LAB MANUAL

FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS LAB (25EE01I)

I&II SEM (EE, EC, CE, ME, CS, IS)

Prepared by

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DAYANANDA SAGAR INSTITUTE OF TECHNOLOGY (POLYTECHNIC)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

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Academic year 2025-2026

Week-1

1a.Demonstrate use of Personal Protective Equipment (PPE) and types

A Personal Protective Equipment (PPE) is clothing or equipment designed to reduce employee exposure to chemical, biological, and physical hazards when on a worksite. It is used to protect employees when engineering and administrative controls are not feasible to reduce the risks to acceptable levels

There are numerous types of workplace safety equipment available depending on the hazard exposure and work conditions. The following are basic PPE that can help protect employees:

1b.Electrocution (Electric shock).Use Videos to demonstrate how to free a person from electrocution

Video link

https://www.youtube.com/watch?v=9Q3StjKVms4

https://www.youtube.com/watch?v=luTRnCoeD4c

https://www.youtube.com/watch?v=xDQi1I04mXc

https://www.youtube.com/watch?v=A1iJkJPI9ws

1. Don't the person

1. Do not go near or touch the person until you're sure the electrical supply has been switched off

2. Be careful in areas that are wet such as bathrooms, pool areas, and wet grounds. Water is an electrical conductor and you may get electrocuted.

3. Separate the Person from Current's Source. To turn off power: Unplug an appliance or shut off power via circuit breaker, fuse box, or outside switch. If you can't turn off power:

Stand on something dry and non-conductive, such as dry newspapers, telephone book, or wooden board.
Try to separate the person from current using non-conductive object such as wooden or plastic broom handle, chair, or rubber doormat.

4. If the person is unconscious and has stopped breathing, begin cardiopulmonary resuscitation (CPR). Position your hand in the center part of the chest, about a couple of inches above the end of the breastbone. Give 30 compressions.

5. If the person is conscious and breathing is normal, and if burns are present, cover with ordinary cling wrap or other non-adhesive dressing, but no ointment or lotion

6...As soon as the victim have been freed from the electrical source, call for an ambulance or medical help if you are alone with the patient.

1c.Demonstration of Pipe and plate Earthing methods Date;

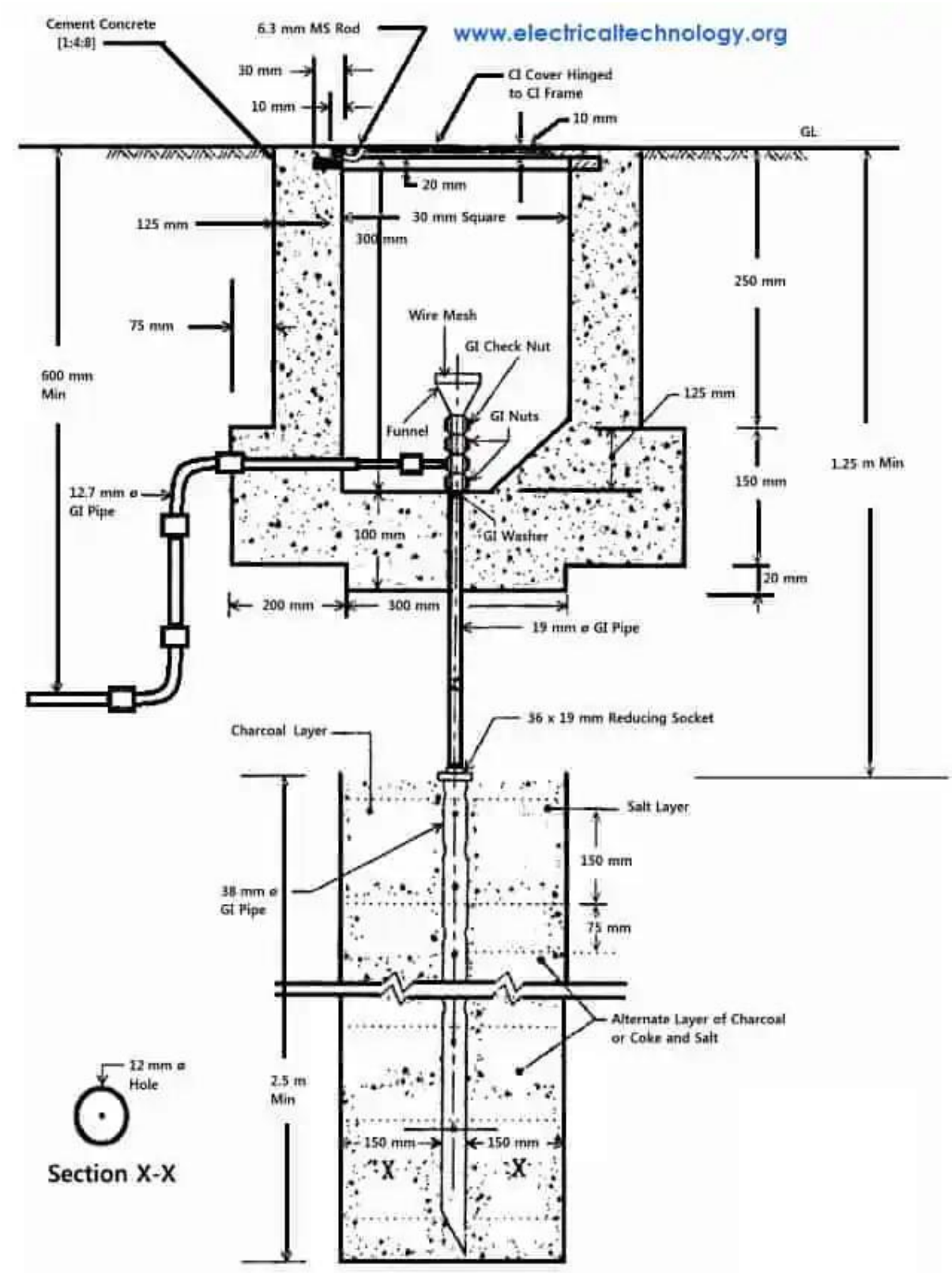
Definition: The process of transferring the immediate discharge of the electrical energy directly to the earth by the help of the low resistance wire is known as the electrical earthing. The electrical earthing is done by connecting the non-current carrying part of the equipment or neutral of supply system to the ground.

Types of Earthing

1. Pipe earthing

2. Plate earthing

Pipe earthing is the best and most efficient way of earthing and is also easily affordable. Pipe earthing uses 38mm diameter and 2 meters length pipe vertically embedded in the ground to work as earth electrodes.



Pipe Earthing

In plate earthing, an earthing plate made of copper or G.I. is buried into the ground at a depth more than 3 metres from the ground level. This earthing plate is embedded in an alternative layer of coke and salts.

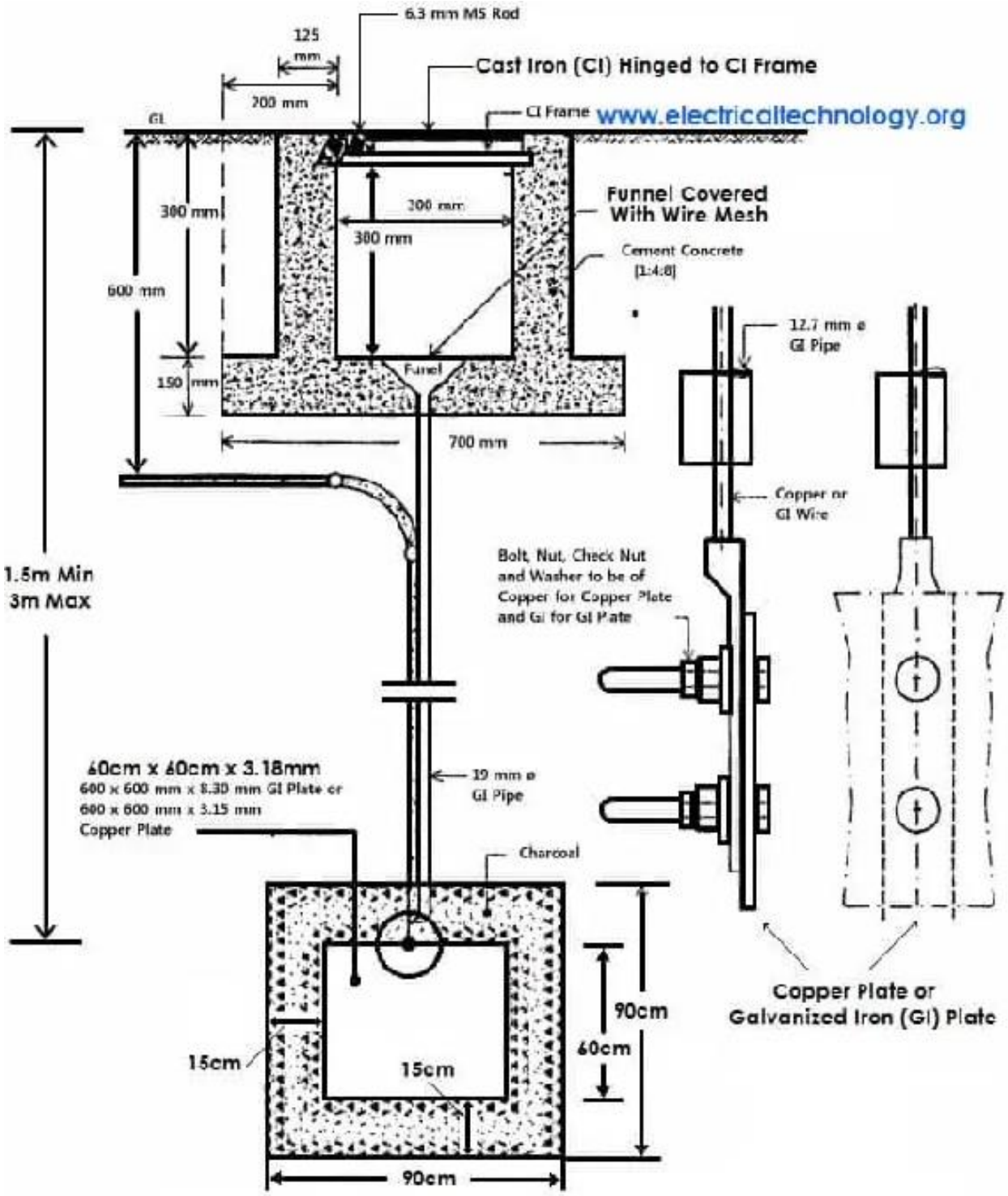


Plate Earthing

1d.Know your Electrical lab. Identify power supply, various components with symbols, Check earthing by measuring the voltage between neutral and earth points. Date:

Power Supply: A power supply is electrical devices that provides electrical power to an electrical and electronic system or device. Power supplies convert AC voltage from the mains to DC voltage and can also adjust the voltage level to suit different circuit requirements.

1. Types:

Batteries: Provide a portable source of DC power.

AC/DC Power Supplies: Provide a controllable source of AC or DC power.

Identification:

Power supplies are typically labeled with voltage and current ratings, and often have multiple output terminals.

2. Components and Symbols:

Measuring Instruments:

Multimeter: Used to measure voltage, current, resistance, and continuity.

Oscilloscope: Used to visualize and analyze the waveforms of electronic signals.

Function Generator: Used to generate various waveforms (sine, square, etc.) at different frequencies.

LCR Meter: Measures inductance, capacitance, and resistance.

Voltmeter: Specifically measures voltage.

Ammeter: Specifically measures current.

Galvanometer: Measures small electrical currents.

Passive Components:

Resistors: Limit the flow of current.

Capacitors: Store electrical energy.

Inductors: Store energy in a magnetic field.

Integrated Circuits (ICs): Complex circuits on a single chip.

Switches: Control the flow of current. Symbol: A gap that closes to complete the circuit.

Diodes: Allow current flow in one direction. Symbol: An arrow pointing in the direction of current flow.

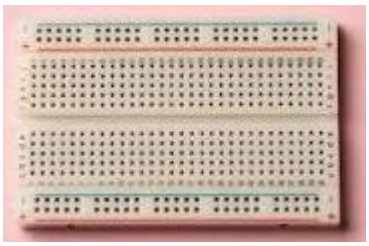
Transistors: Act as switches or amplifiers. Symbols vary depending on the transistor type (BJT, MOSFET, etc.).

3. Checking Earthing (Grounding):

Importance: Earthing provides a safe path for fault currents to flow to the ground, preventing electric shock and protecting equipment.

Procedure:Use a multimeter set to measure AC voltage. Connect the millimeter's red lead to the neutral wire and the black lead to the earth (ground) wire of a mains outlet.

A low voltage reading (ideally close to 0V) indicates proper earthing.



Tools and Accessories:

Breadboard: Used for prototyping circuits without soldering.
Wire Strippers/Cutters: Used to prepare wires for connections.
Pliers/Tweezers: Used for handling small components.
Screwdrivers: Used for assembling and disassembling devices.
Connectors: Used to connect components together.
Light Bulbs: Used to indicate the presence of current.
Fuses: Used to protect circuits from overcurrents.
Potentiometers: Variable resistors.

Week-2

2a.Video demonstration on identification and observation of different ranges and types of meters Date:

https://www.youtube.com/watch?v=gkeJzRrwe5k

https://www.youtube.com/watch?v=gkeJzRrwe5k

https://www.youtube.com/watch?v=DeJW79QBZFI

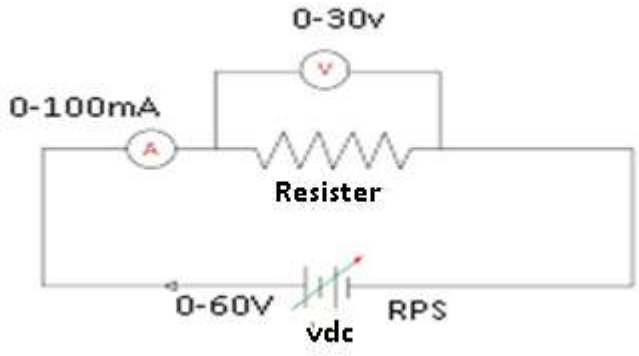
2b.Verification of Ohm's Law using simple circuit Date:

AIM: To Verify Ohm's Law using simple circuit

APPARATUS REQUIRED

1.Ammeter-1no
2.Voltmeter-1no
3.Resister
4.DC power supply
5.Connecting wires

CIRCUIT DIAGRAM



PROCEDURE:

1. Make clean and tight connections according to the circuit diagram.
2. Vary the voltage step by step and observe the reading
3. Note down the value of V from voltmeter and current I from ammeter.
5. Record the readings of the voltmeter and ammeter.
6. Find the resistance R using formula.

FORMULA

R= V / I

CALCULATION

1.

2.

3.

TABULAR COLOUMN

Sl no	Voltmeter reading(v)	Ammeter Reading(A)	Unknown Reading (R) R= V / I Ω
1			
2			
3			

R= Mean resistance= + + + + = _____

RESULT: Ohm's Law using simple circuit is verified

Signature of staff

2c.Demonstrate experimentally Open circuit, closed circuit and short circuit conditions in Simple series circuit. Date:

AIM: To demonstrate experimentally Open circuit, closed circuit and short circuit conditions in Simple series circuit.

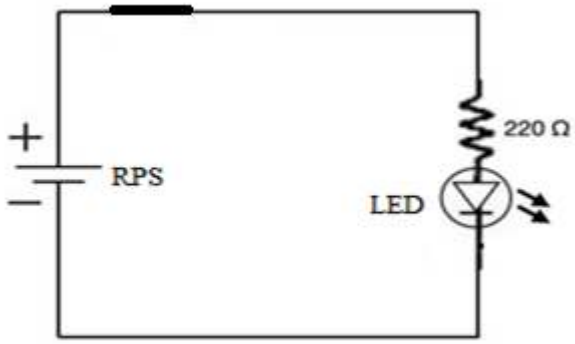
COMPONENTS REQUIRED

1. RPS
2. LED
3.220 ohms resister
4. Connecting wires

CIRCUIT DIAGRAM

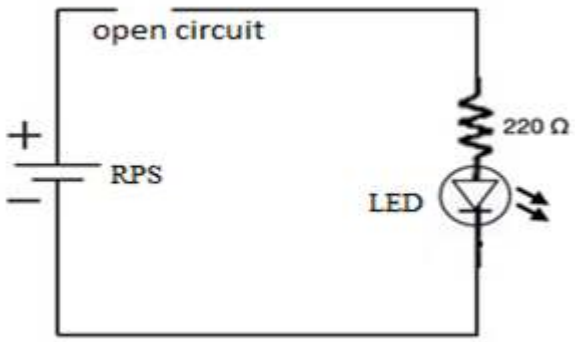
CLOSED CIRCUIT

A circuit in which provides closed path so that current flows through the circuit is called closed circuit. The image given below shows a closed...



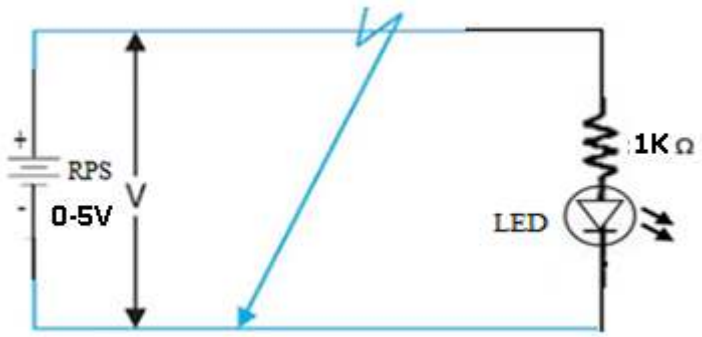
OPEN CIRCUIT

Open circuit: An open circuit is a circuit where the path has been interrupted or "opened" at some point so that current will not flow. An open circuit is also called an incomplete circuit. An open circuit is an electric circuit that does not allow current to pass.



SHORT-CIRCUIT

A short circuit is simply a low resistance connection between the two conductors supplying electrical power to any circuit. This results in excessive current flow in the power source through the ‘short,’ and may even cause the power source to be destroyed



RESULT: Open circuit, closed circuit and short circuit conditions in Simple series circuit is experimentally Demonstrated

Signature of staff

Week-3

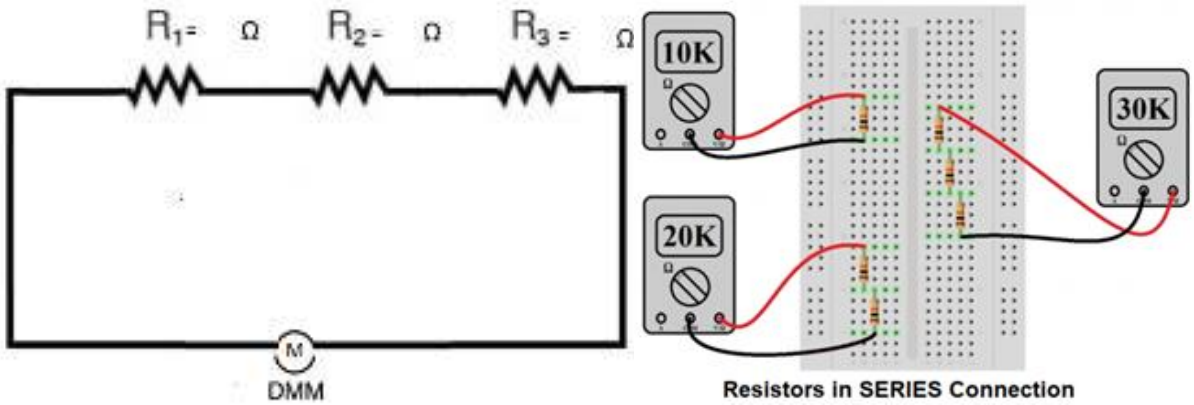
3a. Determine the equivalent Resistance in series resistive circuit Date:

AIM: To determine the equivalent Resistance in series resistive circuit

APPARATUS REQUIRED

1. Digital multimeter
2. Required number of resisters
3. Bread board
4. Connecting wires

CIRCUIT DIAGRAM



PROCEDURE

1. Check all the components for proper working.
2. Check the Resistance values by using Multimeter.
3. Rig up the circuit as shown in the circuit diagram.
4. Switch on Multimeter, turn on to resister mode and observe the value of resistance
5. Tabulate the value and use formula to find resistance in series

TABULAR COLOUMN

Sl no	Value of resistance	Equivalent resistance R= r1+ r2+ r3
1		
2		
3		

FORMULA

Reqv =R1+R2+R3

CALCULATION

1. R1=
2. R2=
3. R3=

Req = R1+R2+R3

= Ω

RESULT: the equivalent Resistance in series resistive circuit is determined

Signature of staff

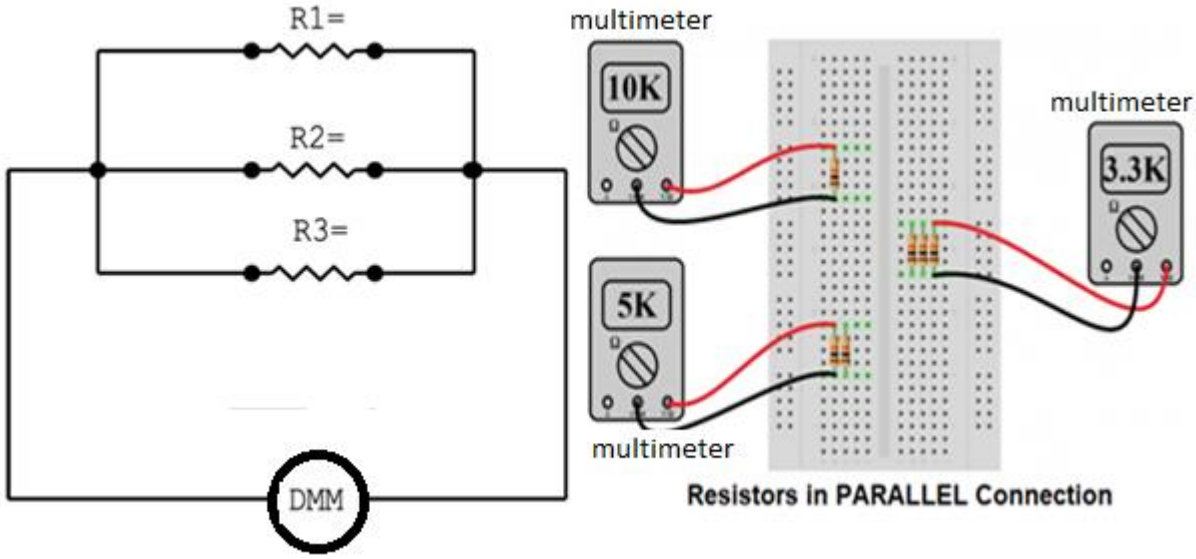
3b. Determine the equivalent Resistance in parallel resistive circuit Date:

AIM: To Determine the equivalent Resistance in parallel resistive circuit

APPARATUS REQUIRED

1. Digital multimeter
2. Required number of Resisters
3. Bread board
4. Connecting wires

CIRCUIT DIAGRAM



PROCEDURE

1. Check the components (Resistors & Multimeter) for proper working.
2. Rig up the circuit as shown in the circuit diagram.
3. Note down the Multimeter readings & tabulate the result
4. Repeat the Experiment for different resistance values.
5. Use the formula to find out resistance in parallel

TABULAR COLUMN

Sl no	Value of resistance	Equivalent resistance
1		
2		
3		

CALCULATION

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$= \frac{1}{\quad} + \frac{1}{\quad} + \frac{1}{\quad} =$$

$$\text{therefore: } R_T = \frac{1}{\quad} =$$

RESULT: the equivalent Resistance in parallel resistive circuit is determined

Signature of staff

Week-4

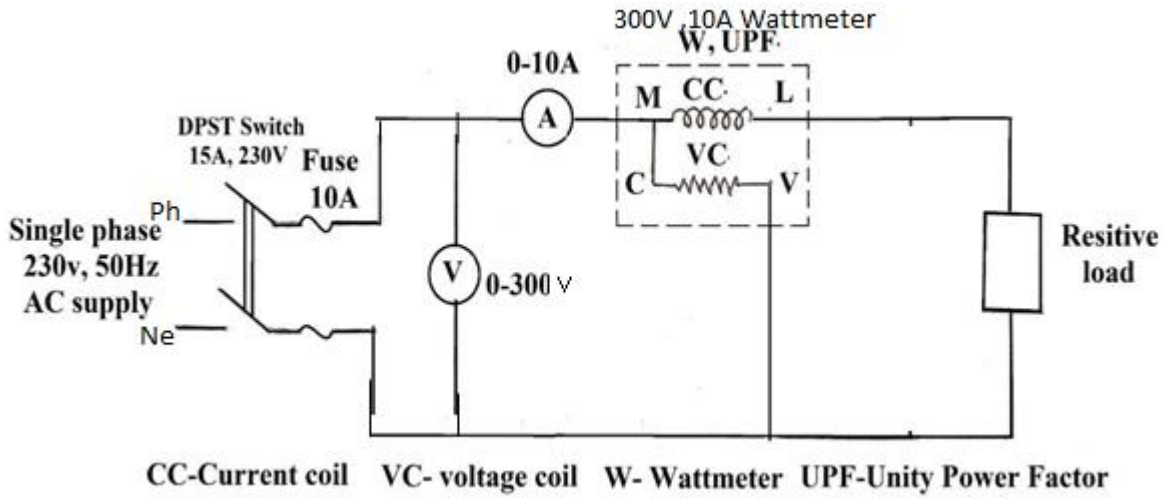
4a.Measure the AC voltage, current, power using relevant measuring instruments in a Single phase AC circuit Date:

AIM: To Measure the AC voltage, current, power using relevant measuring instruments in a Single phase AC circuit

APPARATUS REQUIRED

1. Voltmeter 0-300v (MI)-1no
2. Ammeter 0-10A (MI) -1no
3. Wattmeter 300v, 10A UPF -1no
4. DPST switch -1n0
5. Resistive load -1no
6. Connecting wires as required

CIRCUIT DIAGRAM



Wattmeter constant K=V(selected) X I(selected) x Cosϕ =

Full Scale reading of wattmeter

PROCEDURE

1. Connections are made as per the circuit diagram.
2. Switch on the single phase power supply and then close the DPST switch.
3. Apply the load by Turning ON the switches of resistive load and note down the readings of Ammeter, Voltmeter and Wattmeter.
4. Repeat the step 3 by increasing the load and note down the readings.
5. Open the DPST switch and turn OFF the supply.

TABULAR COLUMN:

Sl.No.	Current in Amps	Voltage V in volts	Power P in watts x K

FORMULA

P= W X K

CALCULATION

1.

2.

3.

RESULT: AC voltage, current, power using relevant measuring instruments in a Single phase AC circuit is measured

Signature of staff

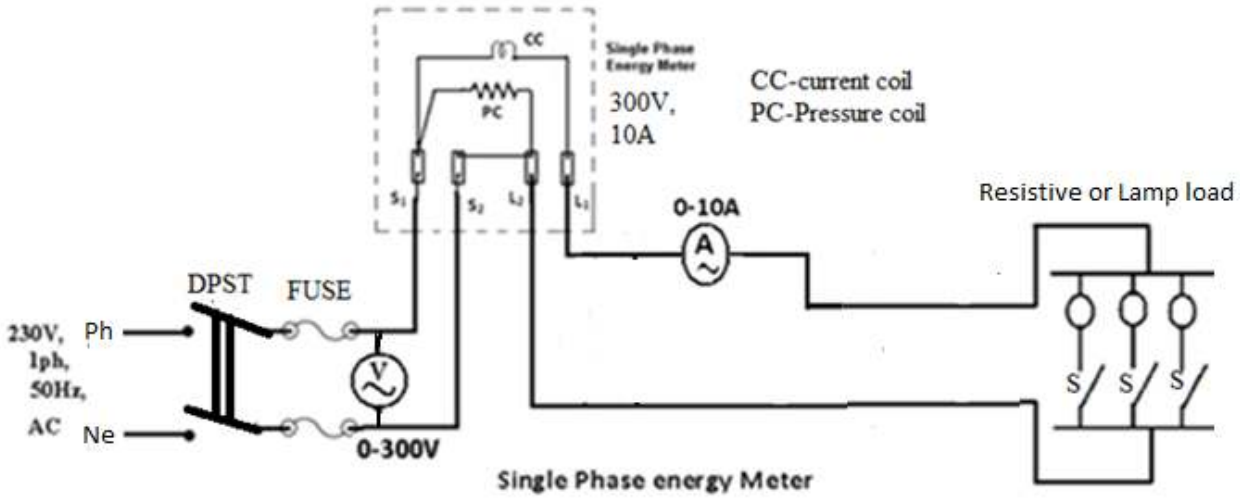
4b.Measurement of energy in a Single phase AC circuit Date:

AIM: To Measure energy in a Single phase AC circuit

APPARATUS REQUIRED

1. Voltmeter-0-300V-1no
2. Ammeter-0-10A
3. Single phase Energy meter-1no
4. DPST switch-1no
5. Resistive load-1no
6. Stop watch
7. Connecting wires

CIRCUIT DIAGRAM



PROCEDURE

1. Connections are made as per the circuit diagram.
2. Switch on the single phase power supply and then close the DPST switch.
3. Apply the load by Turning ON the switches of resistive load and at the same time start the stop watch and note down the readings of Ammeter, Voltmeter and time
4. Turn OFF the load by opening the DPST switch and at the same time stops the stopwatch and note down the reading of stopwatch.
6. Note down the all meter reading, tabulate and calculate the energy using formula

TABULAR COLOUMN

Sl no	I in Amps	V in Volts	Time in seconds	No of Revolution	Energy consumed in Kwh
1				3	
2				3	
3				3	

CALCULATION

Energy consumed E= (V x I x T) / (3600 x1000) in kWh

1.

2.

3.

RESULT: Measurement of energy in a Single phase AC circuit is calculated

Signature of staff

4c. Demonstrate the measurement of Amplitude, peak-peak value, time period and frequency of AC quantity using CRO and function generator. Date:

THEORY on CRO:

1. CRO is a basic instrument employed for the study of several types of waveforms.
2. It can measure various quantities such as peak voltage, frequency, phase difference, pulse-width, delay time, rise time, and fall time.

DISPLAY CONTROLS

Common display control includes:

1. An intensity control is used to adjust the brightness of the waveform. As the sweep speed is increased, there is a need to increase the intensity level.

2. A focus control is used to adjust the sharpness of the waveform.

3. A trace control is used to rotate the trace on the CRO screen.

4. A calibration point is used to calibrate the CRO. It gives a steady square wave at a particular set frequency and voltage. It allows the accurate scaling of the trace. The standard calibration signal is 0.2V at 1 KHz.

VERTICAL CONTROLS

Vertical controls are used to position and scale the wave form vertically.

1. Volts/div.: For selecting desired voltage sensitivity of the vertical amplifier to obtain the proper wave forms on the screen.

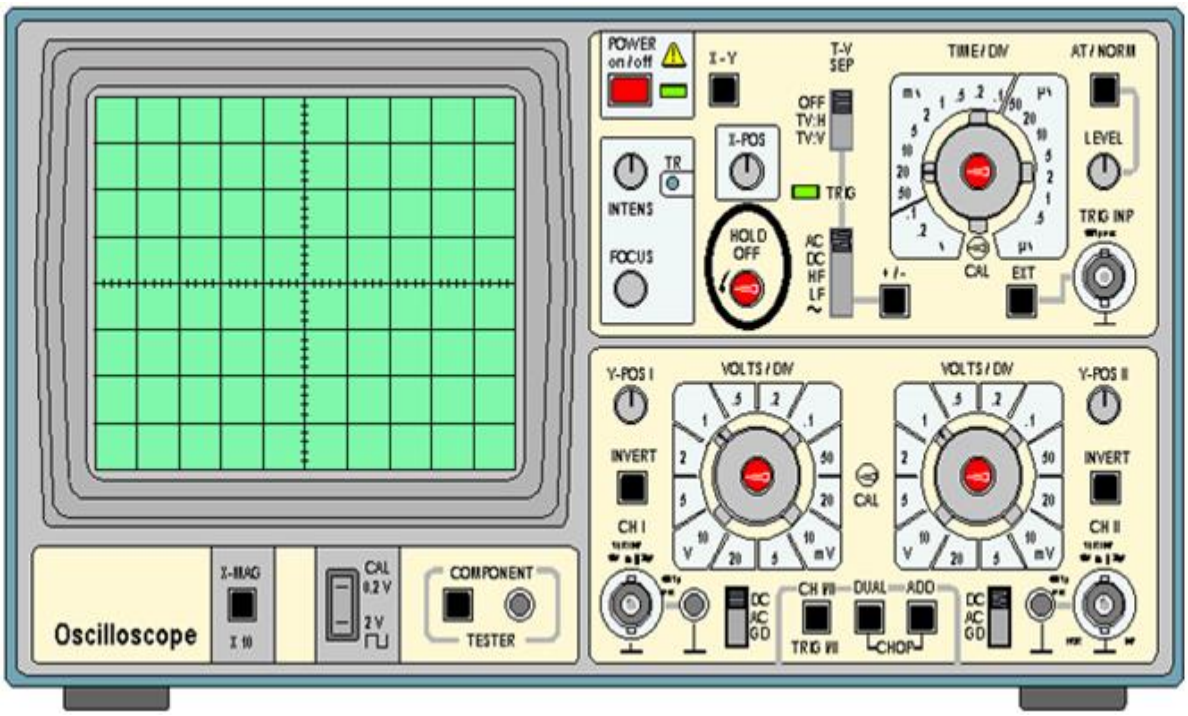
2. Vertical Position knob: To move the trace up or down the on the screen.

HORIZONTAL CONTROLS

Horizontal controls are used to position and scale the wave form horizontally.

1. Time base (time/div) : For selecting desired sweep rate from calibrated steps or admits external signal to horizontal amplifier.

2. X **Position:** Controls horizontal position of trace onscreen.

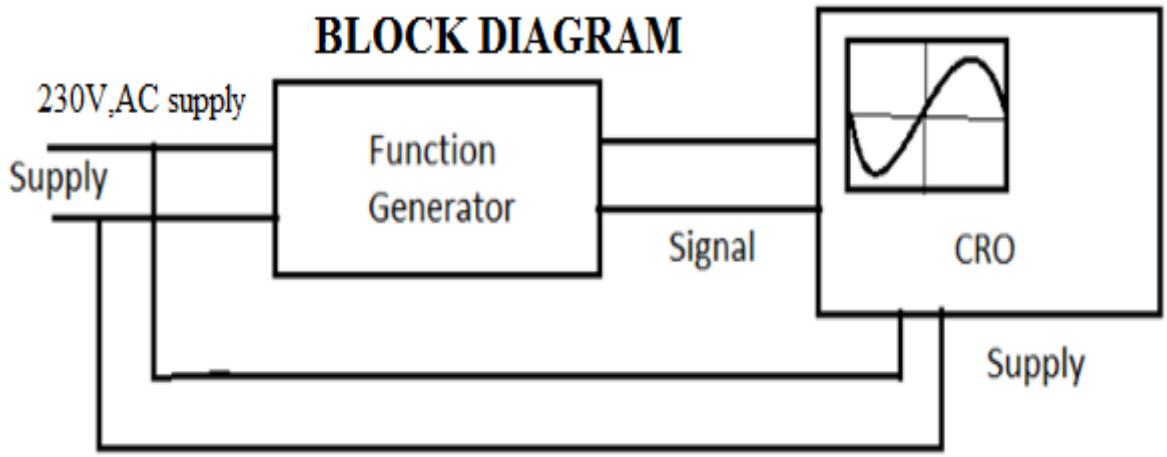


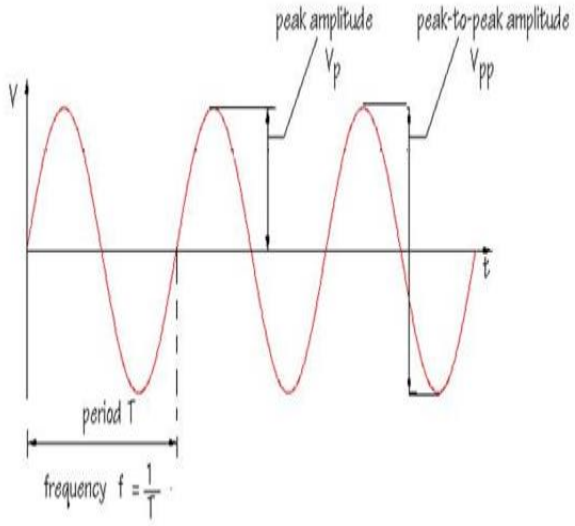
AIM: To measure the frequency, time period, peak voltage and peak to peak voltage of AC quantity using CRO and function generator

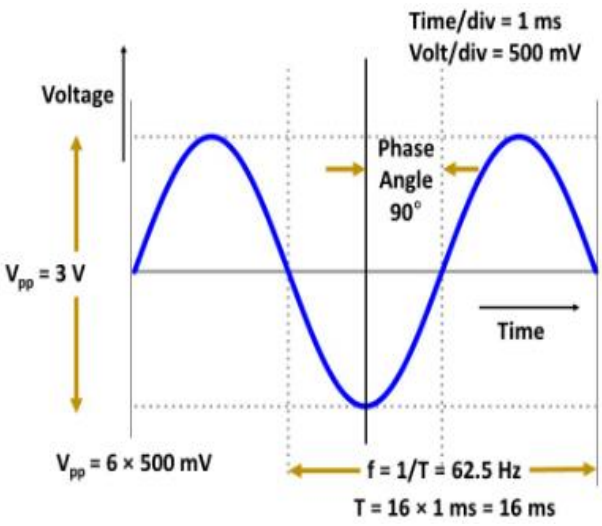
APPARATUS

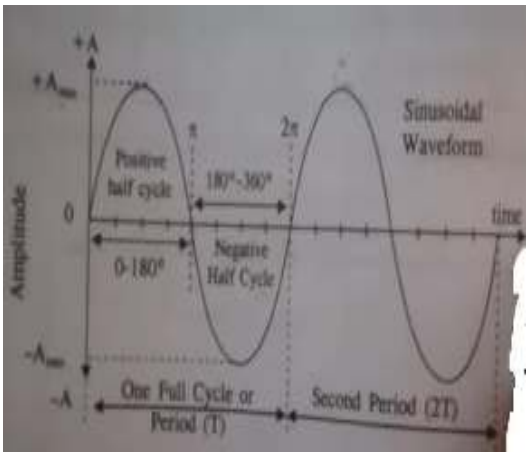
1. Signal generator–02,
2. Cathode Ray Oscilloscope (CRO)–01,
3. Function Generator
3. CRO Probes–02.

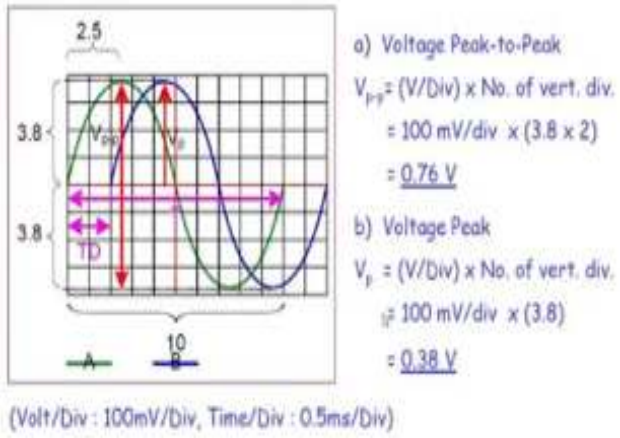
CIRCUIT DIAGRAM











Where V_p= peak voltage in volts
V_{pp}=peak-to-peak voltage in volts
T= Time period in seconds
F= frequency in Hertz

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.

TABULATION

sl no	no of horizontal division(X)	Time / division (y)	T=X*Y	F=1 / T	No. of Vertical Divisions(X)	Voltage/ Division (Y)	Vp-p=X*Y
1							
2							

CALCULATION

Time Period (T) = no of horizontal division x Time per division at knob in ms

=

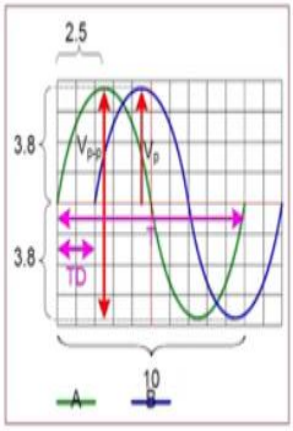
= milli seconds

Frequency (f) = 1/ T =

= Hz

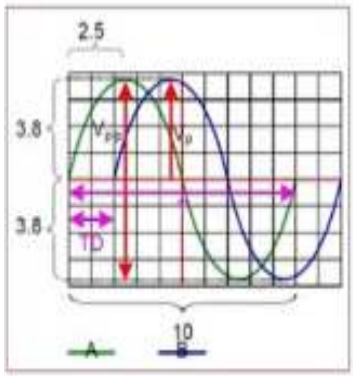
Amplitude (Vpp) = no of vertical divisions x voltage per division at knob in volts

= volts



1 cycle = 10 div
TD = 2 div
Therefore,
1 cycle : 10 div = 360°
1 div = 360° / 10 = 36°
2 div = 2 x 36° = 72°

Phase Difference



(Time/Div : 0.5ms/Div)

a) Period, T
T = (Time/Div) x (no. div/cycle)
= 0.5ms/div x 10
= 5ms
b) Frequency, f
f = 1/T
= 1/5ms
= 200 Hz

Time period and frequency

1 Cycle = ----------div

Difference = ----------div

1 cycle = no of div ---------- = 360^0 Therefore

1 div = 360^0 / no of div ---------- =

---------div = -------x --------- =

RESULT: Amplitude, Peak-to-Peak voltage, Frequency and Time Period are measured successfully using CRO

Signature of staff

Week-5

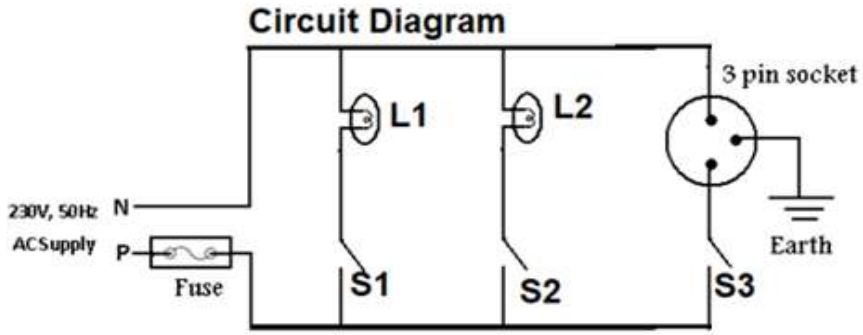
5a. Wire up and test PVC Conduit wiring to control two lamps and one socket independently by providing suitable protective devices. Date;

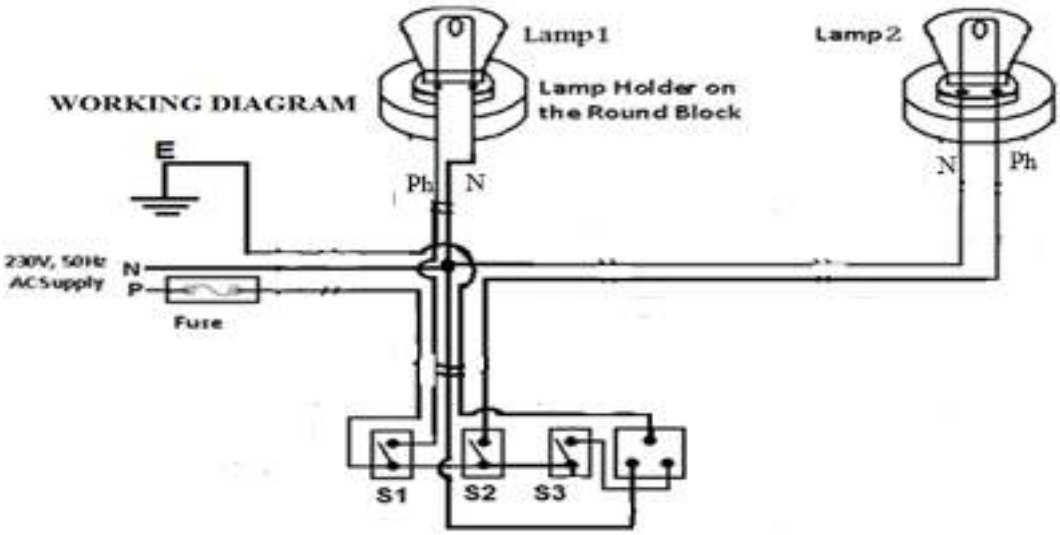
AIM: To Wire up and test PVC Conduit wiring to control two lamps and one socket independently by providing suitable protective devices.

APPARATUS REQUIRED

1. DPST switch-1no
2. Fuse -1no
3. MCB- 1no
4. Incandescent lamp 60w-2nos
5. Lamp holder -2nos
6. Teak wood round block-2nos
7. Teak wood board--1no
8. Half inch PVC pipe
9. 3pin socket -1no
10. Wooden screws
11. junction box-3way, 4way

CIRCUIT DIAGRAM





PROCEDURE

1).keep all the components as per the circuit diagram on the wiring board.
2).Fix the conduit pipes, elbow, junction box, etc. on the board using saddles and screws.
3).Draw the wires straightly by screwing through pipes.
4).Connect and fix the Gang Box, SP switches, Round Blocks, Lamp Holders, Sockets, Fuse, etc.
5).After completing the wiring, fix the lamps on to the lamp holders.
6).Switch on supply.
7).Observe and verify the results for various switch positions.
8).Tabulate the result.

TABULAR COLUMN

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

RESULT: Two lamps and one socket are controlled independently by providing suitable protective devices.

Signature of staff

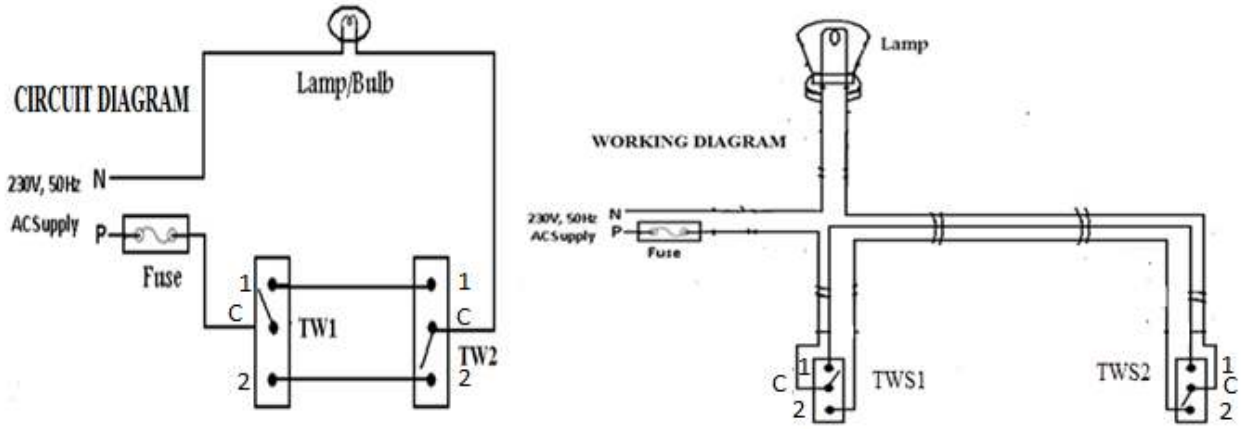
5b. Wire up and test to control one lamp from two places using suitable protective devices (Two- way control/ Staircase wiring) Date:

AIM: To Wire up and test to control one lamp from two places using suitable protective devices (Two- way control/ Staircase wiring)

APPARATUS REQUIRED

1. Wooden wiring board -1no
2. PVC junction box – required nos
3. Two way switch-2nos
4. Lamp holder -1no
5. PVC pipe-required length
6. Connecting wire
7. Saddles
8. Wooden screws

CIRCUIT DIAGRAM



PROCEDURE

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

Switch Positions		Lamp Condition
TW1	TW2	
C1	C1	
C2	C2	
C1	C2	
C2	C1	

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

Signature of staff

Week-6

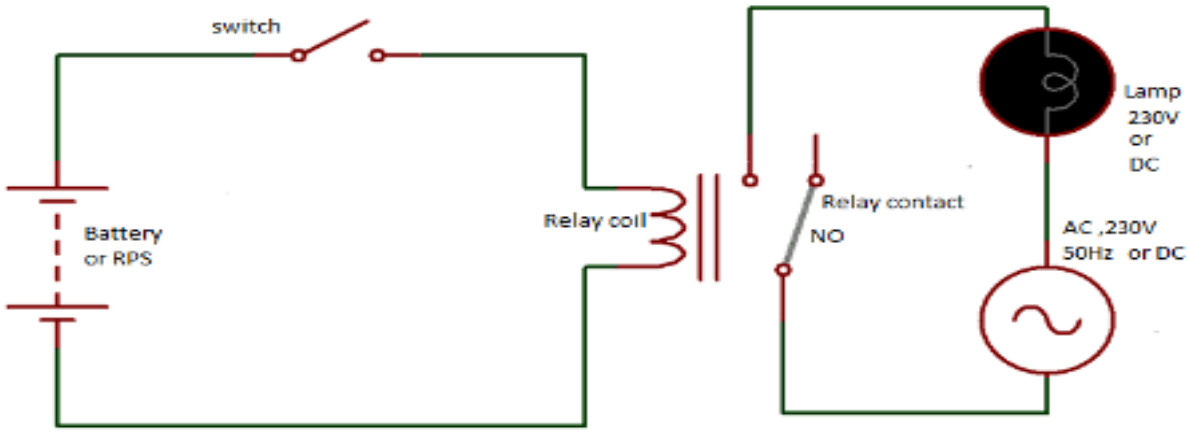
6a.Control a lamp using Electromagnetic Relay Date:

AIM: To Control a lamp using Electromagnetic Relay

APPARATUS REQUIRED

1. Power supply-AC or DC
2. Switch
3. 12V DC Electromagnetic relay
4. lamp-AC or DC
5. Connecting wires

CIRCUIT DIAGRAM



PROCEDURE

1. Identify the common (COM), normally open (NO), and normally closed (NC) terminals on the relay.
2. Connect the DC supply to coil of electromagnetic relay.
3. Connect phase wire to the lamp through NO relay contact and connect the neutral wire to lamp directly.
4. Switch on DC supply and vary voltage required to operate relay and switch on AC supply so that relay is energized, then NO contact will close, completing the circuit and turning on the lamp.
4. Observe the lamp output and record it
5. Switch off the power supply and disconnect them

TABULAR COLOUMN

Sl no	DC supply	Relay	AC supply	Lamp o/p
1	ON		ON	
2	OFF		OFF	

RESULT: lamp is controlled using Electromagnetic Relay

Signature of staff

6b. Demonstrate the concept of Electromagnetic induction using coil, magnet and galvanometer. Date:

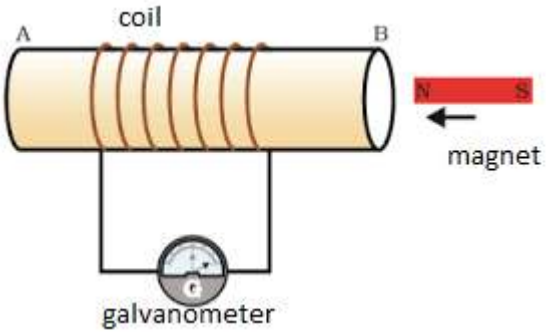
Aim: To demonstrate the electromagnetic induction using coil, magnet and galvanometer

COMPONENTS REQUIRED

1. Tubular material
2. Coil
3. Bar magnet
4. Galvanometer

THEORY: Electromagnetic induction can be demonstrated by moving a magnet near a coil of wire connected to a galvanometer. When the magnet is moved, the magnetic field around the coil changes, inducing a current in the coil, which is indicated by a deflection in the galvanometer needle

CONNECTION DIAGRAM



DEMONSTRATION

1. Setup: Connect a coil of wire to a sensitive galvanometer. The galvanometer is used to detect the presence and direction of any induced current in the coil.

2. Moving the Magnet: Move a bar magnet either towards or away from the coil.

3. Observation: As the magnet moves, the galvanometer needle will deflect, indicating that a current has been induced in the coil.

4. Direction of Deflection: The direction of the deflection will depend on which pole of the magnet is used and whether it is being moved towards or away from the coil.

5. Stationary Magnet: When the magnet is held stationary near the coil, the galvanometer will not show any deflection, indicating that no current is being induced.

Conclusion: The experiment demonstrates that a changing magnetic field (created by the moving magnet) induces an electric current in a nearby coil. This phenomenon is known as electromagnetic induction. The relative motion between the magnet and the coil is crucial for inducing the current.

Signature of staff

6c.Determine experimentally the transformation ratio of a given Transformer

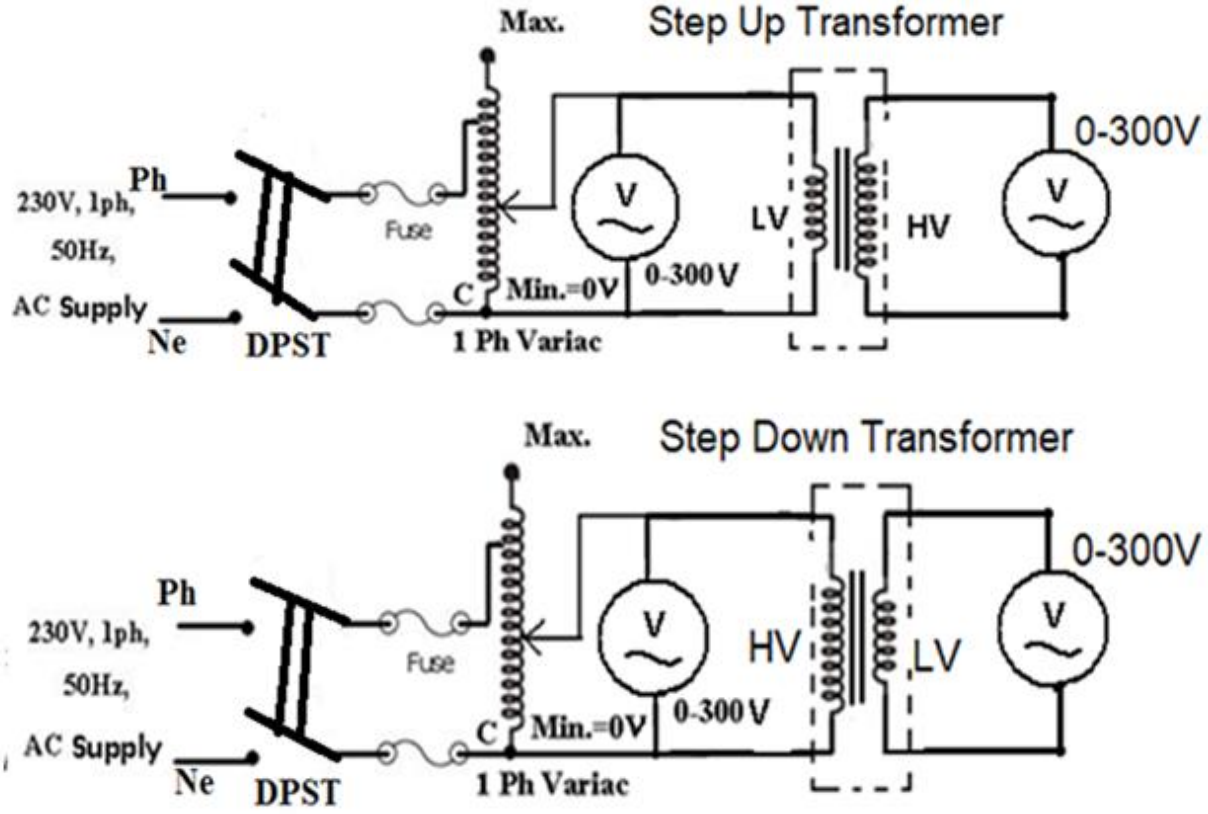
Date:

AIM: To Determine the transformation ratio of a given Transformer

APPARATUS

1. Transformer with different tappings
2. Voltmeter 0-300V
3. Autotransformer
4. Connecting wires

CIRCUIT DIAGRAM



PROCEDURE:

Step-Up Transformer

1. Connections are made as per the circuit diagram.
2. It is made sure that auto transformer is Zero position.
3. The power supply is switched on and the wiper of the auto transformer is varied and the voltage is set to110V.
4. The voltage across the primary and secondary of the transformer is noted down.
5. The wiper of the autotransformer is brought to zero position and the supply is switched off.

Step-Down Transformer

1. Connections are made as per the circuit diagram.
2. It is made sure that auto transformer is Zero position.
3. The power supply is switched on and the wiper of the auto transformer is varied and the voltage is set to220V.
4. The voltage across the primary and secondary of the transformer is noted down.
5. The wiper of the autotransformer is brought to zero position and the supply is switched off.

TABULAR COLUMN

For step up configuration:-

Sl No	V_1 volt	V_2 volt	V_2/V_1	Marked value of V_2/V_1

Average value of Transformation ratio = V_2/V_1 =

For step down configuration:-

Sl No	V_1 volt	V_2 volt	V_2/V_1	Marked value of V_2/V_1

Average value of Transformation ratio = V_2/V_1 =

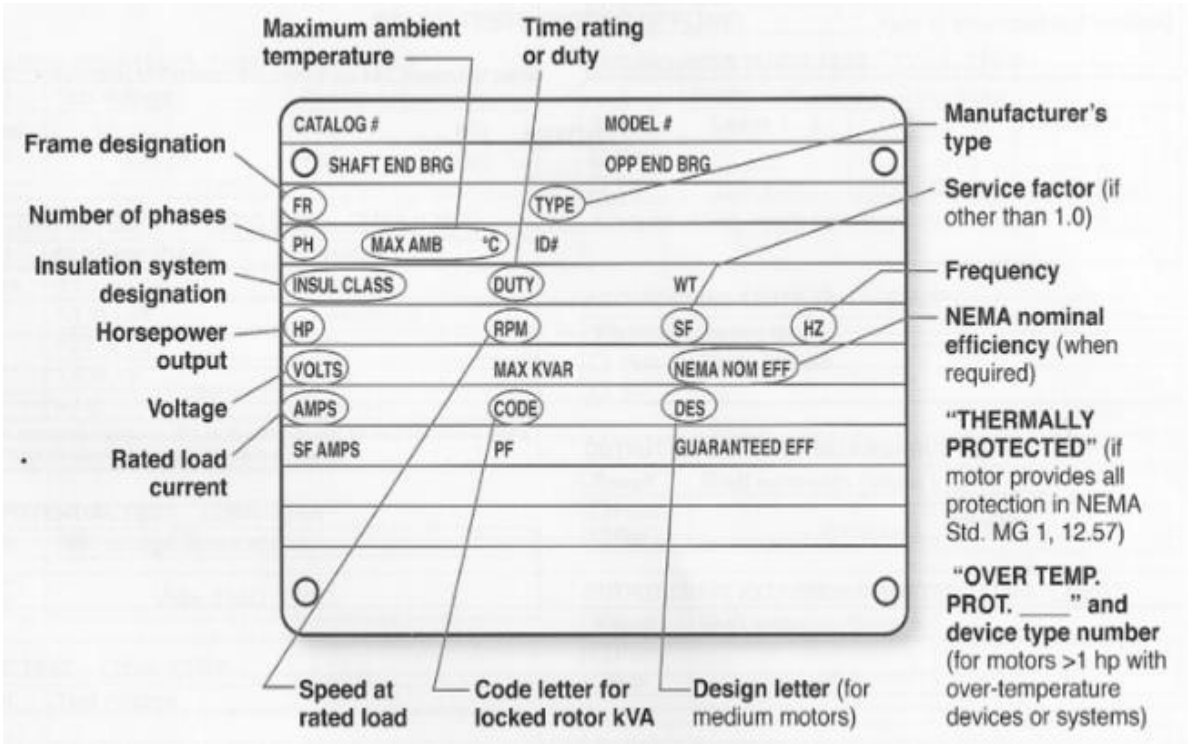
RESULT: the transformation ratio of a given Transformer is determined experimentally

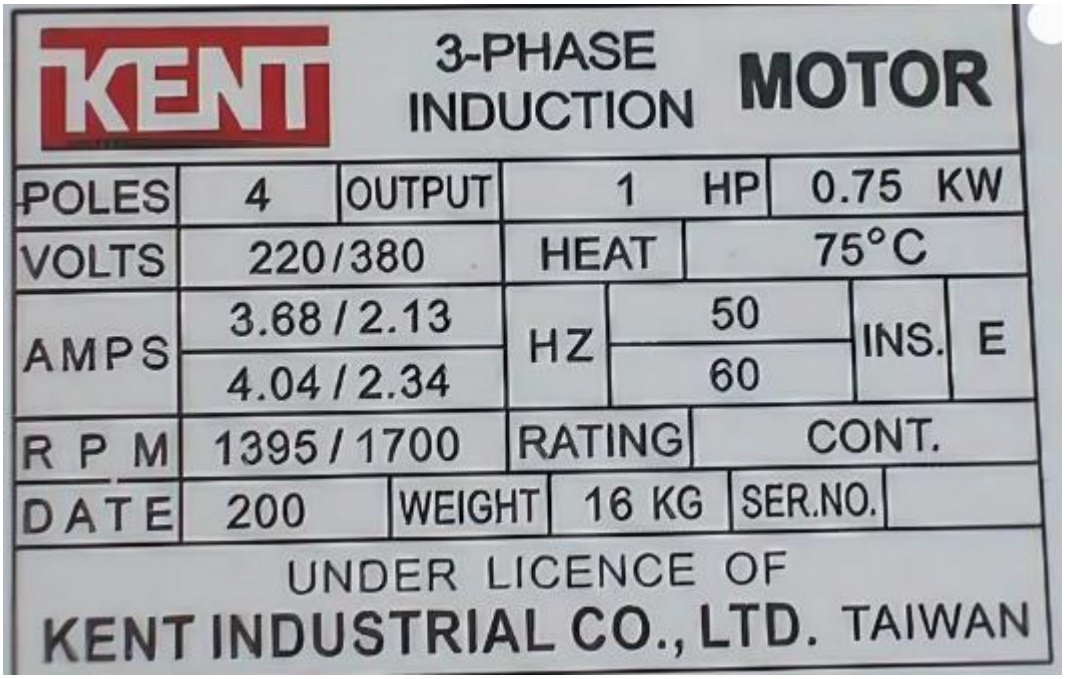
Signature of staff

Week-7

7a. Study the Name plate details of a given Electrical machine Date;

Aim: To study the name plate details of given motor





NEMA requires the following information on a nameplate (although more info may be included)

Frame Designation (FR) – this is typically a two or three digit number followed by one or more letters that identifies important mounting dimensions.

Manufacturers Type (TYPE). Manufacturers may use the TYPE block to designate a product family that identifies the motor's fit or function.

Horsepower Output (kW). Usually labelled as HP or Kw

Time Rating or duty (DUTY). This designation specifies the length of time that the motor can safely carry its nameplate rating. Usually this is continuous (CONT), The duty for motors used intermittently is usually expressed in minutes.

Max Ambient Temp. This is the maximum allowable temperature of the surrounding air to ensure that the motors operating temperature won't exceed the insulation system limit. The standard ambient temperature is 40 Celsius (104 degrees F).

Insulation System Designation. (CLASS, INS. CLS., INSUL CLASS). This indicates the motor winding's thermal endurance using industry standard letter designations sucb as A, B, F, or H.

Speed at Rated Load (RPM). This is the speed at which rated horsepower output is delivered to the load (full-load speed).

Frequency (HZ). The standard frequency is 60 Hz in North America and usually 50 Hz elsewhere

Number of phases (PH). Single or three phase.

Voltage (VOLTS). NEMA defines standard voltage rating for three-phase motors. Some common ratings are 200, 230, 460, and 575 volts.NEMA allows motors to operate at plus or minus 10% of the nameplate voltage rating

Design Letter (DES, NEMA DESIGN, DESIGN). NEMA defines four motor designs (A, B, C, and D) in terms of torque and current characteristics.. Design A motors may be more efficient but are used infrequently because their relatively high starting current can cause nuisance tripping of motor protection circuitry. Design A motors may also require larger than standard size starters.

RESULT: The name plate details of given is studied

Signature of staff

7b.Video demonstration of construction of three phase Induction Motor. Date:

Video link

https://www.youtube.com/watch?v=knxr2r3o9fs

https://www.youtube.com/watch?v=Mle-ZvYi8HA

https://www.youtube.com/watch?v=IKRBDXdgnDg

https://www.youtube.com/watch?v=yw5ipaTjMi4

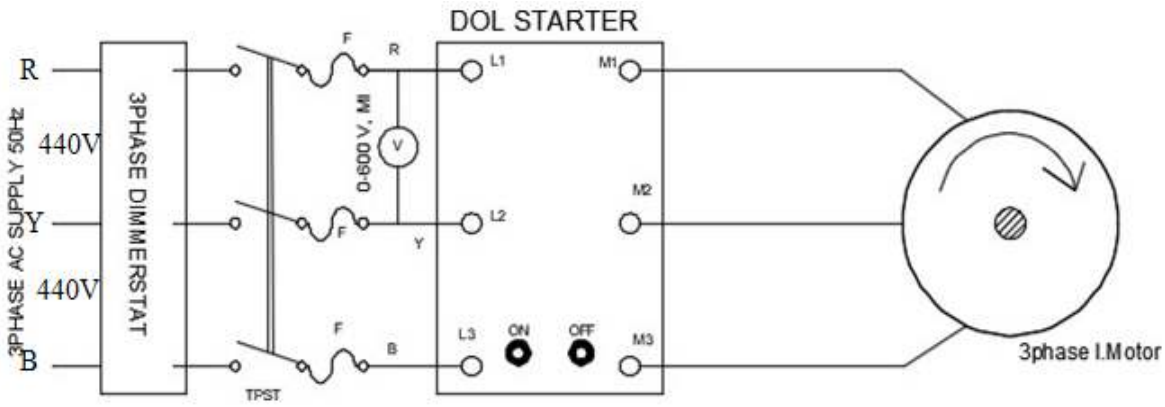
7c. construct a suitable circuit to start and reverse the direction of three phase induction motor using DOL/ Star-delta starter. Date:

AIM: To Construct a suitable circuit to start and reverse the direction of three phase induction motor using DOL/ Star-delta starter..

APPARATUS REQUIRED

1.3phase 440v, 5HP induction motor
2. DOL starter
3. Cable and connecting wire
4. Wire stripper
5. Screw driver

CIRCUIT DIAGRAM



PROCEDURE

1. Connect the circuit elements as shown in the circuit diagram.
2. Close the Supply switch.
3. Switch on the start button (Green) of the starter.
4. Observe the direction of rotation of the motor.
5. Switch off the starter (Red).
6. Open the supply switch
7. Interchange the connections of any two terminals of the supply.
8. Repeat the steps 2 to5
9. Observe the direction of rotation of motor in other direction

TABULAR COLUMN

SL NO	PHASE SEQUENCE	DIRECTION OF ROTATION
1	RYB	
2	RBY	

RESULT: It is observed that the direction of rotation of motor can be reversed by changing the phase sequence.

Signature of staff

Week-8

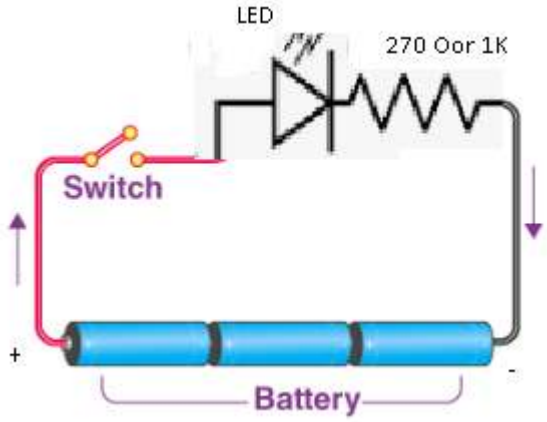
8a.Construct a simple battery using primary cells for the required voltage and to light an LED through a resistor in series. Date:

AIM: To construct a simple battery using primary cells for the required voltage and to light an LED through a resistor in series.

COMPONENTS NEEDED

1. 9V Battery or required to operate LED
2. LED Light (any colour)
3. Resistor (typically between 220Ω to 1kΩ, depending on the LED specifications)
4. Breadboard and Connecting Wires

CIRCUIT DIAGRAM



PROCEDURE

1. Use two or three battery required to operate LED
2. Connections are made as per the circuit diagram
3. Close the switch and observe the output

RESULT: simple battery using primary cells for the required voltage is constructed and tested an LED through a resistor in series.

Signature of staff

8b.Video demonstration on construction of Lithium-Ion battery

Video link

https://www.youtube.com/watch?v=UHZg5-uk1-k&t=4s

Week-9

9a.Prepare a report by carrying out periodic maintenance works required for batteries at institutional level.

REPORT SHOULD BE PREPARED BY STUDENTS

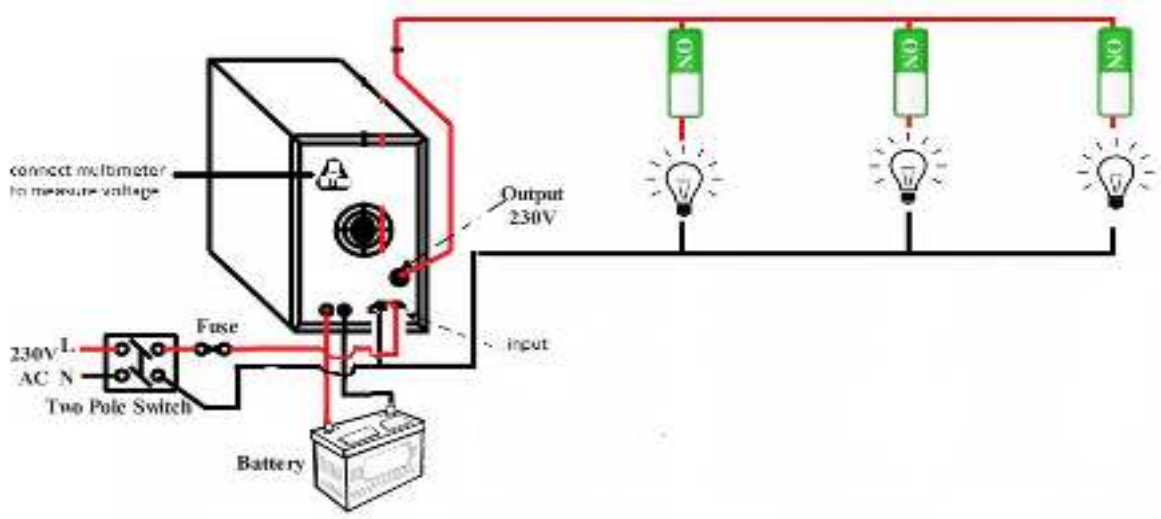
9b.Connect UPS in an electrical lighting system and observe continuity of supply. Measure the AC voltage. Date:

AIM; To Connect UPS in an electrical lighting system and observe continuity of supply, Measurement of AC voltage.

APPARATUS REQUIRED

1. UPS system
2. multimeter
3. Lamp with holder
4. Connecting wires

CIRCUIT DIAGRAM



PROCEDURE

1. Connection are given as per the circuit diagram
2. Connect the UPS into a standard AC power outlet (mains power).
3. Connect the output of the UPS to the input side of the lighting circuit's breaker or fuse. This will supply power to the lights through the UPS and observe output of lighting
4. Set your multimeter to the continuity setting (usually indicated by a diode symbol or a "beep" setting).
5. Connect the test leads to the appropriate points in the circuit to check for a complete path for electricity.If the multimeter beeps or shows a reading near zero, it indicates continuity (a complete circuit).
6. Measure AC Voltage (with Mains Power):
7. Set Multimeter and Switch the multimeter to AC voltage measurement.
8. Place Probes and Connect the multimeter probes to the output terminals of the UPS.
9. Read Voltage and Observe the voltage reading on the multimeter. It should be close to the rated voltage of the UPS (230V).

TABULAR COLOUMN

Sl no	AC main	Lighting o/p	AC voltage
1	ON		

RESULT: UPS in an electrical lighting system is constructed and observed with continuity of supply, Measurement of AC voltage.

Signature of staff

Week-10

10a.Video Demonstration on working of a Simple Electric Vehicle

Video link

https://www.youtube.com/watch?v=kzsyJROQOas

https://www.youtube.com/watch?v=6H5vtu5_SF4

https://www.youtube.com/watch?v=tJfERzrG-D8

https://www.youtube.com/watch?v=_uhDDs5xyoY

https://www.youtube.com/watch?v=tJfERzrG-D8

10b.Video demonstration on solar powered street lighting

https://www.youtube.com/shorts/BfMLVY6Lu1g

https://www.youtube.com/watch?v=Vr7AViY0iOQ

https://www.youtube.com/watch?v=9ItHcz8tzSg

Week-11

11a.Identify and determine the value of resistance, inductance and capacitance using LCR meter

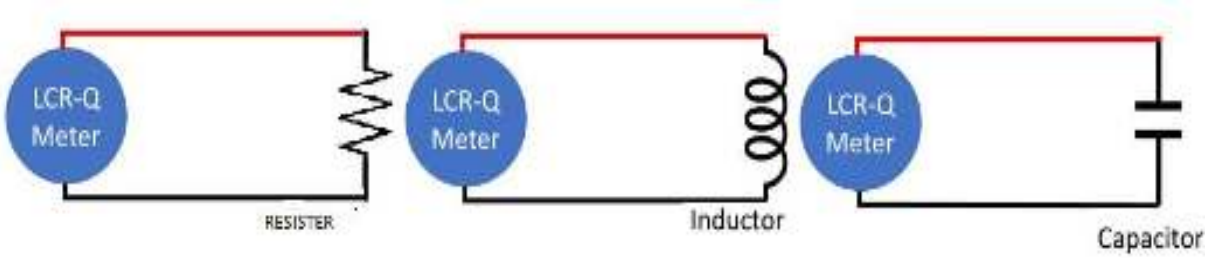
Date:

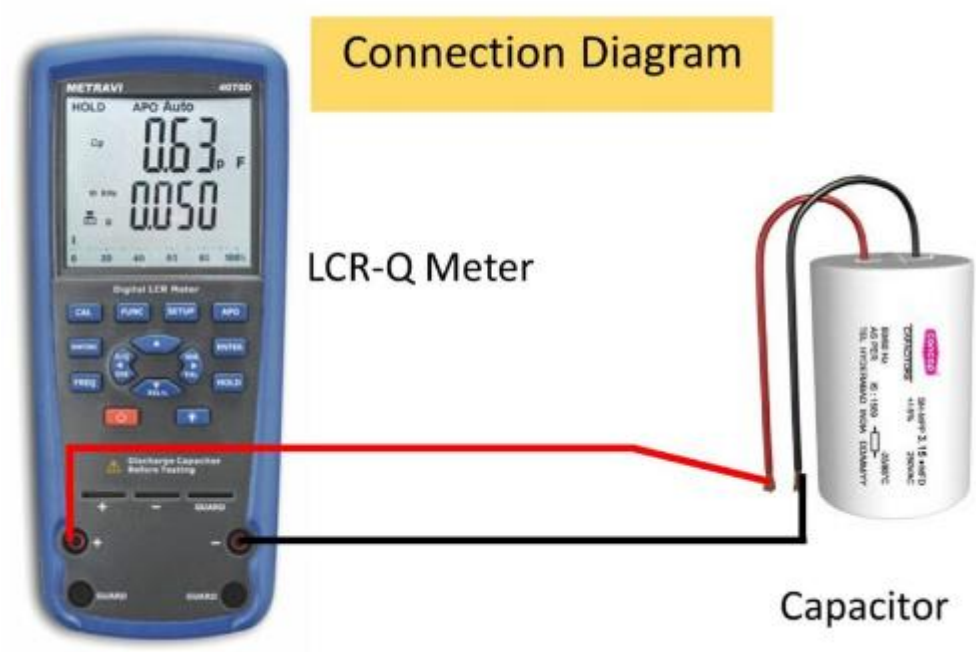
AIM: To Identify and determine the value of resistance, inductance and capacitance using LCR meter

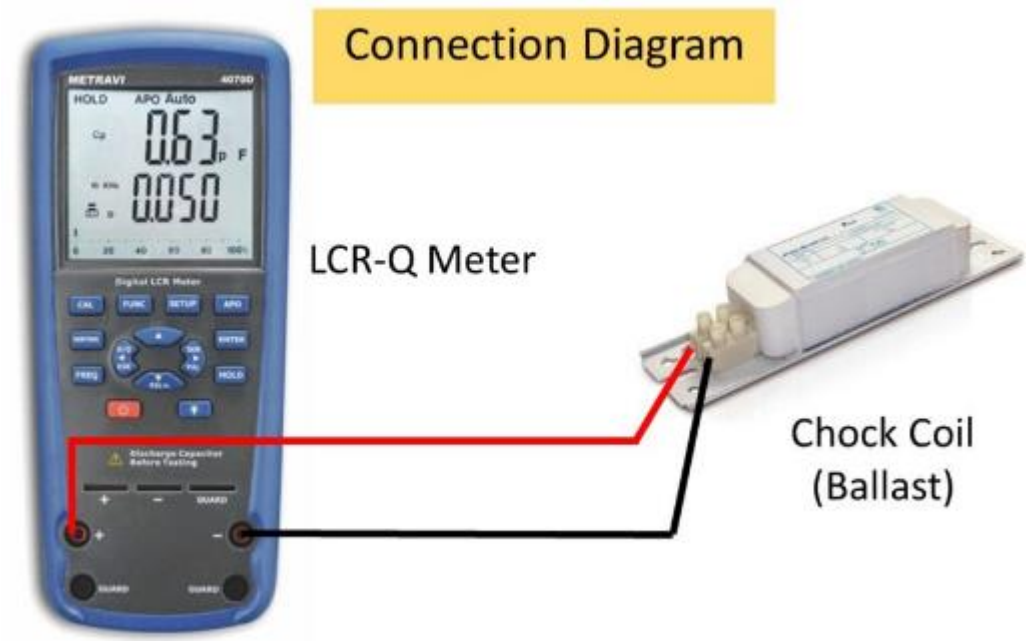
APPARATUS REQUIRED

1. LCR meter
2. Resister as required
3. Inductor (choke)
4. Capacitor
5. Connecting wires

CIRCUIT DIAGRAM







PROCEDURE

1. Connections are made as per diagram
2. first turn the meter to' R' mode and connect resister across the terminal of meter.
3. Observe the value of resistance and tabulate
4. Secondly turn the meter to 'L' Mode and connect choke across the terminal of meter.
5. Observe the value of inductance and tabulate.
6. Thirdly turn the meter to 'C' mode and connect capacitor across the terminal of meter.
7. Observe the value of capacitance and tabulate

TABULAR COLOUMN

Sl no	Value of R	Value of C	Value of L
1			

RESULT: resistance, inductance, capacitance are identified and their values are determined using LCR meter

Signature of staff

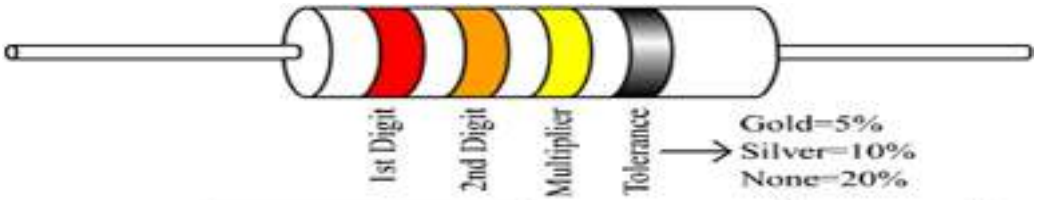
11b. Compute the value of a given carbon resistor using color coding. Date:

AIM: To compute the value of a given carbon resistor using color coding

APPARATUS REQUIRED

1. Digital multimeter
2. Resister as required
3. Patch cords

DIAGRAM



Color	Digit	MULTIPLIER	TOLERANCE
Black	0	$10^0 = 1$	
Brown	1	$10^1 = 10$	
Red	2	$10^2 = 100$	
Orange	3	$10^3 = 1000$	
Yellow	4	$10^4 = 10000$	
Green	5	$10^5 = 100000$	
Blue	6	$10^6 = 1000000$	
Violet	7	$10^7 = 10000000$	
Grey	8	$10^8 = 100000000$	
White	9	$10^9 = 1000000000$	
Gold		$10^{-1} = 0.1$	5%
Silver		$10^{-2} = 0.01$	10%
(none)			20%

Calculate resistor value using color code

The first two bands always denote the first two digits of the resistance value in ohms. On a three or four-band resistor, the third band represents the multiplier.

This multiplier will basically shift your decimal place around to change your value from mega ohms to milliohms and anywhere in between. The fourth color band signifies tolerance. Keep in mind that if this band is absent and you are looking at a three-band resistor, the default tolerance is ±20%.

PROCEDURE

1. Given resistors of different color bands are taken.
2. Using the color code table, the values of resistor 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.

TABULAR COLUMN

BAND	COLOR CODE	NUMERICAL VALUE	MULTIMETER READING
1ST BAND			
2ND BAND			
3RD BAND			
the value of resister is			

The Resister value is----------

RESULT: the value of a given carbon resistor using color coding is computed

Signature of staff

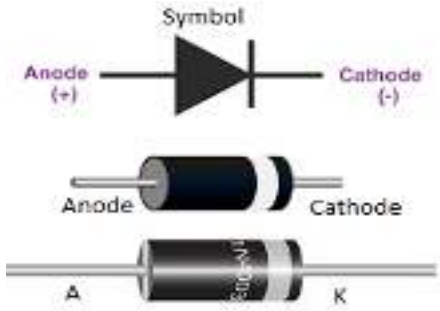
11c. identify the terminals of Diode. Connect the diode in forward and reverse bias modes and observe the status of the LED connected in the circuit. Date:

AIM: To Identify the terminals of Diode. Connect the diode in forward and reverse bias modes and observe the status of the LED connected in the circuit.

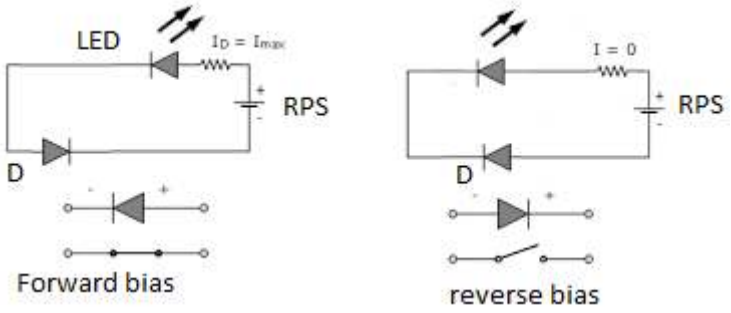
APPARATUS REQUIRED

1. LED (Light Emitting Diode)
2. Diode (e.g., 1N4001)
3. Resistor (e.g., 220 ohms to 1k ohms)
4. Power supply (e.g., 3-5V DC)
5. Connecting wires
6. Breadboard

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.



CIRCUIT DIAGRAM



PROCEDURE

1. Forward Bias

1. Connect the longer leg (anode) of the LED to one end of the resistor.
2. Connect the other end of the resistor to the positive (+) terminal of the power supply.
3. Connect the shorter leg (cathode) of the LED to one side of the diode.
4. Connect the other side of the diode to the negative (-) terminal of the power supply.
5. When the diode is forward biased, current flows through the LED, and it lights up

2. Reverse Bias:

1. Switch the diode's position in the circuit.
2. Connect the diode's anode (non-striped end) to the negative (-) terminal of the power supply.
3. Connect the diode's cathode (striped end) to the LED's cathode.
4. The LED and resistor connections remain the same.

OBSERVATION

Sl no	Forward bias	LED	Reverse bias	LED
1	0-5V		0V	

RESULT: The terminal of Diode is identified and the status of the LED is observed in forward and reverse bias modes connected in diode the circuit.

Signature of staff

Week-12

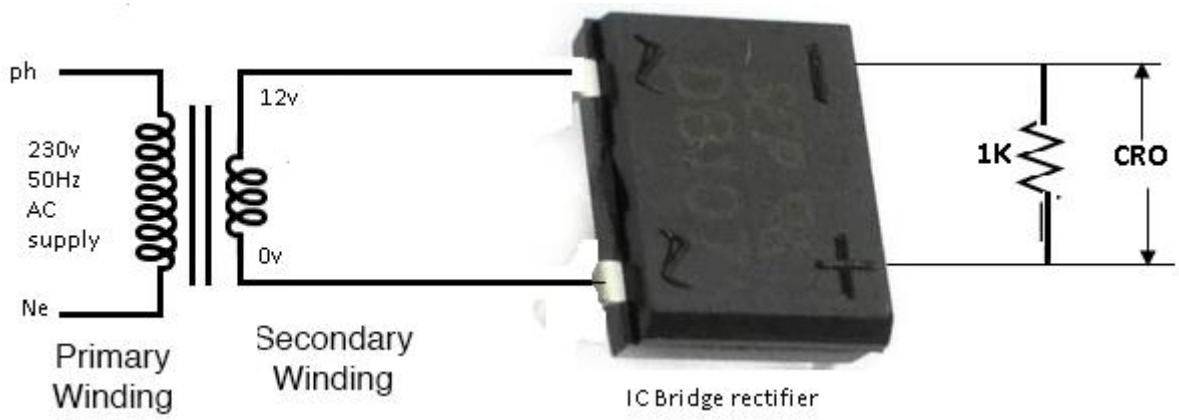
12a.Trace the input and output waveforms of an IC Bridge rectifier. Date:

AIM: To Trace the input and output waveforms of an IC Bridge rectifier.

APPARATUS REQUIRED

1. Bridge rectifier IC
2. CRO
3. Test probs
4. Transformer 230V/12V
5. Connecting wires

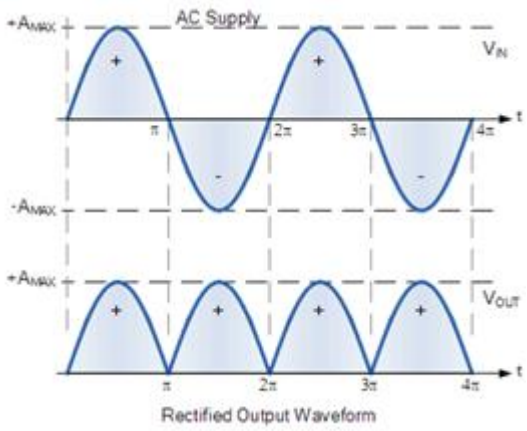
CIRCUIT DIAGRAM



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. Trace the input and output waveform using tracing sheet
5. Switch off power supply.

WAVEFORM



Rectified Output Waveform

RESULT: the input and output waveforms of an IC Bridge rectifier is traced

Signature of staff

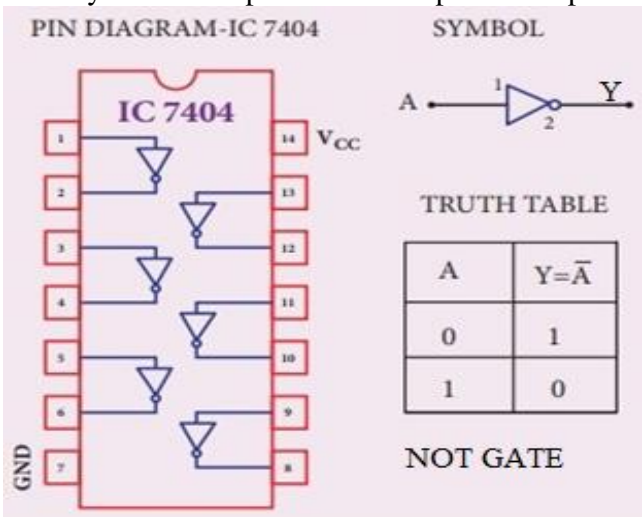
12b. Verify the truth tables of AND, OR, NOT, NAND, NOR, EX-OR gates Date:

AIM: To Verify NOT, AND, OR, NOR, EXOR and NAND gate operations (two inputs).

COMPONENTS REQUIRED

1. NOT gate(IC7404),
2. OR gate(IC7432),
3. NOR gate (IC 7402)
4. X-OR gate (IC 7486),
5. AND gate(IC7408),
6. NAND gate (IC 7400),
7. Digital IC trainer kit,
8. Patch cords

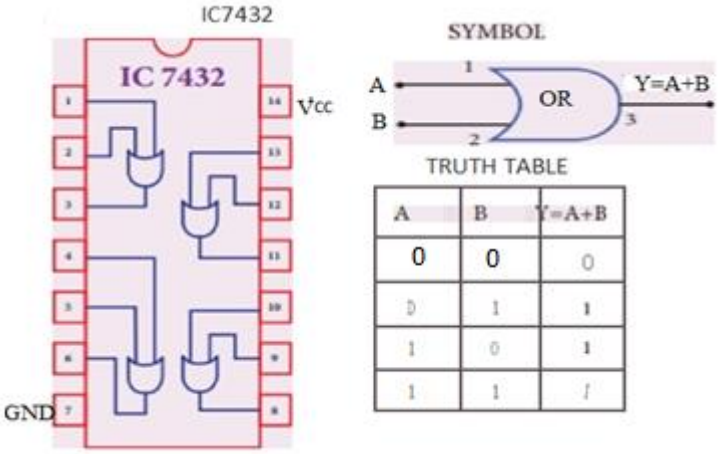
NOT Gate: NOT gate produces the complement of its input. This gate is also called an INVERTER. It always has one input and one output. Its output is 0 when input is 1 and output is 1 when input is 0.



Truth Table of INVERTER Gate

INPUT A	Theoretical OUTPUT $Y = \bar{A}$	Output observed $Y_1 = \bar{A}$
0	1	
1	0	

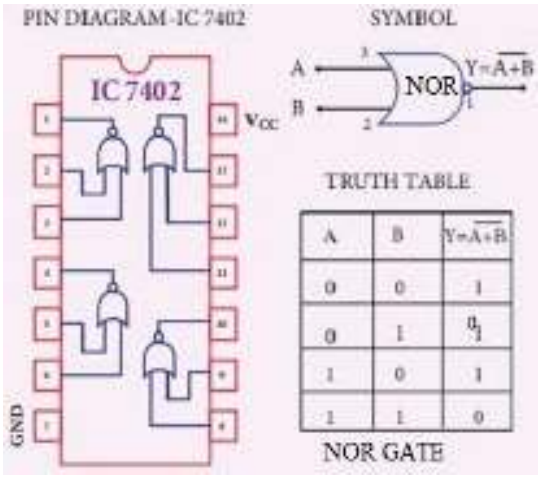
OR Gate: OR gate produces an output as 1, when any or all its inputs are 1; otherwise the output is 0. This gate has minimum 2 inputs but output is always one. Its output is 0 when all input are 0.



Truth Table of OR Gate

INPUTs		Theoretical OUTPUT	Output observed
A	B	Y = A+B	Y_1 = A+B
0	0	0	
0	1	1	
1	0	1	
1	1	1	

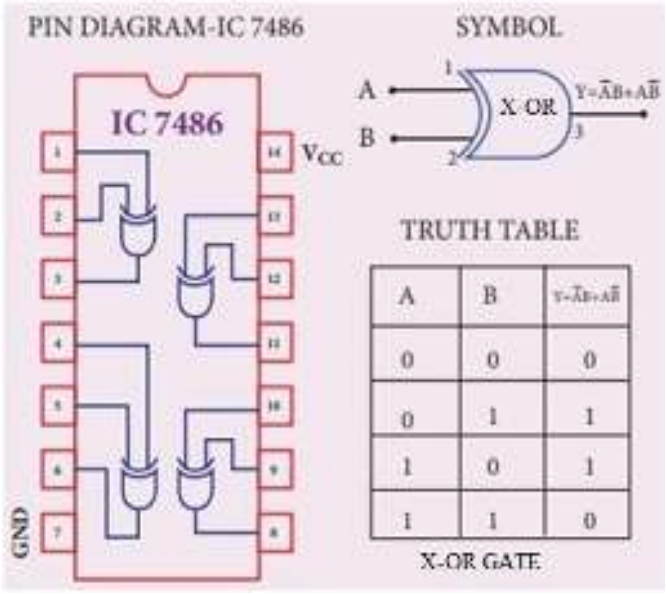
NOR Gate: NOR gate is actually a series of OR gate with NOT gate. If we connect the output of an OR gate to the input of a NOT gate, this combination will work as NOT-OR or NOR gate. Its output is 0 when any or all inputs are 1, otherwise output is 1.



Truth Table of NOR Gate

INPUTs		Theoretical OUTPUT	Output observed
A	B	$Y = \overline{A+B}$	$Y_1 = \overline{A+B}$
0	0	1	
0	1	0	
1	0	0	
1	1	0	

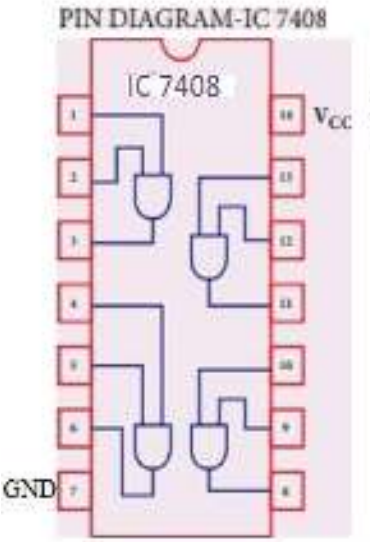
Exclusive OR (X-OR) Gate: X-OR gate produces an output as 1, when number of 1's at its inputs is **odd**, otherwise output is 0. It has two inputs and one output.

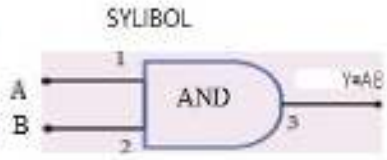


Truth table of Exclusive OR Gate

Inputs		Theoretical O/P	Observed O/P
A	B	Y = A⊕B	Y = A⊕B
0	0	0	
0	1	1	
1	0	1	
1	1	0	

AND Gate: AND gate produces an output as 1, when all its inputs are 1; otherwise the output is 0. This gate can have minimum 2 inputs but output is always one. Its output is 0 when any input is 0.



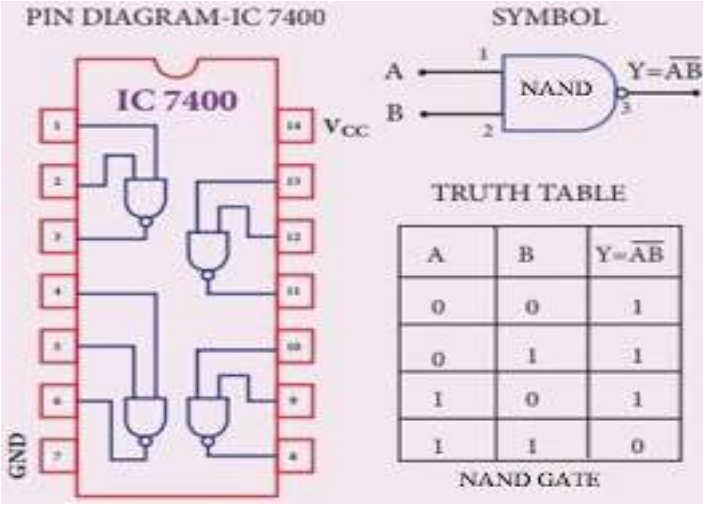


A	B	Y = AB
0	0	0
0	1	0
1	0	0
1	1	1

Truth Table of AND Gate

INPUTs		Theoretical OUTPUT	Output observed
A	B	Y = A.B	Y_1 = A.B
0	0	0	
0	1	0	
1	0	0	
1	1	1	

NAND Gate: NAND gate is actually a series of AND gate with NOT gate. If we connect the output of an AND gate to the input of a NOT gate, this combination will work as NOT-AND or NAND gate. Its output is 1 when any or all inputs are 0, otherwise output is 1.



Truth Table of NAND Gate

INPUTs		Theoretical OUTPUT	Output observed
A	B	$Y = \overline{A.B}$	$Y_1 = \overline{A.B}$
0	0	1	
0	1	1	
1	0	1	
1	1	0	

PROCEDURE

1) Write down truth table of the OR Gate as in table 01.
2) Fix the OR gate IC 7432 in the Digital Trainer.
3) Select any one of the gates in the IC.
4) Connect input terminals of the gate to any input points (switches) in the Trainer.
5) Connect output terminal of the gate to any output device (LED) in the trainer.
6) Connect V_{CC} terminal to +5V and GND terminal to 0V (Biasing supply) in the trainer.
7) Switch on the power supply to the trainer.
8) Apply inputs to the gate as in the truth table. Observe the output and note down in table 01.
9) Verify that observed output is equal to the theoretical output.
10) Switch off the power supply. If you like, verify the other gates in the IC.
11) Repeat the expt for NOT, NOR, X-OR, AND, NAND, Gate using related and related diagrams.

RESULT: The truth table of logic gates AND, OR, NOR, X-OR, NAND, NOT using integrated circuits is verified.

Signature of staff

Week-13

13a.Construct Photo-diode circuit and Test for its working Or Detect an object using IR proximity sensor

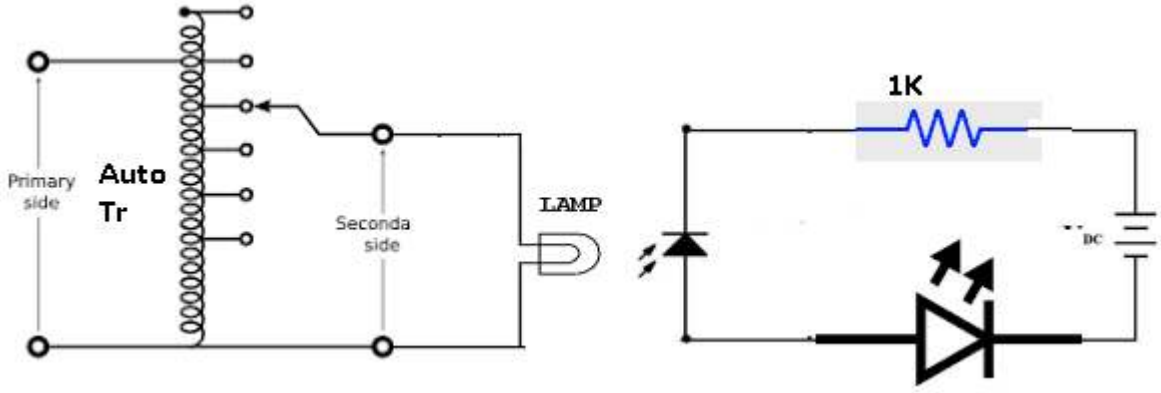
Date:

AIM: To Construct Photo-diode circuit and Test for its working

APPARATUS REQUIRED

1. Auto Transformer
2. 230V Lamp
3. Photodiode
4. LED
5. DC supply
6. Connecting wires

CIRCUIT DIAGRAM



PROCEDURE

1. Connections are made as per the circuit diagram at both sides
2. Switch on AC supply and vary voltage till the bulb glows
3. Then switch on DC supply up to 2 to 5v till LED get ON
4. Observe the working of photodiode
5. LED glows when light fall on photodiode

OBSERVATION TABLE

Sl no	AC voltage	lamp	DC supply	LED
1	Above 100v		0-5v	

RESULT: the Photo-diode circuit is constructed and Tested for its working

Signature of staff

13b. Video demonstration on working of any simple Mechanical/ Electrical Actuator.

Video link

https://www.google.com/search?q=Video+demonstration+on+working+of+any+simple+Mechanical%2F+Electrical+Actuator.&sca_esv=60a23ae29e3c6b22&ei=iPpgaK_2KsnU4-EPw6e8yQE&ved=0ahUKEwiv2uG2nJaOAxVJ6jgGHcMTLxkQ4dUDCBA&uact=5&oq=Video+demonstration+on+working+of+any+simple+Mechanical%2F+Electrical+Actuator.&gs_lp=Egxnd3Mtd2l6LXNlcnAiTVZpZGVvIGRlbW9uc3RyYXRpb24gb24gd29ya2luZyBvZiBhbnkgc2ltcGxlIE1lY2hhbmljYWwvIEVsZWN0cmljYWwgQWN0dWF0b3IuMgoQABiwAxjWBBhHMgoQABiwAxjWBBhHMgoQABiwAxjWBBhHMgoQABiwAxjWBBhHMgoQABiwAxjWBBhHMgoQABiwAxjWBBhHMgoQABiwAxjWBBhHMg0QABiABBiwAxhDGIoFSLhWUIcYWIlPcAF4AZABAJgBAKABAKoBALgBA8gBAPgBAvgBAZgCAaACLpgDAIgGAZAGCZIHATGgBwCyBwC4BwDCBwM0LTHIByY&sclient=gws-wiz-serp#fpstate=ive&vld=cid:3a3d4625,vid:7lI--wj6fsk,st:0

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13c.List commercially available PLCs.

The following are the list of PLC

List of PLC

1. Siemens
2. Rockwell Automation / Allen Bradley
3. Mitsubishi Electric
4. Schneider Electric
5. Omron
6. Emerson (General Electric)
7. Keyence
8. IDEC
9. B & R Industrial Automation
10. ABB
11. Bosch Rexroth
12. Hitachi
13. Phoenix Contact
14. Panasonic
15. LS Electric
16. Eaton
17. Delta Electronic
18. Yokogawa Electric
19. Toshiba
20. Fanuc

THANK YOU