1. Study experiments:

1.1 Study of Laboratory equipments such as Multimeter, RPS, CRO, and Function Generator. List their functions.

1.1a Multimeter

Fig 2.1.Digital Multimeter

A multimeter is also known as a VOM (Volt-Ohm meter), is an electronic measuring instrument that combines several measurement functions in one unit.

Digital multimeters (DMM, DVOM) display the measured value in numerals, and may also display a bar of a length proportional to the quantity being measured.

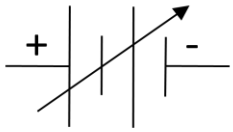
Digital multimeters are now far more common than analog ones, but analog multimeters are still preferable in some cases, for example when monitoring a rapidly-varying value.

A multimeter can be a hand-held device useful for basic fault finding and field service work, or a bench instrument which can measure to a very high degree of accuracy. They can be used to troubleshoot electrical problems in a wide array of industrial and household devices such as electronic equipment, motor controls, domestic appliances, power supplies, and wiring systems.

1.1b D.C. Regulated power supply (DC-RPS)

Fig.2.2a D.C. Regulated power supply (Dual) (Single)

Fig.2.2b D.C. Regulated power supply



0-30V
DC REGULATED POWER SUPPLY(RPS)

Fig 2.2c Symbol

A regulated power supply is an embedded circuit; it converts unregulated AC into a constant DC. With the help of a rectifier it converts AC supply into DC.

Its function is to supply a stable voltage to a circuit or device that must be operated within certain power supply limits.

Applications

- Electronics laboratory
- Mobile Phone power adaptors
- Regulated power supplies in appliances
- Various amplifiers and oscillators

1.1c Cathode Ray Oscilloscope (CRO)

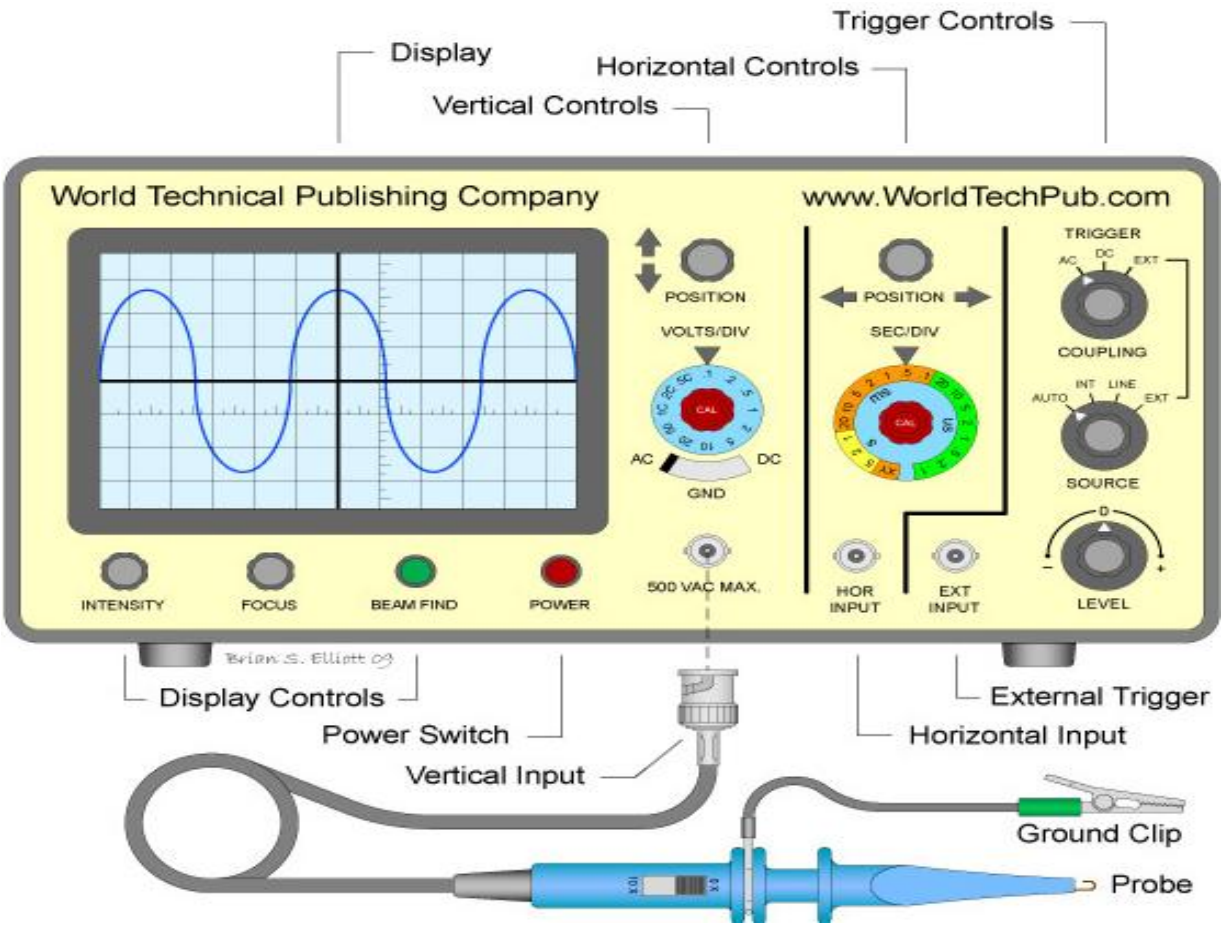


Fig 2.3 Cathode Ray Oscilloscope (CRO)

CRO is a type of electronic test instrument that allows observation of constantly varying signal voltages, usually as a two-dimensional plot of one or more signals as a function of time.

Oscilloscopes are used to observe the change of an electrical signal over time, such that voltage and time describe a shape which is continuously graphed against a calibrated scale.
It is used to measure the AC voltage, Phase relationship, and frequency.

1.1d Function Generator

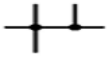
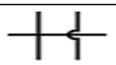
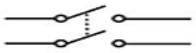
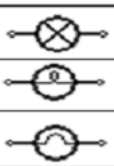
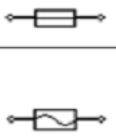
Fig 2.4 Function Generator

A function generator is usually a piece of electronic test equipment used to generate different types of electrical waveforms over a wide range of frequencies.

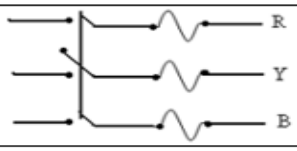
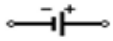
Some of the most common waveforms produced by the function generator are the sine, square, triangular and sawtooth shapes.

1.2 Electrical Symbols:

1.2a Symbols of electrical wire/switch/ground

Sl. No.	Name of Symbol	Symbol	Meaning
1	Electrical Wire		Electrical Conductor
2	Connected Wires		Connected Crossing
3	Unconnected Wires		Wires not Connected
4	SPST Switch Single pole single throw		Serves in circuits for on, off purpose
5	SPDT Switch Single pole Double throw		Selects between two connections
6	DPST Switch Double pole Single throw		It has two contact sets and one conducting path
7	Push button switch(NO)		Momentary Switch Normally Open
8	Push button switch(NC)		Momentary Switch Normally Closed
9	Relay		Relays are the switches which close and open the circuit by action of electromagnet
10	Earth Ground		Provides electric shock protection, Used for zero potential reference.
11	Chassis Ground		Is a link between different metallic parts of a machine to ensure an electrical connection between them.
12	Digital Ground /Common Ground		It is the reference for digital logic ICs
13	Lamp / Light Bulb		Glows / generates light when current flows through it
14	Fuse		Protective device, overcurrent protection, which melts when current exceeds threshold value
15	Electric Bell		Rings when activated
16	Buzzer		Produces Buzzing sound
17	Antenna / Aerial		Transmits and receives radio waves

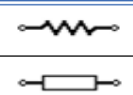
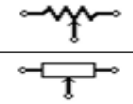
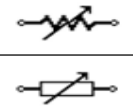
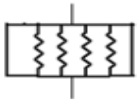
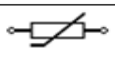
1.2b Symbols of Electrical Sources

1	DC Voltage Source		Generates Constant DC Voltage
2	AC Voltage Source		AC Voltage Source
3	3 Phase AC Supply		3 Phase AC Supply
4	Current Source		Generates Current source
5	Cell		Generates Constant DC Voltage
6	Battery		Combination of cells, gives constant DC Volt

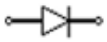
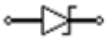
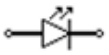
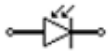
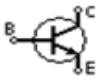
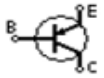
1.2c Symbols of Measuring Devices OR Measuring instruments

1	AC Voltmeter		Used to measure AC voltages when connected across a component. Offers high resistance when connected in parallel.
2	DC Voltmeter		Used to measure DC voltages when connected across a component. Offers high resistance when connected in parallel.
3	AC Ammeter		Used to measure AC current when connected in series. Offers zero resistance when connected in series.
4	DC Ammeter		Used to measure DC current when connected in series. Offers zero resistance when connected in series.

1.2d Symbols of Passive components

1	Resistor		Resistor is a two terminal electrical component that Reduces the current flow in the circuit
2	Potentiometer		Adjustable Resistor, Is a three terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider.
3	Variable Resistor / Rheostat/ load		Adjustable Resistor, It has two terminals.
4	Resistive Load		Nature of the load is Resistive.
5	Photo Resistor / Light dependent Resistor		Resistance changes with changes in light intensity
6	Thermistor		Thermal Resistor whose resistance changes with changes in temperature

1.2e Symbols of Semiconductor Devices or electronic components

1	Diode		Two terminal device Anode and cathode, which conducts in one direction
2	Zener Diode		Conducts in reverse direction when above breakdown voltage
3	LED(Light Emitting diode)		Emits light when current flows through it
4	Photo diode		Allows current flow or conducts when exposed to light
5	NPN Bipolar Transistor		A transistor is a semiconductor device used to amplify or switch electronic signals and electrical power.
6	PNP Bipolar Transistor		Allows current when low potential at base.
7	NMOS Transistor		N-Channel MOSFET Transistor
8	PMOS Transistor		P-Channel MOSFET Transistor

1.2f Symbols of Logic Gates:

1	NOT Gate		Single input Single output logic gate, Inverts the input
2	AND Gate		Two input Single output gate, Outputs 1 when both inputs high
3	NAND Gate		NOT+AND Gate, inverts AND gate output.
4	OR Gate		Outputs 1 when at least one input is High
5	NOR Gate		NOT+OR Gate, Inverts OR gate output
6	XOR|		Exclusive OR Gate, Outputs 1 when inputs are different

1.3 Electrical earthing

Meaning of electrical earthing

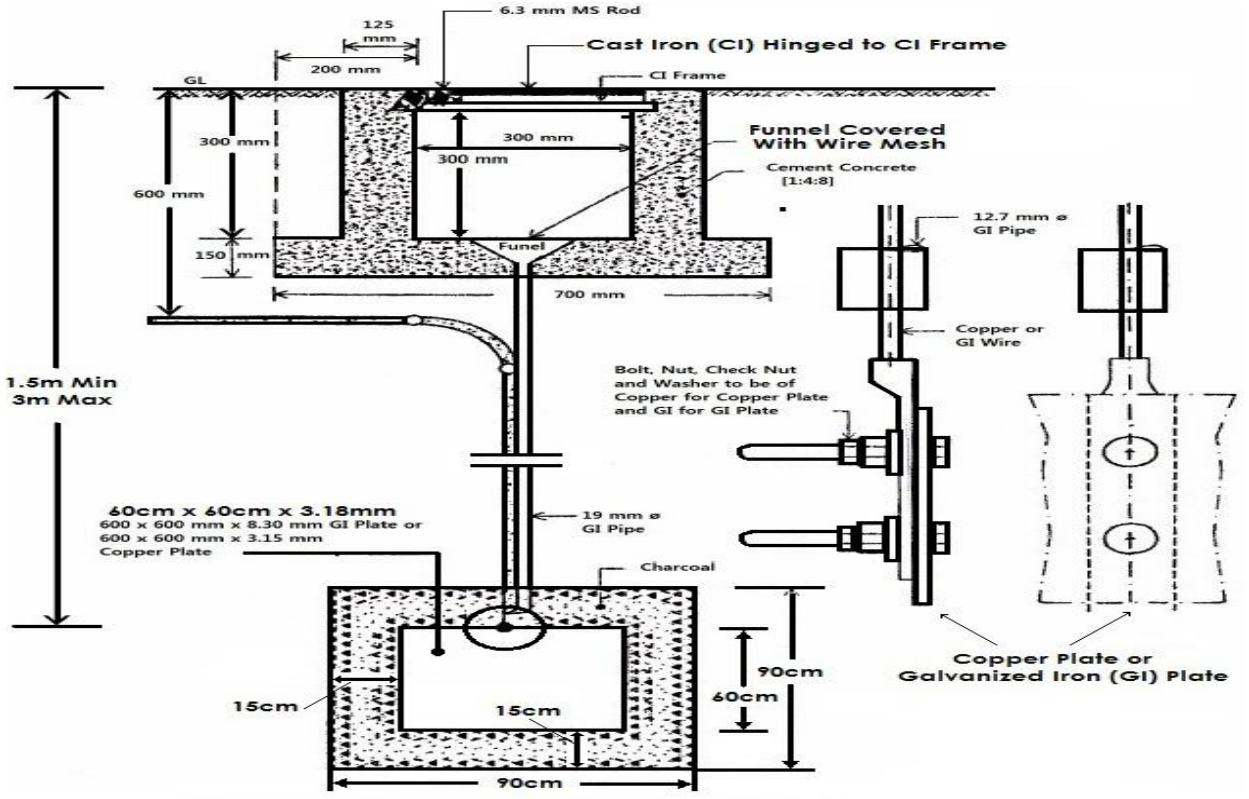
- Electrical earthing is the process of connecting supply neutral or equipment body to earth.
- Practically the potential of earth is taken to be zero.
- Hence, after earthing the appliance, its voltage will be maintained at zero potential.

Need for earthing

- To save human life from electric shock in case if he comes in contact with charged frame due to any fault or due to insulation failure causing leakage current
- To maintain line voltage constant.
- To protect large buildings and all machines fed from overhead lines from lightening.
- To provide return path for telephone, telegraph, and traction work.
- To preovide safety for electrical installation.

Types of earthing

plate earthing



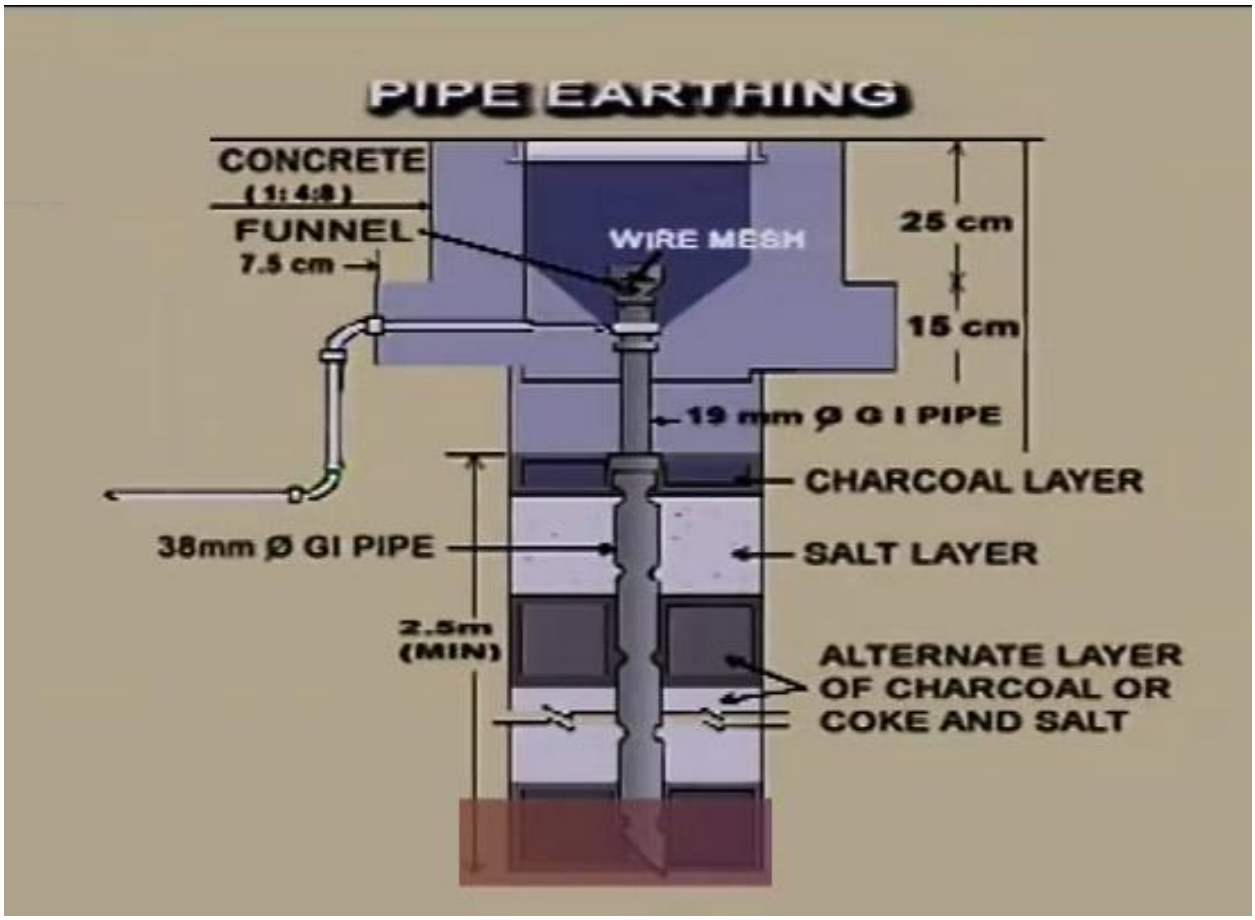
Procedure for plate earthing

- Dig a pit in the ground until sufficient moisture is available in the soil.

(1.5 mts).

- GI or copper plate is connected to earth continuity conductor with bolt and nuts.
- Plate is placed at the bottom of pit and is covered by alternate layers of salt and powdered charcoal. This improves the conduction of soil or decreases earth resistance thereby improves earthing efficiency.
- The bolted earth wire or electrode is drawn through a GI pipe of dia 12.7mm to some convenient point of commencement of supply.
- Another GI pipe of dia. 19mm with funnel at the top with wire mesh is provided to pour water into the pit to ensure better earthing.
- The earthing plate dimentions are 60 cm X60 cm X 3.15mm Galvenised Iron or copper plate

Pipe earthing:



Procedure for Pipe earthing:

- In this system, GI pipe of diameter 38 mm of about 2mts length is connected to another GI pipe of about 19mm dia.
- They are burried verticallyin the wet earth to work as earth electrode.
- The deapth to which the GI pipe should be embedded depends on the moisture content of soil.
- The earth wire is fastened to the top section of pipe with bolts and nuts.
- The pit area around the pipe is filled with salt and charcoal mixture.
- This improves earth conduction and hence improves earthing efficiency.
- The earth wire of suitable size, which carries fault current safely is connected to the main switch, distribution box and individual machine for earthing.

2. Practical Experiments:

Expt. No: 2.1 Date:

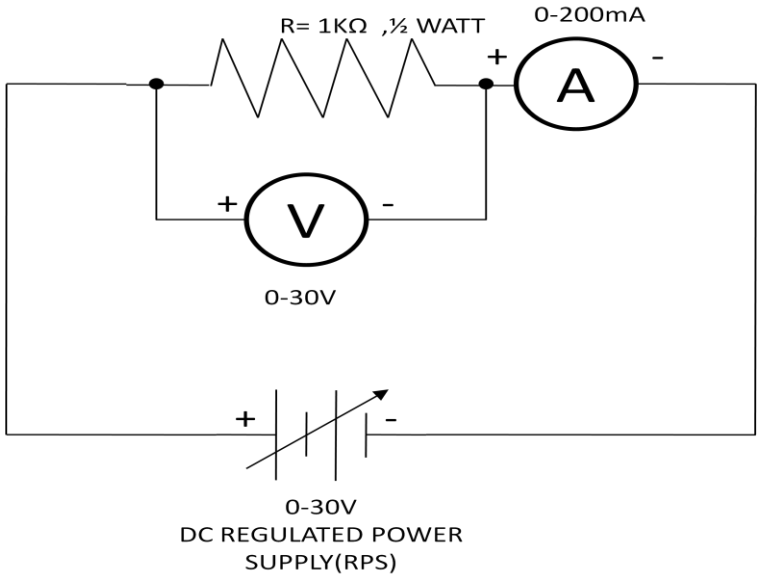
Experiment Name: To measure current and voltage in simple circuit

Aim: To measure current and voltage in simple circuit and calculate unknown resistance OR Verification of Ohms law

Components and equipments required:

Sl.No	Name of the equipment/component	Range	Quantity
1	Resistor	1KΩ,½watt	01
2	Power supply	(0-30)V	01
3	Ammeter	(0-20)mA	01
4	Voltmeter	(0-20)V	01
5	Bread board	-	01
6	Wire	Single strand	10

Circuit diagram:



Theory:

Ohms law states that

The current flowing through a conductor is directly proportional to the voltage applied to the ends of conductor (E or V) and inversely proportional to the Resistance of the conductor(R), provided the temperature is maintained constant

Formula: I=V/R Amps at constant temperature.

Procedure:

1. Connect the circuit as per circuit diagram.
2. Vary the power supply voltage in such a way that the readings are taken in steps of 1V in the voltmeter till the power supply display shows 5V.
3. Note down the corresponding ammeter readings and voltage across resistor
4. Find Resistance Rth=V_R/I Ohm

Tabular Column:

Sl. No.	Voltage across resistor in volts (V)	Current through resistor in mA (I)	Voltage across resistor V_R in volts	$R=V_R/I$ in Ω
1	1V			
2	2V			
3	3V			
4	4V			
5	5V			

Calculation:

Results:

Ohms law is verified.

Unknown Resistance is_____ohm___

Expt. No: 2.2a Date:

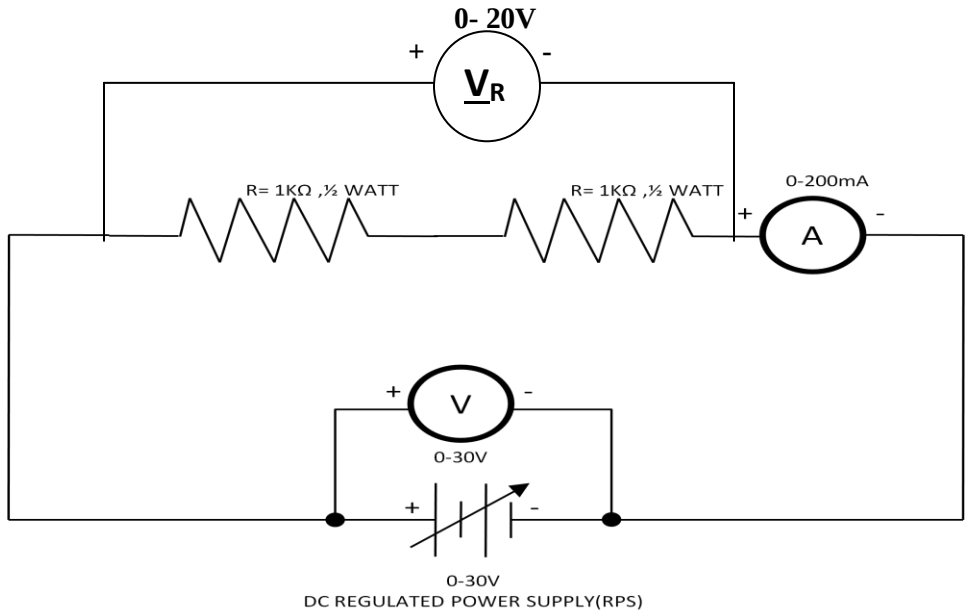
Experiment Name: Verification of effective resistance of Series resistance

Aim: To find out effective resistance of Series resistance

Components and equipments required:

Sl.No	Name of the equipment/component	Range	Quantity
1	Resistor	1KΩ,½watt	02
2	Power supply	(0-30)V	01
3	Ammeter	(0-20)mA	01
4	Voltmeter	(0-20)V	01
5	Bread board	-	01
6	Wire	Single strand	10

Circuit diagram:



Theory:

The total or effective Resistance of a series circuit is equal to sum of all the individual resistances, connected in series.

$R_s=R_1+R_2$

Procedure:

1. Connect the circuit as per circuit diagram.
2. Vary the power supply voltage in such a way that the readings are taken in steps of 1V in the voltmeter till the power supply display shows 5V.
3. Note down the corresponding ammeter readings and voltage across resistor
4. Find Resistance Rs=V_R/I Ohm
5. Compare practical and theoretical value of resistance.

Tabular Column:

Sl. No.	Voltage across resistor in volts (V)	Current through resistor in mA (I)	Voltage across resistors V_R in volts	$R=V_R/I$ in Ω
1	1V			
2	2V			
3	3V			
4	4V			
5	5V			

Calculation:

Theoretical value of resistance

R_1= $R_{2=}$

$R_{th}=R_1+R_2$

Results: Effective resistance of Series resistance circuit is calculated and verified.

Expt. No: 2.2b **Date:**

Experiment Name: the effect of open circuit and short circuit.

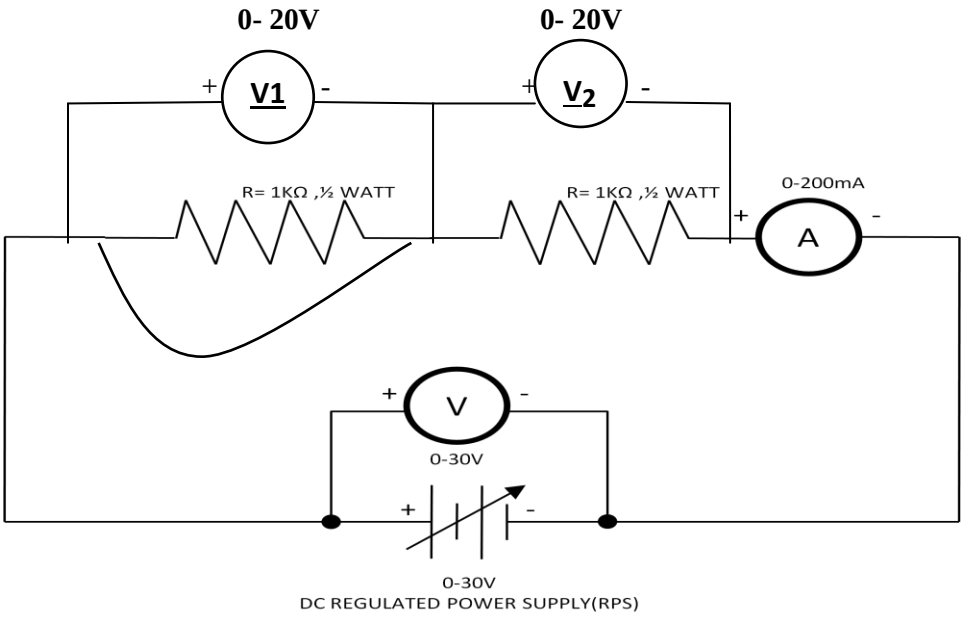
Aim: To understand the effect of open circuit and short circuit

Components and equipments required:

Sl.No	Name of the equipment/component	Range	Quantity
1	Resistor	1KΩ,½watt	02
2	Power supply	(0-30)V	01
3	Ammeter DC	(0-20)mA	01
4	Voltmeter DC	(0-20)V	01
5	Bread board	-	01
6	Wire	Single strand	10

a) Short circuit

Circuit diagram:



Theory:

When one of the components is shorted the resistance of the shorted component becomes zero hence, the effective resistance of the circuit reduces and the current through the circuit increases and voltage drop across shorted component will be zero. The voltage drop across other resistor will be increased.

Procedure:

1. Connect the circuit as per circuit diagram.
2. Vary the power supply voltage in such a way that the readings are taken in steps of 1V in the voltmeter till the power supply display shows 5V.
3. Measure current in the circuit and voltage across each resistor.
4. Note down the corresponding ammeter readings and voltage across resistor
5. Find Resistance $Rs=V_R/I$ Ohm
6. Analyze the effect of short circuit.

Tabular Column:

Sl. No.	Voltage across resistor in volts (V)	Current through resistor in mA (I)	Voltage across resistor R1, V1 in Volts	Voltage across resistor R2, V2 in Volts	Total Voltage across resistors V_R in volts (V1+V2)	$R=V_R/I$ in Ω
1	1V					
2	2V					
3	3V					
4	4V					
5	5V					

Calculation:

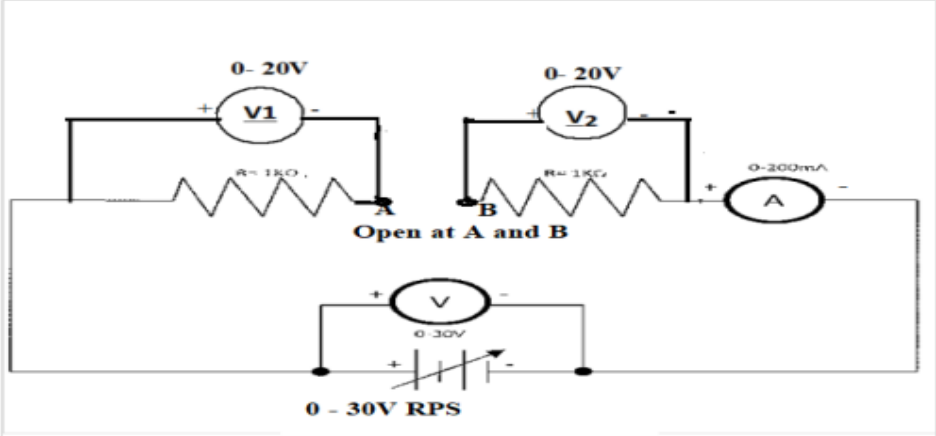
R_1=

$R_{2=}$

Results: Effect of short circuit is analyzed in series circuit.

b) Open circuit

Circuit diagram:



Theory:

When one of the resistor component is open as shown in the circuit diagram there will be a break in the circuit and hence no current flows through the circuit, and voltage drop across each component is zero.

Procedure:

1. Connect the circuit as per circuit diagram.
2. Vary the power supply voltage in such a way that the readings are taken in steps of 1V in the voltmeter till the power supply display shows 5V.
3. Measure current in the circuit and voltage across each resistor.
4. Note down the corresponding ammeter readings and voltage across resistor
5. Find Resistance $Rs=V_R/I$ Ohm
6. Analyze the effect of short circuit.

Tabular Column:

Sl. No.	Voltage across resistor in volts (V)	Current through resistor in mA (I)	Voltage across resistor R1, V1 in Volts	Voltage across resistor R2, V2 in Volts	Total Voltage across resistors V_R in volts (V1+V2)	$R=V_R/I$ in Ω
1	1V					
2	2V					
3	3V					
4	4V					
5	5V					

Results: Effect of open circuit is analyzed in series circuit.

Expt. No:2.3 Date:

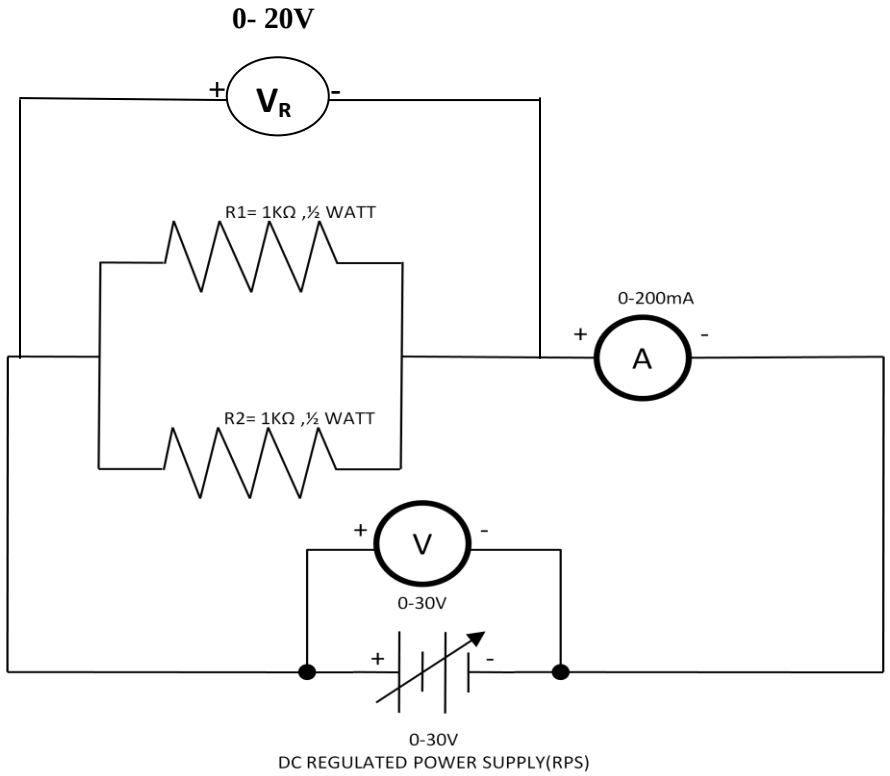
Experiment Name: Verification of effective resistance of Parallel resistance

Aim: Verification of effective resistance of Parallel resistance

Components and equipments required:

Sl.NO	Name of the equipment/component	Range	Quantity
1	Resistor	1KΩ,½watt	02
2	Power supply	(0-30)V	01
3	Ammeter	(0-20)mA	01
4	Voltmeter	(0-20)V	01
5	Bread board	-	01
6	Wire	Single strand	10

Circuit diagram:



Theory:

A Parallel circuit is one in which all the starting ends of resistors are connected to one common point and all the finishing ends of each are connected to another common point**.**

The total or effective Resistance of a parallel circuit is equal to sum of the reciprocal of individual resistance, connected in parallel.

$1/R_P = 1/R_1 + 1/R_2 + 1/R_3 + \ldots\ldots + 1/R_n$

$R_p = \frac{(R1R2)}{(R1+R2)}$ For 2 resistors connected in parallel.

Procedure:

1. Connect the circuit as per circuit diagram.
2. Vary the power supply voltage in such a way that the readings are taken in steps of 1V in the voltmeter till the power supply display shows 5V.
3. Note down the corresponding ammeter readings and voltage across resistor
4. Find Resistance $Rs=V_R/I$ Ohm.
5. Compare practical and theoretical value of resistance.

Tabular Column:

Sl. No.	Voltage across resistor in volts (V)	Current through resistor in mA (I)	Voltage across resistor V_R in volts	$R=V_R/I$ in Ω
1	1V			
2	2V			
3	3V			
4	4V			
5	5V			

Calculation:

R_1= $R_{2=}$

Theoretical value of resistance, $Rp = \frac{(R1*R2)}{(R1+R2)}$ **Ω**

Result: It is found that the practical value of effective resistance when three Resistors are connected in parallel is approximately equal to the theoretical value. Hence the experiment is verified.

Expt. No: 2.4 **Date:**

Experiment Name: Generate and Measurement of AC voltage

Aim: To generate AC voltage by signal generator and measurement time period, frequency,peak vaulue using CRO.

Components and equipments required:

Sl. No	Name of the equipment/component	Range	Quantity
1.	signal generator	-	01
2.	Cathod ray ossilloscope (CRO)	-	01
3.	CRO Probe	-	02
4.	Voltmeter	(0-20)V	01

Circuit diagram:

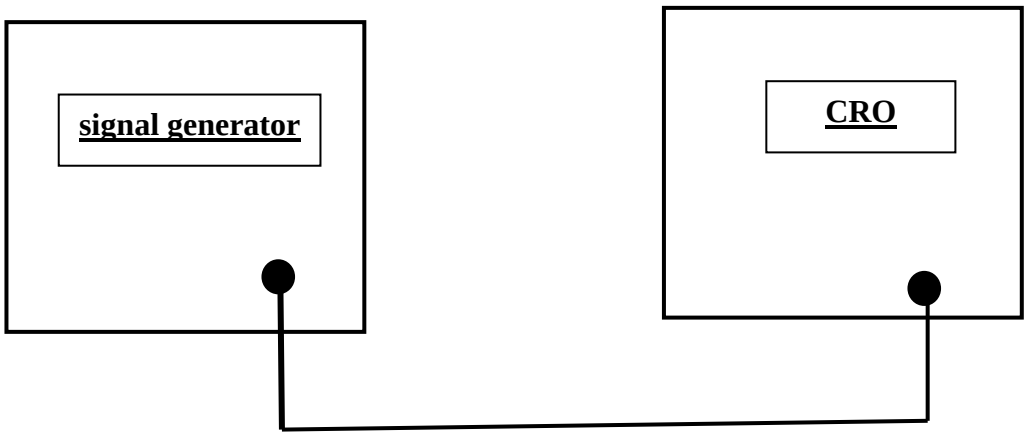


Fig1: Block diagram

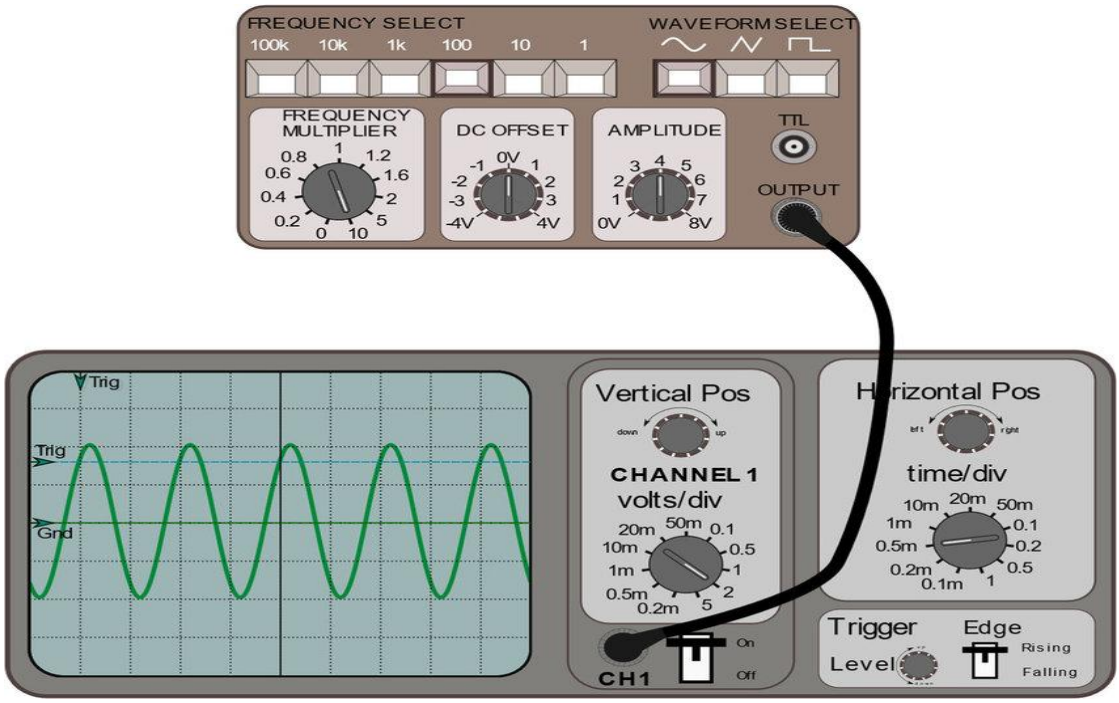
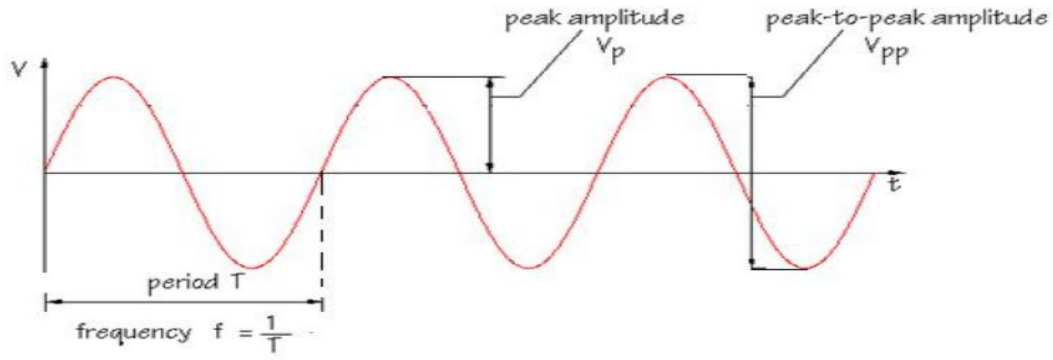


Fig 2: circuit diagram

Theory:



Where V_p= peak amplitude in volts

V_{pp}=peak-to-peak amplitude in volts

T= Time period in seconds

F= frequency in Hertz

Fig3: AC voltage waveform

Sinusoidal Voltage: The voltage that varies as a sine wave with time.

The basic mathematical formula for the sinusoidal voltage is

$V = Vm \sin(\omega t)$ Volts Where: Vm = The maximum value of the V

V= Instantaneous value of Voltage at time t

$\omega = 2\pi f$, The angular velocity is in Radians/Sec/ sec

Amplitude (Peak Value or Crest Value or Maximum Value)

The maximum value reached by an alternating quantity either in positive or negative direction called Amplitude.

Time period (T)

Time required to complete one cycle is called time period. It is measured in seconds.

Frequency (f)

The number of cycles completed in one second is called frequency. Its unit is Hertz (Hz).

Procedure:

1. Connect the Signal generator to CRO by using CRO probes.
2. Switch ON the Power supply.
3. Display the AC voltage waveform on CRO screen.
4. Set the required voltage and frequency for the input waveform in signal generator.
5. Measure the Amplitude, Peak-to-Peak voltage, Frequency, Time Period and Wavelength as shown in the diagram.
6. Note down and tabulate the results.

Calculations:

Tabulations:

We observed from the waveform displayed on CRO that
The peak Amplitude is found to be, Vp =_____V
The peak-to-peak Amplitude is found to be, Vpp =_____V
The Time Period is found to be, T =_____sec
The Frequency is found to be, f =_____Hz

Result: For the given AC voltage waveform Amplitude, Peak-to-Peak voltage, Frequency and Time Period are measured successfully.

Expt. No: 2.5 **Date:**

Experiment Name:Wiring to Control of one lamp from two different places.

Aim: Wire up and test PVC conduit wiring to control Lamp from two different places (staircase wiring).

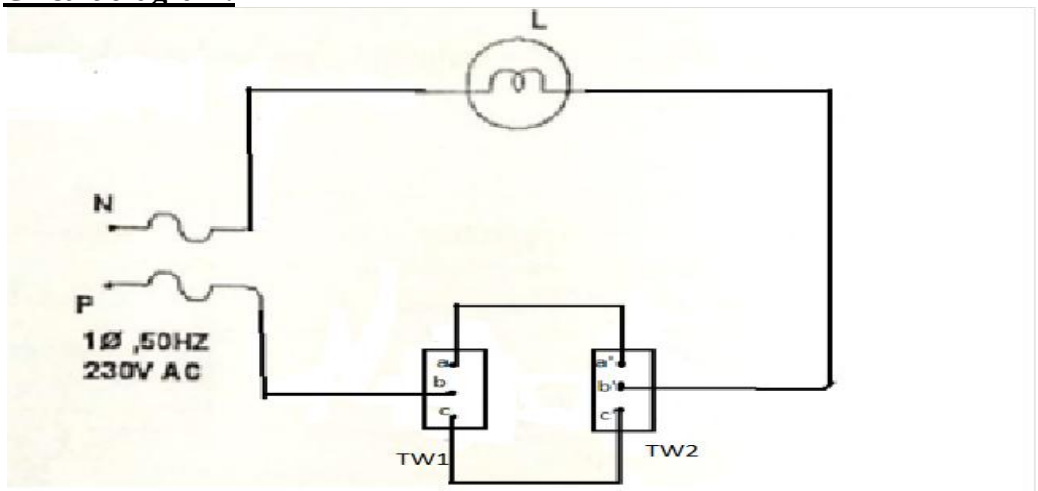
Apparatus and Tools required:

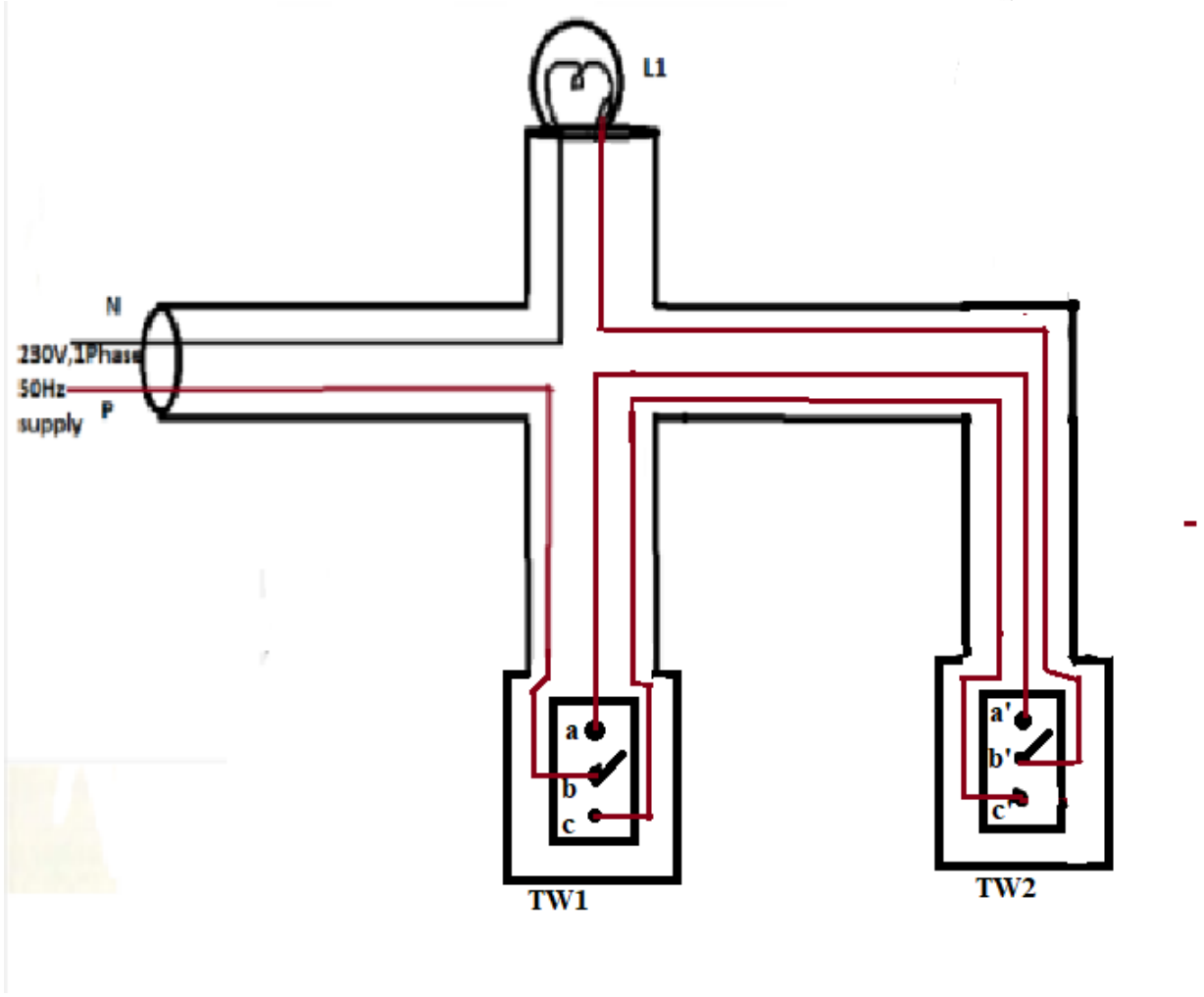
Sl No.	Name of the apparatus	Specifications	Quantity
1	Wooden wiring board	2½"X2'X3"	1
2	PVC Junction box	2 way & 4 way	1 each
3	Two way switch with Gang box	5A,230V	2
4	Lamp holder	5A,230V	1
5	PVC Pipe	½"	5
6	Lamp	40W, 230V	1
7	Copper Wire	1.5SQMM	2m
8	Saddels	½"	6
9	Wooden Screws	¾"	20
10	Screws for Gang box	2"	12
11	Tool Kit	-	1set

Operations to be carried out

1. Marking
2. Cutting
3. Clamping
4. Skinning
5. Wiring
6. Checking
7. Testing
8. Finishing

Circuit diagram:





Wiring diagram

Procedure:

1. The wiring diagram is roughly drawn on the wooden board.
2. Connections are made as shown in the circuit diagram.
3. The two way switches are connected in series with the phase only.
4. The switches and lamps are fixed neatly and tightly.
5. Check the connection once again by the test lamp or multi-meter for proper connections.
6. Switch on the supply and close the DPST switch.
7. Switch on the switches as per the tabular column and verify the results.
8. Switch off all switches, open DPST switch and turnoff the power supply.

Tabular column:

Sl.No	TW1	TW2	LAMP CONDITION
1	cb	c'a'	
2	ca	c'a'	
3	ca	c'b'	
4	cb	c'b'	

Result: PVC conduit wiring is done as per the wiring diagram to control the Lamp from two Different places and tested according tabular column.

Expt. No:2.6 **Date:**

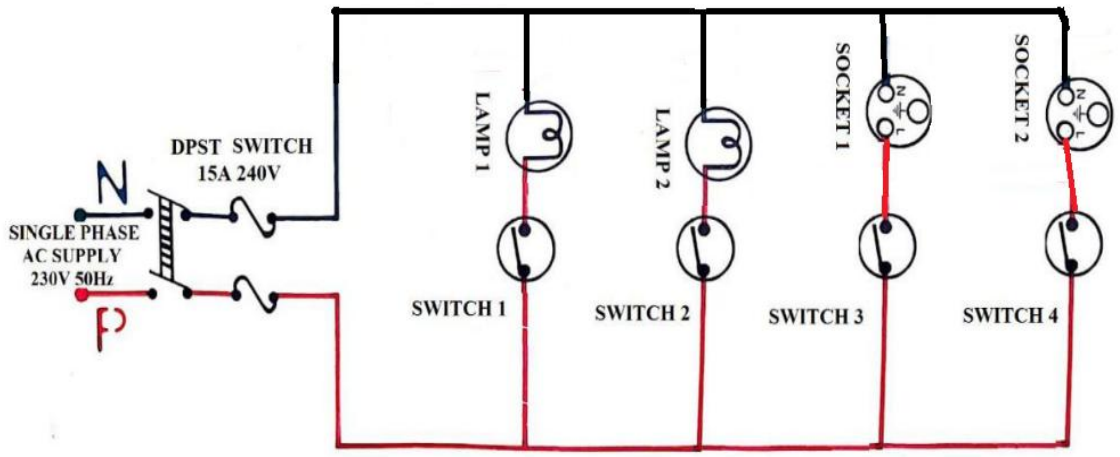
Experiment Name: Wiring to control of two lamps and two sockets independently

Aim: Wire up and test PVC conduit wiring to control of two lamps and two sockets independently

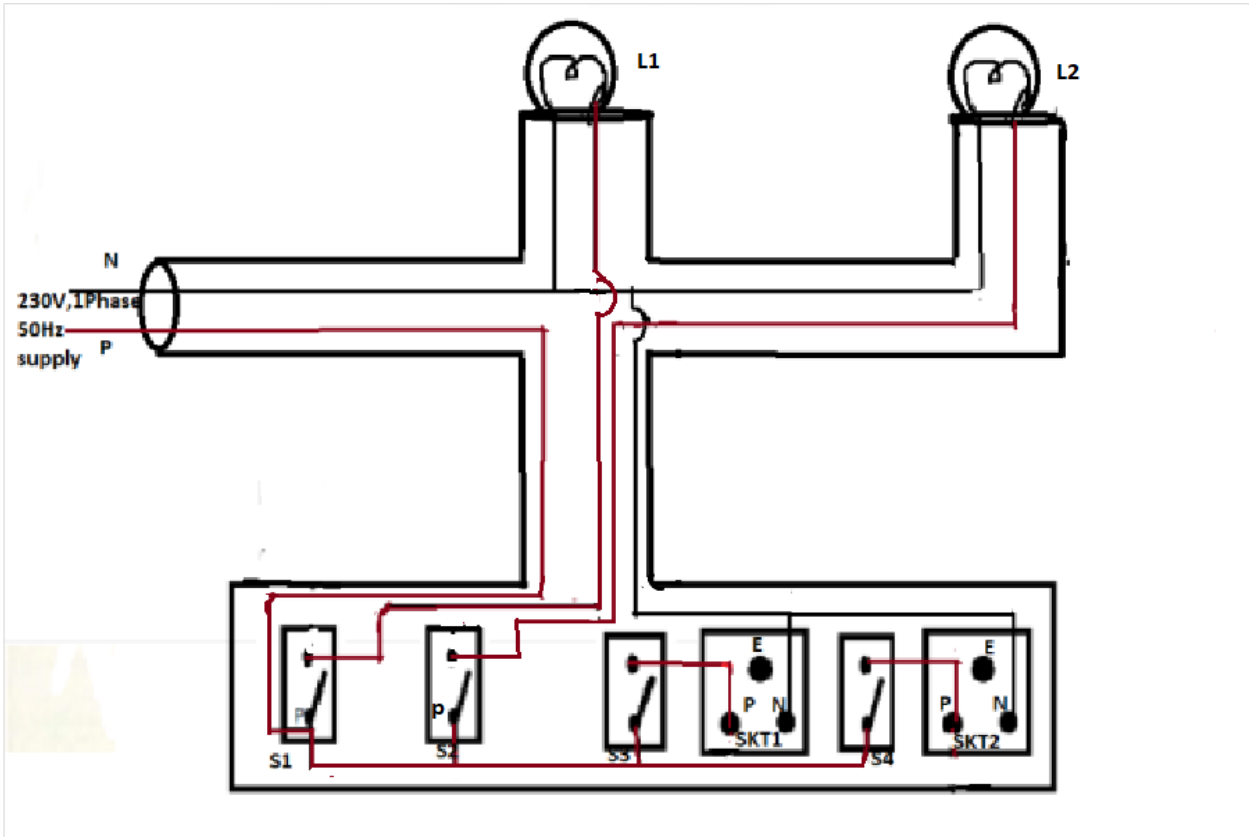
Apparatus and Tools required:

Sl. No.	Name of the apparatus	Quantity	Sl. no	Name of the tools	Quantity
1	DPST Switch	01	1	Screw driver	01
2	Incandescent Lamp 60W	02	2	Cutting plier	01
3	Lamp holder	02	3	Wire stripper	01
4	Teak wood round block	04	4	Tester	01
5	Teak wood board	01			
6	Fuse cutout	02			
7	Half inch PVC pipe	12			
8	3-pin socket	02			
9	Wooden screw	24			
10	Junction box(4 way, 3 way)	03,01			
11	Test lamp	01			
12	Connecting wires	As required			

Circuit diagram:



Wiring diagram



Procedure:

1. The wiring diagram is roughly drawn on the wooden board.
2. Connections are made as shown in the circuit diagram.
3. The switches are connected in series with the phase only.
4. The switches and lamps are fixed neatly and tightly.
5. Check the connection once again by the test lamp or multi-meter for proper connections.
6. Switch on the supply and close the DPST switch.
7. Switch on the switches as per the tabular column and verify the results.
8. Switch off all switches, open DPST switch and turn off the power supply.

Tabular column:

Sl no.	Switch 1	Switch 2	Switch 3	Switch 4	Lamp 1	Lamp 2	Socket 1	Socket 2
1	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
3	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF
4	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON

Result:

PVC conduit wiring is done as per the wiring diagram to controlled the two Lamps and Two Sockets independently and tested according to the tabular column.

Expt. No:2. 7 **Date:**

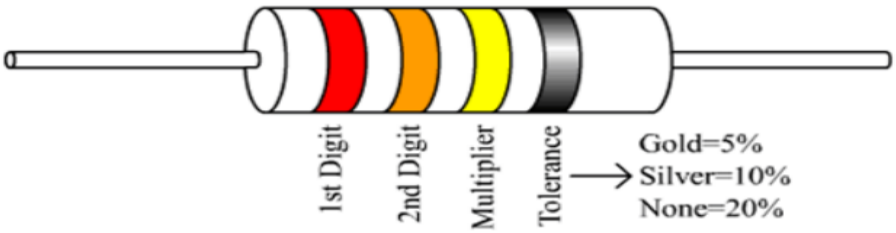
Experiment Name: Color Coding of Resistors

Aim: To determine the value of resistance by color coding method and compare it with multimeter readings.

Components and equipments required:

Sl.No.	Item with Specification	Quantity
1	Digital multimeter	1
2	Assorted resistors	Few
3	Patch cords	1 Set

Diagram :



Color	Digit	Multiplier	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

Theory:

Resistor color-coding:

Resistor Color Coding uses colored bands to quickly identify a resistors resistive value and its percentage of tolerance with the physical size of the resistor indicating its wattage rating.

For example, a resistor with bands of yellow, violet, red, and gold will have first digit 4 (yellow in table below), second digit 7 (violet), followed by 2 (red) zeros: 4,700 ohms. Gold signifies that the tolerance is ±5%, so the real resistance could lie anywhere between 4,465 and 4,935 ohms.

Resistor Value = [Digit1 Digit 2 * multiplier] ± Tolerance

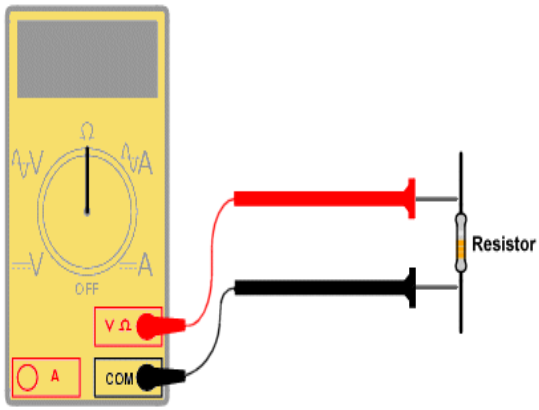
= [47*100] ± 5%

= 4700 ± 5% Ω

Procedure:

1. Given resistors of different color bands are taken.
2. Using the color code table, the values of resistors is calculated.
3. The tolerance value of higher range and lower range is found out.
4. Digital multimeter is taken and the value of resistor is measured by setting the selector switch to resistance range.
5. The difference in measured value and calculated value is noted.

Compare the values of Resistors using colour code and meter method.



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- In order to measure the resistance set mulitimeter to 'Ω' range.
- Connect meter probes to resistor
- Observe the values in meter display.
- Compare the measured value with the theoretical value (which is calculated using colour code method).

Tabular column:

Sl.No	Color band				Resistance value using color code	Resistance value using multimeter
	Digit 1	**Digit 2**	**Digit 3**	**Digit 4**		
1						
2						
3						
4						
5						

Calculations:

Result:

The given resistor value is calculated using color coding and verified using digital multimeter.

Expt. No: 2.8 **Date:**

Experiment Name: Identify the terminals of a diode and test the diode for its condition.

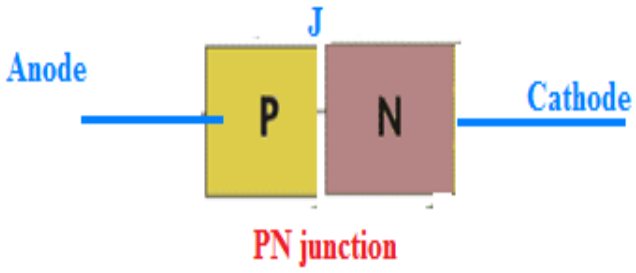
Aim: Identify the terminals of a diode and test the diode for its condition.

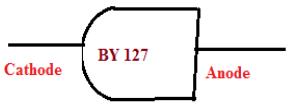
Components and equipments required:

Sl.No	Name of the equipment/component	Range	Quantity
1	Digital multimeter	-	01
2	DIODE	BY127 Or IN4007	01

Theory:

Diode: It is a two terminal semiconductor device formed by joining P type and N type semiconductor.

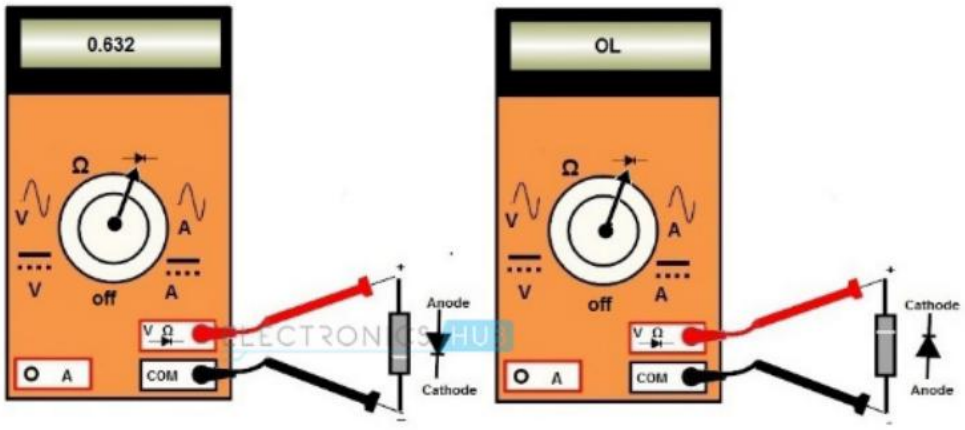




Terminal Identification:

Before testing of the diode we have to identify the terminals of the diode that is anode and cathode. Most of the PN diodes have the white-band on its body and this white-band side terminal is the cathode. And the remaining one is anode. Some diodes may have a different color band, but the color band side terminal is the cathode.

Testing of DIODE:



Procedure:

Identify the terminals anode and cathode of the diode.

1. Keep the digital multimeter (DMM) in diode checking mode by rotating the central knob to the place where the diode symbol is indicated. In this mode multimeter is capable to supply a current of 2mA approximately between the test leads.
2. Connect the red probe to the anode and black probe to the cathode. This means diode is forward-biased.
3. Observe the reading on meter display. If the displayed voltage value is in between 0.6 to Sl No Name Type Range/Specification Qty 1 D.M.M 1 2 Test probes 1 3 Diode 1N4007 1 A, 1000 V 1 0.7 (since it is silicon diode) then the diode is healthy and perfect. For germanium diodes this value is in between 0.25 to 0.3.
4. Now reverse the terminals of the meter that means connect the red probe to cathode and black to anode. This is the reverse biased condition of the diode where no current flows through it. Hence the meter should read OL (which is equivalent to open circuit) if the diode is healthy.

Tabular column:

Sl. no	Multimeter connection with Diode	Reading	Remarks
1	Red to Anode, Black to cathode.		
2	Red to Cathode, Black to Anode		

Result: The given Diode BY127/1N4007 is in good condition.

Expt. No: 2.9 **Date:**

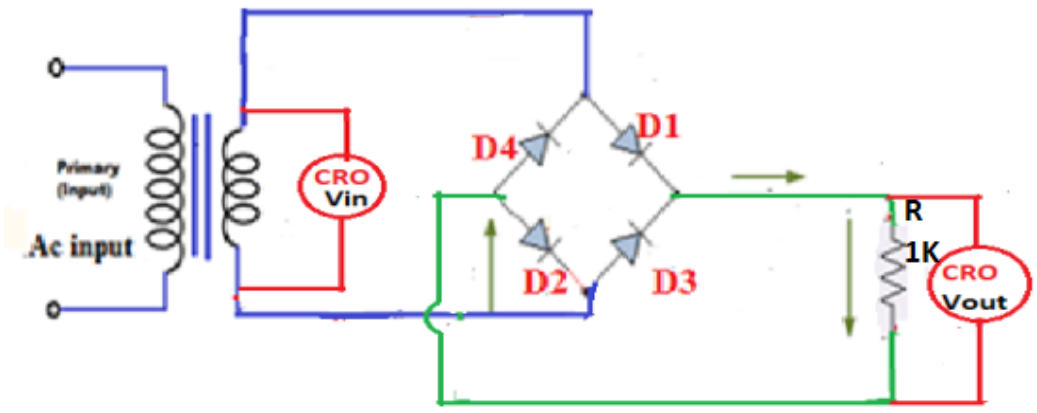
Experiment Name: Full Wave Bridge Rectifier

Aim: a. Build and test full wave bridge rectifier circuit (without filter).
b. Build and test full wave bridge rectifier using IC (without filter).

Components and equipments required:

Sl.No	Name of the equipment/component	Range	Quantity
1	Digital multimeter		01
2	IC	RB156	01
3	DIODE	BY127 Or IN4007	04
4	Transformer	230v/12v-0-12v	01
5	CRO		01
6	CRO probes		02
7	Resistor	1000Ω	01
8	Connecting wires		Lump sum

Circuit diagram



4 Arm bridge rectifier

Theory:

Bridge rectifier consists of four diodes and transformer without center tap as shown in the diagram. During the positive half cycle of the supply, Diode D1 and D2 are forward biased and conduct. Diode D3 and D4 are reverse biased and do not conduct. The current flows through load resistance.

During the negative half cycle, Diode D3 and D4 are forward biased and conduct. Diode D1 and D2 are reverse biased and do not conduct. The current flows through load resistance.

The unwanted AC component present in the output of the rectifier circuit is called ripple. The ripple factor of half wave rectifier is 1.21. The ripple factor of the full wave rectifier is 0.482.

Ripple Factor of Full Wave Rectifier

From the formula of ripple factor, we know that

$$\Gamma = \sqrt{(\frac{V_{rms}}{V_{dc}})^2 - 1}$$

Substituting the values we get the ripple factor of full-wave rectifier as:

$$\Gamma = \sqrt{(\frac{V_{rms}}{V_{dc}})^2 - 1} = 0.48$$

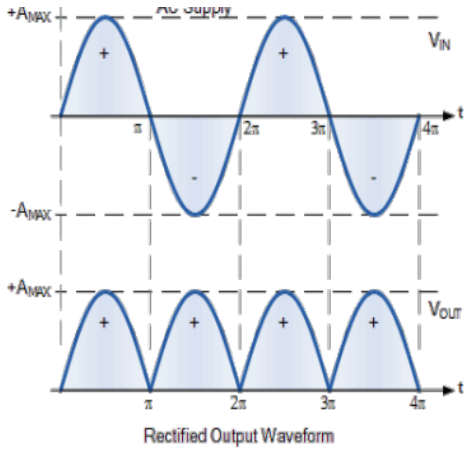
Procedure:

1. Connections are made as per the circuit diagram.
2. Switch on CRO and make settings.
3. Switch on power supply to the rectifier circuit and observe the wave form and trace it.
4. Take readings.
5. Switch off power supply.
6. Calculate ripple factor.

Calculations:

Tabular Column:

SL.NO	With Diode		With IC	
	VDC	VAC	VDC	VAC
1				



Rectified Output Waveform

Result: Waveform shows semiconductor Diode and Rectifier IC can be used as a rectifier

Expt. No:2.10 Date:

Experiment Name: The transistor as an electronic switch.

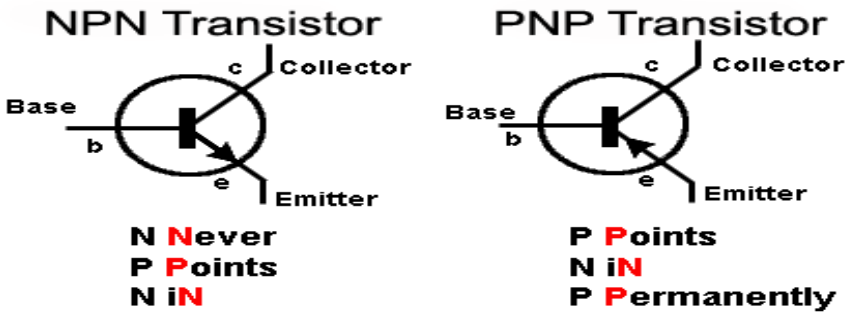
Aim: 1.To identifies and test NPN or PNP transistor and its terminal identification.
2. Construct and test the transistor as an electronic switch

Components and equipments required:

Sl.No	Name of the equipment/component	Range	Quantity
1	Digital multimeter	-	01
2	Transistor	SL100/CL100	01
3	LED	-	01
4	DC Power supply(RPS) dual	0-30V	01
5	Resistor	1000Ω	02
6	Bread board	-	1
7	Connecting wires	-	Lump sum

Theory:

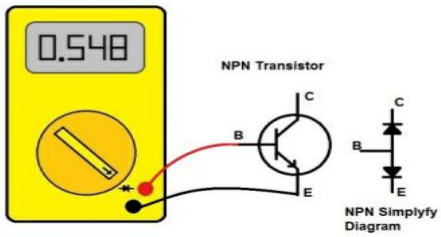
A transistor is a three terminal semiconductor device consists of two pn junctions J1 and J2
There are two types of transistors, namely
(1) n-p-n transistor (2) p-n-p transistor



Steps to identify the NPN type transistor:

1. Keep the Multimeter in the Diode mode.
2. Keep the positive probe to the center pin of the transistor.
3. Touch the negative probe to the pin-1. You will see some voltage in the multimeter.

4. Similarly touch the negative probe to the pin-3 (collector) with respect to the center pin. You will see some voltage in the multimeter.
5. It will ensure that it is a NPN transistor and the center pin must be base. The logic behind this is, in NPN transistor, Emitter (E) – N type material – Equivalent to cathode of the diode. Base (B) – P type material – Equivalent to anode of the diode. Collector(C) – N type material – Equivalent to cathode of the diode.
6. Compare voltage reading between base and terminal 1 and 2, more reading with terminal must be Emitter and other one is Collector.
7. If the multimeter positive probe is connected to anode and negative probe is connected to cathode, then it will show voltage. If the connections are interchanged it will not show any value.



Steps to identify the PNP type transistor:

1. Keep the Multimeter in the Diode mode.
2. Keep the positive probe to the pin-1 (Emitter) of the transistor.
3. Touch the negative probe to the center pin (Base). You will see some voltage in the multimeter.
4. Similarly touch the negative probe to the center pin (Base) with respect to the pin-3 (collector). You will see some voltage in the multimeter. (E) It will ensure that it is a PNP transistor. The logic behind this is, in PNP transistor Emitter –P type material – Equivalent to anode of the diode. Base (B) – N type material – Equivalent to cathode of the diode Collector(C) – P type material – Equivalent to anode of the diode
5. If the multimeter positive probe is connected to anode and negative probe is connected to cathode, then it will show voltage. If the connections are interchanged it will not show any value.

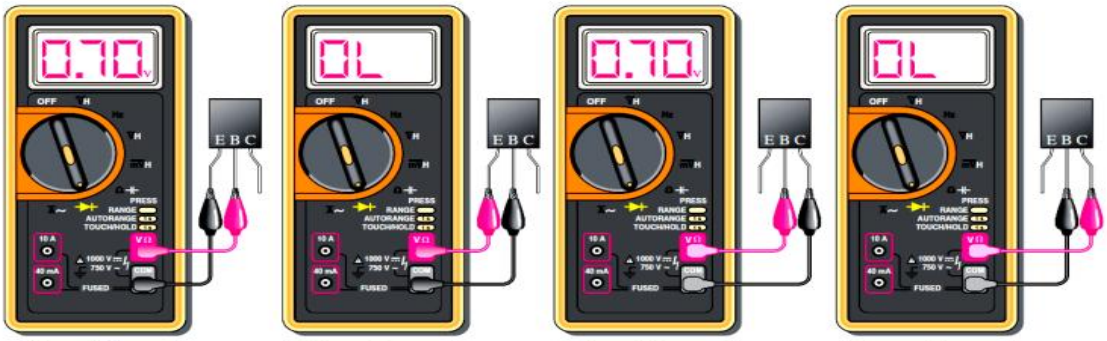
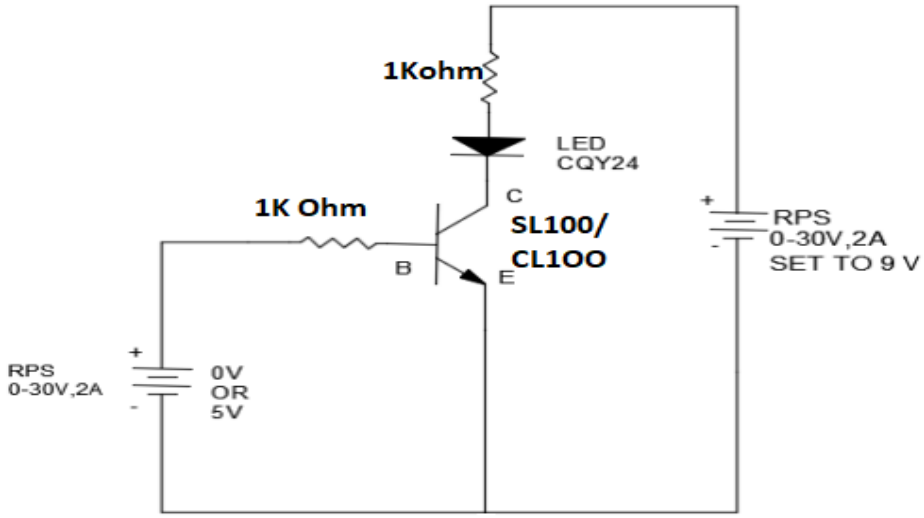


Fig : Typical DMM test of a properly functioning npn transistor. Leads are reversed for a pnp transistor.

b. Build a circuit to test the transistor as an electronic switch.

Circuit diagram



Tabular column:

Sl. no	Base to emitter voltage(VBE) in V	Mode of LED
1	0V	
2	5V	

Procedure:

1. Connections are made as per the circuit diagram.
2. Connect ZERO volts to the input terminals ie. VBE (Base to emitter voltage) and observe the Status of LED.
3. Connect FIVE to the input terminals ie. VBE (Base to emitter voltage) and observe the status Of LED.
4. Switch of the power supply.

Result:

When VBE (Base to emitter voltage) is ZERO Volts LED is not turned ON and when VBE (Base to emitter voltage) FIVE volts LED is turned ON, hence transistor is working as a switch.

Expt. No:2. 11 Date:

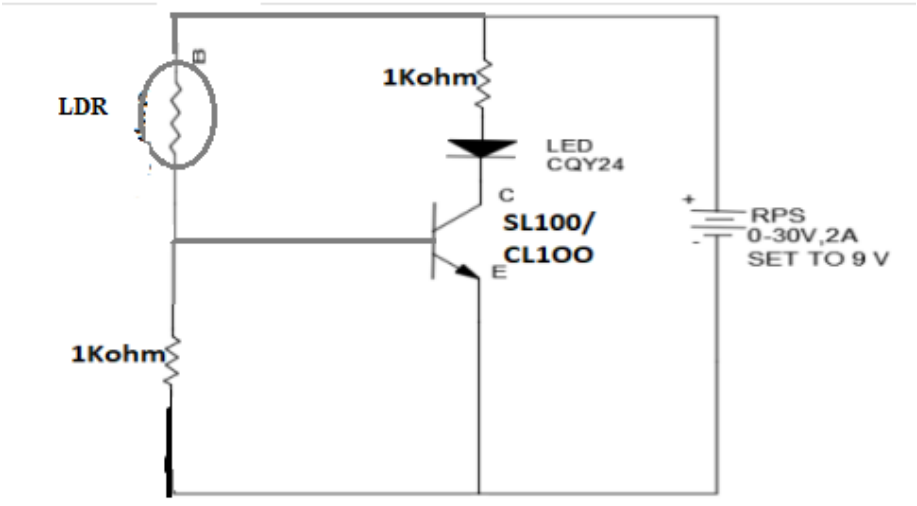
Experiment Name: Photo Sensor

Aim: To connect and test a Photo Sensor to a digital circuit.

Components and equipments required:

Sl.No	Name of the equipment/component	Range	Quantity
1	LDR	-	01
2	Transistor	SL100/CL100	01
3	LED	-	01
4	DC Power supply(RPS) dual	0-30V	01
5	Resistor	1000Ω	02
6	Bread board	-	1
7	Connecting wires	-	Lump sum

Circuit diagram



Theory:

Photo sensor is used to detect the light. Photo sensor circuit will operate depending on light falling on the circuit.

Procedure:

1. Connections are made as per the circuit diagram.
2. 5V supply is given to the circuit.
3. Interrupt light falling on LDR and observe the condition of LED .
4. The sensitivity of the device is varied by varying the trimmer.
5. The supply is switched off.

Tabular column:

Sl. no	Light condition	Mode of LED
1	No light	
2	Presence of light	

Result: Photo Sensor is tested.

Expt. No:2. 12 **Date:**

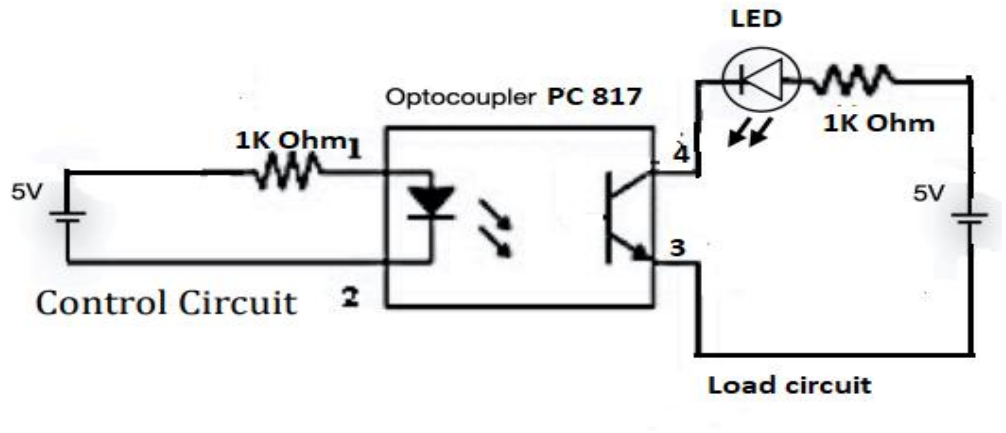
Experiment Name: Relay Using Optocoupler

Aim: To connect and test a relay circuit using an optocoupler.

Components and equipments required:

Sl.No	Name of the equipment/component	Range	Quantity
1	Optocoupler IC	-	01
3	DC Power supply(RPS)	0-30V	02
4	LED		01
5	Resistor	1000Ω	02
6	Bread board	-	1
7	Connecting wires	-	Lump sum

Circuit diagram:



Theory:

Opto-isolators or Opto-couplers, are made up of a light emitting device, and a light sensitive device, all wrapped up in one package, but with no electrical connection between the two, just a beam of light. The light emitter is nearly always an LED. The light sensitive device may be a photodiode, phototransistor, or more esoteric devices such as thyristors, TRIACs etc.

When zero volts is given at the input side LED, then the light doesn't fall on transistor so it doesn't conduct which gives output LED OFF. When some voltage (3V-5V) is given as input then light falls on photo transistor so that it conducts, that makes photo transistor is switched ON and it forms a short circuit this makes the output LED connected to ground through photo transistor, hence it glows.

Procedure:

1. Connections are made as per the circuit diagram.
2. Supply is given to both control circuit and load circuit by turning on both RPS. 3.
3. Push button switch is pressed and the glow of output LED is observed.
4. The supply is switched off.

Tabular column:

Sl. no	Control circuit voltage	Mode of LED
1	0V	
2	5V	

Result :

Relay circuit using optocoupler is realized.

Expt. No: 2.13 **Date:**

Experiment Name: Basic logic gates

Aim: To verify the truth tables of AND, OR, NOT, gates using integrated circuits

Components and equipments required:

Sl.No	Name of the equipment/component	Range	Quantity
1	IC 7402	-	01
3	IC 7432	-	01
4	IC 7408	-	01
5	IC trainer kit	-	01
6	Patch cords	-	05

Theory:

NOT gate: It has one input and one output terminal. When an input is high output is low and vice versa. In NOT gate output is the compliment of input. It is also called as an inverter.

AND gate: It has two or more inputs and only one output. It performs mathematical multiplication operation. The output is high only when all the inputs are high.

OR gate: It has minimum two inputs and only one output. It performs mathematical addition operation. The output is high only when any one of the input is high. OR when all the inputs are zero, then the output is also zero.

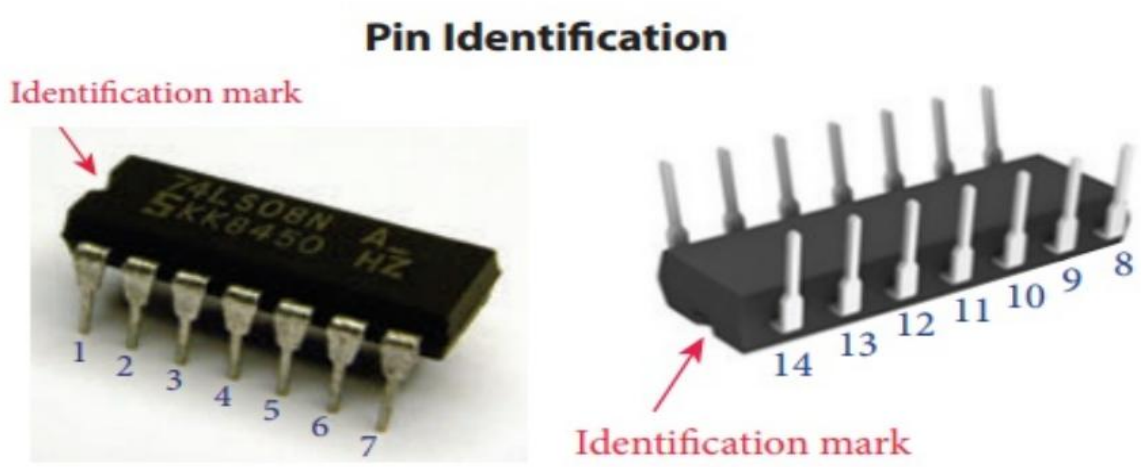


Figure (a) Integrated circuit

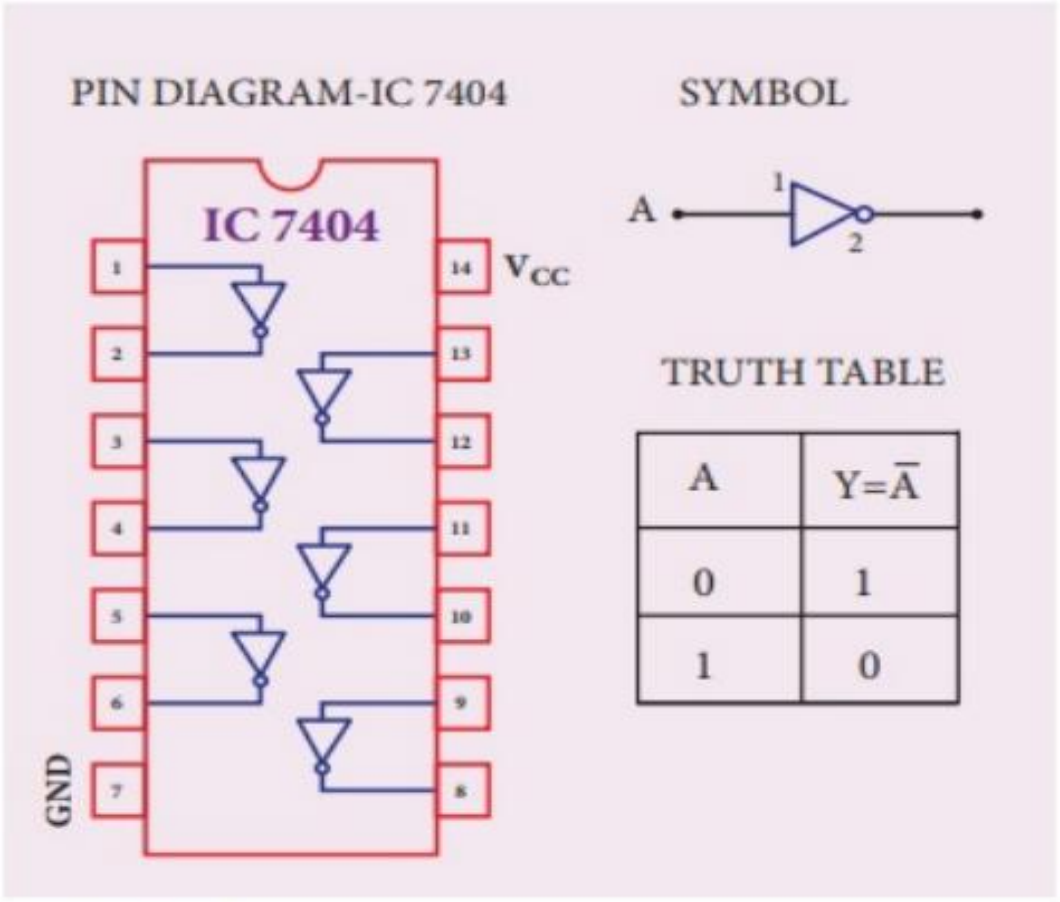
Procedure:

1. Fix the IC on the ziffsocket (IC socket or IC base) provided in digital trainer kit observing the notch, such that notch points top. IT is as shown in fig.
2. Observing input pins and output pins connect inputs to logic switches and output pin to LED socket provided in digital trainer kit.

   Connect pin no. & to supply ground and pin no. 14 to Positive of supply (+VCC)
3. Switch on the supply to IC trainer kit. Give the input to the IC and observe the output at LED.
4. Repeat above for different combinations of inputs like, (0,0), (0,1), (1,0) and (1,1)
5. For each combination of input, note down the condition of LED whether ON or OFF.

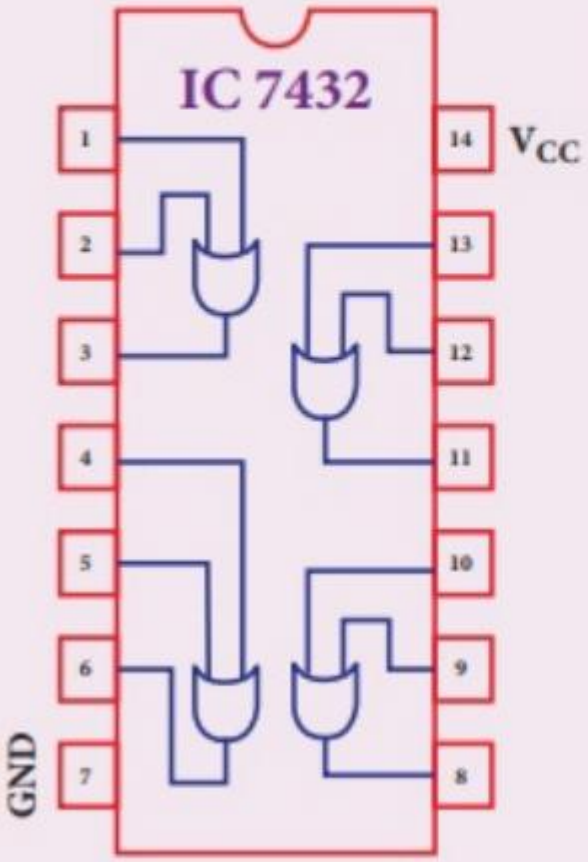
Precautions: VCC and ground pins must not be interchanged while making connections. Otherwise the chip will be damaged.

NOT Gate:



OR Gate:

PIN DIAGRAM-IC 7432

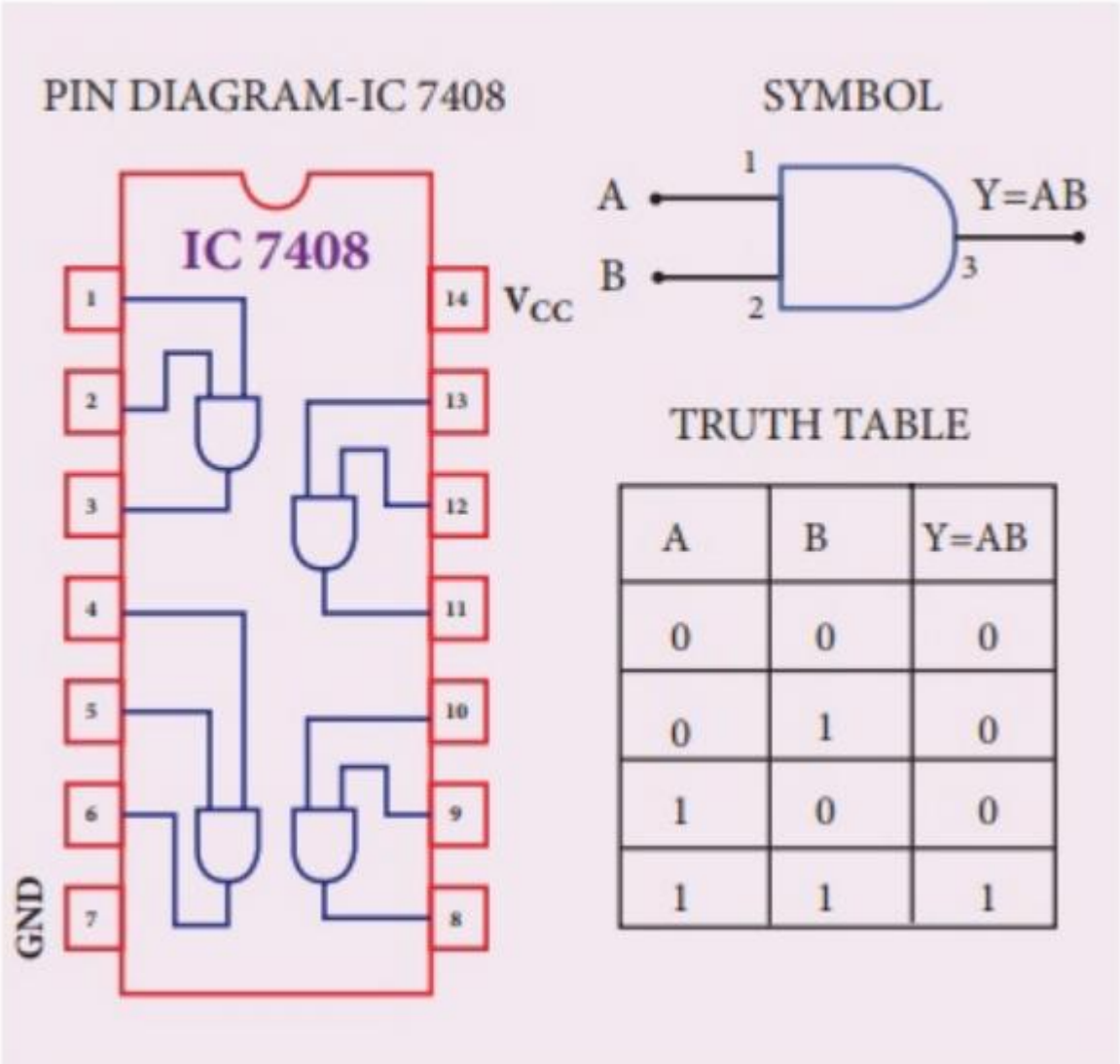


SYMBOL

TRUTH TABLE

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

AND Gate:



Result: The truth table of logic gates AND, OR, NOT using integrated circuits is verified.

Expt. No:2. 14 **Date:**

Experiment Name: NAND, NOR, XOR logic gates

Aim: To verify the truth tables of **NAND, NOR, XOR** gates using integrated circuits

Components and equipments required:

Sl.No	Name of the equipment/component	Range	Quantity
1	IC 7400	-	01
3	IC 7402	-	01
4	IC 7486	-	01
5	IC trainer kit	-	01
6	Patch cords	-	05

Theory:

NAND GATE: The NAND gate or "NotAND" gate is the combination of two basic logic gates, the AND gate and the NOT gate connected in series. The output of a NAND gate is high when either of the inputs is high or if both the inputs are low.

NOR GATE: A NOR gate ("not OR gate") is a logic gate that produces a high output (1) only if all its inputs are false and low output (0) otherwise.

XOR GATE:

XOR gate is a digital logic gate that gives a true (1 or HIGH) output when the number of true inputs is odd.

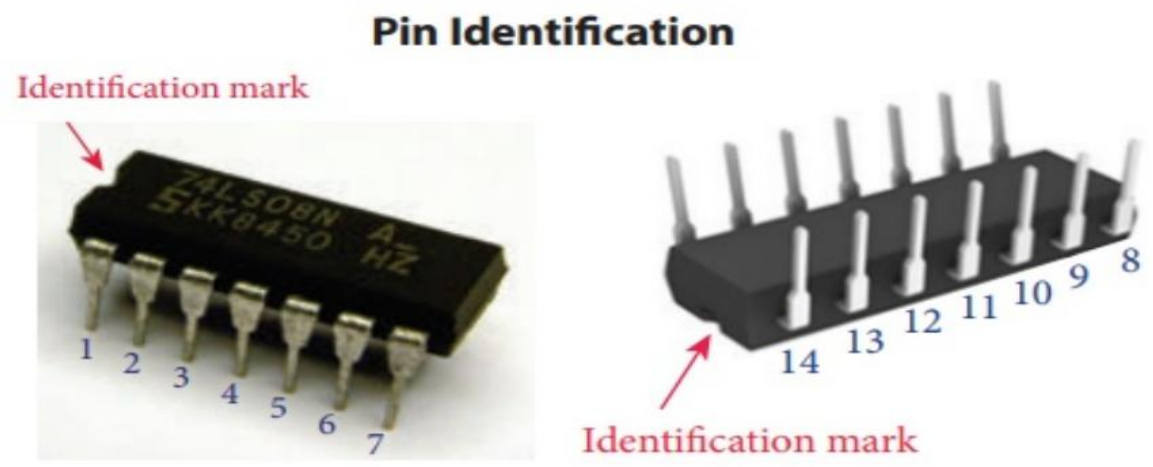


Figure (a) Integrated circuit

Procedure:

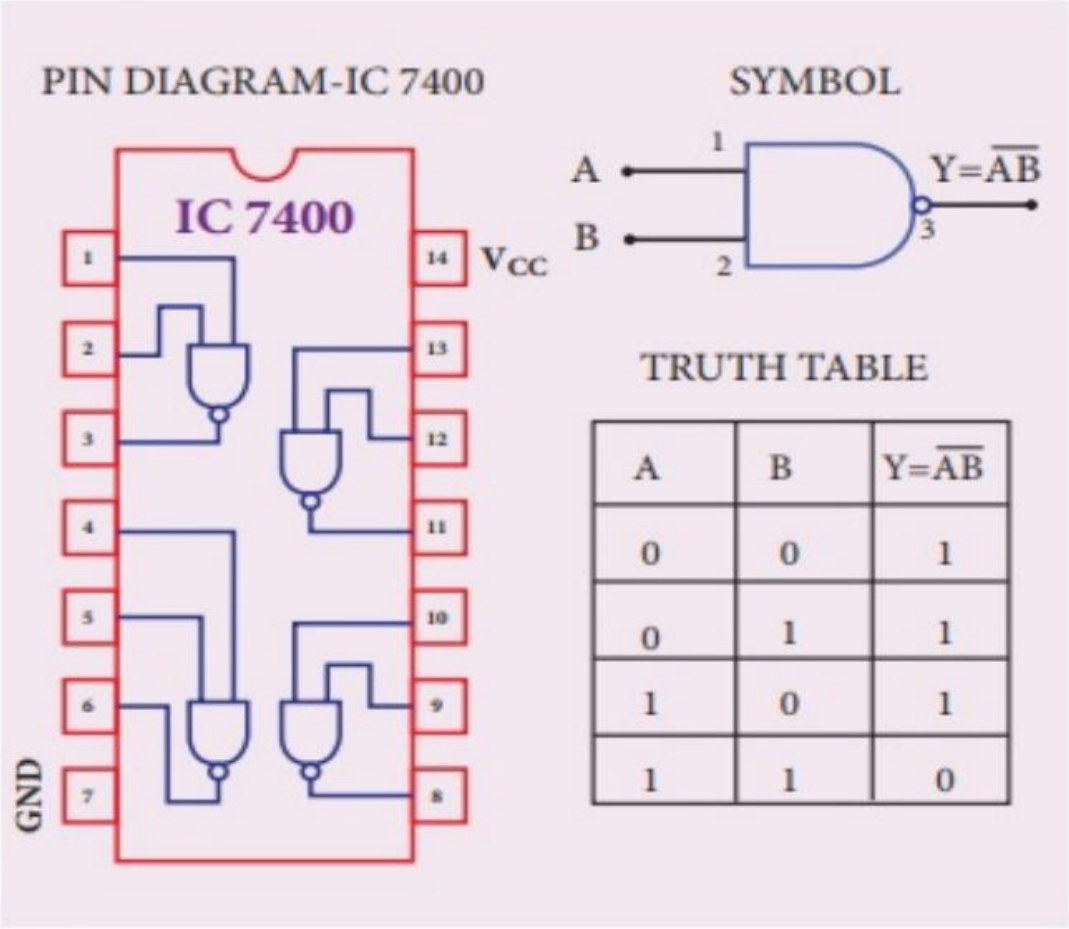
1. Fix the IC on the ziffsocket (IC socket or IC base) provided in digital trainer kit observing the notch, such that notch points top. IT is as shown in fig.
2. Observing input pins and output pins connect inputs to logic switches and output pin to LED socket provided in digital trainer kit.

Connect pin no. & to supply ground and pin no. 14 to Positive of supply (+VCC)

3. Switch on the supply to IC trainer kit. Give the input to the IC and observe the output at LED.
4. Repeat above for different combinations of inputs like, (0,0), (0,1), (1,0) and (1,1)
5. For each combination of input, note down the condition of LED whether ON or OFF.

Precautions: VCC and ground pins must not be interchanged while making connections. Otherwise the chip will be damaged.

NAND Gate:

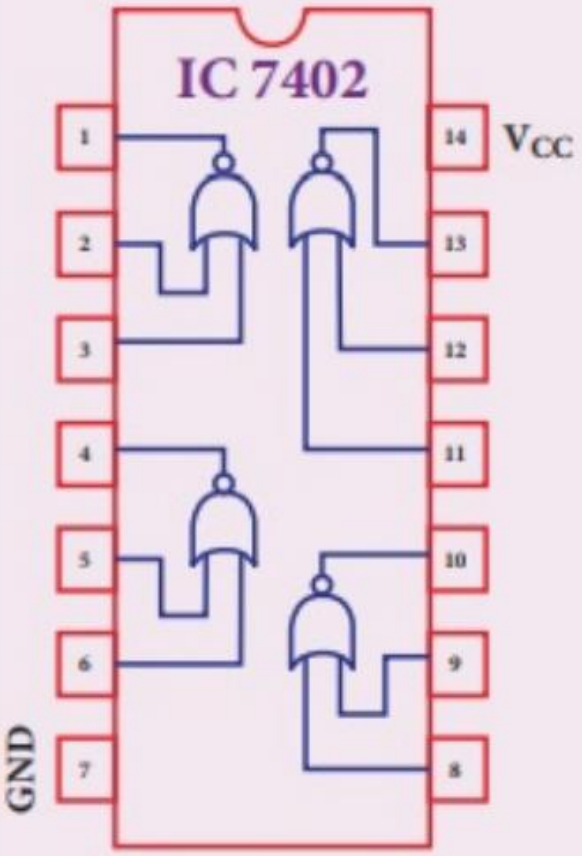


TRUTH TABLE

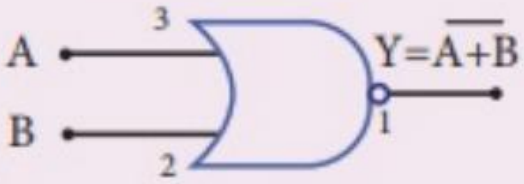
A	B	$Y=\overline{AB}$
0	0	1
0	1	1
1	0	1
1	1	0

NOR Gate:

PIN DIAGRAM-IC 7402



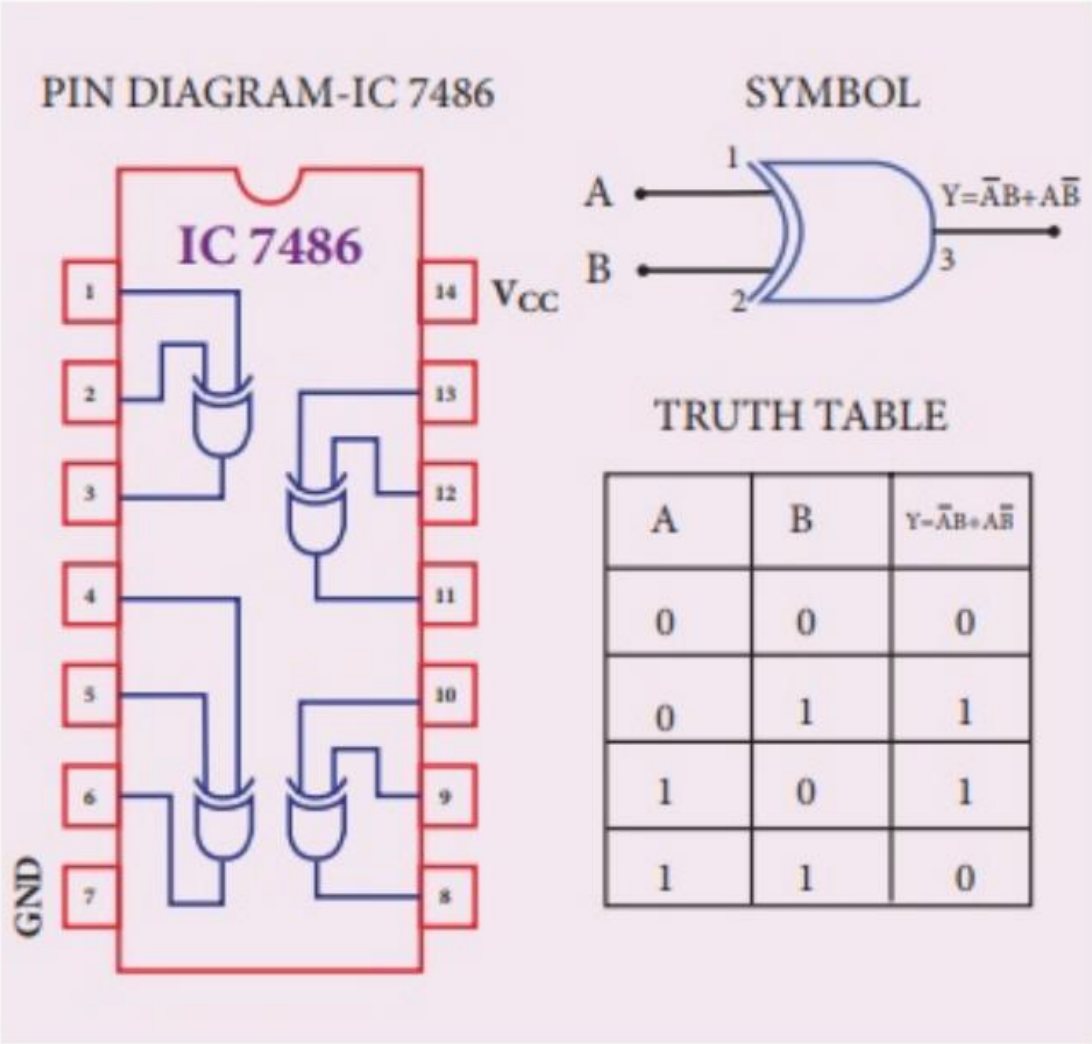
SYMBOL



TRUTH TABLE

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

X-OR Gate :



Result: The truth table of logic gates NAND, NOR, XOR using integrated circuits is verified.