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Skill Council for Persons with Disability

Participant Handbook

Sector
PwD

Sub-Sector
Service & Repair

Occupation
PwD Assistive Aid Service & Repair Technician

Reference ID: **PWD/Q0301, Version 1.0**
NSQF : **Level 3**

Pwd Assistive Aids Repair Technician

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Shri Narendra Modi
Prime Minister of India

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for

SKILLING CONTENT: PARTICIPANT HANDBOOK

Complying to National Occupational Standards of
Job Role/ Qualification Pack: **'Assistive Aids Repair Technician'** QP No.**'PWD/Q0301, NSQF LeveL 3'**

Date of Issuance :

Valid Up to* :

*Valid up to the next review date of the Qualification Pack or the 'Valid up to' date mentioned above (whichever is earlier)

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Acknowledgements

This participant handbook is meant for Assistive Aids Repair Technician is a sincere attempt to ensure the availability of all the relevant information to the existing and prospective job holders in this job role. We would like to thank all the experts and organisations who have helped us by reviewing the content and providing their feedback to improve its quality.

This handbook will help deliver skill-based training for the job role Assistive Aids Repair Technician. We hope that it will benefit all the stakeholders, such as participants, trainers and evaluators. We have made all efforts to ensure the publications meet the current quality standards for the successful delivery of QP/NOS-based training programs. We welcome and appreciate any suggestions for future improvements to this handbook.

About this book

This skilling content is mapped to Model Curriculum of Qualification pack, 'Assistive Aids Repair Technician (PWD/Q0301QP, Ver 1.0)'. This is an NSQF level–3 course and is designed to help participants learn and perform various activities such as performing routine performance checks on tractors; carrying out maintenance and repair of tractor engine and other parts; assembling repaired and serviced tractor parts; checking the performance of the transmission, hydraulic and auto-electrical systems of tractors. In a nutshell, tractor service mechanics play a vital role in keeping the lifeline of Indian farmers, the tractors, in good working condition for the best possible output. This complete book is divided into 10 modules and subsequently into respective units covering the under mentioned compulsory NOS:

1. PWD/N0301: Assemble, repair and maintain a hand propelled tricycle (HPT)
2. PWD/N0302: Assemble, repair and maintain the folding wheelchair
3. PWD/N0303: Assemble, repair and maintain the battery-operated motorized tricycle/ wheelchair
4. PWD/N0304: Repair and maintain Hearing aids (Digital)
5. PWD/N9901: Follow health, safety and hygiene practices
6. PWD/N9902: Communicate effectively with others

Options(Not mandatory):

Option : Self Employment and Entrepreneurship Skills

This unit is about identifying opportunities and developing plans for basic entrepreneurial activity.

1. MEP/N9996: Plan for basic entrepreneurial activity

To enhance learning, URLs and QR codes of freely available learning materials are also provided at the end of related modules/units. The book also contains a few Exercises to facilitate formative assessment. Hence, the participant will be able to enhance his/her knowledge and required skills under the guidance of the trainer with the help of this handbook.

Symbols Used


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1. Basics of Electricity

Unit 1.1 – Fundamentals of Electricity

Unit 1.2 – Circuit Connections

Unit 1.3 – Single Phase and Three Phase Power Supply

Terminal Outcomes

By the end of this module, participants will be able to:

1. Explain the fundamentals of electrical wiring and electricity.

Key Learning Outcomes

At the end of this module, you will be able to:

Theory - Key Learning Outcomes	Practical - Key Learning Outcomes
• Understand basic fundamentals of Electricals. • Explaining the basic key concepts of Voltage, Current, Capacitance, Resistance, KVA, Kwh. • Understand Circuit connections, voltage and current relationship in star & delta configuration. • Understand 3 phase and 1 phase supply familiarity with energy parameters.	• Demonstrate various circuit connections. • Perform electrical circuit. calculations using Ohms law. • Demonstrate the application of Kirchhoff's first and second laws.

Unit 1.1: Fundamentals of Electricity

Unit Objectives

At the end of the session, participant will be able to:

- Understand fundamentals of electricals.
- Explaining the basic key concepts of Voltage, Current, Capacitance, Resistance.

1.1.1: Basic Electricity

Atoms

Atoms are the building blocks of all matter. Atoms are made up of a nucleus and electrons that orbit around the nucleus. Protons and neutrons are the fundamental particles that make up the nucleus.Atoms are said to be in a neutral state when the number of electrons and protons in them is equal. Electrons have a charge that is opposite to positive.The charge carried by protons is positive. Neutrons are neutral. The positive charge of the protons cancels out the negative charge of the electrons, creating a neutral charge. Because of their attraction to protons, electrons are held in place in their orbits.

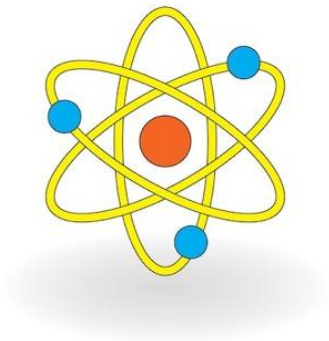

Figure 1.1.1: Structure of an Atom

Electric Charges

Both the number of electrons that are found in orbit around the nucleus of an atom and the number of protons that are found in the nucleus are used to define elements.A substance has a net positive charge if it contains a greater number of protons than electrons, and a substance has a net negative charge if it contains a greater number of electrons than protons. Because the amount of protons in an atom does not change, the positive or negative charge that an atom has is due to either a lack of electrons or an abundance of electrons.

Electrons

Electrons in the outer band have the potential to escape their orbits if a force from the outside world is applied to them, such as when they move through a magnetic field, experience friction, or are subjected to chemical action. Free electrons are another name for these particles.When an electron breaks away from its orbit around an atom, it creates a vacancy that can be filled by an electron that has been ejected from the orbit of another atom. The production of an electron flow is caused by the movement of free electrons from one atom to the next. This is the fundamental principle behind electricity.

Figure 1.1.2: Free Electrons

Conductors

When free electrons flow from one atom to the next, it results in the production of an electric current. Conductors are defined as any substance that enables the free movement of a significant number of electrons.Some examples of materials that have a high electrical conductivity include copper, gold, silver, and aluminium. Copper is one of the best conductors available, and it is also very affordable, hence it is frequently employed in conductive applications.

Insulators

Insulators are materials that allow very few free electrons to move through them.Insulating materials include a variety of common ones like plastic, rubber, glass, mica, and ceramic. Other examples include mica and ceramic. One example of a product that combines the properties of a conductor and an insulator is an electrical cable. In a circuit, electrons travel through a conductor made of copper, and the insulator that surrounds the exterior of the copper conductor keeps the electrons contained within the conductor.

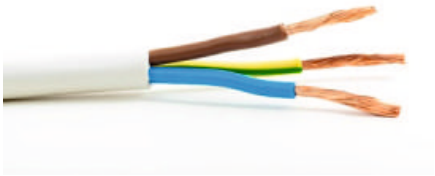

Figure 1.1.3: Wire having Conductor and Insulator

Semiconductors

Devices that possess the qualities of both conductors and insulators can be built out of semiconducting materials like silicon, for example.When an external force is applied in one direction, many semiconductor devices behave like conductors. However, when an external force is applied in the other direction, same devices behave more like insulators.This theory underlies the functioning of transistors, diodes, and all other solid-state electronic devices.

Electricity

There are a lot of different ways to talk about fundamental electricity. When electric current is passed through a conductor, a magnetic field, also known as a "flux," is created all around the conductor. When the conductor is formed into a coil with a significant number of turns, the flux density is increased to its maximum value. In the fields of electronics and electrical engineering, a coil is more commonly referred to as an inductor. Electricity can be defined as the movement of electrical energy through materials that are conductive. A power supply and components that change the form of the electrical energy into other forms of energy are the two components that make up the basic building blocks of an electrical circuit.

There are four fundamental terms related to electricity that we have to be familiar with:

Figure 1.1.4: Fundamental Elements of Electricity

Electrical Current

Electricity can be defined as the movement of electrons across a conductor in the same general direction from one atom to the next atom in the same order. Current is the term used to describe this flow of electrons, and the symbol for current is the letter “I."

The unit of measurement for current is the ampere, which is sometimes shortened to "amps." Amps are represented by the letter "A" as their symbol. Because the quantity of voltage that is present is subject to a considerable range of variation, metric unit prefixes are occasionally employed. A current of 0.001 amps, for instance, is equivalent to 1 milliamp, also written as 1 mA for short.

Direct current is a term used to describe a flow of current that is unchanging in its direction (DC). Alternating current is a type of electric current that reverses its flow at regular intervals (AC).

Current Measurement (Units)		
Unit	**Short Form**	**Decimal Value**
1 Kiloampere	1 kA	1000 A
1 Ampere	1 A	1 A
1 Milliampere	1 mA	0.001 A
1 Microampere	1 µA	0.000001 A

Table 1.1.1: Current Measurement Unit

Voltage

A difference in potential, also known as electromotive force (emf) or voltage, is the force that drives current through a conductor. Voltage is another term for this force. The letter "E" or the letter "V" is used to denote the magnitude of the voltage. Volts, which are also denoted by the letter "V," are the unit of measurement used for determining voltage. Because the quantity of voltage that is present is subject to a considerable range of variation, metric unit prefixes are occasionally employed.

There are many different ways that a voltage can be generated. An electrochemical process is used in the operation of a battery. The method of magnetic induction is used in both the alternator of an automobile and the generator of a power plant.

The presence of an excess of electrons at one terminal and a deficiency of electrons at the other terminal is a property that is shared by all voltage sources. As a consequence of this, there is now a difference in potential between the terminals.

Voltage Measurement (Units)		
Unit	**Short Form**	**Decimal Value**
1 Kilovolt	1 kV	1000 A
1 Volt	1 V	1 A
1 Millivolt	1 mV	0.001 A
1 Microvolt	1 µV	0.000001 A

Table 1.1.1: Current Measurement Unit

Resistance

Resistance is the third component that must be taken into consideration while designing an electrical circuit. The ability of a material, component, or circuit to oppose the flow of electric current is referred to as resistance. Every substance exhibits some level of reluctance to the flow of electrical current.

The degree of resistance shown by a resistive material is dependent not only on its temperature but also on its composition, length, and cross-section. The resistance of a conductor will increase with either an increase in length or a decrease in the cross-section if the temperature remains the same. This is true for any particular material.

The letter "R" denotes the quality of being resistant. The ohm, which is represented by the Greek letter omega(, is the unit of measurement used for the property of resistance. Because one ohm

is a very small unit and circuit resistances are typically quite big values, metric prefixes are frequently used to the resistance values. For instance, one megaohm (also written as one M) is equivalent to one million ohms (also written as one M).

Power

The pace at which work is completed or energy is changed inside an electrical circuit is referred to as the electric power. To put it another way, it is a measurement of the amount of energy that is utilised during a given period of time.Power is denoted by the letter P, and it can be quantified using either the Watt or the Joule per second units.

The mathematical expression for electrical power is

$P = VI$

WhereP stands for power, V stands for potential difference and I refers to the flow of the electric current.

Capacitance

The capacity of a component or circuit to accumulate and store energy in the form of an electrical charge is referred to as its capacitance.

Devices that store energy and come in a wide variety of forms and dimensions are called capacitors. They are formed up of two plates of conducting material (often a thin metal) that are sandwiched between an insulator made of ceramic, film, glass, or any number of other materials, including air.

The capacitance of a system can be represented as the ratio of the electric charge that is carried by each conductor to the difference in potential energy (also known as voltage) that exists between them.

The value of a capacitor's capacitance is expressed in terms of farads (F), which are units named after the English physicist Michael Faraday (1791–1867).

Figure 1.1.4: Capacitor

Exercise

A. Short Questions

Q1. What do you mean by an atom?

Q2. What do you mean by electricity?

B. Match the Columns

1. Match the different elements of electricity given in column A of the table with their corresponding measuring units given in column B.

Connect items in column A to their appropriate ones in column B.

Column A	Column B
i. Resistance	a. Ampere
ii. Kiloampere	b. Ohm
iii. Ampere	c. Farad
iv. Milliampere	d. Volt

Notes

Scan the QR Code to watch the related video

https://www.youtube.com/watch?v=IOPwFNy0bDQ

Agriculture first

Unit 1.2: Circuit Connections

Unit Objectives

At the end of the session, participant will be able to:

- Understand circuit connections, voltage and current relationship in star & delta configuration.
- Demonstrate various circuit connections.
- Perform electrical circuit calculations usingOhm's law.
- Demonstrate the application of Kirchhoff'sfirst and second laws.

1.2.1: Circuit Connections

An electrical circuit, also known as an electrical network or an electric circuit, is formed when a variety of active and passive components are connected to one another in a certain order to create a closed conduit for electrical current. It is necessary for electric current to be able to flow from the source, via any medium that is conductive, and then back to the other terminal of the source.

The following are the primary components of the perfect electric circuit:

- Electrical sources that are primarily composed of electric generators and batteries are what are responsible for delivering electricity to the circuit.
- Controlling devices are used to control electricity. Some examples of controlling devices are switches, circuit breakers, MCBs, and devices that function similarly to potentiometers.
- Protection devices, which include electric fuses, MCBs, and switchgear systems, are primarily responsible for guarding the circuit from abnormal conditions.
- A conducting path is needed to transport electric current from one point in the circuit to another, and most of them are wires or other conductors.
- Load.

Therefore, the two fundamental characteristics of an electric element are its voltage and its current. Electric circuit analysis is a broad phrase that refers to a variety of different methods that can be used to estimate the voltage and current across every element in any electric circuit.

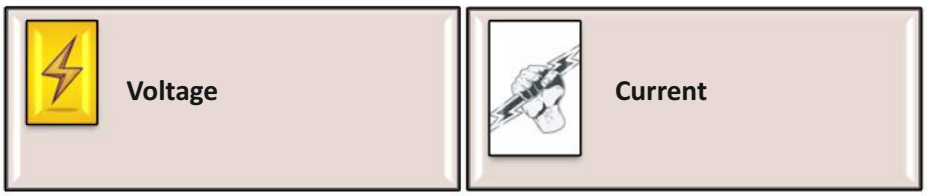

Figure 1.2.1: Main Characteristics of Electric Elemen

The following is a list of the fundamental characteristics of electric circuits:

- A closed path is always considered to be a circuit.
- Always present in a circuit is at least one energy source that also performs the function of an electron source.
- A source of energy, either uncontrolled or controlled, resistors, capacitors, inductors, and other components are all considered to be electric elements.
- The flow of electrons in an electric circuit goes from the terminal with the negative charge to the terminal with the positive charge.
- The flow of current in a typical circuit always moves from the positive terminal to the negative terminal.
- A drop in potential occurs across all the different constituents because of the flow of current.

Circuit Diagram

A simplified representation of the components that make up an electrical circuit is called a circuit diagram. This representation can use either images of the individual parts or symbols that are standard. It illustrates the positions of all the elements in relation to one another as well as the connections between them. It is frequently used to provide an electrician with a visual representation of the circuit. The schematic representation of a straightforward circuit is shown in the accompanying figure.

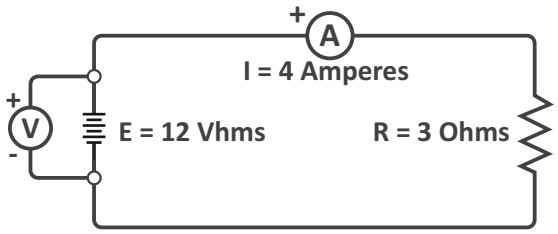

Figure 1.2.2: Circuit Diagram

1.2.1: Circuit Connections

The following are the primary types of electric circuits:

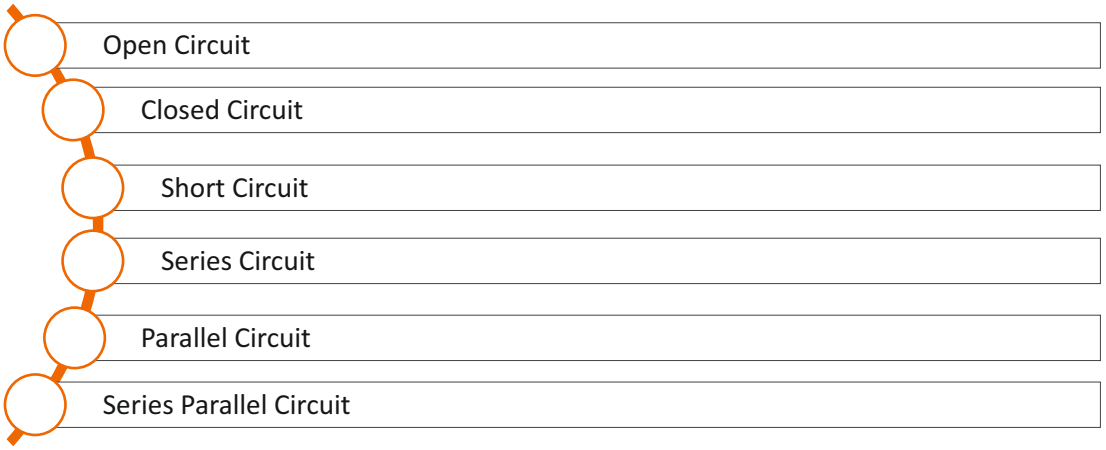

Figure 1.2.3: Types of Circuit

Open Circuit

If there is no flow of current through an electric circuit because one or more of the components of the circuit have become disconnected, the circuit is said to be open circuited.

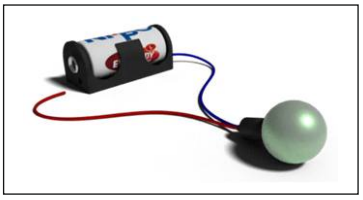

Figure 1.2.4: Open Circuit

Closed Circuit

The circuit is said to be a closed circuit if there is no break in the continuity of the circuit and if current can flow from one portion of the circuit to another part of the circuit.

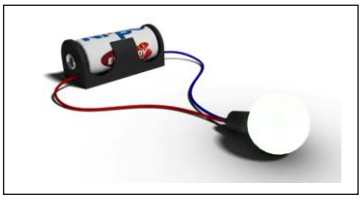

Figure 1.2.4: Closed Circuit

Closed Circuit

The circuit is said to be a closed circuit if there is no break in the continuity of the circuit and if current can flow from one portion of the circuit to another part of the circuit.

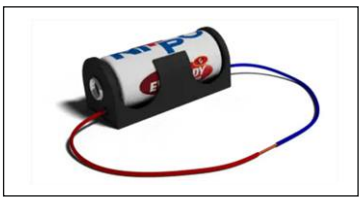

Figure 1.2.5: Short Circuit

Series Circuit

The term "series circuit" refers to a circuit in which all the components of the circuit are linked one after the other in a form like a tail-to-head connection, and as a result, there is only one path along which current can flow.When this occurs, we say that the components of the circuit are connected in series. In an electrical circuit with elements connected in series, the same current passes through all the components at the same time.

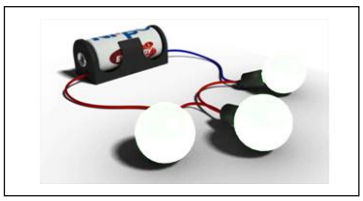

Figure 1.2.6: Series Circuit

Parallel Circuit

A circuit is said to be parallel if the components that make up the circuit are linked in such a way that the voltage drop that occurs across each component is the same.Although the voltage drop across each component in a parallel circuit is the same, the currents that flow through each

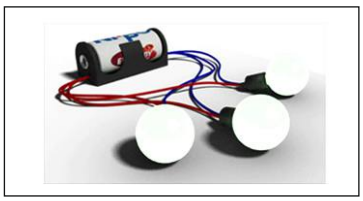

Figure 1.2.6: Series Circuit

Series Parallel Circuit

A series-parallel circuit is a type of electrical circuit that has some of its parts linked in series while other elements are connected in parallel. This type of circuit can have any number of elements.Majority of the circuits that are used in practical applications are series-parallel circuits. The connecting of conductors within the rotor of a DC motor is a relatively common illustration.

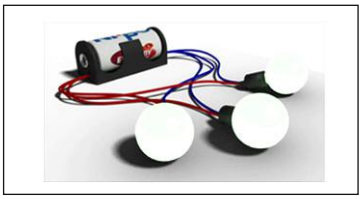

Figure 1.2.6: Series Circuit

1.2.3: Ohm's Law

A voltage source, some kind of load, and conductors that allow electrons to travel between the voltage source and the load are the components that make up a straightforward electric circuit.

Ohm's law is a definition of the relationship between current, voltage, and resistance. It indicates that current varies directly with voltage and inversely with resistance. Ohm's law also reveals that resistance varies directly with current. In mathematical terms, this relationship between current and voltage is written as:

V = IR

Where V is voltage, I is current, and R is resistance.

There are three different ways to express Ohm's law. There is a simple trick you can use to keep in mind which variant of Ohm's law to use. To begin, draw a triangle and place the symbols for current, voltage, and resistance inside the triangle in the order shown in the accompanying image. The next time you need to apply Ohm's law, point your finger on the value that you wish to calculate. The formula can be reconstructed using the remaining letters.

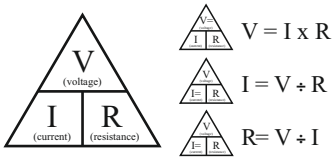

Figure 1.2.8: Ohm's Law Triangle

1.2.4: Kirchhoff's Law

A pair of rules that Gustav Kirchhoff created deal with the conservation of current and energy inside electrical circuits. Kirchhoff's Voltage and Current Law are the names given to these two laws in common parlance. These rules make it possible to compute the electrical resistance of a complicated network, known as its impedance in the case of alternating current, as well as the current flow in the various streams of the network. Let's have a look at what these laws say in the following part, shall we?

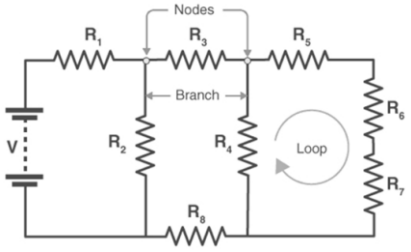

Figure 1.2.9: Complex Electrical Resistance

The First Law of Kirchhoff, also known as Kirchhoff's Current Law. Kirchhoff's Current Law states that since there is no charge loss, the total current that is flowing into a junction or a node is identical to the charge that is flowing out of the node.

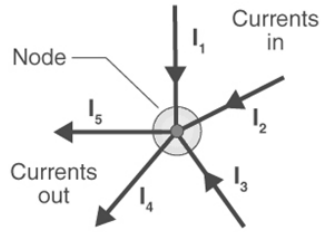

Figure 1.2.10: Kirchhoff's Current Law

Kirchhoff's Second Law or Kirchhoff's Voltage Law

The Second Law of Kirchhoff, also known as Kirchhoff's Voltage Law. Kirchhoff's Voltage Law states that in every closed network, the voltage surrounding a loop is equal to the total of all of the voltage drops that occur in the same loop, and this value is always equal to zero.

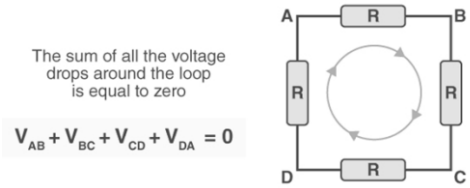

Figure 1.2.10: Kirchhoff's Current Law

Exercise

A. Short Questions

Q1. What do you mean by Ohm's law?

Q2. What do you mean by Kirchhoff's law?

B. Match the Columns

1. Match the Ohm's Law equation given in column A of the table with the value given in column B. Connect items in column A to their appropriate ones in column B.

Column A	Column B
i. Voltage = 5 V and Current = 2 A	a. R = 2 Ohm
ii. Voltage = 10 V and Current = 5 A	b. R = 2.5 Ohm
iii. Voltage = 15 V and Current = 5 A	c. R = 3.25 Ohm
iv. Voltage = 16 V and Current = 5 A	d. R = 3 Ohm

C. Fill in the Blanks

a. Kirchhoff's _____ Law states that in every closed network, the voltage surrounding a loop is equal to the total of all the voltage drops that occur in the same loop, and this value is always equal to zero.

b. Kirchhoff's _____ Law states that since there is no charge loss, the total current that is flowing into a junction or a node is identical to the charge that is flowing out of the node.

c. _____law is a definition of the relationship between current, voltage, and resistance.

Notes

Scan the QR Code to watch the related video

https://www.youtube.com/watch?v=oFTj9LWkmm8

Ohm's Law

Unit 1.3: Single Phase and Three Phase Power Supply

Unit Objectives

At the end of the session, participant will be able to:

- Understand 3 phase and 1 phase supply.
- Familiarity with energy parameters.

1.3.1: Power Supply

Current Supply

Direct current (DC) and alternating current (AC) are both types of sources that can provide the flow of current. In a circuit that uses direct current, electrons move in a continuous stream in a single direction from the power source through a conductor to a load and then back to the power source. This type of circuit is called "one-way." A DC source always maintains the same polarity for the voltage it produces. Batteries and DC generators are both examples of DC sources.

A direct current (DC) generator, on the other hand, causes electrons to flow in one direction before switching to another. In point of fact, an AC generator flips the polarities of its terminal's multiple times each second, which causes the direction of the current to switch with each reversal.

Voltage and current in alternating current always change, and the pattern that they follow is called a sine wave. Either voltage or current can be represented by a sine wave. On the graph that follows, one cycle of a sign wave is plotted along two axes as shown in the accompanying image. The magnitude of the current or voltage, as well as its direction, are represented along the vertical axis. The axis that depicts time is the horizontal one.

When the waveform is above the time axis, just one direction of current flow is being shown. This is what is known as moving in a constructive path. The direction in which current is flowing is indicated by the position of the waveform relative to the time axis. This is what people mean when they talk about the negative direction. A sine wave has 360 degrees for each whole cycle it completes. Both the voltage and the alternating current go through several of these cycles in a single second.

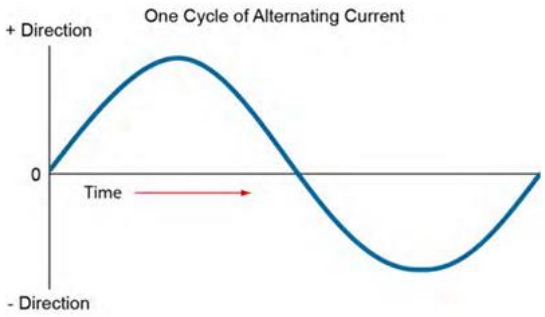

Figure 1.2.10: Kirchhoff's Current Law

Power Phase

The term "phase" comes from the field of electricity and relates to the distribution of a load. The power supply in residential houses is often of the single-phase kind, whereas the power supply in commercial and industrial establishments is typically of the three-phase variety.

Single Phase Power Supply

A single alternating current is carried by a single wire in a single-phase supply, whereas in a three-phase system, three wires carry alternating current with a definite time offset in between the voltage waves. A single-phase supply is also known as a single-wire supply.In India, a single-phase supply is a 220V supply that is delivered through two wires (one called phase and another neutral).

Three Phase Power Supply

The alternating current power circuit for three-phase electricity consists of three wires, and the phase ac signals are spaced apart by 120 degrees.

1.3.2: Energy Parameters

Most of us are familiar with the concept of star ratings for various home appliances. We have learned about it on the internet, and we have even overheard individuals discussing how having a higher star rating is preferable. What exactly does it mean when people talk about things like EER and ISEER, especially in relation to air conditioners and refrigerators?

The use of star ratings, on the other hand, is one of the simplest ways to evaluate and contrast the energy efficiency of various household appliances. When it comes to the many parts of EER, ISEER, and star rating standards, we throw some light on them.

EER and ISEER

Energy Efficiency Ratio (EER) is the name of the grading system that is used by the Bureau of Energy Efficiency (BEE). This is intended for use with electrical equipment found in the house, such as refrigerators, air conditioners, and other home appliances. Despite differences in their capacities and tonnages, air conditioners are always rated in BTU, which is an abbreviation for the British Thermal Unit. This BTU value indicates, given a constant temperature outside, how quickly an air conditioner can reduce the temperature within a room.

The approach of calculating performance based on EER criteria was less than ideal because of India's widely varying temperatures and the significant shifts that occur in temperature throughout the seasons. Because of the significant amount of energy that they consume, air conditioners are a major contributor to high monthly electricity costs. As a result, the Bureau of Energy Efficiency (BEE) in India came out with a brand new seasonal EER rating standard called ISEER.

BEE Label

The BEE power savings label has been updated with the word ISEER, but other than that, there haven't been any significant modifications. The star ratings are presented at the top of this new label, and below them are other details such as the yearly electricity consumption units, a manufacturer unique identification number, product characteristics, and a BEE logo.

Figure 1.3.2: BEE Label

Beginning in 2018, compliance with the Indian Seasonal Energy Efficient Ratio (ISEER) rating standard is required by law. Revisions were made to the existing EER star ratings brackets to accommodate the newly implemented ISEER rating standard. In addition to this, remember that ratings can vary between window air conditioners and split air conditioners. The following table provides ISEER ratings that are current from the 1st of January 2018 through the 31st of December 2019.

ISEER ratings for Window ACs (Fixed and Variable speed)			**ISEER ratings for Split ACs (Fixed and Variable speed)**		
Star level	**Minimum**	**Maximum**	**Star level**	**Minimum**	**Maximum**
1 Star	2.50	2.69	1 Star	3.10	3.29
2 Star	2.70	3.89	2 Star	3.30	3.49
3 Star	2.90	3.09	3 Star	3.50	3.99
4 Star	3.10	3.29	4 Star	4.00	4.49
5 Star	3.30		5 Star	4.50	

Table1.3.1: Star Rating

Exercise

A. Short Questions

Q1. What do you mean by Ohm's law?

Q2. What do you mean by Kirchhoff's law?

B. Match the Columns

1. Match the Ohm's Law equation given in column A of the table with the value given in column B. Connect items in column A to their appropriate ones in column B.

Column A	Column B
i. Voltage = 5 V and Current = 2 A	a. R = 2 Ohm
ii. Voltage = 10 V and Current = 5 A	b. R = 2.5 Ohm
iii. Voltage = 15 V and Current = 5 A	c. R = 3.25 Ohm
iv. Voltage = 16 V and Current = 5 A	d. R = 3 Ohm

C. Fill in the Blanks

a. Kirchhoff's _____ Law states that in every closed network, the voltage surrounding a loop is equal to the total of all the voltage drops that occur in the same loop, and this value is always equal to zero.

b. Kirchhoff's _____ Law states that since there is no charge loss, the total current that is flowing into a junction or a node is identical to the charge that is flowing out of the node.

c. _____law is a definition of the relationship between current, voltage, and resistance.

Notes

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Ohm's Law

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

2. Types of House Wiring and Fault Repair in House Wiring

SCPwD
दिव्याँग व्यक्तियों के लिए कौशल परिषद्
Skill Council for Persons with Disability

Unit 2.1 –Electric Wires and Cables for Houses

Unit 2.2 –Troubleshooting and Repairing of Domestic Electric

Terminal Outcomes

By the end of this module, participants will be able to:

1. Discuss various wiring and faults.
2. Carry out various types of house wiring and repair faults.

Unit 2: Types of House Wiring and Fault Repair in House Wiring.

Key Learning Outcomes

At the end of this module, you will be able to:

Theory - Key Learning Outcomes	Practical - Key Learning Outcomes
• Understand rating and current carrying capacity of wires, cables, fuse, switches, sockets, MCBs, ELCBs and other electrical accessories. • Lay conduit pipe concealed and open wiring, batten, casingcapping and temporary cleat wiring • Ensure correct requirement of wires, cables, fuse, switches and other electrical accessories for optimal expenditure • Ensure wiring and points selected in wiring are according to load growth in future • Understand use of under-voltage protective devices, choice of setting of protective devices, labelling of protective devices, switches and terminals • Understand insulation resistance of all live conductors to earth, insulation resistance between live conductors • Ensure selection of equipment appropriate to external influences, access to switchgear and equipment, presence of warning signs and danger notices. • Ensure open circuit due to overheated switches, socket and wires in control board due to loose contact and overload.	• Develop circuit and wiring diagram and electrical signage, code specifications to plan wiring layouts, consumption points accurately, as may be required. • Use various types of tools, their functions and application for carrying out work. • Implement system in the most economical way. • Implement methods of protection against electric shock. • Use updated technology products and take their ageing into consideration. • Inspect fault locating points e.g. fuse blown, MCB, RCD trip or short circuit location in wiring circuit. • Check polarity to ensure all switches are connected in phase conductors • Check equal distribution of load onthree phase wiring in largeresidential and commercial units. • Check the color coding, connectionand identification of conductors,cables and wires. • Check routing of cables, properselection of conductors, wires and connectors and connection of single pole devices.

Unit 2.1Electric Wires and Cables for Houses

Unit Objectives

At the end of the session, participant will be able to:

- Understand rating and current carrying capacity of wires, cables, fuse, switches, sockets, MCBs, ELCBs and other electrical accessories.
- Lay conduit pipe concealed and openwiring, batten, casing capping and temporary cleat wiring.
- Ensure correct requirement of wires, cables, fuse, switches and other electrical accessories for optimal expenditure.
- Ensure wiring and points selected in wiring are according to load growth in future.
- Understand use of under-voltageprotective devices, choice of setting of protective devices, labelling of protective devices, switches and terminals.
- Understand insulation resistance of all live conductors to earth, insulation resistance between live conductors.
- Ensure selection of equipment appropriate to external influences, access to switchgear and equipment, presence of warning signs and danger notices.
- Ensure open circuit due to overheated switches, socket and wires in control board due to loose contact and overload.
- Develop circuit and wiring diagram and electrical signage, code specifications to plan wiring layouts, consumption points accurately, as may be required.
- Use various types of tools, their functions and application for carrying out work.
- Implement system in the most economical way.
- Implement methods of protection against electric shock.
- Use updated technology products and take their ageing into consideration.

2.1.1: Wires and Cables

Although the phrases wire and cable are sometimes used interchangeably, in technical parlance, a wire is a single electrical conductor, whereas a cable is a bundle of wires that are wrapped in a sheathing and contains numerous conductors.Aluminium or copper are the typical metals used in the construction of electric wires. They are either uninsulated or covered in an extremely thin coating of thermoplastic and can be found in either naked or insulated forms. If the wires have a sheath made of thermoplastic, then the colour of the thermoplastic will indicate whether the wire is a hot wire, a neutral wire, or a ground wire in your electrical arrangement.

Wire Labelling

The nylon-coated thermoplastic electrical wires with a high-heat resistance are often the most popular choice for usage in residential applications of electrical wiring. Labels on wires include:

- THHN or THWN designation
- Substance made of (wire material)
- Maximum voltage rating
- Gauge

Here's what the letters THHN/THWN stand for:

- T – Thermoplastic insulation
- H – Heat resistant
- HH – High heat resistance up to 194 degrees Fahrenheit
- W – Rated for wet locations
- N – Nylon-coated to resist damage from oil or gasoline
- X – Synthetic polymer, flame-resistant

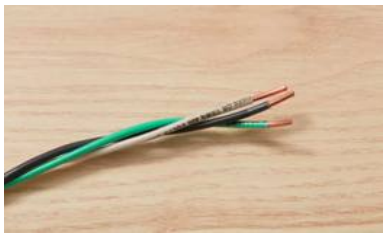

Figure 2.1.1: THHN/THWN Wire

Wire Material

Copper, the most common electrical conductor in domestic settings, will be designated with a "CU" on the majority of wire. Copper wires must be insulated to prevent fires and electrical shocks since electricity travels on the exterior of the wires.

Aluminium wire has a higher conductivity compared to copper wire, but it also deteriorates more quickly. Aluminium wire is not commonly utilised in residential applications for this reason.

Voltage Rating

The maximum voltage rating will be a number, such as 600, and it will represent the greatest voltage that the wire is capable of carrying. 110 to 220 volts is the standard voltage range for residential use.

Multiplying the amperage by the voltage results in the wattage that may be carried by a wire or cable; the formula for this is Amps x Voltage = Watts.

Amperage is the measure of the force of an electric current.

Voltage can be defined as the amount of force required to propel an electric current between two places.

Wattage refers to the amount of electricity that is consumed.

Colours of Wire

The function of a wire can be deduced from the colour of the wire. According to the NEC, the white conductor is the grounded conductor, the green or bare conductor is the equipment grounding conductor, and all other colours of conductors are ungrounded. Wires that are white are typically considered to be neutral, while wires that are green or bare are considered to be ground wires. In most cases, a wire of any other colour is a live one that transmits an electrical current.

- Insulation that is white is typically thought to be neutral; nevertheless, in some circumstances, such as switch loops, it can occasionally function as a hot lead. In existing wiring jobs, white wires may also be labelled with black or red to indicate that they are now being used for a hot connection. This is done to differentiate them from neutral wires.

- Insulation of green colour and bare copper make up the ground wire.
- Insulation that is black denotes a live wire, such as that used for outlets and switches.
- The hot wire for switch legs and hardwired smoke detectors is indicated by the red insulation.
- Insulation in blue and yellow: a live wire being dragged through a conduit.

Gauge

The wire gauge gives an indication of the size of the electrical wire.

Labelling of Cable

The sheathing that surrounds a cable will have printed on it any and all information that is necessary to understand it. Consider the following when deciding whether or not a cable is appropriate for a project:

- The type of cable, such as NM-B or UF, will be specified in this section.
- The diameter of the individual wires included within the cable, measured in gauges such as 14, 12, 10, and others.
- Number of wires: The number of wires corresponds to the gauge. For instance, a number of 14/2 indicates that the cable contains two wires of the same gauge (a ground wire, if it is a component of the cable, is not included in this number).
- When it comes to grounding, the presence of a ground wire is indicated by the word "GROUND" or the letter “G."
- Ratings for voltage: The value of 600 volts is the most typical for use in residential settings, however this can change. This figure represents the maximum voltage that the cable is able to carry without being damaged.
- Underwriters Laboratories has given their stamp of approval and given the cable a safety certification if it has the UL symbol on it.

There is a wide variety of variety within the realm of electrical wires. Every one of them serves a unique purpose and has a particular set of applications. The following are some of the most popular varieties of electrical cables found in households and commercial establishments:

- NM-B Cable: "NM" is an abbreviation for "non-metallic," which describes the flexible sheathing that is normally made of thermoplastic and that encases the cable. The letter "B" denotes a heat rating.

Figure 2.1.2: NM Cable

- **UF Cable:** "UF" stands for underground feeder, and these cables are certified for installation in moist areas and in the ground.

Figure 2.1.3: UF Cable

- AC:AC is an abbreviation for "armoured cable." Also known by the acronym "BX." It consists of a bare bonding wire, as well as hot and neutral wires that have been insulated, all of which are encased in paper.
- Metal-Clad Cable: AC-like in appearance, however the wires are sheathed in plastic rather than paper.

Types of Electrical Wiring

The process of connecting various accessories for the distribution of electrical energy from the supplier to various appliances and equipment in the home such as televisions, lamps, refrigerators, washing machine, fans, air conditioners, and other such things is referred to as "house electrical wiring."

Let's take a look at the many different kind of electrical wiring that may be found in homes and other residential buildings.

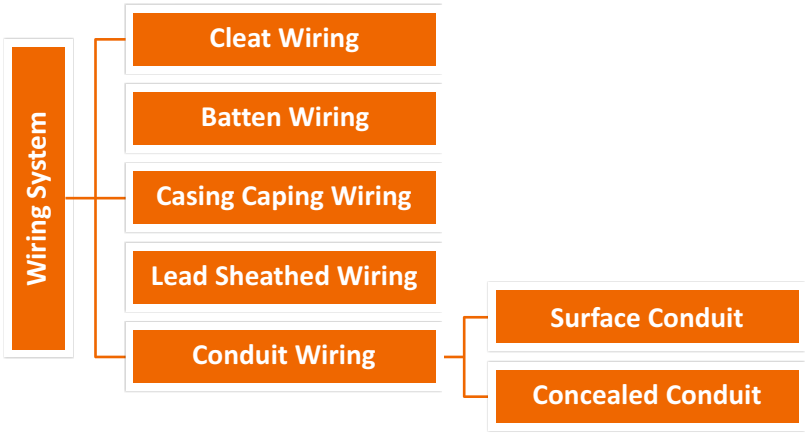

Figure 2.1.4: Home Electric Wiring Types

Cleat Wiring

Wires insulated with PVC or regular VIR are used in this sort of wiring. These wires are then braided and compounded. They are secured to the walls and ceilings by cleats made of porcelain, wood, or plastic that have grooves in them. Due to the fact that it is a temporary wiring system, it is not appropriate for use in residential settings. In addition, the cleat wiring technique is utilised very infrequently in modern times.

The cleat that is being applied in the process of cleat wiring is made up of two parts. The upper section of the segment is known as the cap, while the lower part is referred to as the base. The base has been constructed with grooves, which allow wires to be threaded through them. Next, the cap is put into the base, and finally, the complete cleat is fastened onto a pre-fitted dowel or rowel plug on a wall at a distance of around 6 millimetres.

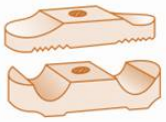

Figure 2.1.5: Cleat

Figure 2.1.6: Cleat with Two Grooves and Three Grooves

Since cleat wiring can be done in either the horizontal or the vertical direction, whenever one circuit of this type of wiring is passed above another circuit, an insulator must essentially be used on lower cables in order to keep the wires of both circuits separate from one another. This is because cleat wiring can be done in either the horizontal or the vertical direction.

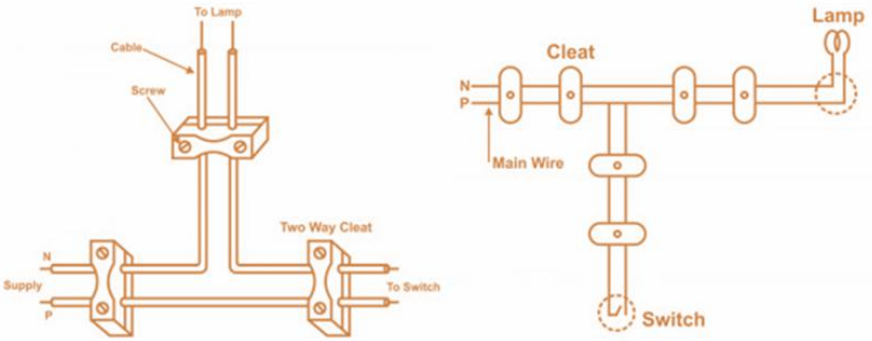

Figure 2.1.7: Cleat Wiring Diagram

Batten Wiring

Batten wiring is a sort of electrical wiring that is accomplished on concrete or ripe walls atop a long and smooth wooden batten by running wires via buckle clips fixed at an equal distance via brass kneels. This method of wiring is referred to as "batten wiring."

Before the batten is applied, it should be varnished appropriately in order to protect it from moisture, and it should not have any knots or joints on it. In addition, the batten should be knot- and joint-free. The clip is attached to the batten in such a way that the hole-end of the clip is kept on the lower side of the assembly. Because the wires are held in the centre of the clip and then carried to the higher end, where they are turned around and fed through the hole on the bottom end, the wires become skintight within the clips. This process is repeated until the upper end.

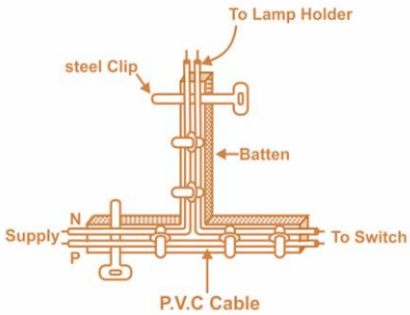

Figure 2.1.8: Batten Wiring Diagram

Casing Capping Wiring

It enjoyed a great deal of success in the past, but due to the widespread adoption of the conduit and encased wiring system, it is currently regarded as an outdated method. PVC, VIR, and any other kind of permitted insulated cables were utilised in the process of wiring this electric system. There are two different types of casing capping wiring systems, and they are as follows:

- Wooden Casing Capping Wiring
- PVC Casing Capping Wiring

Wooden Casing Capping Wiring

A rectangular casing constructed from dried teak wood or cedar timber is utilised in this sort of wire system. This casing features two or three grooves in the shape of an upside-down "U" formed along the length side. Casing is the name given to this large, rectangular-shaped clamp that is currently undergoing the process of having grooves moulded into it. Dowel pins or rowel plugs are used to secure the casing to the wall once it has been attached to the wall. The casing grooves are being fitted with wires at the moment (usually, neutral and phase wires are inserted into grooves separately). Another thin strip of a rectangular form is screwed into place on top of the casing to create what is called a capping. The purpose of this capping is to cover and control the wires that have been placed into the grooves. Because the width of the capping that is installed over the casing is the same as the width of the casing itself, wires are entirely covered when the capping is installed over the casing.

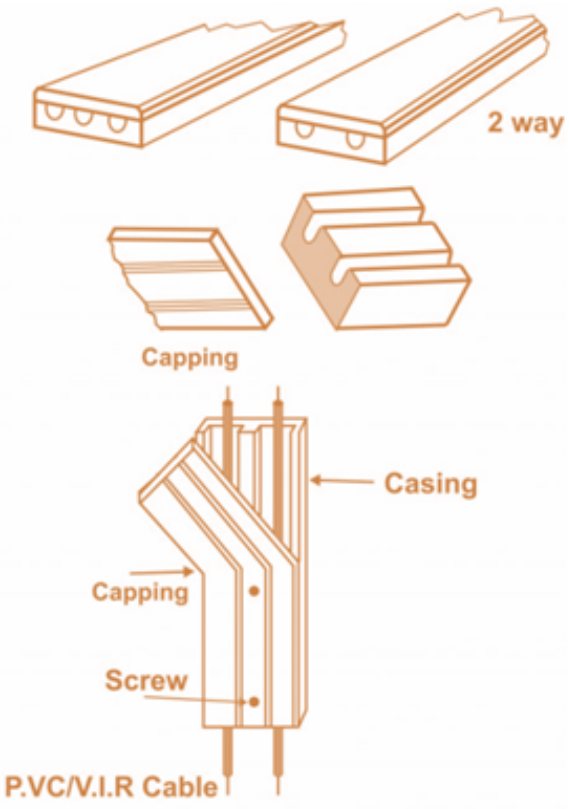

Figure 2.1.9: Wooden Casing Capping

Screws are used to fasten the capping that is placed on top of the casing. The casing itself is fixed using screws to secure it to dowel pins or rowel plugs that have been inserted on the walls. As a result of the lines that have been marked on the casing for the purpose of identifying the various wires, the screws that are going to be used on the casing will not cause any damage to the cables that are already on the casing and will only be able to grasp or control the middle portion of the casing.

PVC Casing Capping Wiring

PVC, not wood, is the material of choice in the construction of this kind of wiring, as the name suggests. When compared to the wiring method that uses wooden casing and capping, this method of wiring is quickly becoming more prevalent in today's society. mainly due to the fact that the majority of the issues that were seen with the casing capping wiring method have been resolved. Dowel pins or rowel plugs are inserted through screws in order to secure a rectangular strip or casing made of PVC to the surface of the wall in this technique of electrical wiring. After that, wires are introduced into this casing, and then they are covered with a casing made of PVC. In contrast to the wooden casing, the PVC casing does not have any grooves; as a result, it is capable of housing a significant proportionally greater quantity of wires than the wooden casing. Because PVC capping does not require screws to be inserted on the casing, this form of capping can be readily removed and reinstalled whenever it is necessary to do so. The breadth of the casing and the capping are both maintained at the same level.

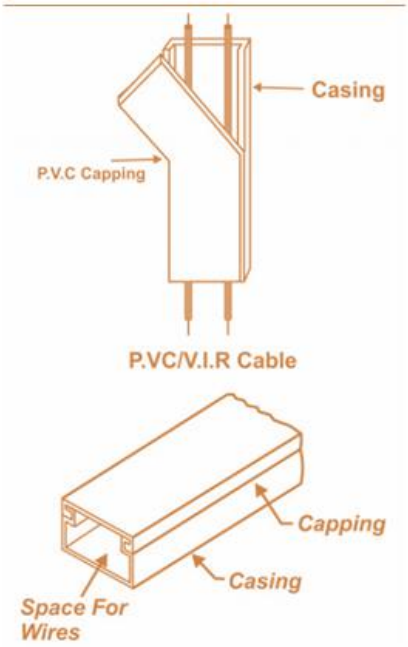

Figure 2.1.10: PVC Casing Capping

Lead Sheathed Wiring

The conductors in this kind of wiring are insulated with VIR, and the sheathing that surrounds them is made of a lead-aluminium alloy that has approximately 95% lead in its composition. The cable is shielded from damage caused by mechanical forces, as well as from the effects of moisture and air corrosion, by this metal casing. To protect against electrolytic action caused by leakage current and to offer safety against the sheath becoming alive, the entire lead covering is made electrically continuous and is linked to earth at the point of entrance. This is done to prevent the sheath from becoming alive. The cables are routed on wooden batten and secured with link clips. The majority of the cable that is used is of the flat twin variety (the cable having two insulated

conductors side by side covered with red and black tape respectively and under one flat covering of lead alloy). In some circumstances, a three-core flat is also utilised, in addition to single cables that are wrapped in a circular sheathing of lead-alloy. One of the ways that looping can be accomplished is by using wiring that consists of twin core cable since it produces the cleanest result.

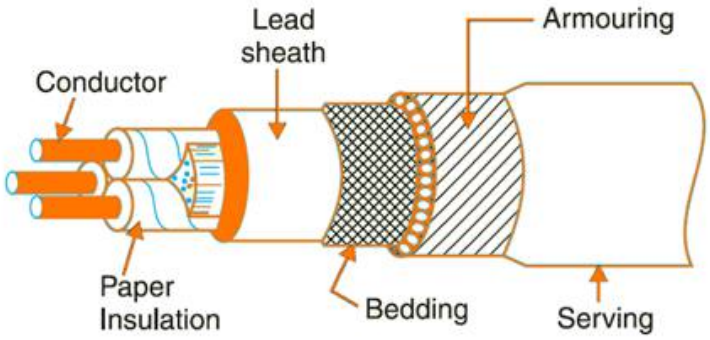

Figure 2.1.11: Lead Sheathed Wire

Conduit Wiring

A conduit wiring system is a type of electrical wiring in which all wires or cables, beginning at the supply and ending at the load, are routed through pipes made of iron or PVC. The purpose of running wires through the pipes is to protect the infrastructure from the potentially damaging impacts of things like severe weather, deterioration caused by wear and tear, the risk of fire, and other environmental factors. When moving wires via pipes, it is imperative that their insulation not be compromised in any way. This must be kept in mind at all times. When compared to the other types of wiring systems, this particular sort of wiring system is the one that sees the most widespread application.

According to the manner in which the pipes are installed, there are two types of conduit wiring:

Surface Conduit Wiring: This type of wiring is referred to as "surface conduit wiring," and it occurs when GI or PVC conduits are put on walls or roofs. The conduits are fastened to the walls using a base clip and a strap with two holes in it. The holes are spaced at regular intervals. The conduits are used for the laying down of electrical wires.

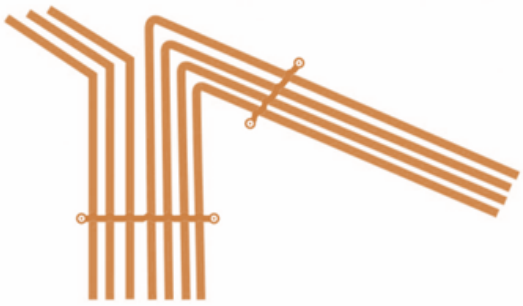

Figure 2.1.12: Surface Conduit Wiring Layout

Concealed Conduit Wiring:It is referred to as "concealed conduit wiring" when the conduits are concealed within the wall slots or carved brick wall. This type of wiring is also known as "rough-in wiring." The conduits are used for the laying down of electrical wires. This is well-liked since it is more robust and more aesthetically pleasing than other options.The conduit wiring system makes use of the two different types of conduits listed below, depending to the structures of the conduits.

- **Metallic Conduit:** When it comes to the gauge, there are two distinct sorts of metal conduit.

o Light Steel Sheet Conduit (Class A Conduit) or Low Gauge Conduit

o Heavy Steel Sheet Conduit (Class B Conduit) or Heavy Gauge Conduit

- **Non- Metallic Conduit:** PVC pipes are very flexible and can be readily twisted or bent, hence they are frequently employed these days in place of non-metallic conduits. This is due to the fact that PVC conduits are widely available and inexpensive.

Conduit wiring typically makes use of PVC and VRI (Vulcanised India Rubber) wires because these materials are ideal for low and medium voltage grades respectively. Tough rubber sheathed PVC wires are utilised in locations where there is a high probability of exposure to moisture, humidity, external shocks, and contusion. It is not a good idea to run flexible wires through conduits because there is a possibility that the insulation on the wires will become damaged or even break down completely during the process of running the wires through the conduits.The following table provides a reflection of the number of cables that can be placed in a particular kind of conduit based on the diameters of those cables.

ISEER ratings for Window ACs (Fixed and Variable speed)			ISEER ratings for Split ACs (Fixed and Variable speed)	
25 cm (1”)	**20 cm (3/4”)**	**15 cm (3/8”)**	**Decimal System**	**British System**
16	10	6	1 / 1.13	1 / .044
13	8	5	3 / 1.38	3 / .029
10	6	4	3 / 1.78	3 / .036
10	6	4	7 / 0.85	7 / .029
7	4	3	7 / 1.00	7 / .036
5	3	2	7 / 1.04	7 / .044

Table 2.1.1: Number of Cables in Conduit

Live, Neutral and Ground Wire

In home circuits, the live wire is almost always coloured red and operates at a high voltage. The neutral wire, which is denoted by the colour black, carries a voltage that is comparable to that of the ground. In India, the difference in potential energy between these two wires is around 220 volts. The earth, often known as the ground wire, offers protection against defects as well as current leaks. Because it is longer, the earth pin ensures that the earth connection occurs first when any device is connected and last when any device is disconnected.

2.1.2: Electrical Accessories

Switches

In order to use an electric device, a switch must be used to either fully complete or partially break an electric circuit. When a switch is set to the ON position, it will complete the circuit and allow electricity to flow freely through it. For a home connection, a switch will typically be rated for a current flow of either 5-6A or 15-16A.

Figure 2.1.13: Switch

Fuse

An electrical fuse is a safety device that functions to give protection against an excessive flow of current in an electrical circuit. It does this by breaking if the current in the circuit becomes too great. A metal wire or strip that melts when an excessive current travels through it is an essential component of an electrical fuse.

Figure 2.1.14: Fuse

Socket

A power socket is a device that allows electrical equipment to be connected to it so that they can get the necessary amount of electric current to function properly.

Figure 2.1.15: Socket

Plug

The moveable connector that is attached to an electrically operated item is called a plug, and the socket is affixed to equipment or the structure of a building and is connected to an electrical circuit that is energized. A plug is a male connection, and it often has protruding pins that are designed to match the holes and female contacts in a socket.

Figure 2.1.15: Plug

MCB

A miniature circuit breaker, often known as an MCB, is an electrical switch that is operated automatically. A miniature circuit breaker's primary function is to protect an electrical circuit from the destruction that can be caused by an excessive current. In order to protect against electrical failures and the failure of equipment, they are designed to trip automatically in the event of an overload or short circuit.

Figure 2.1.16: MCB

Working of MCB

Overcurrent, which is defined as electrical current that is higher than a certain safe current, is what trips small circuit breakers. These breakers feature a moderately robust mechanical mechanism that is meant to minimize the likelihood of failures and false alarms.

When there is an excessive amount of current flowing through the MCB, the bimetallic strip will heat up, flex, and eventually trip. Because of this, a switch is activated, and it shifts the electrical contact points further apart to contain the arc (electrical discharge). The arc is cooled and segmented using something called an arc chute, which is an insulated metal strip. After the issue has been resolved and the MCBs have been reset, the contacts will begin to make contact once more.

A MCB is intended to provide protection not just against overloading but also against short-circuiting. These are identified in a distinct manner by utilizing individual detection procedures. Short-circuit protection is given by the tripping coil, which uses electro-magnetic action, while overload protection is provided by the bimetallic strip, which uses thermal operation.

Within a tenth of a second, the MCB will trip (activate) extremely quickly if the discharge is particularly powerful. In situations in which the overcurrent is getting closer to the limits of safety, the component will respond more slowly.

Types of MCB

There are several different varieties of MCBs available, including types A, B, C, D, K, and Z. However, types B, C, and D are the most important variants to pay attention to. Each one is made to react appropriately to the most likely level of electrical surges that will be present in each environment. These variants have a characteristic that is commonly referred to as their "trip curve," but they may alternatively be referred to as their tripping characteristics or their overcurrent characteristics.

Let's have a look at the several primary types and the variations between them:

MCB Types	Functions
Type B 	The current that is running through a Type B circuit breaker is meant to trip the breaker if it reaches between three and five times the recommended maximum, also known as the "rated load." This type of MCB is the most sensitive and was developed for use in residential applications and low voltage commercial settings, both of which are likely to experience only moderate levels of current surges.
Types C 	Circuit breakers of type C are often utilised in more powerful electrical devices, as well as in areas that are more likely to experience surges of electricity, such as commercial and industrial settings. They are constructed so that they will trip at currents that are between five and ten times higher than their rated load. Examples such as more compact electric motors and fluorescent lighting are provided here.
Types D 	The D-type MCB is the type that is the least sensitive, and it will only trip when the current suddenly surges to between ten and twenty times the limit that is advised. MCBs with a rating of D are designed to withstand extremely high current surges and are intended for use in heavy-duty commercial and industrial applications. Welding equipment, X-ray machines, big motors, and uninterruptible power supply units are some examples of such machinery.
Type K	When the current exceeds eight to twelve times the limit that is recommended for it, these will trip. They are an excellent option for use in motors.
Type Z	These MCBs have a very high level of sensitivity; for them to trip, the current must be more than the rated load by only two or three times. They are utilized in conjunction with more delicate electronics, such as semiconductors, which are prone to experiencing short circuits.

Table 2.1.2: Types of MCB

ELCB

In electrical installations with a high earth impedance, a safety device known as an earth-leakage circuit breaker, or ELCB, is utilized to prevent shocks from occurring. It can detect minute stray voltages on the metal casings of electrical equipment and will break the circuit if the voltage level is high enough to be dangerous.

The primary function of an earth leakage circuit breaker (ELCB) is to detect earth leakages, thereby preventing injuries to people caused by electrical shocks and putting out electrical fires that are created by short circuits.

An earth leakage circuit breaker, also known as an ELCB, is a specialized kind of latching relay that has the incoming mains power of a building connected to its switching contacts. This allows the ELCB to cut off the power in the event of an earth leakage, which is a dangerous circumstance.

Within the installation that it safeguards, the ELCB can detect fault currents flowing from the live (hot) wire to the earth (ground) wire. If there is a high voltage across the sensor coil of the ELCB, the device will turn off the power and stay off until it is manually reset. Therefore, providing protection for the building's electrical system.

Figure 2.1.17: ELCB

MCCB

Molded Case Circuit Breaker is an abbreviation for MCCB. When the load current surpasses the limit that a miniature circuit breaker can safely handle, this other sort of electrical protection device is activated and put into service. In addition to its role as a protector against overload and short circuit faults, the multi-circuit circuit breaker (MCCB) plays a role in the switching of circuits. Even in household applications, it may be used for greater current ratings and fault levels without any problems. MCCBs are typically use in industrial settings due to their extensive current ratings and high breaking capacities.

RCCB

The abbreviation "RCCB" refers to a "Residual Current Circuit Breaker." This residual current device is essentially an electrical wiring device that disconnects the circuit anytime there is a leakage of current flow through the human body or whenever the current is not balanced between the phaseconductors. It is the most reliable device to detect and trip against electrical leakage currents, and as a result, it offers protection against electric shock that is brought on by direct contacts. In most cases, an RCCB will be used in series with an MCB, which will safeguard both components from currents that are too high or too low.

Junction Box

A junction box is an electrical enclosure that holds one or more wiring connections. There might be more than one connection housed in a junction box. The box shields the connections from the effects of the environment as well as inadvertent contact, which is especially important given that the connections typically include weak areas such as wire splices.

Figure 2.1.18: Junction Box

Electrical Control Panel

The electrical control panel in a home serve as both the "brain" and "heart" of the residence's electrical system. It is the component that, once connected to the power line from the utility company, is responsible for distributing current to each and every circuit in your home. Additionally, it is equipped with circuit breakers, which prevent the circuits from becoming overloaded.

Figure 2.1.19: Electrical Control Panel

2.1.3: Domestic Wiring

Load Calculation

You are probably aware that the overall capacity of the house's electrical system is measured in amperage or amps, and that this is how the capacity is expressed. The electrical load estimate is, in its most basic form, the addition of all the Amps that are drawn by your various appliances and fixtures.

Amps = Watts/Volts

Watts = Amps x Volts

The capacity of your complete electrical service as well as the capacity of specific circuits can both be calculated with the use of these calculations. If, for instance, you have a circuit that operates at 200 volts and a service that provides 200 amps, then your total capacity is 40000 watts.

You can easily determine the entire amount of wattage by looking at the wattage ratings that come with each appliance.

After determining the capacity of your home's whole service or of each individual circuit, you can compare it to the load that is now being used. Compute the total amount of wattage that will be drawn from the circuit by adding up the ratings of all the devices and fittings that will be operating at the same time.

House Wiring Diagram

A wiring diagram for a house is a wiring diagram that is drawn in the most direct way possible so that it may readily assist an electrician, such as yourself. This type of design is called a house wiring diagram. The connections between the various components of the circuit, as well as their connections to and from the power supply, are depicted on the diagram.

It takes into account the size of the room, the points of input and output that are created, as well as how easy it is to reach those places, and the proportions of those points.

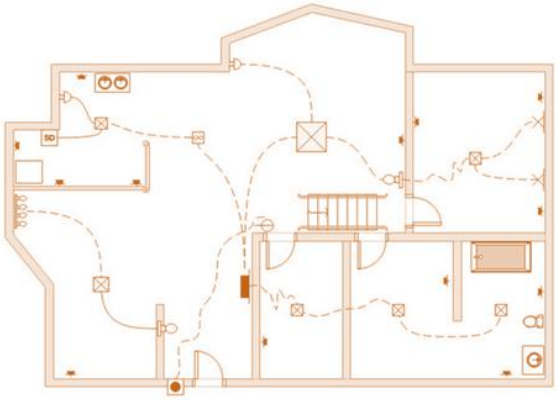

Figure 2.1.20: Home Wiring Diagram

Standard Home Wiring Diagram Symbols

In wiring diagrams, various elements of a circuit are represented by a variety of specific symbols. These symbols include switches, light bulbs, electrical outlets, breakers, smoke detectors, and a great many more. There is a piece that explains electrical symbols that you can read.

The table that follows provides a collection of the most significant symbols along with their respective names.

Sl. #	Elements	Symbols
1	Electrical switchbox	
2	Single pole switch	
3	Three-way switch	
4	3P switch	
5	2P switch	
6	1DP switch	
7	2DP switch	
8	Water tap	
9	Wall light	
10	Circuit breaker	
11	Light bar	
12	Junction Box	
13	Lamp Holder	
14	Water Heater	
15	Electrical Panel	
16	Battery	
17	Fire alarm	
18	Doorbell	
19	Smoke detector	
20	Ground	

Table 2.1.3: Wiring Diagram Symbols

Bedroom Wiring Diagram

Let's imagine a basic bedroom with just the essentials: two light bulbs and a single ceiling fan. In such a scenario, the diagram of the house wiring would look like the one shown below.

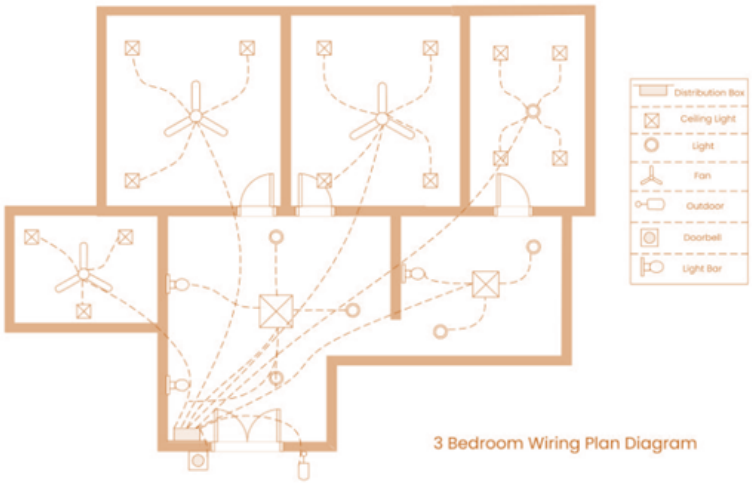

Figure 2.1.21: BedroomHome Wiring Diagram

As can be seen in this picture, the Live, Neutral, and Earth wires each have their own unique colour code to serve as a point of reference. These colours are, in order, red, black, and green. The bulb corresponding to switch number one is connected to that switch, while switch number three is connected to bulb number two. These are straightforward connections, with the live wire and the neutral wire being connected in the appropriate places. The second switch can control the speed of the ceiling fan by connecting to it through a dimmer switch or a regulator. This allows the fan's speed to be adjusted up or down.

2.1.4: Tools and Equipment

Because of the nature of your work, which places a premium on accuracy, precision, and productivity, it is imperative that you have access to the appropriate tools and that those tools be of a high quality and level of functionality.

Tools	Functions
Voltage Tester 	Using a voltage tester to check whether or not it is safe to work on a circuit and to determine whether or not your equipment is functioning correctly. Before working on switches, cabling, junction boxes, or any other areas where a live current may be present, electricians are required to confirm that there is no voltage present, as this is a requirement imposed by health and safety standards. When there is a current, this instrument will light up, which is a signal to you that you need to turn it off.
Spanner 	A spanner is one of the tools that has the widest range of applications. It is typically employed in electrical work that requires loosening or tightening nuts and bolts, but in a hurry, it can also function as a clamp, grips, or even a lever. Its most common application is in electrical work.

Tools	Functions
Hacksaw 	Any competent electrician should have a good hacksaw at their disposal. A hacksaw is a hand-powered saw with a modest number of teeth, an adjustable frame, and a grip handle. It is used to cut through metal or PVC conduits.
Electrical Tape 	Electrical tape is a vital component for cable management because of its ability to insulate wires. It is available in many various colours, and each hue has a distinct function. Insulation requires the use of black, while low voltage requires red, high voltage requires orange, and so on. Even if black is the colour that is utilized the most, it is still beneficial to have the entire rainbow in your kit.
Cable Cutters 	Cable cutters are not only able to cut cable, but they can also grip, bend, twist, or strip thin gauge wires. Additionally, the construction of cable cutters is quite exact.
Insulated Screwdrivers 	Insulated screwdrivers include a plastic handle cover that has been particularly developed to be thick and non-conductive. This cover protects you from any unforeseen live currents that may be present. It is also helpful in protecting delicate electrical parts that could be harmed in the event that there is an electrical short.
Wire Strippers 	Wire strippers are tools that are frequently utilised in the field of electrical work. These tools are designed to remove the insulation covering electric wires in order to connect, replace, or repair the wire.
Insulated Pliers 	Insulated pliers are flexible tools that can be used for a wide variety of difficult electrical operations, such as twisting wires. Because the pliers you use need to be insulated for your protection, it is in your best interest to make an investment in a high-quality brand that will last a long time.
Safety Knife 	As an electrician, you will spend a lot of time cutting wire. In addition, the fact that the surface you are cutting is quite small and can be moved about quickly increases the likelihood that the blade may slip. The blade on a safety knife is typically quite short, making it a more dexterous tool for doing this activity.
Circuit Finder 	Simply connect the transmitter to one of the available outlets, and you will be able to identify a circuit using the panel's controls. This instrument will spare you a few problems because most homes do not have an accurate reader; therefore, there is no need to speculate or randomly toss switches in order to locate the correct circuit.

Tools	Functions
Other Tools and Safety Equipment 	• Hammer • Hacksaw & Blade • Chiesel • Groove Cutter • Cramping tool • Wire sheather • Multimeter • Voltmeter • Ampere meter • Megger • Earth tester • Bocky • Lamp Tester • Testing Pen • Drill (Hilty Type) M/c Handheld • Slow speed hand drill machine • Level Check (water level) • 30 M tape roll • 5 M tape roll • Steel Wire • Continuity Tester • Safety belts • Helmet • Safety Shoes • Insulating Gloves • Goggles • Mask • Toolbox • Adjustable Wrench

Table 2.1.4: Tools and Equipment

Exercise

A. Short Questions

Q1. What do you mean by home wiring diagram?

Q2. Describe common types of wires and cables.

B. Match the Columns

1. Connect items in column A to their appropriate ones in column B.

Column A	Column B
i. Live Wire	a. Black Colour
ii. Neutral Wire	b. Red Colour
iii. Ground Wire	c. Watt/Volts
iv. Amps	d. Green Colour

C. Fill in the Blanks

a. A _____is an electrical enclosure that holds one or more wiring connections.

b. _____is a vital component for cable management because of its ability to insulate wires.

c. The _____in a home serve as both the "brain" and "heart" of the residence's electrical system.

Notes

Scan the QR Code to watch the related video

https://www.youtube.com/watch?v=ofWq03WPeK0

House Wiring – Wire Size

Unit 2.2 Troubleshooting and Repairing of Domestic Electric Wiring

Unit Objectives

At the end of the session, participant will be able to:

- Inspect fault locating points e.g. fuse blown, MCB, RCD trip or short circuit location in wiring circuit.
- Check polarity to ensure all switches are connected in phase conductors.
- Check equal distribution of load on three phase wiring in large residential and commercial units.
- Check the color coding, connection and identification of conductors, cables and wires.
- Check routing of cables, proper selection of conductors, wires and connectors and connection of single pole devices.

2.2.1: Short Circuit

A short circuit happens when the current discovers a way to bypass the appliance on a path that has little or no resistance; for example, when frayed insulation exposes a wire and allows it to touch the frame of the appliance, which allows the current to flow directly to the ground. This allows the current to flow through the appliance without encountering any obstacles.

During a short circuit, there is an abrupt change in the direction that the electrical current is travelling, and the resistance will plummet to a much lower level than it was before, causing the electrical flow to spike and carrying a massive volume of unimpeded current through an unexpected pathway. This causes the electrical flow to spike and cause an explosion.

Figure 2.2.1: Short Circuit

A connection between two conductors in an electrical circuit that has a low resistance is what constitutes a short circuit. Any circuit can have an electrical supply. Because of this, an excessive amount of current flows through theshort in the power source, which could ultimately lead to the power source being completely ruined.

If there is a fuse in the supply circuit, it will do its function and explode, which will open the circuit and cause the flow of current to halt. Protecting against short circuits is another function of an MCB's job description.

Both direct current and alternating current (DC and AC) circuits have the potential to have a short circuit. In the event that the source of the short is a battery, the battery will be depleted very quickly and will get quite hot as a result of the high current flow.

Short Circuit vs Overload

People frequently get overload and short circuit confused with one another since both of these issues generate problems for the system in a manner that is analogous. The difference between a short-circuit and an overload is an important one to establish a differentiation between.

When there is a short-circuit in a network, the voltage at the point where the fault is located drops to zero, and an abnormally large amount of current travels across the network to the location where the fault lies.

On the other hand, an overload indicates that the system is being subjected to loads that are greater than the levels for which it was built. Under these circumstances, the voltage at the point where the overload occurs may be low, but it will not be zero. It's possible that the low voltage circumstances will continue on for some distance beyond the overload point and into the rest of the system.

Although the currents running through the overloaded equipment are at a high level, they are noticeably lower than those running through a short circuit.

Causes of Short Circuit

The occurrence of a short circuit in the power system is almost always the consequence of some form of anomalous conditions within the system. There is a possibility that it was brought on by either internal or external factors.

- Internal effects are created by the failure of equipment or transmission lines, which can be traced back to the corrosion of insulation within a generator, transformer, or other electrical device. These problems could be caused by the insulation becoming worn over time, an unsuitable design, or incorrect installation.
- Lightning surges are one example of an external force that can cause insulation to fail, which in turn can lead to a short circuit. overloading of the equipment, which results in excessive heating; mechanical damage caused by customers, etc.

Fixing of Short Circuit

Follow these methods to fix any short circuits you may have:

Step 1: Determine which of the household appliances has undergone a short circuit within it.

Step 2: Determine the precise place within the electrical system where the short circuit is occurring.

Step 3: Install a brand-new wire to replace the outdated and broken one.

Step 4: After stripping away portion of the insulation from the ends of the new wires, solder the new wires to the existing wires.

Step 5: Check that the wires have been attached securely, and then activate the circuit breaker to see if the installation was successful.

2.2.2: MCB Trip

MCBs are also known as time delay tripping devices because they trip and shut down the system whenever there is an overcurrent flowing for a longer period of time and there is a threat to the entire circuit. This causes the MCB to be known as a time delay tripping device. In the event of a short circuit, however, these devices are able to trip and cut off the power supply in a timeframe of only 2.5 milliseconds.

The condition referred to as a "Fault" in an electrical system is one that has developed as a result of the improper functioning of one or more electrical components or practises. If a fault is not remedied in a timely manner, it could result in a very dangerous situation such as an explosion or a fire. Not only that, but the amount of time for which a fault remains in a system, it continuously deteriorates the system's health, resulting in high energy losses and increased thermal stress upon the system. Because faults are dangerous to the system and need to be cleared as quickly as possible, there is a need for a device that is not only able to clear the fault but also has a shorter opening time in order to save the let-through energy and limit the thermal stress.

Reasons for MCBs Tripping

In general, there are two types of errors that most frequently wreak havoc on the system:

- Overload is a fault situation that occurs in a system when a circuit draws a higher current than its rating. This causes the system to be in an overloaded state. For instance, if we pull 10 A of current from a socket rated for 6 A, we are considered to be in an overload condition.
- A short circuit is a condition in which an extremely low resistance path is created due to an accidental or intentional connection between two or more conductors, which results in the sudden increase of current to its peak value and the voltage getting minimised to an extremely lower magnitude. This condition can occur when there is an accidental or intentional connection between the conductors. Short circuits can be dangerous.

How to Fix MCBs Tripping

- Make sure that there isn't anyone using extension cords or multiple plugs.
- Wires in broken or damaged electrical equipment and gadgets should be replaced immediately.
- When not in use, make sure that all of the electrical equipment and appliances are unplugged.

It is necessary to keep a tally of the number of devices that are in operation when the temperature is hot or cold.

Exercise

A. Short Questions

Q1. What do you mean by short circuit?

Q2. Describe the reasons for MCB tripping.

B. Fixing of Short Circuit

1. Write down the steps to fix the short circuit.

Steps	Actions
Step 1	
Step 2	
Step 3	
Step 4	
Step 5	

Notes

Scan the QR Code to watch the related video

https://www.youtube.com/watch?v=NCqh_D3B0ao

Short Circuit

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
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& ENTREPRENEURSHIP

N·S·D·C
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Corporation
Transforming the skill landscape

SCPwD
दिव्याँग व्यक्तियों के लिए कौशल परिषद्
Skill Council for Persons with Disability

3. Main Distributions, Control Circuits and Protection in House

Unit 3.1 –Single Phase Home Wiring

Terminal Outcomes

By the end of this module, participants will be able to:

1. Install controlling and protection devices for different circuits.
2. Carry out joining and connecting wire to fixtures and components to form circuits.

Unit 3: Mains, Distribution, Controls Circuits and Protection in House

Key Learning Outcomes

At the end of this module, you will be able to:

Theory - Key Learning Outcomes	Practical - Key Learning Outcomes
• Understand standard location of service line connection. • Understand layout of main switch, circuit breakers require at main board. • Understand types of conduit, batten, underground and open wiring. • Read plan Ensure around obstructions like electrical wiring, gas fittings etc. • Prepare extended line for additional points with bearing capacity of existing system or augment/replace existing lines to withhold the additional load. • Ensure proper working and functioning of all protective devices that are necessary to save lives of human, livestock, animals through earthing diagrams (TT). • Ensure fuse, switch or circuit breaker is not placed in an earthed neutral conductor and are wired only in the phase conductor only. • Ensure all connections are made properly, tightened and color coding • Ensure that the correct type, size and current-carrying capacity of cables is chosen to bear the load. • Ensure that all accessible points which may be switched on/off must be easily approached by the users and made as per CEA guidelines standards. • Understand types of earthing plate and pipe earthing lay out location. • Understand importance of earth connection with household gadgets and equipments.	• Install controlling and protection devices for different circuits being used for lighting and power loads at each floor or portion. • Locate and mark the position of conduit pipe Ensures, connections into the structures with proper equipment like measuring tape, hammer, saw, drill machines etc. • Cut openings in structures to accommodate conduit pipes or pipe fittings, using hand or power tools. • Lay conduit pipe with clamps. • Install brackets and hangers tosupport electrical equipment. • Install, replace and repair lighting fixtures and electrical control and • distribution equipment, such as tube lights, lamps, chandeliers, regulators switches, relays and circuit breaker panels. • Lay and pull wires through conduits and through holes in walls, ceiling, lanterns and floors. • Join and connect wire to fixtures and components to form circuits. • Install the protective device i.e. ratings as per the load. • Make connections and operate instruments to check the healthiness of house wiring in terms of leakage insulation resistance. Operate instruments to check the continuity, open circuit, short circuit and load flow.

Theory - Key Learning Outcomes	Practical - Key Learning Outcomes
• Understand procedure of earth connection with appliance, socketsmain board and distribution board. • Use of devices available in market • such as Timers, impulse relay, programmable switch, twilight switch, movement detector. • Ensure and assembling of various type, design and capacity fans, tube lights, LED Lights, bulbs, lamps, doorbells, switches, geysers, inverters, exhaust fan, safety alarms, decorative lights and chandeliers. • Ensure of various size and capacity water pump motors according to the load with their control circuit of water level in tank.	

Unit 3.1 Single Phase Home Wiring

Unit Objectives

At the end of the session, participant will be able to:

- Understand standard location of service line connection.
- Understand layout of main switch, circuit breakers require at main board.
- Understand types of conduit, batten, underground and open wiring.
- Read plan Ensure around obstructions like electrical wiring, gas fittings etc.
- Prepare extended line for additional points with bearing capacity of existing system or augment/replace existing lines to withhold the additional load.
- Ensure proper working and functioning of all protective devices that are necessary to save lives of human, livestock, animals through earthing diagrams (TT).
- Ensure fuse, switch or circuit breaker is not placed in an earthed neutral conductor and are wired only in the phase conductor only.
- Ensure all connections are made properly, tightened and color coding.
- Ensure that the correct type, size and current-carrying capacity of cables is chosen to bear the load.
- Ensure that all accessible points which may be switched on/off must be easily approached by the users and made as per CEA guidelines standards.
- Understand types of earthing plate and pipe earthing lay out location.
- Understand importance of earth connection with household gadgets and equipments.
- Understand procedure of earth connection with appliance, socketsmain board and distribution board.

3.1.1: Single Phase Wiring

A single-phase supply has one phase wire, sometimes known as the "hot wire," and one neutral wire, both of which are linked to the energy metre by PSPCL as the input supply 220V.The MCB distribution box receives the output 220V supply, which is collected from the energy metre.The ELCB, DP MCB, and Isolator are the components that make up the main control.

In order to deliver phase to the individual switch boards of rooms etc. in a house, a number of SP-MCBs are put in the MCB Box.The neutral wire from the MCB Box is connected to the neutral link of each socket on the switch board as well as any other loads.

Switches are mounted on the switch board of each room so that its respective load, such as a fan, light, and TV, refrigerator, press, washing machine, and so on, can be operated through its respective sockets.

A circuit is defined as any load (single phase) that is linked to a supply of 220 V and is afterwards controlled by a switch.

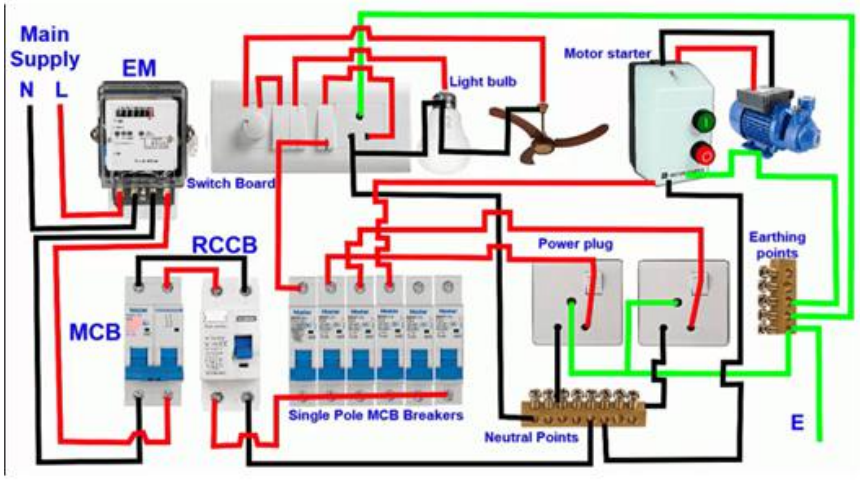

Figure 3.1.1: Single Phase Wiring Diagram

Circuit Load

In most cases, the following load points are available in every room:

- LED Tube lights
- LED Bulbs
- Fan
- Lamp Points
- Sockets
- TV
- AC

Each load or point (on/off) is controlled by its own switch, which is connected through wires, MCBs, fuses, and other components that make up the circuit.

Per Load Items Needed

- PVC wires: Generally 4.0 mm2, 2.5 mm2, 1.5 mm2, 1.0 mm2, 0.75mm2
- MCB distribution Board: 6 Way, 8W, 10W, 12W, 16W
- MCB's: 6 AMP,10A, 16A, 20A, 25A, 32A, (SP/SPN)
- RCCB or ELCB: 16A, 25A, 32A
- Switches: 6Amp, 16 Amp, 20 Amp
- Sockets: 5 Pin 6 Amp, 6 Pin-16Amp, 20A, 25A, 32A
- Bell Switch: 6Amp
- 2-Way Switch: 6 Amp
- Various loads in rooms
- DP Isolator

PVC conduit pipe: During the construction process in Linter, a heavy-duty pipe measuring 25 millimetres in diameter and bearing the ISI mark should typically be laid.

Current Calculation and Item Selection

Every electrical and electronic appliance has a mandatory requirement to display its voltage and current rating, such as:

- Voltage: 220V
- Power: 9Watt/15W/40W/100W/250W/1500W/2500W
- Frequency: 50HZ
- Rated Current-In: determined according to load
- Power Factor: 0.8 or 0.9
- Made in India is stamped on the product along with the manufacturer's name and trade mark, which is an ISI mark.

The current that will be drawn by the load is taken into consideration when choosing the appropriate cables, switches, MCBs, Main MCB, plug tops, and so on. For example;

Power of Air Conditioner Load: 2000W

Voltage: 220V

Current = Power/Voltage X Power Factor

= 2000/220 X 0.8

= 11.36 Ampere

The following is a list of items that can be used for AC load, based on the above calculated current:

- Switch: 16A - 220V
- Socket: 16A – 220V
- Plug Top: 16A – 220V
- MCB/SPN: 16A – 220V
- PVC wires: 2.5 mm2

3.1.2: Earthing

When wiring a house, earthing is a step that must absolutely be completed as it is a mandatory safety precaution. It serves a very important purpose in preventing electric shock to humans.

Procedure

Step 1: Dig down until you reach a level where you can see moist clay.

Step 2: Place G.I. pipe, copper plate, or copper strip deeply into the ground until they reach the floor level.

Step 3: Fill the bore with various substances such as salt, charcoaletc., and then periodically pour water into the bore using a funnel or the pipe mouth.

Step 4: Connect the pit with MCB Box using copper earth wire or G.I.wire.

Step 5: Ensure that an earth wire extends from the MCB Box to all switch boxes, fan boxes, metal boxes, and other similar locations, as well as all power outlets.

It is important to keep in mind that if there is any current leakage or phase contact with any metal box or appliance, etc., the ELCB in the MCB Box will sense it and trip the main supply. ELCB can trip at currents ranging from 30 mA to 100 mA. The supply cannot be turned back on until the fault has been fixed.

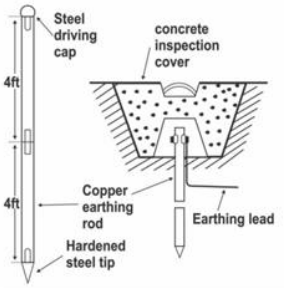

Figure 3.1.2: Earthing

3.1.3: House Wiring Procedures

Preparatory Work

- Carry out the work in accordance with the most recent GFC designs that have been given the go-ahead by the Electrical Consultant. Each and every one of the electrical conductors should be of the appropriate size and have the appropriate current rating for the application they are intended for.
- Always use an ISI-approved, reputable brand of medium or heavy gauge rigid PVC conduit with a diameter between 20 and 32 millimetres and a wall thickness of 2 millimetres for electrical wiring that conforms to all designs and standards.

Electrical Piping Work

- Conduits need to be installed across the bottom steel rods of the roof slab so that electrical piping work can be done over the slab. The conduits then need to be correctly attached to the reinforcement using binding wires.
- It is imperative that an electrician be present during the process of concreting the roof. He or she must remain vigilant to ensure that the pipes are securely fastened in place and that the cement slurry or grout does not penetrate the pipes. However, it is not uncommon for pipes to become damaged as a result of the movement of workers or RMC pipe lines running over roof slabs prior to and during the process of concrete construction. In such circumstances, an electrician must act immediately, cut the conduit, and join the two pieces of the damaged pipe by either using a collar pipe or purchasing a new pipe in order to finish the job.
- When it comes to the work on the floor piping, care should be taken to ensure that the piping is only completed at the time or shortly before the flooring work begins.
- The entire process of cutting the vertical groove must be carried out in accordance with the drawing, and the pipes must be fastened in the appropriate manner. It is strongly recommended to steer clear of horizontal groove cutting for pipes in walls whenever it is at all possible, and specifically in situations where hollow blocks are utilised, strictly horizontal groove chasings are not allowed.
- Pipes should never be bent locally or using ready-made bends; this practise should be rigorously avoided. Bends that are utilised in the connecting of electrical pipes should adhere to ISI criteria and have a bending radius that is 2.5 times greater than the pipe's diameter. For pipes that are hidden from view, the bends should have a big radius and be constructed using bending spring.

Switch Boxes

- It is required that all switch boxes, whether they are made of wood or modular switches, be disguised in the wall in such a way that they should only protrude from the wall plaster surface by a maximum of one to three millimetres. The reference for the thickness of the plaster is the bull markings, and it has been validated by the engineer in charge. In addition, the type of wall finish, such as lime plaster finishing, punning or Glazed Tiles or stone cladding or Marble or Granite, etc., needs to be determined in conjunction with the related architectural designs and the Project Engineer. This can be done. The projection of the switch box will be determined by the finish. The purpose for this is to make sure that the switch box extends 0.5 mm beyond the painted surface and that the edges do not break during the electrical wiring process, which occurs when the electrical wire is drawn.
- In order to prevent damage to the switch boxes caused by the plastering work, cover all of the boxes with thermocol and masking tape or fake plates. These coverings should be removed once the electrical wiring work has been finished.
- Pass GI pull wires constructed of 16 gauge are placed within the pipes, and they have an additional loop length of six inches for the draw electrical wire.

Wiring Cables

The wiring cables that are used for the works should be of an ISI-approved make and should have a grade of 1100V. The cables should also be insulated with PVC and be made of stranded copper. The electricwire with the following cross section is the one that is recommended for usage in most cases.

- 1.0 Sq. mm wire: Earthing for light point electrical wire, 5A socket outlets and Fan Circuits.
- 1.5 Sq. mm wire: Light point wiring, 5A socket outlets & fan circuits and Earthing for Power Circuits.
- 2.5 Sq. mm wire: Lighting Circuit, Earthing for Sub mains.
- 4.0 Sq. mm wire: Power Circuit.
- 6.0 Sq. mm wire: Sub mains or as per drawing

Electrical wires often follow this colour coding, with red, yellow, and blue representing the phases, black representing the neutral, and green representing the earth.

Electrical Earthing

Every light fixture needs to have an earthing terminal installed, and that termination needs to be connected to the earth continuity conductor.

Tools Required for Electrical Piping and Electric Wiring Works

Hand Tools: Cutting pliers, flat screw drivers, testers, Nose pliers, file, ring spanner set, star screw drivers, Box spanner set, Hacksaw blade, Hacksaw frame, wire stripper, chisel, hammer, Metal tool box, hole saw cutter, blow lamp, line thread, crimping tools, curtain spring, telephone crimping tool, bending spring

Power Tools: Hammer drilling machine, air blowing machine, angle grinding machine, small drilling machine, hammer drill bits, DC segmented blades, Non segmented blades.

Measuring Instruments: Measuring Tape, Spirit Level, Megger, Lux Meter, Mutimeter, Tong Tester, Digital Clamp Meter and Earth Resistance Tester.

Mounting Height of Electrical Accessories as per IS Standards

- Light switch: 1250 mm above Finished Floor Level
- Bell Push: 1250 mm above Finished Floor Level
- Socket Outlet: 300 mm above Finished Floor Level
- TV or Telephone Outlets: 300 mm above Finished Floor Level
- Bedside Accessories: 600 mm above Finished Floor Level
- Socket Outlets in the Kitchen: 1140 mm above Finished Floor Level and (+300mm from Counter Top)
- Cooker Control unit: 1140 mm above Finished Floor Level and (+300mm from Counter Top)
- Wall Lights: 2200 mm above Finished Floor Level.
- 15 A in Utility for Washing Machine: 900 mm above Finished Floor Level.
- Connection Unit for Exhaust Fan: 2300 mm above Finished Floor Level.

Inspection QC Methodology

- Check that the locations of all electric junction boxes, drop points, and fan boxes correspond to the drawings.
- Check the inner diameter of the pipe, as well as the permitted tolerance for pipes and the wall thickness, using a slide calliper.
- Confirm Before the roof slab was concreted, all of the pipes were bound to the reinforcement steel in the correct manner. During the flooring operation, the pipes on the floor were checked.
- Check that the solvent cement that was applied to all of the joints is securely holding.
- Make sure that any openings that have been cut in the wall, open ends of pipes, and electric ducts are completely sealed.
- Make certain that pipes that are running parallel to one another do not contact and are free from one another, i.e. that there are no holes in the concrete.
- Make sure that the test lamp approach is used to charge all of the electrical points.
- Randomly tripping an electrical circuit allows for inspection of both the Earth Leakage Circuit Breaker (ELCB) and the Residual Current Circuit Breaker (RCCB).
- Perform a test with the multimeter. And check that the voltage from phase to neutral has been measured as 220 volts.

Exercise

A. Short Questions

Q1. What do you mean by electrical earthing?

Q2. Describe single phase house wiring system.

B. Match the Columns

1. Connect items in column A to their appropriate ones in column B.

Column A	Column B
i. Light Switch	a. 300 mm above Finished Floor Level
ii. Socket Outlet	b. 1250 mm above Finished Floor Level
iii. Bedside Accessories	c. 1140 mm above Finished Floor Level
iv. Socket Outlets in the Kitchen	d. 600 mm above Finished Floor Level
v. Wall Lights	e. 900 mm above Finished Floor Level
vi. 15 A in Utility for Washing Machine	f. 2200 mm above Finished Floor Level
vii Connection Unit for Exhaust Fan	g. 1140 mm above Finished Floor Level and (+300mm from Counter Top)
viii Cooker Control unit	h. 2300 mm above Finished Floor Level

Notes

Scan the QR Code to watch the related video

https://www.youtube.com/watch?v=IRjSuAq3m9g

Earthing for Home

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

SCPwD
दिव्याँग व्यक्तियों के लिए कौशल परिषद्
Skill Council for Persons with Disability

4. Maintenance & Repair of Household Gadgets

Unit 4.1 –Single Phase Motor

Unit 4.2– Repair and Maintenance of Home Gadgets

Terminal Outcomes

By the end of this module, participants will be able to:

1. Perform check to verify the need for repair of gadgets.
2. Carry out maintenance and adjustment of Household gadgets.

Unit 4: Maintenance and Repair of Household Gadgets

Key Learning Outcomes

At the end of this module, you will be able to:

Theory - Key Learning Outcomes	Practical - Key Learning Outcomes
• Specifications of the electricalequipment and gadgets. • Understand the capacity in kW, load in Amperes and power consumption inkWH for each appliance. • Check connection of equipment and status of tripping device. • Ensure presence of appropriatedevices for isolating and switching. • Operate principle of single phase motor, various types of motors like self-start, capacitor start, capacitorrun, universal motors and theirapplications and functions ofcondenser. • Understand how a rotating field is developed in single phase motor. • Understand the significance of the number of poles in motor winding for rpm, speed and connections for change of direction. • Check insulation resistance of motor winding with live conductors to earth and between live conductors. • Various parts of motors, pumps and their functions like ball bearings, cooling fans, fins and bushes. • Various types of winding wires, their gauge and insulating materials for motor winding. • Understand material used to make various types of heating elements like nicrome, kanthal, eureka etc., various shape, size and capacity of heating elements according to applications and usages.	• Check connection of equipment and status of tripping device. • Operate principle of single phase motor, various types of motors like self-start, capacitor start, capacitor run, universal motors and their applications and functions of condenser. • Check insulation resistance of motor winding with live conductors to earth and between live conductors. • Various parts of motors, pumps and their functions like ball bearings, cooling fans, fins and bushes. • Various types of winding wires, their gauge and insulating materials for motor winding.

Theory - Key Learning Outcomes	Practical - Key Learning Outcomes
• Understand types of thermal insulations used in electrical gadgets like mica, asbestos, ceramics, glasswool etc. • Understand about timers (motorized, mechanical), thermal relays, bimetallicstrips. • Ensure preventive maintenance, regular cleaning, oiling, greasing of household gadgets like fans, desert cooler, water pump motors etc. • Ensure replacement of damaged switches, MCB, fan- capacitor, regulator, lighting points i.e. holder, choke, starters, water coolers and their pump & motor. • Ensure regular maintenance of - iron, toaster, induction-plate & cooker. • Ensure regular maintenance of doorbells, FL tube starters & chokes. • Preventative maintenance of batteries. • Ensure soldering of winding wires, cables and their joints in electrical gadgets. • Verify system grounding and measure insulation resistance. • Clean solar panels for removal of dust, bird droppings, pollen, leaves, branches etc. as per maintenance schedule. • Ensure all electrical connections as per specification, measure and record DC voltages and currents and identify the faults in the system. • Check for working condition of fuses, circuit breakers and all cables for loose connections. • Take adequate precautionary measures while handling electrical system adhering to relevant health and safety standards. • Understand that if reason of error is not clear, do not try to fix anything and call OEM repair and maintenance team.	• Check connection of equipment and status of tripping device. • Operate principle of single phase motor, various types of motors like self-start, capacitor start, capacitor run, universal motors and their applications and functions of condenser. • Check insulation resistance of motor winding with live conductors to earth and between live conductors. • Various parts of motors, pumps and their functions like ball bearings, cooling fans, fins and bushes. • Various types of winding wires, their gauge and insulating materials for motor winding.

Unit 4.1 Single Phase Motor

Unit Objectives

At the end of the session, participant will be able to:

- Operate principle of single phasemotor, various types of motors likeself-start, capacitor start, capacitor run, universal motors and their applications and functions of condenser.
- Understand how a rotating field is developed in single phase motor.
- Understand the significance of the number of poles in motor winding for rpm, speed and connections for change of direction.
- Check insulation resistance of motor winding with live conductors to earth and between live conductors.
- Various parts of motors, pumps and their functions like ball bearings, cooling fans, fins and bushes.
- Various types of winding wires, their gauge and insulating materials for motor winding.
- Understand material used to make various types of heating elements like nichrome, kanthal, eureka etc., various shape, size and capacity of heating elements according to applications and usages.
- Understand types of thermal insulations used in electrical gadgets like mica, asbestos, ceramics, glass wool etc.
- Understand about timers (motorized, mechanical), thermal relays, bimetallic strips.

4.1.1: Motor

We are able to obtain mechanical energy in the quickest and most effective way possible thanks to electric motors. We may discover single-phase, two-phase, and three-phase motors with coiled starting winding, as well as motors with coiled start-up winding that also contain a capacitor, depending on the number of supply phases that are needed. The choice between the two will be determined by the amount of electricity that is required.

Single Phase Motor

A rotary machine that can convert electrical energy into mechanical energy is referred to as a single-phase motor. This type of motor is powered by electricity.

A power source with a single phase is required for it to function properly. They include both hot and neutral types of wiring in their construction. Their power can reach 3 kilowatts, and the voltages that they are supplied with change in synchrony.

They are only capable of producing a single alternating voltage. The circuit consists of just two wires, and the amount of current that is always flowing through them is consistent.

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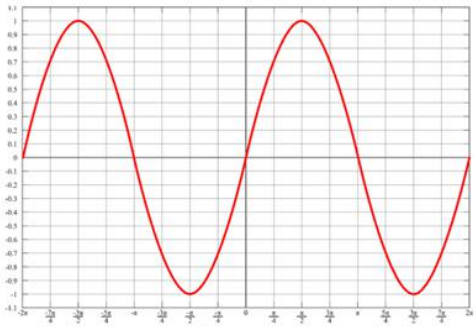

Figure 4.1.1: Alternating Voltage of Motor

These are typically compact motors that have a constrained amount of torque. There are, on the other hand, single-phase motors that can work with connections of up to 440V and have a power output of up to 10 horsepower.

They are only capable of generating an alternative magnetic field, which implies that they require a capacitor in order to get started. They are unable to generate a rotating magnetic field.They are not difficult to fix or maintain, and they are reasonably priced.

The majority of uses for this kind of motor may be found in residential and commercial settings, as well as in retail and wholesale establishments. The most typical applications for them are found in household appliances, heating, ventilation, and air conditioning (HVAC) systems found in homes and businesses, and other equipment like as drills, air conditioners, and openers and closers for garage doors.

Single Phase vs Three Phase Motor

A single-phase motor and a three-phase motor are the two varieties of motors that are available. Single-phase motors often have a lifespan that is many years longer than their three-phase counterparts and require significantly less maintenance. These motors are generally employed in devices and equipment that require lesser levels of horsepower or when it is inefficient to use a three-phase motor. Other common applications include air conditioning and refrigeration.

There is an AC winding that is placed on the stator of a single-phase motor, and there are short-circuited conductors that are placed in a cylindrical rotor of a single-phase motor. The construction of a single-phase motor is comparable to that of a three-phase motor. One of the most significant distinctions between the two types of motors is that a single-phase motor has a supply coming into the stator from only one phase (hence the name).

Uses of Single - Phase Motor

Single-phase motors are typically utilized in apparatus and machines that are of a more compact size and call for a lesser amount of horsepower (for example, one horsepower). This includes a variety of pieces of machinery, including:

- Clocks
- Refrigerators, freezers, and heaters
- Fans, table fans, ceiling fan, exhaust fans, air coolers and water coolers
- Blowers
- Washing machines
- Machine tools

- Dryers
- Photostats and printers
- Water pumps and submersible
- Computers
- Grinders
- Drilling machines

Working of Single - Phase Motor

Single phase motors do not have the ability to start themselves if they do not have an auxiliary stator winding that is powered by an out of phase current. When the motor is started and while it is operating, there is a capacitor connected in series with the permanent-split capacitor motor's auxiliary winding. Because single-phase motors are incapable of producing a magnetic field on their own, the rotor can only be turned by manually activating the switch that controls the motor. Once the rotor of this kind of motor is placed in motion and a magnetic field is established, and only then, will the motor be able to function.

Advantages	Disadvantages
Single-phase motors provide several advantages that make them preferable in many situations. To begin, • The production cost of single-phase motors is far lower than that of most other types of motors. • Single-phase motors normally demand for very little maintenance, very infrequently call for repairs, and when they do, the repairs are typically simple and straightforward to carry out. • Single-phase motors will also last for many years, and most of the time, failures in single-phase motors are caused by improper application rather than a manufacturing problem in the motor itself.	Single-phase motors may have fewer moving parts than three-phase motors, but this does not mean that they are error-proof or that nothing could ever go wrong with them. • On rare occasions, they have been known to fail to start at all, run slowly or overheat, or even overheat or run slowly on occasion. • If a jolt is experienced while touching the motor, this indicates that there is a problem with the motor that needs to be fixed as soon as possible.

4.1.2: Parts of Motor

The rotor and the stator are the two most important components that make up an AC motor. The outermost layer, known as the stator, always stays in one place. Windings inside it convert the incoming electrical current into a magnetic field in order to operate. Because of this, the rotor becomes magnetised in the opposite polarity, which leads it to repulsion and rotation. It is possible to wind the stator with two or more distinct sets of windings, which are referred to as poles. The speed of the motor is determined by the number of poles it has. The following synchronous speeds are available as standard options: 900, 1,200, 1,800, and 3,600 revolutions per minute (rpm). An induction motor has the appearance of a squirrel-cage motor and rotates at a rate that is marginally slower than that of a synchronous motor. Motor slip is the term used to describe the decrease in speed.

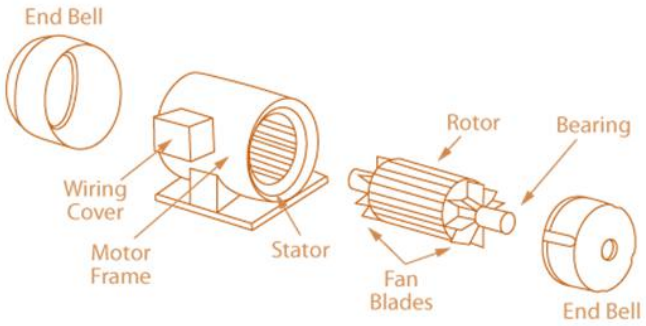

Figure 4.1.2: Parts of AC Single-Phase Motor

Rotor

The rotor is made up of bars that are either made of copper or aluminum and run lengthwise. These bars create electric current, which ultimately results in the formation of a magnetic field. The term "induction motor" comes from the way that this type of motor produces current. The squirrel-cage and winding designs are the two options available for the rotor of an induction motor.

- The squirrel-cage rotor is the most popular type of rotor and looks like a steel cylinder with aluminum or copper conductors running through it.
- A wound-rotor has windings that are coupled to external resistances using slip rings.

Magnetic Poles

The number of poles in a motor is always an even number, and they are sold in pairs (north and south). The synchronous speed of an AC motor can be determined, in conjunction with the frequency, by the number of poles present in the motor.

Number of Poles	Synchronous Speed, rpm	
	50 Cycles (Hz)	60 Cycles (Hz)
2	3,000	3,600
4	1,500	1,800
6	1,000	1,200
8	750	900
10	600	720

Motor Slip

The term "slip" refers to the speed differential between the synchronous speed and the actual speed of the rotor. At full load, the majority of AC induction motors have between 3 and 5 percent slip. Ratings for rpm that take into account slip can be seen on motor plates and in catalogues produced by manufacturers.

Critical Torque Levels

The speed-torque (S-T) curve illustrates the four different torque values that must be considered when selecting a motor and applying it. The torque that is available at zero speed for accelerating is referred to as locked-rotor. The pull-up is the most basic exercise that may be performed during acceleration. When a motor is suddenly loaded beyond its capacity, it will create a torque known as breakdown torque shortly before it completely seizes up.

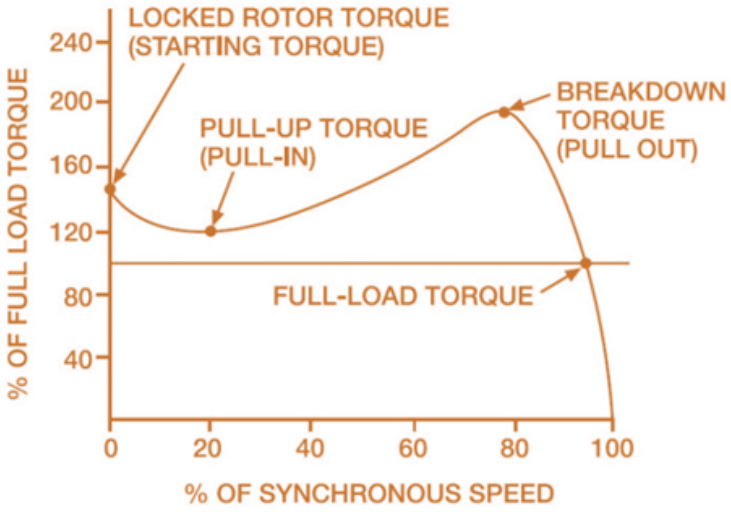

Figure 4.1.3: Speed-Torque Curve

Motor Windings

The motor winding refers to the form of winding of the electrical conductor for generating a magnetic field needed to operate the rotors in an electric motor – e.g. a servo motor. The design determines the available torque, the electromagnetic force in the system, the electrical resistance, and consequently the application. When the winding is wound more tightly, more torque and force are generated. However, as the speed of the winding increases, so does the amount of resistance and waste heat. In this manner, a motor winding that is tailored to the requirements of a certain application can be utilised.

Figure 4.1.4: Motor Windings

Ball-Bearing

Electric motor ball bearings are bearings that are used to support electric motors and make them operate by distributing the power between various elements of the machine or turning the shaft. As the name suggests, electric motor ball bearings are bearings that are used to support electric motors.

Cooling Fan

Fan cooled motors include an axial fan attached to the rotor of the motor (often on the opposite end as the output shaft) that rotates with the motor. This allows for additional airflow to be provided to the motor's internal and exterior parts, which helps to cool the motor.

Fins

The fins let the wind to blow across their surface, which helps to cool it down, and also transmit heat from the fins' surface to the surrounding air.

Bushes

A carbon brush, also known as a motor brush, is a small element of a motor that is responsible for conducting electrical current between the wires of a motor or generator that are stationary (known as the stator) and the wires that are revolving (known as the rotor).

Timer

When a motor is first turned on, it generates what is known as an initial inrush current. When multiple motors are started at the same time, the combined inrush currents of all of these motors have the potential to generate line disruptions across the system and trigger the nuisance tripping of overcurrent protection devices.

It is possible that it will be desired to give a time interval between the starting of two or more motors when those motors are controlled from the same pushbutton station. Timing relays are just one of the many tools at our disposal for accomplishing this goal.

Timers are built in a manner that is analogous to that of control relays; specifically, they consist of a low-voltage armature and coil, and when they are powered, they either open or close a set of contacts. The addition of some kind of delay mechanism that keeps the auxiliary contacts from changing their state for some predetermined amount of time is the defining characteristic of timers. This delay mechanism can be thought of as a delay circuit.

Thermal Relays

Thermal overload relays are used to prevent various electrical components, including motors, transformers, and others, from overheating. These relays are typically positioned at spots along an electric circuit in which there are multiple devices connected to the circuit. If one of these components gets too hot, it could potentially destroy not just itself but also the other components of this circuit.

Bimetallic Strips

A temperature change is converted into a mechanical displacement by using a strip made of two different metals. When heated, the strip is composed of two distinct metal strips, each of which expands at a different rate than the other.

To create a structure that reacts to shifts in temperature by bending in a predetermined direction, two strips of different metals are mechanically connected together along their length. This can be done by using rivets or by fusing the metals together along their length.

4.1.2: Parts of Motor

There are five different kinds of single-phase induction motors, and each one is distinguished from the others by the impedance that is linked to the auxiliary winding of the motor.Each variety of motor has a set of benefits and drawbacks that are singular to itself.

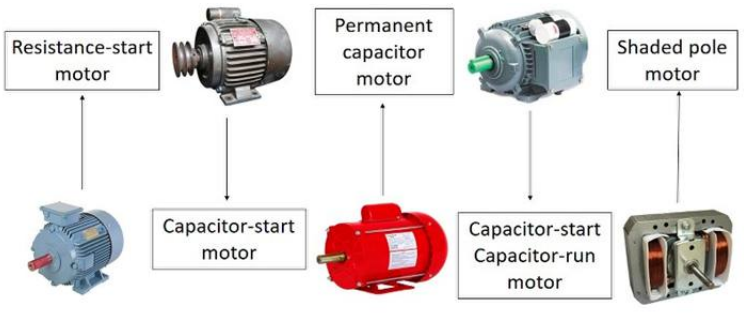

Figure 4.1.5: Types of Single-Phase Motor

Resistance-Start Single-Phase Induction Motor

In this technique, an extremely high resistance is connected in series with the auxiliary winding of the motor, as is depicted in the accompanying picture.

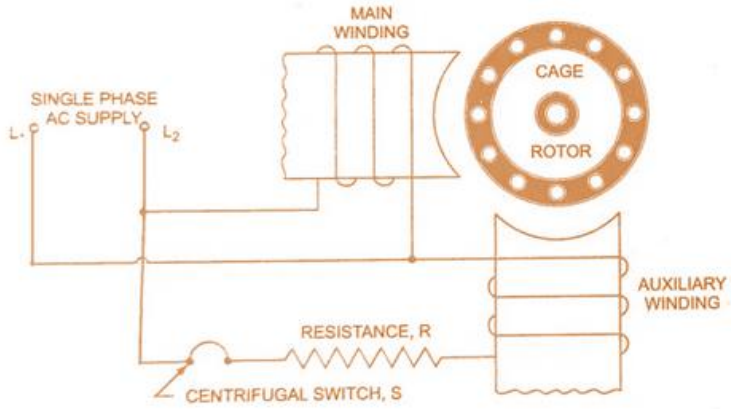

Figure 4.1.6: Resistance Start Single-Phase Motor

The following expression describes the overall inductance of both windings:

- A high resistance, but a relatively low inductive reactance, can be found in the auxiliary winding.
- In contrast to its low resistance, the primary winding exhibits a high inductive reactance.

These motors are perfect for use exclusively with loads that have a low level of inertia and require a moderate amount of starting torque. It contains a variety of instruments such as grinders, fans, blowers, and other such items.

Capacitor-Start Single-Phase Induction Motor

The resistance-start method has been refined to produce this new method. An electrolytic capacitor is connected in series with the auxiliary winding of this component. In this situation:

- The capacitive reactance of the auxiliary winding is significantly higher.
- A significant amount of inductive reactance can be found in the primary winding.

Because of this, the current flowing through the primary winding lags behind the voltage that is being applied, but the current flowing through the auxiliary winding leads the voltage that is being applied.

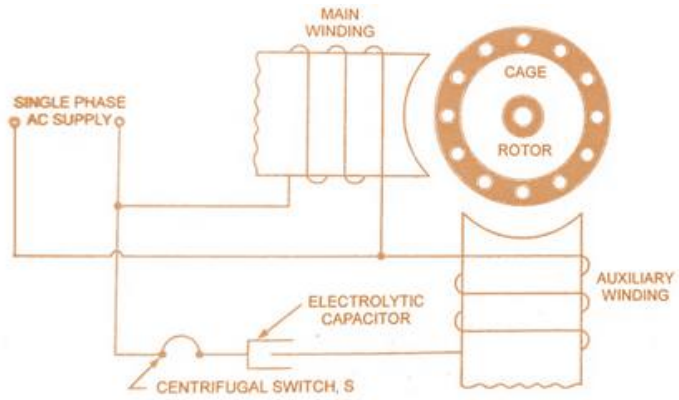

Figure 4.1.7: Capacitor Start Single-Phase Motor

Capacitor-Start, Capacitor-Run Single-Phase Induction Motor

The utilization of an electrolytic capacitor does boost the beginning torque; nevertheless, there are two issues associated with this practice:

- These capacitors are solely designed for use in light-duty applications. When utilized for an extended period, it deteriorates.
- When the motor is started an excessive number of times in a short period of time, the dielectric of the capacitor becomes destroyed.

Therefore, the utilization of capacitor-start and capacitor-run motors comes highly recommended as the means to obtain smooth starting and operating circumstances. As can be seen in the image, it makes use of two distinct capacitors that are connected in parallel with one another.

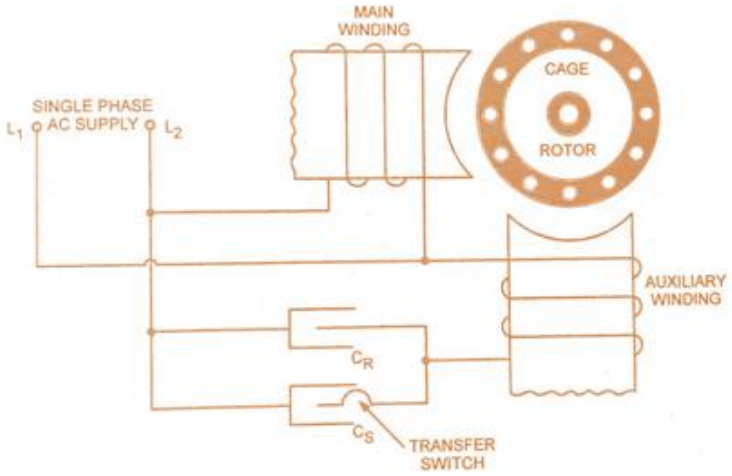

Figure 4.1.8: Capacitor Start, Capacitor-Run Single-Phase Motor

- The first one is a capacitor that has been soaked in oil (Cr). A capacitor with a continuous rating and a lower value describes this component.
- The second item is referred to as an electrolytic capacitor (Cs). It is a capacitor designed for shortduty use that has a greater value.

During the starting process, both capacitors continue to be connected to the circuit. A greater beginning torque is produced because of the addition of the total capacitance.

These motors provide superior starting and operating torque, making them an excellent choice for use in compressors, refrigerators, and pumps.Because of the minimal noise they produce, they are ideally suited for usage in settings such as hospitals and recording studios.

Permanent Capacitor Single-Phase Induction Motor

One capacitor is connected in series with this motor's auxiliary winding, but not more than that. In this case, the capacitor continues to be connected to the circuit both while it is starting up and when it is operating normally. Therefore, there is no requirement for a centrifugal switch, as was covered in the earlier paragraphs on the different types of single-phase induction motors.

The benefits offered by this motor are comparable to those offered by an induction motor with a capacitor start and a capacitor run. This motor, however, cannot provide optimal starting and running conditions because it only has one capacitor. This limits the motor's potential applications. An insulated foil paper capacitor is used in this device.

They work wonderfully in ceiling fans, blowers, room coolers, and a variety of other uses found in the home.

Because the motor may be easily turned around, they are most useful for applications such as induction regulators and furnace controllers.

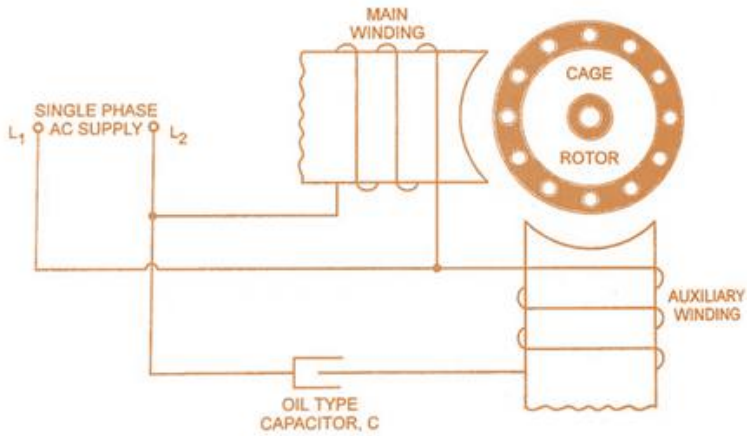

Figure 4.1.9: Permanent CapacitorSingle-Phase Motor

Shaded Pole Motor

This motor is completely unique in comparison to the sorts of single-phase induction motors described above. It does not include any moving switch parts or capacitors of any kind. Its exciting coil is furnished with prominent poles, which are located on its stator. As may be seen in the image, a copper strap, also known as a shading coil, wraps around twenty-five percent of the stator pole.

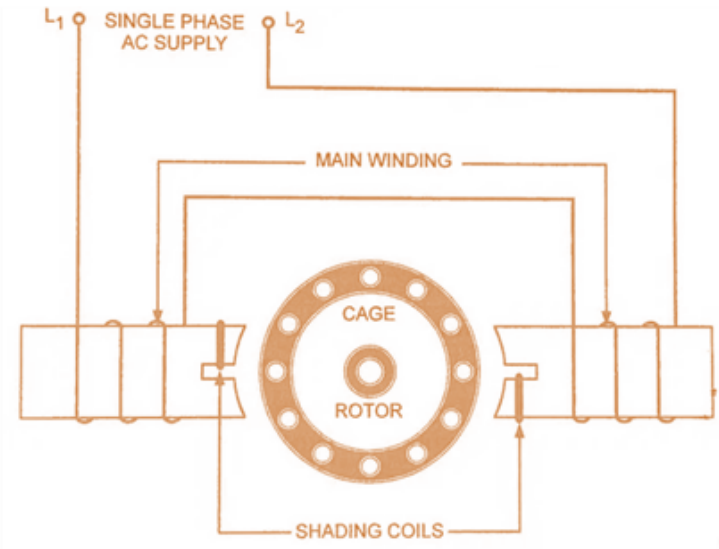

Figure 4.1.10: Shaded Pole Single-Phase Motor

Because of the low starting torque, they are only appropriate for use in devices such as electric clocks, miniature fans, and toys.

They are also excellent choices for machinery used in small businesses, such as photocopiers and vending machines.

4.1.4: Heating Elements

A component that is designed to serve the goal of heating, a heating element is characterised by its combination of material that is both electrically conducting and insulating.

Component: A heating element is comprised of more than just the heating alloy on its own. It is an assembly of pieces that consists of a framework made of insulating material and lead connectors, both of which are included in the assembly. If we take the example of a heater with an open coil, for instance, the heating alloy is normally held in place or suspended by mica or ceramic insulators. The heater coils are connected to the circuit in a secure manner by the wire connections.

Electrically Conductive: The essential heart of an electric heater is the heating element alloy contained within it, which, when applied to a current, converts the thermal energy stored in electrical energy into thermal energy. It is the component of a heater that bears the brunt of the electrical load. We refer to this type of heat production as "Resistive Heating" when it occurs. In some circles, it is also referred to as Joule Heating.

A heating element is more than the sum of its component parts because it was designed to perform a certain function. It is the result of deliberate design. To create a functional component that can be utilised for heating, alloy and insulators need to go through a process of manipulation.

Materials Used in Heating Elements

The element that makes up the bulk of a heater is almost always made of metal and can take the form of a wire, a ribbon, or a pattern engraved into a metal foil. Ceramic, plastic, or silicone impregnated with a conductor may also be utilised in the construction of a heater.

Properties that include the physical, thermal, electrical, and metallurgical realms are shared by all heating elements made of metal. When searching for the optimal solution for a certain application, it is important to take into account the qualities of the material in question. Differences in behaviour that are influenced by temperature, such as electrical resistance and thermal expansion, can seem very different depending on the material.

Nichrome

Because it possesses the following characteristics, nichrome wire is frequently utilised in the capacity of heating element in heating appliances.

- It provides a very high level of resistance. Therefore, a significant quantity of electrical energy is changed into a significant quantity of thermal energy.
- It is able to withstand temperatures up to the boiling point without succumbing to the melting point due to its high melting point.
- Even at very high temperatures, it has a low propensity to easily oxidise.

Kanthal

The ferritic iron-chromium-aluminium alloy known as Kanthal® A-1 can withstand temperatures of up to 1,400 degrees Celsius (2,550 degrees Fahrenheit). The alloy has a high resistivity and very good oxidation resistance, both of which are characteristics that distinguish it.

Eureka

Eureka is another name for the Nickel-Copper alloy that is known as Constantan.The typical composition of this material is 55% copper and 45% nickel.The minimal thermal change of its resistivity, which is consistent over a broad range of temperatures, is its most distinguishing characteristic.

Due to its high resistivity, the alloy wire known as Constantan is most commonly utilised in thermocouples and other forms of electrical resistance heating. Nickel and copper are the two primary components of this wire.It maintains its resistivity over a broad temperature range without variation.

4.1.5: Thermal Insulations

Insulators of heat are materials that resist the buildup of heat. Wool, fibreglass, rock wool, polystyrene, polyurethane, mica, asbestos, ceramics, and perlite are some of the more common types of thermal insulators. Because they are such poor heat conductors, the materials used for thermal insulation are excellent at insulating against heat loss.

Thermal Insulation Process

Conduction, convection, and radiation are the three distinct modes of operation that are involved in the process of thermal insulation.

Any of the aforementioned types of insulation can stop heat from escaping by convection. In the context of this discussion, convection refers to the flow of warm air inside the structure. Warm air has a natural tendency to rise, and when it does so, it will be replaced with cooler air as it moves through the building. By filling a cavity wall with insulation, as an illustration of how thermal insulation can cut down on heat losses due to convection, the air within that cavity is restricted in its movement, which reduces the amount of convection that is taking place. This is just one example of how thermal insulation can do this.

The process of reflecting radiation, or in this case radiant heat, is how thermal insulation that operates by radiation achieves its effect. It is able to accomplish this goal as a result of its construction using a material that is reflective, such as aluminium foil.

Exercise

A. Short Questions

Q1. What do you mean by single-phase motor?

Q2. Describe different types of single-phase induction motors.

B. Match the Columns

1. Connect items in column A to their appropriate ones in column B.

Column A	Column B
i. Resistance Start Motor	a. Refrigerator
ii. Capacitor-Start, Capacitor-Run Motor	b. Grinders
iii. Permanent Capacitor Motor	c. Miniature Fan and Toys
iv. Shaded Pole Motor	d. Ceiling Fan

C. Fill in the Blanks

a. _____motors are perfect for use exclusively with loads that have a low level of inertia and require a moderate amount of starting torque.

b. _____motors provide superior starting and operating torque, making them an excellent choice for use in compressors, refrigerators, and pumps.

c. _____is a small element of a motor that is responsible for conducting electrical current between the wires of a motor or generator that are stationary (known as the stator) and the wires that are revolving (known as the rotor).

Notes

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https://www.youtube.com/watch?v=awrUxv7B-a8

Single-Phase Induction Motor

Unit 4.2 Repair and Maintenance of Home Gadgets

Unit Objectives

At the end of the session, participant will be able to:

- At the end of the session, participant will be able to:
- Ensure preventive maintenance, regular cleaning, oiling, greasing of household gadgets like fans, desert cooler, water pump motors etc.
- Ensure replacement of damaged switches, MCB, fan- capacitor, regulator, lighting points i.e. holder, choke, starters, water coolers and their pump & motor.
- Ensure regular maintenance of - iron, toaster, induction-plate & cooker.
- Ensure regular maintenance of doorbells, FL tube starters & chokes.
- Preventative maintenance of batteries.
- Ensure soldering of winding wires, cables and their joints in electrical gadgets.
- Clean solar panels for removal of dust, bird droppings, pollen, leaves, branches etc. as per maintenance schedule.
- Ensure all electrical connections as per specification, measure and record DC voltages and currents and identify the faults in the system.
- Check for working condition of fuses, circuit breakers and all cables for loose connections.
- Take adequate precautionary measures while handling electrical system adhering to relevant health and safety standards.
- Understand that if reason of error is not clear, do not try to fix anything and call OEM repair and maintenance team.

4.2.1: Preventive Maintenance

Maintenance that is carried out on physical assets on a regular and consistent basis in order to lessen the likelihood of an equipment breakdown is referred to as preventive maintenance. Home appliances that receive routine preventative maintenance work more smoothly, continue to provide a high degree of protection for their owners, and help the owners avoid major and expensive repairs in the future.

Time-based triggers, usage-based triggers, and condition-based triggers are the three primary categories of preventative maintenance. In order to avoid unexpected breakdowns, it is best practise to schedule and carry out some form of the aforementioned preventative maintenance procedures on each and every piece of home gadgets. Many times, the manufacturer will provide some instructions on how the equipment should be maintained.

Time-based Preventive Maintenance

A preventative maintenance activity can be scheduled using a time-based technique using a predetermined time interval, such as once every 10 days. Other examples include initiating preventive maintenance on the first day of the month or once every three months. This could involve, for instance, performing regular inspections of essential pieces of equipment.

Utilization-based Preventive Maintenance

When a predetermined threshold is reached in terms of asset utilisation, usage-based preventive maintenance will initiate an appropriate maintenance action. After a predetermined amount of time, kilometres travelled, or cycles of production are some examples of this.

Condition-based Preventive Maintenance

A sort of preventative maintenance known as condition-based maintenance is described here. It is a maintenance approach that analyses the actual condition of an asset to identify what maintenance activity needs to be done, and it does this through the use of condition-based monitoring. According to the principles of condition-based maintenance, preventative maintenance should only be carried out when specific indications reveal signals of deteriorating performance or an impending breakdown. For instance, preventative maintenance will be scheduled when a given component's vibration hits a certain level, which indicates that the component should be replaced or lubricated. This will ensure that the component continues to function properly.

4.2.1: Maintenance of Home Gadgets

Wall Fan

Weekly maintenance on the electric fan is recommended and from time to time, give the electric fan a thorough cleaning.

Weekly Cleaning

- Step 1: Unplug the electric fan
- Step 2: Blast away the dust
- Step 3: Use a vacuum cleaner to clean both the panel
- Step 4: Wipe down the fan

Deep Cleaning

- Step 1: Turn off the electric fan
- Step 2: Remove the front grill
- Step 3: Unscrew the blade nut
- Step 4: Remove the rear grill
- Step 5: Wash the grills and blade
- Step 6: Vacuum the body of the fan
- Step 7: Reassemble the fan

Exhaust Fan

- Step 1: Remove the exhaust cover
- Step 2: Vacuum out dust
- Step 3: Wipe the blades with dusting cloth
- Step 4: Fix the exhaust cover back to its position

Ceiling Fan

- Step 1: Vacuum and dust the fan
- Step 2:Remove the blades and clean with dusting cloths
- Step 3: Clean the motor of the fan
- Step 4: Lubricate the bearings of the fan with grease
- Step 5: Affix the blades

Steam Iron

- Step 1: Rinse out the water reservoir with hot water
- Step 2: Pour vinegar into the water chamber and set it on high
- Step 3: Leave it for 3 – 5 minutes
- Step 4: Turn off the iron and remove the vinegar

- Step 5: Leave it to air dry and cool
- Step 6:Wipe out the entire iron and chord with damp clean cloth

Toaster

- Step 1: Unplug the toaster
- Step 2: Remove the crumbs
- Step 3: Scrub the toaster
- Step 4: Clean the outside the toaster

Cooktop

- Step 1: Mix 1 part baking soda with 1 part white vinegar in a dish or spray bottle.
- Step 2: Cover the hob with solution and leave for 30 minutes.
- Step 3: Wipe the product with a moist cloth after the time is over.
- Step 4: Spray white vinegar over the hob and dry with a microfibre cloth to make it shine.

Refrigerator

- Step 1: Clean the coil
- Step 2: Maintain the temperature
- Step 3: Check the gasket
- Step 4: Change the filters
- Step 5: Close the door
- Step 6: Keep it level

Washing Machine

- Step 1: Replace the water hoses
- Step 2:Move the machine
- Step 3: Keep the machine level
- Step 4: Clean the lint filter
- Step 5: Wash the washing machine

Air Conditioner

- Step 1: Get the air filter washed and cleaned
- Step 2:Get the coils cleaned
- Step 3: Ensure that condenser unit fan is in good condition
- Step 4: Get the condensate drain inspected

Water Pump

- Step 1: Check the bearing temperature, lubricant level, and vibration
- Step 2: Mechanical seals to show no sign of leakage, packing to leak at the rate of 40-60 drops/min
- Step 3: Overall vibration – visual, sound, touch analysis
- Step 4: Discharge pressure – check to ensure gauges are reading at acceptable levels

Solar Panel

- Making an appointment with your solar installation to check that everything is in working condition is part of the preventative maintenance that should be performed.
- This method, as opposed to curative maintenance, which entails the resolution of a discovered flaw or failure, should normally take place once a year.

Exercise

A. Short Questions

Q1. What do you mean by preventive maintenance?

Q2. Describe different types of preventive maintenance.

B. Write down preventive maintenance of following home appliances

Ceiling Fan

Steps	Actions
Step 1	
Step 2	
Step 3	
Step 4	
Step 5	

Toaster

Steps	Actions
Step 1	
Step 2	
Step 3	
Step 4	
Step 5	

Steam Iron

Steps	Actions
Step 1	
Step 2	
Step 3	
Step 4	
Step 5	

Cooktop

Steps	Actions
Step 1	
Step 2	
Step 3	
Step 4	
Step 5	

Notes

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Preventive Maintenance of Home Appliances

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MINISTRY OF SKILL DEVELOPMENT
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Skill Development
Corporation
Transforming the skill landscape

SCPwD
दिव्याँग व्यक्तियों के लिए कौशल परिषद्
Skill Council for Persons with Disability

5. Assemble, Repair and Maintain HPT

Unit 5.1 Hand Propelled Tricycle (HPT) – Assembly, Repair and Maintenance

Terminal Outcomes

By the end of this module, participants will be able to:

1. Assemble a Hand Propelled Tricycle (HPT).
2. Repair and service of HPT.

Unit 5: Assemble, Repair and Maintain a Hand Propelled Tricycle (HPT)

Key Learning Outcomes

At the end of this module, you will be able to:

Theory - Key Learning Outcomes	Practical - Key Learning Outcomes
• List the sources of material required in the assembly of HPT. • Describe the various parts of HPT and their function. • Describe the common faults that occur in HPT and the tools required to repair. • List the tools and equipment used toassemble/ service HPT. • Explain the steps of the standard operatingprocedures for assembly and repair of HPT. • Explain the safety measures prescribed forhandling various equipment andcomponents of HPT. • Describe the steps to test and repair HPT.	• Prepare a list of various HPT components, tools & equipment required for assembly and repair. • Demonstrate the steps of assembling various parts of HPT (pedal crank, brake assembly) in line with manufacturer's guidelines). • Demonstrate the working of HPT. • Perform a check of the various parts of HPT to identify problems. • Demonstrate the steps to accurately complete the process of repair of HPT. • Show how to re-align panels and components of HPT. • Perform the process for adjustment of the braking system. • Perform the steps required to align the wheels. • Show the steps for inflation of tyres and lubrication of operating mechanisms. • Conduct a test drive to ensure accurate functioning of the repaired HPT.

Unit 5.1Hand Propelled Tricycle (HPT) – Assembly, Repair and Maintenance

Unit Objectives

At the end of the session, participant will be able to:

- List the sources of material required in the assembly of HPT.
- Describe the various parts of HPT and their function.
- Describe the common faults that occur in HPT and the tools required to repair.
- List the tools and equipment used toassemble/ service HPT.
- Explain the steps of the standard operatingprocedures for assembly and repair of HPT.
- Explain the safety measures prescribed forhandling various equipment andcomponents of HPT.
- Describe the steps to test and repair HPT.
- Prepare a list of various HPT components, tools & equipment required for assembly and repair.
- Demonstrate the steps of assembling various parts of HPT (pedal crank, brake assembly) in line with manufacturer's guidelines).
- Demonstrate the working of HPT.
- Perform a check of the various parts ofHPT to identify problems.
- Demonstrate the steps to accuratelycomplete the process of repair of HPT.
- Show how to re-align panels andcomponents of HPT.
- Perform the process for adjustment of thebraking system.
- Perform the steps required to align thewheels.
- Show the steps for inflation of tyres andlubrication of operating mechanisms.
- Conduct a test drive to ensure accurate functioning of the repaired HPT.

5.1.1: HPT and its Components

People who struggle with their mobility can benefit tremendously from using a hand-propelled tricycle. The Hand Propelled Tricycle is built in such a way that the rider can use either hand to propel the vehicle, while the other hand can be used to steer the vehicle. This makes it ideal for individuals who have limited mobility in one or both of their legs.

Driving Mechanism

Utilizes a conventional chain and sprocket set-up as its propulsion system.

Steering Mechanism

The steering rod serves the dual purpose of directional control as well as braking in the steering mechanism. Steering Mechanism The hand grip on the steering rod is specifically engineered to last longer and is composed of a type of rubber that does not leave marks.

Components of HPT

The following components make up a hand-propelled tricycle that is of high quality and durability.

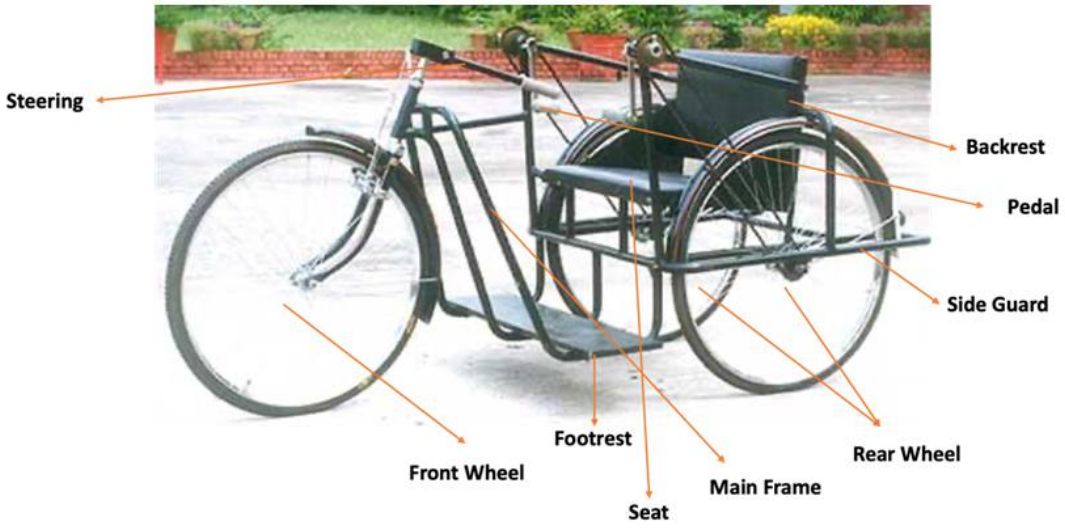

Figure 5.1.1: Hand Propelled Tricycle (HPT)

- Main Frame
- Steering Rod
- Hand Brake
- Chain and Sprocket
- Wheel with Spokes
- Footrest
- Seat
- Backrest
- Pedals
- Side Guards
- Wheel Mudguards

Other Accessories

The following accessories are available for attachment to the hand-propelled tricycle, which can make the riding experience more enjoyable overall.

- A hood that provides shelter from both the heat and the rain.
- A compartment or storage area in the back for personal effects and objects that are required.
- Head Lamp
- Bell or Horn

5.1.2: Assembly of HPT

Tools and Equipment

Here's the list of essential tools:

- Allen wrenches: 4mm, 5mm, and 6mm.
- Wrenches: 9mm, 10mm, 13mm, 14mm, and 15mm.
- Phillips Screwdriver
- Scissors or a Box-Cutter Utility Knife
- Air Pump

Other Supplies

- Chain lubricant
- Grease

Assembly Process

- Step 1: Check all the components are in good shape and quality
- Step 2: Take out tube, rim and tyre and assemble all three wheels.
- Step 3: Inflate the tyres with the help of air pump and ensure that airs are filled
- Step 4: Take out the main frame and fix front and rear wheels.
- Step 5: Ensure that wheels are fixed perfectly in the slots given in the frame.
- Step 6: Take out the chains, sprockets and pedals and affix them in the given slot.
- Step 7: Lubricate the chains perfectly.
- Step 8: Place the mud guard over the wheels.
- Step 9: Fix the steering in the front on the given slot of the frame.
- Step 10: Place the hand brake in the steering.
- Step 11: Ensure that brakes are tightly fixed and when apply works perfectly.
- Step 12: Place the seat on the frame.
- Step 13: Place the backrest on given slot of the frame.
- Step 14: Check that footrest is intact in the frame.
- Step 15: Drive and check that the tricycle is working perfectly.

5.1.3: Maintenance and Repair of HPT

Weekly Maintenance

- **Step 1:** Make sure the chain is clean and lubricated.
- **Step 2:** Make sure there is no corrosion or damage on the wheel spokes or eyelets.
- **Step 3:** Check the air pressure in the tyres.

Monthly Maintenance

- **Step 1:** Check the tread depth of the tyres and look for any cracks in the rubber.
- **Step 2:** Verify that the head stem, wheel bearings, chain, gear cluster (back chain wheels), chain rings (front cogs), and back chain wheels are all in working order (handlebars).

- **Step 3:** Make sure that all of the reflectors and lights are correctly fastened, and that they are working.

Annual Maintenance

- **Step 1:** Examine the frame for any damage.
- **Step 2:** Take off the handlebar tape so you may inspect it for rust and any potential vulnerabilities.
- **Step 3:** When you get new tyres, check that they are the correct size to fit your vehicle.
- **Step 4:** When you change the chain, you should also change the gear cluster because they tend to wear down at the same rate.

Puncture Repairing

Step 1: Getting Started

- Before removing the chain from the rear wheels, you need to make sure it is on the smallest cog possible.
- Remove the brake from its attachment to the wheel.
- Always proceed with caution and never attempt to force anything.
- By depressing the little pin that is located on the tyre valve, you can ensure that the tyre has lost all of its air.

Step 2: Remove half the tyre

- To pull the tyre bead away from the rim, firmly squeeze the tyre wall seams together along the whole circumference of the tyre.
- To remove the tyre, tyre levers must be used, and one of the levers must be hooked between the rim and the tyre wall on one side.
- To release the tyre, hook the other lever into the same position as the first one, and then run it around the rim. Check to see that the levers are not going to squeeze the inner tube. It is possible to remove the tube even with only half of the tyre detached from the rim. It is not necessary for you to take out the entire tyre.

Step 3: Locating the Point of Puncture.

- First remove the tube, then lift the valve out of the hole in order to locate the puncture. After that, partially inflate the tube.
- Listen for a hissing sound and feel around the tube to locate any air that may be leaking out. Another option is to submerge the tube in water and look for bubbles as a way to pinpoint the location of the hole. Before moving forward with the repair, you need to make sure that the tube is completely dry.

Step 4: Putting the patch in place

- Roughen up the surface of the area that has been punctured using either the metal scraper that was included with your puncture repair kit or some sandpaper.
- Apply glue to the area that has been roughened up and wait at least two minutes for the adhesive to set.
- Investigate both the interior and exterior of the tyre for anything that might have caused the puncture, and clear away any debris you find. In addition to that, inspect the tyre for any cuts.

- Take a patch out of your repair kit and peel off the metal foil backing it's attached to. Apply the patch to the adhesive surface with a firm pressing motion.
- Make sure that the spoke vents are covered by the rim tape, and that it is centred within the rim well.

Step 5: Putting the tyre back on the vehicle

- In the event that the tyre has been removed in its entirety, check to see that the tread pattern is oriented in the appropriate way. Place one tyre wall over the rim edge on one side, ensuring that the tread remains aligned in the appropriate direction throughout the process.
- Before inserting the tube into the rim of the tyre, you should first partially inflate the tube so that any wrinkles can be removed.
- Start at the valve and roll the tube that is only partially inflated into the well on the rim of the rim.
- After the tube has been seated into the rim well, give the tube valve a good, solid push to ensure that it is properly seated.
- Begin rolling the tyre's exterior wall onto the rim by starting at the valve and working your way around. In order to accomplish this, you should not utilise the levers. Always make sure to double check that the tube is not being compressed by the tyre.
- To increase the amount of stretch in the tyre, begin at the valve and roll or pinch the rubber in a forward motion. This should be done in the event that the tyre is a snug fit.
- After the tyre has been mounted, you should inflate the tube, after which you should inspect the valve for any more air leaks and ensure that the tyre does not have any bulges.

Exercise

A. Short Questions

Q1. What do you mean by hand propelled tricycle?

Q2. Describe the components of a hand propelled tricycle.

B. Write down process of puncture repairing

Steps	Actions
Step 1	
Step 2	
Step 3	
Step 4	
Step 5	

Notes

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https://www.youtube.com/watch?v=LCt32DW1pbk

Manufacturing of Hand Propelled Tricycle

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& ENTREPRENEURSHIP

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National
Skill Development
Corporation
Transforming the skill landscape

SCPwD
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Skill Council for Persons with Disability

6. Assemble, Repair and Maintain a Folding Wheelchair

Unit 6.1 – Folding Wheelchair and its Parts

Unit 6.2 – Assembling, Repairing and Maintenance of Folding Wheelchair

Terminal Outcomes

By the end of this module, participants will be able to:

1. Assemble a folding wheelchair.
2. Repair and service a folding wheelchair.

Unit 6: Assemble, Repair and Maintain the Folding chair

Key Learning Outcomes

At the end of this module, you will be able to:

Theory - Key Learning Outcomes	Practical - Key Learning Outcomes
• Describe the various parts of a folding wheelchair and their function. • Select the standard gradings of various components and hardware and fittings used in the assembly of a folding wheelchair. • List the tools and equipment used to assemble/service a folding wheel chair. • Explain the procedure of repair and maintenance of a folding wheel chair. Describe the steps for quality check to ensure the smooth functioning of the folding wheelchair.	• Select the various parts of a folding wheel chair. • Demonstrate the steps of fitting a strip folding and its fasteners on a folding wheelchair. • Show the steps to assemble cloth guard with the side frame using self- tapping screw. • Demonstrate how to fix both side frames assembly with strip holding. • Demonstrate how to fit a rim assembly, tyre mounting, axle fitting with the rear wheel, using appropriate fasteners as per specifications. • Show how to fix a castor wheel with stem, fork, and plate bearings. • Demonstrate the assembly of seat and back rest with appropriate self- tapping screw. • Show the steps to assemble foot rest with rubber pad in the folding wheelchair. • Perform a check of the various parts of a folding wheelchair to identify faults. • Perform repair and service of folding wheelchair. • Conduct a test drive to ensure accurate functioning of the folding wheelchair.

Unit 6.1 Folding Wheelchair and its Components

Unit Objectives

At the end of the session, participant will be able to:

- Describe the various parts of a folding wheelchair and their function.

6.1.1: Wheelchair

People who have trouble walking often make use of assistive equipment, and one of the most prevalent ones is the wheelchair. Wheelchairs are designed to encourage mobility and improve quality of life for those who use them.When an individual's needs and the conditions of their environment are met, a wheelchair is considered appropriate. Other criteria for appropriateness include the wheelchair's ability to provide proper fit and postural support based on sound biomechanical principles, as well as its safety and durability.

Benefits of Wheelchair

The following are some of the advantages of utilising a proper wheelchair:

Figure 6.1.1: Benefits of a wheelchair

Selection of Wheelchair

The following important considerations should be taken into account when choosing a wheelchair for a person with a disability:

- Strength of the user
- Storage
- Frequency of use
- Transferring to and from wheelchair
- Areas where wheelchair would be used

6.1.2: Types of Wheelchairs

Let's have a look at the various wheelchair options that are available.

Self-Propelled

This model of wheelchair is likely the one that sees the most daily use. People who use wheelchairs on a daily basis and have sufficient muscle in the upper part of their bodies, particularly in their arms, frequently make use of seats like this. These types of wheelchairs feature four wheels (two smaller caster wheels in front and two large side wheels), push-rims, footrests, and a back cushion. These wheelchairs are distinguished from those that are propelled by an attendant by virtue of the presence of push-rims. The user of a self-propelled wheelchair propels themselves across the environment with the assistance of the chair's push-rims. Therefore, the user needs to have sufficient strength in their arms.

There are two categories of wheelchairs that propel themselves:

Folding Frame	Rigid Frame
A wheelchair with the ability to fold up can be compressed so that its two sides are brought closer together. When it is in the folded condition, the wheelchair requires a smaller amount of space when it is being stored. These wheelchairs are able to be transported into a car with relative ease and may also be readily kept in a home or office setting.This type of wheelchair has a seat that is constructed of a material that can be folded, such as fabric, leather, or a synthetic substance called artificial leathercloth. A seat with such a high degree of flexibility enables the chair's sides to fold and come closer together.	Wheelchairs of this sort cannot be folded up for storage. Wheelchair users who rely on their chairs on a daily basis favour these since they are more durable. The seats of chairs with rigid frames can be constructed out of solid materials such as metal, wood, plastic, and so on. These chairs have a heavier structure than those that fold up.
 *Figure 6.1.2: Folding wheelchair*	 *Figure 6.1.3: Rigid Frame wheelchair*

These chairs are frequently fabricated on demand specifically for the purchaser. A variety of wheelchair accessories, such as those listed below, might be attached to self-propelled wheelchairs.

- Anti-tip bars or wheels
- Safety belts
- Adjustable backrests
- Tilt and/or recline features

- Extra support for limbs or head and neck
- Holder for crutches
- Holder for oxygen tanks
- Drink holders
- Mud and wheel-guards

Attendant-Propelled

The rear of these wheelchairs are equipped with handles that make it easier for an attendant to propel the wheelchair ahead. The wheels on this sort of chair are often more compact than those seen on chairs that propel themselves. On occasion, the attendant's handles will come equipped with their own built-in brakes. Additionally, parking brakes are offered, and the attendant has the option of using either his hand or foot to apply them.

Figure 6.1.4: Attendant-Propelled wheelchair

Motorized or Powered Wheelchair

Electricity provides the propulsion for wheelchairs known as powerchairs. The frame of the wheelchair contains batteries as well as electric motors, which are responsible for turning the wheels. On the armrest of these chairs is a joystick that serves as the chair's controller. If the chair is intended to be controlled by an attendant, the joystick could in some instances be mounted on the upper side of the chair.Motorized wheelchairs may easily travel further than 15 kilometres on a single charge of their battery. In the event that the individual utilising the wheelchair is unable to manipulate the joystick, many other forms of control methods, such as:

- Head-switches
- Chin-operated joysticks
- Sip-and-puff controllers

Figure 6.1.5: Powered wheelchair

Other Types of Wheelchair

We gained familiarity with the types of wheelchairs that are most frequently put into use. However, there are also a number of additional formats that are more specialised. For example:

- Standing wheelchair
- Mobility Scooter
- Sports Wheelchair
- Reclining Wheelchair
- Beach Wheelchair
- Stair Climbing Wheelchair

6.1.3: Parts of Wheelchair

People who have trouble walking often make use of assistive equipment, and one of the most prevalent ones is the wheelchair. Wheelchairs are designed to encourage mobility and improve quality of life for those who use them.When an individual's needs and the conditions of their environment are met, a wheelchair is considered appropriate. Other criteria for appropriateness include the wheelchair's ability to provide proper fit and postural support based on sound biomechanical principles, as well as its safety and durability.

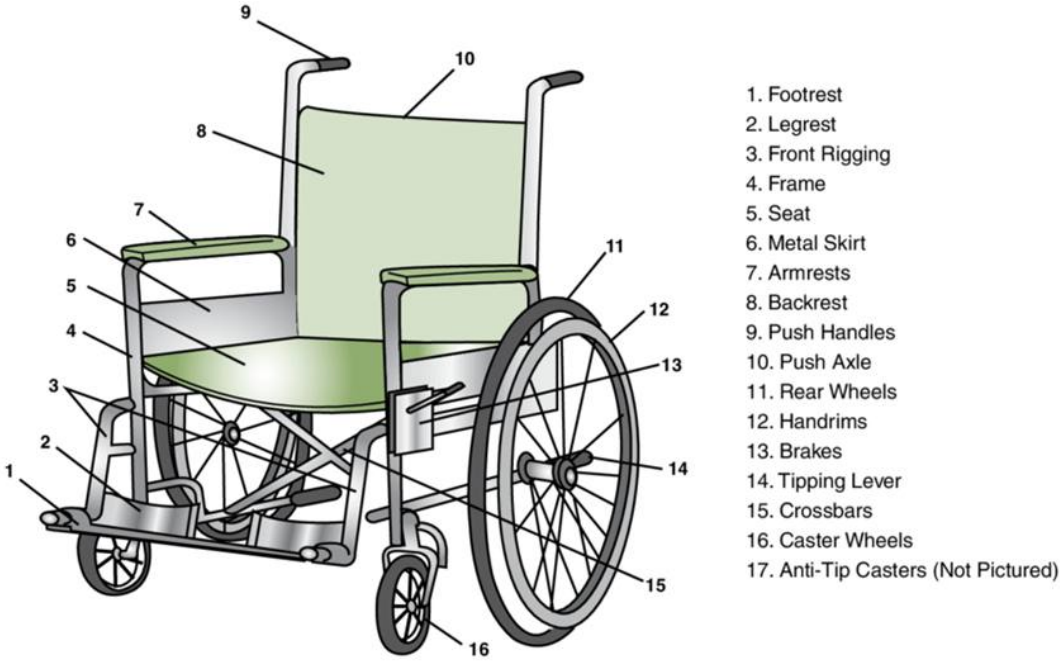


Figure: 6.1.1.1: Parts of Wheelchair

The frame is the most fundamental component of a manual wheelchair, and it also has the greatest impact on how well the chair performs. However, the components that are attached to the frame in order to create a manual wheelchair that is functional are also significant. The tyres, wheels, axles, casters, leg rests, and armrests are the most important parts. Other important parts are the armrests.

Tyres

Wheelchair tyres are typically made of either solid rubber or pneumatic rubber (air-filled). Wheelchairs with standard sizes almost invariably have solid rubber tyres, and lightweight wheelchairs may have solid rubber tyres as an option. These tyres have a high rolling resistance, which results in a rough ride, but they have low wear rates and require little maintenance. Another benefit is that they are inexpensive. Wheelchairs that are considered ultralight almost always, and wheelchairs that are considered lightweight occasionally, employ pneumatic tyres. These tyres feature a reduced rolling resistance, a softer ride, and a lower overall weight, but they have a high wear rate and require a lot of care. They are also lower in weight (particularly in maintaining appropriate air pressure).

Wheels

The spokes (wires) or moulds are used to make the wheels most of the time (mag). The diameter of wheelchair wheels can range anywhere from around 30 to 66 centimetres (12 to 26 inches) in circumference, depending on the wheelchair's intended use. Molded wheels require nothing in the way of upkeep and maintenance. On the other hand, they are noticeably more cumbersome and offer a lower level of responsiveness than spoked wheels.

Axles

Axles for the rear wheels can either be permanent or equipped with a quick-release mechanism. Wheelchairs that fall into the "standard" category nearly always have fixed axles. Wheelchairs that are classified as ultralight will nearly always have quick-release axles, while wheelchairs that are classified as lightweight will either have fixed or quick-release axles. Fixed axles consist of a bolt and a locknut that must be removed using special equipment before the rear wheel can be attached to the frame. A quick-release system consists of a button on the end of the axle that, when depressed, makes it possible to quickly remove the tyre without the need for any additional tools. It's possible that this is an essential step in the process of disassembling a wheelchair so that it can be transported in a car. The quick-release axle, on the other hand, needs to be monitored frequently and requires less maintenance than the fixed axle.

Casters

The diameter of the casters can range from around 7.6 to 23.8 centimetres (about 3 to 9 inches), with the bulk of them falling within the range of 12.7 to 20.3 centimetres (about 5 to 8 inches). Caster tyres may be made of solid rubber or pneumatic rubber, although caster wheels may only have either mag or solid hubs.

Leg rests

There are three different options for the leg rests:

- Fixed
- Swing-away
- Elevating

They are made consisting of a footplate that provides support for the individual's feet and a hanger that is attached to the frame of the device. Leg rests that are fixed in place are an inherent part of the frame; as a result, the whole system is less in weight because there are fewer components. Transfers into and out of the wheelchair are made much simpler by the availability of swing-away leg rests, which detach from the frame of the wheelchair and swing away from it. The leg position can be raised or lowered by adjusting the angle at which the lower extremities are positioned in respect to the seat surface using elevating leg supports. This is frequently essential in order to address the

unique physiologic concerns of an individual (e.g., swelling in the lower extremities).

Armrests

The armrests can either have a height that is set or one that can be adjusted. Armrests make it easier for an individual to transfer because they provide a handhold for them. They provide a means for weight shifting and support for the individual's upper extremities when the individual is not propelling the wheelchair. They also provide support for the individual's upper extremities when the individual is propelling the wheelchair. If the individual has the strength to lift his or her body weight using the upper extremities, then the individual does not need these supports.

Exercise

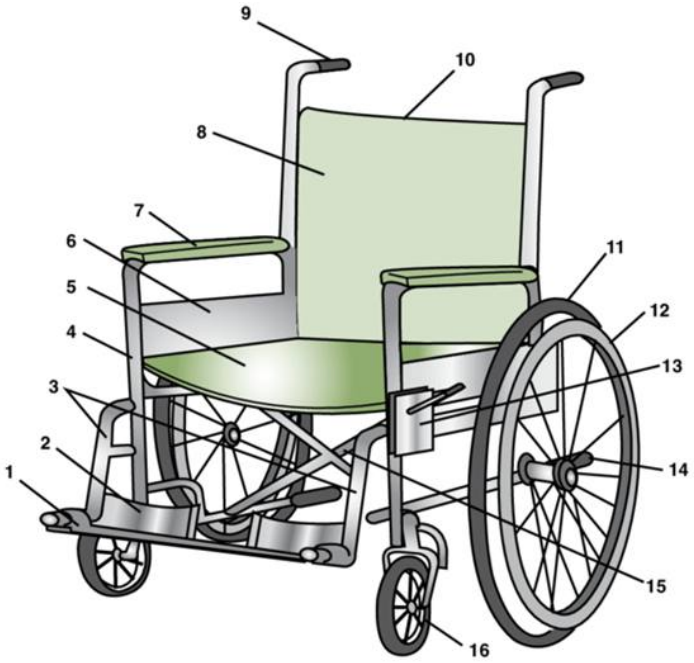
A. Short Questions

Q1. What do you mean by wheelchair?

Q2. Describe different types of wheelchairs.

B. Label the diagram

1. Describe various parts of a wheelchair.



Unit 6.2 Assembly, Repair and Maintenance of Folding Wheelchair

Unit Objectives

At the end of the session, participant will be able to:

- Select the standard gradings of various components and hardware and fittings used in the assembly of a folding wheelchair.
- List the tools and equipment used to assemble/service a folding wheel chair.
- Select the various parts of a folding wheel chair.
- Demonstrate the steps of fitting a strip folding and its fasteners on a folding wheelchair.
- Show the steps to assemble cloth guard with the side frame using self-tapping screw.
- Demonstrate how to fix both side frames assembly with strip holding.
- Demonstrate how to fit a rim assembly, tyre mounting, axle fitting with the rear wheel, using appropriate fasteners as per specifications.
- Show how to fix a castor wheel with stem, fork, and plate bearings.
- Demonstrate the assembly of seat and back rest with appropriate self-tapping screw.
- Show the steps to assemble foot rest with rubber pad in the folding wheelchair.
- Perform a check of the various parts of a folding wheelchair to identify faults.
- Perform repair and service of folding wheelchair.
- Conduct a test drive to ensure accurate functioning of the folding wheelchair.

6.2.1: Assembly of Folding Wheelchair

The assembly of the side frame is responsible for supporting a castor frame piece, pivoting shafts of the folding mechanism, axles of the driving wheel, and a seat back tube. It is possible to construct the side frame assemblies using compression or injection moulded composite polymers. The assemblies are made up of two parts that are secured together after being constructed. Adjusting the angle of the seat is accomplished by rotating the side frame assemblies around a pivot point that is situated in an area of the side frame assembly that is both forward and upward.

Let's get familiar with the process of putting together a wheelchair.

Step 1: Determine which components of the wheelchair are necessary for the assembly process, and then check to see that you have the necessary number of those components.

Name of the Parts	Quantity
Chassis	1 Pieces
Rear Wheels	2 Pieces
Castor Wheels	2 Pieces
Back Rest	1 Pieces
Foot rest Or Footplates	1 Pieces 2 Pieces
Brakes or Handbrake	2 Pieces 1 Pieces
Side Guard	2 Pieces
Anti-tip	2 Pieces
Push handles	2 Pieces

Step 2:Mount the rear wheels.

- To unlock the Quick release mechanism, you will need to press the button located in the middle of the hub.
- Place the wheel axle completely into the housing located on the chassis.
- Take your finger off the button, and then pull the wheel in the opposite direction to see if it moves freely.

Step 3: Mount the castor wheels.

- Put the castor fork's axle into the housing on the housing's end.
- Install the washer first, followed by the anchor nut, onto the axle.
- Make sure there is no slack in the anchor nut once you have tightened it, but the castor fork should still be able to revolve freely.

Step 4: Mount the foot rest.

- Put some lubricant on it and then insert the footrest tubes into the frame of the chassis.
- You can make adjustments to the height by picking one of the holes (1) that should be the centre hole (2).
- Install the screws and make sure they are snug.
- Position the plastic cover lids appropriately.
- To loosen a 19 mm spanner, use a plastic hammer to give it a few light taps.

Step 5: Mount the backrest.

- Use a bolt and washers to secure the back rest to the chassis.
- Turn the screw (1) anticlockwise to loosen it, then adjust the back rest lock (2) until the pin (4) falls out.
- To ensure that the pin slides easily into the slot, pull the wire a few times in order to test it. The screw should then be tightened (1).
- It is important to complete this task simultaneously on both sides.

Step 6: Mount the brakes

- Position the brake bracket so that it is flush against the chassis tube.
- Turn the screw clockwise a little bit.
- Engage the parking brake and adjust it so that it dips approximately 5 mm into the tyre after it has been inflated to 8 bar.
- Turn the screw all the way in.

Step 7: Mount the side guards.

- Put the side guards in the brackets that are located on either side of the seat.

Step 8: Mount the anti-tip device.

- Install the anti-tip device so that it looks like the photographs depict.
- Put a washer on each of the bolts, one on each side.

Step 9: Mount the push handles.

- Put the handle of the push button into the frame tube of the back rest.
- The threaded hole (1) should centre hole (2).
- To make the push handle more secure, insert the screw into the hole and turn it clockwise.

6.2.2: Maintenance of Folding Wheelchair

The type of use that a manual wheelchair is put through affects both the model that it is and the level of maintenance that it requires. It is important to keep in mind that some components see more wear and tear than others, and as a result, they must constantly be in ideal condition in order to guarantee that they will continue to perform as intended and remain safe.

- On a monthly basis, the tyre pressure should be checked, as well as the general condition of the tyres.
- Make sure that the brakes are in good working order and that they have been calibrated correctly, paying particular attention to the fittings.
- Check the tightness of each screw once every three to four months. Verify that all of the joints that are significant for the safety of the user are equipped with self-locking bolts of the appropriate type.
- Use a gentle cleaning solution to wipe down the frame of the chair. Simply using soap and water to clean the backrest and cushion is the only method recommended. When in doubt, refer to the instructions provided by the manufacturer.
- Use only the original parts, or those that are recommended by the company that made your wheelchair.
- If the seat becomes wet while being used, make an effort to dry it off afterward, and avoid putting it away while it is still wet. If the wheelchair has been in the presence of sand or salt, it needs to be cleaned thoroughly because either substance might ruin the wheel bearings.
- Applying a very modest amount of oil to the axes will make disassembly much easier to do. This should be done on a usage-based schedule, although once every two months is the frequency that is typically recommended. In the event that the chair becomes difficult to move or if it starts to creak, the moving parts should also be oiled.

6.2.3: Repair of Folding Wheelchair

Replacing a Flat Tyre

1. Let as much air out of the tyre as you possibly can.
2. Position a tyre lever so that it is beneath one edge of the tyre and above a spoke. While pressing down on the lever, rotate the tyre until the area under the lever is free from the rim. Put the end of the tyre lever that has the hook around the corresponding spoke in order to secure it. When applying pressure to the tyre, it is recommended that you have a firm grip on the tyre lever close to the end that is located under the tyre. This is because the tyre levels are made of plastic and have a propensity to break.
3. Position the second tyre lever so that it is a few inches away from the first tyre lever.
4. Repeat the previous step of pressing down on the lever until the corresponding portion of the tyre is flipped over the rim. Then, move this tyre lever clockwise around the tyre until one edge of the tyre is entirely detached from the rim.
5. Take the tube out of the slot.
6. Run your finger along the inside of the tyre as well as the rim, and remove any shards of glass or any other sharp items or surfaces that may have damaged the tube by running your finger down the inside of the tyre and along the rim.
7. Inflate the new tube until it maintains its circular shape as you continue to inflate it.
8. Insert the tube into the tyre in such a way that the stem of the valve fits through the corresponding hole in the rim.
9. Starting at the valve stem and going around the rim, knead the tyre back onto the rim by hand, starting at the centre of the rim. It's possible that if you only use your four hands, you won't be able to get the tyre entirely back on the rim. Tire levers can be used to fasten the remaining portion of the tyre onto the rim of the wheel.
10. Ensure that the stem of the valve is positioned so that it is perpendicular to the rim (i.e. not slanted). When required, correct it.
11. Reinflate the tube to the pressure that is specified on the tire's sidewall.

Exercise

A. Short Questions

Q1. What do you mean by assembly of a wheelchair?

Q2. Describe the importance of maintenance.

B. Describe the process of wheelchair assembly

Steps	Actions
Step 1	
Step 2	
Step 3	
Step 4	
Step 5	
Step 6	
Step 7	
Step 8	
Step 9	

Notes

Scan the QR Code to watch the related video

https://www.youtube.com/watch?v=8Z9R1C_TwQM

Manufacturing of Wheelchair

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Transforming the skill landscape

7. Assemble, Repair and Maintain Battery - Operated Motorized Tricycle/ Wheelchair

SCPwD
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Skill Council for Persons with Disability

Unit 7.1 – Assemble, Repair and Maintain Battery-Operated Motorized Tricycle

Terminal Outcomes

By the end of this module, participants will be able to:

1. Assemble a battery-operated motorized tricycle/ wheelchair.
2. Carry out service and repair on a battery-operated motorized tricycle/wheelchair.

Unit 7: Assemble, repair and maintain a battery-operated motorized tricycle/ wheelchair

Key Learning Outcomes

At the end of this module, you will be able to:

Theory - Key Learning Outcomes	Practical - Key Learning Outcomes
• Describe the various parts of a battery-operated motorized tricycle/wheelchair and their function. • List the tools and equipment required for repair of the motorizedwheelchair. • Explain the steps of the standard operating procedures for assemblyand repair of a battery-operated motorized tricycle/wheelchair. • Explain the function and the operating procedure of a digital multi-meter. • State how to use a SMPS battery charger. • Describe the steps for repair and maintenance of a battery-operated motorized tricycle/ wheelchair. • State the common faults in a battery-operated motorized tricycle/ wheelchair and discuss solutions.	• Perform the steps to assemble the various parts of a battery- operated motorized tricycle/wheelchair. • Demonstrate how to use a digital multi-meter to check the battery of a battery-operated motorized tricycle/wheelchair. • Show the steps for acceleration and speed check on a battery- operated motorized tricycle/ wheelchair. • Perform a check on the functioning of horn, light, and indicator. • Show the steps to replace the battery, if required. • Select the appropriate tools and equipment required for repair and maintenance of a battery-operated motorized tricycle/wheelchair. • Perform a check to identify any loose/wrong wiring or physical damage in a battery-operated motorized tricycle/ wheelchair. • Show the steps for repair and maintenance of a battery- operated motorized tricycle/wheelchair as per industry standards. • Conduct a test drive to ensure accurate functioning of a battery-operated motorized tricycle/ wheelchair.

Unit 7.1 Assemble, Repair and Maintain Battery-Operated Motorized Tricycle

Unit Objectives

At the end of the session, participant will be able to:

- Describe the various parts of a battery- operated motorized tricycle/wheelchair and their function.
- List the tools and equipment required for repair of the motorized wheelchair.
- Explain the steps of the standard operating procedures for assembly and repair of a battery-operated motorized tricycle/wheelchair.
- Explain the function and the operating procedure of a digital multi-meter.
- State how to use a SMPS battery charger.
- Describe the steps for repair and maintenance of a battery-operated motorized tricycle/ wheelchair.
- State the common faults in a battery- operated motorized tricycle/ wheelchair and discuss solutions.
- Perform the steps to assemble the various parts of a battery- operated motorized tricycle/wheelchair.
- Demonstrate how to use a digital multi-meter to check the battery of a battery-operated motorized tricycle/wheelchair.
- Show the steps for acceleration and speed check on a battery- operated motorized tricycle/ wheelchair.
- Perform a check on the functioning of horn, light, and indicator.
- Show the steps to replace the battery, if required.
- Select the appropriate tools and equipment required for repair and maintenance of a battery-operated motorized tricycle/wheelchair.
- Perform a check to identify any loose/wrong wiring or physical damage in a battery-operated motorized tricycle/ wheelchair.
- Show the steps for repair and maintenance of a battery- operated motorized tricycle/wheelchair as per industry standards.
- Conduct a test drive to ensure accurate functioning of a battery-operated motorized tricycle/ wheelchair.

7.1.1: Parts of a Battery- operated Motorized Tricycle or Wheelchair

A battery-operated motorized tricycle or wheelchair typically consists of several parts that work together to provide mobility and support to the user. Here are the main parts of such a device and their functions:

Frame: The frame of the tricycle/wheelchair is the basic structure that supports all other components. It is made of sturdy materials such as aluminum, steel or titanium to provide strength and durability.

Wheels: The wheels of the tricycle/wheelchair are responsible for its movement. The rear wheels are usually larger and powered by a motor, while the front wheels are smaller and provide stability and support. The wheels can be made of rubber, foam or pneumatic material.

Motor:The motor is responsible for powering the rear wheels and driving the tricycle/wheelchair forward. It is usually an electric motor that runs on batteries and can be controlled by a joystick or other control system.

Battery: The battery is the power source for the motor. It is typically a rechargeable lithium-ion battery that provides enough power to run the tricycle/wheelchair for several hours on a single charge.

Controller: The controller is the device that regulates the speed and direction of the tricycle/wheelchair. It receives signals from the joystick or other input device and sends them to the motor.

Joystick: The joystick is the main input device for controlling the tricycle/wheelchair. It is typically mounted on the armrest of the wheelchair and allows the user to control the direction and speed of the tricycle/wheelchair.

Seat: The seat is where the user sits while using the tricycle/wheelchair. It is typically padded for comfort and can be adjusted to accommodate different users.

Footrests: The footrests provide support for the user's feet while using the tricycle/wheelchair. They can be adjusted to accommodate users of different heights and can also be folded up when not in use.

Overall, these parts work together to provide the user with a safe, comfortable, and efficient mode of mobility.

7.1.2: Tools and Equipment to RepairMotorized Tricycle or Wheelchair

The tools and equipment required for repairing a motorized wheelchair will depend on the specific issue that needs to be addressed. However, here are some common tools and equipment that may be required:

Screwdrivers: A set of screwdrivers with different sizes and types may be required to remove screws and bolts.

Wrenches: Different sizes of wrenches may be needed to tighten or loosen nuts and bolts.

Pliers: Pliers may be required for gripping, twisting, or cutting wires or cables.

Multimeter: A multimeter is an essential tool for diagnosing electrical problems and testing the battery voltage, resistance, and continuity.

Soldering iron: A soldering iron may be needed to fix or replace damaged wires or connectors.

Wire strippers: Wire strippers are used to remove the insulation from wires, making it easier to work with them.

Battery charger: A battery charger may be required to charge the battery if it's not holding a charge or if it has drained completely.

Tire pump: A tire pump may be required to inflate the tires if they are low on air.

Lubricant: A lubricant may be required to lubricate the moving parts of the wheelchair, such as the wheels and bearings.

Replacement parts: Replacement parts such as fuses, switches, batteries, and motors may be required depending on the nature of the repair needed.

7.1.3: Standard Operating Procedures for Assembly and Repair

The standard operating procedures for assembly and repair of a battery-operated motorized tricycle/wheelchair can vary depending on the manufacturer and the specific model of the vehicle. However, here are some general steps that can be followed:

Assembly

Step 1 - Unpack the components: Remove all the components from the packaging and ensure that all parts are present.

Step 2 - Assemble the frame: Follow the instructions to assemble the frame of the tricycle/wheelchair, including attaching the wheels, handlebars, and seat.

Step 3 - Install the motor: Depending on the design of the vehicle, the motor may need to be installed and connected to the battery and wiring.

Step 4 - Attach the battery: Connect the battery to the wiring and install it in its designated location on the vehicle.

Step 5 - Test the vehicle: Turn on the power switch and test the vehicle to ensure that it's functioning correctly. Check the brakes, lights, and speed settings to ensure that everything is working as expected.

Repair

Step 1 - Identify the problem: Use diagnostic tools such as a multimeter to identify the source of the problem.

Step 2 - Disassemble the affected component: Depending on the problem, the affected component may need to be disassembled to access the damaged or faulty part.

Step 3 - Replace or repair the faulty part: Replace or repair the damaged or faulty part as needed, using appropriate tools and equipment. This may include replacing a motor, battery, or wiring.

Step 4 - Reassemble the component: Reassemble the component after the repair is complete.

Step 5 - Test the vehicle: Test the vehicle to ensure that the repair has been successful and that the vehicle is functioning correctly.

It's important to follow the manufacturer's instructions for assembly and repair, as well as any safety guidelines, to ensure that the tricycle/wheelchair is assembled and repaired correctly and safely.

7.1.4: Digital Multimeter

A digital multimeter (DMM) is an electronic device used to measure different electrical quantities like voltage, current, resistance, continuity, and more. Here's an overview of its function and operating procedure:

Function

The main function of a digital multimeter is to measure electrical quantities with high accuracy and precision. The device contains an analog-to-digital converter (ADC) that converts the measured analog signal to a digital signal, which is displayed on the DMM's screen.

Operating Procedure

Select the function and range: The first step is to select the function (voltage, current, resistance, etc.) you want to measure and the appropriate range. For example, if you want to measure DC voltage, select the DC voltage function, and choose the range that is higher than the voltage you expect to measure.

Connect the leads: Connect the test leads to the DMM and the circuit you want to measure. Make

sure the leads are connected properly to avoid any short circuits or wrong readings.

Take the measurement: Once the leads are connected, take the measurement by touching the probes to the circuit points. If you are measuring voltage or current, make sure the DMM is connected in series or parallel with the circuit.

Read the measurement: The DMM will display the measured value on its screen in digits. Some DMMs also have a bar graph or other display features to help you interpret the reading.

Interpret the results: After you have the measurement, you can interpret the results and determine if the circuit is working correctly or not. You can also use the DMM to troubleshoot electrical problems by measuring different components and comparing the readings to the expected values.

Turn off the DMM: After you have finished using the DMM, turn it off to conserve battery life.

In a nutshell, a digital multimeter is an indispensable piece of equipment for performing very accurate and precise measurements of electrical quantities. You can use a digital multimeter (DMM) to diagnose electrical issues, evaluate the operation of circuits, and carry out a wide variety of other jobs that are connected to electrical measurement so long as you follow the operating procedure.

7.1.5: SMPS Battery Charger

A Switched Mode Power Supply (SMPS) battery charger is a device that is used to charge batteries using high-frequency switching technology. Here's a step-by-step guide on how to use an SMPS battery charger:

- Ensure that the charger is compatible with the battery you want to charge. Check the battery voltage and current rating to make sure they match the specifications of the charger.
- Connect the charger to the battery. Connect the positive and negative terminals of the charger to the corresponding terminals on the battery. Ensure that the polarity is correct to prevent damage to the battery or the charger.
- Plug the charger into an AC outlet. Connect the charger to an AC outlet using the power cord provided. Make sure the outlet is grounded and provides the correct voltage and frequency for the charger.
- Turn on the charger. Turn on the charger by pressing the power button or switch. Some chargers may have an LED indicator that shows the charging status of the battery.
- Monitor the charging process. Monitor the charging process and check the battery voltage and current periodically to ensure that the battery is charging properly. If the charger has a built-in timer, it will automatically shut off when the battery is fully charged.
- Turn off the charger. Once the battery is fully charged, turn off the charger and disconnect it from the battery and the AC outlet. Do not leave the charger connected to the battery for an extended period as it may damage the battery.

7.1.6: Repair and Maintenance of a Battery-operated Motorized Tricycle/ Wheelchair

Here are the steps for the repair and maintenance of a battery-operated motorized tricycle/wheelchair:

1. Regular Cleaning

Battery-operated motorized tricycles/wheelchairs should be cleaned regularly to remove dirt, dust, and debris. Use a soft cloth or sponge and mild detergent to clean the exterior and interior

parts of the tricycle. Avoid using water or any abrasive materials that may damage the electronic components.

2. Inspection of the Battery and Charger

Inspect the battery and charger for any damage or signs of wear and tear. Check the terminals and connectors for corrosion or loose connections. If there are any issues, clean or tighten the connections as necessary. If the battery or charger is damaged or not functioning properly, replace them with a new one.

3. Inspection of Tires and Wheels

Check the tires and wheels for any damage, wear, or punctures. Replace any damaged or worn-out tires and wheels with new ones. Ensure that the tires are inflated to the recommended pressure level.

4. Inspection of Brakes

Check the brakes for any damage, wear, or malfunction. Test the brakes to ensure that they are functioning properly. If there are any issues, adjust or replace the brakes as necessary.

5. Inspection of Control Panel and Joystick

Check the control panel and joystick for any damage or signs of wear and tear. Test the buttons and joystick to ensure that they are working properly. If there are any issues, repair or replace the control panel or joystick.

6. Lubrication of Moving Parts

Lubricate the moving parts of the tricycle, such as the joints, hinges, and bearings, to ensure smooth operation. Use a recommended lubricant to avoid damaging the parts.

7. Check for Loose Bolts and Nuts

Check for any loose bolts and nuts on the tricycle and tighten them as necessary. This will prevent any issues caused by loose parts.

8. Test Drive

Finally, test drive the tricycle to ensure that it is functioning properly. Make sure that the battery is fully charged before the test drive.

By following these steps, you can ensure the proper repair and maintenance of a battery-operated motorized tricycle/wheelchair, which will help prolong its lifespan and ensure its safe operation.

7.1.7: Common Faults in a Battery-operated Motorized Tricycle/Wheelchair

Here are some of the common faults that may occur in a battery-operated motorized tricycle/wheelchair and the possible solutions:

1. Battery Problems

One of the most common issues with battery-operated motorized tricycles/wheelchairs is battery-related problems. The battery may not hold a charge, or it may discharge quickly, causing the tricycle to stop working. To fix this issue, you can replace the battery with a new one or have it tested and reconditioned it.

Battery Replacement

The steps to replace the battery in a battery-operated motorized tricycle or wheelchair are as follows:

Turn off the vehicle: Before replacing the battery, turn off the vehicle and disconnect it from any power source.

Locate the battery: The battery is usually located under the seat or on the side of the vehicle. Check the owner's manual to locate the battery if you are unsure.

Remove the old battery: Use a wrench or screwdriver to remove the bolts or screws that hold the battery in place. Carefully remove the old battery from the vehicle.

Clean the battery compartment: Use a clean cloth to wipe down the battery compartment and remove any dirt or debris that may have accumulated.

Install the new battery: Carefully place the new battery in the compartment, making sure it is properly aligned with the terminals. Secure the battery in place with the bolts or screws.

Connect the terminals: Connect the positive terminal of the battery to the positive cable, and the negative terminal of the battery to the negative cable. Tighten the nuts or bolts securely.

Turn on the vehicle: Once the battery is properly installed and connected, turn on the vehicle to ensure it is working properly. Test the throttle and brakes to make sure they are functioning correctly.

Charge the battery: If the battery is not fully charged, plug the charger into the battery and allow it to charge fully before using the vehicle.

Dispose of the old battery properly: Batteries contain hazardous materials and should be disposed of properly. Check with your local recycling center or battery retailer for instructions on how to dispose of the old battery safely.

Overall, replacing the battery in a battery-operated motorized tricycle or wheelchair is a simple process that can be done with basic tools.

2. Motor Problems

Another common issue with battery-operated motorized tricycles/wheelchairs is motor problems. The motor may stop working or may not provide enough power to move the tricycle. To fix this issue, you can check the motor connections and replace the motor if necessary.

3. Brake Problems

Brake problems are also common in battery-operated motorized tricycles/wheelchairs. The brakes may not work correctly, making it difficult to stop the tricycle. To fix this issue, you can adjust the brakes, replace the brake pads, or replace the entire brake system if necessary.

4. Control Panel Problems

Control panel problems may also occur in battery-operated motorized tricycles/wheelchairs. The control panel may not work correctly, or the joystick may not respond. To fix this issue, you can check the connections and replace the control panel or joystick if necessary.

5. Tire Problems

Tire problems, such as flat or punctured tires, can also occur in battery-operated motorized tricycles/wheelchairs. To fix this issue, you can replace the tire or repair it with a patch or sealant.

6. Loose Connections

Loose connections can also cause issues in battery-operated motorized tricycles/wheelchairs. The connections may become loose over time, causing the tricycle to stop working. To fix this issue, you can tighten the connections or replace the faulty parts.

In a nutshell, the common faults that may occur in a battery-operated motorized tricycle/wheelchair are battery problems, motor problems, brake problems, control panel problems, tire problems, and loose connections. By identifying the fault and applying the appropriate solution, you can restore the tricycle to its proper working condition.

Performance Check of the Functioning of Horn, Light, and Indicator

Performing a check on the functioning of horn, light, and indicator in a battery-operated motorized

tricycle or wheelchair is essential to ensure the vehicle is safe to use. Here are the steps to perform this check:

Turn on the vehicle: Turn on the vehicle and ensure the battery is fully charged.

Check the horn: Press the horn button and listen for a sound. If the horn does not work, check the wiring and connections to ensure they are secure. Replace the horn if it is damaged or not functioning correctly.

Check the lights: Turn on the headlights and taillights and check if they are working properly. If the lights are dim or not functioning correctly, check the wiring and connections to ensure they are secure. Replace any damaged bulbs or connections.

Check the indicators: Turn on the indicators and check if they are functioning correctly. Ensure the bulbs are working correctly and replace any damaged bulbs. Check the wiring and connections to ensure they are secure.

Test drive: Take the vehicle for a test drive to ensure the horn, lights, and indicators are functioning correctly while in motion. This will help you identify any issues that may have been missed during the stationary check.

Fix any issues: If any issues are found during the check, fix them before using the vehicle. Seek the help of a professional mechanic if necessary.

7.1.8: Steps for Acceleration and Speed Check

Performing an acceleration and speed check on a battery-operated motorized tricycle or wheelchair is important to ensure the vehicle is operating safely and efficiently. Here are the steps to perform this check:

Turn on the vehicle: Turn on the vehicle and ensure the battery is fully charged.

Clear the area: Move the vehicle to an open area where there are no obstacles or people. This will ensure that the test can be performed safely.

Acceleration check: Accelerate the vehicle slowly from a stationary position and note the time it takes to reach a predetermined speed. For example, you can start the test from 0 mph and measure the time it takes to reach 5 or 10 mph. Repeat this process multiple times to get an accurate measurement. If the vehicle is not accelerating properly, check the battery, motor, and throttle to ensure they are functioning correctly.

Speed check: Once the vehicle has reached the desired speed, use a speedometer to measure the actual speed of the vehicle. You can also use a GPS device or a speed-tracking app on a smartphone. Ensure that the speedometer or speed-tracking device is accurate to get an accurate measurement.

Test drive: Take the vehicle for a test drive to ensure it is functioning correctly at higher speeds. Pay attention to any unusual noises or vibrations and address them if necessary.

Adjustments: If the acceleration or speed is not up to par, check and fix it and make the necessary adjustments to the battery, motor, and throttle to ensure the vehicle is operating safely and efficiently.

Exercise

A. Short Questions

Q1. What do you mean by a battery-operated tricycle or wheelchair?

Q2. Describe common problems of a battery-operated tricycle or wheelchair.

B. Match the Columns

Connect items in column A to their appropriate ones in column B.

Column A	Column B
Step 1	a. Insert the Red wire into the VΩ jack.
Step 2	b. Insert the black wire into the COM jack.
Step 3	c. Place the probes to the two ends of the material and set the resistance
Step 4	d. Turn the dial to Ω

C. Fill in the Blanks

a. The_____of the tricycle/wheelchair is the basic structure that supports all other components.

b. The_____is responsible for powering the rear wheels and driving the tricycle/wheelchair forward.

c. _____is typically mounted on the armrest of the wheelchair and allows the user to control the direction and speed of the tricycle/wheelchair.

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8. Repair and Maintain Hearing Aids (Digital)

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Skill Council for Persons with Disability

Unit 8.1 – Hearing Aids

Unit 8.2 – Repairing and Maintenance of Digital Hearing Aids

PWD/ N0304

Terminal Outcomes

By the end of this module, participants will be able to:

1. Perform check to verify the need for repair of Hearing aids (Digital).
2. Carry out maintenance and adjustment of hearing aids (Digital).

Unit 8: Repair and Maintain Hearing Aids (Digital)

Key Learning Outcomes

At the end of this module, you will be able to:

Theory - Key Learning Outcomes	Practical - Key Learning Outcomes
• Describe the various types of hearing aids and their functions. • Describe the various parts of a hearing aid (Digital) and their functions. • Explain the steps for maintenance and repair of hearing aids (Digital). • Describe how to use basic electronic components to service and repair hearing aids (Digital). • State the common faults in a hearing aid (Digital) and discuss solutions.	• Show how to assemble electronic circuits using basic electrical tools (like multi-meters, soldering equipment etc.). • Select the appropriate method and tools to repair a hearing aid (Digital). • Demonstrate the steps to repair common faults in a hearing aid (Digital). (check if battery is on or volume is set too low). • Perform the steps for maintenance of the hearing aid (such as cleaning the hearing aid, replacing the battery etc.). • Show the steps to reassemble a hearing aid (Digital) after repair. • Conduct a test to ensure the proper functioning of the hearing aid after repair.

Unit 8.1 Hearing Aids

Unit Objectives

At the end of the session, participant will be able to:

- Describe the various types of hearing aids and their functions.
- Describe the various parts of a hearing aid (Digital) and their functions.

8.1.1: Hearing Aids and its Types

Hearing Aids

Hearing aids are compact electronic devices that can be worn in or behind the ear to improve a person's hearing. It makes some sounds louder so that a person with hearing loss can listen, speak, and engage more completely in daily activities. Hearing aids are able to improve a person's ability to hear in both quiet and loud environments.

Figure 8.1.1: Hearing Aids

Hearing aids are most helpful for people who suffer hearing loss as a consequence of damage to the microscopic sensory cells in the inner ear known as hair cells. This type of hearing loss makes it more difficult for the person to hear and understand speech. Sensorineural hearing loss is the name given to this particular form of hearing impairment. The damage may be brought on by illness, the natural process of ageing, or trauma brought on by loud noises or certain medications.

Working of Hearing Aids

A hearing aid boosts the volume of sound waves when they enter the ear canal.

Those hair cells that have survived sense greater vibrations and turn them into neural signals that are then transmitted to the brain.

Figure 8.1.2: Working of Hearing Aids

Remember the more severely a person's hair cells are damaged, the more severe their hearing loss will be, and the higher the amplification level of their hearing aid will need to be in order to compensate. However, there are limits to the amount of amplification that may be provided by a hearing aid due to practical considerations. Even significant vibrations won't be translated into brain impulses if the inner ear has been severely injured to the point where it can't process them. In this circumstance, the use of a hearing aid would be pointless.

Parts of Hearing Aids

Hearing aids are comprised of four primary components:

- Microphone
- Amplifier
- Speaker
- Battery

The sound is picked up by the hearing aid's microphone, which then transforms the sound waves into electrical impulses and transmits them to an amplifier for amplification. After boosting the strength of the signals, the amplifier next delivers them to the listener's ear through a speaker.Hearing aids require a constant source of power, which is provided by the battery.

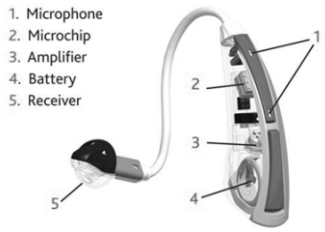


Figure 8.1.3: Parts of Hearing Aid

Hearing aids vary in the following ways:

- Design
- The technology that is utilised in the process of amplifying (i.e., analogue vs. digital)
- Special features

Some hearing aids also include earmolds or earpieces, which are designed to improve the quality of sound by directing the flow of sound into the ear. The nature and degree of a person's hearing loss, as well as their listening preferences and the demands of their lifestyle, all play a role in the choice of hearing aid.

Analogue vs Digital Hearing Aids

Hearing aids can function in a variety of ways, depending on the electronics inside. Analog and digital electronics are the two primary categories of this field.

Analogue: The sound waves are converted into electrical signals by analogue aids, and these signals are then amplified. Hearing aids that are analogue and customizable are made to order so that they can cater to the specific requirements of each individual user. Your audiologist will consult with you to determine the ideal settings for your hearing aid, and the company that makes it will then configure it accordingly. Hearing aids that are analogue and programmable typically come with more than one program or preset. The hearing aid can be programmed on a computer by an audiologist, and you can modify the settings to accommodate a variety of listening contexts, from a tiny room with little background noise to a noisy restaurant to a vast open space like a theatre or stadium. All forms of hearing aids have the capability of utilizing analogue and programmable technology. The cost of analogue aids is typically lower than the cost of digital aids.

Digital: Before amplifying the sound, digital aids transform sound waves into numerical codes, which are conceptually comparable to the binary code used by computers. Because the code also contains information on the pitch or loudness of a sound, the aid can be specially tuned to amplify certain frequencies more than others, depending on the information contained in the code. An audiologist has greater leeway to tailor a hearing aid to the individual requirements of a user as well as the sonic characteristics of specific listening settings thanks to digital technology. These aids also have the capability of being trained to concentrate on noises originating from a certain direction. Every kind of hearing aid can benefit from the incorporation of digital technology.

Let us know more about analogue and digital hearing aids.

Analogue Hearing Aids	Digital Hearing Aids
	
• Amplification of continuous sound waves is a key feature of analogue hearing aids.	• When sound waves are converted into digital signals, digital hearing aids generate an exact duplicate of the original sound.
• In essence, these hearing aids boost the volume of every sound, whether it's speech or background noise.	• Digital hearing aids use computer chips to interpret speech and other noises in the environment.
• It is possible to customize some analogue hearing aids.	• Enhanced sound quality may be possible in some listening environments because to the digital hearing aids' more sophisticated signal processing (for example, background noise and whistle reduction).
• It has a microchip that allows the hearing aid to be customized for a variety of listening situations, from a quiet environment to a noisy restaurant to a vast open space like a soccer field. • noise.	• They also allow for further customization of the transmitted sound to accommodate a user's unique pattern of hearing loss.
• Hearing aids with analogue programmability can save several settings for different environments.	• Moreover, digital hearing aids may save several different settings in their internal storage.
• A simple click of a button can adjust the hearing aid's settings to account for variations in the surrounding noise.	• Most people today who need a hearing aid are only given the option of digital devices.

8.1.2: Styles of Hearing Aids

Hearing aids can be broken down into three primary categories based on their design. The styles vary in terms of their size, whether they are worn on or inside the ear, and the amount of sound amplification that they provide (see image below).

Figure 8.1.3: Styles of Hearing Aids[1]

Behind-the-Ear (BTE)

Behind-the-ear (BTE) hearing aids have the majority of their components housed in a small plastic case that is worn behind the ear. This case is linked to either an earmold or an earpiece by a length of clear tubing. Because it can fit a variety of earmold kinds, this form is frequently selected for young children. Earmolds need to be replaced as the child develops and grows. Additionally, the BTE aids are simple to clean and maintain, in addition to being relatively dependable.

Mini BTE

A brand new type of BTE aid known as a small BTE aid (sometimes known as a "on-the-ear" aid). It can also be worn on or behind the ear, but it is much smaller. A tube that is very slender and nearly undetectable is utilised to link the hearing aid to the ear canal. Mini BTEs may use a conventional earmold or they may be equipped with a comfortable ear piece that can be inserted into the ear canal (also known as a "open fit"). Mini BTEs not only provide for reduced occlusion or "blocked up" sensations in the ear canal, but they also allow for increased comfort, reduced feedback, and solve issues regarding cosmetic appearance for many users.

In-the-Ear (ITE)

Hearing aids known as ITEs are designed to sit entirely within the ear canal and can be utilised for treating mild to severe cases of hearing loss. The strong plastic was used to construct the enclosure that houses the electronic components. Some ITE aids may come equipped with supplementary components, such as a telecoil, depending on the model. Hearing aids may be equipped with a component known as a telecoil, which is a miniature magnetic coil that redirects sound signals away from the hearing aid's microphone and towards the device's internal circuitry. Conversations that

take place through telephone can now be heard more clearly as a result. People who have trouble hearing can also benefit from the use of telecoils in public places that have been outfitted with specialised sound systems known as induction loop systems. Many places of worship, schools, airlines, and auditoriums have installed induction loop systems for the hearing impaired. ITE aids are not often recommended for use by children under the age of six since the casings need to be replaced so frequently due to the natural development of the ear.

In-the-Canal (ITC) and Completely-in-the-Canal (CIC)

Canal aids are available in two different types and are designed to be inserted into the ear canal. The in-the-canal (ITC) hearing aid is designed to conform to the dimensions and contours of the ear canal of the wearer. A completely-in-canal hearing aid, often known as a CIC hearing aid, fits entirely within the ear canal. Both types can treat hearing loss ranging from low to moderate to severe severity.

Because of their diminutive size, canal aids can be challenging for a person to both adjust and remove. Additionally, canal aids have a smaller internal volume, which means there is less room for batteries and other accessories like telecoils. Because of their smaller size, their power and volume are typically not adequate for use by young children or by those with severe to profound hearing loss. Because of this, they are typically not advised for these groups of people.

Exercise

A. Short Questions

Q1. What do you mean by analogue hearing aids?

Q2. What do you mean by digital hearing aids?

B. Fill in the Blanks

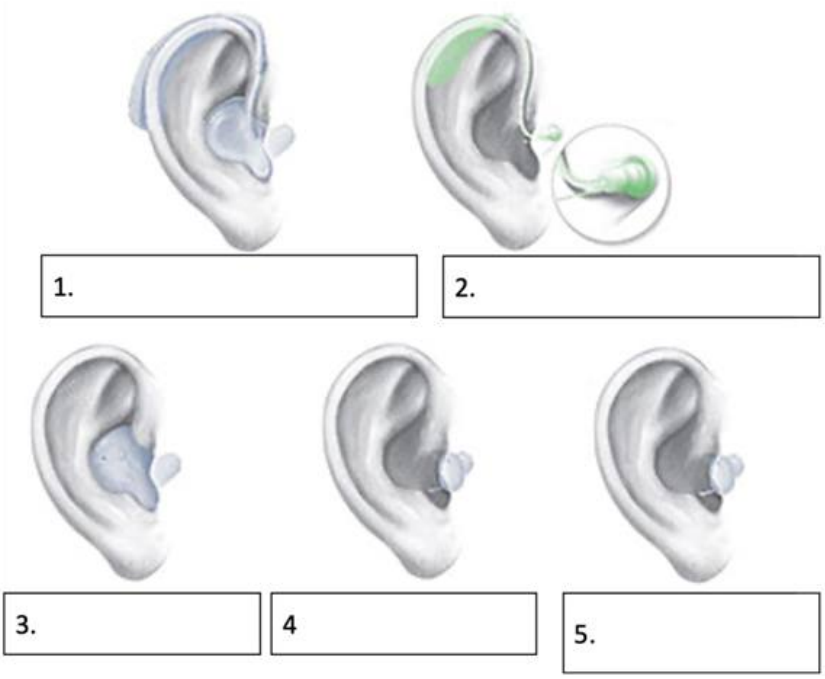
a. _____hearing aids have the majority of their components housed in a small plastic case that is worn behind the ear.

b. Hearing aids can be broken down into _____ primary categories based on their design.

c. In_____ aid sound waves are converted into electrical signals.

C. Label the diagram

1. In the given image you have to label it as per the style of hearing aids.



Notes

Scan the QR Code to watch the related video

https://www.youtube.com/watch?v=TW2uGcYeZ-Y

Hearing Aids

Unit 8.2 Repair and Maintenance of Digital Hearing Aids

Unit Objectives

At the end of the session, participant will be able to:

- Explain the steps for maintenance and repair of hearing aids (Digital).
- Describe how to use basic electronic components to service and repair hearing aids (Digital).
- State the common faults in a hearing aid (Digital) and discuss solutions.

8.2.1: Repairing Tools and Equipment

Digital Multimeter

A digital multimeter is a piece of testing equipment that combines multiple electronic measurement functions into a single device. It is also known as the Ohm meter and the Volt Ohm meter. Another name for it is the voltmeter. The measurements of amps, volts, and ohms are the standard and fundamental measurements that are carried out by a multimeter. In addition to that, modern digital multimeters can perform a wide variety of other measures by utilizing digital and logic technologies. Temperature, frequency, continuity, capacitance, and other similar factors could be among them.

Figure 8.2.1: Parts of Digital Multimeter

With the use of a multimeter, we will now learn how to measure the numerous important components that make up an electronic circuit.

Measurement of Voltage

The following steps for the measurement of voltage are described below:

Step 1: Insert the black wire into the COM jack.

Step 2: Insert the Red wire into the V jack.

Step 3: Turn the dial to the AC or DC voltage function.

Step 4: Connect the black probe to the battery's negative terminal.

Step 5: Connect the Red probe to the battery's positive terminal.

Step 6: Connect the black lead to the circuit first, followed by the red lead.

Step 7: Set AC or DC voltage as per your requirements.

Step 8: To measure dc volts and ac volts, press the multimeter's designated

Step 9: Note the display of measurements on the LCD panel.

Step 10: To prevent electrical shock or gadget damage, remove the red lead first.

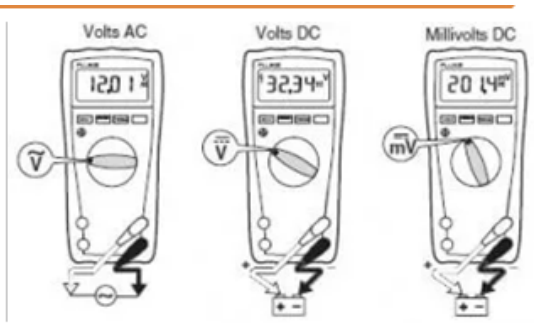


Figure 8.2.2: Measurement of Voltage by Multimeter

Measurement of Current

The following steps for the measurement of voltage are described below:

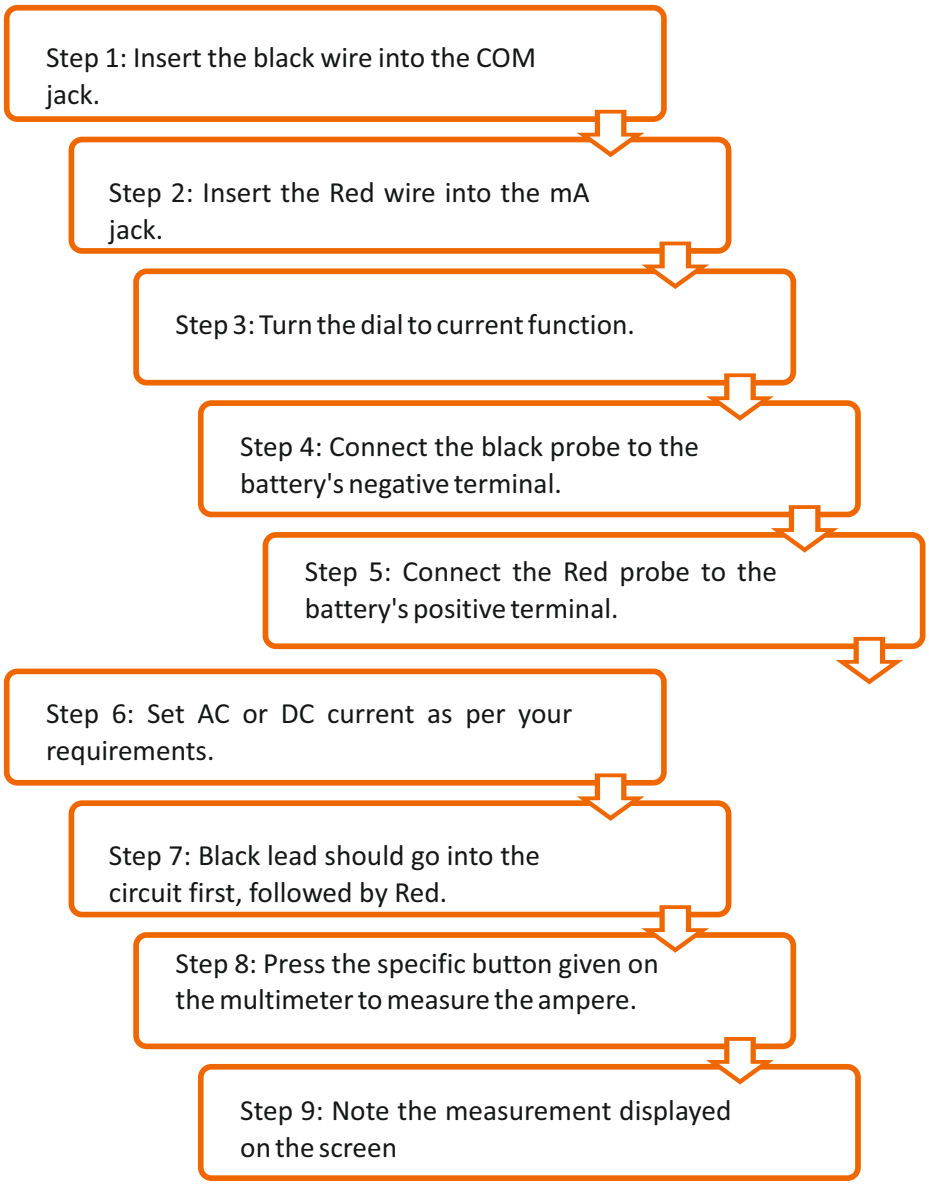


Figure 8.2.3: Measurement of Current by Multimeter

Measurement of Resistance

The path taken by the flow of electricity is effectively obstructed when resistance is present. Because resistance is inversely proportional to current, as stated by Ohm's law, increasing the amount of resistance in a circuit will lead to a decrease in the amount of current that flows through the circuit.

The following steps for the measurement of voltage are described below:

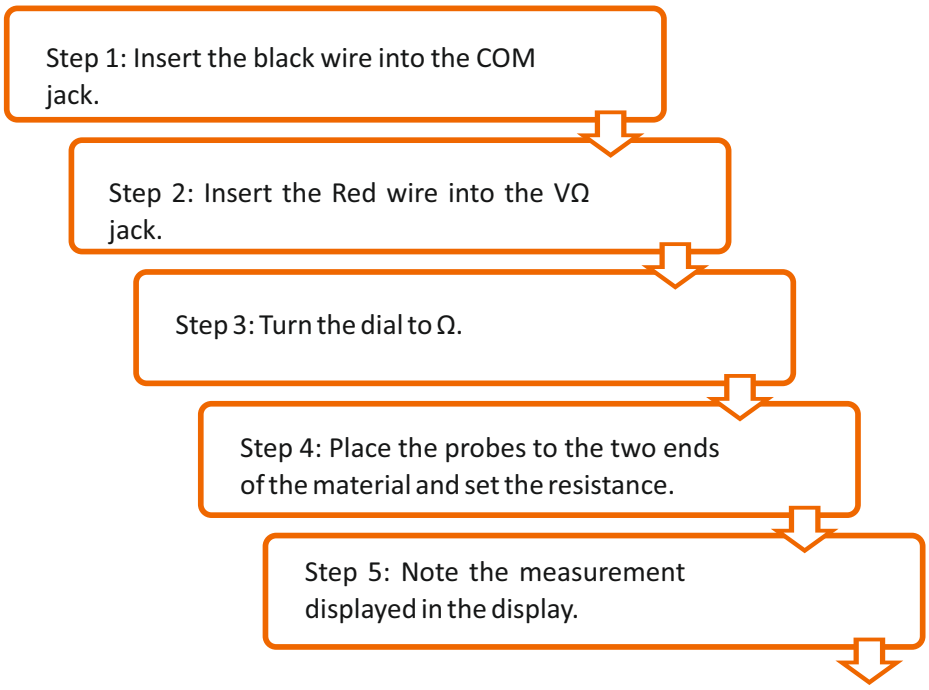


Figure 8.2.4: Measurement of Resistance by Multimeter

Soldering Iron

Melting solder in a soldering iron is the first step in the soldering process, which is used to link various kinds of metals together. Solder is a metal alloy that is often formed of tin and lead and is melted using a hot iron. Solder is used to join metal parts together. First, the iron is brought to temperatures higher than 600 degrees Fahrenheit, and then, once it has cooled, a powerful electrical link is formed.

The heat from a soldering iron that is attached to a temperature controller is used to melt the solder. It is heated to temperatures beyond its melting point, which is approximately 600 degrees Fahrenheit, which then causes it to melt, which then cools to create the soldered joint. The melting point of the material is determined by its resistance to heat.

A de-soldering tool can be used to remove solder, in addition to its primary function of forming reliable electrical connections.

Solder is a metal alloy that is used to form strong permanent bonding; examples include copper joining in circuit boards and copper pipe joints. Solder may also be used to join copper pipes. It is also obtainable in a variety of diameters and kinds, including lead and lead-free variants, with diameters ranging from.032" to.062", respectively. The flux is a material that is utilized to enhance and improve the mechanical properties of the solder, and it may be found inside the solder core.

Soldering Station

The soldering iron is controlled by a soldering station that is often located nearby. The process of soldering is made easier to handle thanks to its temperature control, holders for the soldering iron, and other accessories.

Figure 8.2.5: Soldering Station

Printed Circuit Board (PCB)

A printed circuit board, also known as a PCB, is a type of board that is used to support mechanically and electrically connect electronic components. This is accomplished by using conductive pathways, tracks, or signal traces that are etched from copper sheets and laminated onto a substrate that is not conductive.

Figure 8.2.6: Hearing Aids PCB

8.2.2: Maintenance of Digital Hearing Aids

When properly maintained and cared for, a hearing aid has the potential to survive for a significantly longer period of time. Let's figure out how to make preventative maintenance recommendations to the user:

- Inform them that hearing aids should never have any contact with heat or moisture under any circumstances.
- It is important to clean hearing aids in accordance with the instructions provided in the user manual.
- Tell them that when they are wearing hearing aids, they should not use hairspray or any other products that are designed for the care of their hair. This will help prevent any damage to their hearing aids.
- Be sure to turn off hearing aids when they are not being used. This will help preserve the battery life.
- Tell them to replace any batteries that have lost their charge as soon as possible.
- Make the suggestion that they should always have spare batteries.
- Make sure that any additional objects that are easily swallowed are stored where children and animals cannot access them.

8.2.3: Troubleshooting of Digital Hearing Aids

The following are the four problems that are most frequently encountered by those who use hearing aids:

- There is no sound coming from my hearing aids at all (or my hearing aids are "dead")
- The volume on my hearing aids has to be adjusted.
- My hearing aids produce a distorted or "strange" sound.
- My hearing aids are whistling or giving me feedback at the same time.

Let's begin by taking a look at an exploded image of a digital hearing aid before moving on to the processes involved in troubleshooting. Asily swallowed are stored where children and animals cannot access them.

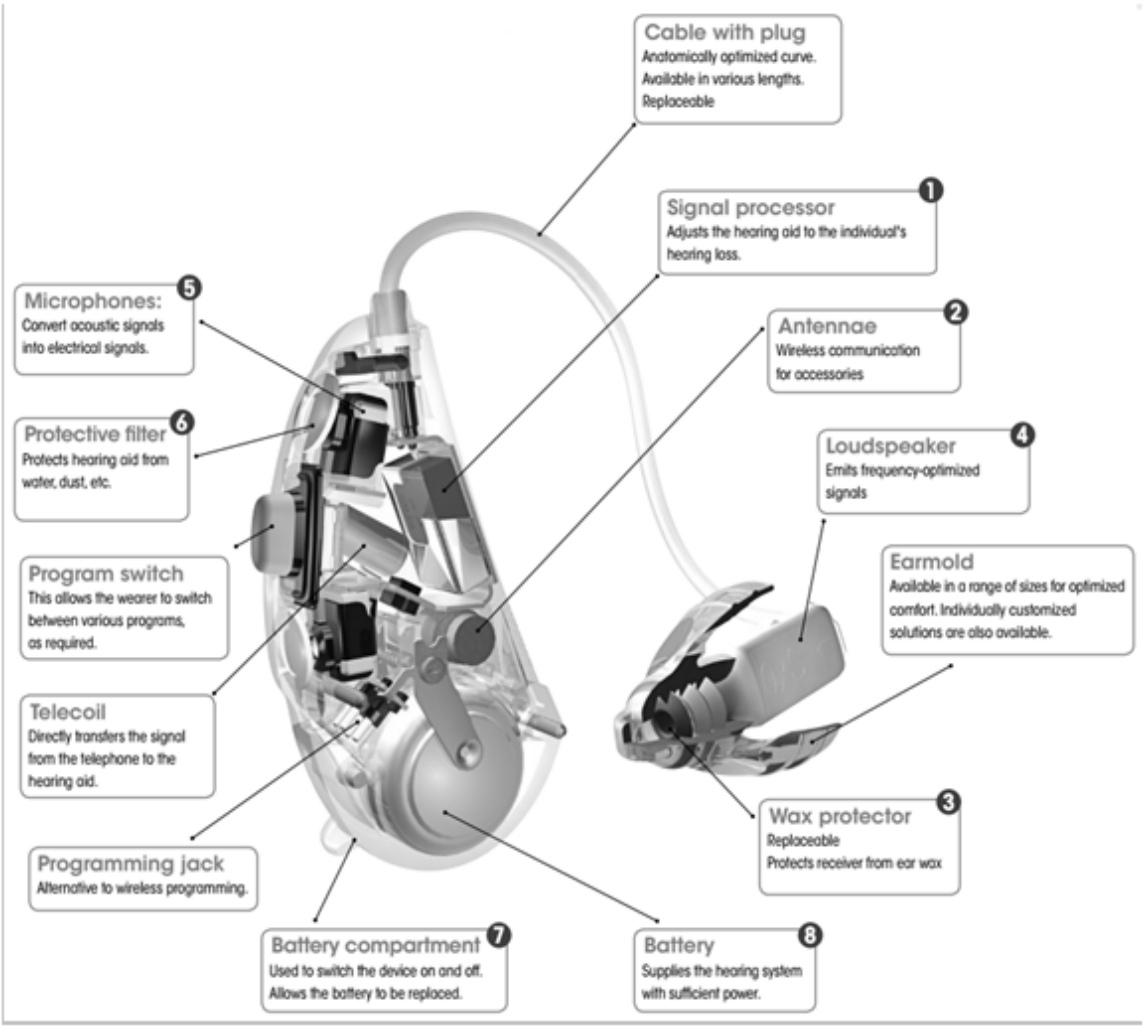


Figure 8.2.3: Digital Hearing Aids Exploded View

Hearing Aids are not Producing Sound

- Examine hearing aid visually. Earwax blocking mic or sound outlet? Remove trash. If the hearing aid is damaged, repair or replace it.
- Activate your hearing aid. If your hearing aids are rechargeable, make sure to dock them properly. Check the battery door on hearing aids that use disposable batteries. If the battery door won't close, it's probably inverted. Remove and reinstall the battery. The door will close easily if put correctly.
- App or hearing aid volume can be increased. Using a manual volume control wheel, check sure it's fully on.
- Toggle custom programmes and memories. If you can change settings, do so and listen for few minutes.
- Replace disposable batteries if needed. Check the old battery's voltage to confirm it's dead before removing the sticker off the new battery. Wait two minutes after removing the sticker to activate a new battery before inserting it in your hearing aids.
- Most hearing aids aren't waterproof, so check whether they got wet.

Hearing Aids are not Loud Enough

- Check hearing aids visually. Earwax blocking mic or sound outlet? If it is a behind-the-ear (BTE) hearing aid with tubing, check for cracks, blockages, or moisture beads. Replace tubing, filters, or domes at a hearing centre.
- App or hearing aid volume up. Adjust a manual volume control wheel a few times to hear the volume change.
- Switch programmes or memory. Ensure that it has not switched to a different software by accident.
- Check your hearing.
- Replace disposable batteries if needed. Check the old battery's voltage to confirm it's dead before removing the sticker off the new battery. Wait two minutes after removing the sticker to activate a new battery before inserting it in your hearing aids.
- Most hearing aids aren't waterproof, so check whether it has got wet or not.

Hearing Aids produce Distorted Sound

- Check the connectors on disposable batteries. When the door is closed, these prongs connect to the battery.
- Is there any sign of Corrosion?
- Clean the battery contacts by opening and closing the battery compartment.
- Replace the battery and check the sound.

Hearing Aids are giving Whistling or Feedback

- If hearing aids are whistling, remove it and re-insert it.
- Turn down the volume.
- The earwax blockage could cause feedback in two ways: turning up the volume to hear through the earwax, leaking out more sound than usual, or sound can bounce off any blockage in your ear canal and leak back out.
- For behind-the-ear (BTE) hearing aid with an earmold and tubing, examine the tubing to see if it's brittle, hard, or fractured.

Exercise

A. Short Questions

Q1. What do you mean by analogue and digital hearing aids?

Q2. Describe common problems of hearing aids?

B. Match the Columns

1. Match the step numbers of measurement of resistancewith multimeter given in column A of the table with the procedure given in column B. Connect items in column A to their appropriate ones in column B.

Column A	Column B
i. Step 1	a. Insert the Red wire into the VΩ jack.
ii. Step 2	b. Insert the black wire into the COM jack.
iii. Step 3	c. Place the probes to the two ends of the material and set the resistance
iv. Shaded Pole Motor	d. Turn the dial to Ω

C. Fill in the Blanks

a. A _____ is a type of board that is used to support mechanically and electrically connect electronic components.

b. A _____is a piece of testing equipment that combines multiple electronic measurement functions into a single device.

c. The soldering iron is controlled by a _____that is often located nearby.

Notes

Scan the QR Code to watch the related video

https://www.youtube.com/watch?v=VqHvDt6kcpU

Current Measurement with Digital Multimeter

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9. Communicate Effectively with Others

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Unit 9.1 –People First Language (PFL)

Unit 9.2 –Bias-Free Communication

Unit 9.3 –Gender Sensitivity

Unit 9.4 –Workplace Harassment and POSH

Unit 9.5 – Preparation of Teaching Material

Unit 9.6–Digital Communication

PWD/N9902

Terminal Outcomes

By the end of this module, participants will be able to:

1. Demonstrate acceptance towards a diverse population.

Unit 9: Communicate Effectively with Others

Key Learning Outcomes

At the end of this module, you will be able to:

Theory - Key Learning Outcomes	Practical - Key Learning Outcomes
• Explain People First Language (PFL). • Explain the significance of disability sensitization. • Discuss the challenges faced by a person with Disability • Demonstrate bias-free communication disability at the workplace and suggest ways to assist them. • Explain bias-free communication. • Explain gender concepts (gender as a social construct, gender sensitivity, gender equality etc.), issues and applicable legislations. • Discuss workplace harassment, its indicators and the process of reporting it. • Discuss Prevention of Sexual Harassment Act, 2013. • Differentiate between ethical and unethical behaviour and practices. • Discuss the benefits of understanding the socio -economic status, disability, challenges and aspirations of the learners. • Explain the protocols to be followed while dealing with persons with disability, who are at increased risk of sexual abuse as per guidelines.	• Compile a list of words and phrases indicating the appropriate use of people first language • Demonstrate bias-free communication while interacting with differently abled students in a classroom environment. • Design sample teaching material/ activities to inculcate skills such as peer bonding, confidence, etc. • Demonstrate how to use smart phone features such as messaging, clock, calculator, cameras, etc. • Demonstrate how to connect to internet, Bluetooth etc. and create an email ID. • Demonstrate the use of various social media platform and safety and security measures related to it.

Unit 9.1 People First Language (PFL)

Unit Objectives

At the end of the session, participant will be able to:

- Explain People First Language (PFL).
- Compile a list of words and phrases indicating the appropriate use of people first language.
- Explain the significance of disability sensitization.
- Discuss the challenges faced by a Persons with Disability.

9.1.1: People First Language (PFL)

To show that you understand and value persons with disabilities, you should use People First Language (PFL), which emphasizes the individual rather than the person's disability. By putting the emphasis on the person rather than the ailment or disability, Person-First Language (PFL) is often regarded as the most appropriate way to address disability and diversity. Instead of terms like "the disabled," which define people solely by their impairment, PFL prefers to use terms like "person with a disability" and "individuals with disabilities."

PFL Words and Phrases

You should keep in mind that a disability description is nothing more than a formal medical diagnosis. In many ways, a person with a disability is no different from others.Let's have a look at the PFL words and phrases that are listed in the table below.

Instead of	Say
Handicap or disable	Persons with Disability
He or she is mentally retarded	He or she has cognitive disability/diagnosis
She or he is autistic	She or he has autism
Brain damaged	Brain injury
Normal or healthy kids	Children without disabilities
He or she is a learning-disabled person	He or she has learning disability
He has Down's; a mongoloid	He has Down Syndrome
She has problems with/has special needs	She needs or she uses

Table9.1.1: PFL Words and Phrases

9.1.2: Challenges of Persons with Disability

Almost everyone has to deal with adversity at some point in their lives. However, those with disabilities may face more frequent and more significant obstacles. According to the World Health Organization, there are many types of barriers. The World Health Organization defines obstacles as follows:

Factors in one's surroundings that, either in isolation or in combination, lead to impairment and disability. Some examples of these are:

- Barriers include "an inaccessible physical environment.
- A dearth of appropriate assistive technology (assistive, adaptive, and rehabilitative devices).
- Widespread stigma against those with disabilities.
- Insufficient or non-existent services, systems, and policies that prevent people with health conditions from fully participating in all aspects of society.

Many times, people with disabilities face a plethora of obstacles that collectively make even the most basic of daily tasks next to impossible. Seven most frequent obstacles that people face. Multiple obstacles frequently appear at once.

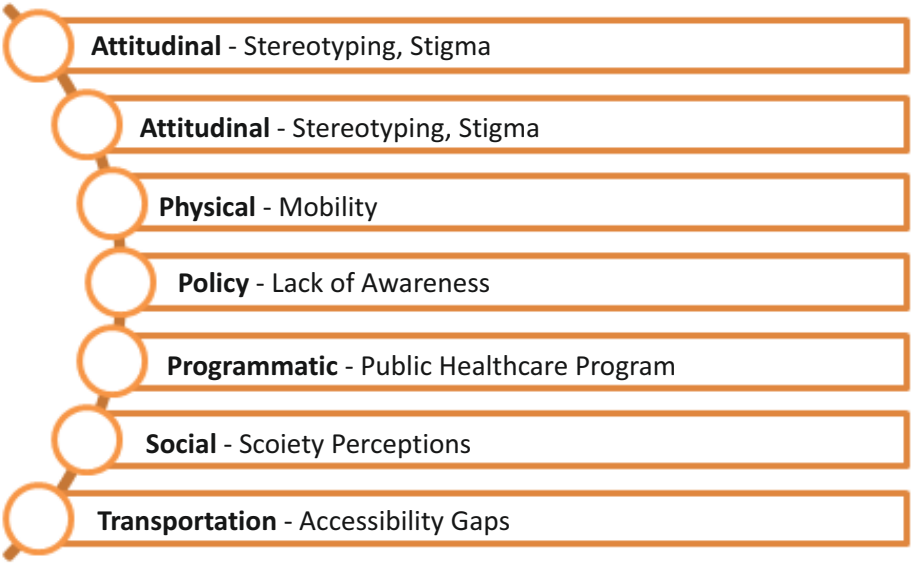

Figure 9.1.1: Barriers for Persons with Disability

9.1.2: Challenges of Persons with Disability

It is essential to keep in mind that people with disabilities are, first and foremost, PEOPLE who share more similarities with you than differences and should be treated in the same manner as everyone else. When interacting with persons who have disabilities, it is essential to steer clear of generalisations and clichés. In order to dispel some of the most widespread misconceptions and myths concerning people with disabilities, the following information should be kept in mind:

- People with disabilities range in age from infants to seniors and come from a wide variety of cultural and socioeconomic backgrounds.
- Work is done by people with various disabilities.
- Families are important to people who have disabilities.
- People with impairments have aspirations and plans for the future.

- There is no guarantee that every person who has a disability will seek or require assistance.
- Those who are legally blind or have low vision may need to wear corrective lenses.
- Some deaf individuals are able to communicate using sign language or lip reading, however this is not always the case.
- Some wheelchair users may still be able to walk for short distances, therefore the term "paralyzed" does not apply to everyone who uses one.
- It is not always the case that delayed or sluggish speech is an indication of a slowed mental activity.
- People who have learning impairments aren't always less intelligent than other people; they just have a different method of acquiring knowledge.

Exercise

A. Short Questions

Q1. What do you mean by People First Language (PFL)?

Q2. What do you mean by disability sensitization?

B. Match the Columns.

Column A	Column B
i. Attitudinal Barriers	a. Text and Video
ii. Communication Barriers	b. Stereotyping and Stigma
iii. Social Barriers	c. Dairy microbiology
iv. Programmatic Barriers	d. Dairy technology

C. Fill in the Blanks

a. People who have learning impairments aren't always less _____ than other people; they just have a different method of acquiring knowledge.

b. Some wheelchair users may still be able to walk for _____ distances.

c. People with impairments have _____ and plans for the future.

Notes

Scan the QR Code to watch the related video

https://www.youtube.com/watch?v=03d9b3ugUL0

People First Language (PFL)

Unit 9.2 Bias-Free Communication

Unit Objectives

At the end of the session, participant will be able to:

- Explain bias-free communication.
- Demonstrate bias-free communicationdisability at the workplace and suggestways to assist them.
- Demonstrate bias-free communication while interacting with differently abled students in a classroom environment.

9.2.1: Bias-Free Communication

The language we use can often reveal our preconceived notions and biases. While our expressions and body language may reassure our listeners that we are not being offensive when we speak, this is much less effective while writing.

Use straightforward, impartial, and stereotype-free language to prevent frustrating or offending people with disabilities. Don't generalize people based on their gender, race, ethnicity, sexual orientation, or physical ability.

For example, when we use adjectives in the place of collective nouns, we frequently end up with labels. Instead of using the terms "the disabled" or "the schizophrenics," try referring to "those with disabilities" or "people who have been diagnosed with schizophrenia."

9.2.2: Effective Communication

The first and most important rule in good communication with people who have impairments is to "ask first." After doing so, you should wait for directions on how you may assist the individual or the best way to communicate with them. People with disabilities are no different from anyone else; they are, after all, people first who, like the rest of us, aspire to lead lives that are independent, meaningful, and productive. A person who has a handicap may at times make a request for an accommodation in the hopes that it will allow them to fully participate in an activity.

Requesting to meet in a quiet environment or having an interpreter who can facilitate a dialogue over the phone or through a relay service are two examples of how this could be done. Asking a person who has a disability what will benefit them the most is something you should feel comfortable doing. They will know what works best for them. When you are in charge of hosting an event, make sure to inquire about any necessary accommodations throughout the sign-up process. People who have impairments will have the chance to let you know about this, which will buy you some time to make the necessary accommodations so that they may take part in the activity in its entirety.Remember the following guidelines:

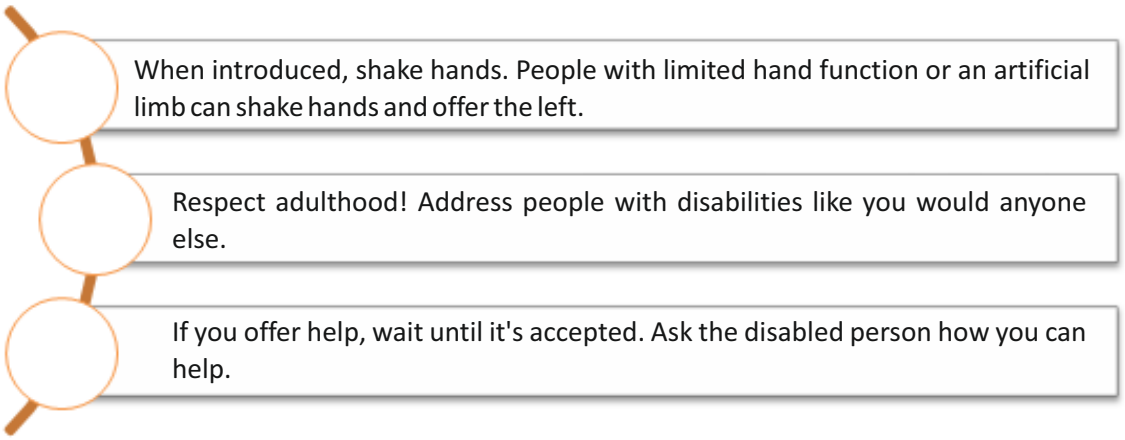

Figure 9.2.1: Effective Communication Strategies

Let's start by learning how to speak with people who are deaf or blind so that we can demonstrate our ability to communicate without bias toward people who have disabilities.

How to Speak with Someone who is Blind or has Low Vision

- Be confident and approach people by introducing yourself in a regular voice before asking for anything. Keeping your voice down is highly encouraged.
- Always introduce yourself and the person you are speaking with when in a group conversation.
- If you need to move around or leave, let the person know.
- Never force someone to follow you; if someone wants to grasp your arm or elbow, let them.
- Whenever you're giving someone instructions, it's important to be detailed and precise. If there are stairs, specify their number and orientation (left, right, etc.).
- Provide verbal instructions or, if serving as a guide, lay the person's hand lightly on the back or arm of the chair to help them find their seat.

Written materials in a format that is accessible may be necessary for individuals who are blind or have low vision. It's possible that the contents will need to be recorded on a computer or delivered in Braille. It is possible that a person will want someone to read the materials out loud to them in order for them to comprehend the content and take part in the activities.

Communicating with Deaf or Hard of Hearing

- Get someone's attention before you start talking to them (i.e., gently wave your hand in their line of vision or tap the person gently on the shoulder or arm).
- Always address the person, not the interpreter, when communicating with someone who uses sign language.
- The grammar, context, and norms of Indian Sign Language (ISL) are distinct from those of English.
- Keep in mind that some people who are deaf may have difficulty communicating verbally while others may have trouble communicating at all.
- You should talk clearly in a regular tone of voice and keep your hands away from your face when communicating with someone who reads lips.
- Don't use tobacco products or gum.

Exercise

A. Short Questions

Q1. What do you mean by bias-free communication?

Q2. What do you mean by effective communication with persons with disability?

B. Match the Columns.

Column A	Column B
i. The disabled	a. a. Person who is deaf
ii. The deaf	b. Person with Disability
iii. Hearing loss	c. Person without disability
iv. Normal person	d. Person who is hard of hearing

C. Fill in the Blanks

a. Get someone's _____ before you start talking to them.

b. Always address the person, not the _____, when communicating with someone who uses sign language.

c. You should talk clearly in a regular _____and keep your hands away from your face when communicating with someone who reads lips.

Notes

Scan the QR Code to watch the related video

https://www.youtube.com/watch?v=26yJbGh7w3A

Bias-free Language

Unit 9.3 Gender Sensitivity

Unit Objectives

At the end of the session, participant will be able to:

- Explain gender concepts (gender as a social construct, gender sensitivity, gender equality etc.), issues and applicable legislations.

9.3.1: Sex and Gender

Let's look at the distinction between sex and gender before we move on to discussing what it means to be sensitive to people of different genders. Although both names are frequently used interchangeably and are very similar to one another, they are not the same thing.

According to the World Health Organization (WHO), the term "sex" refers to the anatomical and physiological differences that distinguish men and women. To put it another way, it describes the individual's physiology at the time of birth.

Whereas, according to the World Health Organization (WHO), gender refers to the socially created roles, attitudes, activities, and characteristics that a specific society regards to be appropriate for men and women respectively.

Now that the difference between sex and gender has been established, let's examine what gender sensitization entails.

9.3.2: Gender Sensitization

In the context of gender sensitivity, the concept of gender sensitization refers to the acknowledgment of gender roles, the identification of privileges and forms of discrimination that exist within genders, and most crucially, the development of gender awareness.

Because representation is so vitally important, gender sensitivity training is also very crucial. Not only can advocating for equality through representation of a person and group offer a sense of inclusion to a community that was previously marginalized, but it also promotes equality. Organizations need to have the correct mix of talent, which should not be limited by gender to have a healthy culture that is focused on performance. In a world in which responsibility is becoming more crucial than it has ever been before, companies only have today to make the changes that count, as they won't be able to hide behind the veil of ignorance any longer after tomorrow.

An insensitive workplace not only makes it difficult for employees to learn and advance in their positions, but it also fosters an environment that is unfriendly to employees. The goal of every member of an organization is to learn and advance in their jobs. Awareness of gender differences

among employees is of the utmost significance since it contributes to their feelings of being appreciated and cared for by the firm. Finally, to improve society overall, organizations have a moral obligation to breach established conventions in order to mold the present-day structures into something more desirable.

Figure 9.3.2: Gender Sensitization

In the cultures of organizations that do not place a priority on gender sensitization, inequality and discrimination have become accepted practices. The acceptance of this kind of culture results in increased employee turnover, higher absence rates, and other negative outcomes. A policy like this one also encourages the notion that there is one gender that is superior to the other. Let's get educated on the best practices for fostering a gender-sensitive workplace now.

- Develop policies and procedures that are gender sensitive.
- Facilitate gender awareness through a series of trainings and workshops.
- Establish employee-fitting recruitment procedures by being a company committed to equal opportunity.
- Developing infrastructure and facilities that are easily accessible.
- It is essential for upper management to take an active role in the design and execution of policies and projects related to awareness and education.

Figure 9.3.3: Gender Sensitization Approach

Gender Equality

The concept of gender equality refers to a situation in which individuals of all genders share the same rights, duties, and opportunities. Everyone, including women, men, transgender and gender nonconforming people, people of all ages, and families, is impacted by gender inequity.

9.3.3: Gender Sensitization Legislation in India

To combat issues of discrimination and gender inequality, the government of India has passed a number of laws designed to protect women from being exploited or harassed, as well as to prohibit exploitation of women. Among these are:

- The Right of Children to Free and Compulsory Education (RTE) Act, 2009
- The Criminal Law (Amendment) Act, 2013
- The Protection of Women from Domestic Violence Act, 2005
- The Dowry Prohibition Act, 1961
- The Indecent Representation of Women (Prohibition) Act, 1986
- The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013

The Criminal Law (Amendment) Act of 2013

Exercise

A. Short Questions

Q1. Define as per WHO about sex and gender?

Q2. What do you mean by gender sensitization?

B. Match the Columns.

Column A	Column B
i. According to WHO, sex refers to	a. Socially created roles, attitudes, activities, and characteristics
ii. According to WHO, gender refers to	b. Anatomical and physiological differences
iii. Gender sensitivity	c. Series of trainings and workshops
iv. Gender Awareness	d. Acknowledgement of gender roles

C. Fill in the Blanks

a. _____refers to the acknowledgement of gender roles, the identification of privileges and forms of discrimination that exist within genders, and most crucially, the development of gender awareness.

b. Establish _____ recruitment procedures by being a company committed to equal opportunity.

c. An _____ workplace not only makes it difficult for employees to learn and advance in their positions, but it also fosters an environment that is unfriendly to employees.

Notes

Scan the QR Code to watch the related video

https://www.youtube.com/watch?v=O5jRVOkAWOc

Gender Sensitivity

Unit 9.4 Workplace Harassment and POSH

Unit Objectives

At the end of the session, participant will be able to:

- Discuss workplace harassment, its indicators and the process of reporting it.
- Discuss Prevention of Sexual Harassment Act, 2013.
- Explain the protocols to be followed whiledealing with persons with disability, who are at increased risk of sexual abuse as per guidelines.
- Differentiate between ethical and unethical behaviour and practices.

9.4.1: Workplace Harassment

Harassment in the workplace occurs when an employee or group of employees feels threatened by their colleagues or when their colleagues degrade them. The only goal of someone who harasses their coworkers is to make their victims feel unsafe and uncomfortable in their environment. There are several terms that can be used to refer to workplace harassment, such as "workplace bullying," "mobbing," "workplace hostility," etc.

Harassment includes a wide variety of forms of discrimination and public displays of infringing behavior, and it is not limited to any one group. Persons are engaging in harassment when they target many groups at the same time. These groups can include women, members of racial or sexual minorities, people with disabilities, immigrants, and others. Because it is impossible to define harassment in the workplace using a single, comprehensive, and sound framework, workplace harassment fundamentally calls for a pluralistic arrangement.

Any form of harassment, including verbal or physical harassment, sexual favours, psychological or emotional harassment, or any other form, is unacceptable in the workplace. There are four primary categories of inappropriate behaviour in the workplace, and they are as follows:

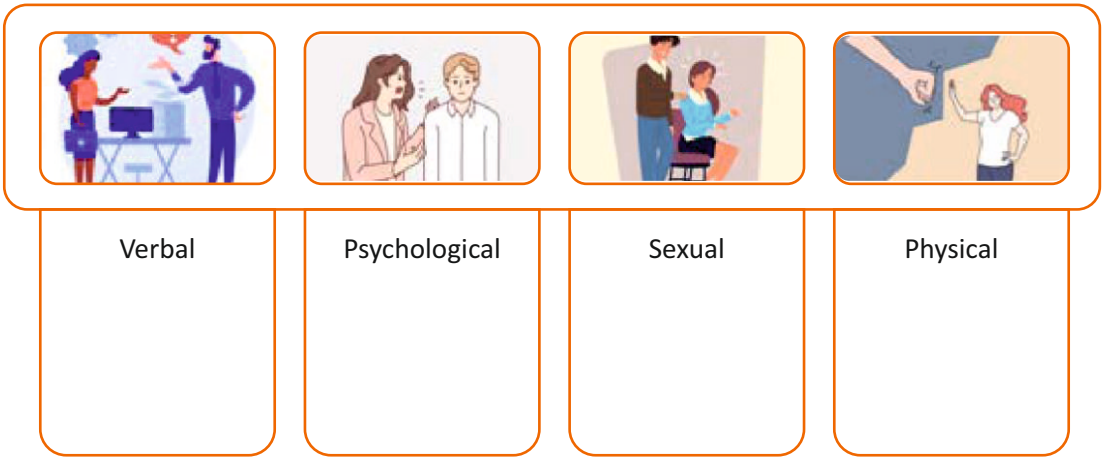

Figure 9.4.1: Types of Harassment at Workplace

Verbal Harassment

A common definition of verbal harassment is when one person uses language toward another person in such a way that causes that person pain, often in an emotional or psychological sense. The following are a few examples of verbal harassment that can take place in the workplace

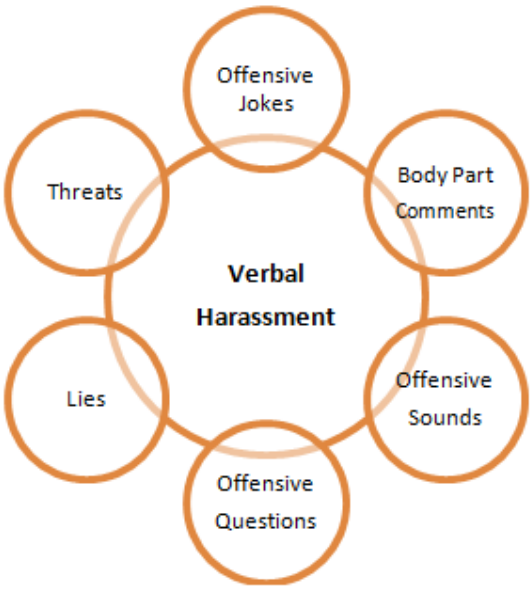

Figure 9.4.2: Examples of Verbal Harassment at Workplace

Psychological Harassment

Repetition of painful, hurtful, bothersome, embarrassing, or insulting words, behaviour, or acts is an example of psychological harassment. When this occurs, the workplace becomes toxic, threatening the victim's physical and mental well-being.

Sexual Harassment

There are many different contexts in which sexual harassment might take place. The harasser may identify with any gender and may have any relationship to the victim, including being a direct manager, indirect supervisor, coworker, peer, or colleague. The victim may also be a colleagueor peer.

The following are examples of several types of sexual harassment:

- Making the terms of employment or progress contingent, either expressly or implicitly, on the provision of sexual favours is sexual favorism.
- Sexual assaults that involve the use of force.
- Requests for sexual favours.
- Verbal harassment of a sexual nature, including comments related to sexual behaviours or orientation, can be a form of sexual harassment.
- Physical contact or touching that is not desired.
- Unwelcome sexual approaches.
- Having a conversation about sexual stories, fantasies, or relations while at work, school, or other improper venues.

- The experience of feeling forced to participate in sexual activity with another person.
- Putting oneself in a vulnerable position or engaging in sexual activity on oneself.
- Unwanted images, emails, or text messages that include sexually explicit content.

Physical Harassment

There are many different levels of physically harassing behaviour in the workplace. The inappropriate touching of clothing or flesh, physical assaults, threats, or damage to personal property are all examples of this type of harassment.

9.4.1: Workplace Harassment

Sexual Harassment of Women at Workplace (Prevention, Prohibition & Redressal) Act 2013 provides protection to women at workplace and to prevent sexual harassment of women in any form, prohibition of sexual harassment at workplace and to redress the grievance of the victim of sexual harassment at workplace. Provision has been made to punish the guilty person by taking strict legal action.

The main objective of this act is to provide complete security to women and provide them a sexual exploitation free environment at the workplace so that women can work freely without any fear wherever they are working. Don't be afraid of loss of shame etc.

Physical harassment	Verbal harassment	Non-verbal harassment	*Quid pro quo* harassment
Touching	Unwelcome suggestions or hints	Unwelcome gestures	Attempts to influence process of employment
Sexual assault	Sexual advances	Indecent exposure	Person in position of authority rewards only those who respond to sexual advances
Actual/attempted rape	Comments with sexual overtones	Display of sexually explicit pictures and objects	Insinuation that lack of sexual submission will affect employment
Strip search by opposite sex	Sex-related jokes or insults	Sexually suggestive looks, staring or ogling	Punishment for refusing to comply with propositions
Kissing and hugging	Comments about a person's body	Suggestive body language	Rewards for sexual co-operation
Fondling	Enquiries about a person's sex life	Sexually oriented letters, faxes or e-mails	
	Unwelcome whistling directed at a person/group		

Table9.4.1: Types of Sexual Harassment at Workplace

Salient features of the POSH Act

- The Act prevents sexual harassment of women at work, bans sexual harassment, and redresses women's concerns.
- Every firm must have an internal sexual harassment complaints committee.
- Sexual harassment of women at work can be reported within 3 months after the incidence, or within 3 months of the last recurrence.
- This Internal Complaints Committee will investigate sexual exploitation complaints and redress the victim.
- Each district must have a local complaints committee. Women's sexual exploitation complaints will be heard and redressed.
- The victim may register a complaint with the Internal Complaints Committee or the Local Complaints Committee within 3 months of the incident by providing a valid cause for the delay.
- If a sexual harassment victim is mentally disables, physically disabled, or dead, her legal heirs or another person may submit a complaint. can
- After reviewing complaints filed with the Internal Complaints Committee or Local Complaints Committee, the Chairman and members will create a report and give a copy to the employer and District Officer within 10 days.
- During the investigation of a complaint, the complainant or complainant's target must work elsewhere.
- During the investigation, the complainant/victim is provided 3 months' leave or other remedies as prescribed by law.
- After investigating a sexual harassment accusation, the guilty party will be punished.
- If the Complaints Committee's investigation finds no evidence of sexual harassment, it will notify the employer and the District Magistrate that no action is needed.
- If the sexual harassment claim is proven, the Complaints Committee will ask the employer to take action against the accused, since sexual harassment is considered misconduct under the service standards. If there's no service rule, make one. Rule-following is required. Victim compensation will be withheld from the accused's wages.
- This act includes a grievance settlement provision. If the victim wants, before the investigation begins, she and the accused of sexual harassment can settle the complaint by conciliation.

If a woman's sexual exploitation complaint is fraudulent or filed with improper intention, she will be punished following an investigation. Such punishment shall be based on the service rule or, if none exists, the prescribed rule.

9.4.3: Sexual Abuse Risk for Persons with Disability

Individuals with Disabilities have a higher risk of being sexually exploited due to the following factors.

- Negative public attitudes toward persons with disabilities
- Social isolation
- Lack of accessible transportation
- Reliance of people with disabilities on others for care
- Communication barriers

- Learned compliance of people with disabilities
- Lack of knowledge about healthy intimate relationships
- Nature of the disability
- Gender
- Lack of resources and/or lack of knowledge of existing resources
- Lack of control of their personal affairs
- Perceived lack of credibility of people with disabilities when they disclose sexual violence

9.4.4: Ethical and Unethical Behaviour

Doing what is right is, in a nutshell, what constitutes ethical behaviour. Unethical activity is the opposite of ethical behaviour. Unethical behaviour in the workplace can undoubtedly include any actions that are in violation of the law, such as stealing from a coworker or physically assaulting someone. However, unethical behaviour can also cover much broader areas, such as the intentional violation of business laws or the use of hard-sell sales methods that may be lawful, strictly speaking, but that take excessive advantage of human frailties. Both of these examples are examples of unethical behaviour. It is possible to find instances of unethical behaviour in any industry, as well as in a wide variety of fields and settings.

Exercise

A. Short Questions

Q1. What do you mean by POSH Act 2013?

Q2. What do you mean by harassment?

B. Match the Columns.

Column A	Column B
i. Verbal Harassment	a. Repetition of painful words or behaviour
ii. Psychological Harassment	b. Offensive jokes
iii. Sexual Harassment	c. Inappropriate touching of clothing or flesh
iv. Physical Harassment	d. feeling forced to participate in sexual activity

C. Fill in the Blanks

a. Accordingto POSH Act, 2013, sexual harassment of women at work can be reported within _____months after the incidence.

b. Article _____ enjoins on the Government not to discriminate against any citizen of India(including disabled) on the ground of religion, race, caste, sex or place of birth.

c. On _____ the Parliament of India adopted legislation that made the Rehabilitation Council of India a Statutory Body.

Notes

Scan the QR Code to watch the related video

https://www.youtube.com/watch?v=VqiEf7hbttY

Prevention of Sexual Harassment (POSH), 2013

Unit 9.5Preparation of Teaching Material

Unit Objectives

At the end of the session, participant will be able to:

- Discuss the benefits of understanding the socio-economic status, disability, challenges and aspirations of the learners.
- Design sample teaching material/activities to inculcate skills such as peer bonding, confidence, etc.

9.5.1: Know Your Learners

Even though you have developed the course, there is no assurance that learners would rush to enroll in it. Learners of today have other options available to them besides sitting through classes that don't pique their interest.

So, how can you make your learners interested in what you have to offer? You have to get people excited about it. You have to pique their interest. You are obligated to offer solutions to the challenges they face. And most importantly, you need to persuade them that consuming your information will result in a positive change in their lives. But the question is how to do that with ease. Here are the answers:

- By knowing what your learners expect from you.
- By knowing your learners, so you can deliver exactly what they need.
- By having a deeper understanding of them you can approach them like a friend and guide them like a mentor to make them change their behavior and attitudes.

So, if you know your learners, it will be worth your time as you will be more capable of:

- Grab attention and persuade learners more easily
- Improve course engagement and decrease dropout rates
- Enhance knowledge retention
- Happy and motivated lifelong learners

Persons with Disability as Your Learner

In the training workshop for people who require special supports and care, it is of the utmost importance to maintain a vigilant state of mind. Therefore, it will be easier for you to fulfil the position of job coach for inclusion if you are aware about their socioeconomic level, the obstacles they face, and what their ambitions are for themselves.

9.5.2: Teaching Learning Material

The educational resources for teaching and learning should improve the learning skills of people with disabilities. The following is a list of the various kinds of instructional learning material and tools to make learning easier. It is essential to emphasise that educational resources for people with disabilities need to be provided in a format that may be easily accessed.

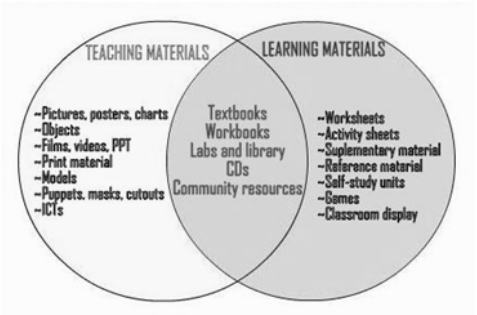

Figure 9.5.1: Teaching Learning Materials

How to Prepare a Teaching Material for Persons with Disability

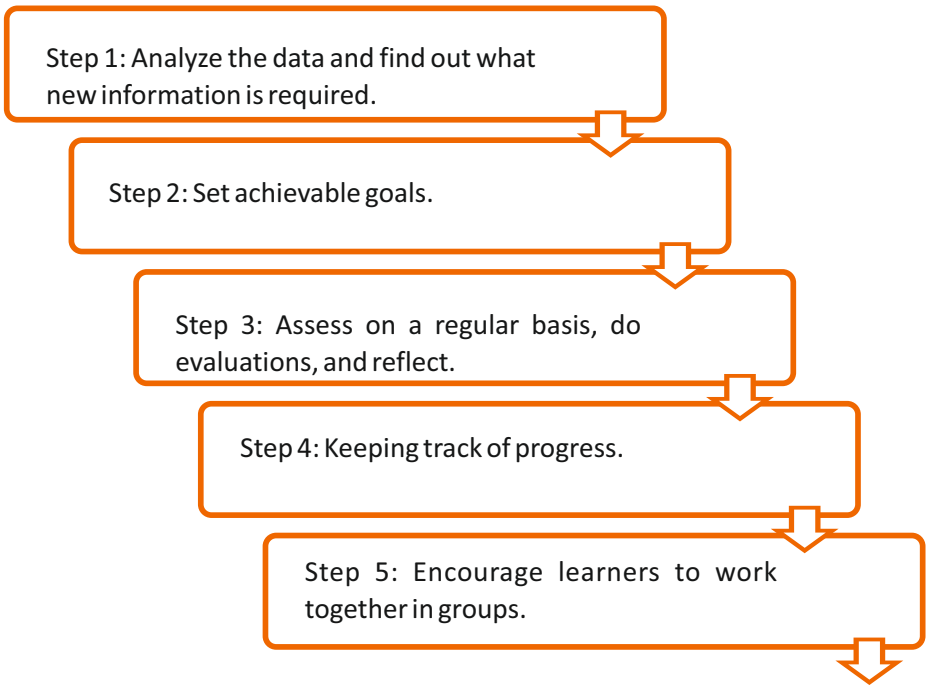

Figure9.5.2: Teaching Learning Materials Preparation

Exercise

A. Short Questions

Q1. What do you mean by teaching learning material?

Q2. Describe the importance of knowing your learners.

B. Match the Columns.

Column A	Column B
i. Step 1 of TLM Preparation	a. Set achievable goals
ii. Step 2 of TLM Preparation	b. Analysis of data
iii. Step 3 of TLM Preparation	c. Progress tracking
iv. Step 4 of TLM Preparation	d. Regular assessment

C. Fill in the Blanks

a. In the training workshop for people who require special supports and care, it is of the utmost importance to maintain a _____ state of mind.

b. It is essential to emphasize that educational resources for people with disabilities need to be provided in a format that may be easily _____.

c. Encourage learners to work together in _____.

Notes

Scan the QR Code to watch the related video

https://egyankosh.ac.in/bitstream/123456789/35093/1/Unit-12.pdf

Teaching Learning Material

Unit 9.6 Digital Communication

Unit Objectives

At the end of the session, participant will be able to:

- Demonstrate how to use smart phone features such as messaging, clock, calculator, cameras, etc.
- Demonstrate how to connect to internet, bluetooth etc. and create an email ID.
- Demonstrate the use of various socialmedia platform and safety and security measures related to it.

9.6.1: Smartphone

A smartphone is a type of mobile phone that can perform additional functions in addition to making phone calls and sending text messages. Internet browsing and the execution of software programmes are both possible on smartphones in the same way that they are on computers. Touch screens are typically employed in smartphones to facilitate user interaction with the devices. There are thousands of apps available for smartphones, including games, programmes for personal use, and applications for commercial use. These apps all run on the phone.

The capabilities and functions that come standard on today's smartphones elevate their status to that of something more than just a phone. The following is a rundown of the most sought-after capabilities available on modern smartphones.

- Receive and make phone calls, as well as send and receive text messages.
- Take images and videos, display them, and save them.
- navigation of the Internet and the ability to send and receive e-mails
- GPS functionality for locating and navigating one's whereabouts.
- Audio and music can be recorded and played back.
- Show the current time and date in addition to providing access to additional services like an alarm clock, stopwatch, and timer.
- Show information on the current weather and temperature.
- Take dictation verbally and make some notes.
- Personal digital assistant software such as Apple's Siri, Google Assistant, or Microsoft's Cortana.
- Gain access to several tools, such as a calculator, a book reader, and a torch.

9.6.2: Bluetooth Connection

Bluetooth is a wireless technology that transmits data across short distances using radio waves. This technology can be found in both stationary and mobile devices. This basically means that you will be able to play music from your phone on a wireless speaker or talk without having to use your hands while you are driving your vehicle.

Figure9.6.2: Bluetooth Symbol

Bluetooth Pairing

The process of connecting two Bluetooth devices is referred to as pairing. The procedures that you will need to carry out in order to finish the pair will vary from one device to the next (phones, speakers, watches, headphones, TVs, etc.). Be sure to examine the instructions that come with each device for information on discovery mode, requirements for pairing, and other relevant details.

When the pairing mode is activated on your device, a signal of some kind, such as a blinking light or a quiet beep, should be displayed on it.

What are the steps to connecting a Bluetooth device to an Android handset?

1. Launch the Settings app on your mobile device and select Bluetooth (or navigate to Settings > Connections > Bluetooth).
2. Check to see if the Bluetooth is active (the button should be blue).
3. Verify that your Bluetooth device is both powered on and set to the discovery mode before continuing. You will need to wait for it to appear in the Available Devices section of your phone.
4. To connect your Bluetooth device, tap its name in the Available Devices section.
5. If there is a checkmark that says "Connected" next to the name of the device, then your gadget is ready to be used. If it says "Not Connected," all you need to do to reconnect is tap the device name once more.

9.6.3: Internet Connection

The term "Internet Connection" refers to a connection that is made available by an Internet Service Provider and that makes it possible for individual computers or other pieces of hardware to communicate with one another over the public Internet, either on their own or after being registered within a Local Area Network.

How to do the Internet Installation Yourself at Home

1. Determine where you will install your modem and router.
2. If your modem and router are two independent devices, then plug in your modem, and then plug in your router.
3. Engage your internet service, if it is not already active.
4. Establish and configure your Wi-Fi network.

Figure 9.6.3: Internet Connection

9.6.4: Email ID Creation

On a computer network, a mailbox that can send and receive electronic mail, often known as email, is identified by a unique string of characters known as an email address. Since the 1980s, all email addresses have adhered to the same format, which is represented by the symbol @. See the example below.

neelima@domainname.com

How to Make an Email Address for Yourself

Create an account with an email provider of your choosing, such as Gmail or Yahoo! Mail, in order to generate a personal email address that will remain the same even if you move schools, employment, or the company that provides your internet access. In order to generate a one-of-a-kind email address for you, the email provider will frequently ask for your first and last names. In most cases, users will include their given name in the email address, making it simple to identify the sender of the message. Simply come up with a password for accessing your emails in a secure manner, and you will be good to go.

Gmail Email Account Creation

Step 1: Choose a Google Account type

- Go to the Google Account sign in page.
- Click Create account.
- Enter your name.
- In the "Username" field, enter a username.
- Enter and confirm your password. When you enter your password on mobile, the first letter isn't case sensitive.
- Click Next.

  Optional: Add and verify a phone number for your account.
- Click Next.

Step 2: Protect your account with recovery info

If you forget your password or someone is using your account without your permission, updated recovery info makes it much more likely you'll get your account back.

9.6.5: Safe Use of Social Media

Social media are virtual communities and networks where individuals produce, share, and exchange information and ideas. The Communications and Marketing Office oversees Facebook, Twitter, Instagram, LinkedIn, and YouTube.

Figure9.6.4:Social Media

Social Media Safety

- Facebook and Twitter are fantastic for connecting with friends. But remember these social media safety tips.
- Set your privacy. Use your social networking sites' privacy and security settings. They help you manage and control your online experience. This page's bottom has Facebook privacy settings.
- Protect your privacy. Be careful what you share on social media. More information you post makes it easy for someone to steal your identity, access your data, or stalk you.
- Computer protection. Start with computer security. Install antivirus.
- Take action. Remove harassers from your friends list, block them, and report them to the site administrator.
- Password-protect everything. Passwords should be at least eight characters long and include letters, digits, and special characters (such as +, @, #, or $).
- Social networking platforms require caution. Even links from friends can contain malware or be phishing attacks. Don't click anything questionable. Verify the link's legitimacy with your friend.

Exercise

A. Short Questions

Q1. What do you mean by social media safety?

Q2. Describe Bluetooth pairing process.

B. Match the Columns.

Column A	Column B
i. Smartphone	a. Wireless Technology
ii. Bluetooth	b. Applications
iii. Internet	c. A mailbox that can send and receive electronic mail
iv. Email	d. Internet Service Provider (ISP)

C. Fill in the Blanks

a. _____ is a wireless technology that transmits data across short distances using radio waves.

b. _____are typically employed in smartphones to facilitate user interaction with the devices.

c. On a computer network, a mailbox that can send and receive electronic mail, often known as _____.

Notes

Scan the QR Code to watch the related video

https://www.youtube.com/watch?v=sMLVkBxke20

Privacy and Social Media

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Transforming the skill landscape

SCPwD
दिव्याँग व्यक्तियों के लिए कौशल परिषद्
Skill Council for Persons with Disability

10. Follow Health, Safety, and Hygiene Practices

PWD/N9902

Terminal Outcomes

By the end of this module, participants will be able to: **PWD/N9901**

1. Discuss health, hygiene and safety practices.

Unit 10: Follow Health, Safety, and Hygiene Practices

Key Learning Outcomes

At the end of this module, you will be able to:

Theory - Key Learning Outcomes	Practical - Key Learning Outcomes
• Discuss the health, hygiene and safety requirements for PwD in their surrounding environment as per guidelines. • Discuss the various emergencies that may happen such as fire, accident, fall etc. • Describe alternative ways and aids (audio alarms for the blind and visual alarms, simple diagrams or pictures, wheelchair, etc.) to ensure the safety of PwD. • Discuss the process and significance of reporting accidents and hazards. • Explain the importance of maintaining a clean and tidy workplace. • Discuss the significance of maintaining personal hygiene. • Discuss the significance of following health and hygiene practices as per guidelines.	• Prepare a summary of health and safety requirements specific to PwD. • Demonstrate safety drills for different emergency situations. • Demonstrate ways to administer basic first aid in different situations to PwD and the correct use of PPE.

Unit 10.1Personal and Workplace Hygiene

Unit Objectives

At the end of the session, participant will be able to:

- Discuss the significance of maintaining personal hygiene.
- Discuss the significance of following health and hygiene practices as per guidelines.

10.1.1: Personal Hygiene

Maintaining a high level of personal hygiene in both your professional and personal life is critical. Personal hygiene refers to the practice of caring for one's body and keeping it in good condition to seem neat and acceptable in public settings such as the workplace. Because you interact with other people at most of your professions, maintaining a high level of personal cleanliness is essential to creating an atmosphere that is as pleasant and productive for everyone involved. A well-prepared presentation of self not only fosters an impression of professionalism but also has the potential to boost one's own feelings of self-assurance and respect for oneself.

Let's check out some methods for keeping yourself neat and tidy so you can feel confident in social situations.

Sl. No.	Activities	Descriptions	Image View
1	Daily Shower	• Every day, shower or bathe and use soap or body wash to remove germs. • Apply deodorant after washing to prevent body odour. • If you perspire easily, bring wipes, deodorant, and new clothes to work if you work in a warm setting.	
2	Clean Hair	• Shampoo and brush your hair daily to keep it neat. If you work in hospitality or around food/drink, use a hair net. • Keep your beard clean. If you work with food/drink, a hair net may be required.	

Sl. No.	Activities	Descriptions	Image View
3	Clean Clothing	• Always wear clean clothes to work. Your garments should be ironed and hole-free. • Crumpled, worn, smelly garments aren't allowed at work.	
4	Clean Nails	• Clean and trim your nails. • Wash your hands after using the restroom and throughout the day. • In kitchens and hospitals, nail polish and jewellery are not allowed, so check your company's policy.	
5	Oral Hygiene	• Brush your teeth every morning to decrease tooth decay, oral illnesses, and bad breath. • Use a decent toothbrush and fluoride toothpaste, and brush for 2 minutes, reaching all tooth surfaces.	

Table10.1.1: Personal Hygiene

Personal Hygiene for Persons with Disability

Despite the fact that people with disabilities experience higher health issues than the general population, many of the measures required to maintain a healthy lifestyle are the same for everyone.

They should engage in regular physical activity, eat a balanced diet, see a doctor regularly, avoid tobacco products and illegal drugs, and stay socially and civically engaged to keep their mental and emotional health in good shape. Make sure they have a basic understanding of how to practise good personal hygiene and how to eat a healthy, well-rounded diet.

Figure10.1.1: Hygiene and Nutrition

10.1.2: Workplace Hygiene

The maintenance of good hygiene in the workplace is essential to the maintenance of a healthy workforce. A happier and more productive workforce is one that is in good health. A healthy workplace reduces the likelihood of employees being sick, which benefits everyone involved. Let's learn about the four components that contribute to fundamental hygiene in the workplace.

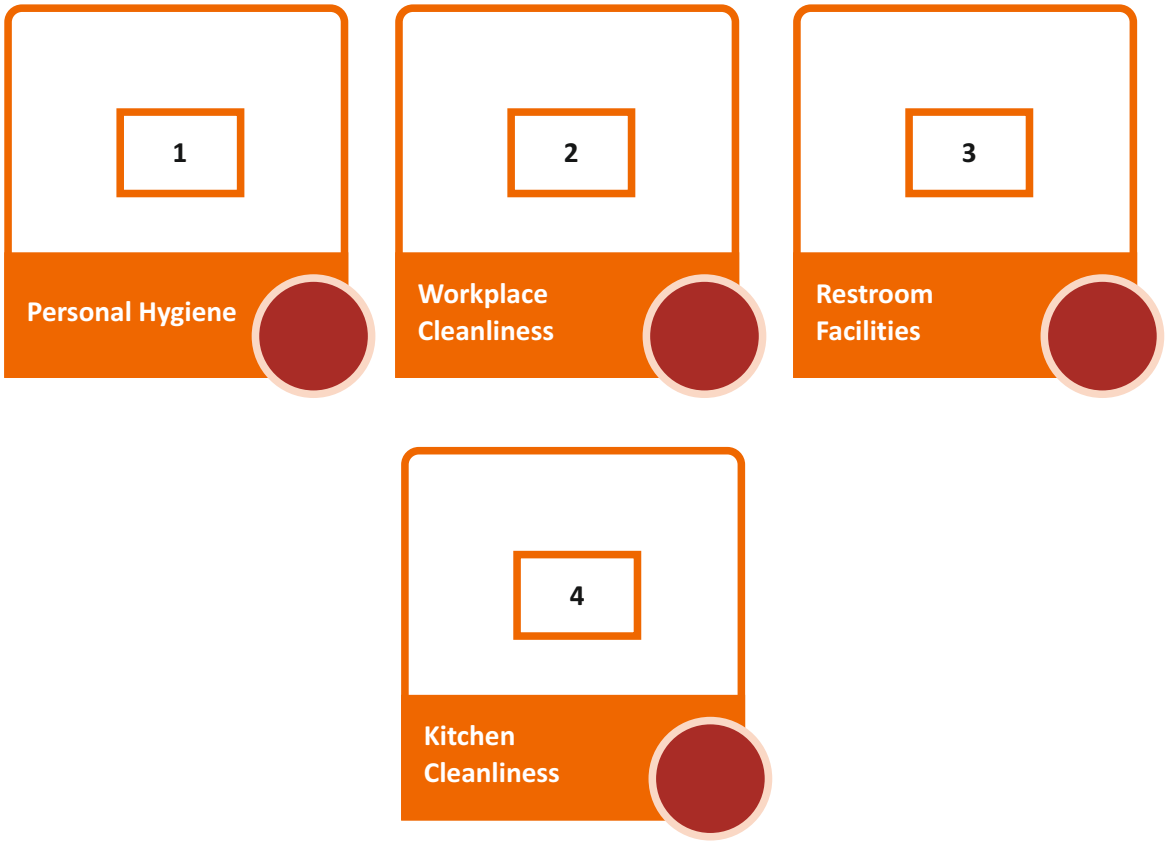


Figure10.1.2: Components of Workplace Hygiene

What are some ways that can keep the workplace clean?

Implement a Hygiene Policy

Give the employees a formal guideline to follow regarding cleanliness. Inform them of your goals and expectations with relation to maintaining a clean working environment. This will help to indicate to the workforce that the company likewise places a high priority on maintaining a clean and sanitary working environment.

Make sure that the Restroom is Clean

In order to keep a healthy working atmosphere, it is absolutely necessary to have toilets that are kept clean. In addition to that, double-check to make sure that there is an enough supply

Regular Cleaning

Ensure that your place of business is cleaned on a regular basis. This will assist avoid the spread of illnesses, and a clean workplace is essential to maintaining both morale and a sense of professionalism in the workplace.

Exercise

A. Short Questions

Q1. What do you mean by personal hygiene?

Q2. What steps will you take to ensure the cleanliness of the workplace?

B. Match the Columns.

Column A	Column B
i. Personal hygiene	a. Restroom cleaning
ii. Workplace hygiene	b. Shower
iii. Hygiene policy	c. Good food
iv. Kitchen cleaning	d. Good place to work

C. Fill in the Blanks

a. _____refers to the practice of caring for one's body and keeping it in good condition to seem neat and acceptable in public settings such as the workplace.

b. A well-prepared presentation of self not only fosters an impression of professionalism but also has the potential to boost one's own feelings of _____and respect for oneself.

c. The maintenance of good hygiene in the workplace is essential to the maintenance of a_____.

Notes

Scan the QR Code to watch the related video

https://www.youtube.com/watch?v=t1_f681HCL8

Workplace Hygiene

Unit 10.2 Health and Safety Measures at Workplace for Persons with Disability

Unit Objectives

At the end of the session, participant will be able to:

- Discuss the health, hygiene and safety requirements for PwD in their surrounding environment as per guidelines.
- Discuss the various emergencies that may happen such as fire, accident, fall etc.
- Describe alternative ways and aids (audio alarms for the blind and visual alarms, simple diagrams or pictures, wheelchair, etc.) to ensure the safety of PwD.
- Discuss the process and significance of reporting accidents and hazards.

10.2.1: Health and Safety

Persons with Disability (PwD)

According to Person with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995, disability means:

- Blindness
- Low Vision
- Leprosy Cured
- Hearing Impairment
- Locomotor Disability
- Mental Retardation
- Mental Illness

10.2.2: Emergency Handling

An unexpected circumstance in the workplace that endangers your workers, customers, or the general public; causes your activities to be disrupted or stopped; or causes damage to either the physical or environmental environment is referred to as an emergency.

Emergencies can be caused by natural occurrences or by human actions, and can include the following:

- Earthquakes
- Floods
- Fires
- Toxic gas releases
- Chemical spills
- Radiological accidents
- Explosions
- Civil unrest
- Violence in the workplace that results in injuries and psychological distress

Emergency Action Plan

The following are required components of any emergency action plan:

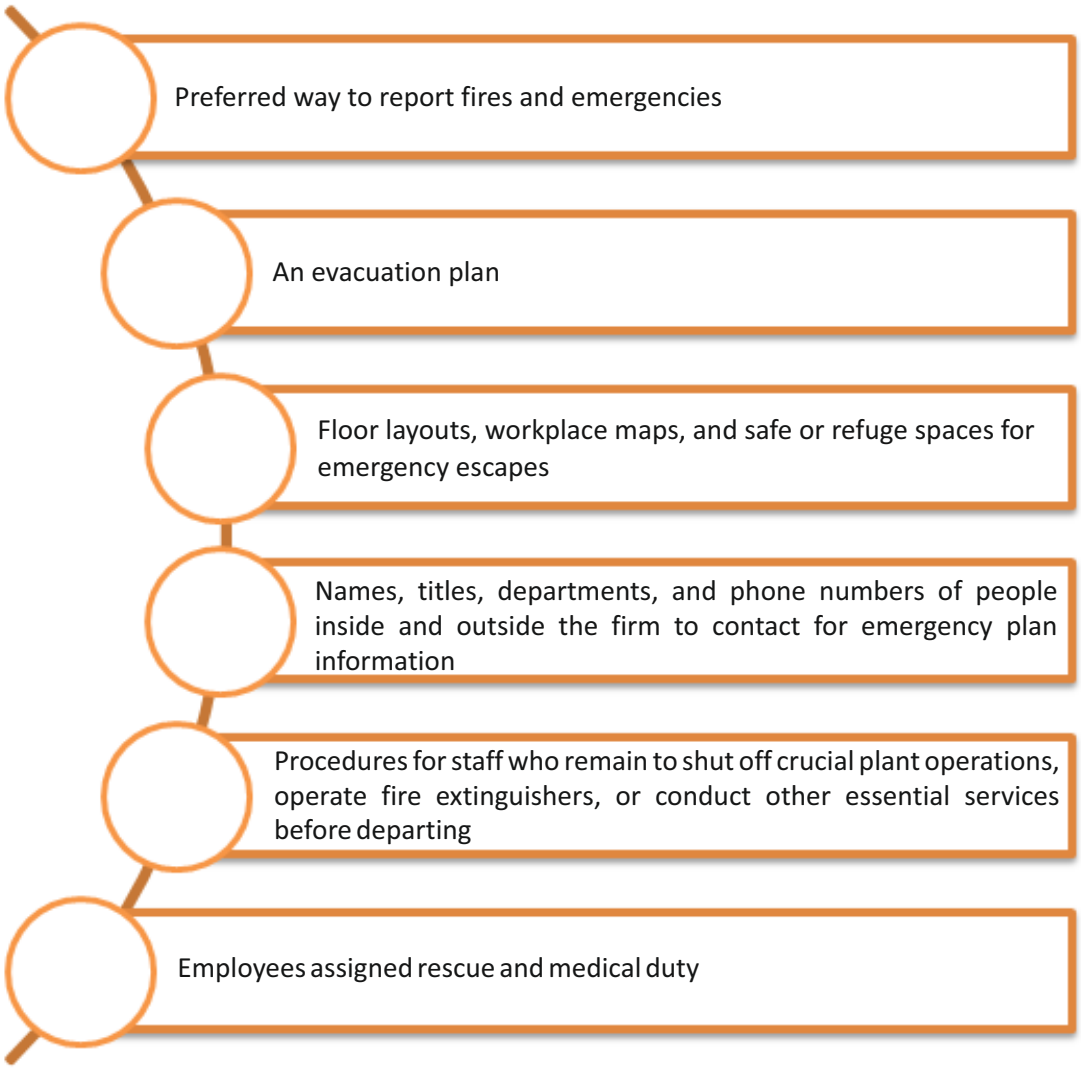


Figure10.2.1: Blueprint of Emergency Action Plan

Planning of Handling the Emergency

Step 1: Special-needs identification

- Slow walkers to wheelchair users with mobility problems.
- Visually challenged people may need help learning evacuation routes or descending escape stairs.
- Hearing-impaired people who need modified audible alarms.
- People recovering from a stroke, a broken leg, a sprained ankle, or knee or hip replacement surgery.
- People with respiratory issues or pregnancy who tire easily need extra support or additional time to evacuate.
- People with mental impairments may become confused during an emergency, lose their sense of direction, or need simpler emergency directions.

Step 2: Individual discussion

Permanently or severely disabled people know how to be helped. A minute with the person will yield important information. Helpers should be instructed to avoid injuring themselves or others. This is important while lifting or carrying someone.

Step 3: Write down

Identify times (of the day and week) and locations in the workplace where basic life safety or emergency contingency plans may not work.

Step 4: Review periodically

Role-playing or audio-visual assistance may be more effective than standard knowledge transmission methods. Practicing will boost confidence in an emergency. It will also ensure that lifesaving procedures are taken in an emergency.

Practice includes walkthroughs, publicized drills, and surprise drills.

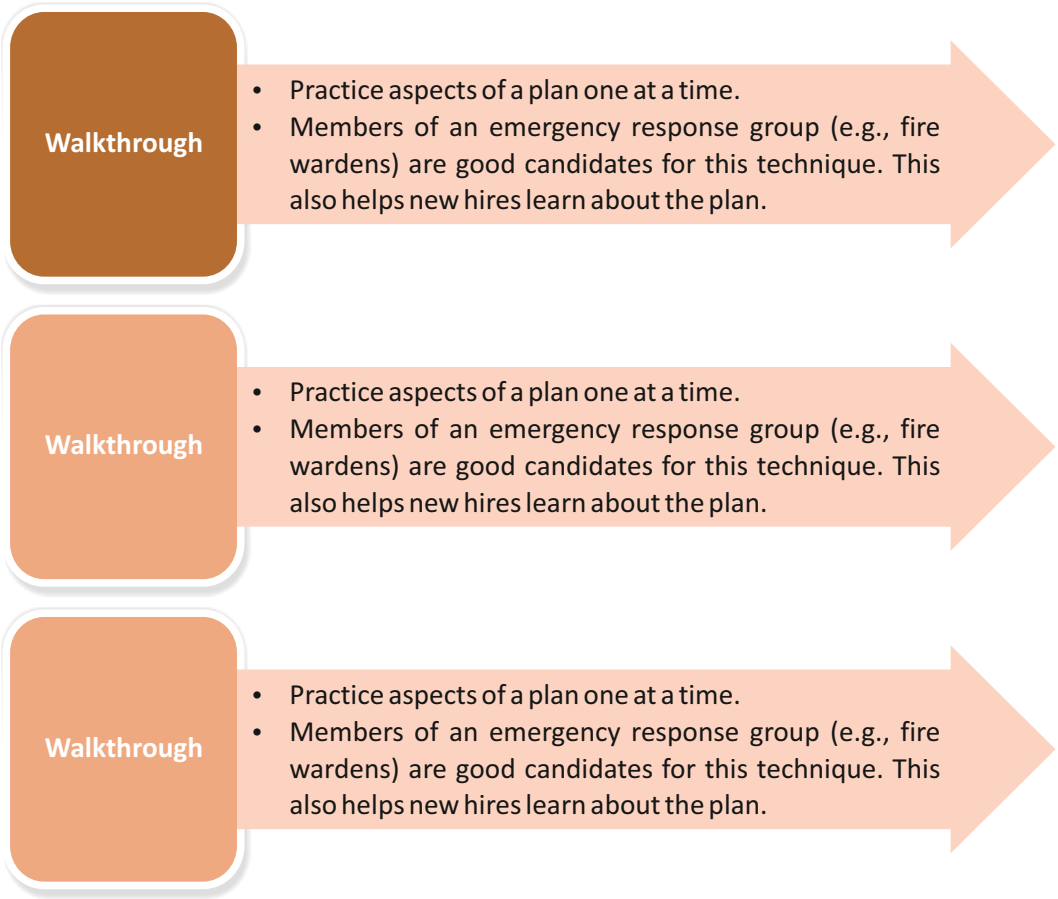


Figure10.2.2: Periodic Drill of Emergency Planning

Special Equipment or Devices

In the workplace, it is of the utmost significance to ensure that individuals with disabilities have access to the necessary notification appliances.

Sl. No.	Impairment or Disability Types	Notification Devices
1	Hearing Impairment	Light, vibrations, and air movement.
2	Visual Impairment	Tactile Signage – Braille signs Audible Remote Signage
3	Mobility Limitations	Wheelchair Permanently installed system for stairways

Table10.2.1: Emergency Notification Devices

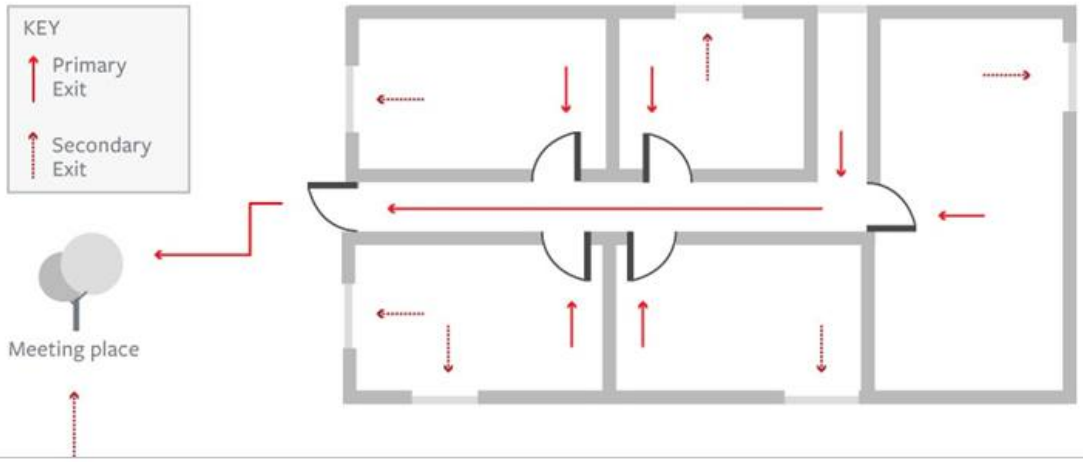
Fire Evacuation Plan

It is the obligation of employers to lessen or do away with any hazards that may be present in the workplace in terms of health and safety. This encompasses any dangers, known or unknown, related with prospective or actual fire threats. It is the responsibility of the employees to ensure that the employer's risk reduction measures, such as an emergency plan for fire evacuation, are adhered to at all times.

Employers should adhere to the following three steps of evacuation in the event of a fire when developing an effective evacuation plan for their employees:

The term "Stage 1" refers to an immediate evacuation, "Stage 2" refers to a lateral evacuation, and "Stage 3" refers to a partial evacuation.

When a stage 1 evacuation is ordered, everyone who is inside the building or on the work site must leave immediately. Individuals are required to shift laterally to a safer area during a stage 2 evacuation, such as transferring to a different room or region of the building. Everyone must leave the floor when the stage 3 evacuation procedure is initiated.



First Aid Application

Disability First Aid includes:

- CPR in a bed
- Responding to a seizure in a wheelchair
- Recognition and assistance for Autonomic Dysreflexia
- Choking in a bed
- Consent and communication in a disability setting

- Choking in a wheelchair
- Pressure sores and infection signs
- Understanding a Not for Resuscitation form
- How to use a bag valve mask (BVM) during CPR
- Recognizing and responding to depression and suicide warning signs in a disability setting.

10.2.3: Accidents and Hazards Reporting

In the case of an injury, it is essential to provide workers, sub-contractors, and visitors with first aid and medical treatment that is both prompt and effective. Incidents might be Minor, Serious, or Major, but they all need to be examined to determine what happened in order to avoid them from happening again. Incidents can range in severity from minor to serious to major.

Employees are required to report any accidents or injuries that occur on the job so that employers can ensure that their workers get the appropriate medical treatment as quickly as is practically possible. Accidental deaths have been attributed to minor scratches that were not treated in a timely manner.

In addition, there must be a system in place that allows for the prompt and accurate reporting of hazards, incidents, and other occurrences that pose an actual or potential threat to the health and safety of individuals or the environment. This is necessary in order for the risk assessment to be able to determine the appropriate corrective actions that can be taken.

Depending on the severity of the risk posed by the hazard or the occurrence at hand, quick action may need to be done in order to stop other people from being hurt. This may need the activation of emergency procedures or other activities to control the immediate risk to persons in the vicinity, such as barricading the area or notifying the Workers in Charge, amongst other possible measures. In the event that an injury has been sustained, rapid first aid treatment should be administered by a first aider who is appropriately qualified.

How to report Accidents and Hazards

There are numerous report formats used by companies. In addition to this, they have several guidelines for what should be reported. It is typical practise to document mishaps that result in a person sustaining an injury.

A form may include the following:

- Date and time of the report
- Name of person reporting
- A short description of what happened; who and what and when and where, as well as the name of the injured person(s).

Handover the report to that manager or supervisor at the worksite. The report should be written as soon as possible after the event.

Exercise

A. Short Questions

Q1. What do you mean by emergency at workplace?

Q2. How do you plan to report any incidents involving potential dangers or accidents at workplace?

B. Match the Columns.

Column A	Column B
i. Hearing impairment	a. Braille
ii. Visual impairment	b. Light or vibrations
iii. Mobility impairment	c. Ontime reporting
iv. Hazard incidents	d. Wheelchair

C. Fill in the Blanks

a. An unexpected circumstance in the workplace that endangers your workers, customers, or the general public; causes your activities to be disrupted or stopped; or causes damage to either the physical or environmental environment is referred to as an emergency_____.

b. Depending on the severity of the risk posed by the hazard or the occurrence at hand, _____may need to be done in order to stop other people from being hurt.

c. In the workplace, it is of the utmost significance to ensure that individuals with disabilities have access to the necessary notification _____.

Notes

Scan the QR Code to watch the related video

https://www.youtube.com/watch?v=v1Ll7oLiHLA

First Aid Treatment to Persons with Disability

Unit 10.3Workplace Cleanliness and Waste Management

Unit Objectives

At the end of the session, participant will be able to:

- Explain the importance of maintaining a clean and tidy workplace.

10.3.1: Workplace Cleanliness

The practice of keeping a clean workplace not only contributes to the creation of a healthier atmosphere for employees and it also assist businesses in becoming more effective and productive. A cluttered desk, uneaten food, and stacks of discarded paper are just some of the most typical factors that lead to an untidy working environment. A clean workplace contributes to an improvement in the level of professionalism and motivation displayed by employees, in addition to fostering an environment that is more conducive to good health in the workplace.Maintaining a clean working environment is essential for the success of any business. It helps in following ways:

- Increasing the productivity of employees
- Helps in maintaining the well-being of employees
- Professional display of the organization
- Helps in cost saving

In order to maintain a clean working environment, the following is a list of the five most important cleaning materials.

Equipment used for Floor Cleaning

It is absolutely necessary for the cleanliness of any place of business to have access to the appropriate floor cleaning equipment. Evaluate the requirements of your workplace to determine whether or not you require industrial cleaning, scrubbing, and sweeping equipment, or whether a simple mop or broom would do the job just fine.

In addition, a place of business will need to have access to a high-quality commercial vacuum equipped with an appropriate filtration system in order to successfully remove and contain dust and grime from carpets, floors, ceilings, and walls.

Disinfectants

High-touch and high-contact areas need to be cleaned and disinfected often, preferably right after each use, in order to ultimately limit the spread of germs throughout the workplace. The light switches, keyboards, phones, doorknobs, counters, workstations, and handrails of the stairs are all examples of areas that are utilized frequently.

Hand Soaps

One of the most effective strategies to maintain a healthy office environment, protect employees from getting sick and stop the transmission of illness to other members of the team, and keep your hands clean is to ensure that you always wash your hands after using the restroom.

This indicates that everyone in the place of employment should regularly wash their hands with soap and water for at least 20 seconds, such as after using the restroom or handling food. In the event that soap and water are not easily accessible, another option is to use an alcohol-based hand sanitizer that has at least 60 percent alcohol.

Microfiber Cloth

Microfiber cloths are an indispensable component of any effective cleaning routine because of their ability to sanitise hard surfaces without the application of harsh chemicals. Because the tiny, hook-shaped fibres that make up a microfiber cloth are only 1/16 the thickness of a human hair, they are exceptionally good at capturing viruses. Traditional disinfectants are able to eradicate the majority of germs but not all of them. Microfiber cloths, on the other hand, do not have the ability to destroy germs; rather, the microfibers themselves can remove germs from a variety of surfaces.

Microfiber cloths can be used for a variety of cleaning tasks, including dusting surfaces, removing fingerprints from monitors, and sanitising touch points like a keyboard and mouse. These cloths should be easily accessible in all workplaces.

Bins

Making sure there are sufficient bins in the workplace that are the appropriate size and that they are emptied on a consistent basis is one of the simplest ways to keep odours under control and to contain waste.

10.3.2: Waste and its Management

Waste

A product or substance is considered to be waste when it can no longer serve the purpose for which it was designed. Whereas in natural ecosystems waste (i.e., oxygen, carbon dioxide, and dead organic matter) is used as food or a reactant, waste materials arising from human activities are highly resistant to decomposition and take a significant amount of time to do so.

The following are some of the ways that waste can be sorted:

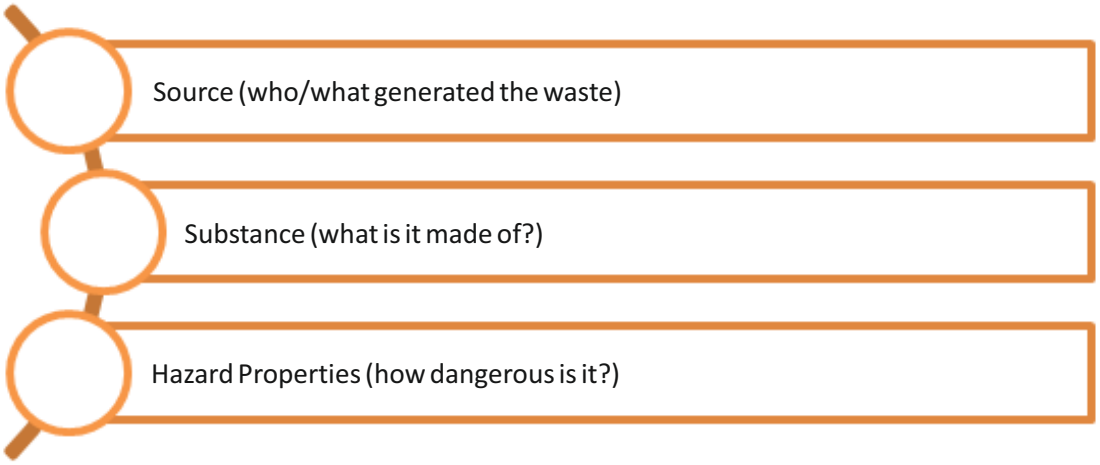


Figure10.3.1: Classification of Waste

There are five categories that encompass all of the waste produced. These include:

- Liquid Waste: Soiled water, wash water, organic liquids, waste detergents, and even, on occasion, rainwater are all examples of this.
- Solid Waste: Plastic, Paper, Card, Tins & Metals and Ceramics & Glasses
- Organic Waste: Food
- Recyclable Waste: Building materials of brick, metal, paper, and furniture
- Hazardous Waste: Toxic chemical, electronic waste and medical waste

Waste Management

Let's get an understanding on how to properly manage our waste at the office.

Figure10.3.2: Waste Management

Exercise

A. Short Questions

Q1. What do you mean by workplace cleanliness?

Q2. What do you mean by waste management?

B. Match the Columns.

Column A	Column B
i. Solid waste	a. Rainwater
ii. Liquid waste	b. Paper
iii. Organic waste	c. Toxic chemicals
iv. Hazardous waste	d. Food

C. Fill in the Blanks

a. A product or substance is considered to be_____ when it can no longer serve the purpose for which it was designed.

b. Maintaining a clean working environment is essential for the success of any_____.

c. _____ are an indispensable component of any effective cleaning routine because of their ability to sanitize hard surfaces without the application of harsh chemicals.

Notes

Scan the QR Code to watch the related video

https://www.youtube.com/watch?v=4JDGFNoY-rQ

Waste Management and Recycling

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