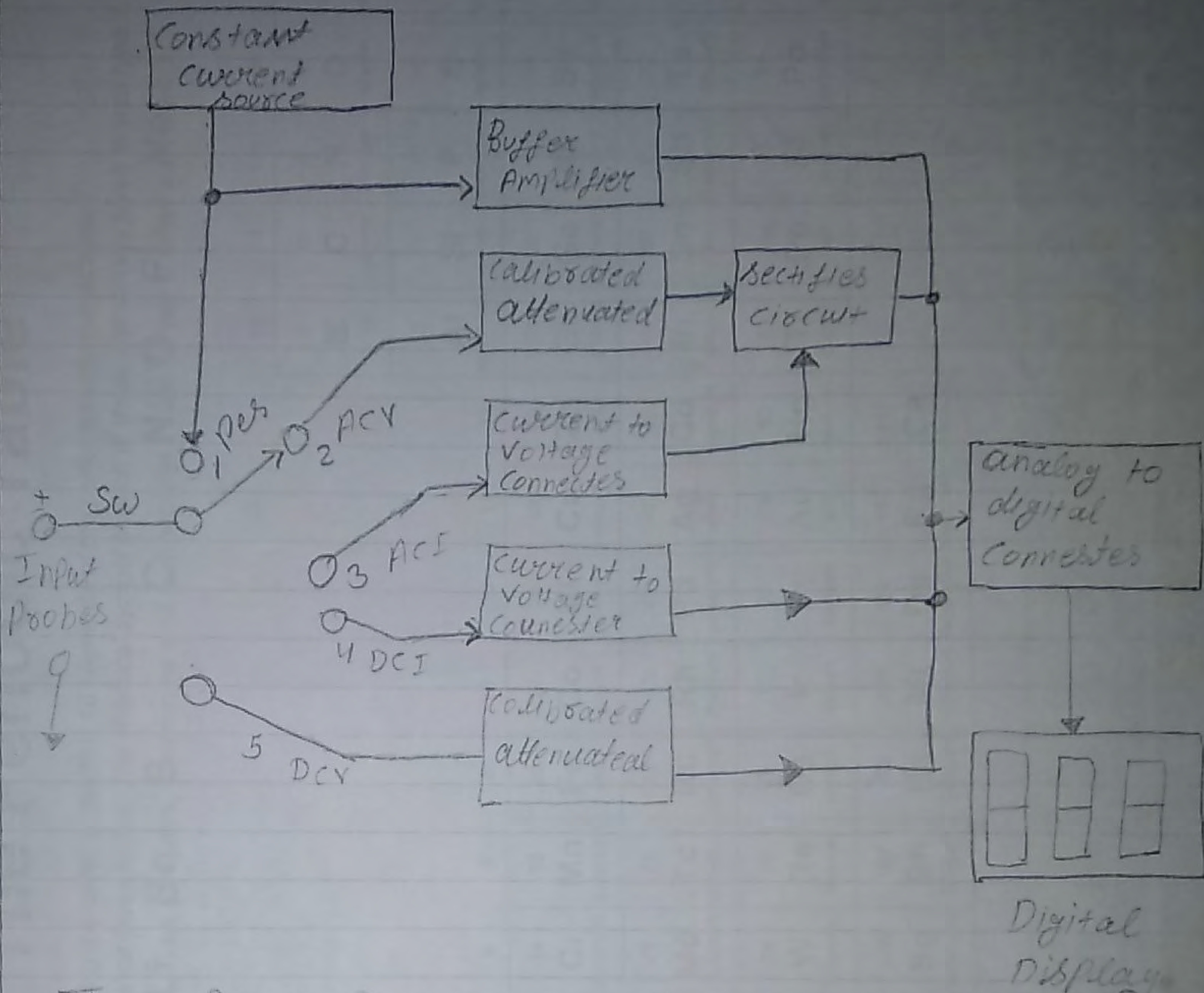

The Block Diagram of digital multimeter

Date

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Experiment No. 1

Object - Study of Digital Multimeter (DMM).

Theory - While most analog meters require no power supply, give a better visual indication of trends and changes, suffer less from electric noise and isolation problems, and are simple and inexpensive digital meter offer higher accuracy and input impedance unambiguous readings at greater viewing distances, smaller size, and a digital electrical output (for interfacing with external equipment) in addition to visual readout.

A DMM is very important laboratory instrument it is used to measure AC/DC Voltage AC/DC current and resistance. Since it gives digital display, it is very accurate. The accuracy is sometimes called as resolution of digital multimeter Resolution is also related with sensitivity of Multimeter Greater is the sensitivity higher is the resolution it has one more advantage. It has very high input resistance. So Minimum loading effects are produced on the electrical quantity like Voltage or current under measurement it also Provides over ranging indicator i.e. if the unknown Voltage or current increases beyond its capacity it shows 1- on the display.

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1 To measure resistance - Connect an unknown resistor across its input probes keep rotary Switch in position-1. Some current flows through he resistor from this voltage is directly proportional to its resistance. This voltage is buffered by the buffer amplifier and then fed to A/D converter, to get digital display in ohms.

2 To measure Ac Voltage → Connect an unknown Ac voltage across input probes keep rotary switch in position -2 The voltage is attenuated, if it is above the selected range and then rectified to convert it into proportional Dc voltage. It is then fed to A/D converter to get the digital display in Volts.

3 To Measure AC Current - This circuit measures the current indirectly. Because the circuit can measure only Voltage and the A/D converter can convert voltage into proportional digital signals. So the current is converted into proportional voltage first and the measured.
Connect an unknown Ac current across input probes Keep the swich in position-3. The current an unknown is converted proportionally into voltage with the help of I-V converter and then rectified. Now the voltage in terms of Ac current is fed to A/D converter to get digital display in Amperes.

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4 To measure Dc current - Here also the circuit Measures the current indirectly Connect an unknown Dc current across input probes. Keep the swith in Position-4 The current in converted Proportionally into voltage with the help of I-V converter. Now the voltage in terms of Dc current is fed to A/D converter to get the digital dispaly in Amperes.

5. To measure Dc voltage - Connect an unknown Dc voltage across input probes. Keep the switch in position-5 the voltage is attenuated, if it is above the selected range and then directly fed to A/D converter to get the digital display in Volts.

Battery installation -

1 Disconnect the test leads from the meter.
2 Remove the protective rubber holster (if installed)
3 Open the battery door by loosening the screw using a Phillips head screwdriver.
4 Insert the battery into battery holder, observing the correct polarity.
(5) Put the battery door back in place secure with the screw.

DIODE TEST

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1 insert the black test lead banana plug into the negative Com Jack and the red test lead banana Plug into the Positive diode Jack.

2 Turn the function switch to the (·))) Position.

3 Touch the test Probes to the diode under test. Forward voltage will indicate 400 to 700mV. Reverse voltage will indicate "1". Shorted devices will indicate near 0mV. Shorted devices will indicate near 0mV and an open device will indicate "1" in both Polarities.

BATTERY TEST

1 Insert the black test lead banana plug into the negative COM jack and the red test lead banana plug into positive V jack.

2 Select the 1.5V or 9v BAT position using the function switch.

3 Connect the red test lead to the positive side of the 1.5V or 9v battery and black test lead to the negative side of the 1.5v or 9v battery

4 Read the voltage in the display.

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PRECAUTIONS:-

1 All connections should be tight.

2 All steps should be followed carefully.

3 Reading and calculations should be taken carefully

4 Don't touch the live terminals.

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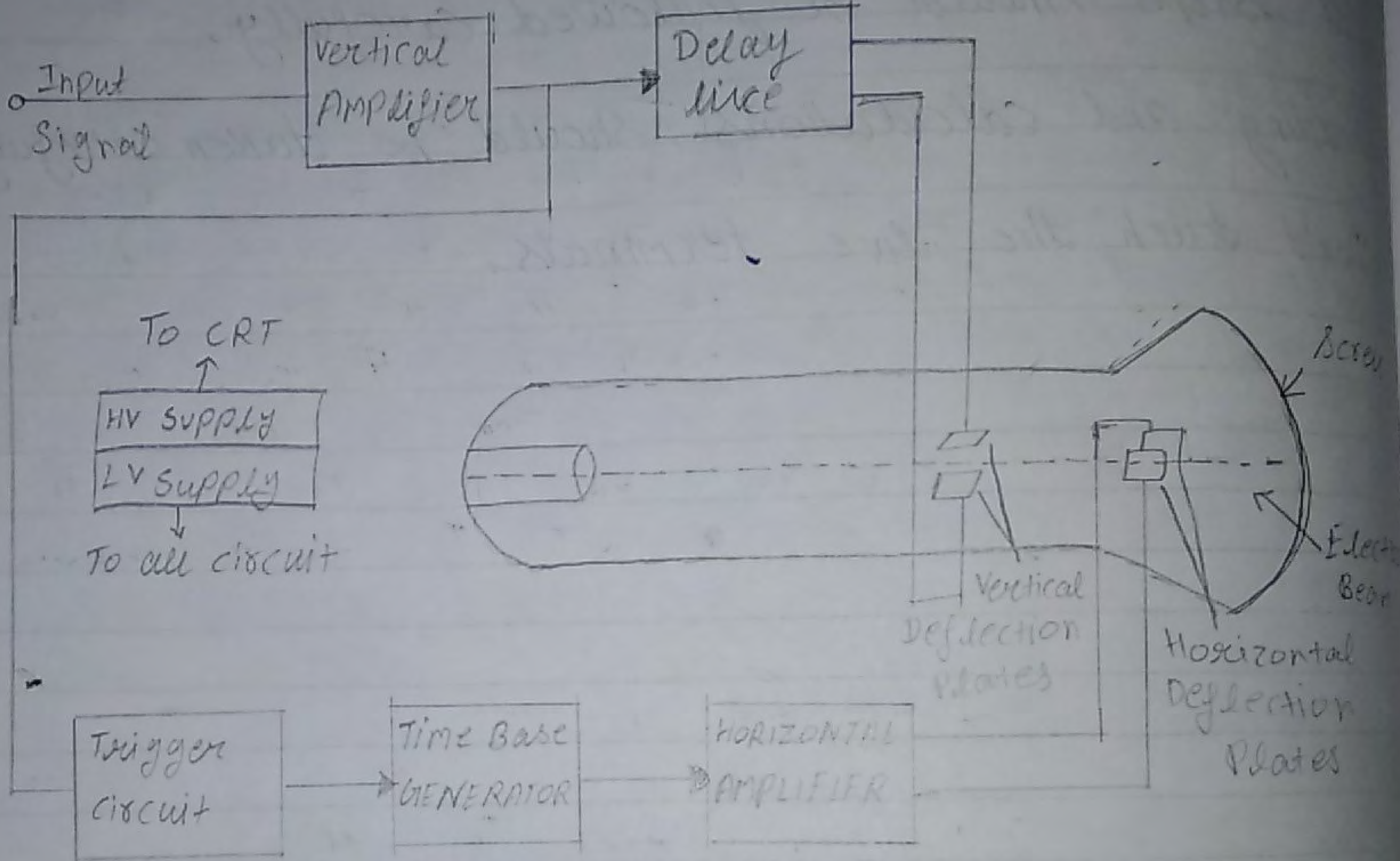
Black Diagram :



Date

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Experiment - 2

Object: Study of CRO & simple measurement of Voltage, frequency using CRO

Apparatus: CRO, Signal generator etc.

Theory:

1 Block Diagram Description of CRO:

The instrument employs a cathode ray tube (CRT) which is the heart of the oscilloscope it generates the electrons beam. accelerates the beam to a high velocity deflect the beam to creat the image and contains a phosphor screen where the electron beam eventually becomes visible. For accomplishing these ~~task~~ tasks varius ~~electrical sigi~~ signals and voltages are required. which are provided by the power supply circuit of oscillioscope Low voltage supply is required for the heater of the electric gun for generation of electron beam and high voltage of the order of ~~few thoush~~ thousand volts is ~~requi~~ required for other control circuits of the oscilloscope say a few hundred volts is required for other control circuits of the oscillascope Horizontal and vertical deflection plates are

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fitted between electron gun and screen deflect the beam according to the input signal. Electron beam strikes the screen and creat a visible spot. This spot is deflected on the horizontal direction (X-axis) with constant time dependent rate this is accomplished by a time base circuit diflection plates through the vertical amplifier, which raises the patential of the input signal to a level that will provide usable deflection of the electrons beam Now electron beam deflects in two directions horizental on X axis and vertical on Y axis. A triggering circuit is provide for synchronizing two type of deflections so that horizontal deflection starts at the same point of the input vertical signal each time it sweeps. A basic block diagram of a genral purpose oscilloscope is shown in figure.

II Front panel controls:

1 Intensity and power ON:

On clockwise rotation, CRO will be turned ON and on further clockwise rotation will adjust the brigthness ie intensity of the waveform under study. ~~adjust~~

2 Focus:-
This control knob adjust the CRT focus.

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3 HOR Position :-

For two IP CRO The waveform can be shifted horizontally to either right or left. The clockwise rotation move the waveform to right while anticlockwise rotation move the waveform to upwards while anticlockwise rotation moves the waveform to left.

4 vertical position :-

(For two type IP CRO knobs are present) The waveform can be shifted vertically to either UP or Down. The clockwise rotation moves the waveform upwards while anticlockwise rotation move the wave form downwards.

5 Neon lamp or LED indicator.

Lighted Neon/LED indicates power on.

6 vertical Gain :

This knob can be used to control the gain of the vertical amplifier. it adjust the amplitude of waveform in vertical direction.

7 Time Base Frequency :

Time base rotary switch when rotated in clockwise direction, increases frequenty while in anticlockwise

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direction decreass frequency as per the range mentoned at the knob.

Screen :-

It consists of diffrent vertical and horizontal lines, farming graphical pattern on which different type of waveforms are their respective amplitude and frequency etc are calculated.

Cal 1v :-

(Calibration value may change depending on the manufacture) it gives a calibration 1V peak to peak

Input terminal :-

For dual channel oscilloscope, Two different input terminals are present.

Mode select :-

This knob is a rotary switch and is used to select.

(a) X-Y Mode, (b) CH1 (c) CH2 (d) dual Mode.

Level :-

This knob adjusts the trigger level on I/P signal. It is used to get stable W/f on the screen.

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Conclusion :-

The CRO has been studied in detail and different measurement using CRO has been performed.

(12)

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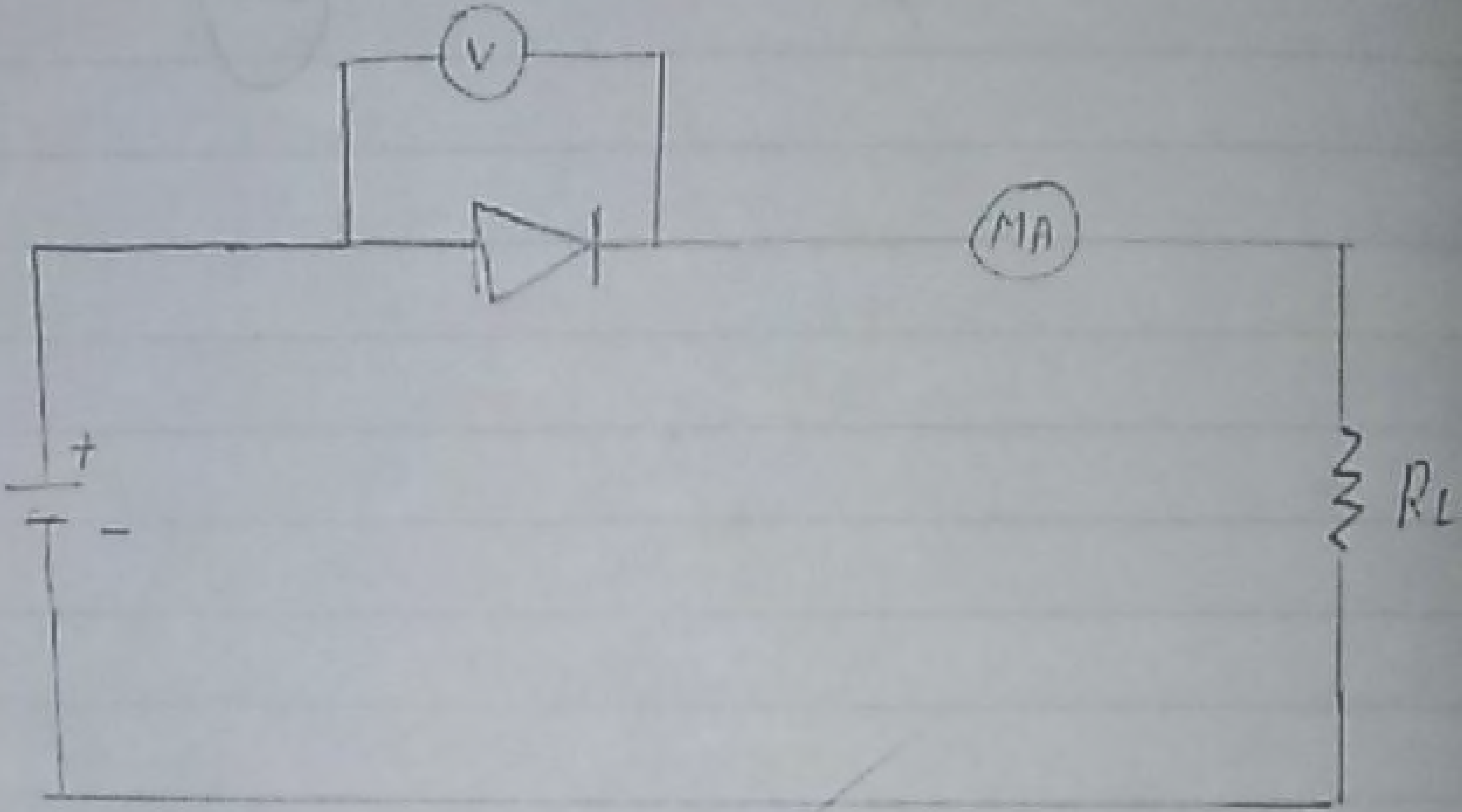
V
MA
+
-
RL

Date

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Experiment 3

Object :- To determine the V-I characteristic of a PN junction diode in forwar ~~bai~~ biassed mode.

Apparatus used :- PN junction Diode IN400, Resistance, Regulated power supply, DC milli ammeter, DC voltmeter, Bread board and Connecting wires.

Theory :-

Donor impurities (Pentavalent) are introduced into one side and acceptor impurities into the other side of a singal crystal of an intrinsic semiconductor to from p-n diode with a junction called depletion region (this region is depleted off the charg carriers). This region gives rise to a potential barrier V_γ called cut-in voltage. This is the voltage ~~acess~~ across the diode at which it starts conducting. The P-N junction can conduct beyound this potential. The P-N junction supports uni-directional current flow if +ve terminal of the ~~x~~ input supply is connecting to anode (P-side) and -ve terminal of the input supply is connected to cathode (N-side), then diode is said to be forward biassed. In this condition the hight of the potential barrier at the junction

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is lowered by an amount equal to given forward baising voltage. Both the holes from p-side and electrons from n-side cross the junction simultaneously and constitute a forward current (injected-minority current - due to holes crossing the junction and entering N-side of the diode due to electrons crossing the junction and entering P-side of the diode). Assuming current flowing through the diode to be very large, the diode can be approximated as short-circuited switch.

Observation table

S.No.	Potential (V)	Current (mA)
1	0.7	1
2	1.4	7.5
3	2	12.5
4	2.5	22.5
5	5	50

Result :- Discuss the nature of the curves obtained for forward bias mode.

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Precautions:-

All connections should be tight.

All steps should be followed carefully.

Readings and calculations should be taken carefully.

Don't touch the live terminals.

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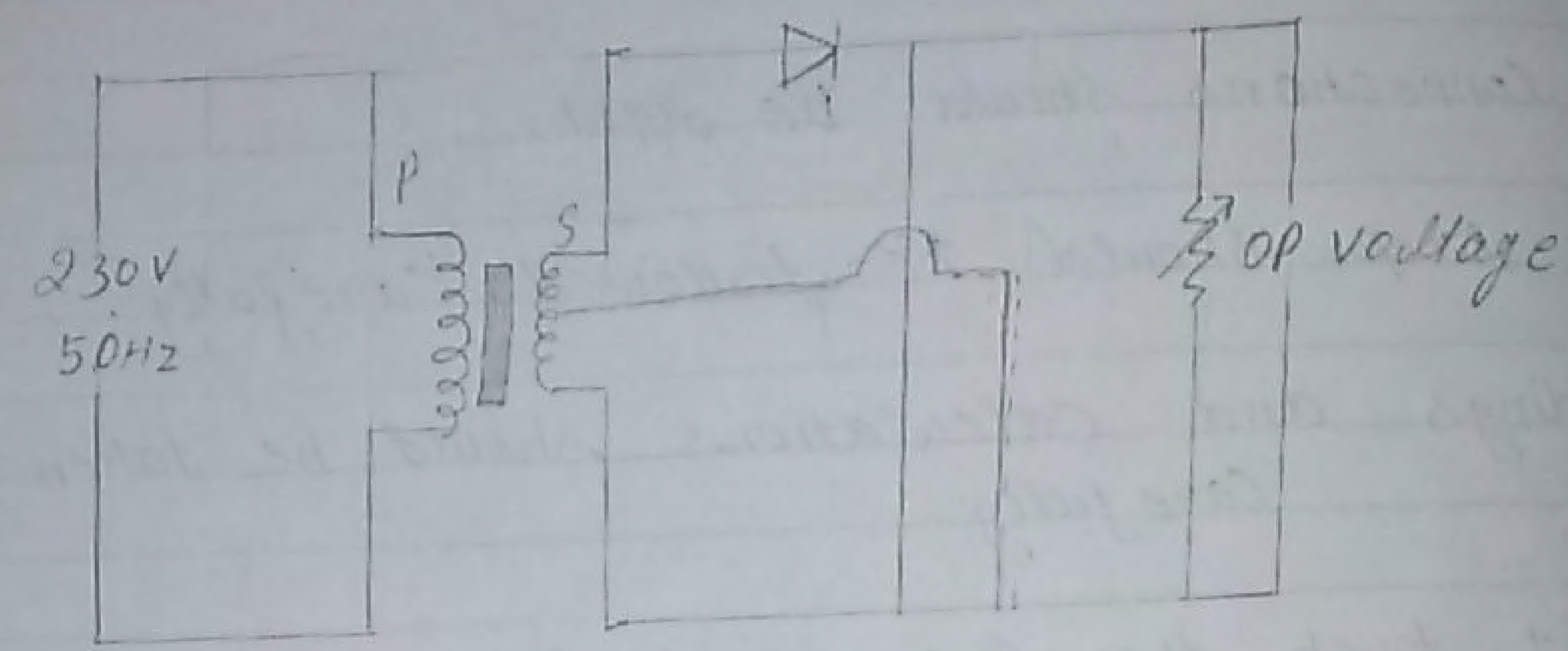
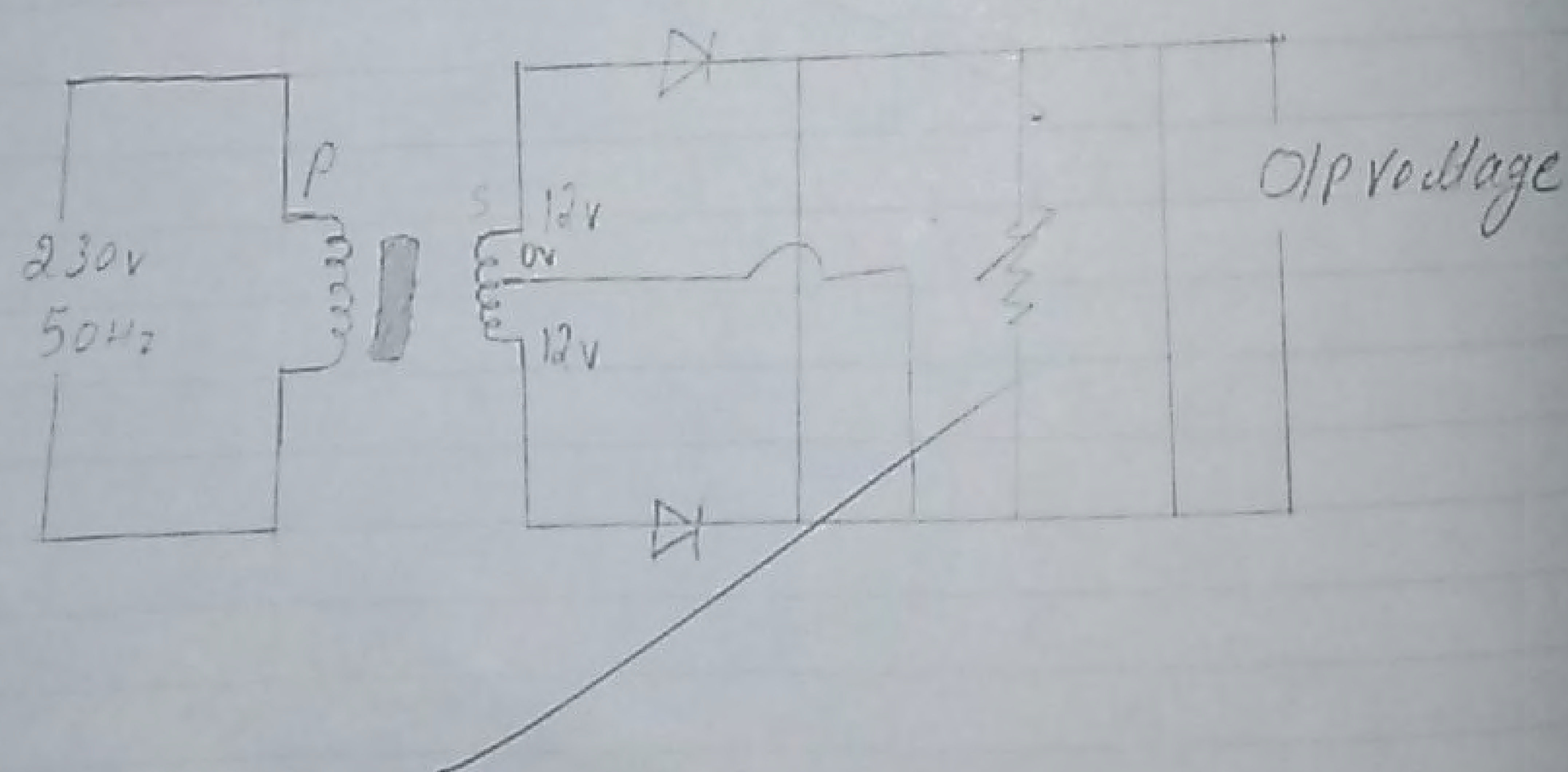

P
S
230V
50Hz
O/P voltage


P
S
12V
0V
12V
230v
50Hz
O/P voltage

Date

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Experiment 4

Object : Study of full wave rectifier with and without filter.

Apparatus : AC supply (12V-0-12V), PN Diodes IN4007, Capacitor, connecting wires, variables resistor (0-10) kΩ, Breadboard, Multimeter.

Theory : The circuit of a center-tapped full wave rectifier uses two diode 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 is conducts and current flows through load resistor RL. During Negative half diode and diode D2 becomes forward biased and D1 reverse biased. Now D2 conducts and current flow through the load resistor RL in the same direction. There is a continuous current flow through the load resistor RL during both the half cycles and will get unidirectional current as shown in the model graph. The difference between fullwave and half wave rectifier is that a full waves rectifier allows unidirectional (one-way) current

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To the load during the entire 360 degrees of the input signal and half-wave rectifier allows this only during one half cycle (180 degree).

Procedure

1 Connections are made as per the circuit diagram.

2 Connections the ac mains to the primary side of the transformer and the secondary si to the rectifier.

3 Measure both ac voltage at the input side of the rectifier.

4 Measure both ac and dc voltage at the output side the rectifier.

5 Find theoretically dc voltage by using the formula.

$$V_{dc} = \frac{2V_m}{\pi} = \frac{2\sqrt{2}}{\pi} V_{rms}$$

The Ripple factor is calculated by using formula

$$r = \frac{\text{ac output voltage}}{\text{bc output voltage}} = \sqrt{\left(\frac{V_{rms}}{V_{dc}}\right)^2 - 1}$$

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6 The theorietical values of Ripple factors with and without capacitor are calculated.

7 From the value of Vac and Vdc practical values of Ripple factors are calculated. The practical values are compared with theoretical values.

Observations :

S.No	Parameters	Full wave Rectifier without capacitor filter	Full wave Rectifier with capacitor filter
1	voltages at the diode input Vrms in volts	3.26V	0.01
2	D.C. output voltage (measured) Vdc in volts	6.35	10.25
3	D.C. output voltage (calculated) i.e. Vdc Ripple factor	6.35	10.25
4	$r = \sqrt{\left(\frac{V_{rms}}{V_{dc}}\right)^2 - 1}$	0.497	0.0097

Result :

The Ripple factor = 0.492 (with capacitor filter)

The Ripple factor = 0.0097 (without capacitor filter)

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Precautions:

1 All connections should be tight.

2 All steps should be followed carefully.

3 Readings and calculations should be taken carefully.

4 Don't touch the live terminals.

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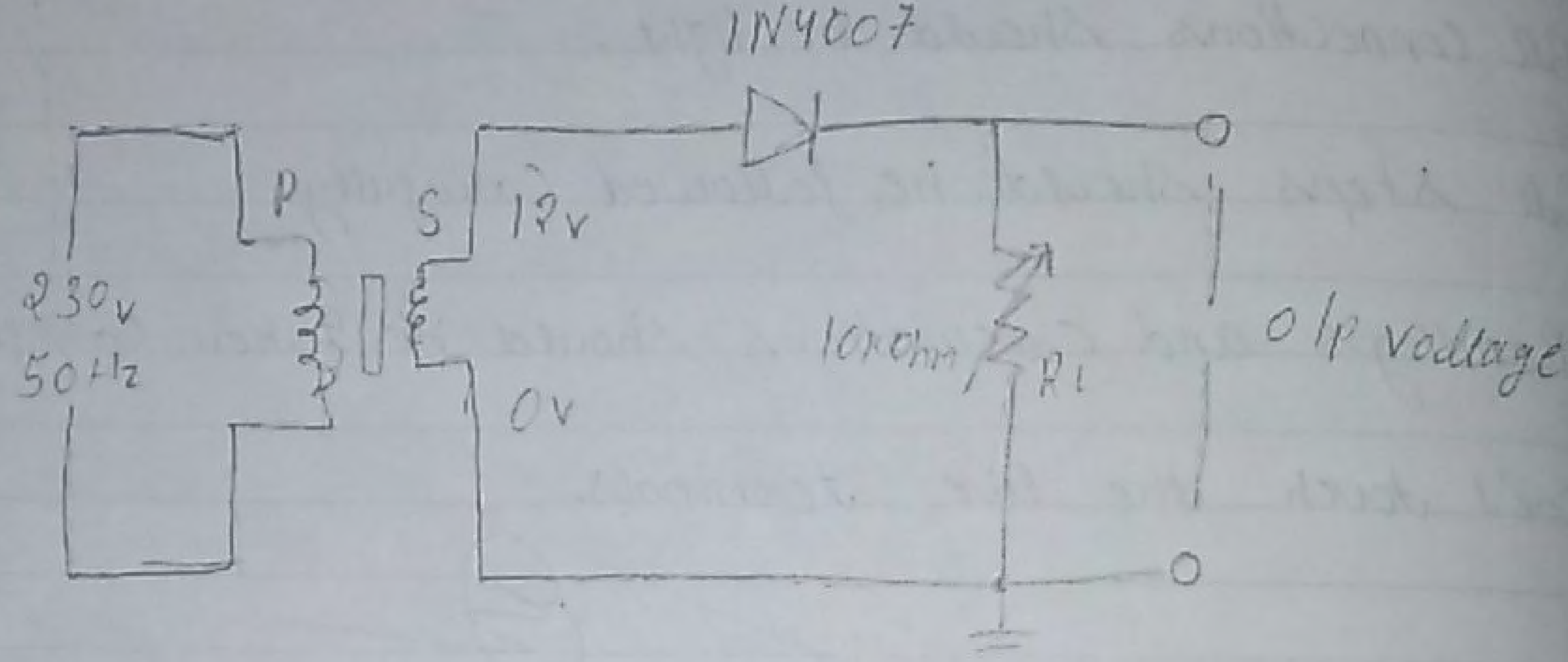
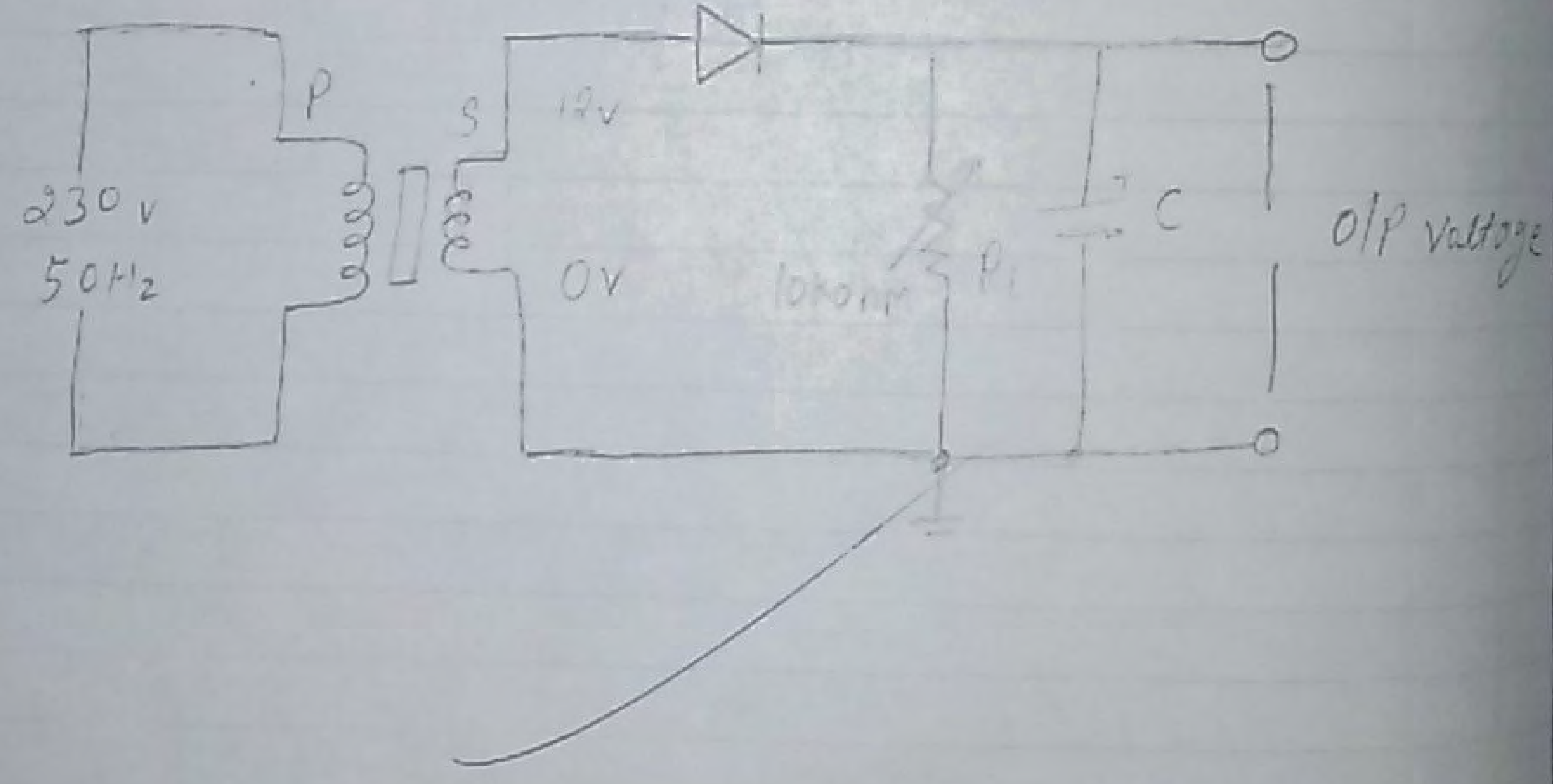
Without Filter



With Filter



Experiment 5

Object: Study of Half-Wave Rectifier with and Without filter.

Apparatus:- Ac Supply 12v, PN Diode 1N4007, Capacitor, Variable Resistor, Connecting wires, Breadboard, Multimeter

Theory:-

During positive half-cycle of the input voltage, the diode D1 is in forward bias and conducts through the load resistance RL. Hence the current produces an output voltage across the load resistor RL which has same shape as the positive half cycle of input voltage.
During the negative half cycle of the input voltage, the diode is reverse biased and there is current through the circuit. ie. the voltage across RL is zero.
The average value of the half wave rectifier o/p voltage is the value measured on dc voltmeter.

Procedure:-

1 Connecting are made as per the circuit diagram.

2 Connecting the primary side of the transformer

to ac mains and the secondry side to the rectifier input.

3 By the multimeter, measure the ac input Voltage of the rectifier and, ac and dc Voltage at the output of the rectifier.

4 Find theoretically dc Voltage by using the formula

$$V_{dc} = \frac{V_m}{\pi} = \frac{\sqrt{2}}{\pi} V_{rms}$$

The Ripple factors is calculated by using the formula

$$\gamma = \frac{\text{ac output voltage}}{\text{dc output Voltage}} = \sqrt{\left(\frac{V_{rms}}{V_{dc}}\right)^2 - 1}$$

Observations:

S.No	Parameters	Half wave Rectifier Capacitor filter	Halfwave Rectifier with Capacitor filter
1	Voltage at the diode input V_{rms} in vols.	5.29 v	14.43 v
2	DC output voltage V_{dc} in Volts	6.31 v	14.02 v
3	D.C output voltage	7.76 v	1.22 v
4	Ripple factor $\gamma = \sqrt{\left(\frac{V_{rms}}{V_{dc}}\right)^2 - 1}$	4.229	0.087

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Result

The Ripple factor = 0.087 (with Capaciter Filter)

The Ripple factor = 1.229 (with Capacitor Filter)

Precautions:

1 All connections should be tight.

All steps should be followed carefully.

Readings and calculations should be taken carefully.

Don't touch the live terminals.

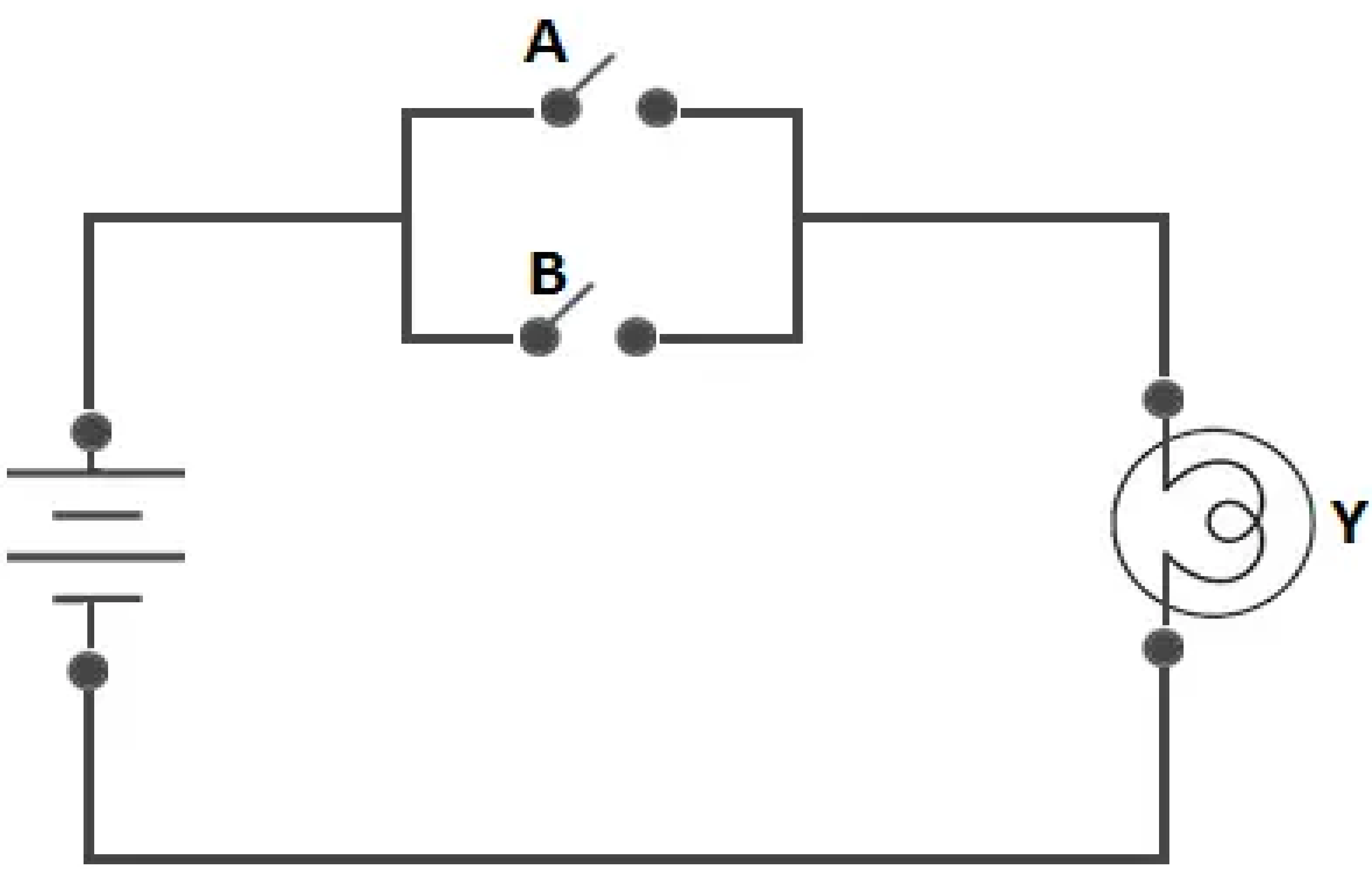
Teacher's Signature ____

OR GATE

Symbol

A	B	Y = A + B
0	0	0
0	1	1
1	0	1
1	1	1

Truth Table



Electrical Circuit

Date

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Experiment - 6

Object :- Verify the OR gate.

Apparatus :- Bread boad, LED, Connecting wire, D.C supply, IC 7432.

Theory : The OR gate is used to perform the logical addition also known as the OR junction. An OR gate has two or ~~th~~ more input signals and only one output signal. for an OR gate, the output of voltage is high if any one or all the input Voltage are high.

the output of OR gate is 1 if either one or all inputs are 1

The logical equation of OR gate is $Y = A + B$

Use : In Calculator, Computer and digital watch

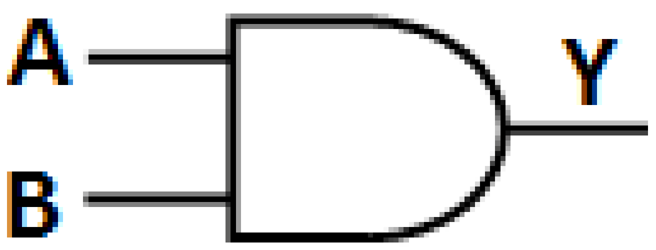
Precaution :

1 All Connection should be tight.

2 All steps should be followed carefully.

Teacher's Signature

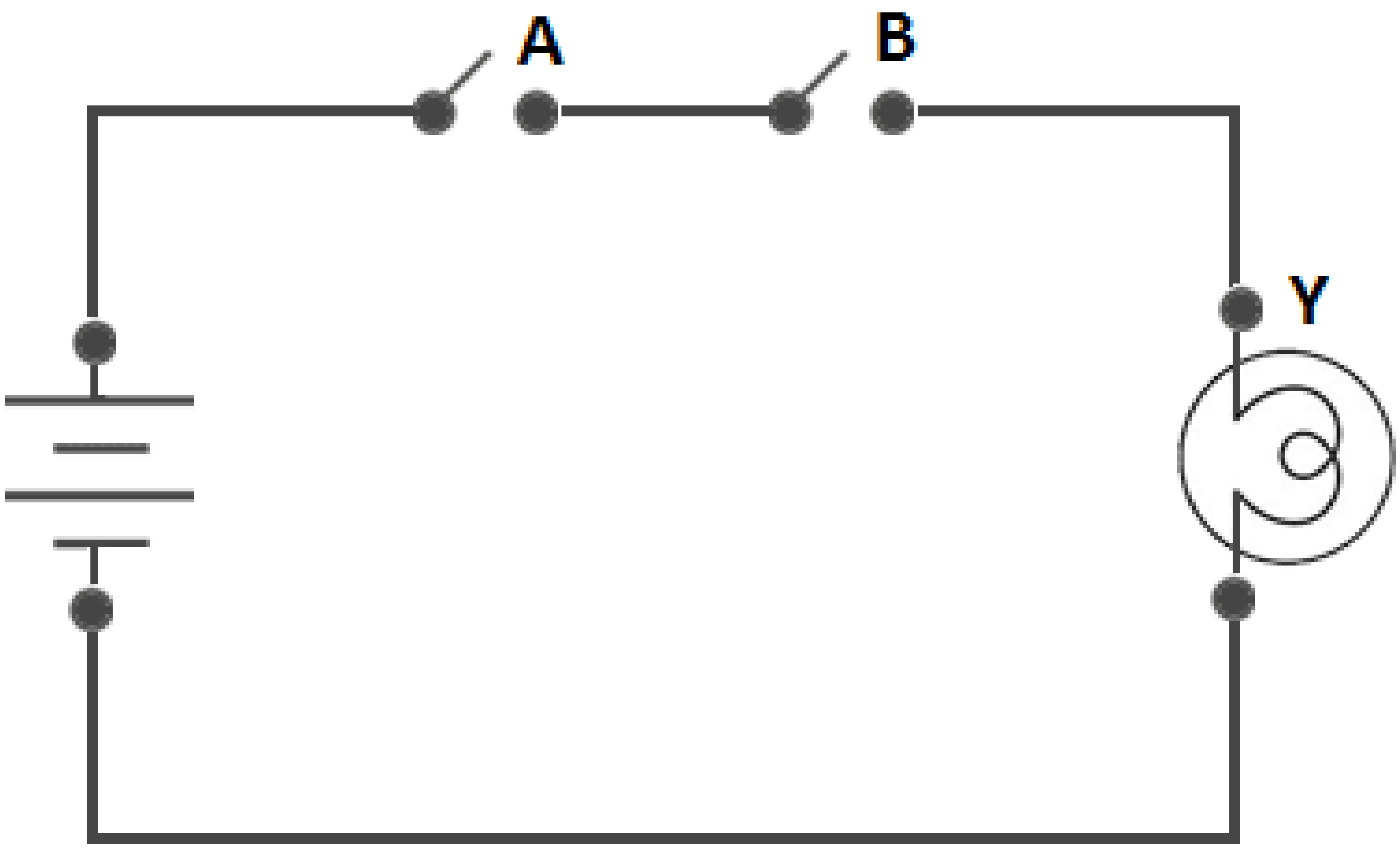
AND GATE



Symbol

A	B	Y = A * B
0	0	0
0	1	0
1	0	0
1	1	1

Truth Table



Electrical Circuit

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Experiment - 7

Object : To verify the AND gate.

Apparatus : Bread board, connecting wires, LED, D.C supply . IC 7408.

Theory : The AND gate is used to perform the logical multiplication also known as AND function the gate has two or more inputs and a signal single output of AND gate is high only if all inputs are high.
The output of AND gate is 1 only if all the inputs are 1.

The logical equation of AND gate is $Y = A.B$
The above logical equation means that Y is true if both A and B are true.

Use :
Digital watch, Calculator and Computer.

Precautions :-
1. All connection should be tight.
2. All steps should be followed carefully.

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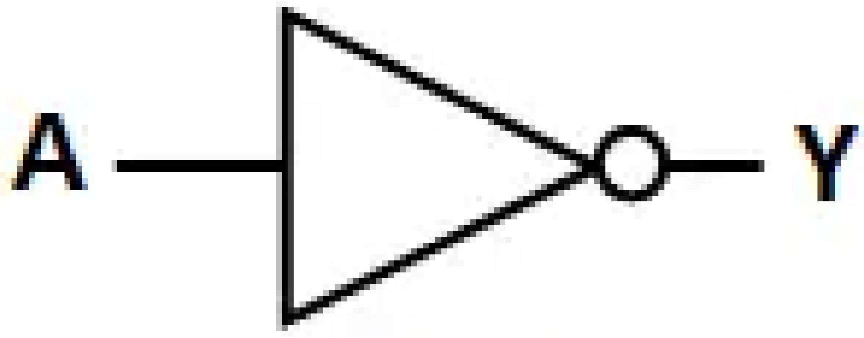
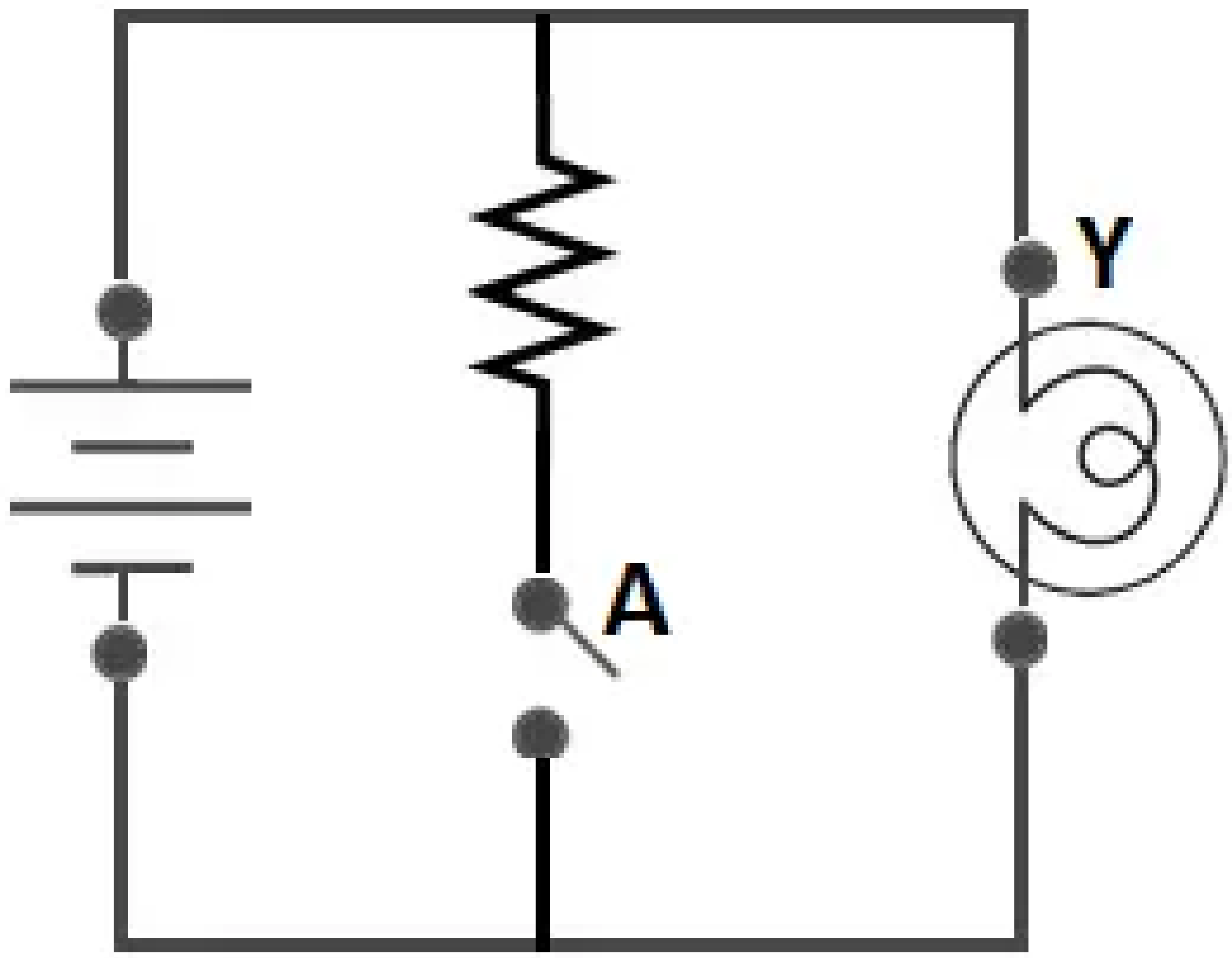
NOT GATE



Symbol

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

Truth Table



Electrical Circuit

Experiment - 8

Object :- verify the NOT gate.

Apparatus :- Bread boad, D.C supply, Connecting wire, I C 7404.

Theory :- The NOT gate or inverter is used to perform a basic logic function called inversion also known as complementationl. This means that an inverter or NOT gate changes one logic level to the opposite level. In other words, it changes a 1 to a 0 and a 0 to a 1. NOT gate has only one input and one output. Not gate is known as inverter because output state is always opposite to the input state.

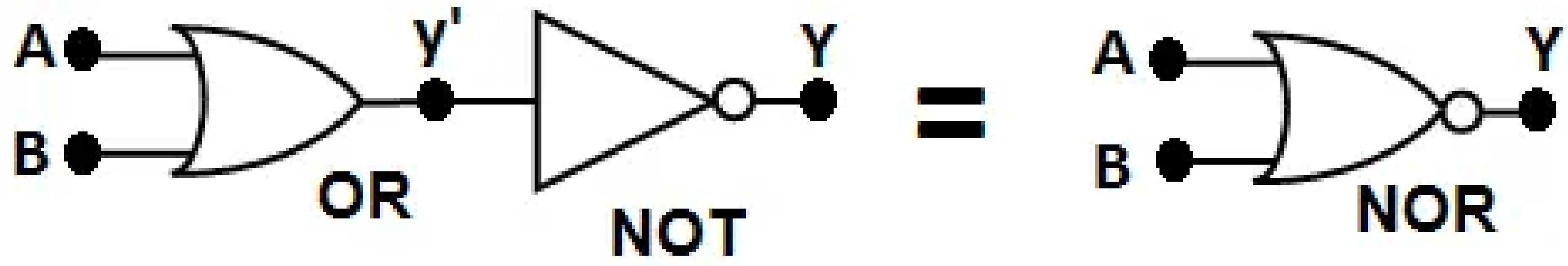
Use :

In calculator, digital watch and computer.

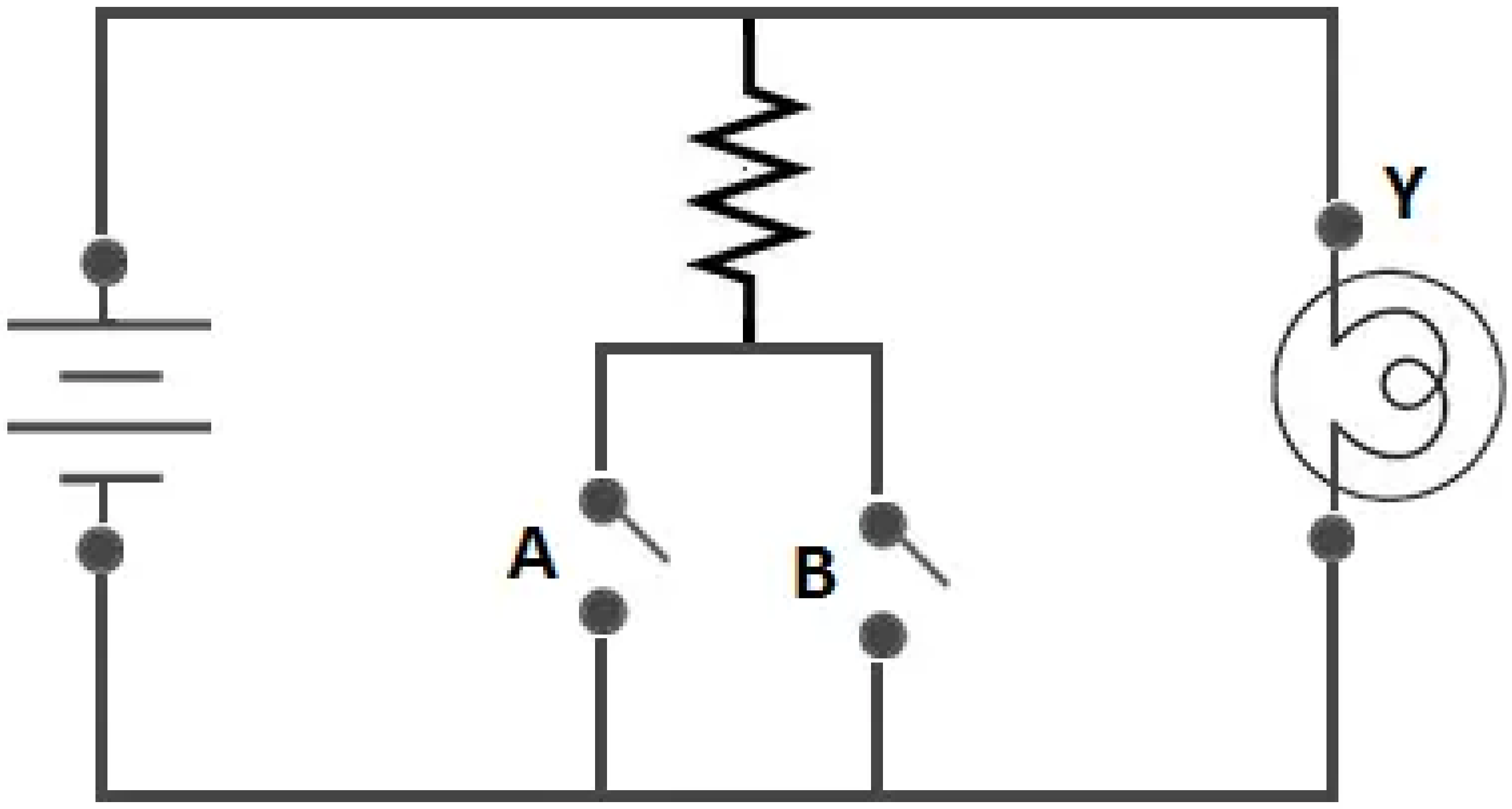
Precautions:

1 All connection should be tight.

2 All steps should be followed carefully.



NOR GATE



Electrical Circuit

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

Truth Table

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Experiment - 9

Object : To verify the NOR gate

Apparatus : Bread boad, Connecting wire, d.c Supply, I.C 7402

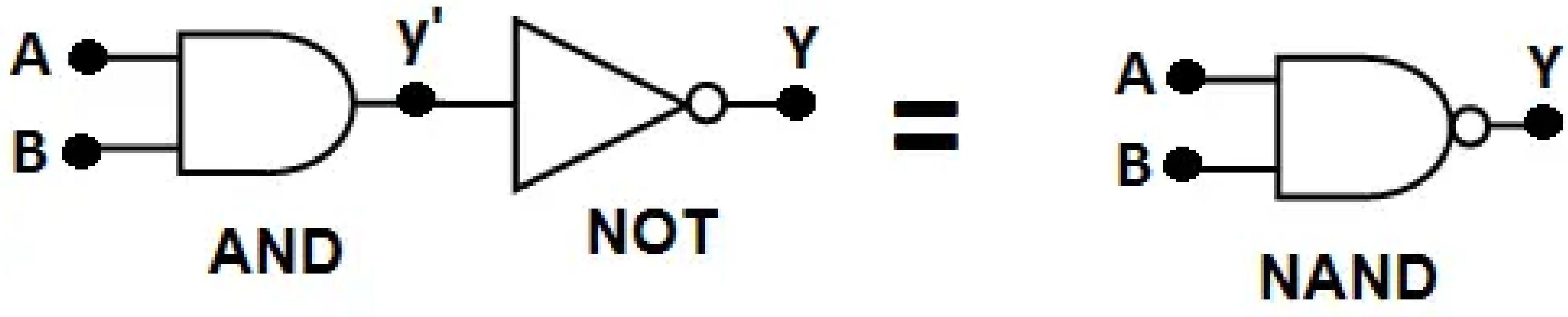
Theory : The word NOR implies an OR function with an inverted output of a NOR gate is high (1) only if all input are low. Hence from symbol, it is clear that NOR gate operates like an OR gate followed by an inverter. The logical function of NOR gate may be stated by equation $Y = \overline{A+B}$

In digital watch, calculator and computer

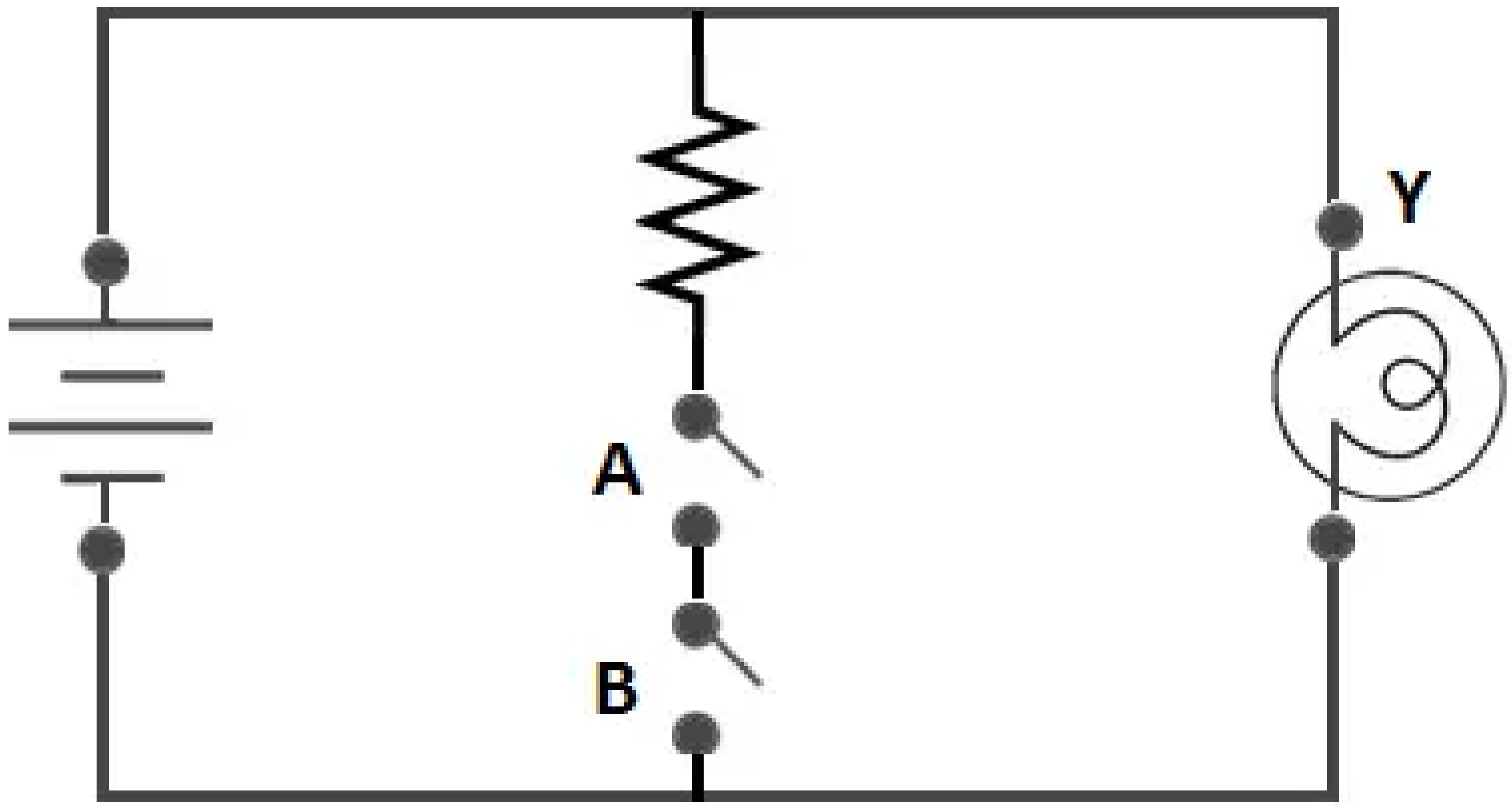
1 All connection should be right.

2 All steps should be followed carefully

Teacher's Signature ______



NAND GATE



Electrical Circuit

A	B	$Y = \overline{A*B}$
0	0	1
0	1	1
1	0	1
1	1	0

Truth Table

Date

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Experiment -10

Object : To verify the NAND gate.

Apparatus: Bread board, Connecting wire, d.c Supply.

Theory:

The word NAND implies on AND function with an Invested output. The output of a NAND gate is low (0) only if all the input are high. Hence from symbol it is Clean that NAND gate operator like a NAND gate followed by an Inverter.

To the logical function of NAND gate may be stated by equation $Y = \overline{A.B}$

Use : In digital, watch, calculator and Computer

Precautions:

1 All Connection should be tight

2 All steps should be followed carefully.

Teacher's Signature