LENDI INSTITUTE OF ENGINEERING AND TECHNOLOGY
An Autonomous Institution
Approved by AICTE & Permanently Affiliated to JNTUK, Kakinada
Accredited by NBA & NAAC with “A” Grade
Jonnada (Village), Denkada (Mandal), Vizianagaram Dist – 535 005

Department of Electrical and Electronics Engineering

LAB MANUAL

Name of the laboratory : Electrical Engineering Workshop

Regulation : R 20

Subject Code : R20EEE-ES1104

Branch : EEE

Year & Semester : I B.Tech- I Semester

INSTITUTE VISION, MISSION

DEPARTMENT VISION, MISSION PEO & PO/PSO

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INSTITUTE

VISION

Produce globally competent and quality technocrats with human values for the holistic needs of industry and society.

MISSION

- Creating an outstanding infrastructure and platform for enhancement of skills, knowledge and behaviour of students towards employment and higher studies.

- Providing a healthy environment for research, development and entrepreneurship, to meet the expectations of industry and society.

- Transforming the graduates to contribute to the socio-economic development and welfare of the society through value based education.

Department of Electrical and Electronics Engineering

VISION

To be a hub for imparting knowledge, skills, and behavior for exemplary contributions in the field of Electrical and Electronics Engineering.

MISSION

- To impart Technical Education through the state-of-the-art infrastructure facilities, laboratories and instruction.
- To inculcate industry oriented learning through industrial visits, internships, projects at Industries, MOUs, to make students' technically skills oriented.
- Creating conducive environment for higher education, employment and entrepreneurship through quality education, professional skills and research.
- To promote societal commitment among students by inculcating moral and ethical values.

Department of Electrical and Electronics Engineering

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Graduates shall have strong foundation in core and allied Electrical and Electronics Engineering, in sciences and mathematics, to become globally competent in designing, modeling and critical problem solving.

PEO2: Graduates shall involve in research activities in the field of electrical and electronics engineering through lifelong learning and provide solutions to engineering problems for sustainable development of society.

PEO3: Graduates shall have good communication skills and socio-ethical values for getting employment or higher studies by excelling in competitive examinations and be able to work in supportive and leadership roles.

PROGRAM OUTCOMES (POs)

PO1	**Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
PO4	**Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-Long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Capable of design, develop, test, verify and implement electrical and electronics engineering systems and products.

PSO2: Succeed in national and international competitive examinations for successful higher studies and employment.

COURSE OUTCOMES (COS)

S. No	DESCRIPTION
CO.1	Explain the limitations, tolerances, Safety aspects of electrical systems and wiring
CO.2	Select wires/cables and other accessories used in different types of wiring.
CO.3	Make simple lighting and power circuits.
CO.4	Measure current, voltage and power in a circuit.
CO.5	Apply starting methods to AC and DC Machines.

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COURSE DATA SHEET

PROGRAM: **ELECTRICAL AND ELECTRONICS ENGINEERING**	DEGREE: **B-Tech (U.G)**
COURSE: **ELECTRICAL ENGINEERING WORKSHOP LAB**	SEMESTER: **I-I** CREDITS: **1.5**
COURSE CODE: **R20EEE-ES1104** REGULATION: **R20**	COURSE TYPE: **CORE**
COURSE AREA/DOMAIN: **CORE ENGINEERING**	CONTACT HOURS: **3 hours/Week.**
CORRESPONDING LAB COURSE CODE (IF ANY):	LAB COURSE NAME (IF ANY):

SYLLABUS:

Exp. No.	NAME OF THE EXPERIMENT	HOURS
1	Study of various electrical tools and symbols.	**3**
2	Identify different types of cables/wires and switches, fuses & fuse carriers, MCB and ELCB, MCCB with ratings and usage.	**3**
3	Wiring of light /fan circuit using two way/three way control (stair case wiring) Go-down wiring/Tunnel wiring.	**3**
4	Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and energy meter.	**3**
5	Measurement of voltage, current, resistance in DC circuit.	**3**
6	Measurement of voltage, current and power in single phase circuit using voltmeter, ammeter and wattmeter. Calculate the power factor of the circuit.	**3**
7	Wiring of backup power supply including inverter, battery and load for domestic Installations.	**3**
8	Starting of DC shunt motor using three point starter	**3**
9	Starting of DC series motor using two point starter	**3**
10	Starting of single phase induction motor	**3**
11	Starting of three phase induction motor	**3**
12	Measurement of Earth Resistance using Megger	**3**
	TOTAL HOURS	**36**

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T	Uppal S.L(2003) Electrical Wiring , Estimating and Costing, Khanna Publishers, Delhi.
T	Dhogal P S Basic Electrical Engineering I Tata Mc Grow Hill 2011
T	Singh R P. Electrical Workshop Safety, Commissioning, Maintenance and testing of electrical equipments I K International (P) Ltd 2013
R	Edward Hughes(Sept.2010), Electrical & Electronics Technology,(10th ed.), Pearson Education India Ltd
R	Punmia B C(2005), Surveying Vol.1, (16th ed), Laxmi Publications, New Delhi

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	YEAR-SEM
-	Intermediate Physics	General Understanding of Basic Electrical and Electronic Circuits	-

COURSE OBJECTIVES:

1	To demonstrate the usage of measuring equipment
2	To identify different protective equipment's and their usage.
3	To train the students in setting up simple wiring circuits
4	To impart methods in electrical machine wiring
5	To explain the starting methods of dc motors
6	To explain the starting methods of single phase and three phase induction motors.

COURSE OUTCOMES:

S. No.	DESCRIPTION	PO(1..12) MAPPING	PSO(1,2) MAPPING
1	Explain the limitations, tolerances, Safety aspects of electrical systems and wiring.	PO1, PO2, PO3, PO9,P012	PSO1,PSO2
2	Select wires/cables and other accessories used in different types of wiring.	PO1, PO2, PO3, PO9,PO12	PSO1,PSO2
3	Make simple lighting and power circuits.	PO1, PO2, PO3, PO9,PO12	PSO1,PSO2
4	Measure current, voltage and power in a circuit.	PO1, PO2, PO3, PO9,PO12	PSO1,PSO2
5	Apply starting methods to AC and DC Machines.	PO1, PO2, PO3, PO9,P012	PSO1,PSO2
COURSE OVERALL PO/PSO MAPPING: PO1, PO2, PO3, PO9,P012/PSO1,PSO2			

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH: 3; MEDIUM: 2; LOW:1 **):**

S.No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	-	-	-	-	-	2	-	-	2	1	1
CO2	2	1	2	-	-	-	-	-	2	-	-	2	1	1
CO3	2	1	2	-	-	-	-	-	2	-	-	2	1	1
CO4	2	1	2	-	-	-	-	-	2	-	-	2	1	1
CO5	2	1	2	-	-	-	-	-	2	-	-	2	1	1
CO*	2	1	2	-	-	-	-	-	2	-	-	2	1	1

** For Entire Course, PO & PSO Mapping*

POs & PSO REFERENCE:

PO1	Engineering Knowledge	PO7	Environment & Sustainability	PSO1	Capable of design, develop, test, verify and implement electrical and electronics engineering systems and products.
PO2	Problem Analysis	PO8	Ethics	PSO2	Succeed in national and international competitive examinations for successful higher studies and employment.
PO3	Design & Development	PO9	Individual & Team Work		
PO4	Investigations	PO10	Communication Skills		
PO5	Modern Tools	PO11	Project Mgt. & Finance		
PO6	Engineer & Society	PO12	Life Long Learning		

COs VS POs MAPPING JUSTIFICATION:

S.NO	PO/PSO MAPPED	LEVEL OF MAPPING	JUSTIFICATION
ES1104.1	PO1,PO2,PO3,PO9,PO12/PSO1,PSO2	2,1,2,2,2,1,1	Students Can learn various safety practices in electrical systems and usage of various tools used in electrical field.
ES1104.2	PO1,PO2,PO3,PO9,PO12/PSO1,PSO2	2,1,2,2,2,1,1	Student can understand and identify the various wires/cables, protection devices used in electrical system.
ES1104.3	PO1,PO2,PO3,PO9,PO12/PSO1,PSO2	2,1,2,2,2,1,1	Students will able to make simple wiring circuits
ES1104.4	PO1,PO2,PO3,PO9,PO12/PSO1,PSO2	2,1,2,2,2,1,1	Students can easily measure the voltage and current in AC & DC circuits.
ES1104.5	PO1,PO2,PO3,PO9,PO12/PSO1,PSO2	2,1,2,2,2,1,1	Students will able to understand the starting methods of AC & DC machines
ES1104*	PO1,PO2,PO3,PO9,PO12/PSO1,PSO2	2,1,2,2,2,1,1	The Overall it will make Students to Understand Very Basic Concepts of Electrical Engineering.

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS, POs & PSOs:

SNO	DESCRIPTION	PROPOSED ACTIONS	PO/PSO MAPPED
1	Electrical circuit Design	Topics to be covered along with the lab curriculum.	Topics to be covered along with the lab curriculum.

WEB SOURCE REFERENCES:

1	http://www.electrical4u.com/
2	http://nptel.ac.in/courses/
3	http://www.electricaleasy.com/
4	http://www.learnerstv.com/

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☑CHALK & TALK	☐ STUD. ASSIGNMENT	☐ WEB RESOURCES	☐ NPTEL/OTHERS
☐ LCD/SMART BOARDS	☐STUD. SEMINARS	☐ ADD-ON COURSES	☐ WEBNIARS

ASSESSMENT METHODOLOGIES-DIRECT

☐ASSIGNMENTS	☐STUD. SEMINARS	☑ TESTS/MODEL EXAMS	☑ UNIV. EXAMINATION
☑ STUD. LAB PRACTICES	☑ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

Prepared by **Approved by**

Lab In-charge **Head of the Department**

I Year - I Semester

S. No.	Course code	Course Title	Category	L	T	P	Credits
8	R20EEE-ES1104	Electrical Engineering Workshop	ES	0	0	3	1.5

Electrical Engineering Workshop LAB

I Year – I SEMESTER

Course Objectives:

- To demonstrate the usage of measuring equipment
- To identify different protective equipment's and their usage.
- To train the students in setting up simple wiring circuits
- To impart methods in electrical machine wiring
- To explain the starting methods of dc motors
- To explain the starting methods of single phase and three phase induction motors.

Course Outcomes: At the end of the course, students are able to

1. Explain the limitations, tolerances, Safety aspects of electrical systems and wiring. (L2)
2. Select wires/cables and other accessories used in different types of wiring. (L3)
3. Make simple lighting and power circuits. (L3)
4. Measure current, voltage and power in a circuit. (L3)
5. Apply starting methods to AC and DC Machines. (L3)

List of Experiments:

1. Study of various electrical tools and symbols.
2. Identify different types of cables/wires and switches, fuses & fuse carriers, MCB and ELCB, MCCB with ratings and usage.
3. Wiring of light /fan circuit using two way/three way control (stair case wiring) Go-down wiring/Tunnel wiring.
4. Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and energy meter.
5. Measurement of voltage, current, resistance in DC circuit.
6. Measurement of voltage, current and power in single phase circuit using voltmeter, ammeter and wattmeter. Calculate the power factor of the circuit.
7. Wiring of backup power supply including inverter, battery and load for domestic Installations.
8. Starting of DC shunt motor using three point starter
9. Starting of DC series motor using two point starter
10. Starting of single phase induction motor
11. Starting of three phase induction motor.

LIST OF EXPERIMENTS (Performed in the lab)

S. No	Name of the Experiment
1	Study of various electrical tools and symbols.
2	Identify different types of cables/wires and switches, fuses & fuse carriers, MCB and ELCB, MCCB with ratings and usage.
3	Wiring of light /fan circuit using two way/three way control (stair case wiring) Go-down wiring/Tunnel wiring.
4	Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and energy meter.
5	Measurement of voltage, current, resistance in DC circuit.
6	Measurement of voltage, current and power in single phase circuit using voltmeter, ammeter and wattmeter. Calculate the power factor of the circuit.
7	Wiring of backup power supply including inverter, battery and load for domestic Installations.
8	Starting of DC shunt motor using three-point starter
9	Starting of DC series motor using two-point starter
10	Starting of single-phase induction motor
11	Starting of three phase induction motor
Additional Experiment	
12	Measurement of Earth Resistance using Megger

INDEX

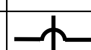
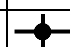
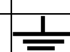
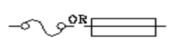
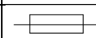
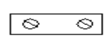
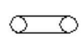
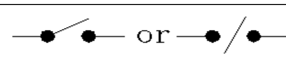
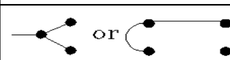
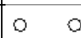
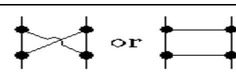
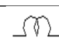
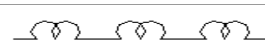
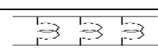
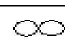
EXPERIMENTS

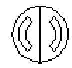
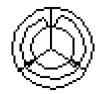
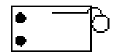
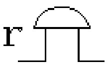
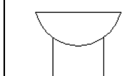
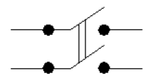
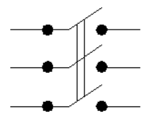
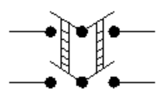
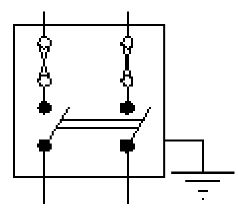
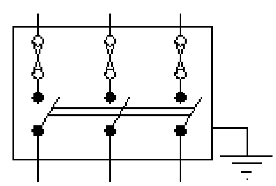
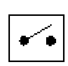
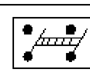
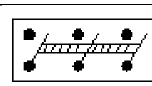
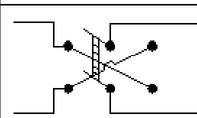
Exp No: 1 **Date:**

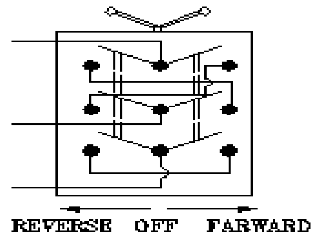
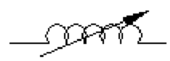
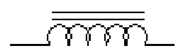
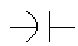
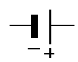
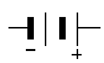
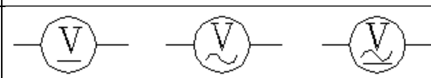
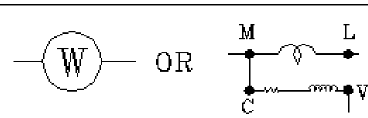
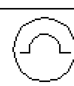
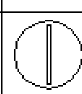
STUDY OF VARIOUS ELECTRICAL TOOLS AND SYMBOLS

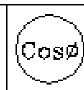
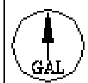
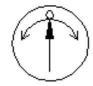
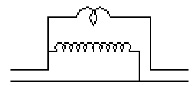
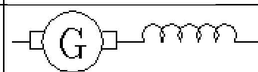
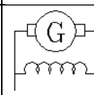
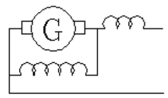
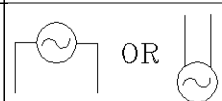
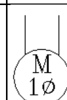
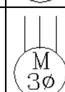
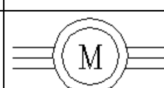
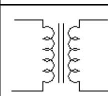
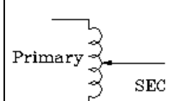
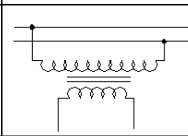
AIM: To study the various electrical symbols and tools

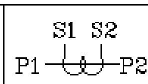
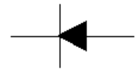
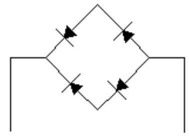
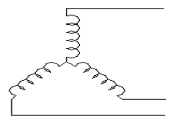
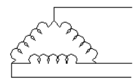
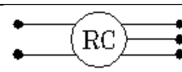
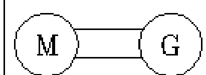
SYMBOLS:

Sl. No	Name of the Symbol	Symbol
1	Direct Current	=
2	Positive	+
3	Negative	–
4	Alternating Current	~
5	Single phase	1Ø or 1 ~
6	Three phase	3Ø or 3 ~
7	Phase sequence	**R Y B**
8	Neutral	N or ± or O
9	Crossed wires	
10	Connected wires	
11	Earth	
12	Fuse (TCC wire)	
13	Cartridge Fuse	
14	Porcelain Connector Single Way	
15	Neutral Link	
16	Single pole Switch	
17	Two-way Switch	
18	Push button Switch	
19	Intermediate Switch	
20	Lamp	
21	Lamp in Series	
22	Lamp in parallel or Lamp Load	
23	Fan	

24	Fan Regulator	
25	Two-Pin Wall socket	
26	Three-Pin Wall socket	
27	Two-Plate Ceiling Rose	
28	Three-Plate Ceiling Rose	
29	Electric bell	 or 
30	Electric Buzzer	
31	Double-pole switch	
32	Triple-pole switch	
33	Knife blade, double-pole, double-throw switch	
34	Double pole, iron clad main switch with fuses	
35	Triple- pole, iron clad main switch with fuses	
36	Oil immersed single-pole switch	
37	Oil immersed double-pole switch	
38	Oil immersed triple-pole switch	
39	Reversing Switch (double pole)	

40	Reversing Switch iron clad (triple pole)	
41	Fixed Resistance	
42	Variable Resistance	
43	Coil (inductive coil or reactor)	
44	Variable inductive coil	
45	Choke coil	
46	Fixed Condenser(Capacitor)	
47	Variable Condenser(Capacitor)	
48	Cell	
49	Battery	
50	Ampere meter or Ammeter (i)ac, (ii)dc, (iii) ac/dc	
51	Volt meter (i)ac, (ii)dc, (iii) ac/dc	
52	Watt meter	
53	Ohm meter	
54	Multi meter	
55	Phase indicator meter	

56	Power factor meter	
57	Frequency meter	
58	Galvanometer	
59	Synchroscope	
60	Single phase energy meter	
61	Series Generator (or Motor)	
62	Shunt Generator (or Motor)	
63	Compound Generator (or Motor)	
64	Single-phase Supply(Source)	
65	Three-phase alternator(Source)	
66	Single-phase motor	
67	Three-phase Squirrel cage induction motor	
68	Three-phase slip-ring induction motor	
69	Single-phase Transformer	
70	Single-phase Auto-Transformer	
71	Potential Transformer	

72	Current Transformer	
73	Half-wave metal rectifier	
74	Full-wave metal rectifier	
75	Star Connection	
76	Delta Connection	
77	Rotary Converter	
78	Motor-Generator set (mechanically coupled)	

TOOLS:

Wrench: Wrench or spanner is a tool used to provide grip and mechanical advantage in applying torque to turn objects usually rotary fasteners such as nuts and bolts or keep them from turning. Higher quality wrenches are typically made from chromium-vanadium alloy tool steels and we often drop-forged. They are frequently chrome-plated to resist corrosion and for ease of cleaning.

Screw driver: Screw driver is a tool used screws into something. It has an axial shaft with a tip of certain shape that fits into the head of screw. On the other end of the screw driver is a cylindrical handle to be held by a person’s hand. As the handle is rotated it creates a torque that turns the tip via the screwdriver’s shaft. A screwdriver is therefore a mechanism to apply torque to a screw and turns it in the spaces.

Hammer: Hammer is a tool consisting of a weighted head fixed to a long handle that is swung to deliver an impact to a small area of an object. Hammers are used for a wide range of driving applications.

Insulation tape: Electrical tape or insulation tape is a type of pressure sensitive tape used to insulate electrical wires and other materials that conduct electricity. It can be made of many plastics but vinyl is most popular as it starches well and gives an effective and long-lasting insulation. Electrical tape for class H insulation is made of Fiber glass cloth.

Tester: Testes is also called as test light, test lamp, voltage tester or mains tester is a piece of electronic test equipment used to determine the presence of electricity in a piece of equipment under test. Non-contact test lights can detect voltage on insulated conductors.

Drilling Machine: Drilling machine is a tool primarily used for round holes of driving fastener. Drills vary widely in speed, power and size. They are commonly used in wood working, metal working, machine tool fabrication, construction and utility projects, specially designed versions are made for medicine, space and miniature applications.

Cutting pliers: Pliers are a hand tool used to hold objects firmly possibly developed from tongs used to handle not metal in bronze age. They are also useful for bending and compressing a wide range of materials advantage, allowing the force of hand’s grip to the amplified and focused on an object with precision

RESULT:

OUTCOME:

Exp No: 2 **Date:**

IDENTIFY DIFFERENT TYPES OF CABLES/WIRES AND SWITCHES, FUSES & FUSE CARRIERS, MCB AND ELCB, MCCB WITH RATINGS AND USAGE

AIM: To Identify different types of cables/wires and switches, fuses & fuse carriers, MCB and ELCB, MCCB with ratings and usage.

ELECTRICAL CABLE TYPES

•Coaxial cable – used for radio frequency signals, for example in cable television distribution systems.

• Communications cable

• Direct-buried cable

• Flexible cables

• Heliax cable

• Non-metallic sheathed cable (or nonmetallic building wire, NM, NM-B)

• Metallic sheathed cable (or armored cable, AC, or BX)

• Multicore cable (consist of more than one wire and is covered by cable jacket)

• Paired cable – Composed of two individually insulated conductors that are usually used in DC or low-frequency AC applications

• Portable cord – Flexible cable for AC power in portable applications

• Ribbon cable – Useful when many wires are required. This type of cable can easily flex, and It is designed to handle low-level voltages.

• Shielded cable – Used for sensitive electronic circuits or to provide protection in high-voltage applications.

• Single cable (from time to time this name is used for wire)

• Submersible cable

• Twin ax cable

• Twin-lead – This type of cable is a flat two-wire line. It is commonly called a 300 Ω line because the line has an impedance of 300 Ω. It is often used as a transmission line between an antenna and a receiver (e.g., TV and radio). These cables are stranded to lower skin effects.

• Twisted pair – Consists of two interwound insulated wires. It resembles a paired cable, except that the paired wires are twisted

TYPES OF SWITCHES

A switch is a device which is designed to interrupt the current flow in a circuit, in other words, it can make or break an electrical circuit. Every electrical and electronics application uses at least one switch to perform ON and OFF operation of the device.

So the switches are the part of a control system and without it, control operation cannot be achieved. A switch can perform two functions, namely fully ON (by closing its contacts) or fully OFF (by opening its contacts).

When the contacts of a switch are closed, the switch creates the closed path for current flow and hence load consumes the power from source. When the contacts of a switch are open, no power will be consumed by the load as shown in below figure.

There are numerous switch applications found in wide variety fields such as home, automobiles, industrial, military, aerospace and so on. In some applications multi way switching is employed (like building wiring), in such cases two or more switches are interconnected to control an electrical load from more than one location.

Switches can be of mechanical or electronic type,

MECHANICAL SWITCHES

must be activated physically, by moving, pressing, releasing, or touching its contacts. Mechanical switches can be classified into different types based on several factors such as method of actuation (manual, limit and process switches), number of contacts (single contact and multi contact switches), number of poles and throws (SPST, DPDT, SPDT, etc.), operation and construction (push button, toggle, rotary, joystick, etc), based on state (momentary and locked switches), etc.

ELECTRONIC SWITCHES

do not require any physical contact in order to control a circuit. These are activated by semiconductor action. The electronic switches are generally called as solid-state switches because there are no physical moving parts and hence absence of physical contacts. Most of the appliances are controlled by semiconductor switches such as motor drives and HVAC equipment’s.

There are different types of solid-state switches are available in today market with different sizes and ratings.

1. Mechanical Switches
    1.1. Single Pole Single Throw Switch (SPST)
    1.2. Single Pole Double Throw Switch (SPDT)
    1.3. Double Pole Single Throw Switch (DPST)
    1.4. Double Pole Double Throw Switch (DPDT)
    1.5. Push Button Switch
    1.6. Toggle Switch
    1.7. Limit Switch
    1.8. Float Switches
    1.9. Flow Switches
    1.10. Pressure Switches
    1.11. Temperature Switches
    1.12. Joystick Switch
    1.13. Rotary Switches
2. Electronic Switches
    2.1. Bipolar Transistors
    2.2. Power Diode
    2.3. MOSFET
    2.4. IGBT
    2.5. SCR
    2.6. TRIAC
    2.7. DIAC
    2.8. Gate Turn-Off Thyristor

FUSES:

Fuses are the earliest means of protection against overcurrent's in circuits. Basically, the fuse consists of a short length of suitable material (often a thin wire). When the current flow is greater than the fusing current of the fuse, it will get hot and burn (melt), thus interrupting the fault current before damage could be caused. The size of the wire is designed to carry indefinitely the normal circuit current (rated current) and usually designed to fuse (melt/burn) at about 1.7 – 2 times the rated current carrying capacity. They have inverse time characteristics. Accordingly, the operation of the fuse is faster when the fault current is larger. In addition to operating for short circuits between the live and neutral, fuses are expected to operate under overload conditions. Over-loading occurs when extra power is taken from the supply. The increased current due to over-loading will have an immediate effect on the cables; they will begin to heat up. If the over-loading is sustained the result could be an accelerated deterioration of the cable insulation and its eventual breakdown to cause an electrical fault. A heavy-sudden over-load for a very short period (e.g. such as in Motor starting) is not very serious since the over-load current flows for a short time and the rise in cable temperature is not very high. At the standstill the motor behaves as the short circuit secondary transformer and it draws heavy current from mains, which can cause the damages at the starting. It can cause the heavy drops in power line. So direct online starting of motor is not desirable. The motor has to be started at reduced voltage. For heavy duty motors some starting methods are used or resistance has to be included in the circuit at starting.

Applications of Fuses

Electrical or Electronic Fuses are one of the main components in almost all electrical or electronic circuits, systems and applications. Some of the commonly known applications of Fuses are mentioned below.

- Power Transformers
- Home Electrical Wiring
- All Electrical Appliances (Air Conditioners, Washing Machines, TV, Music Systems, etc.)
- Motor Starters
- Mobile Phones
- Laptops
- Power Adapters
- Cameras
- Printers, Scanners and Photocopiers
- All Automobile (Cars, Bikes, Trucks, Buses, etc.)
- All Electronic Devices (Hard Disks, DVD Writers, DVD Players, etc.)
- Gaming Consoles

MCB Miniature Circuit Breaker (MCB) is a device which can open or close a circuit either manually or automatically under all conditions like no load, full load and fault conditions. it consists of a moving contact and affixed contact. It is so designed that it can operate manually under normal condition and automatically under fault condition. Under normal conditions the contacts of MCB remain closed and carry normal full load current. When the fault occurs the secondary current of CT increases thus energizing the trip coil, there by the CB contacts are opened and circuit is disconnected from the bus bar. The main advantage of MCB is that when it trips off due to a fault it cannot be switched on again until the fault is rectified. MCB is an electromechanical device which guards an electrical circuit from an over current, that may effect from short circuit, overload or imperfect design. This is a better option to a Fuse since it doesn't require alternate once an overload is identified. An MCB can be simply rearranged and thus gives a better operational protection and greater handiness without incurring huge operating cost. The operating principle of MCB is simple.

Fig: Miniature Circuit Breaker

An MCB function by interrupting the stability of electrical flow through the circuit once an error is detected. In simple conditions this circuit breaker is a switch which routinely turns off when the current flows through it and passes the maximum acceptable limit. Generally, these are designed to guard against over current and overheating.

MCB is substituting the rewireable switch-fuse units for low power domestic and industrial applications in a very quick manner. In wiring system, the MCB is a blend of all three functions such as protection of short circuit, overload and switching. Protection of overload by using a bimetallic strip & short circuit protection by used solenoid.

These are obtainable in different pole versions like single, double, triple pole & four poles with neutral poles if necessary. The normal current rating is ranges from 0.5-63 A with a symmetrical short circuit breaking capacity of 3-10 KA, at a voltage level of 230 or 440V.

Characteristics of MCB

The characteristics of an MCB mainly include the following

- Rated current is not more than 100 amperes
- Normally, trip characteristics are not adjustable
- Thermal/thermal magnetic operation

ELCB -Earth Leakage Circuit Breaker:

The ELCB is used to protect the circuit from the electrical leakage. When someone gets an electric shock, then this circuit breaker cuts off the power at the time of 0.1 secs for protecting the personal safety and avoiding the gear from the circuit against short circuit and overload.

Fig: Earth Leakage Circuit Breaker

ELCB is a security device used in electrical system with high Earth impedance to avoid shock. It notices small stray voltages on the metal fields of electrical gear, and interrupt the circuit if an unsafe voltage is detected. The main principle of Earth leakage protectors is to stop injury to humans and nature due to electric shock.

This circuit breaker is a specialized kind of latching relay that has structures incoming mains power connected through its switching contacts so that this circuit breaker disconnects the power supply in an unsafe condition.

The ELCB notices fault currents from live to the ground wire inside the installation it guards. If enough voltage emerges across the sense coil in the circuit breaker, it will turn off the supply, and stay off until reset by hand. A voltage-sensing earth leakage circuit breaker doesn't detect fault currents from exist to any other ground body.

Characteristics of ELCB

The characteristics of an ELCB mainly include the following

- This circuit breaker connects the phase, earth wire and neutral
- The working of this circuit breaker depends on current leakage

MCCB-Molded Case Circuit Breaker:

The MCCB is used to control electric energy in distribution n/k and is having short circuit and overload protection. This circuit Breaker is an electromechanical device which guards a circuit from short circuit and over current. They offer short circuit and over current protection for circuits ranges from 63 Amps-3000 Amps. The primary functions of MCCB is to give a means to manually open a circuit, automatically open a circuit under short circuit or overload conditions. In an electrical circuit, the over current may result faulty design

Fig: Molded Case Circuit Breaker

The MCCB is an option to a fuse since it doesn't need an alternate once an overload is noticed. Unlike a fuse, this circuit breaker can be simply reset after a mistake and offers enhanced operator safety and ease without acquiring operating cost. Generally, these circuits have thermal current for over current and the magnetic element for short circuit release to work faster.

Characteristics of MCCB

The characteristics of an MCCB mainly include the following

- The range of rated current us up to 1000 amperes
- Trip current may be adjusted
- Thermal/thermal magnetic operation

RESULT:

OUTCOME:

Exp No: 3 **Date:**

WIRING OF LIGHT /FAN CIRCUIT USING TWO WAY/THREE WAY CONTROL (STAIR CASE WIRING) GO-DOWN WIRING/TUNNEL WIRING

AIM: To Perform Wiring of light /fan circuit using two way/three-way control (stair case wiring) Go-down wiring/Tunnel wiring

GO-DOWN WIRING

APPARATUS:

S.No	Name	Quantity
1	Switch(1-Way)	1
2	Switch(1-Way)	2
3	lamp	3
4	Bulb holder	3
5	fuses	2
6	Connecting wires	As required

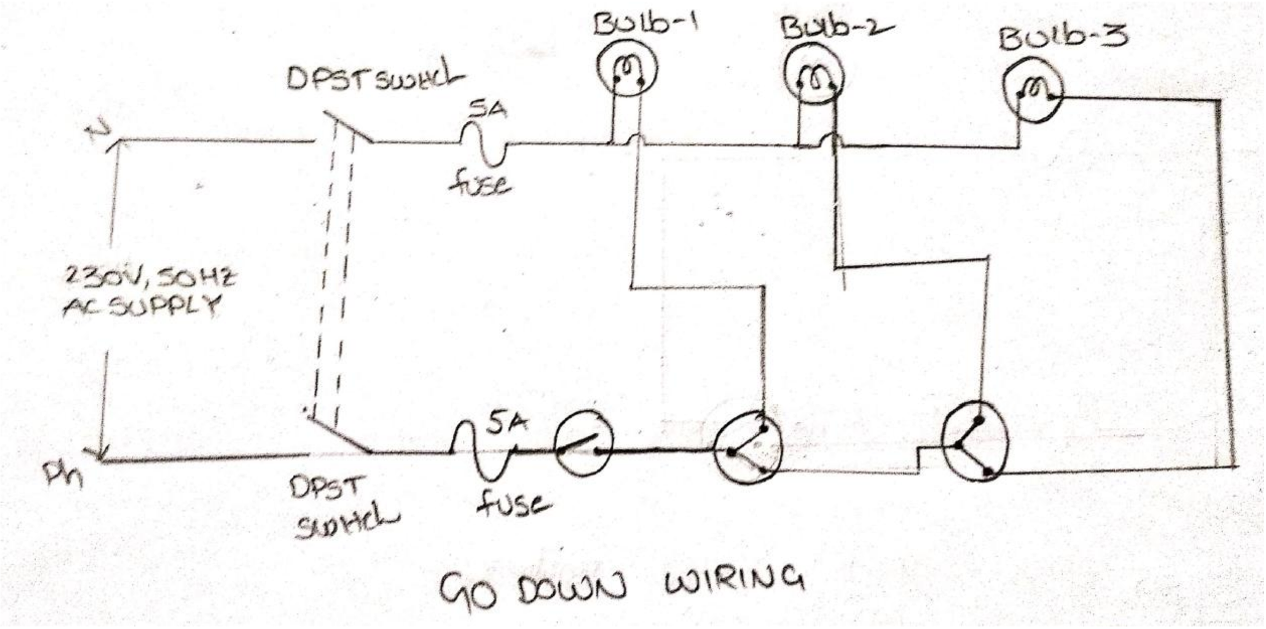
THEORY:

Go-Down Wiring:

This type of wiring is used to control a light or fan from two or more places, typically in a go-down (a room at a lower level, such as a basement or storage area). It can be achieved by using a two-way or three-way circuit to control the device from different levels of the building.

- It requires either two-way or three-way switching as described above, depending on whether two or more points of control are needed.

CIRCUIT DIAGRAM:



PROCEDURE:

1) Connect all the components as per the circuit diagram
2) Switch on the supply and operate the switches
3) Observe the operation of go down wiring

TUNNEL WIRING

APPARATUS:

S.No	Name	Quantity
1	Two-Way switch	4
2	Bulb	3
3	Bulb Holder	3
4	Connecting wires	As required

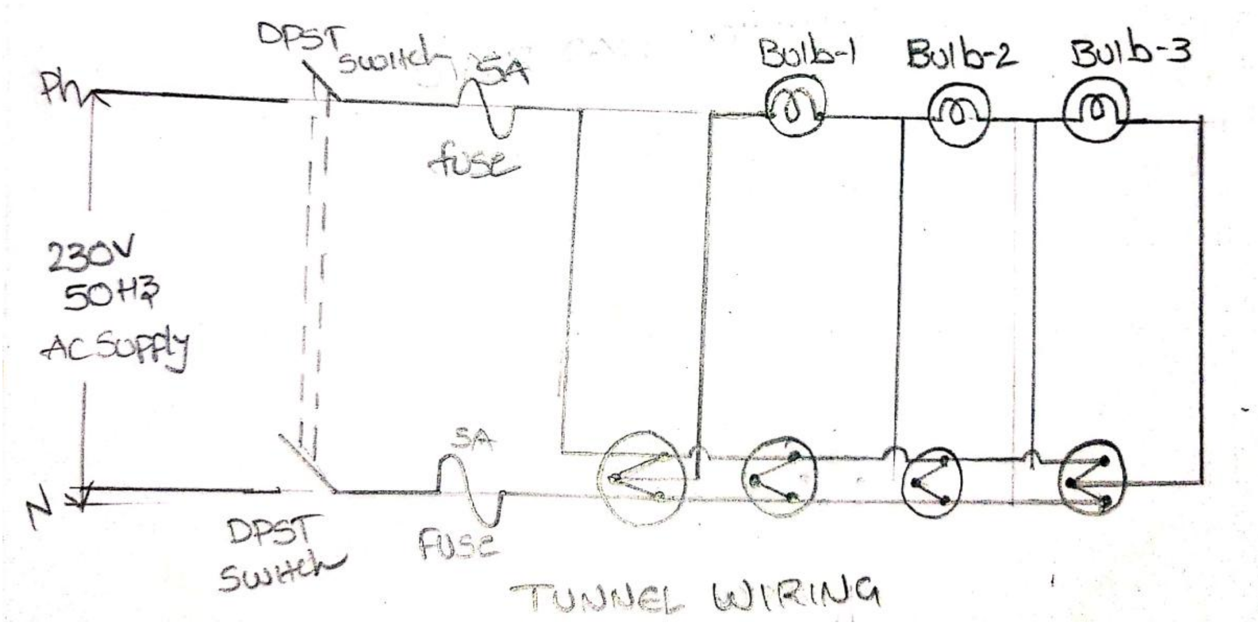
THEORY:

Tunnel Wiring:

Tunnel wiring is used in areas where multiple entry and exit points (such as tunnels or long corridors) require the light or fan to be controlled from various points along the tunnel.

- The wiring follows a three-way control system, using an intermediate switch to allow control from multiple locations.

CIRCUIT DIAGRAM:



PROCEDURE:

1) Connect all the components as per the circuit diagram
2) Switch on the supply and operate the switches
3) Observe the operation of tunnel wiring

STAIR CASE WIRING

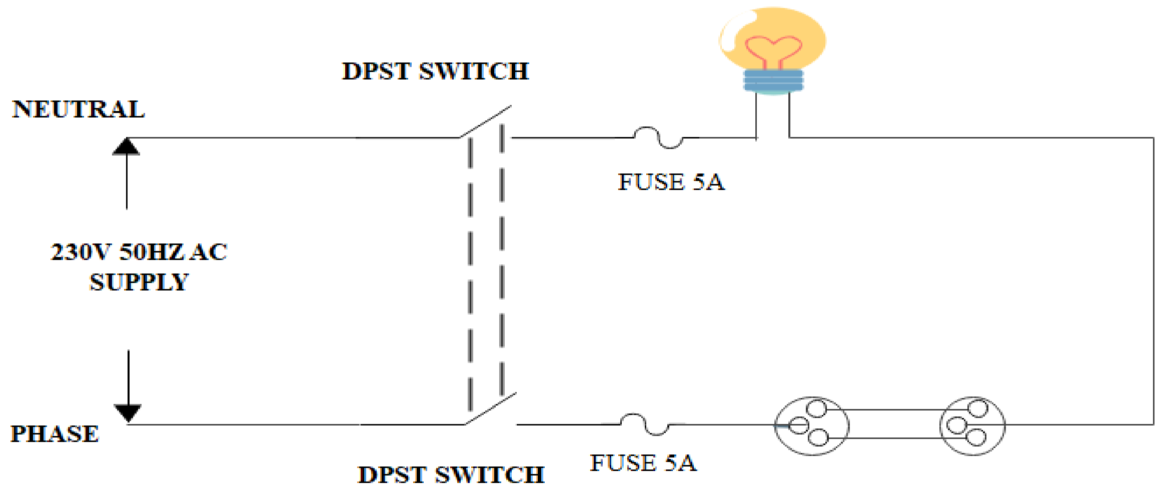
APPARATUS:

S.NO	NAME	QUANTITY
1	Two-Way switch	2
2	Bulb	1
3	Bulb Holder	1
4	Connecting wires	As required

THEORY:

Staircase wiring is a specific type of electrical wiring used to control a light from two different locations, typically at the top and bottom of a staircase. This allows you to turn the light on or off from either location, making it very useful for safety and convenience in staircases or long hallways.

CIRCUIT DIAGRAM:



STAIR CASE WIRING

PROCEDURE:

1) Connect all the components as per the circuit diagram
2) Switch on the supply and operate the switches
3) Observe the operation of stair case wiring

PRECAUTIONS:

1) Avoid loose connections.
2) Switch OFF the supply before making the connections.
3) Do not touch the bare conductors.

RESULT:

OUTCOME:

Exp No: 4 **Date:**

WIRING OF POWER DISTRIBUTION ARRANGEMENT USING SINGLE PHASE MCB DISTRIBUTION BOARD WITH ELCB, MAIN SWITCH AND ENERGY METER

AIM: To perform wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and energy meter

APPARATUS:

S.NO	NAME	RANGE	QUANTITY
1	Energy meter	230V	1
2	ELCB	1psc	1
3	MCB	5psc	1
4	Bulb	40W	1
5	switch	230V,50HZ,6A	1
6	Connecting Wires		
7	Main double pole circuit breaker		1
8	Electric pole	230V,50HZ	1

THEORY:

In electrical distribution systems, a single-phase distribution board plays a crucial role in managing and distributing electrical power safely and efficiently. The combination of Miniature Circuit Breakers (MCBs), Earth Leakage Circuit Breakers (ELCBs), Main Switches, and Energy Meters ensures safety, fault protection, and energy monitoring for residential or small commercial setups.

1. Main Switch

The Main Switch is an essential component that controls the entire electrical system in a building.

2. Energy Meter

The Energy Meter is used to measure the total amount of electrical energy consumed by the system. It is usually installed after the main switch to record the consumption in kilowatt-hours (kWh). The meter helps in monitoring power usage and is crucial for energy billing purposes. Energy meters come in two types: analog and digital, both serving the purpose of accurately measuring electrical energy consumption.

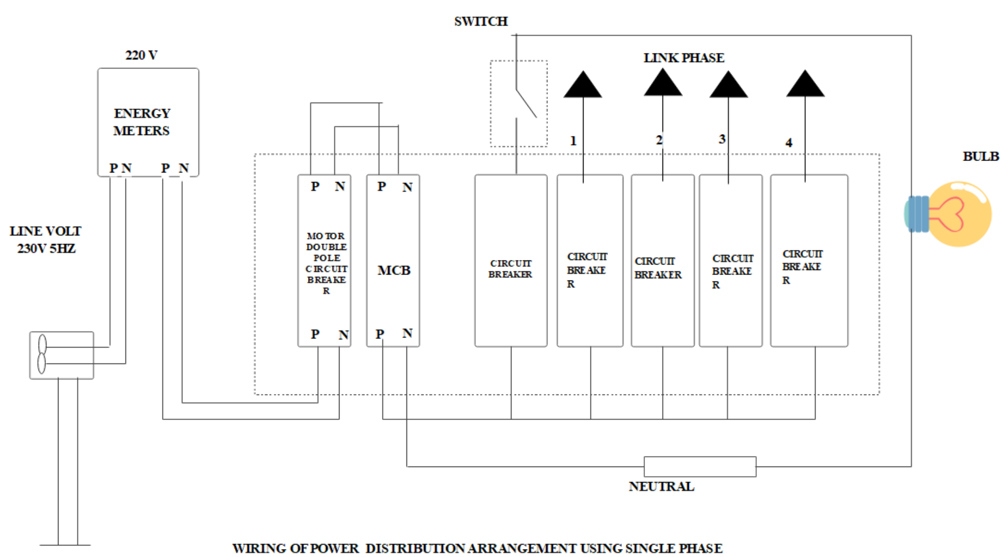
3. ELCB (Earth Leakage Circuit Breaker)

The ELCB is a safety device that is used to prevent electric shocks caused by earth leakage.

4. MCB (Miniature Circuit Breaker)

The MCB is a protective device that automatically disconnects a circuit in case of overload or short circuit.

CIRCUIT DIAGRAM:



WIRING OF POWER DISTRIBUTION ARRANGEMENT USING SINGLE PHASE MCB DISTRIBUTION BOX WITH ELCB, MAIN SWITCH, ENERGY METER

PROCEDURE:

1) Electric pole line meter connection phase and electric pole line neutral connection neutral.
2) Meter to MCB connection phase and neutral.
3) Main MCB to distribution board MCB phase and neutral connection.
4) ELCB to MCB line connection to circuit breaker1, circuit breaker 2, circuit breaker 3, circuit breaker 4, circuit brekaer5.
5) ELCB to neutral connection.
6) One switch board is connected to one miniature circuit breaker.
7) Switch output load connection and neutral output load connection.
8) If we ON the switch the bulb glows and if we OFF the switch it will off.

RESULT:

OUTCOME:

Exp No: 5 **Date:**

MEASUREMENT OF VOLTAGE, CURRENT, RESISTANCE IN DC CIRCUIT

AIM: To Measure voltage, current, resistance in DC circuit.

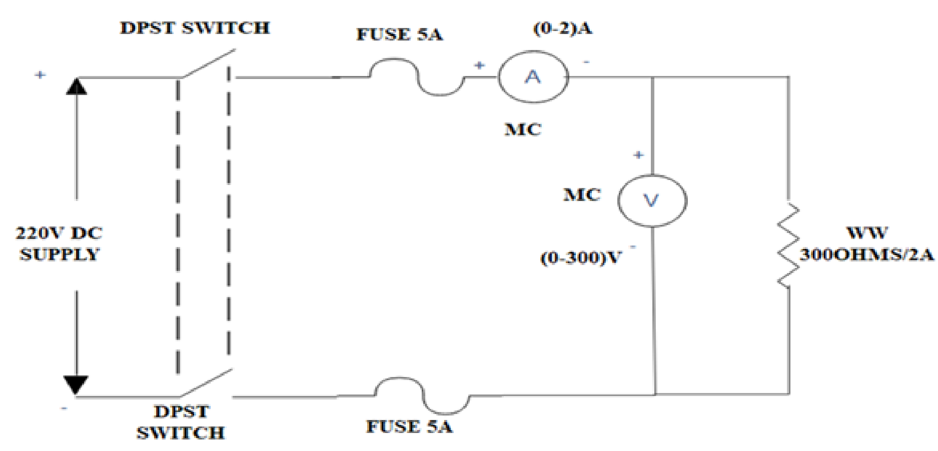
APPARATUS:

S.NO	METER	TYPE	RANGE	QUANTITY
1	Ammeter	M.I	(0-2)A	1
2	Voltmeter	M.I	(0-300)V	1
3	Wattmeter	UPF	300v/2A	1
4	Rheostat	WW	300Ω/2A	1
5	Connecting wires	----		As required

THEORY:

In any electrical circuit, it is essential to measure different parameters such as voltage, current, and resistance to understand the behavior of the circuit. These measurements are made using specialized instruments: voltmeter, ammeter, and ohmmeter. In a DC circuit, accurate measurements of voltage, current, and resistance are crucial for understanding circuit performance, troubleshooting, and ensuring safe operation. The voltmeter, ammeter, and ohmmeter are the primary tools used to measure these electrical parameters. Proper connection and selection of ranges for these instruments are important to obtain correct readings and to protect the instruments from damage.

CIRCUIT DIAGRAM:



MEASUREMENT OF VOLTAGE, CURRENT, RESISTANCE IN A DC CIRCUIT

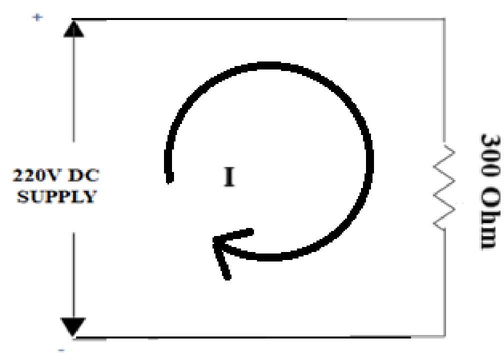
PROCEDURE:

1) Make the connections as per circuit diagram
2) Note down the values of voltage, current, power from voltmeter, ammeter, wattmeter
3) Calculate the value of resistance by using above noted values.

TABULAR FORMS:

	Voltage(v)	Current(A)	Resistance(Ω)
Theoretical Values			
Practical Values			

CALCULATIONS:



PRECAUTIONS:

1) Avoid loose connections.
2) Switch OFF the supply before making the connections.
3) Do not touch the bare conductors.

RESULT:

OUTCOME:

Exp No: 6 **Date:**

Measurement of voltage, current and power in single phase circuit using voltmeter, ammeter and wattmeter. Calculate the power factor of the circuit

AIM: To Measure voltage, current and power in single phase circuit using voltmeter, ammeter and wattmeter. Calculate the power factor of the circuit.

APPARATUS:

S.NO	METER	TYPE	RANGE	QUANTITY
1	Ammeter	M.I	(0-2)A	1
2	Voltmeter	M.I	(0-300)V	1
3	Wattmeter	UPF	300v/2A	1
4	Choke coil	----	---	1
5	Connecting wires	----		As required

THEORY:

In a single-phase AC circuit, voltage, current, and power are key parameters to understand the behavior of the electrical system. These parameters can be measured using different instruments, each providing valuable information about the circuit's operation.

1. Voltmeter:

- The voltmeter is used to measure the voltage (or potential difference) across a load or component in the circuit. In an AC circuit, it measures the RMS (Root Mean Square) value of the voltage.
- The voltmeter is connected in parallel to the load, ensuring that the voltage drop across the load is accurately measured.

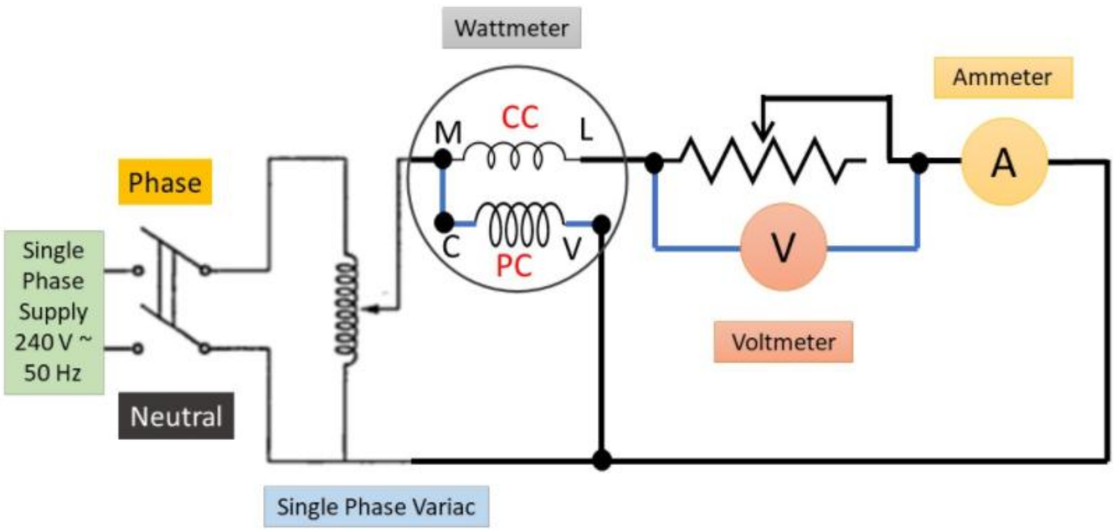
2. Ammeter:

- The ammeter measures the current flowing through the circuit. It measures the RMS value of the current in an AC circuit, which represents the equivalent DC current that would produce the same heating effect in a resistor.
- The ammeter is connected in series with the load to measure the current that flows through it.

3. Wattmeter:

- The wattmeter measures the active power (P) consumed by the load. In an AC circuit, the wattmeter uses both the current and voltage to calculate the power, taking into account the phase difference between them.
- The wattmeter is connected in such a way that its current coil is in series with the load, and its potential coil is across the load.

CIRCUIT DIAGRAM



PROCEDURE:

1) Make the connections as per circuit diagram
2) Note down the values of voltage, current, power from voltmeter, ammeter, wattmeter
3) Calculate the power factor by using above noted values.

TABULAR FORMS:

S.NO	Voltage(v)	Current(A)	Power(W)

CALCULATIONS:

$$\mathbf{P = V * I * Cos\emptyset}$$

$$\mathbf{Cos\emptyset} = \frac{P}{VI}$$

PRECAUTIONS:

1) Avoid loose connections.
2) Switch OFF the supply before making the connections.
3) Do not touch the bare conductors.

RESULT:

OUTCOME:

Exp No: 7 **Date:**

WIRING OF BACKUP POWER SUPPLY INCLUDING INVERTER, BATTERY AND LOAD FOR DOMESTIC INSTALLATIONS

AIM: To perform wiring of wiring of backup power supply including inverter, battery and load for domestic installations

APPARATUS:

S.NO	NAME	RANGE	QUANTITY
1	Energy meter	230V	1
2	Battery	150 AH	1
3	Inverter	950 VA	1
4	MCB	6 A	1
5	Bulb	40W	3
6	switch	230V,50HZ,6A	1
7	Connecting Wires		
8	Electric pole	230V,50HZ	1

THEORY:

A backup power supply system is designed to provide electricity to a household during power outages or when the main grid supply is unavailable. It typically consists of an inverter, a battery, and a load. These components work together to ensure that essential appliances or devices continue to function when there is no access to grid power.

1. Inverter:

An inverter is an electrical device that converts DC (Direct Current) power, typically supplied by the battery, into AC (Alternating Current) power, which is used by most household appliances.

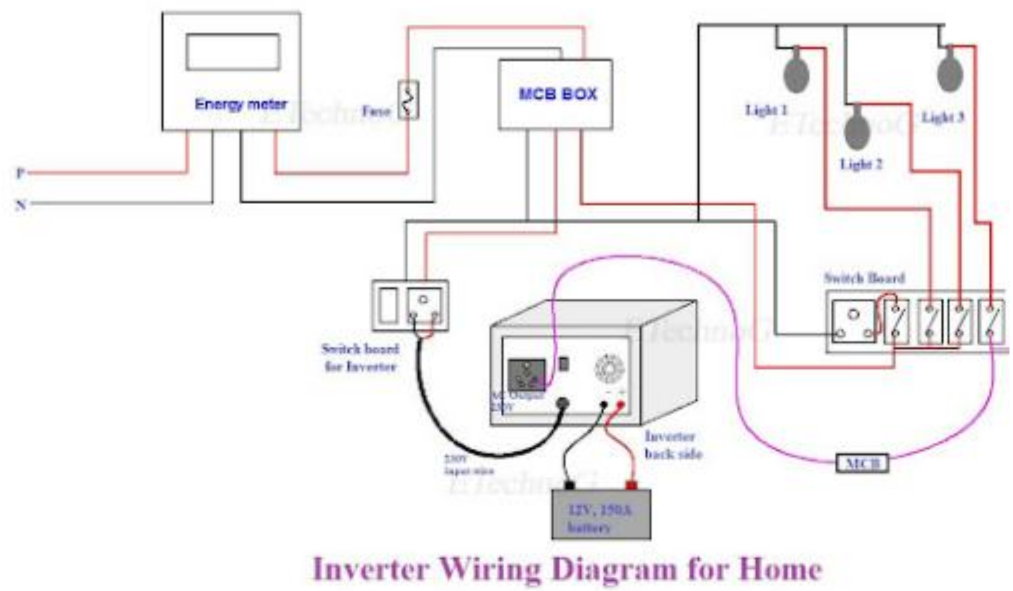
2. Battery:

The battery stores energy in the form of DC power. This stored energy is used by the inverter when there is a power outage, allowing appliances to keep running. The size of the battery is typically determined by its capacity (measured in Ampere-hours, Ah) and the load's total power demand.

PRODECURE:

1) Connections are made as per circuit diagram
2) Initially connect the battery to the inverter
3) Inverter is connected to the switch board which is connected to MCB box
4) Initially all lights are turned on through main supply
5) Switch off the main supply then inverter will turned on
6) All the lights will be turned on through inverter supply

CIRCUIT DIAGRAM



PRECAUTIONS:

1) All connections should be tight.
2) Never touch or try to touch any test point in Inverter Trainer Kit
3) The circuit should be according to circuit diagram.
4) Don't reverse polarity of Battery Input
5) Never short circuit terminals of battery

RESULT:

OUTCOME:

Exp No: 8 **Date:**

STARTING OF DC SHUNT MOTOR USING THREE POINT STARTER

AIM: To start DC SHUNT motor by using three-point starter

NAME PLATE DETAILS:

S.NO	PARAMETER	RATING
1	Power	3 H.P
2	Armature current	12 A
3	Armature Voltage	220 V
4	Speed	1500 RPM

APPARATUS:

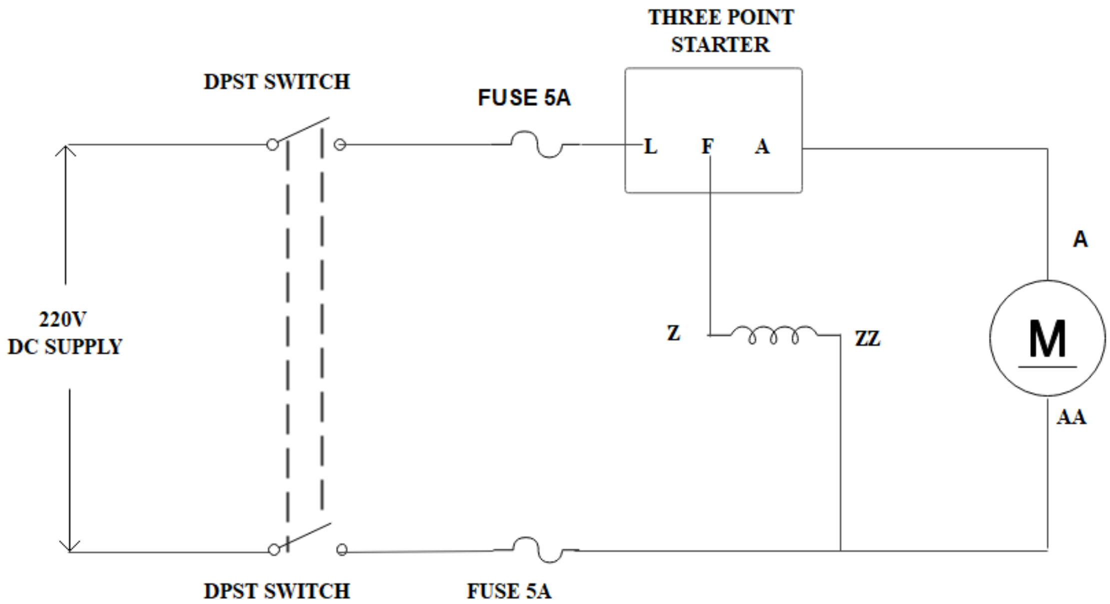
S.NO	Name	Range	Type	Quantity
1	Connecting wires		-----	As required
2	Electrical Load			1

THEORY:

The Three-Point Starter is used to start DC motors, particularly shunt motors, to safely limit the initial inrush current and protect the motor from damage during startup.

Start-Up: When the motor is started, the **starter handle** is moved to the "start" position, which connects a high resistance in series with the armature to limit the current.
Gradual Acceleration: As the motor picks up speed, the handle is gradually moved towards the "run" position, reducing the resistance.
Full Speed: When the motor reaches full speed, the resistance is bypassed, and the motor runs on full supply voltage.
Protection: **No-Volt Coil** disconnects the motor if the supply voltage fails.
Overload Relay disconnects the motor if excessive current is drawn (overload condition).

CIRCUIT DIAGRAM:



STARTING OF DC SHUNT MOTOR USING THREE POINT STARTER

PROCEDURE:

1) Connections are made as per circuit diagram
2) Switch on the supply by using DPST switch
3) Vary the starter terminals from initial to final position
4) Observe the working of motor
5) Disconnect the supply by using DPST switch

PRECAUTIONS:

1. Avoid loose connections.
2. Switch OFF the supply before making the connections.
3. Do not touch the bare conductors.

RESULT:

OUTCOME:

Exp No: 9 **Date:**

STARTING OF DC SERIES MOTOR USING TWO POINT STARTER

AIM: To start DC series motor by using two-point starter

NAME PLATE DETAILS:

S.NO	PARAMETER	RATING
1	Power	3 H.P
2	Armature voltage	220 V DC
3	Armature current	13.6 A
4	Speed	1500 RPM

APPARATUS:

S.NO	Name	Range	Type	Quantity
1	Electrical load		Resistive	1
2	Connecting wires		-----	As required

THEORY:

The **Two-Point Starter** is used to safely start a **DC Series Motor** by limiting the initial inrush current and ensuring proper protection during startup.

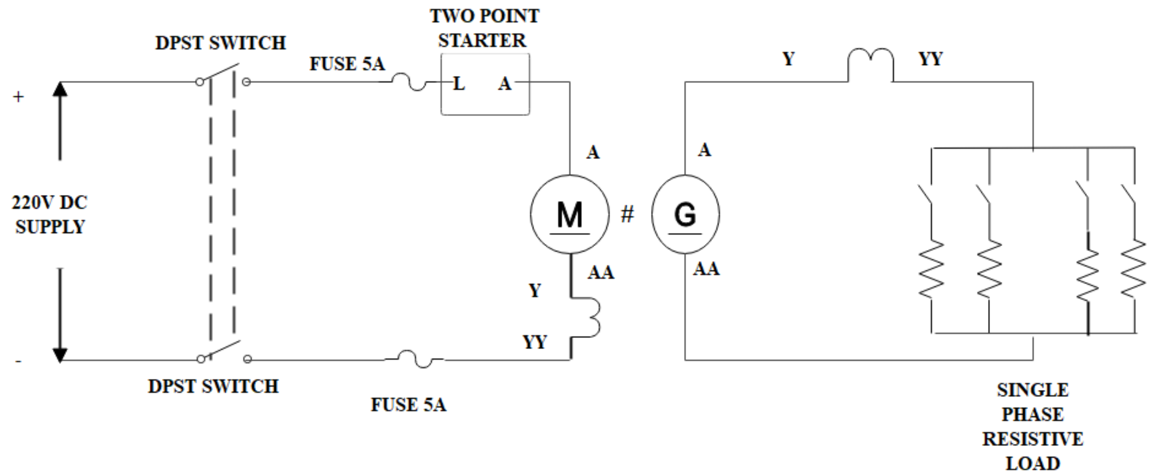
Starting: When starting the motor, the two-point starter handle is moved to the "start" position. This places a high resistance in series with the armature to limit the current flow, preventing a high inrush current.

Gradual Acceleration: As the motor begins to accelerate, the handle is moved toward the "run" position. The resistance is reduced gradually, allowing more current to flow and the motor to speed up.

Full Speed: When the motor reaches its rated speed, the resistance is completely bypassed, and the motor runs at full supply voltage.

Protection: If the current exceeds a safe value (indicating an overload), the overload relay disconnects the motor to prevent damage.

CIRCUIT DIAGRAM:



STARTING OF DC SERIES MOTOR USING TWO POINT STARTER

PROCEDURE:

1) Connections are made as per circuit diagram
2) Switch on the supply by using DPST switch
3) Make sure that generator should have load before starting starter
4) Vary the starter terminals from initial to final position
5) Observe the working of motor
6) Disconnect the supply by using DPST switch

PRECAUTIONS:

4) Avoid loose connections.
5) Switch OFF the supply before making the connections.
6) Do not touch the bare conductors.

RESULT:

OUTCOME:

Exp No: 10 **Date:**

STARTING OF SINGLE-PHASE INDUCTION MOTOR

AIM: To start the single-phase induction motor by using DOL starter

NAME PLATE DETAILS:

S.NO	PARAMETER	RATING
1	Power	1H.P
2	Primary voltage	230 V
3	Load current	5.8 A
4	Phase & frequency	1-Φ & 50 HZ
5	Speed	1400 RPM

APPARATUS:

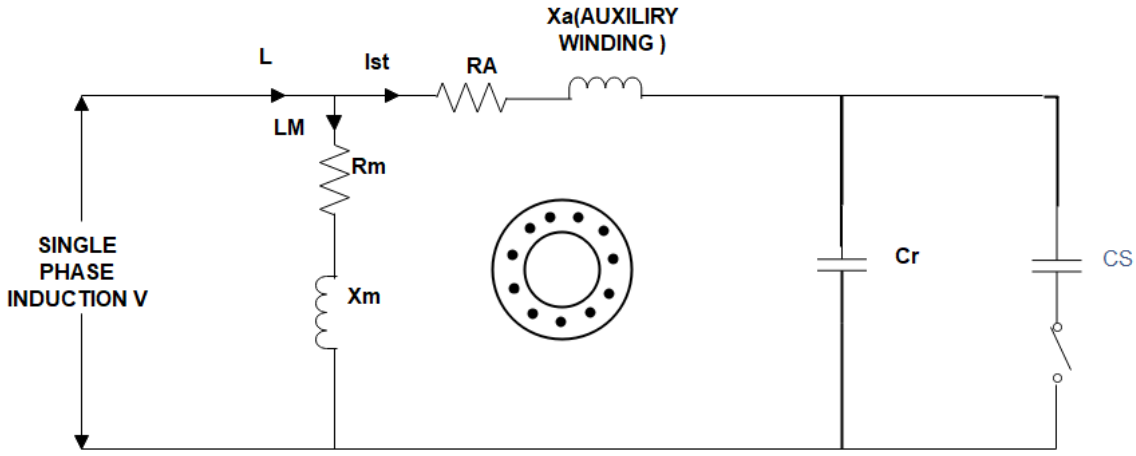
S.NO	APPARATUS	QUANTITY
1	DOL starter	1
2	1-phase induction motor	1
3	Connecting wires	As required

THEORY:

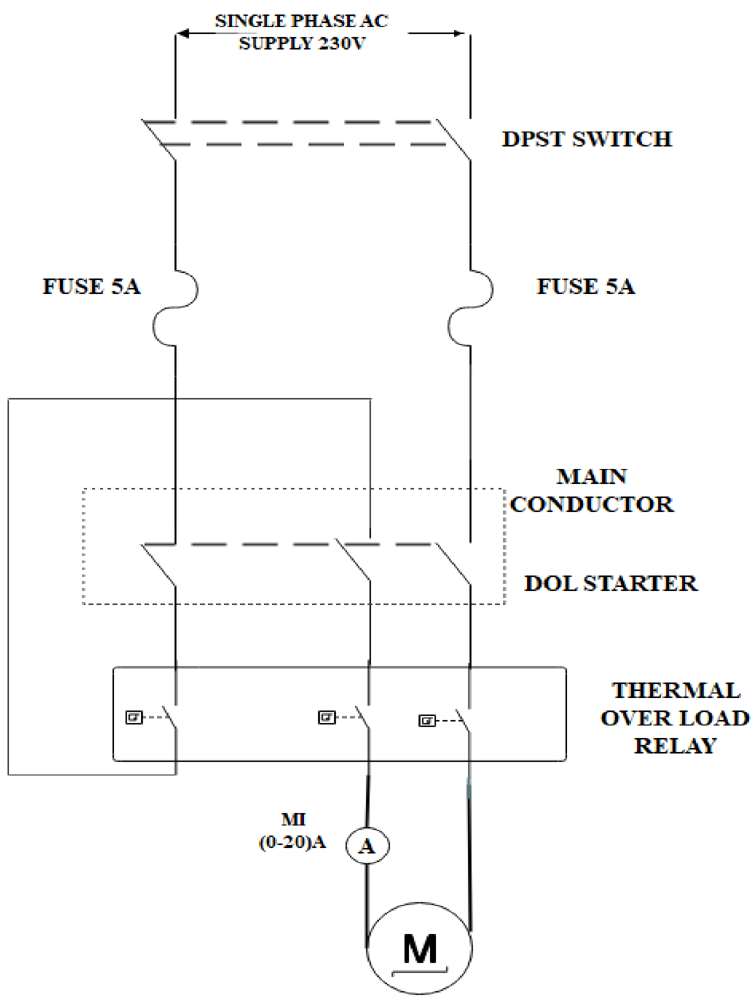
To understand the process of starting a single-phase induction motor, which is widely used in domestic and light industrial applications but requires special methods to start because it cannot self-start like a three-phase motor.

1. A **starting winding** is placed in parallel with the main winding.
2. The starting winding is connected in **series with a capacitor** (or a resistor in some cases), which shifts the phase of the current, creating a rotating magnetic field that produces the starting torque.
3. Once the motor reaches a certain speed, a **centrifugal switch** disconnects the starting winding, and the motor runs using only the main winding.

CIRCUIT DIAGRAM:



SQURAL CAGE ROTOR



STARTING OF SINGLE PHASE INDUCTION MOTOR

PROCEDURE:

1) Connections are made as per circuit diagram
2) Switch on the supply by using DPST switch
3) Press start button to start the motor
4) Observe the motor in running condition
5) Press stop button to stop the motor
6) Disconnect the supply by using TPST switch

PRECAUTIONS:

1) Avoid loose connections.
2) Switch OFF the supply before making the connections.
3) Do not touch the bare conductors.

RESULT:

OUTCOME:

Exp No: 11 **Date:**

STARTING OF THREE PHASE INDUCTION MOTOR

AIM: To start the 3-Phase induction motor by using starter

NAME PLATE DETAILS:

S.NO	PARAMETER	RATING
1	Power	3 H.P
2	Primary voltage	415 V
3	Load current	4.7 A
4	Phase & frequency	3-Φ & 50 HZ
5	Speed	1400 RPM

APPARATUS:

S.NO	APPARATUS	QUANTITY
1	3-Phase Variac	1
2	3-Phase Induction Motor	1
3	Connecting Wires	As required

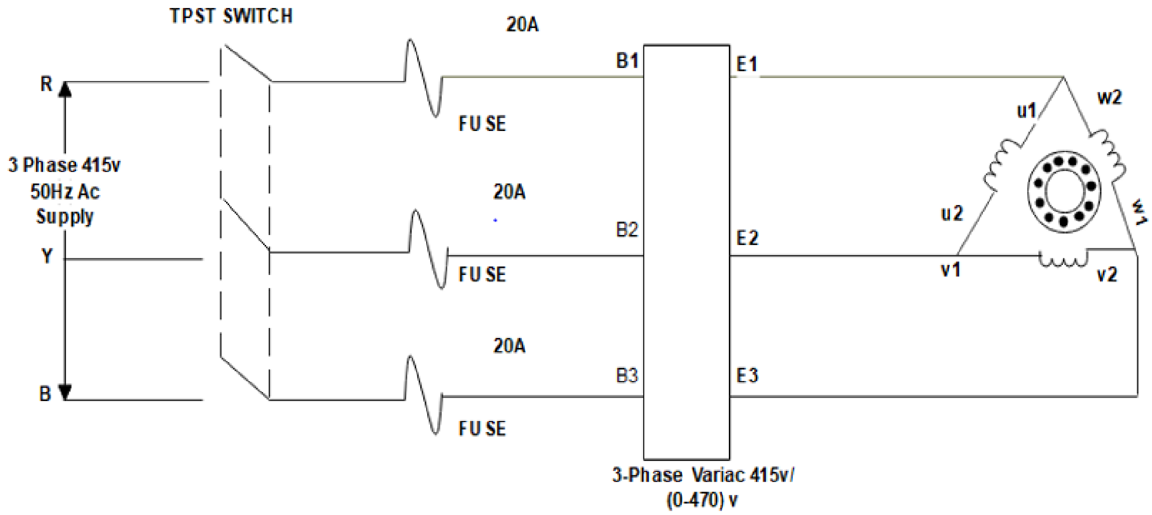
THEORY:

To understand the methods used for starting a three-phase induction motor safely, effectively, and efficiently. The goal is to limit the inrush current and ensure the motor starts smoothly without causing damage to the electrical supply or the motor itself.

A **three-phase induction motor** operates by producing a rotating magnetic field that induces current in the rotor, creating torque.

At startup, the motor draws high inrush current (approximately 5 to 7 times the rated current) due to the absence of back EMF.

CIRCUIT DIAGRAM:



STARTING OF 3 PHASE INDUCTION MOTOR

PROCEDURE:

1) Connections are made as per circuit diagram
2) Switch on the supply by using TPST switch
3) Slowly increase the applied voltage by using 3-phase variac
4) Observe the motor in running condition
5) Disconnect the supply by using TPST switch

PRECAUTIONS:

1) Avoid loose connections.
2) Switch OFF the supply before making the connections.
3) Do not touch the bare conductors.

RESULT:

OUTCOME:

Exp No: 12 **Date:**

MEASUREMENT OF EARTH RESISTANCE USING MEGGER

AIM: To measure the earth's resistance using Megger.

APPARATUS REQUIRED:

S.No.	Name of the Apparatus	Quantity
1	Earth Resistance Tester	1
2	Spikes	2
5.	Connecting wires	As Required

Theory:

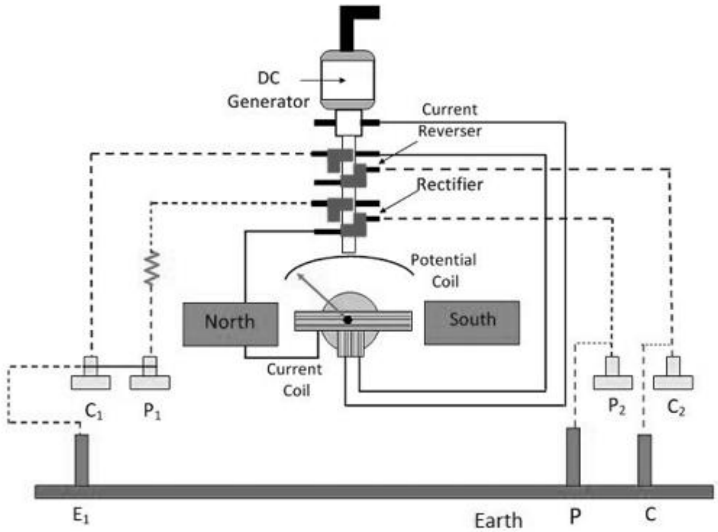
The earth resistance (also known as ground resistance) refers to the resistance encountered by an electrical current when it flows from an electrical system to the earth. Proper grounding is essential for the safety of electrical installations, ensuring that any fault current has a low-resistance path to the earth, thus preventing electrical shocks and protecting electrical equipment. To assess the effectiveness of the grounding system, the earth resistance must be measured. This measurement is typically performed using an instrument known as a megger, also referred to as an earth resistance tester. A megger applies a known test voltage to the earth electrode and measures the resulting current, enabling the calculation of the earth resistance.

A megger for earth resistance measurement typically consists of the following components:

1. Test Leads: These are connected to the earth electrode and the surrounding earth for measurement.
2. Current Source: The megger generates a known current, which is applied to the ground system.
3. Current Meter: Measures the current that flows through the earth system when the voltage is applied.
4. Voltage Meter: Measures the potential difference (voltage) applied between the earth electrode and the surrounding earth.
5. Earth Electrodes: The earth electrode is connected to the installation's grounding system, and auxiliary electrodes are placed in the surrounding earth at specific distances from the main electrode to complete the measurement.

The measurement of earth resistance is an important aspect of ensuring the safety and effectiveness of electrical grounding systems. By using a megger, the earth resistance can be easily measured, allowing for proper maintenance and compliance with safety standards. The use of the megger helps ensure that electrical faults are safely directed to the ground, protecting both personnel and equipment.

Megger Diagram:



Procedure:

1. Take the wires which are connected to the earth.
2. Name the terminal wires as 1,2,3.
3. Connect the wires to the assumed pair of terminals (1,2) to the megger and note down the values of earth's resistance. Here terminals of extra pair are (1,3) & (2,3).
4. Connect the wires to the assumed pair of terminals (2,3) to the megger and note down the values of earth's resistance. Here terminals of extra pair are (1,2) & (1,3).
5. Connect the wires to the assumed pair of terminals (3,1) to the megger and note down the values of earth's resistance. Here terminals of extra pair are (1,2) & (2,3).

Tabular Form:

Sl.No.	Assumed Pair of Terminals	Terminals of Extra Pair	Values of Earth's Resistance
1			
2			
3			

RESULT:

OUTCOME: