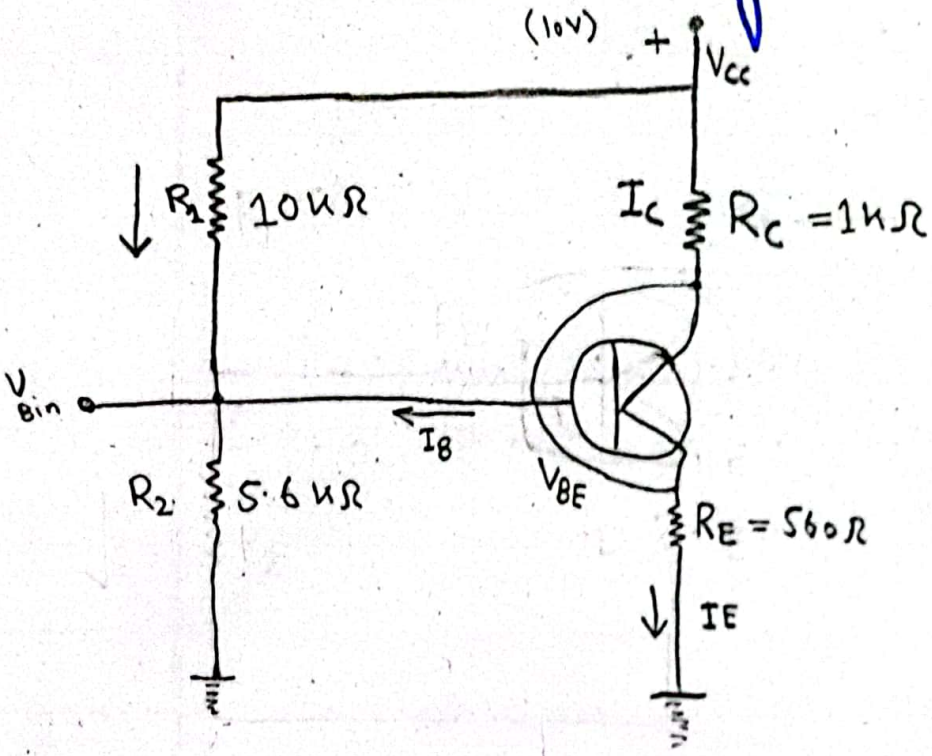
Transistor BVF 420, 4 Resistance, 1 Battery Breadboard, Connecting wires, multimeter, Oscilloscope.

Procedure :-

(1) Connecting all the components on the breadboard according to the circuit diagram.

(2) To check the Ic current, Connect the Positive terminal of the multimeter or oscilloscope connecting with the resistance to Side of the positive terminal of the battery And negative terminal of the

Circuit - Diagram :



multimeter or oscilloscope to the resistance of the resistance of the collector side of the transistor.

(3) To check the I_B, Connect the Positive terminal of the multimeter or oscilloscope with the resistance to the side of the base of transistor.

(4) To check the common collector - Base- Configuration, Connect the One side of the multimeter or oscilloscope to the base. And the other side of the multimeter or oscilloscope to the collector of the transistor.

(5) To check the common Emitter - Base configuration, Connect the Positive terminal of the multimeter or oscilloscope with the base, And negative terminal of the multimeter or oscilloscope with the emitter of the transistor.

Calculation :-

By using Voltage devider theorm :-

Voltage across base V_B :

$$V_B = \frac{V_{cc} R_2}{R_1 + R_2} \quad \text{——} (1)$$

According to KVL : $V_B = V_{BE} + V_E$ —(2)

OR

$$V_E = V_B - V_{BE} \quad \text{——} (3)$$

Also by KVL :

$$V_{CE} = V_C - V_E \quad \text{——} (4)$$

$I_E = I_C + I_B$; I_B is negliigible

So, $I_E \approx I_C$

Also,

$$V_E = I_E R_E \Rightarrow I_E = \frac{V_E}{R_E} \text{ (ohm's Law)}$$

$$V_C = I_C R_C \Rightarrow I_C = \frac{V_C}{R_C}$$

And;

$$R_{in\,(Base)} = \frac{V_B}{I_B} = \frac{V_B}{I_C / B_{DC}} = \frac{B_{DC} V_B}{I_C}$$

Also,

$$B_{DC} = \frac{I_C}{I_B}$$

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(6) To check the I_E, connect the positive terminal of the multimeter or oscilloscope with the emitter of the transistor and negative terminal of the multimeter or oscilloscope is grounded.

(7) To check the I_{BE} connect the Positive terminal of the multimeter or oscilloscope with collector and negative terminal of the multimeter or Oscilloscope with the emitter.

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Practical no # 05

"Emitter Biassing"

Principle :

The emitter of the transistor is biased with 'dc' Source and the collector with another 'dc' Source.

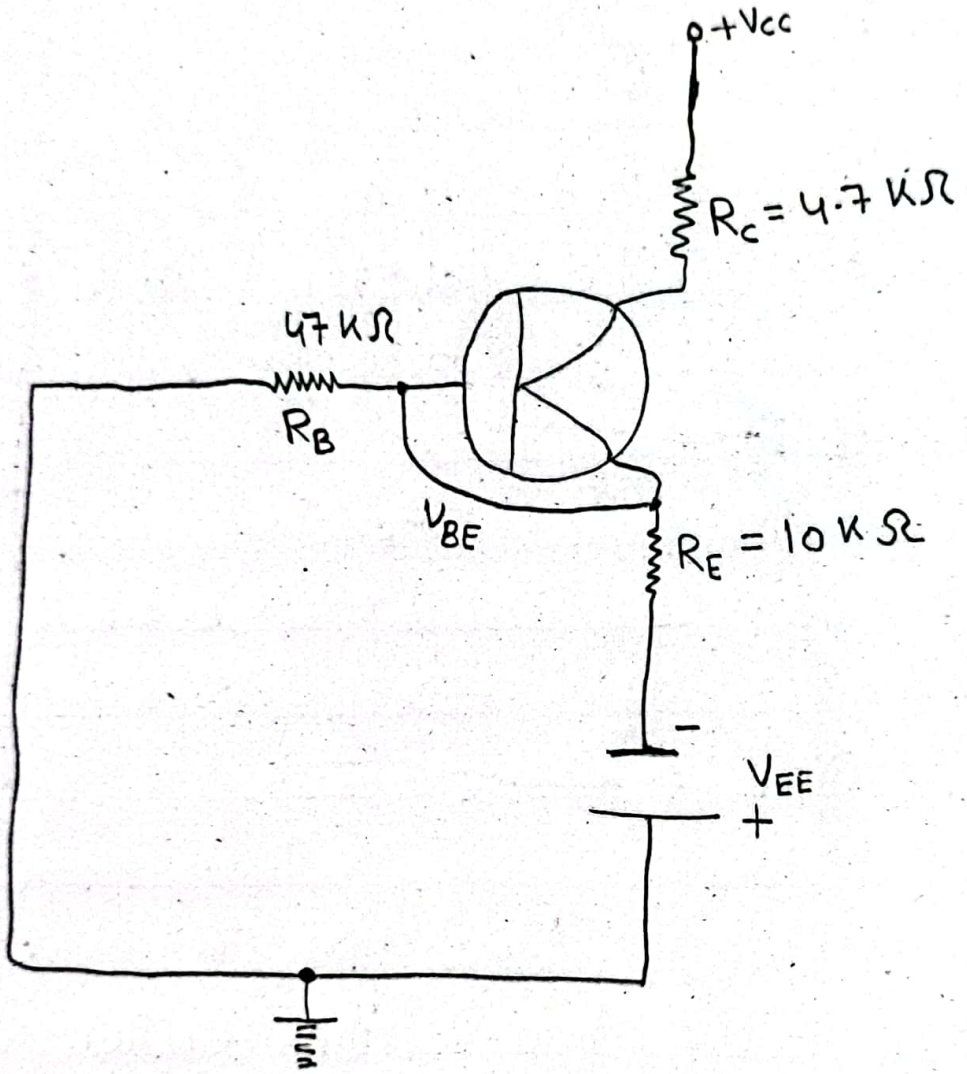
Apparatus :

i) Transistor ii) Resistors
iii) 2 DC- Source iv) Bread board
v) Multimeter vi) Connecting wires

Procedure :

- Connect the transistor in such a way that the emitter with a resistance (10kΩ) is connected to the -ve terminal of the dc Source (V_{EE}) which is equall to half of the dc - supply that is connected to the collector (V_{CC})

Circuit - Diagram:



- Connect the +ve terminal of the V_{EE} and base with its resistance (47 kΩ) to the ground.
- Connect the collector with its resistance (4.7 kΩ) with +ve terminal of the V_{CC} and -ve terminal to the ground.

Why we use -ve terminal with emitter and +ve to the ground of V_{EE}?

So, that -ve terminal pushed the electron and we can find Potential difference across "R_E"

NOTE:-

KVL states: Sum of all the voltages at the components is equall to the Source Voltage.

OR

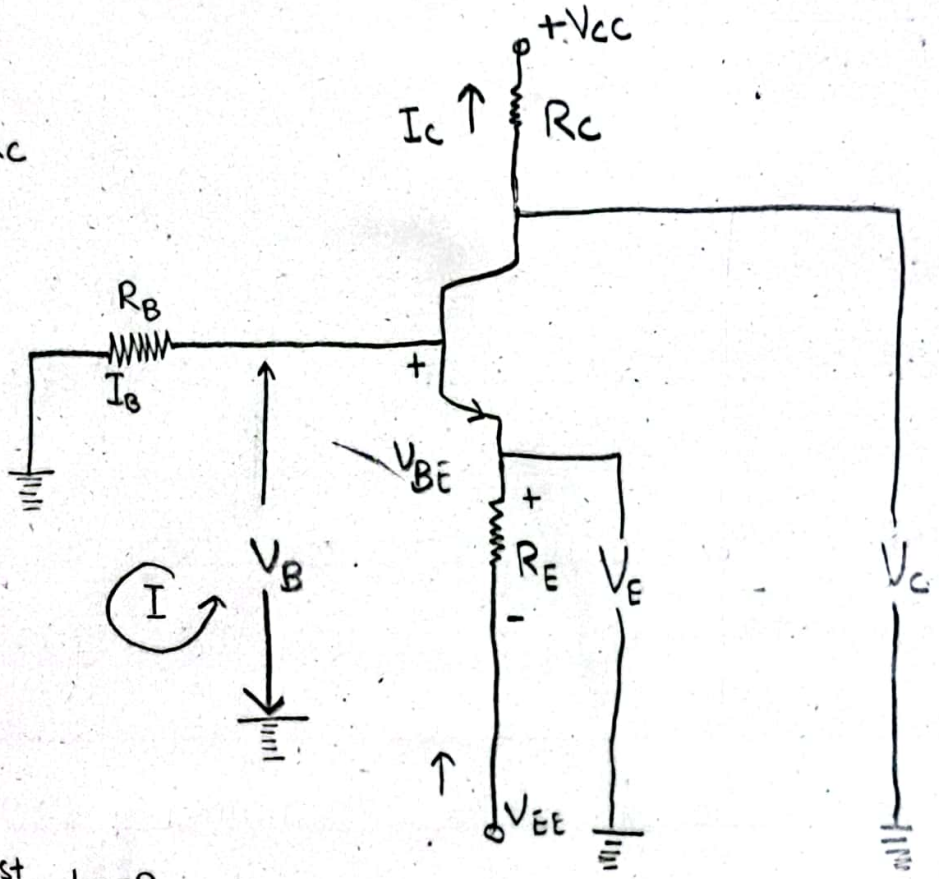
Sum of all the Voltages Including Source = zero

Calculation

NOTE

$V_{CE} = V_C - V_E$

$V_C = V_{CC} - I_C R_C$



From 1st Loop

$$-(-V_{EE}) + I_E R_E + V_{BE} + I_B R_B = 0$$

$$\Rightarrow I_E R_E + \frac{I_C}{\beta} R_B = -V_{EE} - V_{BE} \qquad \therefore I_B = \frac{I_C}{\beta} = \frac{I_E}{\beta}$$

$$\left(I_E R_E + \frac{I_E}{\beta} R_B\right) =$$

$$I_E \left(R_E + \frac{R_B}{\beta}\right) = -V_{EE} - V_{BE}$$

$$I_E = \frac{-V_{EE} - V_{BE}}{\left(R_E + \frac{R_B}{\beta}\right)} \approx I_C$$

And

$$\boxed{V_B = V_{BE} + V_E} \qquad \boxed{V_E = V_{EE} + I_E R_E}$$

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Practical no #06

"Implementation of OR GATE"

OR-GATE:

OR GATE has two Inputs and One output. Output is zero where both inputs are zero.

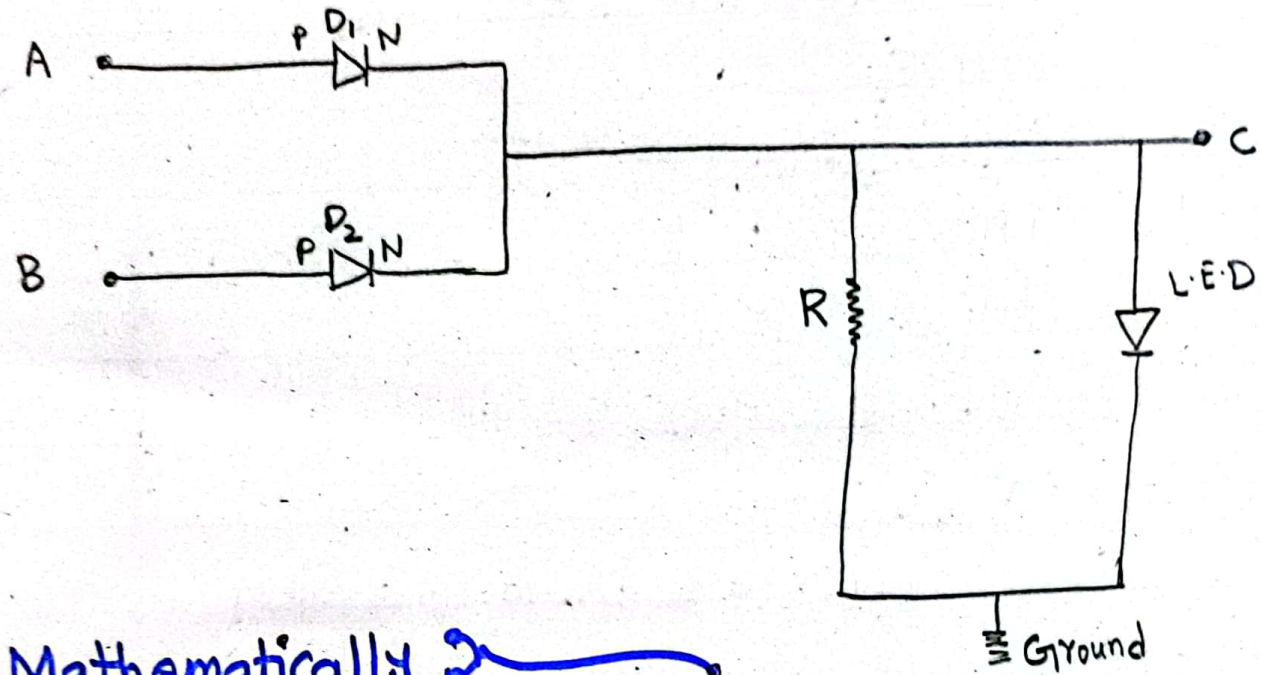
Apparatus:

Bread board, Battery Resistor, Connecting wires, LED and Diodes.

Procedure:

* The breadboard can be setup with both switches (for Input and Light emitting diodes
* Connect two diodes on the breadboard and n- terminal of diodes connected together and p- terminal get logic.
* Connect the resistor between the n-Sides of two diodes, and also Connected the L.E.D between the

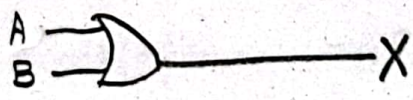
Circuit - Diagram



Mathematically

$$X = A + B$$

Logic Symbol



n-sides of diodes.

* Both L·E·D and resistor are grounded
* Output of wire of resistor Connected with positive terminal of L·E·D and negative terminal of the L·E·D connected with -ve side of the breadboard.
* When Voltage through battery is applied on D_1. It is forward baised and hence conduct. The current flow through resistance to L·E·D and it begins to glow
* When Voltage is applied across the both diodes then the both diodes cunduct and Voltage are parallel and current flow via R and and Causes L·E·D to glow.

Truth-Table :

A	B	X
0	0	0
0	1	1
1	0	1
1	1	1

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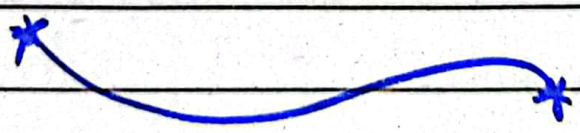
* When Voltage is not given to both the diodes then diodes does not Conduct and output is zero and hence L.E.D does not glow.

Result

In the experiment we have verified the truth-table of OR-Gate Problems and operations.

Precaution

⇒ Connection must be tighted
⇒ Connection should be Joined Correctly
⇒ Input Voltage must be of 5V



Practical no #07

Implementation of AND GATE

AND - GATE

And - GATE has two Inputs and one output. The output is only 1 when both inputs are 1.

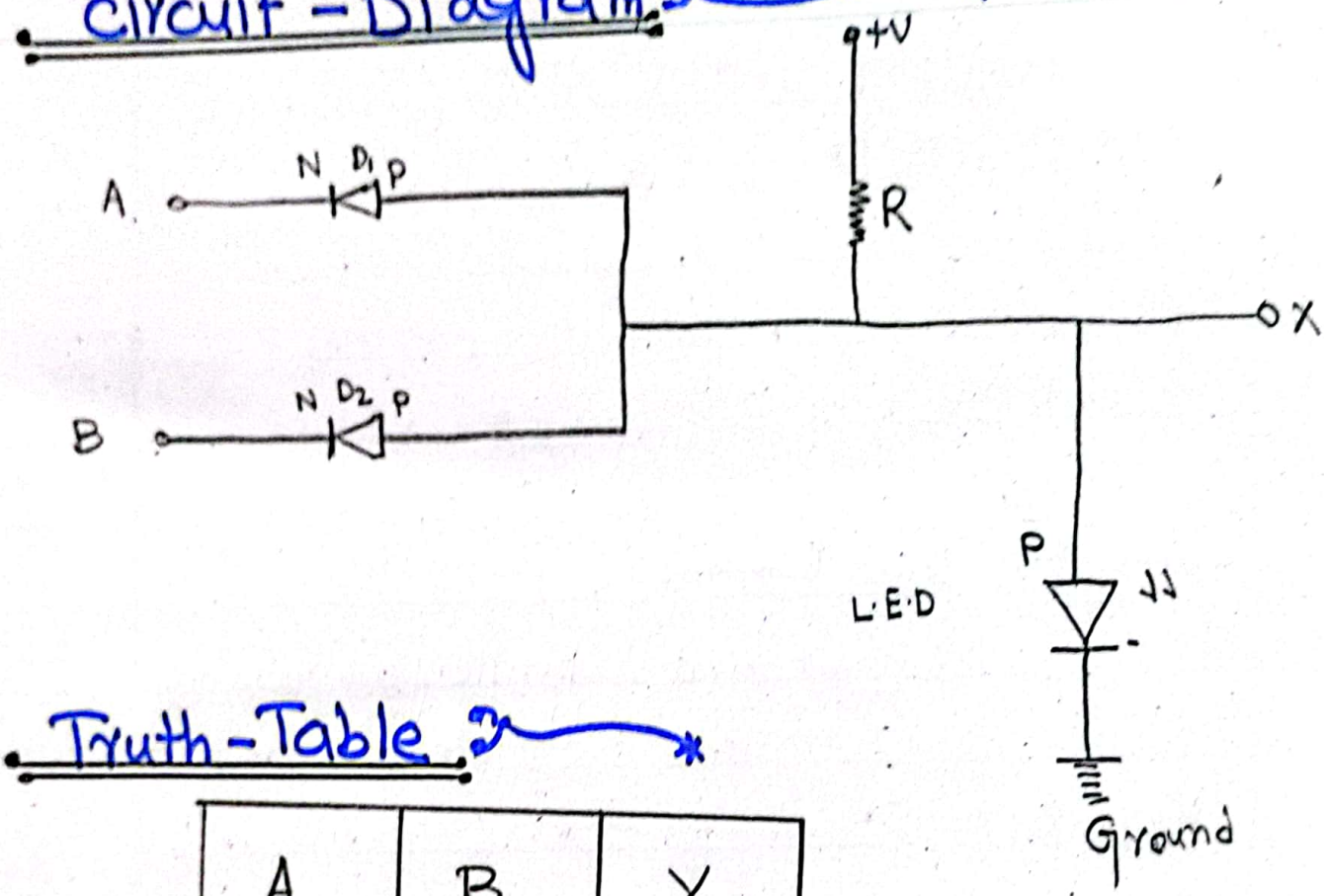
Apparatus

Breadboard, Battery, Connecting wires, L.E.D, Diodes, Resistor.

Procedure

* The breadboard can be setup with both switches (For input) and light emitting diodes (for output).
* Connect two diode on breadboard and P- terminal of diodes connect together.
* Connect positive wire of the battery across the one side of breadboard. and -ve wire of battery across the other side of the breadboard.
* Connect Positive wire and

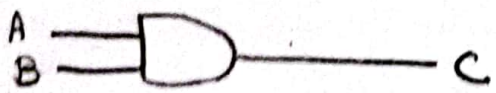
Circuit - Diagram



Truth - Table

A	B	X
0	0	0
0	1	0
1	0	0
1	1	1

Symbol



P-terminal of battery together.

Result :-

In this experiment we have verified the truth-table of logic gate AND GATE, In this we obtain 1 as output only in the case that if both inputs are 1. Otherwise output will be zero (0).

Precaution :-

* Connection must be tighted
* Connection should be joined carefully
* A Continiuess Voltage of +5V should be supply to the n-terminal of diodes and the L.E.D
* Input Voltage must be of 5V.

Practical no #08

"Implementation of NOT GATE"

NOT-GATE has One input and One Output. The Output is Only One when the input is Zero.

Apparatus

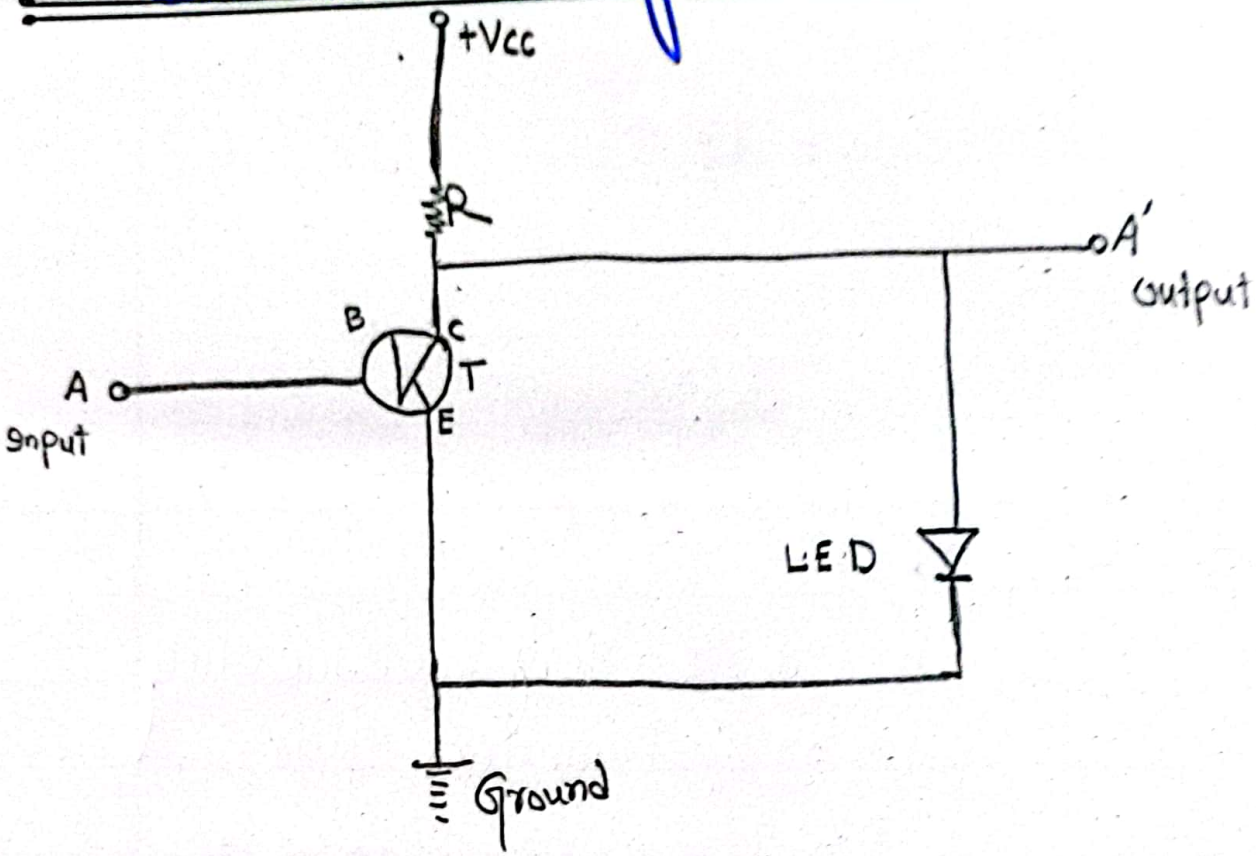
Breadboard, Battery, Connecting wires, L.E.D, C828 Transistor, Two Resistor (1 KΩ, 470Ω)

Procedure

* Breadboard can be setup with Single Switch (for input) and (for output).
* Connect the Positive +ve wire of the battery accross the One side of the breadboard and another side (-ve) side of the battery Connect through the wire to the Other side of the breadboard.

Resistor Should be connected to the collector of transistor. And

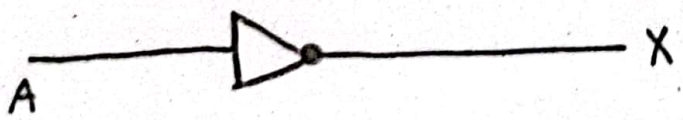
Circuit - Diagram



Truth - Table

A	$X = \bar{A}$
1	0
0	1

Symbol



Collector should be +ve. (Connect with +ve side of the breadboard)

* Connect the +ve terminal of the L·E·D between the collector and resistor and -ve terminal of the L·E·D should be grounded Emitter of the transister should be grounded at breadboard.

* Now give input (0) to the base of the transistor by connecting the base of the (-ve) side of the of breadboard means, (-ve) side of the battery. In this case emitter-base junction is not forward biased because emitter and base are connected to negative terminal of the battery. And as a result transistor does not work and all the current flow to L·E·D through resistor and L·E·D glows which show output 1.

* Now give input (1) to base of the transistor. R_1 Provides input which is connected to +ve terminal of battery. In this case, emitter - base junction is forward biased and current flow from collector to emitter and ground L.E.D does not glow.

Result :-

In this experment we have verified the truth-table of NOT-GATE

Precaution :-

⇒ Connection must be tighted

⇒ Connection should be Joind carefully.

Practical no #09

"Implementation of NOR-GATE."

NOR function is just the reverse of the OR-function It has two inputs and one output. In this case logic gate output 1 is obtained when all input are 0.

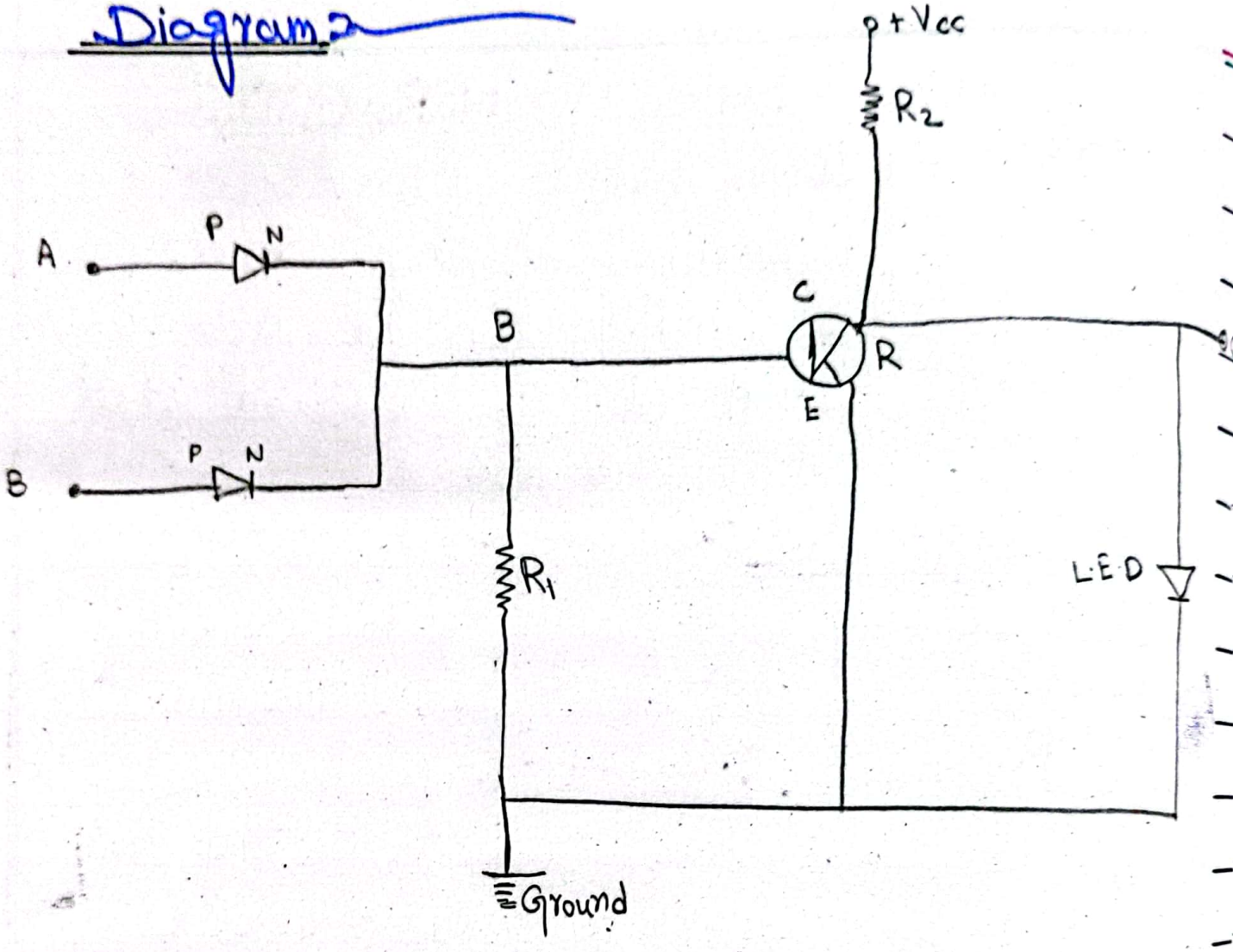
Apparatus

Bread board, battery, Resistor, Connecting wires L.E.D, Diodes and Transistor.

Procedure

* The breadboard can be setup with both switches (for input and L.E.D)
* Connect two diodes on bread board and n-type terminal of breadboard Connect together and P-type terminal gets logic
* Now Connect a transister in breadboard and provide Potential of +5V to Collector
* Connect the positive terminal of the L.E.D to the collector and -ve

Diagram :



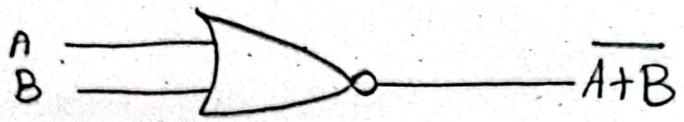
Truth-Table :

A	B	X= A+B	$\overline{A+B}$
0	0	0	1
0	1	1	0
1	0	1	0
1	1	1	0

terminal ground.

* Connect the emitter to the -ve terminal of battery (ground)
* Connect the output of OR-GATE to the base of the transistor as a input
* Now give inputs to diodes. When input 0 is given on both sides of diodes then output is 0, But inverter (Transistor) inverts the output into 1.
* When we provide input 1 on one side and zero (0) on other sides then output become 1 and the current passes through transistor and flows all the current through collector to emitter and then to ground and no current will pass through the L.E.D and over all output 0.
* When both diodes are provided input

Logic Symbol :



1, then the output will be also 1 and all the current pass through base and to emitter then ground And L.E.D which is connected with Collector does not glow, hence output is zero.

Result :-

We have verified the truth-table of NOR-GATE which show the output is only 1 when all inputs are zero

Practical no #10

"Implementation of NAND-GATE"

NAND-GATE is just the reverse of the AND-function. It has two inputs and one outputs. The gate gives an output of 1. If its both inputs are zero or atleast one input is zero.

Apparatus

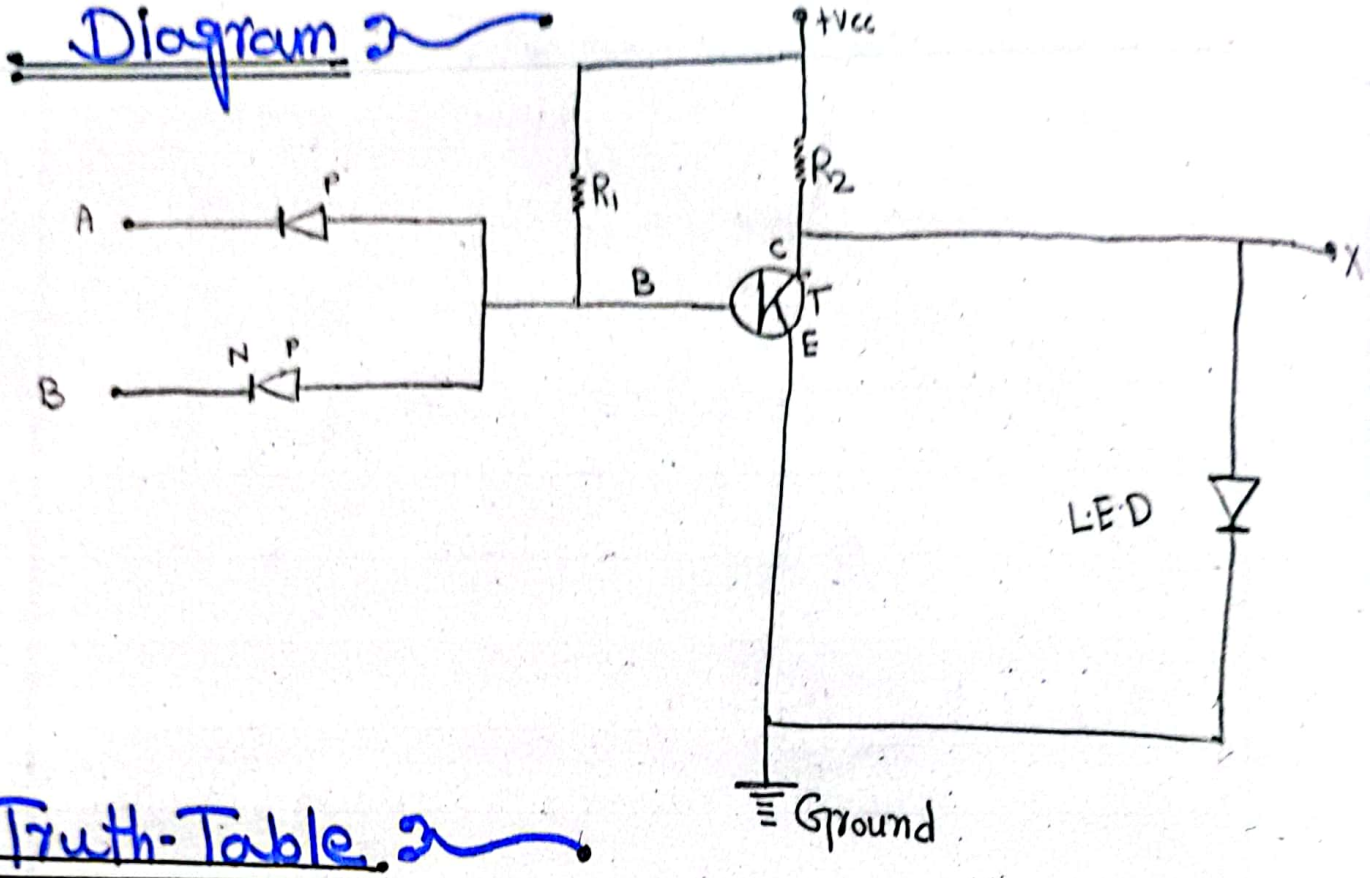
Breadboard, battery, Resistor Connecting wires, L.E.D, Transistor, diodes

Procedure

* Connect two diodes on breadboard and these P-terminal are common and n-terminal get logic.
* Now connect the transistor in bread board and provide a potential of +5V to collector.
* Connect the +ve terminal of L.E.D between collector of transistor and resistance and ground.

Connect emitter with -ve terminal

Diagram :-



Truth-Table :-

A	B	X=A·B	$\overline{A \cdot B}$
1	0	0	1
0	1	0	1
0	0	0	1
1	1	1	0

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of battery.

* Connect the output of diodes with the base of transistor.

* Now give input to diodes, If we give 1 input on both sides then the output on the P-type sides of diodes will be also 1 and this output which is due to reversed biased of diode will be the input of Inverter.

* And then all the current flows from base to emitter then ground.

* If we give input 1 on one side of the diodes and 0 on the other side of the diode or both input are zero, then the output will also be zero. And current will flow from collector to L.E.D through resistance and output will be 1.

Logic - Symbol

Result :-

We have verified the truth table of NAND - GATE, which show that the output will be low (0) when both inputs are high (1)

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