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GUNUPUR, Dist-Rayagada(O)

CONTENTS

EXPERIMENT NO. :-1

AIM OF THE EXPERIMENT:-

To study about different electronic components and devices.

OBJECTIVE:-

Familiarization of electronic components such as Resistor, capacitor, Bread board, LEDs, ICs, Diode, Transistors etc. Testing and measurement of component values using digital multi meter.

COMPONENTS REQUIRED:-

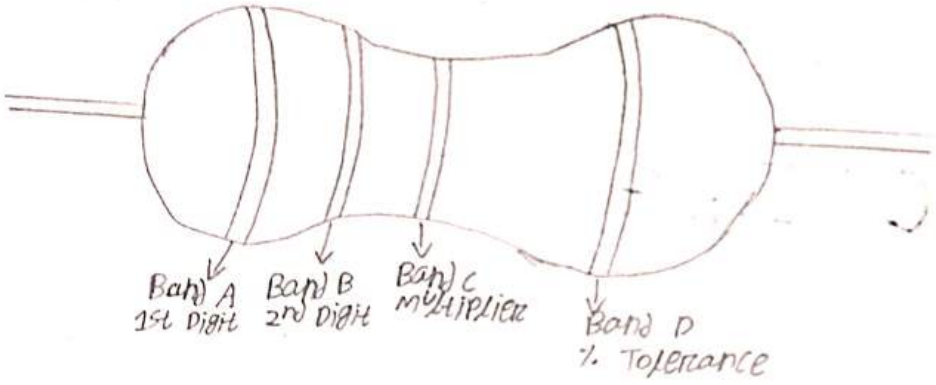
Digital Multi meter
Different Component :- Resistor, Diode, capacitor and transistor.

THEORY:-

RESISTOR:-

Most axial resistors use a pattern of colored strips to indicate resistance. A "4 Band" identification is the most commonly used color coding scheme on all resistors. It consists of four color bands that are painted around the body of the resistor.

EXPERIMENT NO -1

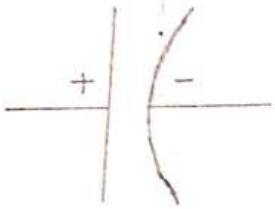


Resistor values are always coded in "ohms" (Ω).

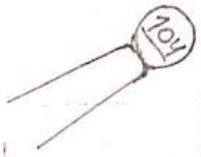
Colorz	Digit	Multiplierz	Tolerance (±)
Black	0	10^0 (1)	
Brown	1	10^1	1
Red	2	10^2	2
orange	3	10^3	
Yellow	4	10^4	
Green	5	10^5	0.5
Blue	6	10^6	0.25
violet	7	10^7	0.1
Grey	8	10^8	
white	9	10^9	
Gold		10^{-1}	5
Silver		10^{-2}	10
(none)			20

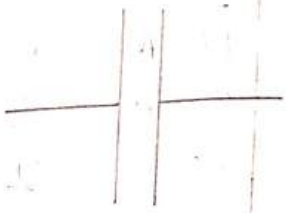
CAPACITOR:-

A capacitor is a device which stores electrical charge. A basic capacitor has two parallel plates separated by an insulating material.
The unit of capacitor is "Farad" (F).
Capacitance values are normally smaller such as μf, nf, pf.



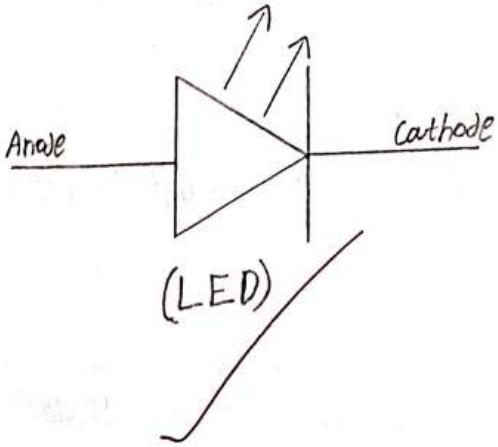
Polarized Electrolytic capacitor and its electric symbol





Non-polarized ceramic capacitor and its electric symbol

(DIODE)



(LED)

Electrolytic Capacitor:- An electrolytic capacitor is a type of capacitor that uses an electrolytic, an ionic conducting liquid, as one of its plates, to achieve a larger capacitance per unit volume than other types. They are used in relatively high current and low frequency electrical circuits.

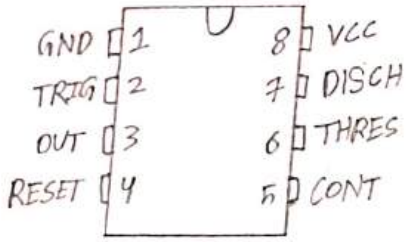
Ceramic Capacitor:- These capacitors are generally non polarized and almost as common as radial electrolyte capacitors. Generally, they use an alpha numeric marketing system. The number of part is the same as resistor except that the value represented is in pf. They may also be written out directly for instance 2n2 = 2.2nf.

BREAD BOARD:-

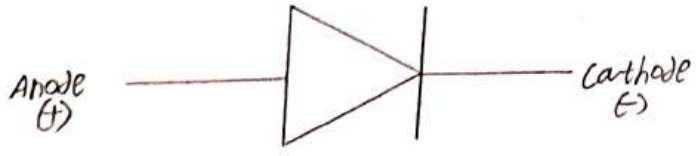
A bread board is used to build and test circuits quickly before finalizing any circuit design. The bread board has many holes into which circuit components like ICs and Resistors can be inserted. A typical bread board.

LED:-

A light emitting diode (LED) is a semiconductor device that emits light when an electric current is passes through it. Light is produced when the particles that carry the current (known as electrons and



INTEGRATED CIRCUIT (IC)



(P-N Junction Diode)

holes) combines together with in the semi conduction material.

INTEGRATED CIRCUIT (IC):-

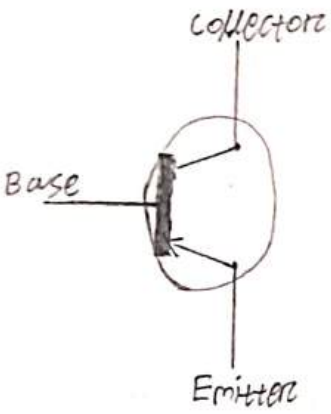
An integrated circuit (IC) is a small semiconductor based electronic device consisting of fabricated transistors, resistors and capacitors. Integrated circuits are the building blocks of most electronic devices and equipment.
An integrated circuit also known as chip or microchip.

DIODE:-

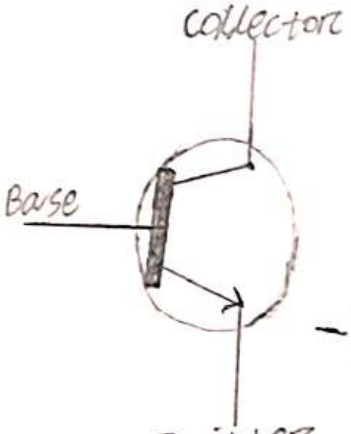
A diode is a specialized electronic component with two electrodes called the anode and the cathode.
Diodes are basic unidirectional semiconductor devices that will only allow current to flow through them in one direction only.

Semiconductor Diode:- A P-n junction diode is a two terminal devices, which allows the electric current in only one direction which block the electric current in opposite or reverse direction. If the diode is forward biased, it allows the electric current flow on the other hand if the diode is reverse biased it blocks the electric current flows. P-N junction semiconductor device.

zener Diode



P-n-P



n-P-n

(TRANSISTOR)

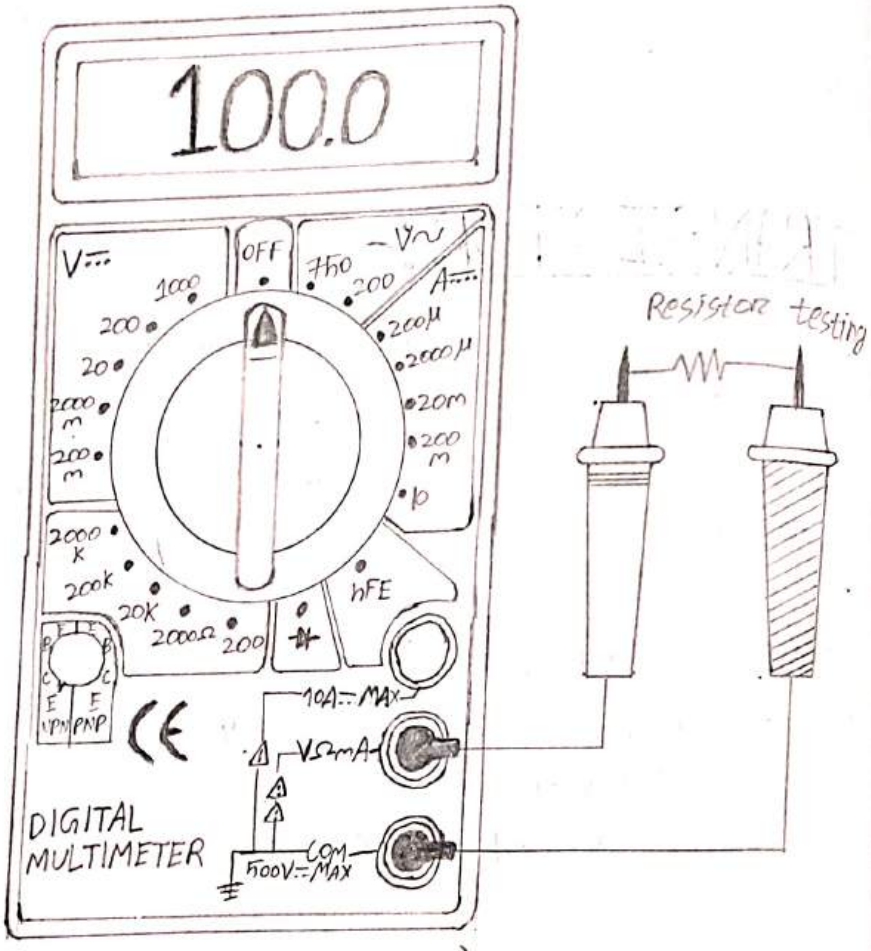
Zener Diode:- A heavily doped semiconductor diode which is designed to opposite in reverse direction is known as the zener diode. In other words, the diode in which specially designed for optimizing the break down region is known as the zener diode.

TRANSISTOR:-

A transistor is a semiconductor device used to amplify or switch electronic signals and electrical power. It is composed of semi conduction material usually with at least three terminals for connection to an external circuit.
The transistor has three terminals named as Emitter, Collector and Base.
The Transistor is of two types:-

(a) N-P-N type
(b) P-N-P type

(a) N-P-N type:- The transistor in which one P-type material is placed between two N-type material is known as N-P-N transistor. In N-P-N transistor the direction of movement of an electron is from the emitter to collector (current is from collector to emitter) region due to which the current consistutes in the transistor.


100.0
V⎓
1000
200
20
2000 m
200 m
OFF
⁂ Ω
200
A⎓
200µ
2000µ
20m
200 m
10
2000 K
200K
20K
2000Ω
200
hFE
10A⎓ MAX
VΩmA
COM
500V⎓ MAX
DIGITAL MULTIMETER
Resistor testing

(MULTIMETER)

(b) P-N-P type:- The transistor in which one N-type material is placed between two P-type materials is known as P-N-P transistor. In P-N-P transistor the direction of movement of an electron is from the collector to emitter (current is from emitter to collector) region due to which the current constitutes in the transistor.

MULTIMETER:-

A digital multi meter (DMM) is a test tool used to measure two or more electrical values principally voltage (Volts), current (amps) and resistance (Ohms). It is a standard diagnostic tool for technicians in the electrical / electronic industries.

TABULATION:-

RESISTOR:-

Sl. No.	Colour of rings				True value (Ω)	Measured value (Ω)	% of Error
	1	2	3	4			
1	Brown	Black	orange	silver	10KΩ ± 10	10.34KΩ	3.4
2	Red	Red	Yellow	Golden	220kΩ ±5	23.2 kΩ	5.45
3	Yellow	violet	Brown	Golden	470Ω ±5	460Ω	-2.12
4	Brown	Black	Black	Golden	10Ω ±5	16Ω	9.1

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CAPACITOR:-

Sl. No.	Type of Capacitor	True value (μf)	Measured value (μf)
1	Electrolytic	100	123.1
2	ceramic	10×10^4	0.20

DIODE:-

Sl. No.	Type of Diode	True value	measured value
1	LED		Glow
2	zeherd Diode	0.7	814
3	Silicon Diode	0.7	600

TRANSISTOR:-

Sl. No.	Type of Transistor	Gain (β)
1	PNP	306
2	NPN	462

CONCLUSION:-

In this experiment we have studied about different component like resistor, capacitor, diode and transistor. and the percentage of error in resistor is 3.9575%.

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EXPERIMENT No. :- 2

Aim of the experiment:-

To study about ohm's law and realize the relationship between voltage and current.

Apparatus Required:-

Sl. NO	Name of the experiment	Range	TYPE	Quantity
1	Ammeter	0-1A AC	MI	1
2	voltmeter	0-300V AC	MI	1
3	Incandescent lamp	230V, 200W	WW	1
4	Connecting wires	230V, 5A, 1/18	PVC coated	As per required
5	Avto transformer (variac)	0-270V, 15A	WW	1

Theory:-

There are two types of lamp which are in common use. one is filament lamp and the other is gaseous discharge lamp. The filament lamps are incandescent lamp. The filament of these lamps when heated due to electric current emits radiation of visible spectrum. The filament is mostly made up of tungsten wires whose melting point is 3400°C at normal.

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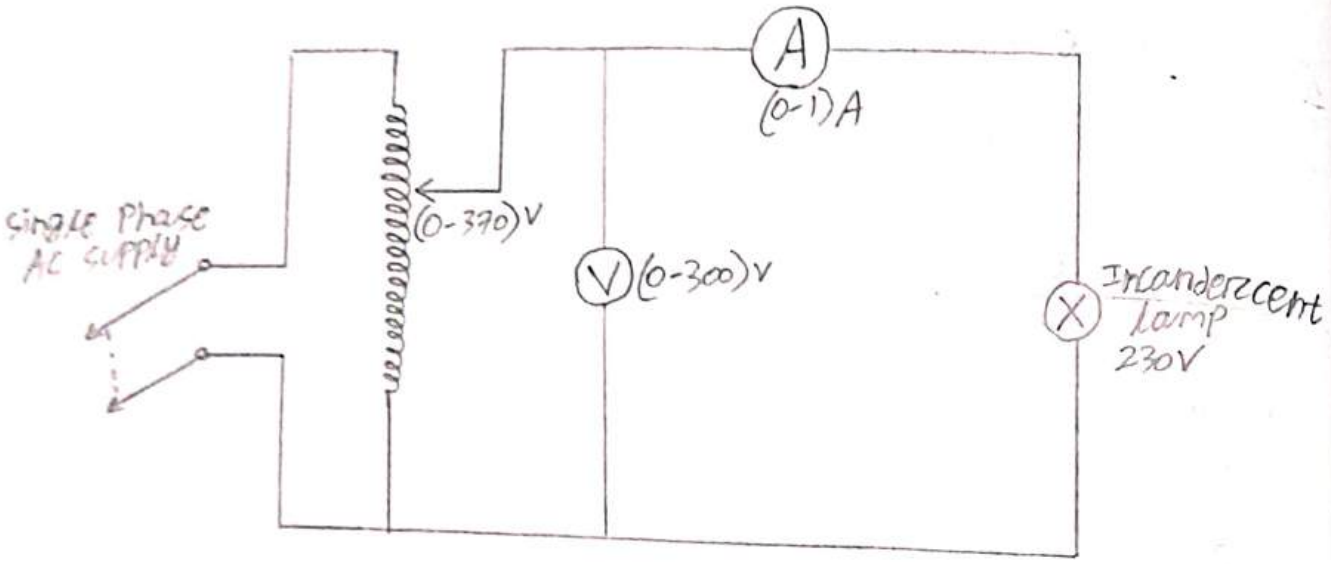

(V-I) Characteristic of
Incandercent lamp

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Scale:
In X-Axis - 1 unit = 0.02A
In Y-Axis - 1 unit = 10V

270
220
210
200
190
180
170
160
150
140

Voltage (V) →

0.60 0.64 0.68 0.72 0.76 0.80

Current (I) →

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Procedure :-

i) The circuit is connected according to the circuit diagram.

ii) By adjustment of varriac to 100v, the ammeter and voltmeter reading were taken.

iii) The reading of voltage by vary in steps of 20 volt of voltmeter & ammeter were taken.

iv) The voltage is varied up to 230 volts and 5-10 reading were taken.

v) The V-I graph has been drawn in the ~~graph paper~~.

Tabulation:-

Sl. No.	Voltmeter Reading	Ammeter Reading	$R=\frac{V}{I}$ in ohm
1	230	0.78	294.87
2	220	0.77	285.71
3	210	0.75	280.00
4	200	0.73	273.97
5	190	0.71	267.60
6	180	0.69	260.86
7	170	0.67	253.73
8	160	0.65	246.15
9	150	0.63	238.09
10	140	0.61	229.50

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Mean Resistance,

$$R = \frac{\Sigma R}{10} = 263.048\,\Omega$$

CONCLUSION:-

From the above observation table Vα I.

28/1/25

Experiment No:-3

AIM OF THE EXPERIMENT:-
Study and use of oscilloscope and signal generator to view waveforms and measure amplitude and ~~frequency~~ of a given waveform.

OBJECTIVE:-
- To introduce the basic structure of a cathode ray oscilloscope.
- To get familiar with the use of different control switches of the devices.
- To visualize an ac signal, measure the amplitude, frequency and time period.

COMPONENTS REQUIRED:-
- Cathode Ray oscillator (CRO)
- Function generator (FG)
- connecting probes.

THEORY:-
The cathode ray oscilloscope (CRO) is a common laboratory instrument that provides accurate ~~time~~ and amplitude measurements of voltage signals even a wide range of frequencies. It is reliability, stability and ease of operation makes it suitable as a general purpose of laboratory instrument. A general purpose oscilloscope consists of the following parts:-
→ cathode ray tube
→ vertical amplifier
→ Delay line
→ Time base generator

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→ Horizontal amplifier
→ Trigger circuit
→ Power supply

CATHODE RAY TUBE:-

It is the heart of the oscilloscope when the electrons emitted by the electron gun strikes the phosphor screen, a visual signal is displayed on the CRT.

VERTICAL AMPLIFIER:-

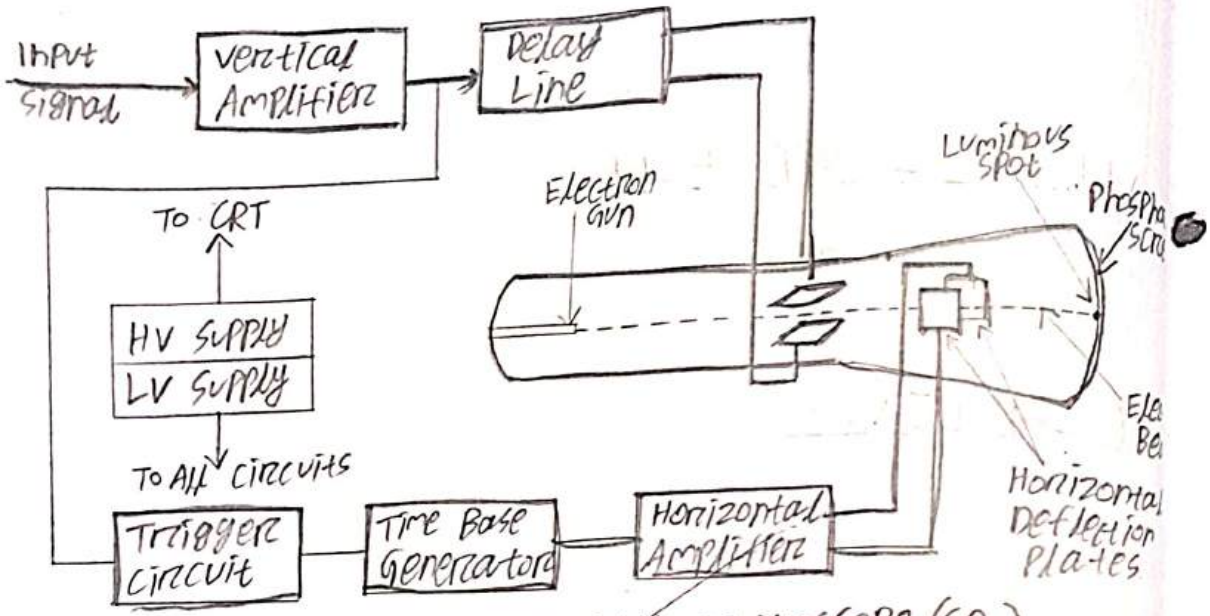
The input signals are amplified by the vertical amplifier. Usually the vertical amplifier is a wide band amplifier which passes the entire band of frequencies.

DELAY LINE:-

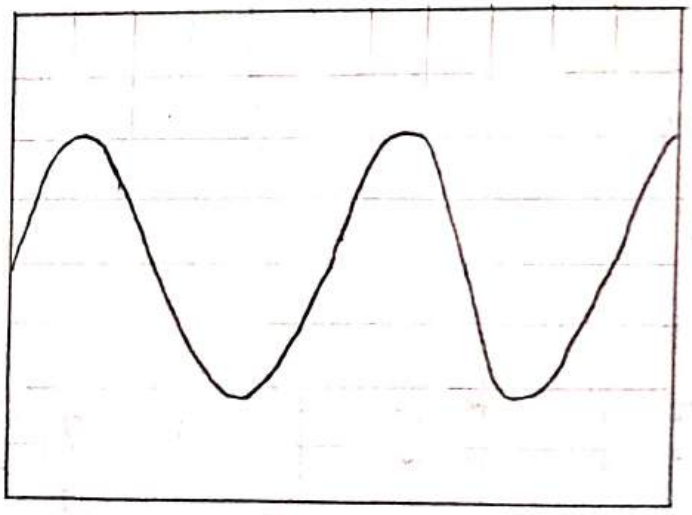
As the name suggest, this circuit is used to delay the signal for a period of time in a vertical section of CRT. The input signal is not applied directly to the vertical plates because the part of the signal gets lost, when the delay time is not used. Therefore, the input signal is delayed by a period of time.

TIME BASE GENERATOR:-

Time base circuit uses a uni-junction transistor, which is used to produce the sweep. The saw tooth voltage produced by the time base circuit is required to deflect the beam in the horizontal section. The saw tooth voltage at a constant time dependent rate.



Block Diagram of Cathode Ray Oscilloscope (CRO)



No. of vertical Div.

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HORIZONTAL AMPLIFIER:-
The saw tooth voltage produced by the time base circuit is amplified by the horizontal amplifier before it is applied to horizontal deflection plates.

TRIGGER CIRCUIT:-
The signals which are used to active the trigged circuit are converted to trigger pulses for the precision sweep operation whose amplitude is uniform. Hence, input signal and the sweep frequency can be synchronized.
i.e. In a CRO, a triggering circuit is provided for synchronizing two types of deflection so that horizontal deflection starts at the same point of the input vertical signal each time it sweeps.

PROCEDURE :-
→ Turn on the oscilloscope.
→ Adjust the intensity and focus of the trace.
→ use the X & Y Knobs to centre the trace horizontally and vertically.
→ connect the cable from CH1 of the CRO to function generator.
→ A signal will appear on the screen.
→ make sure that the inner red knobs of the volt/div and the Time/div are locked clockwise.
→ set the frequency of the generator to 100Hz.
→ Adjust the volt/div and time/div knobs so that you get a suitable size signal.
→ Count the number of vertical squares lying within the signal, then calculate the peak to peak values as:-
VP-P = No. of vertical Div. * Volt/Divs.

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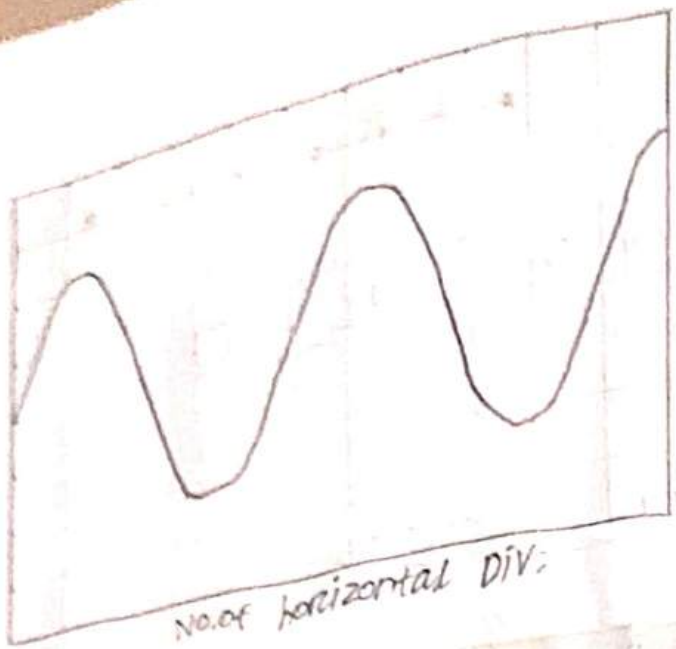
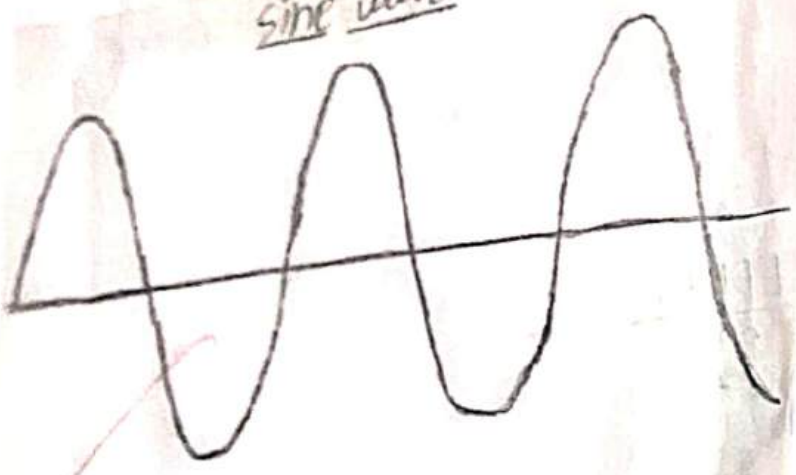
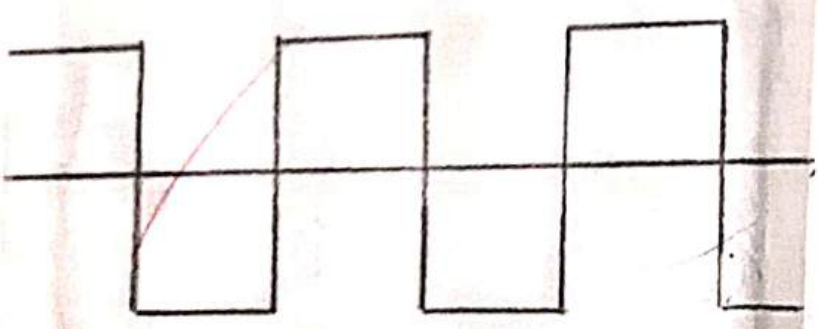


Sine wave



V=0.82V
T= 0.0036sec
f= 277.7711z

Savarze wave



V = 0.8V
T = 0.0036sec
f = 277.77 Hz

→ Count the number of horizontal squares lying with in the duty cycle, then calculate time values as:-
Time = No. of horizontal DIV. * Time/DIVS.

→ Calculate the frequency of signal by using formula:-
Frequency = 1/T.

CALCULATIONS:-

For Sine wave

(i) Amplitude = 13 X 0.2 X 0.2 = 0.52 V

(ii) Time Period = 18 X 0.2 = 3.6×10^{-3} = 0.0036 sec

(iii) Frequency = 277.77 Hz

For square wave

(i) Amplitude = 8 X 0.5 X 0.2 = 0.8 V

(ii) Time Period = 18 X 0.2 = 3.6×10^{-3} = 0.0036 sec

(iii) Frequency = 277.77 Hz

Triangle wave

a = 0.8V
T = 0.0046SEC
f = 217.391Hz

For Triangular wave:-

(i) Amplitude = 8 X 0.5 X 0.2 = 0.8 V

(ii) Time period = 23 X 0.2 = 4.6 X 10^{-3} = 0.0046 sec

(iii) Frequency = 217.391 Hz

OBSERVATIONS:-

Sl No.	Type of wave	voltage (V)	Time Period (S)	Frequency (Hz)	
				Practical	Theory
1	Sine wave	0.52 V	0.0036 sec	277.77 Hz	
2	Square wave	0.8 V	0.0036 sec	277.77 Hz	
3	Triangular wave	0.8 V	0.0046 sec	217.391 Hz	

CONCLUSION:-

we have measured amplitude, time period and frequency for the given wave form.

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4/2/25

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SEMESTER 2nd SHEET No. 16

EXPERIMENT NO:- 4

AIM OF THE EXPERIMENT:-
To verify Thevenin's theorem in a DC network.

APPARATUS REQUIRED:-

Sl. No.	Components	Type	Rating	Quantity
1	Trainer kit		0-15V	1
2	Ammeter	DC	250Ma	1
3	Multi-Meter	Digital	0-99999	1
4	Patch Chords	Double Ended	0.5W	As per Required

THEORY:-
I am verifying Thevenin's theorem, which states that any linear network can be replaced by an equivalent voltage source (Vth) in series with a resistance (Rth). The voltage (Vth) is the open-circuit voltage at the load terminals, and the resistance (Rth) is the resistance of the network seen from the load terminals with all voltage sources replaced by their internal resistances.

To determine Vth, I follow these steps:

- I remove the load resistance.
- I measure the open-circuit voltage across the load terminals.

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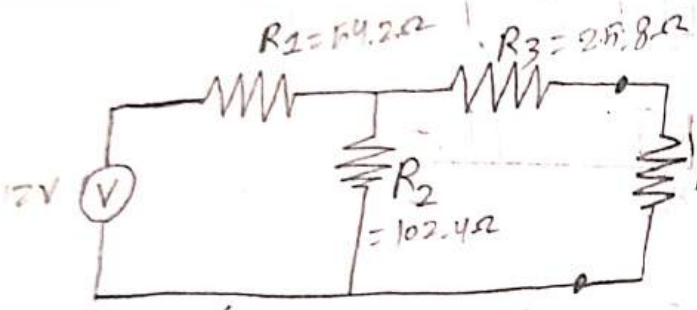
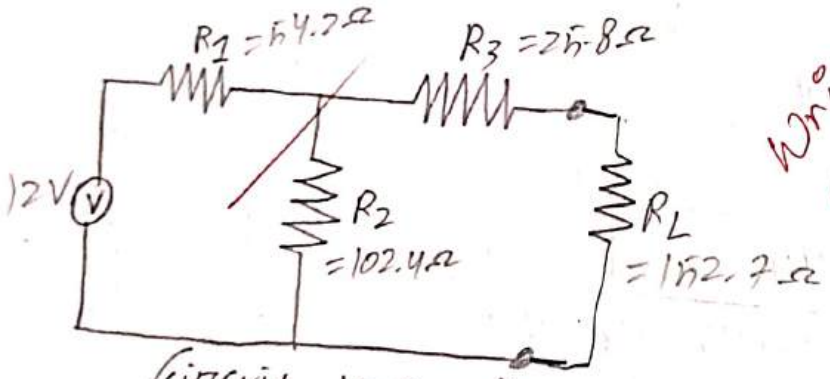
CIRCUIT DIAGRAM :-



(Circuit diagram)



(Circuit diagram)

Write the values of R_1, R_2 & R_3 and V

To determine Rth, I proceed as follows:
- I open the voltage source.
- I replace the voltage source with its internal resistance.
- I remove the load resistance.
- I measure the equivalent resistance (Rth) across the open load terminals.

Once I obtain Vth and Rth, I calculate the load current IL using the formula:

$$I_L = \frac{V_{th}}{R_{th} + R_L}$$

PROCEDURE:-

1. First, I short the 12 V DC terminals (+ and −).
2. I measure the equivalent resistance (Rth) across P3 and P4.
3. Next, I connect the (0-12V) DC supply to the 12V DC terminals of the given circuit.
4. I then measure the voltage Vth across the terminals P3 and P4.
5. After that, I short P4 and L2, then connect an ammeter across P3 and L1 in the Thevenin's equivalent circuit.
6. I also place an ammeter across P9 and L5 in the general electrical circuit and record the readings.
7. Finally, I compare the ammeter readings of the general electrical circuit and Thevenin's equivalent circuit to confirm the theorem.

OBSERVATION :-

Voltage across 102.4Ω (R_2) Resistor is

$$= \frac{12 \times 102.4}{54.2 + 102.4}$$

$$V_{R_2} = 7.84V$$

$R_1 = 54.2\Omega$

$R_2 = 102.4\Omega$

$R_3 = 25.8\Omega$

$$R_{th} = (54.2 \,||\, 102.4) + 25.8$$

$$= 35.44 + 25.8$$

$$= 61.24\Omega$$

$$I_L = \frac{7.84}{61.24 + 152.7}$$

$$= 0.036A$$

$$= 36mA$$

The value of $R_1 = 54.2\Omega$, $R_2 = 102.4\Omega$ and $R_3 = 25.8\Omega$

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SEMESTER 2nd SHEET No. 19

TABULATION:-

Sl No.	Practical		Theoretical	
	I_L (mA)	V_{th} (V)	I_L (mA)	V_{th} (V)
1	36.7mA	7.78V	36 mA	7.78V

CONCLUSION :-

The practical values of Thevenin's equivalent voltage and resistance closely match the theoretical calculations, validating Thevenin's theorem. Any slight variations can be attributed to experimental limitations such as measurement errors and component tolerances.

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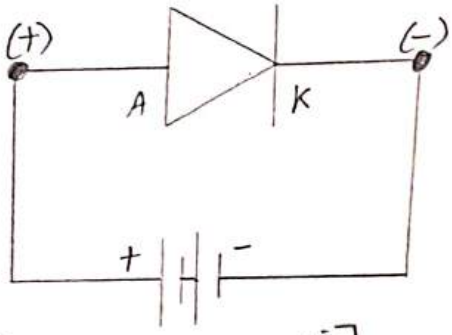
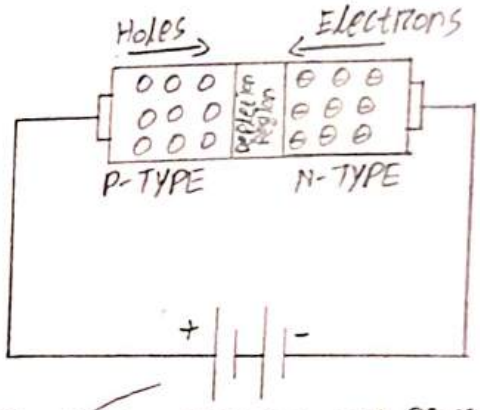
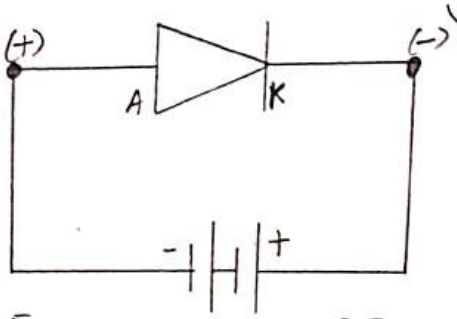


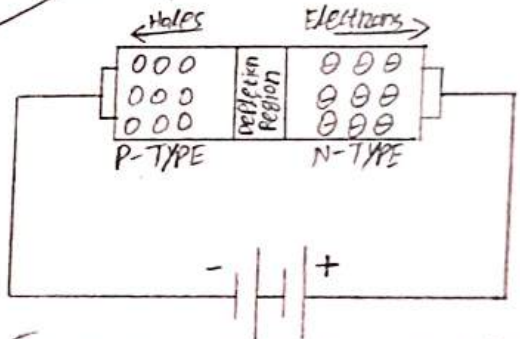
[Forward biased connection]



[PN Junction Diode Forward Biasing]



[Reverse biased connection]



[PN Junction Diode Reverse Biasing]

EXPERIMENT NO. :-05

AIM OF THE EXPERIMENT :-
To study the V-I characteristics graph of P-N junction diode.

APPARATUS REQUIRED :-
- → Patch chords
- → V-I characteristics board
- → multi-meter
- → Ammeter (mA, μA)

OBJECTIVE :-
To Plot graph for forward and reverse biased condition of a P-N junction diode.

THEORY :-

Biasing :- The process by which an external DC voltage is applied to the electric circuit in P-N junction biasing is performed.

Forward Biasing :- The diode is forward biased by connecting the P-side of the positive terminal and the N-side to the negative terminal of the supply voltage. At a particular voltage, the width of the depletion region vanishes and a sharp rise in current and voltage is observed as threshold or knee voltage.

Reverse Biasing :- The diode is reverse biased by connecting the N-side to the positive terminal and the P-side to the negative terminal of the supply voltage. Due to this, more negative ions are generated in the P-side and more positive ions in the N-side, increasing the width of the depletion region. When the applied voltage is increased, the diode enters the breakdown region at a particular point, and this negative voltage is noted as the Peak Inverse voltage (PIV). The PIV is the maximum reverse voltage applied to a diode before entering the breakdown region.

NAME Rajesh Rana

UNIV. ROLL _____

DATE 25/02/25

COLL. ROLL 24CSEAIML025

Date :

Page No.:

Scale :

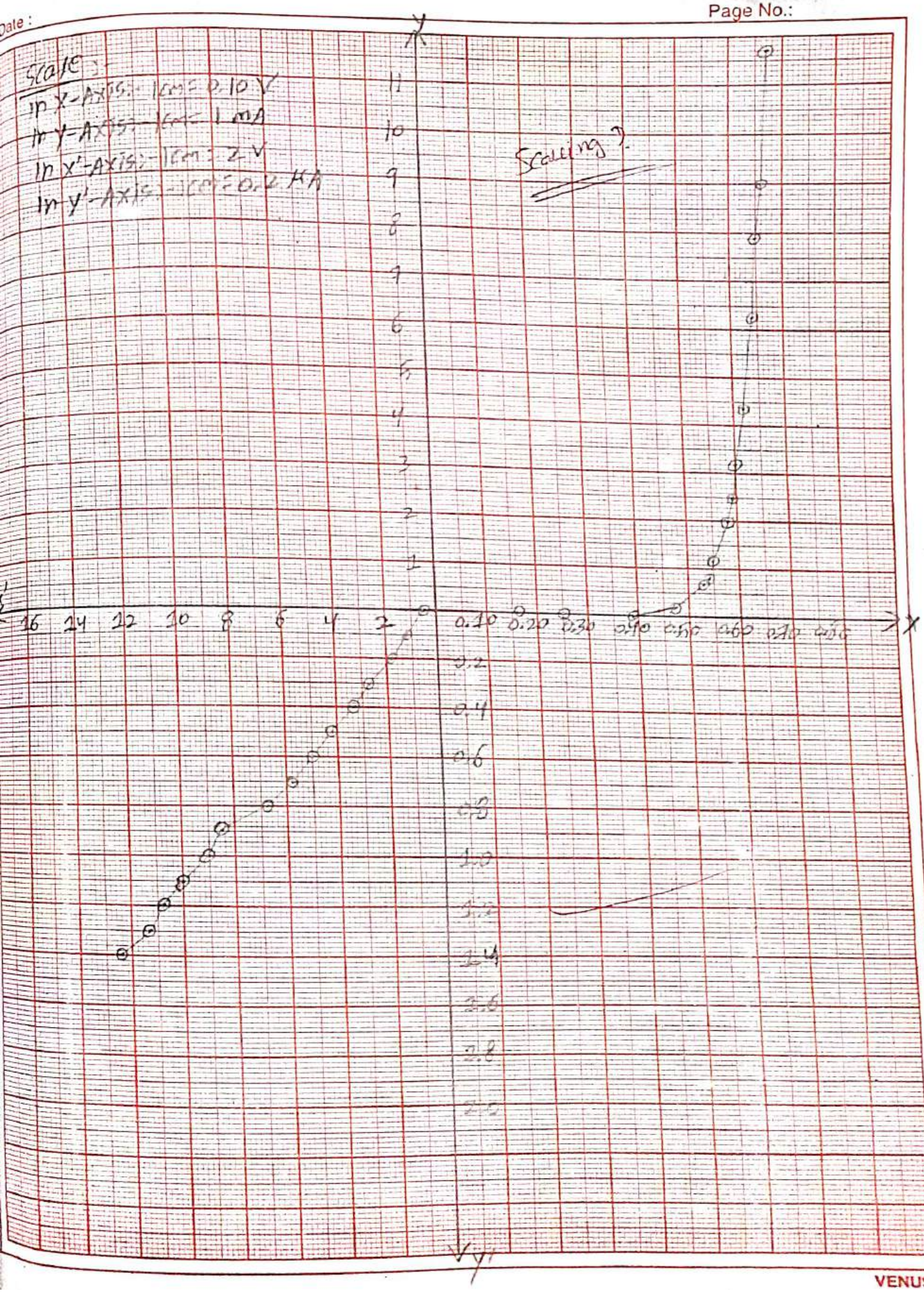
In X-Axis :- 1cm = 0.10 V

In Y-Axis :- 1cm = 1 mA

In x'-Axis :- 1cm = 2 V

In y'-Axis :- 1cm = 0.2 μA

Scaling :



PROCEDURE :-

For Forward Biased :-

→ The circuit is connected so that the positive side of the external DC source is connected to the P-side of the diode and the negative side to the N-side.

→ An ammeter and a multimeter are connected to the diode. The ammeter used is a milliampere ammeter.

→ The DC voltage is varied in steps up to 8V (up to knee voltage), and the corresponding ammeter readings are noted.

For Reverse Biased :-

→ The positive side of the external DC source is connected to the N-side, and the negative side is connected to the P-side of the diode.

→ The applied voltage is varied up to the breakdown voltage.

→ The corresponding ammeter readings are noted.

OBSERVATIONS :-

Forward Biased :-

Sl. No.	Voltage (V) in volt	current (I) in mA
1	0.16	0
2	0.25	0
3	0.39	0
4	0.47	0.2
5	0.53	0.7
6	0.54	0.8
7	0.55	1.2
8	0.58	2.0
9	0.59	2.5
10	0.60	3.2
11	0.62	4.4

UNIV. ROLL _____ NAME Rajesh Rana

25/02/25

12	0.64	6.3
13	0.65	7.9
14	0.66	9.0
15	0.67	11.7

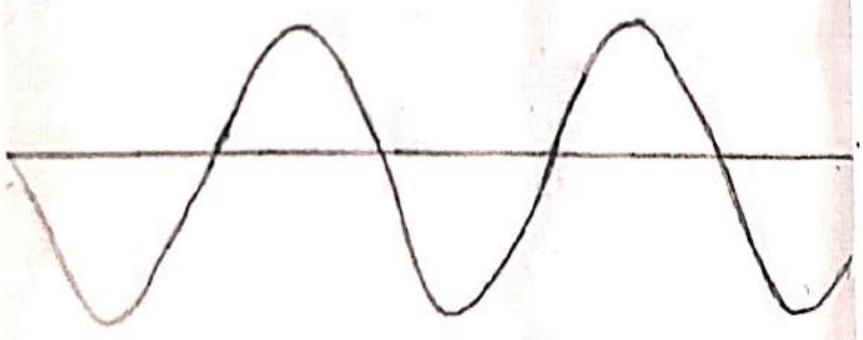
Reverse Biased:-

Sl. No.	Voltage (V) in Volt	Current (I) in μA
1	0.5	0
2	1.1	0.1
3	1.8	0.2
4	2.6	0.3
5	3.4	0.4
6	4.10	0.5
7	5.0	0.6
8	5.8	0.7
9	6.9	0.8
10	8.5	0.9
11	9.0	1.0
12	10.0	1.1
13	10.8	1.2
14	11.4	1.3
15	12.4	1.4

CONCLUSION:-
The V-I characteristics of a P-N junction diode in both forward and reverse bias are successfully studied.

Sandip 4/3/25

INPUT SIGNAL



Amplitude - 9V

EXPERIMENT NO:- 06

Aim Of The Experiment:-
To study about the half-wave & full-wave rectifier circuits with and without capacitor filters and recording the output waveforms.

Objective:-
→ To trace the input and rectified output waveforms.
→ measurements of average and root mean square values of the rectifier output.

Components Required:-
→ Rectifier trainer kit
→ CRO
→ CRO Probe
→ voltmeter
→ connective wire

Theory:-
semiconductor diode is a simple the combination of P-type and N-type material. It is formed by doping half of the silicon crystal with trivalent impurity (P-type) and the half with pentavalent material (N-type). It has the characteristics of passing.

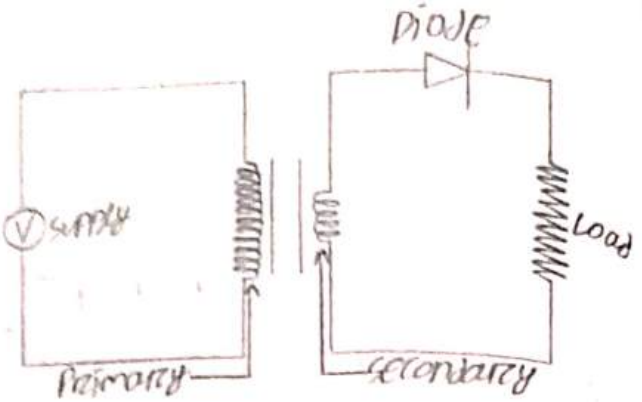
Rectifier:- It is a device which converts AC voltage to pulsating DC voltage using one on one diode. It is two types:- one is half wave rectifier and second is full wave rectifier. The conversional currents flow through D, load resistor (R_L) and upper half of the secondary winding, similarly during -ve half cycle.

UNIV. ROLL _____ NAME Rajesh Rana

DATE 04/03/25

HALF WAVE

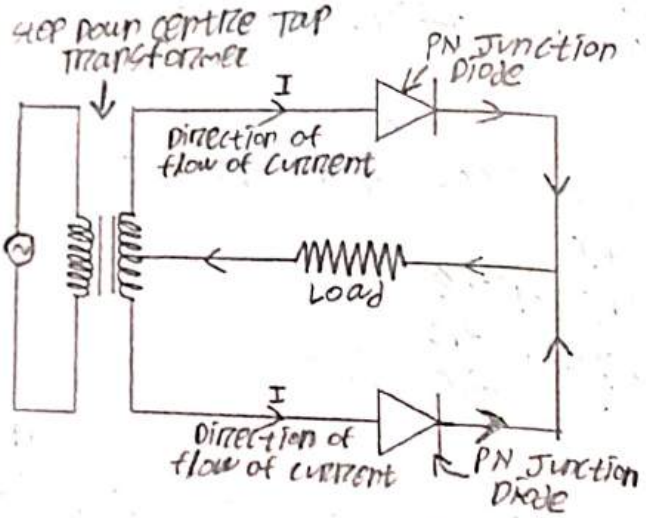
Amplitude 8V



[Half wave Rectifier]

FULL WAVE

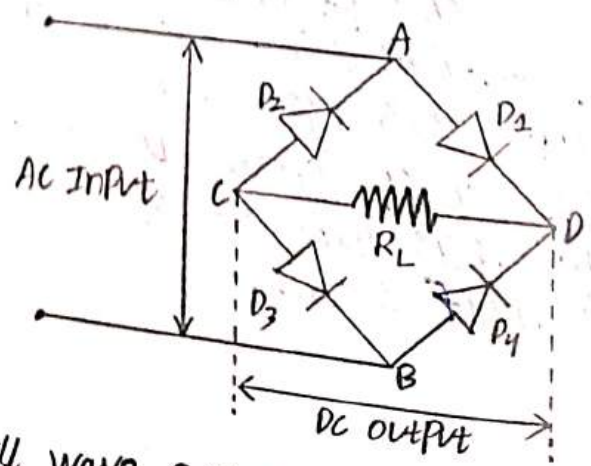
Amplitude -8V



[Full wave Rectifier]

BRIDGE WAVE

Amplitude: -7V



[Full wave Bridge Rectifier]

Half wave rectifier:-

- The rectifier conducts currently only during the positive half cycle at input AC supply, in which the diode is forward biased.

$$V_o = I.R_L$$

- For negative half cycle of AC input supply no current flows and so on voltage appears across the road as diode is reverse biased and hence open circuit.

$$V_o = 0V$$

- The transformer allows to step up/step down the AC input voltage and also isolate the rectifier circuit from line and thus reduces the risk as electric shocks.
- The AC supplier deliver power only on the time i.e. output is low.

Full wave rectifier:-

- In the positive half cycle, A becomes positive B becomes negative this makes D1 forward bias, D2 reverse bias and open circuit. Hence D1 conduct current while D2 does not.
- The conventional current flows through D1, load resistor (R_L) and upper half of the secondary winding.
- similarly, during -Ve half cycle end A becomes -ve and B is +ve and D1 is reversed and D2 is forward bias. Hence, current flows through D2, R_L and lower half of winding.

Full wave bridge rectifier:-

- Here +ve diode are used without using center taped transformer.
- The AC supply to be rectified is applied to the diagonally end of the bridge through transformer.
- During the +ve half cycle of the voltage and if A becomes +ve and B becomes -ve then D_2 and D_3 is forward bias. These two diode will be the forward biased. These two diode will be the series through the load (R_L). Hence DC supply output is obtained across R_L.

UNIV. ROLL _____ NAME Rajesh Rana

• In -ve half cycle D_2, D_3 are reversed biased while D1 and D4 are forward bias. So, current conductive through D1, D4 and R_L. Hence output across it each case (P/V) of each diode is V_m.

Procedure :-

→ First configure the half wave rectifier circuit as shown in the circuit diagram.
→ I noted the values of all components and connected the primary side of the transformer to the AC main supply while the secondary side was connected to the input circuit.
→ I measured the DC and AC voltage and current values both with and without load.
→ I repeated the process with an 'L' and 'C' filter to observe variations in the DC and AC voltage and current values.
→ I followed the same procedure of the full-wave rectifier and the full-wave bridge rectifier circuits.

Observation and calculation table :-

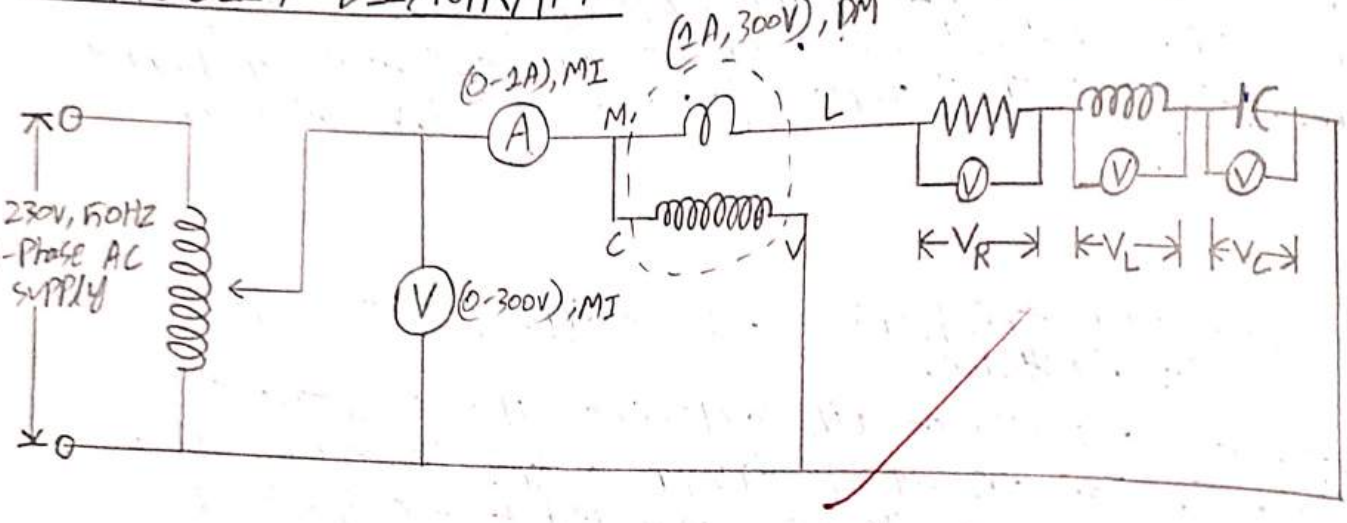
Sl. No.	Types of Rectifier	Input voltage (V)	Rectified out voltage(V)
1	Half wave	9V	8V
2	Full wave	9V	8V
3	Full wave bridge	9V	7V

Conclusion :-

This experiment confirmed that half-wave rectifiers allow conduction only during the positive half-cycle, while full-wave rectifiers provide continuous pulsating DC output. The bridge rectifier improves efficiency without requiring a center-tapped transformer.

11/03/25

CIRCUIT DIAGRAM:-



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SEMESTER 2nd SHEET No. 26

EXPERIMENT NO:- 07

AIM OF THE EXPERIMENT:-
Measurement of current voltage power factor in series R-L-C circuit excited by a single phase AC supply.

APPARATUS REQUIRED:-

SL NO.	Components	Rating	TYPE	Quantity
1	Voltmeter	0-300V	MI	1
2	Ammeter	0-1A	MI	1
3	Wattmeter	1A, 300V	DM	1
4	Bulb	230V, 40W	Resistive	1
5	Choke	230V, 40W	Inductive	1
6	Capacitor	230V, 0.25μf	Electrolytic	1
7	Varjac	0-230-270V, 8A	WW	1
8	connecting wires	230V, 5A, 1/18 SWG	PVC coated	As per required

THEORY:-
Power in an electrical circuit can be measured using a wattmeter. A wattmeter consists of two coils, namely current coil and pressure coil or potential coil. The current coil is marked as ML and pressure coil is marked as a CV. The current coil measures the quantity that is proportional to the current in the circuit. The pressure coil measures quantity that is proportional to the voltage in the circuit. The given wattmeter is loaded by direct loading. The ammeter is connected in series to the wattmeter. Since the same current flows in both the coils, the current and voltage across the circuit are constant. The power consumed by the load is measured using the wattmeter

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COLL. ROLL 24CSEAIML015 DATE 11/03/25

and calculated using the relation given below.
A series RLC circuit with kirchoff's voltage law given:

$$V = V_R + V_L + V_C$$
$$= I(R + JW_L + 1/JW_C)$$
$$= IZ$$

In the above circuit, one can say whether current leads or lags the voltage. It depends upon relative value of terms W_L & $1/W_C$.
There can be three possibilities
If $W_L > 1/W_C$ the current leads the voltage and circuit behaves as induced circuit.
If $W_L < 1/W_C$ the current leads the voltage and circuit behaves as capacitive circuit.
Special case: At resonance the current through the circuit becomes in Phase with supply voltage.

PROCEDURE :-

- I connect the circuit as shown in the circuit diagram.
- Initially, I ensure that no load is applied
- Before switching on the Power supply, I set the auto transformer to its minimum voltage position.
- I set the rated voltage using the auto transformer and measure the voltmeter, ammeter, and wattmeter readings under no-load conditions. I also carefully note the multiplication factor mentioned on the wattmeter.
- I apply the load by adjusting the RLC load.
- I measure and record the values of the voltmeter, ammeter and wattmeter.
- I repeat steps 5 and 6 until the ammeter reading reaches 10A.
- After taking all the readings, I slowly reduce the load to the minimum and bring the voltage to the lowest setting on the auto transformer. Then, I switch off the power supply.
- I calculated the indicated power using the given formula.
- I determine the power factor using the given formula.

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SEMESTER 2nd SHEET No. 28

FORMULA:-

Actual Power = W * multiplication factor.
where, W = observed wattmeter reading
Apparent Power = VI
where, V = Voltmeter reading
I = Ammeter reading
power factor, $\cos\phi$ = Actual Power / Apparent Power.

OBSERVATION:-

Sl. No.	Voltage V (Volt)	current I (Amp)	Wattmeter Reading (Watt)		measured power (VA)	Power factor ($\cos\phi$)	mean
			observed	Actual			
1	140 V	0.20 A	15.9	23.6	28	0.84	
2	160 V	0.21 A	7.2	28.8	33.6	0.85	
3	180 V	0.22A	8.7	34.8	39.6	0.87	0.868
4	200 V	0.23A	10.2	40.8	46	0.88	
5	220V	0.24A	11.9	47.6	52.8	0.90	

CONCLUSION:-

This experiment verified the measurement of current, voltage and power factor in a series RLC circuit. The results confirmed theoretical phase relationships and the dependence of power factor on circuit parameters.

18/03/25

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SEMESTER 2nd SHEET No. 29

EXPERIMENT NO :- 08

Aim of the experiment :-
Power factor measurement for fluorescent lamp.

Apparatus Required :-

Sl No	Name of the Equipment	Range	Type	Quantity
1	Fluorescent lamp	230V, 20W	Tube	1
2	Voltmeter	0-1A	MI	1
3	Ammeter	230V, 20W	MI	1
4	Choke coil	230V, 20W	Inductive	1
5	Starter	230V, 20W	Glow type	1
6	Capacitor	2.5 μf	Oil filled	1
7	Wattmeter	1A, 300V	DM	1
8	connecting wires	230V, 1/18 SWG	PVC coated	As per required
9	Variac	0-230V, 8A	WW	1

Theory :-
A fluorescent lamp is a low pressure mercury discharge lamp with inner surface coated with suitable fluorescent materials. This consists of glass tube provided at both ends with caps having two pins an oxide coated tungsten filament. tube contains argon or krypton gas to facilitate starting with small quantity of mercury under low pressure. Fluorescent material when subjected to electromagnetic radiations of particular wavelength produced by the discharge through the mercury vapor get excide and in turn gives out radiations at some other wavelength which falls under visible spectrum. Power factor of the lamp is somewhat low and is about 0.5 lagging due to induction of the choke. A condenser, if connected across the supply improves the power factor. When rated supply applied, full supply voltage appears across starter electrode 1 and 2 which are enclosed in a glass

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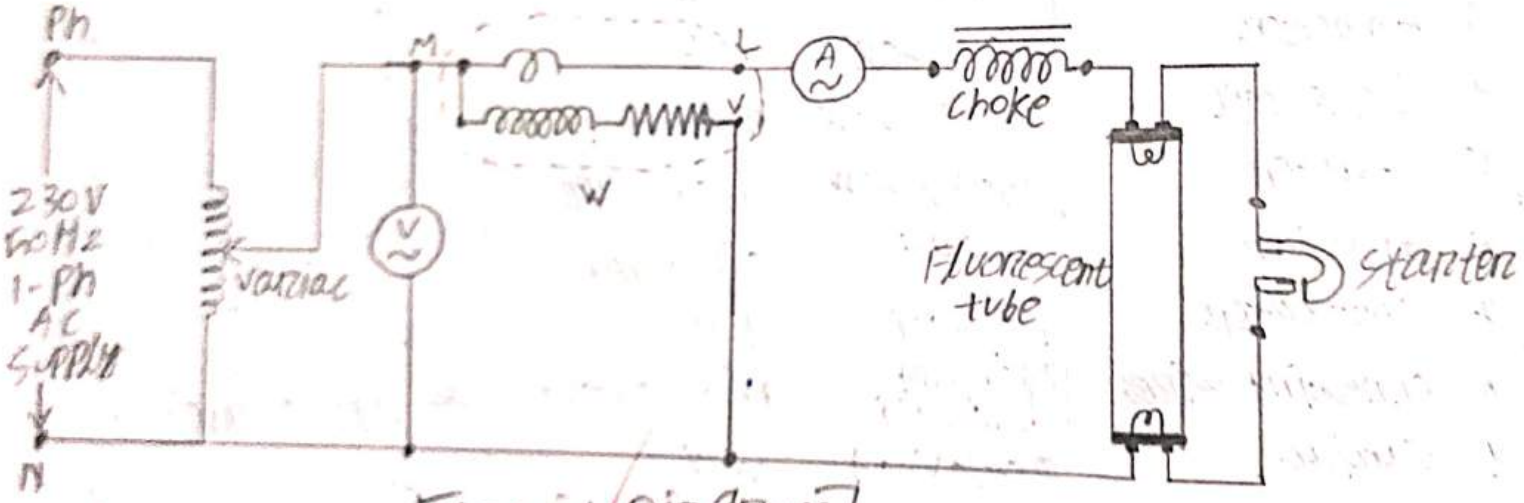
COLL. ROLL 24CSEAIML015 DATE 18/03/25



Circuit Diagram

bulb filled with argon gas. This voltage causes discharge in the argon gas with consequent heating of electrodes. Due to this heating, the electrodes P which is made of bimetallic strip, bents and closes contact of the starter. At this stage, the choke the filament M1 and M2, of the tube T and the starter becomes connected in series across the supply. A current flow through filament M1 and M2 and heats them. meanwhile the argon discharge in the starter tube, the electrodes P and causes a sudden break in the circuit. This causes a high value of induced emf in the choke. The induced emf in the choke is applied across tube light electrodes M1 and M2 and is responsible for initiating a gaseous discharge because initial heating has already created good number of free electrons in the vicinity of electrodes. Thus the starts giving light output.

once the discharge through the tube light is established, a lower voltage than supply voltage is required maintain. A reduction during running condition is achieved by having voltage drop in the choke.

The capacitor connected the starter terminals P and Q is used to suppress the electromagnetic waves generated at the gap due to sparking, thereby reducing the disturbance causes to nearby radio and tv receivers.

Procedure:-

I connected the circuit, switched on the supply, and slowly increased the voltage to the rated level. I noted the voltage, current, and power readings and calculated the power factor.

Calculation:-

Actual Power = observed power × M.F(y)

Power factor = $\cos\phi$ = actual Power / V × I

$\cos\phi$ = Actual Power / V × I

UNIV. ROLL _____ NAME Rajesh Rana

COLL. ROLL 24CSEAIML015 DATE 18/03/25

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SEMESTER 2nd SHEET No. 31

Observation Table:-

Sl. No.	voltmeter reading in volts	Ammeter reading in Ampere	wattmeter reading in watt		power factor = cos ϕ	mean
			observed	Actual		
1	220	0.42	9.6	38.4	0.41	
2	210	0.38	8.7	34.8	0.43	
3	200	0.36	7.9	31.8	0.44	0.442
4	190	0.33	7.2	28.8	0.45	
5	180	0.30	6.5	26	0.48	

Conclusion :-

In this experiment, I successfully connected in the circuit, measured voltage, current and power and calculated the power factor. The results help in understanding the circuit's efficiency and performance.

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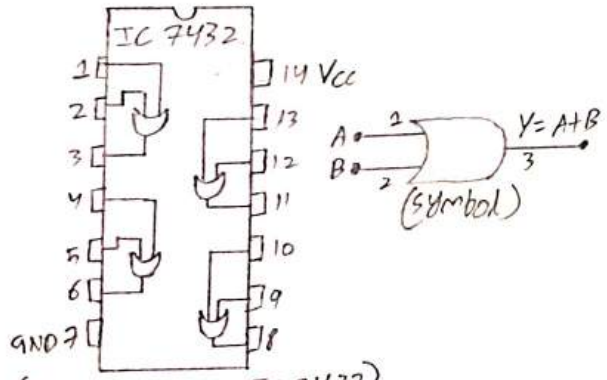
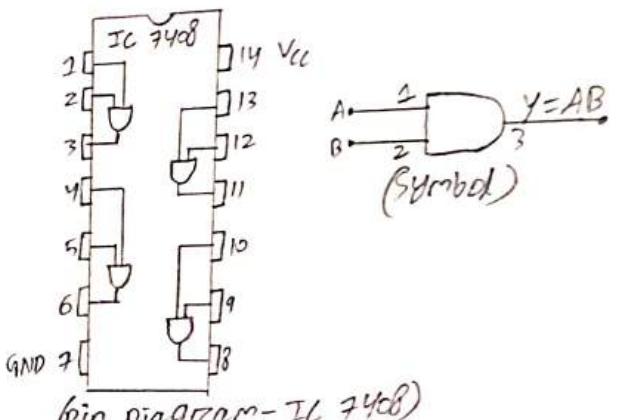
OR Gate:-



(Pin Diagram - IC 7432)

AND Gate:-



(Pin Diagram - IC 7408)

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EXPERIMENT NO:- 01

Aim Of The Experiment:-
To study and verify different logic gates.

Objective:-
To familiarize with circuit implementations using ICs and test the behaviour of different logic gates.

Components Required:-
→ Digital bread board / Project board
→ Connecting Patch chords
→ IC 7400, IC 7408, IC 7432, IC 7402, IC 7404, IC 7486

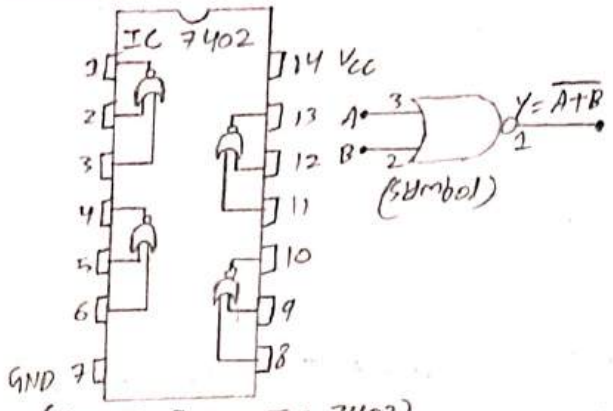
Theory:-
The basic logic gates are the building blocks of more complex logic circuits. These logic gates perform the basic Boolean function such as AND, OR, NAND, NOR, Inversion, Exclusive OR and Exclusive NOR.
These basic logic gates are implemented as small scale integrated circuits (IC) or as part of more complex medium scale (MSI) or very large scale (VLSI) integrated circuits. Digital IC gates are classified not only by their logic operation but also the specific logic-circuit family to which they belong. Each family has its own basic electronic circuit upon which more complex digital circuits and functions are developed.

Gate	Description	Truth Table		
OR	The output is active high if any one of the input is in active high stable. mathematically, Q = A+B	A	B	output
		0	0	0
		0	1	1
		1	0	1
		1	1	1
AND	The output is active high only if both the inputs are in active high state. mathematically, Q = A.B	A	B	output
		0	0	0
		0	1	0
		1	0	0
		1	1	1

UNIV. ROLL _____ NAME Rajesh Rana

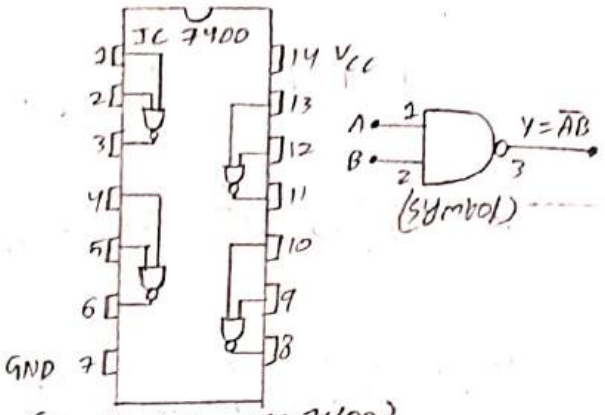
COLL. ROLL 24CSEAIML025 DATE 08/04/25

NOR Gate:-



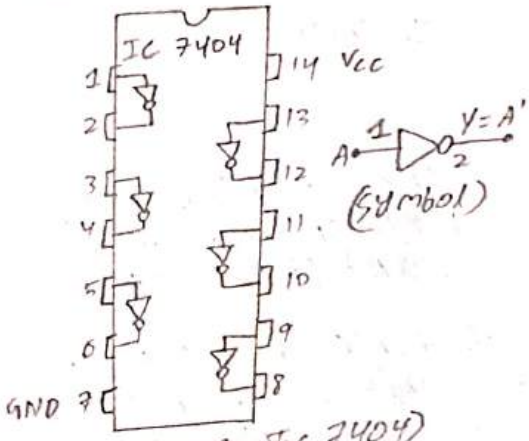
(Pin Diagram - IC 7402)

NAND Gate:-



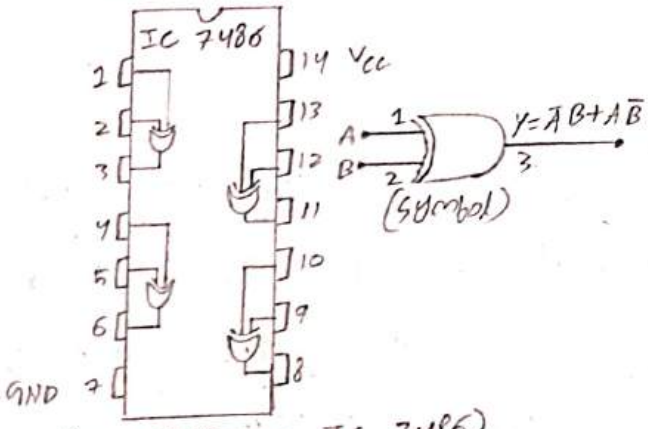
(Pin Diagram - IC 7400)

NOT Gate:-



(Pin Diagram - IC 7404)

X-OR Gate:-



(Pin Diagram - IC 7486)

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SHEET No. 33

Gate	Description	Truth Table		
NOR	The output is active high only if both the inputs are in active low state. Mathematically, $Q=(A+B)'$	A	B	output
		0	0	1
		0	1	0
		1	0	0
		1	1	0
NAND	The output is active high only if any one of the inputs is in active low state. mathematically, $Q=(A.B)'$	A	B	output
		0	0	1
		0	1	1
		1	0	1
		1	1	0
NOT	In this gate the output is opposite to the input state. mathematically, $Q=A'$		A	output
			0	1
			1	0
XOR	The output is active high only if any one of the input is in active high state. mathematically, $Q=A'B+AB'$	A	B	output
		0	0	0
		0	1	1
		1	0	1
		1	1	0

Conclusion:-

The experiment successfully demonstrated the working of basic logic gates including AND, OR, NOT, NAND, NOR and XOR using digital ICs. The observed outputs matched the expected truth tables, verifying the correct operation of each gate. This practical exercise enhanced our understanding of digital logic fundamentals and circuit behaviour.

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